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European Union emission inventory report 1990–2012 under the UNECE Convention on Long-range Transboundary Air Pollution (LRTAP)

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European Union emission inventory report 1990–2012 under the UNECE Convention on Long-range Transboundary Air Pollution (LRTAP)

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Units, abbreviations and acronyms

AD	Activity data
As	Arsenic
BaP	Benzo(a)pyrene
BbF	Benzo(b)fluoranthene
BkF	Benzo(k)fluoranthene
C_6H_6	Benzene
CCGT	Combined-cycle gas turbine
Cd	Cadmium
CDR	Central Data Repository (of the EEA's Eionet Reportnet)
CEIP	Centre on Emission Inventories and Projections
CH_4	Methane
CLRTAP	(UNECE) Convention on Long-range Transboundary Air Pollution
CO	Carbon monoxide
CO_2	Carbon dioxide
COPERT	COmputer Programme to calculate Emissions from Road Transportation
CORINAIR	CORe INventory of AIR emissions
Cr	Chromium
CRF	(UNFCCC) common reporting format (for greenhouse gases)
CS	Country specific
Cu	Copper
D	Default value
DECC	Department of Energy and Climate Change
Defra	Department for Environment, Food and Rural Affairs
DG	Directorate-General
EEA	European Environment Agency
EF	Emission factor
Eionet	European Environment Information and Observation Network
EMEP	European Monitoring and Evaluation Programme (Cooperative programme for monitoring and evaluation of the long-range transmissions of air pollutants in Europe)
EPER	European Pollutant Emission Register
E-PRTR	European Pollutant Release and Transfer Register
ERT	Expert Review Team
ETC/ACM	European Topic Centre on Air Pollution and Climate Change Mitigation of the EEA
ETS	Emissions Trading Scheme
EU	European Union
FGD	Flue-gas desulphurisation
GDP	Gross domestic product
Gg	1 gigagram = 10^9 g = 1 kilotonne (kt)
GHG	Greenhouse gas
HBEFA	Handbook Emission Factors for Road Transport
HCB	Hexachlorobenzene
HCE	Hexachloroethane
HCH	Hexachlorocyclohexane
HFC(s)	Hydrofluorocarbon(s)
Hg	Mercury
HM(s)	Heavy metal(s)
IE	Included elsewhere (notation key)
IIR	Informative inventory report
IPCC	Intergovernmental Panel on Climate Change

I-TEQ	International toxic equivalents
KCA	Key category analysis
kg	1 kilogram = 10^3 g (gram)
LCP	Large combustion plant
lindane	Gamma-HCH
LPS(s)	Large point source(s)
LRTAP	Long-range Transboundary Air Pollution
LTO	Landing/take-off
M	Method
Mg	1 megagram = 10^6 g = 1 tonne (t)
MoEW	Ministry of Environment and Water
Mt	Megatonne
N_2O	nitrous oxide
NA	Not applicable (notation key)
NE	Not estimated (notation key)
NEC Directive	EU National Emission Ceilings Directive (2001/81/EC)
NFR	Nomenclature for reporting/UNECE nomenclature for reporting of air pollutants
NH_3	Ammonia
Ni	Nickel
NMVOC(s)	Non-methane volatile organic compound(s)
NO	Not occurring (notation key)
NO_2	Nitrogen dioxide
NO_X	Nitrogen oxides
NR	Not relevant (notation key)
O_3	Ozone
PAH(s)	Polycyclic aromatic hydrocarbon(s)
Pb	Lead
PCB(s)	Polychlorinated biphenyl(s)
PCDD/F(s)	Polychlorinated dibenzodioxin(s)/dibenzofuran(s)
PFC(s)	Perfluorocarbon(s)
PM	Particulate matter
PM_{10}	Coarse particulate matter (particles measuring 10 μm or less)
$PM_{2.5}$	Fine particulate matter (particles measuring 2.5 μm or less)
POP(s)	Persistent organic pollutant(s)
PRTR	Pollutant Release and Transfer
PS	Plant specific
QA	Quality assurance
QC	Quality control
RIVM/PBL	Rijksinstituut voor Volksgezondheid en Milieu (National Institute for Public Health and the Environment)/Netherlands Environmental Assessment Agency
S	Sulphur
SCR	Selective catalytic reduction
Se	Selenium
SF_6	Sulphur hexafluoride
SNAP	Selected nomenclature for reporting of air pollutants
SNCR	Non-selective catalytic reduction
SO_2	Sulphur dioxide
SO_X	Sulphur oxides
t	1 tonne (metric) = 1 megagram (Mg) = 10^6 g
T	Tier (method)
TFEIP	Task Force on Emission Inventories and Projections
Tg	1 teragram = 10^{12} g = 1 megatonne (Mt)
TJ	1 terajoule
TSP(s)	Total suspended particulate(s)
UNECE	United Nations Economic Commission for Europe
UNFCCC	United Nations Framework Convention on Climate Change
VOC(s)	Volatile organic compound(s)
Zn	Zinc

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Executive summary

This document is the annual European Union (EU) emission inventory report under the United Nations Economic Commission for Europe (UNECE) Convention on Long-range Transboundary Air Pollution (LRTAP) (UNECE, 1979). The report and its accompanying data constitute the official submission by the European Commission on behalf of the EU as a party, to the Executive Secretary of UNECE. The report is compiled by the European Environment Agency (EEA) in cooperation with the EU Member States.

Under the LRTAP Convention, parties (including the EU) are obliged and invited to report emissions data for numerous air pollutants:

- main pollutants: nitrogen oxides (NO_X), non-methane volatile organic compounds (NMVOC), sulphur oxides (SO_X), ammonia (NH_3) and carbon monoxide (CO);
- particulate matter (PM): primary PM (fine particulate matter ($PM_{2.5}$) and coarse particulate matter (PM_{10}) and total suspended particulates (TSPs);
- priority heavy metals (HMs): lead (Pb), cadmium (Cd) and mercury (Hg);
- additional HMs: arsenic (As), chromium (Cr), copper (Cu), nickel (Ni), selenium (Se) and zinc (Zn);
- persistent organic pollutants (POPs): polychlorinated dibenzodioxins/ dibenzofurans (PCDD/Fs), polycyclic aromatic hydrocarbons (PAHs), hexachlorobenzene (HCB), hexachlorocyclohexane (HCH) and polychlorinated biphenyls (PCBs);
- additional reporting of the individual PAHs benzo(a)pyrene, benzo(b)fluoranthene, benzo(k) fluoranthene and indeno(1,2,3-cd)pyrene.

These pollutants harm human health and the environment. In addition, certain species also contribute to the formation of ozone (O_3) and PM in the atmosphere, and have an indirect and direct effect on radiative forcing and hence on the climate.

This report describes:

- the institutional arrangements and preparation processes that underpin the EU's emission inventory, methods and data sources, the key category analyses, and information on uncertainty, completeness and underestimations (Chapter 1);
- emission trends for the EU-28 as a whole and for individual Member States, and the contribution made by important individual emission sources to emissions (Chapter 2);
- sectoral analyses and emission trends for key pollutants (Chapter 3);
- information on recalculations as well as planned and implemented improvements (Chapter 4).

Emission data presented in this report are included in the accompanying annexes and are also available for direct download through the EEA's data service ([1]) (EEA, 2014a).

EU-28 emission trends

Figure ES.1 presents the aggregated EU-28 emission trends of the main pollutants, particulates, HMs and POPs, for the period from 1990 to 2012 ([2]).

([1]) The online data viewer for the EU LRTAP Convention data set.

([2]) By 15 February each year, Member States must report emission data for years up until the current year, minus two. Thus, by 15.02.2014, Member States were obliged to report for the years until 2012. Emission inventory data (both for air pollutants and greenhouse gases (GHGs)) can typically only be compiled and reported by countries with a 12-to-15-month delay, approximately. This delay is mainly a result of the time needed for official national and/or trade statistics to become available (typically up to 12 months following a calendar year), together with the time needed for subsequent data processing, calculations and quality assurance and quality control (QA/QC) checks.

Box ES.1 Definition of the term 'emission trend(s)' within this report

Emission trend(s)
In this report, 'emission trend(s)' are the increases and decreases of emission levels over time, i.e. the changes in emission data in the time series; the term is not used in the statistical sense.

Emission trends of main air pollutants between 1990 and 2012

Across the EU-28, the largest emission reduction for the main pollutants was of SO_X. Emissions in 2012 were 84 % less than in 1990. This reduction is the result of a combination of measures: fuel switching in energy-related sectors — away from high-sulphur–containing solid and liquid fuels to low-sulphur fuels such as natural gas; the fitting of flue-gas desulphurisation (FGD) abatement techniques in industrial facilities; and the impact of EU directives relating to the sulphur content of certain liquid fuels.

Emissions of the other main air pollutants have also dropped considerably since 1990, including emissions of the three air pollutants primarily responsible for the formation of ground-level O_3: CO (66 % reduction), NMVOC (60 % reduction) and NO_X (51 % reduction). In the 'Road transport' sector, emissions reductions were achieved for these three pollutants primarily through legislative measures requiring abatement of vehicle tailpipe emissions. NO_X emissions decreased considerably in the electricity/energy generation sectors as a result of certain technical measures: the introduction of combustion modification technologies (e.g. use of low NO_X burners), implementation of flue-gas abatement techniques (e.g. NO_X scrubbers and selective catalytic reduction (SCR) and selective non-catalytic reduction (SNCR) techniques), and fuel switching from coal to gas (EEA, 2014b).

NH_3 emissions fell less than emissions of the other main polutants (– 28 %), with large reductions in absolute terms occurring, especially in Poland, the Netherlands, Germany and Romania; all other countries (except Spain) also reported decreases. These reductions are mainly a result of improved manure management.

Emission trends of main air pollutants between 2011 and 2012

Emissions of NO_X and SO_X dropped by 3.4 % and 9.7 %, respectively. NH_3 emissions fell by 1.5 %. NMVOC and CO emissions decreased by 2.9 % and 3.2 % between 2011 and 2012.

The drop in NO_X emissions is mainly due to reductions reported in Italy, Greece and Spain. The 'Road transport' sector recorded the largest reductions of NO_X (in absolute terms) from 2011 to 2012.

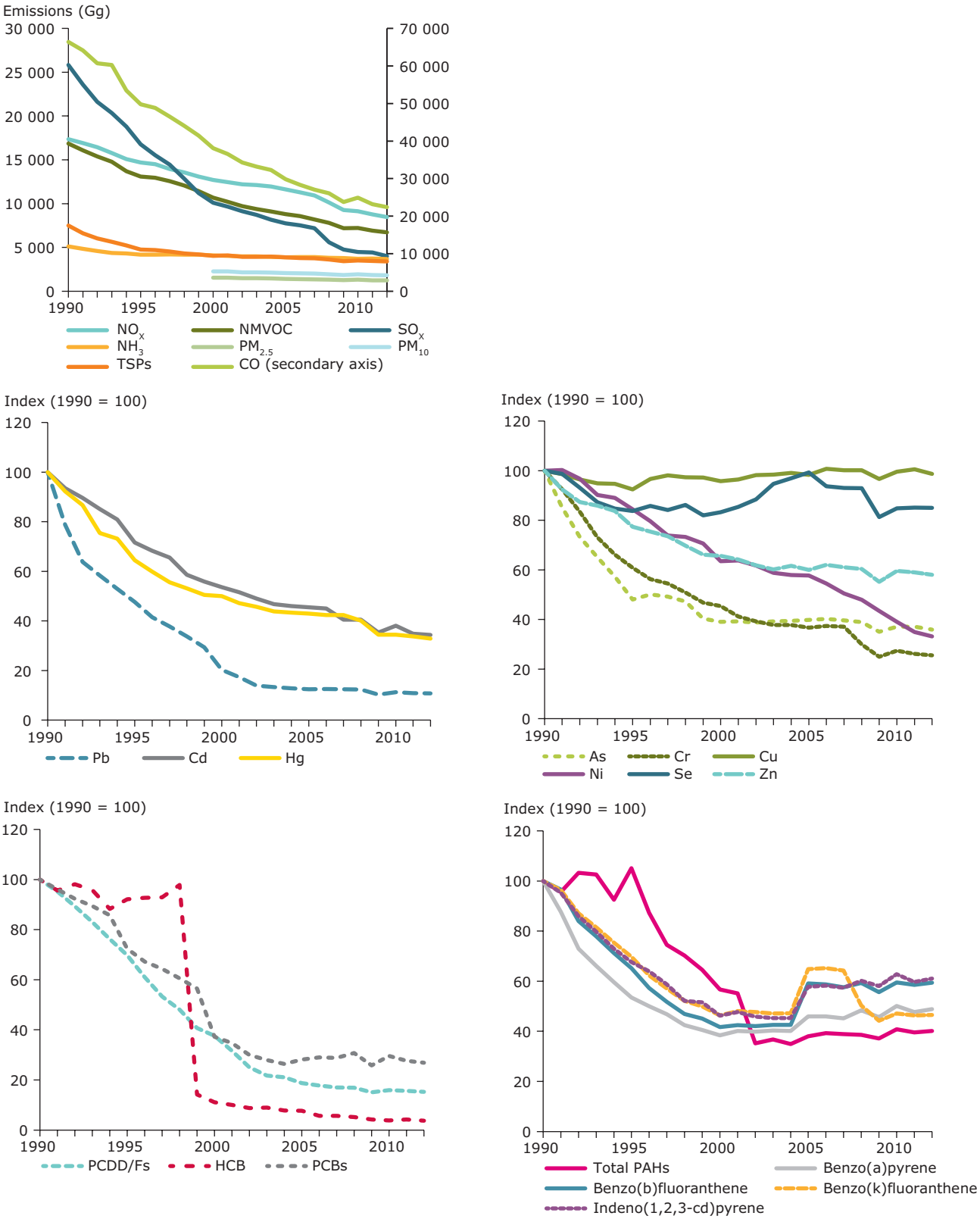
Between 2011 and 2012, NMVOC emissions fell, mainly due to emissions reductions in Italy, Germany and France. France and Germany reported in their informative inventory reports (IIRs) (Appendix 5) that the decrease of NMVOC emissions from 1990 to 2012 is due to increasingly strict regulations and controls, resulting in more cars with catalytic converters as well as reduced petrol consumption. The 'Solvent and product use' and 'Road transport' sectors contributed most to the reduction of NMVOC from 2011 to 2012 (in absolute terms).

Bulgaria, Romania and Spain reported the highest reductions of SO_X. The sectors 'Energy production and distribution' and 'Energy use in industry' contributed most to the reduction of SO_X from 2011 to 2012 (in absolute terms).

CO emissions decreased, mainly due to reductions of emissions in France, Italy and the United Kingdom. The sectors 'Road transport', 'Industrial processes' and 'Energy use in industry' contributed most to the reduction of CO emissions from 2011 to 2012 (in absolute terms).

NH_3 emissions decreased mainly due to reductions of emissions in France, Germany and Poland. The agricultural sector showed the largest reductions of NH_3 (in absolute terms) from 2011 to 2012.

Figure ES.1 EU-28 emission trends for the main air pollutants, PM, HMs and POPs



Note: Parties to the LRTAP Convention are formally requested to report emissions of PM from the year 2000 onwards. Hence emission trends for these years only are shown.

The drop in HCB emissions between 1998 and 1999 is due to a considerable reduction reported by the United Kingdom.

The increase of benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene and indeno(1,2,3-cd)pyrene emissions from 2004 to 2005 is a result of differences between gap-filled (up to 2004) and submitted (from 2005 onwards) data from Romania.

Emission trends of other air pollutants

Emissions for the main HMs (Pb, Cd, Hg), dioxins and furans, HCB and PCBs have also dropped substantially since 1990, in the order of 60 % or more. Much progress has been made since the early 1990s in reducing point-source emissions of these substances, particularly from industrial facilities. This has been achieved partially through improved abatement techniques for wastewater treatment and incinerators in metal refining and smelting industries; in some countries, the emissions reduction follows the closure of older industrial facilities due to economic restructuring. However, the decrease rate in total emissions was higher between 1990 and 2000 than in the following years.

With the exception of Cu and Se, whose emissions remained stable over the years, reductions since 1990 are reported for additional HMs (As − 64 %, Cr − 74 %, Ni − 67 % and Zn − 42 %), and for total PAHs (− 60 %), and the PAHs benzo(a) pyrene (BaP) (− 51 %), benzo(b)fluoranthene (BbF) (− 41 %), benzo(k)fluoranthene (BkF) (− 53 %) and indeno(1,2,3-cd)pyrene (IP) (− 39 %).

TSPs have seen a reduction of 55 % from 1990. For PM_{10} and $PM_{2.5}$, the aggregated EU-28 emission reduction achieved since 2000 is 19 % for both. Total PM emissions dropped mainly thanks to the introduction or improvement of abatement measures across the energy, road transport, and industry sectors, coupled with other developments in industrial sectors, like fuel switching from high-sulphur–containing fuels to low-sulphur-containing fuels.

EU-28 key categories and main emission sources

EU-28 key categories are the individual sources that overall contributed the most to 2012 emissions of pollutants, determined by a level assessment ([3]) for each of the main air pollutants, PMs, priority HMs and the POPs, except HCH ([4]).

A total of 49 different emission inventory source categories were identified as being key categories for at least 1 pollutant. A number of emission categories were identified as being key categories for more than 1 of the 14 pollutants assessed. The most relevant key categories are listed in Table ES.1.

Figure ES.2 shows the share of EU-28 emissions by sector group. As observed in past years, each of the main air pollutants has one major source category: for NO_X this is 'Road transport'; for SO_X, 'Energy production and distribution'; for NH_3, 'Agriculture'; for NMVOC, 'Solvent and product use'; and for CO, 'Commercial, institutional and households'.

NO_X emissions from the 'Road transport' sector have decreased by 54 % since 1990. The road transport group is nevertheless a major source of the ozone precursors NO_X and CO in the EU; in 2012 it contributed 39 % and 25 % of total EU-28 emissions respectively. It is also a major source of NMVOC, $PM_{2.5}$, PM_{10} and lead emissions. Passenger cars and heavy-duty vehicles are the principal contributors to NO_X emissions from this sector; for CO in 2012, passenger cars alone contributed around 70 % of emissions from the 'Road transport' sector.

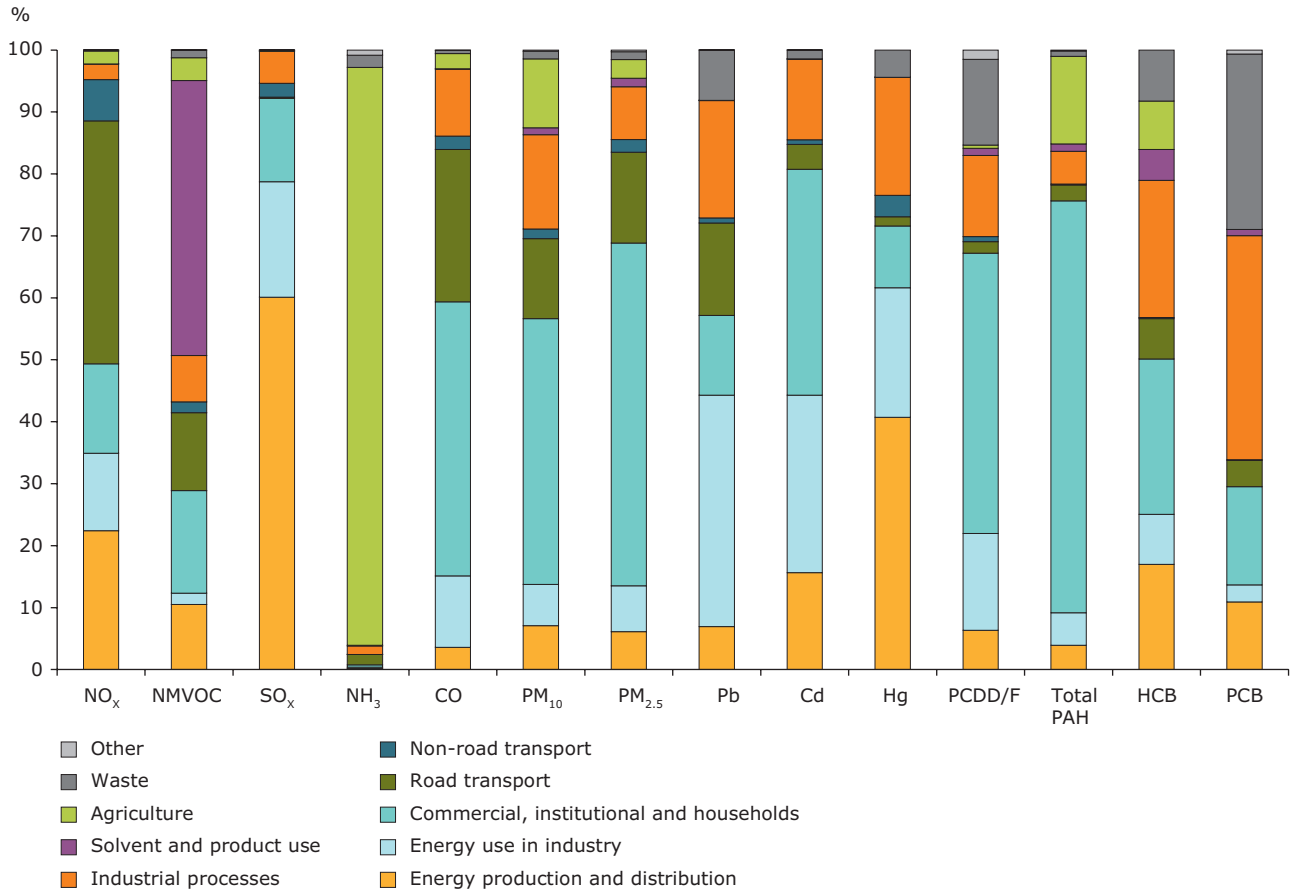
Table ES.1 Most relevant key categories for air emissions

Name of key category	No of occurrences as key category
1 A 4 b i — Residential: Stationary plants	13 times (NO_X, SO_X, CO, NMVOC, Cd, Hg, Pb, HCB, PCDD/Fs, PM_{10}, $PM_{2.5}$, PCBs, total PAHs)
1 A 1 a — Public electricity and heat production	11 times (NO_X, SO_X, CO, Pb, Cd, Hg, HCB, PCDD/Fs, PM_{10}, $PM_{2.5}$, PCBs)
1 A 2 f i — Stationary combustion in manufacturing industries and construction: Other	9 times (NO_X, SO_X, CO, Hg, Pb, Cd, PCDD/Fs, PM_{10}, $PM_{2.5}$)
2 C 1 — Iron and steel production	8 times (CO, Cd, Hg, Pb, PCDD/Fs, $PM_{2.5}$, PCBs, HCB)
1 A 3 b i — Road transport: Passenger cars	7 times (NO_X, CO, NMVOC, PM_{10}, $PM_{2.5}$, Pb, HCB)

([3]) A key category level assessment identifies those source categories that have a significant influence on a country's total inventory in terms of their absolute level of emissions. In this report, the categories that are collectively responsible for 80 % of the total emissions of a given pollutant are classified as key categories (EMEP/EEA, 2013).

([4]) Due to insufficient data for HCH, the EU total is incomplete and an analysis could not be carried out.

Figure ES.2 Share of EU-28 emissions of the main pollutants by sector group



The 'Commercial, institutional and households' sector is the most important source for CO, $PM_{2.5}$, PM_{10}, Cd, dioxins and furans and total PAHs. Energy and process-related emissions from industry contribute considerably to the overall emissions of a number of the HMs and POPs.

The LRTAP Convention emission inventory report: changes made in 2014

Developments between 2013 and 2014 include:

- the inclusion of a table on the effect of gap-filling on EU emission data for the year 1990;
- information on underestimations moved to the introduction; a new figure on the number of source categories that are 'not estimated' (NE) for the year 2012 was also included;
- brief information on proposed adjustments of the Member States is included.

Recalculations are made by Member States for one or more years. Between the submission in 2013 and this year recalculations resulted in emission changes for all pollutants for the year 2011, although for NO_X, NMVOC, NH_3, TSPs, Pb, Hg, As and Cr these are negligible.

The highest recalculations of 1990–2011 data occurred in the PAHs benzo(a)pyrene, benzo(b) fluoranthene, benzo(k)fluoranthene and indeno(1,2,3-cd)pyrene: this is due to differences of Poland's gap-filled 2014 inventory, compared with gap-filled and submitted data of the 2013 inventory. Further, considerable recalculations of benzo(k)fluoranthene emissions were carried out because of changes in the data for category '1 A 4 b i — Residential: Stationary plants' submitted by Poland. Poland will repeat the recalculations of PAH emissions in the category 1 A 4 b i for the next submission to improve consistency of the trend (comment received from Poland in 2014).

In their IIRs (see Appendix 5), Austria, Belgium, Bulgaria, Cyprus, Denmark, Estonia, Finland, France, Germany, Ireland, Italy, Latvia, Lithuania, the Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden and the United Kingdom gave explanations and justifications for

Table ES.2 Changes in 2011 emissions due to recalculations

Pollutant	NO_x	NMVOC	SO_x	NH_3	TSPs	CO	Pb	Cd	Hg	As	Cr	Cu	Ni	Se	Zn
Type of change	→	→	↘	→	→	↘	→	↘	→	→	→	↘	↘	↘	↗

Pollutant	PCDD/Fs	Total PAHs	HCB	HCH	PCBs	Benzo(a)-pyrene	Benzo(b)-fluor-anthene	Benzo(k)-fluor-anthene	Indeno-(1,2,3-cd)-pyrene	$PM_{2.5}$	PM_{10}
Type of change	↗	↓	↘		↑	↘	↘	↓	↓	↗	↗

Note: Based on data submitted in 2013 and 2014.
→ Indicates changes ranging between − 1.5 % and 1.5 %.
↗ Indicates changes ranging between 1.5 % and 5 %.
↘ Indicates changes ranging between − 1.5 % and − 5 %.
↑ Indicates changes higher than 5 %.
↓ Indicates changes lower than 5 %.

their recalculations of parts or the whole time-series (e.g. methodological improvements, revisions of emission factors, reallocations, revisions of activity data, and corrections of errors). In other instances, information on the rationale behind recalculations is not always provided.

EU progress in meeting its 2010 emission reduction targets under the Gothenburg Protocol

The Gothenburg Protocol to the UNECE LRTAP Convention (UNECE, 1999) sets emission ceilings which parties to the protocol must meet: these ceilings, for 2010 and after, pertain to the pollutants NO_X, NMVOC, SO_X and NH_3. In addition to the ceilings for individual countries, the protocol also specifies ceilings for the EU, itself a party to the protocol.

The EEA published its annual update of the NEC Directive status report (EEA, 2014c) in May 2014. The *NEC Directive status report 2013* analyses the 2012 emission data for EU Member States reported under Directive 2001/81/EC on national emission ceilings for certain atmospheric pollutants, known as the EU National Emission Ceilings (NEC) Directive (EC, 2001). For the EU Member States, the NEC Directive contains national emission ceilings that are either equal to or more ambitious than those set out in the Gothenburg Protocol.

Table ES.3 shows the aggregated emissions for the year 2012 (as reported by the EU-15 Member States originally listed in the Gothenburg Protocol), in comparison to the respective 2010 emission ceilings specified for the EU.

Table ES.3 Comparison of emissions reported for 2012 by EU-15 Member States, with UNECE Gothenburg Protocol EU emission ceilings

Pollutant	EU-15 emissions year 2012 (Gg)	European Union (EU-15) Gothenburg Protocol 2010 ceilings (Gg)	Difference (%)	Sum of individual EU-15 ceilings (Gg) ([a])
NO_x	6 489	6 671	– 3 %	6 648
NMVOC	5 056	6 600	– 23 %	6 600
SO_x	2 157	4 059	– 47 %	4 044
NH_3	2 916	3 129	– 7 %	3 128

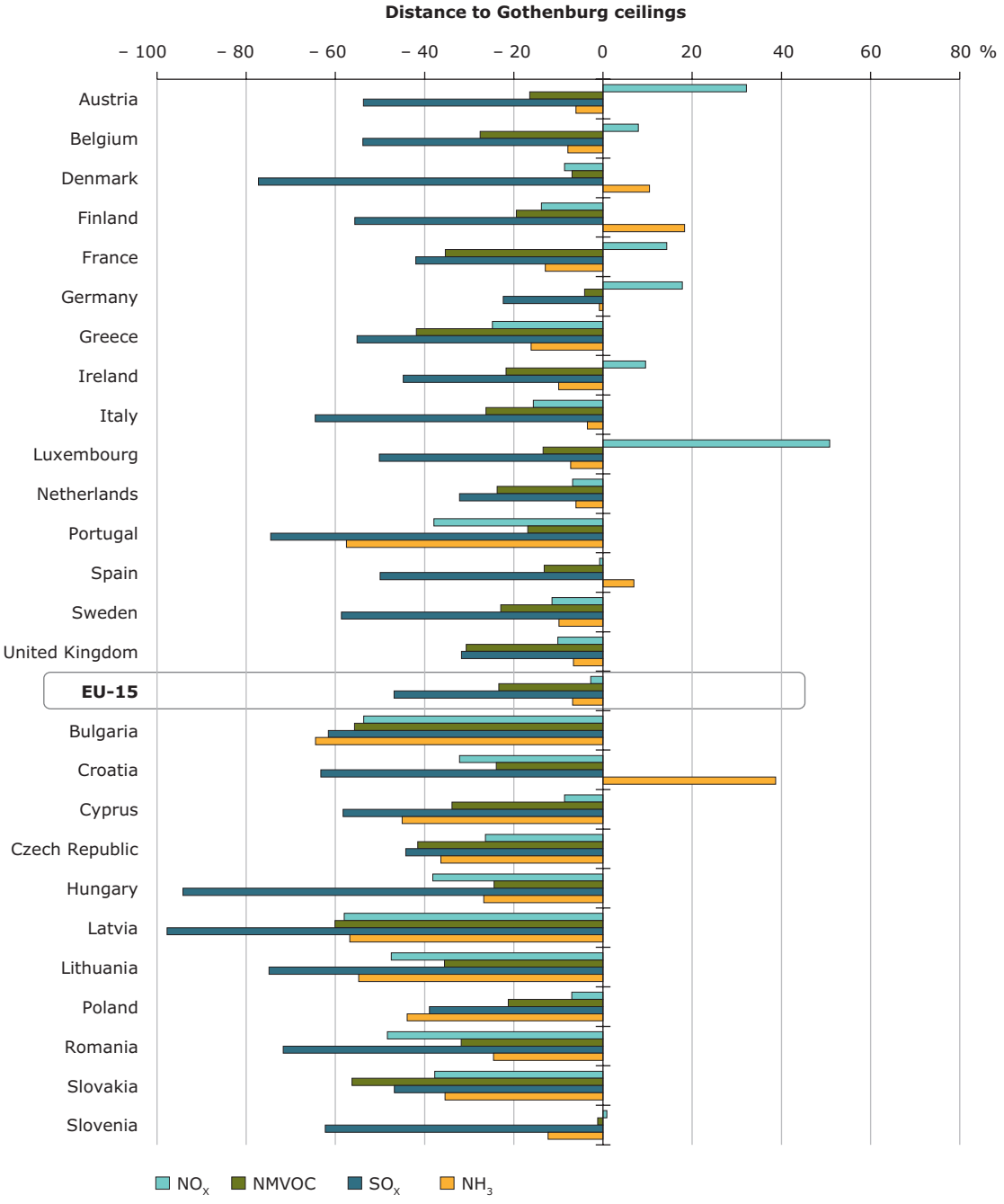
Note: ([a]) Emission ceilings are also specified for the individual EU-15 Member States. The sum of these ceilings is, in some instances, different to the ceilings specified for the European Community (EU-15) as a whole.

Data for this comparison are based on a mix of fuel sold and fuel used (Austria, Belgium, Ireland, Luxembourg, the Netherlands and the United Kingdom). For Spain, data for the compliance checks are national totals for the EMEP grid domain.

Belgium, Croatia, Denmark, France, Germany and Spain have already proposed data adjustments ([5]). However, these adjustments are pending approval and have not yet been considered for the EU inventory.

([5]) In 2012, the Executive Body for the LRTAP Convention decided that adjustments to emission reduction commitments, or to inventories for the purposes of comparing total national emissions with them, may be applied in some circumstances (UNECE, 2012a).

Figure ES.3 Distance to Gothenburg ceilings for EU Member States



Note: Estonia and Malta do not have a Gothenburg ceiling.

Data for this comparison are based on a mix of fuel sold and fuel used (Austria, Belgium, Ireland, Luxembourg, the Netherlands and the United Kingdom). For Spain, data for the compliance checks are national totals for the EMEP grid domain.

Belgium, Croatia, Denmark, France, Germany and Spain have proposed data adjustments ([6]). However, these adjustments are pending approval and have not yet been considered for the EU inventory.

([6]) In 2012, the Executive Body for the LRTAP Convention decided that adjustments to emission reduction commitments, or to inventories for the purposes of comparing total national emissions with them, may be applied in some circumstances (UNECE, 2012a).

Compliance checking in this report is based on reporting on the basis of fuel sold, except for Austria, Belgium, Ireland, Lithuania, Luxembourg, the Netherlands and the United Kingdom. These countries may choose to use the national emissions total calculated on the basis of fuel used in the geographic area of the party as a basis for compliance (UNECE, 2009). For Spain, data for the compliance checks are national totals for the EMEP grid domain. For all pollutants, the emissions in 2012 were below the respective pollutant ceilings.

Figure ES.3 shows whether the Gothenburg ceilings were met in 2012, for all EU Member States. Seven Member States reported NO_X emissions higher than their ceilings, and four (Denmark, Finland, Germany and Spain) exceeded their NH_3 ceiling. In 2012, no Member State exceeded its NMVOC and SO_X ceilings. It should also be noted that all new Member States (EU-12) have met their emission ceilings for all pollutants, except Slovenia for NO_X and Croatia for NH_3.

Status of reporting by EU-28 Member States

In 2014, Member States were requested to report emission inventory data and an IIR. All Member States reported air emission inventories, and 27 Member States reported activity data until 12 May 2014. An IIR was provided by 24 Member States. Five Member States reported gridded data and data on large point sources. Projections were reported by 19 Member States. Detailed information on the Member States' submissions is presented in Appendix 3.

Methods and data sources

The data source for the EU inventory is the Member States' emission inventories. The data sources for these underlying inventories may vary across the different Member States, but should be in line with the methodologies of the convention's guidelines for emission reporting (*Guidelines for reporting emission data under the Convention on Long-range Transboundary Air Pollution)* and the *EMEP/EEA air pollutant emission inventory guidebook — 2013)* (UNECE, 2009; EMEP/EEA, 2013). This ensures that the best available method is being used to compile the EU inventory, notwithstanding possible inconsistencies. The main data sources are national statistics, energy balances, agricultural statistics, etc. or any other reporting in line with other national/international reporting requirements (e.g. Directive 2001/80/EC on the limitation of emissions of certain pollutants into the air from large combustion plants (known as the Large Combustion Plants Directive), the Emissions Trading Scheme legislation (Directive 2009/29/EC amending Directive 2003/87/EC so as to improve and extend the greenhouse gas emission allowance trading scheme of the Community) and the European Pollutant Release and Transfer Register (E-PRTR) Regulation (Regulation (EC) No 166/2006 concerning the establishment of a European Pollutant Release and Transfer Register and amending Council Directives 91/689/EEC and 96/61/EC).

Member State submissions contain various data gaps for particular pollutants or years in the time series. A gap-filling procedure was developed to address this issue, and was applied from 2010 to 2014; it has resulted in a more comprehensive determination of EU emission trends and the most significant emission sources of the various pollutants than seen in previous years. Gap-filling procedures could not be applied if emission data were not available for any year. In such instances, the EU-28 emission totals for these pollutants are not considered complete, i.e. they are underestimated.

Generally, there is less need for gap-filling of 2012 data than for gap-filling of data from 1990 onwards. The need to gap-fill emissions underlying the Gothenburg Protocol is very low, compared to other pollutants.

Recommendations for improved data quality

Carrying out a more comprehensive gap-filling procedure again led to improvements in the completeness of the EU emission inventory, especially for the main pollutants where complete emission trends for the EU-28 can be reported. Despite clear progress in recent years concerning the completeness of reporting, a number of data gaps remain in the official data sets received from Member States. The completeness of Member State submissions can therefore be further improved, particularly for historic 1990-to-2000 data and for certain pollutants such as HMs and POPs.

This report also contains several recommendations that may further improve the EU inventory quality in future. Member States should submit complete inventories and use proper notation keys for instances where estimated values are not available. They should recalculate emissions data for past years when new methods or new scientific

knowledge become available. In this context, it is recommended that Member States review and apply the information contained in the updated *EMEP/EEA air pollutant emission inventory guidebook — 2013* (EMEP/EEA, 2013) when compiling their emission inventory data sets.

Further, Member States are encouraged to report their emission inventories on the basis of fuel sold for 'Road transport', in line with the reporting guidelines (UNECE, 2009).

Member States are encouraged to follow up on requests from the EEA or ETC/ACM during the compilation of the EU-28 inventory, by either resubmitting inventory data in NFR format or by updating next year's inventory to reflect new insights gained or errors identified.

Finally, national emission inventory experts are encouraged to participate as expert reviewers in the joint annual EMEP/EEA inventory review process. Such activities (aimed specifically at supporting and improving the quality of national inventories) are key methods to ensure that high-quality data are available for the EU's own inventory.

1 Introduction

This report and its accompanying data are provided by the European Commission (on behalf of the European Union (EU)) as an official submission to the secretariat for the Executive Body of the Long-range Transboundary Air Pollution (LRTAP) Convention.

The report covers the following subjects: the formal institutional arrangements that underpin the EU's emission inventory (Chapter 1); emission trends reported by Member States, and the contribution of key categories to total emissions (Chapter 2); sectoral analysis and emission trends for key pollutants (Chapter 3); and information on recalculations and planned improvements (Chapter 4).

EU-28 emission totals are estimated for the pollutants for which data should be reported under the LRTAP Convention (see Appendix 2), i.e. emissions of:

- main pollutants: nitrogen oxides (NO_X), non-methane volatile organic compounds (NMVOC), sulphur oxides (SO_X), ammonia (NH_3), carbon monoxide (CO);
- particulate matter (PM): primary PM (coarse ($PM_{2.5}$) and fine (PM_{10}) and total suspended particulates (TSPs);
- priority heavy metals (HMs): lead (Pb), cadmium (Cd) and mercury (Hg);
- additional HMs: arsenic (As), chromium (Cr), copper (Cu), nickel (Ni), selenium (Se) and zinc (Zn);
- persistent organic pollutants (POPs): polychlorinated dibenzodioxin/polychlorinated dibenzofurans (PCDD/Fs), polycyclic aromatic hydrocarbons (PAHs), hexachlorobenzene (HCB), hexachlorocyclohexane (HCH) and polychlorinated biphenyls (PCBs);
- additional reporting of the individual PAHs benzo(a)pyrene (BaP), benzo(b)fluoranthene (BbF), benzo(k)fluoranthene (BkF) and indeno(1,2,3-cd) pyrene (IP).

Emission estimates are not always available for all pollutants in each year, due to gaps in the data reported by Member States. A more complete gap-filling process was trialled in 2010 for the compilation of the EU inventory, and was refined in 2011. Nevertheless, for certain pollutants (i.e. PM, TSPs, HMs and POPs), some Member States did not report data for any year, which meant that such gap-filling techniques could not be applied. For these pollutants, the EU-28 total thus remains incomplete. The details of the gap-filling methodology used are provided in Section 1.4.

Several annexes accompany this inventory report:

- Annex A provides a copy of the formal LRTAP Convention data submission of the EU for the years from 1990 to 2012 for the EU-28, in the required United Nations Economic Commission for Europe (UNECE) reporting format (nomenclature for reporting NFR09);
- Annex B provides the updated EU NO_X emissions data for the period between 1987 and 1989, provided in accordance with the requirements of the 1988 NO_X protocol of the LRTAP Convention;
- Annex C provides results of the key category analysis (KCA) for the EU-28, showing the main emitting sectors for each pollutant;
- Annex D provides the gap-filled inventory of the EU-28, colour-coded for the different data sources used and the different additional gap-filling methods applied;
- Annex E provides Member States projections for NO_X, NMVOC, SO_X, NH_3, $PM_{2.5}$ and PM_{10} emissions for the years 2010, 2015, 2020, 2030 and 2050.
- Annex F-I provides the LRTAP Convention data submission of the EU for the years from 1990

to 2012 for the EU-9, EU-12, EU-15 and EU-27. Information on the country grouping is given in Appendix 2, LRTAP Convention emission reporting programme for 2013, Table A2.2.

1.1 Background

1.1.1 Reporting obligations under the Convention on Long-range Transboundary Air Pollution (LRTAP)

The EU ratified the UNECE's Convention on LRTAP (UNECE, 1979) in 1982. Article 2 of the convention states that 'the Contracting Parties, taking due account of the facts and problems involved, are determined to protect man and his environment against air pollution and shall endeavour to limit and, as far as possible, gradually reduce and prevent air pollution including long-range transboundary air pollution'.

The convention has an established process for negotiating measures to control specific pollutants through legally binding protocols. Since 1984, eight protocols have come into force. The most recent, the 1999 Protocol to Abate Acidification, Eutrophication and Ground-level Ozone (UNECE, 1999), came into force on 17 May 2005.

Table 1.1 presents the status of ratification of each protocol by the EU. The status differs across Member States.

On 4 May 2012, the Executive Body for the LRTAP Convention adopted amendments to the Gothenburg Protocol (UNECE, 2013). The new text of the protocol includes national emission reduction commitments for the main air pollutants to be achieved in 2020 and beyond. Further, the revised protocol will include emission reduction commitments for fine PM. Black carbon (a short-lived climate forcer) is included as a component of PM. Several of the protocol's technical annexes were revised with updated sets of emission limit values (emission standards), both for key stationary sources and for mobile sources of air pollution. For the EU, the emission reduction commitments from 2005 emission levels for 2020 and beyond are 59 % for sulphur dioxide (SO_2), 42 % for NO_X, 6 % for NH_3, 28 % for NMVOC and 22 % for $PM_{2.5}$ (UNECE, 2013).

The UNECE LRTAP Convention Executive Body approved the revised *Guidelines for reporting emission data under the Convention on Long-range Transboundary Air Pollution* at its 26th session in December 2008 (UNECE, 2009). These revised reporting guidelines describe the data that parties should report under the LRTAP Convention and its

Table 1.1 EU ratification status of the LRTAP Convention and related protocols

LRTAP Convention and its protocols	Status of ratification
Convention on Long-range Transboundary Air Pollution (1979) ([a])	Signed and ratified (approval)
Protocol on Long-term Financing of the Cooperative Programme for Monitoring and Evaluation of the Long-range Transmission of Air Pollutants in Europe (1984) ([b])	Signed and ratified (approval)
Protocol on the Reduction of Sulphur Emissions or their Transboundary Fluxes by at least 30 % (1985) ([c])	Not signed
Protocol concerning the Control of Emissions of Nitrogen Oxides or their Transboundary Fluxes (1988) ([d])	Ratified (accession)
Protocol concerning the Control of Emissions of Volatile Organic Compounds or their Transboundary Fluxes (1991) ([e])	Signed
Protocol on Further Reduction of Sulphur Emissions (1994) ([f])	Signed and ratified (approval)
Protocol on Persistent Organic Pollutants (1998) ([g])	Signed and ratified (approval)
Protocol on Heavy Metals (1998) ([h])	Signed and ratified (approval)
Protocol to Abate Acidification, Eutrophication and Ground-level Ozone (1999) ([i])	Ratified (accession)

Note: ([a]) UNECE, 1979 (Geneva Convention).
([b]) UNECE, 1984.
([c]) UNECE, 1985 (Helsinki Protocol).
([d]) UNECE, 1988 (Sofia Protocol).
([e]) UNECE, 1991 (Geneva Protocol).
([f]) UNECE, 1994 (Oslo Protocol).
([g]) UNECE, 1998a (Aarhus Protocol).
([h]) UNECE, 1998b (Aarhus Protocol).
([i]) UNECE, 1999 (Gothenburg Protocol. Amendments to the protocol were adopted on 4 May 2012).

protocols. A summary of the reporting requirements is provided in Appendix 2 to this report.

In 2014, parties were requested to report emissions data for NO_X, NMVOC, SO_X, NH_3, CO, HMs, POPs and PM, as well as associated activity data. As in the last two years, the EU also includes pollutants that can be reported additionally (As, Cr, Cu, Ni, Se, Zn, BaP, BbF, BkF, IP and TSPs). The deadline for individual parties to submit data to the LRTAP Convention is 15 February of each year, with a separate deadline of 15 March for submitting the accompanying inventory reports. The EU has separate reporting dates specified in the reporting guidelines, which allow time for the compilation of an aggregated inventory based on the individual submissions from Member States. EU-28 inventory data should be submitted by 30 April and the accompanying inventory report by 30 May, each year.

The reporting guidelines also request parties to report emission inventory data using an updated format: the European Monitoring and Evaluation Programme (EMEP) NFR09 format.

In 2012, the Executive Body for the LRTAP Convention decided that adjustments to emission reduction commitments, or to inventories for the purposes of comparing total national emissions with them, may be applied in some circumstances, in the event that such a circumstance contributes to a party being unable to meet one of its reduction commitments (UNECE, 2012a).

These circumstances are as follows:

(a) emission-source categories are identified that were not accounted for at the time when emission reduction commitments were set;

(b) emission factors used to determine emission levels for particular source categories for the year in which emission reduction commitments are to be attained are significantly different than the emission factors applied to these categories when emission reduction commitments were set;

(c) the methodologies used for determining emissions from specific source categories have undergone significant changes between the time when emission reduction commitments were set and the year they are to be attained.

The EMEP Steering Body will review any supporting documentation and assess whether the adjustment is consistent with the circumstances and the guidance for adjustments (UNECE, 2012b). The review will be made available to the parties, who have the option of making a submission to the Implementation Committee in accordance with Decision 2006/2 (UNECE, 2006).

In 2014, Belgium, Croatia, Denmark, France, Germany and Spain proposed data adjustments. However, these adjustments cannot be considered for the EU inventory until they have been approved.

1.1.2 Reporting obligations under the National Emission Ceilings (NEC) Directive and the EU Greenhouse Gas Monitoring Mechanism

EU Member States report their emissions of NO_X, NMVOC, SO_2 and NH_3 under Directive 2001/81/EC on national emission ceilings for certain atmospheric pollutants, known as the EU National Emission Ceilings (NEC) Directive (EC, 2001). They also report emissions of NO_X, SO_2, NMVOC and CO under Decision 280/2004/EC concerning a mechanism for monitoring Community greenhouse gas emissions and for implementing the Kyoto Protocol, known as the EU Greenhouse Gas Monitoring Mechanism (EC, 2004), for the United Nations Framework Convention on Climate Change (UNFCCC) (UNFCCC, 1992). This information should also be copied by Member States to the European Environment Agency (EEA) European Environment Information and Observation Network (Eionet) Reportnet Central Data Repository (CDR) (Eionet, 2014a). Table 1.2 provides an overview of these different reporting obligations for EU Member States.

Reporting obligations under the LRTAP Convention and NEC Directive have now been harmonised overall since the adoption of the updated reporting guidelines. They differ from the UNFCCC obligations in terms of the inclusion of domestic and international aviation and navigation in the reported national total. The main differences between the different reporting instruments are summarised in Table 1.3. The overall impact of these differences is small for most Member States.

Table 1.2 Overview of air emission reporting obligations in the EU, 2013–2014

Legal obligation	Emission reporting requirements ([a])	Annual reporting deadline for EU Member States	Annual international reporting deadline for the EU
LRTAP Convention	Emissions ([b]) of NO_X (as NO_2), NMVOC, SO_X (as SO_2), NH_3, CO, HMs, POPs ([c]) and PM	15 February 2014	30 April 2014
NEC Directive	Emissions of NO_X, NMVOC, SO_2 and NH_3	31 December 2013	n/a
EU Monitoring Mechanism/ UNFCCC	Emissions ([d]) of CO_2, CH_4, N_2O, HFCs, PFCs, SF_6, NO_X, CO, NMVOC and SO_2	15 January 2014 to the European Commission and 15 April 2014 to the UNFCCC	15 April 2014

Note: ([a]) The European Community/Union has signed a number of protocols over the years, with varying numbers of Member States included in the commitments. Therefore, emission reporting must be provided separately for the EU-9, EU-12, EU-15, EU-27 and EU-28 (see Appendix 2, Table A2.2 for explanations of the EU country groupings).

([b]) Parties are formally required to report only on the substances and for the years set forth in protocols that they have ratified and that have entered into force.

([c]) Starting with the 2010 reporting round, the list of POPs has been reduced to PCDD/Fs, total PAHs, HCB, HCH and PCBs.

([d]) Greenhouse gases (GHGs): methane (CH_4); nitrous oxide (N_2O); hydrofluorocarbons (HFCs); perfluorocarbons (PFCs); sulphur hexafluoride (SF_6).

Table 1.3 Air pollutant reporting obligations comparison: the LRTAP Convention, NEC Directive and EU Monitoring Mechanism/UNFCCC

	Included in national totals	Not included in national totals: memo item
Domestic aviation (LTO)	NEC, LRTAP, UNFCCC	n/a
Domestic aviation (cruise)	UNFCCC	NEC, LRTAP
International aviation (LTO)	NEC, LRTAP	UNFCCC
International aviation (cruise)	n/a	NEC, LRTAP, UNFCCC
National navigation (domestic shipping)	NEC, LRTAP, UNFCCC	n/a
International inland shipping	NEC, LRTAP	UNFCCC
International maritime navigation	n/a	NEC, LRTAP, UNFCCC
Road transport (fuel sold) (*)	NEC, LRTAP, UNFCCC	n/a

Note: (*) In addition, parties may also report emission estimates based on fuel used as an additional 'memo item'.

International inland shipping refers to shipping activity on continental waters, and international maritime navigation to marine water. Air emissions resulting from inland shipping are included, as they are more relevant in terms of air quality for the surrounding environment.

n/a: not applicable.

LRTAP: NO_X, NMVOC, SO_X, NH_3, CO, HMs, POPs, PM.

LTO: Landing and take-off.

NEC: NO_X, NMVOC, SO_2, NH_3.

UNFCCC: NO_X, NMVOC, SO_X, CO.

1.2 Institutional arrangements

1.2.1 Member States

Member States are responsible for selecting the activity data, emission factors and other parameters used for their national inventories. Member States should also follow the reporting guidelines (UNECE, 2009) and apply the methodologies contained in the latest version of the EMEP/EEA guidebook, which at the time of writing, is the *EMEP/EEA air pollutant emission inventory guidebook — 2013* (EMEP/EEA, 2013).

Member States are also responsible for establishing QA and QC programmes for their inventories. Where Member States compile an inventory report, a description of the QA and QC activities and recalculations should be included.

In addition to submitting their national LRTAP inventories and inventory reports, through participation in the Eionet network (see Section 1.2.2 below), Member States also take part in the annual review and commenting phase of the draft EU inventory report. Member States check their national

data and information used in the inventory report, and if necessary, send updates. General comments on the inventory report are also provided.

1.2.2 The EEA, European Commission, Eionet and ETC/ACM

European Environment Agency (EEA)

The EEA assists the European Commission's Directorate-General for the Environment (DG Environment) in compiling the annual EU LRTAP inventory.

EEA activities include:

- overall coordination and management of the inventory compilation process;
- coordination of activities of the EEA's European Topic Centre on Air Pollution and Climate Change Mitigation (ETC/ACM), which undertakes the data checking, compilation and draft report-writing tasks;
- communication with the European Commission;
- communication with Member States;
- circulation of the draft EU emission inventory and inventory report;
- hosting the official inventory database, and carrying out web dissemination of data and the inventory report.

Since 2004, the EEA and EMEP have supported a separate annual quality review of emission data submitted by countries. Findings are provided to countries each year with the objective of improving the quality of emission data reported. A joint report summarising the review findings is published each year by EMEP. Section 1.6 below provides further details of the annual data review process.

European Commission

The European Commission formally submits the EU's emission inventory data and inventory report to EMEP through the Executive Secretary of UNECE.

European Topic Centre on Air Pollution and Climate Change Mitigation (ETC/ACM)

With regard to the EU's LRTAP Convention emissions inventory, the main ETC/ACM ([7]) activities include:

- initial checks, testing and centralised review of Member State submissions in cooperation with EMEP/CEIP, and compiling results from those checks (status reports, country synthesis and assessment reports, country review reports);
- consulting with Member States (via the EEA) in order to clarify data and other information provided;
- preparing the gap-filled EU emission inventory and inventory report by 30 April, based on Member State submissions (subsequently submitted by the Commission to UNECE);
- preparing the updated EU emission inventory and inventory report by 30 May.

European Environment Information and Observation Network (Eionet)

The work of the EEA and the ETC/ACM is facilitated by Eionet (EC, 1999), which comprises the EEA (supported by its European Topic Centres), a supporting network of experts from national environment agencies, and other bodies that deal with environmental information (Eionet, 2014b). Member States are requested to use the CDR of the Eionet Reportnet tools to make their LRTAP Convention submissions available to the EEA.

1.2.3 Planning, preparation and management

Each year, Member States upload their individual emission estimates and inventory reports to the CDR. The EEA (via the ETC/ACM) compiles the data from the CDR and performs a QA and QC analysis. Should any clarifications be needed or inconsistencies detected, Member States are contacted directly by the ETC/ACM (via the EEA). Data gaps in Member States' inventories are gap-filled, and the gap-filled data are compiled into an EU total inventory. The European Commission formally submits the EU's emission inventory data

([7]) The current ETC/ACM was established by contract between the lead organisation, the National Institute for Public Health and the Environment (RIVM, Rijksinstituut voor Volksgezondheid en Milieu), and the EEA in 2014. It works with 14 organisations and institutions across 10 European countries.

and IIR to EMEP through the Executive Secretary of UNECE.

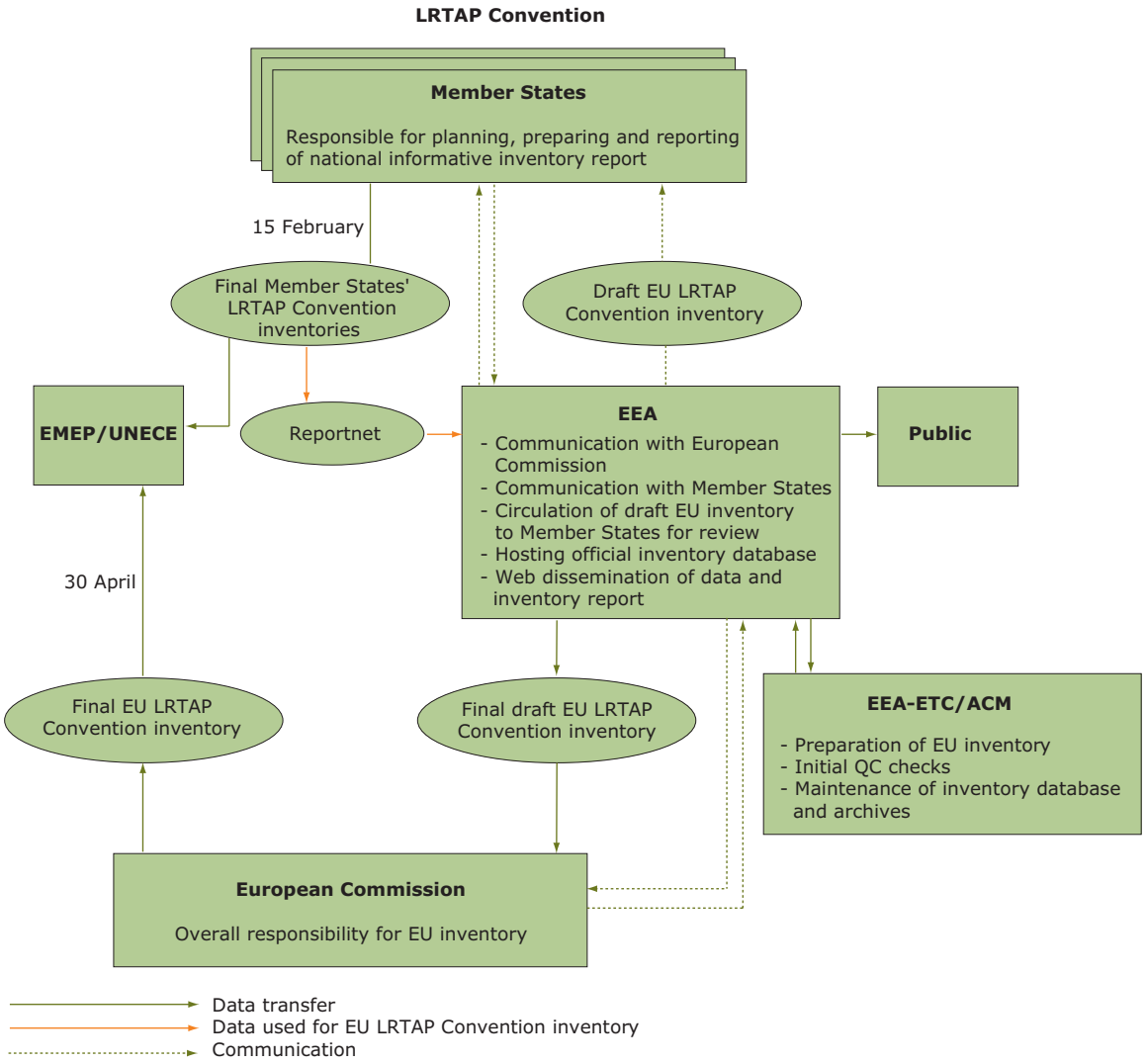
Throughout this process, the EEA acts as the main contact point for the European Commission, the ETC/ACM and the Member States. It manages the timely and complete submission under the LRTAP Convention and its protocols.

1.3 Inventory preparation process

No specific EU directive implements the LRTAP Convention's requirements for estimating air emissions and preparing air emission inventories. The basis of reporting for individual Member States and for the EU remains the LRTAP Convention (UNECE, 1979), its protocols (Table 1.1) and subsequent decisions taken by the Executive Body. As noted earlier, the reporting guidelines describe the data that parties should report under the LRTAP Convention and its protocols. Under the agreement between Eionet countries and the EEA concerning priority data flows, EU Member States are requested to post a copy of their official submission to the LRTAP Convention in the CDR, by 15 February each year. The ETC/ACM subsequently collects the data from the CDR, compiles the gap-filled EU LRTAP Convention emission inventory database, and produces a EU LRTAP Convention emission inventory and inventory report.

Within this legal and procedural framework, preparation of the annual LRTAP Convention emission inventory involves the following: provision of data by Member States; receipt of data on behalf of the European Commission and the EEA, and finally, data compilation, gap-filling of missing data and preparation of the actual inventory by the EEA and its ETC/ACM. The inventory and accompanying

Figure 1.1 Data flow for compiling the EU LRTAP Convention emission inventory



documentation are then made publicly available through the EEA website. Figure 1.1 presents a flow chart illustrating the data flow used to compile the EU's LRTAP Convention emission inventory.

1.4 Methods and data sources

The EU LRTAP Convention emission inventory is based on an aggregation of data reported by Member States. Member States should have reported inventory data to UNECE (and were requested also to provide a copy of these data to the EEA) no later than 15 February 2014.

The updated reporting guidelines (UNECE, 2009) request that emissions data be provided by parties to the convention using the NFR09 format. In total, 27 Member States used the new NFR09 reporting templates. Table 1.4 indicates which information the parties provided, but does not indicate the completeness of each category. Detailed information on the Member States' submissions is presented in Appendix 3.

The recommended structure for an IIR involves a general description of methodologies and data sources used. This includes an overview of emission factors (country specific or default (i.e. of the EMEP/EEA guidebook (EMEP/EEA, 2013))) used in the national inventory, specifying sources of default emission factors and methods. This also includes an elaborated description of activity data sources where data differ from national statistics. The following two subsections summarise the information provided by Member States in their IIRs, helping readers understand the foundation of the EU inventory. For detailed descriptions of methodologies and data sources, see the IIRs of Member States (see Appendix 5, Member State informative inventory reports (IIRs) for IIR references).

Figure 1.2 Dates of first data submissions received from Member States (as of 12 May 2014)

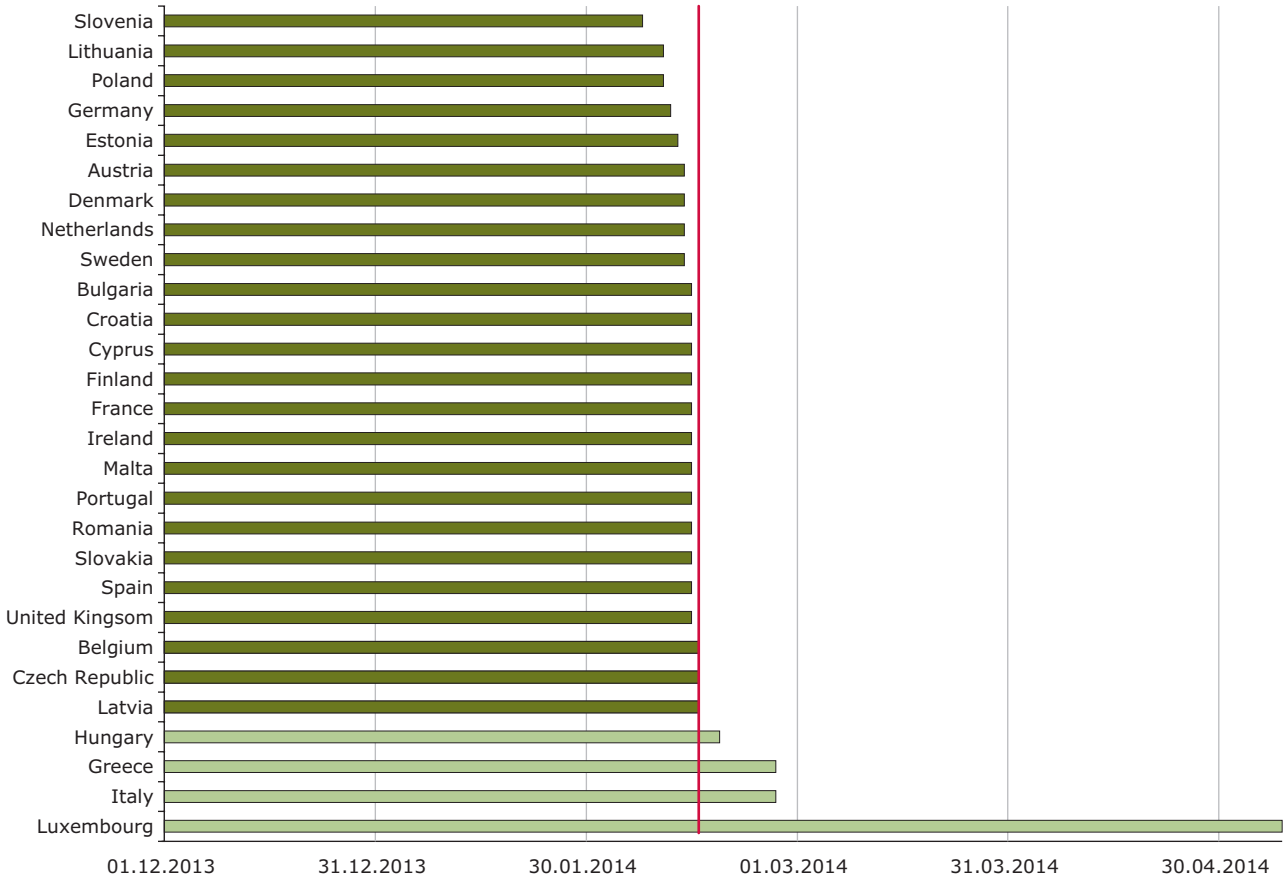


Table 1.4 Status of reporting by Member States (as of 12 May 2014)

Member State	Air emission inventory	Activity data	Informative inventory report	Gridded data	Large point sources	Projections
Austria	x	x	x			x
Belgium	x	x	x			x
Bulgaria	x	x	x			x
Croatia	x	x	x	x	x	x
Cyprus	x	x	x	x	x	x
Czech Republic	x	x				
Denmark	x	x	x			x
Estonia	x	x	x			x
Finland	x	x	x	x	x	x
France	x	x	x			x
Germany	x	x	x			x
Greece	x		x			x
Hungary	x	x				
Ireland	x	x	x			
Italy	x	x	x			
Latvia	x	x	x			x
Lithuania	x	x	x	x	x	x
Luxembourg	x	x				
Malta	x	x				
Netherlands	x	x	x			x
Poland	x	x	x			
Portugal	x	x	x			
Romania	x	x	x			x
Slovakia	x	x	x			x
Slovenia	x	x	x			x
Spain	x	x	x	x	x	x
Sweden	x	x	x			
United Kingdom	x	x	x			x

Note: An 'x' indicates that the Member States submitted the information, but does not provide an indication of the completeness of the provided information. For example, 'x' marked in the category 'Air emission inventory' only indicates that at least some pollutants for some years have been reported. For detailed information on the completeness of reporting, see Appendix 3, Status of reporting.

1.4.1 Data sources

The data source for the EU inventory is Member States' emission inventories. Data sources for these underlying inventories may vary across the different Member States, but all should follow the recommendations of the EMEP/EEA guidebook (EMEP/EEA, 2013). This ensures that although inconsistencies might occur, the best available method is used to compile the EU inventory. The main data sources are national statistics, energy balances, agricultural statistics, etc. or any other reporting in line with national/international reporting requirements (e.g. the Large Combustion Plants Directive (2001/80/EC), the Emissions Trading Directive (2009/29/EC), and European Pollutant Release and Transfer Register (E-PRTR) Regulation No 166/2006).

Detailed information concerning the data sources used by Member States should be documented in the IIRs, if available. The level of detail varies widely across Member States, although the main data sources are official national statistics. Table 1.5 summarises commonly used data sources for the various sectors.

Table 1.5 Data sources commonly used for inventory sectors

Energy	Energy balances, EU Emissions Trading Scheme (EU ETS) data, large combustion plant data and large point source (LPS) surveys
Transport	Energy balances, vehicle fleet statistics
Industry and solvents	National production statistics, trade statistics, data from plant operators (facility reports), reporting under the European Pollutant Emission Register (EPER) and European Pollutant Release and Transfer Register (E-PRTR)
Agriculture	National agricultural statistics, specific studies
Waste	Landfill databases, national studies, national statistics, information from municipalities

Sources for emission factors vary according to the tier method used. One main source for emission factors is provided in the EMEP/EEA guidebook (EMEP/EEA, 2013), but they can also be country or even plant specific. A survey on the emission factors used by the Member States for all emission sources cannot be carried out, as this information is not uniformly available: some countries report details on their methodologies, while others do not. Detailed information is available in the IIRs submitted by Member States; references to these reports are provided in Appendix 5.

1.4.2 Comparison of Member State emissions calculated on the basis of fuel sold vs fuel consumed in road transport

In Article IV, paragraph 15, the reporting guidelines (UNECE, 2009) specify how emissions from transport should be reported: 'For emissions from transport, parties within the EMEP region should calculate and report emissions consistent with national energy balances reported to Eurostat or the International Energy Agency. Emissions from road vehicle transport should therefore be calculated and reported on the basis of the fuel sold in the Party concerned […] In addition, Parties may report emissions from road vehicles based on fuel used or kilometres driven in the geographic area of the Party. The method for the estimate(s) should be clearly specified in the IIR.'

In paragraph 16 of the guidelines, the basis for compliance checking is detailed: 'For Parties within the EMEP region for which emission ceilings are derived from national energy projections based on the amount of fuels sold, compliance checking will be based on the reporting on the basis of fuels sold in the geographic area of the Party. Other Parties within the EMEP region (Austria, Belgium, Ireland, Lithuania, Luxemburg, the Netherlands, Switzerland and United Kingdom) may choose to use the national emission total calculated on the basis of fuels used in the geographic area of the Party as a basis for compliance.'

When fuel purchased within a country is actually used outside the country (and vice versa), transport emissions estimated using the amount of fuel sold within a country can differ significantly from those estimated using fuel consumed.

In the EU inventory, emissions from road transport are based on fuel sold, except for Belgium, the Netherlands and the United Kingdom. Belgium is aware of the need to report transport emissions based on fuel sold and is working to resolve this issue. It is one of the priorities of the Technical Group on Transport of the Working Group 'Emissions' of the Coordination Committee for International Environmental Policy (CCIEP) to reach a solid solution that can be applied consistently across all three Belgian regions (Appendix 5, Belgium's IIR). The Netherlands reported its inventory (national total and data for the categories) on the basis of fuel used, and reported an additional national total on the basis of fuel sold. But as there are no fuel sold data available for the categories, the Netherlands' emission data based on fuel used were used to compile the EU inventory. Only the CLRTAP submissions of Austria, the Czech Republic, Ireland, Luxembourg and the Netherlands reported national totals in the NFR templates based on fuel used that differed from emissions based on fuel sold. For these countries, Table 1.6 shows the difference between total emissions for the year 2012, calculated using the two approaches.

The other decisive factor for achieving consistent EU numbers is the method Member States use to calculate their emissions from road transport.

Table 3.5 indicates that the COmputer Programme to calculate Emissions from Road Transportation (COPERT) (EMEP/EEA, 2009) is not used by all countries; moreover, even where COPERT is used, different versions of the programme may be applied. The impact of using these different approaches for EU transport emissions has not been quantified.

Table 1.6 Comparison of Member States' total emissions calculated on the basis of fuel sold and fuel consumed, 2012

Member States		NO_x Gg	NMVOC Gg	SO_x Gg	NH_3 Gg	PM_{10} Gg	$PM_{2.5}$ Gg	CO Gg	Cd Mg	Hg Mg	Pb Mg	Dioxin g	Total PAH Mg	HCB kg	HCH kg	PCB kg
Austria	National Total	180	136	17	62	34	19	609	1	1	15	38	8	41	NR	NR
	National Total (FU)	141	133	18	62	33	18	587	1	1	15	37	7	41	NR	NR
	Difference	– 21 %	– 2 %	4 %	0 %	– 4 %	– 4 %	– 4 %	0 %	0 %	0 %	– 1 %	– 6 %	0 %		
Czech Republic	National Total	211	129	158	64	34	20	342	1	3	23	45	19	3	NE	34
	National Total (FU)	213	123	158	64	35	20	345	1	3	23	45	20	3	NE	34
	Difference	1 %	– 4 %	0 %	0 %	1 %	1 %	1 %	0 %	0 %	0 %	1 %	0 %	0 %		0 %
Ireland	National Total	74	43	23	105	13	8	118	0	0	16	15	2	1	NA	17
	National Total (FU)	71	43	23	105	13	8	114	0	0	15	15	2	NA	NA	17
	Difference	– 3 %	– 1 %	0 %	0 %	– 2 %	– 2 %	– 3 %	– 1 %	0 %	– 6 %	0 %	– 1 %			0 %
Luxembourg	National Total	46	9	2	7	10	3	43	NR	NR	NR	1	1	0	0	2
	National Total (FU)	17	8	2	6	8	1	24	0	0	0	1	1	1	0	2
	Difference	– 64 %	– 9 %	– 1 %	– 3 %	– 17 %	– 48 %	– 44 %				27 %	0 %	68 %		– 1 %
Netherlands	National Total	267	146	34	NE	25	13	569	NE	NE	16	NE	NE	NE	NE	NE
	National Total (FU)	248	146	34	120	27	13	561	1	1	16	23	4	2	NO	0
	Difference	8 %	0 %	0 %		– 7 %	2 %	2 %			– 1 %					

1.4.3 General methods

The methods used by Member States should follow those described in the EMEP/EEA emissions guidebook (EMEP/EEA, 2013). Overall, Member States do follow this recommendation, which ensures that best available methods are used for estimating national emissions and that inventories are improved continuously. Moreover, the technical review procedures set up by the EMEP CEIP check and assess parties' data submissions in accordance with the review guidelines, with a view to improving the quality of emission data and associated information reported to the LRTAP Convention.

1.4.4 Data gaps and gap-filling

Ideally, there should be no need to gap-fill the reported inventory data, as it is the responsibility of Member States to submit full and accurate inventory data sets. However, as Tables 1.9 and 1.10 indicate, Member State submissions contain various data gaps for particular pollutants or years in the time series.

Some of the most frequent problems observed occur when:

- submissions (whole national inventory) are not provided for the most recent year and/or other years;
- emissions of some pollutants (e.g. PM, HMs, POPs and NH_3) are not provided, for a single year, several years or the entire time-series;
- sectoral emissions are missing and only national totals are provided.

The EMEP reporting guidelines (UNECE, 2009) require that submitted emission inventories be complete. Before 2010, the inventory for the European Community was already partially gap-filled; official data reported by Member States

under other reporting obligations (e.g. the NEC Directive (EC, 2001) and the EU Greenhouse Gas Monitoring Mechanism (EC, 2004)) were used to fill gaps. Nevertheless, this process still resulted in the Community's inventory being incomplete for certain pollutants and years.

Reflecting the need to submit a more complete data set, several discussions were held in 2008 and 2009 with Member State representatives to agree on approaches that would achieve more complete gap-filling of the EU emission inventory. At a meeting in September 2009 ([8]), Member State representatives agreed to trial an improved procedure in 2010. In line with this agreement, the gap-filling procedure used during the compilation of the EU's 2010, 2011 and 2012 emissions inventory was performed following a methodology paper developed by the EEA and ETC/ACM (EEA, 2009). This procedure is also consistent with the suggested techniques to fill emission data gaps described in the EMEP/EEA guidebook (EMEP/EEA, 2013).

A stepwise approach was used to fill gaps in the national data sets.

1. Emission trends of all pollutants were compiled from 1990 onward using the Member State LRTAP Convention emission inventories provided to the EEA in 2014.

2. For Member States that did not report complete data, emissions data reported in 2014 officially by Member States under the EU Greenhouse Gas Monitoring Mechanism (NO_X, NMVOC, SO_2 and CO), and subsequently under the NEC Directive (NO_X, NMVOC, SO_2 and NH_3), were used in the first instance to fill gaps. In this step, notation keys were not used.

3. In a further step, notation keys reported in 2014 by Member States under the EU Greenhouse Gas Monitoring Mechanism (NO_X, NMVOC, SO_2 and CO), and subsequently under the NEC Directive (NO_X, NMVOC, SO_2 and NH_3), were used to fill any remaining gaps.

4. LRTAP Convention data submitted to EMEP/CEIP in 2014 was the next source used to fill remaining gaps (in fact, there should be no difference between the MS LRTAP Convention emission inventories provided to the EEA and the data submitted to EMEP/CEIP).

5. In the next step, Member State LRTAP Convention emission inventories provided to the EEA in previous years were used to fill gaps still remaining, followed by emission data reported in previous years under the EU Greenhouse Gas Monitoring Mechanism.

6. Older LRTAP Convention data submitted to EMEP/CEIP were the final source of official information used to fill gaps.

7. Finally, for all remaining cases of missing data, further gap-filling procedures were applied in accordance with the procedures described by the EEA (2009).

The further gap-filling procedures described in Step 7 are summarised below.

(a) Linear interpolation was performed if one or several years in the middle of a time series were missing.

(b) Linear extrapolation was performed if one or several years at the beginning or at the end of a time series were missing, and if at least 5 consecutive years showing a clear trend ($r^2 \geq 0.6$) were available. Extrapolation 'backwards' was never allowed to result in negative values.

(c) If fewer than 5 consecutive years were available as a basis for extrapolation, or if years did not show a clear trend (this is the case when $r^2 < 0.6$), the value of the previous or next year was used to fill the gaps.

(d) If the notation keys NA or NO were used as a basis for gap-filling, they were treated as '0' and were not gap-filled.

Moreover, gap-filling was only applied where national total and sectoral data were unavailable, or where a national total was available but there were no sectoral data. In the former instance, sectors were first gap-filled and then summed to determine the total. In the latter instance, the sectoral split of the previous or following year was used to fill the gaps. If a national total was available but the sectoral data were incomplete, no gap-filling was carried out.

Tables 1.7 and 1.8 show how gap-filling affects the total emissions at EU level. Generally, the need to gap-fill 2012 data is much lower than it was for 1990

([8]) Meeting of the Air and Fuels Committee under Directive 96/62/EC: Information on the Member States reporting under the NEC Directive (2001/81/EC), 28.09.2009, Brussels.

Table 1.7 Effect of gap-filling on EU emission data for the year 2012

Pollutant	Reporting of national totals in 2012								Gap-filling			
	Number of Member States reporting emission values	Number of Member States reporting 'NE'	Number of Member States reporting 'NR'	Number of Member States reporting 'NA'	Number of Member States reporting 'NO'	Number of Member States reporting 'IE'	Number of Member States reporting 0	Number of Member States not reporting (empty cells)	Number of Member States gap-filled with value	Number of Member States gap-filled with notation key	Effect on EU national total	EU-28 inventory complete?
NO_x	28	0	0	0	0	0	0	0	0	0	0 %	Yes
NMVOC	28	0	0	0	0	0	0	0	0	0	0 %	Yes
SO_x	28	0	0	0	0	0	0	0	0	0	0 %	Yes
NH_3	28	0	0	0	0	0	0	0	0	0	0 %	Yes
$PM_{2.5}$	27	0	0	0	0	0	0	1	0	0	0 %	No
PM_{10}	27	0	0	0	0	0	0	1	0	0	0 %	No
TSP	27	0	0	0	0	0	0	1	0	0	0 %	No
CO	28	0	0	0	0	0	0	0	0	0	0 %	Yes
Pb	26	0	0	0	0	0	0	2	1	1	19 %	No
Cd	26	0	0	0	0	0	0	2	1	1	3 %	No
Hg	26	0	0	0	0	0	0	2	1	1	17 %	No
As	24	0	2	0	0	0	0	2	1	1	2 %	No
Cr	24	0	2	0	0	0	0	2	1	1	3 %	No
Cu	24	0	2	0	0	0	0	2	1	1	0 %	No
Ni	24	0	2	0	0	0	0	2	1	1	12 %	No
Se	22	2	2	0	0	0	0	2	2	1	0 %	No
Zn	24	0	2	0	0	0	0	2	1	1	1 %	No
PCDD/Fs	26	0	0	0	0	0	0	2	1	0	0 %	No
Benzo(a)pyrene	20	3	1	0	0	2	0	2	1	0	0 %	No
Benzo(b)fluoranthene	20	3	1	0	0	2	0	2	1	0	0 %	No
Benzo(k)fluoranthene	19	3	1	0	0	2	1	2	1	0	0 %	No
Indeno(1,2,3-cd) pyrene	20	3	1	0	0	2	0	2	1	0	0 %	No
Total PAHs	26	0	0	0	0	0	0	2	1	0	0 %	No
HCB	26	0	0	0	0	0	0	2	1	0	0 %	No
HCH	2	5	2	7	4	0	5	3	0	1	0 %	No
PCBs	24	0	1	0	1	0	0	2	2	0	0 %	No

Note: The analysis refers only to the national total in 2012 for the entire territory.

Table 1.8 Effect of gap-filling on EU emission data for the year 1990

Pollutant	Reporting of national totals in 1990								Gap-filling			
	Number of Member States reporting emission values	Number of Member States reporting 'NE'	Number of Member States reporting 'NR'	Number of Member States reporting 'NA'	Number of Member States reporting 'NO'	Number of Member States reporting 'IE'	Number of Member States reporting 0	Number of Member States not reporting (empty cells)	Number of Member States gap-filled with value	Number of Member States gap-filled with notation key	Effect on EU national total	EU-28 inventory complete?
NO_x	22	0	0	0	0	0	0	6	6	0	16 %	No
NMVOC	22	0	0	0	0	0	0	6	6	0	10 %	No
SO_x	22	0	0	0	0	0	0	6	6	0	25 %	No
NH_3	22	0	0	0	0	0	0	6	6	0	20 %	No
$PM_{2.5}$ (*)	12	2	7	0	0	0	0	7	15	0	43 %	No
PM_{10} (*)	12	2	7	0	0	0	0	7	15	0	45 %	No
TSP	14	2	5	0	0	0	0	7	13	0	33 %	No
CO	22	0	0	0	0	0	0	6	6	0	15 %	No
Pb	20	0	0	0	0	0	0	8	7	1	11 %	No
Cd	20	0	0	0	0	0	0	8	7	1	45 %	No
Hg	20	0	0	0	0	0	0	8	7	1	33 %	No
As	18	0	2	0	0	0	0	8	7	1	45 %	No
Cr	18	0	2	0	0	0	0	8	7	1	24 %	No
Cu	18	0	2	0	0	0	0	8	7	1	21 %	No
Ni	18	0	2	0	0	0	0	8	7	1	27 %	No
Se	17	1	2	0	0	0	0	8	7	1	13 %	No
Zn	18	0	2	0	0	0	0	8	7	1	32 %	No
PCDD/Fs	20	0	0	0	0	0	0	8	8	0	44 %	No
Benzo(a)pyrene	14	3	1	0	0	2	0	8	7	0	22 %	No
Benzo(b)fluoranthene	14	3	1	0	0	2	0	8	7	0	30 %	No
Benzo(k)fluoranthene	13	3	1	0	0	2	1	8	7	0	46 %	No
Indeno(1,2,3-cd) pyrene	14	3	1	0	0	2	0	8	8	0	57 %	No
Total PAHs	20	0	0	0	0	0	0	8	7	0	47 %	No
HCB	20	0	0	0	0	0	0	8	7	0	3 %	No
HCH	6	3	2	7	2	0	0	8	0	1	0 %	No
PCBs	18	0	1	0	1	0	0	8	9	0	25 %	No

Note: The analysis refers only to the national total in 1990 for the entire territory.
(*) Parties to the LRTAP Convention are formally requested to report emissions of PM for the year 2000 and after.

data. It is notable that in 2012 few Member States reported no emission values or notation keys, or the notation key 'not estimated' (NE); this incidence is highest for HCH, with 13 Member States reporting 'NE', 0 or empty cells. On the whole, the contribution of gap-filling is rather low. In contrast, gap-filling of 1990 data can constitute a high percentage of the national total (e.g. over 45 % for As, Cd and PM_{10}; see Table 1.8).

Still, inventories for all pollutants cannot be considered complete: even when the notation keys NE or 0, and in some cases, NR, are used for gap-filling, the respective inventory is still considered incomplete at EU level.

Tables 1.9 and 1.10 show how the various officially reported data sets were used to supplement the LRTAP Convention data submissions for those Member States where gap-filling was required. The trend tables in Chapter 2 provide an initial overview indicating which data have been gap-filled. Annex D offers a more detailed overview, showing, for each Member State, which data were gap-filled and how this was performed.

Compared with previous years, the gap-filling procedure used from 2010 to 2014 has resulted in a more accurate determination of EU emission trends and of the most significant emission sources of the various pollutants. For certain pollutants (PM, some HMs and POPs), particular Member States in certain cases lacked data for all years, and gap-filling was thus impossible. In such instances, the EU-28 emission totals for these pollutants are not considered complete (i.e. they are underestimated).

1.4.5 Gridded data

According to the revised reporting guidelines, parties within the geographical scope of EMEP should report gridded data every 5 years, commencing in 1990. Gridded data for the EU were last submitted in 2012 (EEA, 2012) and hence are not reported again this year. However, it should be noted that in 2014, Croatia, Cyprus, Finland, Lithuania and Spain provided gridded data for one or several years (see Table A3.1).

1.4.6 Large point sources (LPSs)

Parties within the geographical scope of EMEP are also required to provide data on LPSs every 5 years, commencing in 2000. LPS data for the EU were last submitted in 2012 (EEA, 2012) and hence are not reported again this year. However, it is noted that in 2014, Croatia, Cyprus, Finland, Lithuania and Spain provided LPS data for one or several years (see Table A3.1).

Further information concerning the last submission of EU LPS data is provided in Annex G of the annual European Community emission inventory report 1990–2010 (EEA, 2012).

1.5 Key category analyses

1.5.1 EU-28 key category analysis (KCA)

It is good practice to identify key inventory categories in a systematic and objective manner by performing a quantitative analysis, either of the magnitude of emissions (a 'level' assessment) or of the change in emissions from year to year (a 'trend' assessment), relative to total national emissions. A key category is defined as an emission-source category that has significant influence on a country's total inventory in terms of the absolute level of emissions, the trend in emissions, or both. In this report, categories jointly responsible for 80 % of the national total emission of a given pollutant are classified as key categories (as per the EMEP/EEA guidebook (EMEP/EEA, 2013)).

EU-28 key categories were determined using a level analysis of 2012 emissions for each pollutant (following any necessary gap-filling). It should be noted that when the notation IE ('included elsewhere') was used by a Member State for a particular source/pollutant combination, the KCA is likely to have underestimated the category concerned, and overestimated that in which emissions were reported instead. In addition, as described earlier, PM, HMs and POPs data from some Member States could not be gap-filled, as no data were reported for any years. To enable presentation of a provisional KCA for these pollutants, in these instances emissions were aggregated without including data for all the EU-28 Member States. The trend tables in Chapter 2 presenting Member State emissions show the instances where data were not reported.

Chapter 2 provides a summary of the top 5 EU-28 key categories in 2012, for each pollutant. A complete list of all EU-28 key categories for NO_X, NMVOC, SO_X, NH_3, $PM_{2.5}$, PM_{10} and CO, HMs (Pb, Cd, Hg) and POPs (PCDD/Fs, total PAHs, HCB and PCBs) emissions is also given in the following subsection. Due to the sparse data availability for HCH, the EU total of this pollutant is incomplete and the KCA could not be performed. Detailed KCA calculations are provided in Annex C to this report.

Table 1.9 Data sources of the main pollutants NO_X, NMVOC, SO_X, NH_3, CO, $PM_{2.5}$, PM_{10} and TSP emissions, used for the 2014 EU-28 inventory compilation (as of 12 May 2014)

Member State	NFR as provided as LRTAP Convention submission via Eionet		CRF as provided under Council Decision 280/2004/EC via Eionet (NO_X, NMVOC, SO_X, CO)	NFR as provided via NEC Directive (NO_X, NMVOC, SO_X, NH_3)	Data submitted via LRTAP Convention to EMEP (CEIP database)
	NO_X, NMVOC, SO_X, NH_3, CO	$PM_{2.5}$, PM_{10} and TSPs			
Austria	1980–2012	1990, 1995, 2000–2012			
Belgium	1990–2012	2000–2012			
Bulgaria	1990–2012	1990–2012			
Cyprus	2008–2012	2008–2012	CO: 1990–2007		
Czech Republic	2011–2012	2011–2012	NO_X, NMVOC: 1990–2005, 2009; SO_X: 1990–2005, 2008–2009; CO: 1990–2010		NH_3: 2001, 2009; PM_{10}, TSP: 2001, 2009; $PM_{2.5}$: 2009
Denmark	1985–2011; SO_X: 1980–2012	2000–2012			
Estonia	1990–2012	$PM_{2.5}$, PM_{10}: 2000–2012; TSP: 1990–2012			
Finland	NO_X, SO_X, NH_3: 1980–2012; NMVOC: 1987–2012; CO: 1990–2012	2000–2012			
France	NO_X, SO_X, NH_3, CO: 1980–2012; NMVOC: 1988–2012	1990–2012			
Germany	1990–2012	$PM_{2.5}$, PM_{10}: 1995–2012; TSP: 1990–2012			
Greece	1990–2012				
Hungary	1990–2012	2000–2012			
Ireland	NO_X, NMVOC, SO_X: 1987, 1990–2012; NH_3, CO: 1990–2012	1990–2012			
Italy	1980–2012	1990–2012			
Latvia	1990–2012	2000–2012			
Lithuania	1990–2012	1990–2012			
Luxembourg	1990–2012	1990–2012			
Malta	2000–2012	2000–2012	1990–1999		
Netherlands	1990–2012	1990–2012			
Poland	1995–2012	1995–2012	NO_X, NMVOC, SO_X: 1990–1994; CO: 1990, 1992–1994		
Portugal	1990–2012	1990–2012			
Romania	2005–2012	2005–2012	1990–2004		
Slovakia	2000–2012	2000–2012	1990–1999		
Slovenia	NO_X, SO_X, CO: 1980–2012; NH_3: 1986–2012; NMVOC: 1990–2012	2000–2012			
Spain	1990–2012	2000–2012			
Sweden	1990–2012	1990–2012			
United Kingdom	1980–2012	1980–2012			

Table 1.10 Data sources of HMs (Pb, Cd, Hg, As, Cr, Cu, Ni, Se, Zn) and POP (PCDD/Fs, total PAHs, BaP, BbF, BkF, IP, HCB, HCH and PCBs) emissions, used for the 2014 EU-28 inventory compilation (as of 12 May 2014)

Member State	NFR as provided as LRTAP Convention submission via Eionet			Data submitted via LRTAP Convention to EMEP (CEIP database)
	Pb, Cd, Hg, As, Cr, Cu, Ni, Se, Zn	PCDD/Fs, HCB, HCH, PCBs	PAHs: Benzo(a)pyrene, Benzo(b)fluoranthene, Benzo(k)fluoranthene, Indeno(1,2,3–cd)pyrene, total PAHs	
Austria	1985–2012 (Pb, Cd, Hg)	1985–2012(PCDD/Fs, HCB)	1985–2012 (total PAHs)	
Belgium	1990–2012	1990–2012	1990–2012 (total PAHs)	
Bulgaria	1990–2012	1990–2012 (PCDD/Fs, HCB, PCBs)	1990–2012	
Cyprus	2008–2012	2008–2012 (PCDD/Fs, HCB, PCBs)	2008–2012	
Czech Republic	2011–2012	2011, 2012 (PCDD/Fs, HCB, PCBs)	2011–2012	HMs, PCDD/Fs, total PAHs, PCB: 2001, 2003–2006, 2009; other PAHs, HCB: 2003–2006, 2009
Denmark	1990–2012	1990–2012 (PCDD/Fs, HCB, PCBs)	1990–2012	
Estonia	1990–2012	1990–2012 (PCDD/Fs, HCB, PCBs)	1990–2012	
Finland	1990–2012 (Pb, Cd, Hg, As, Cr, Cu, Ni, Zn)	1990–2012 (PCDD/Fs, HCB, PCBs)	1990–2012 (total PAHs)	
France	1990–2012	1990–2012 (PCDD/Fs, HCB, PCBs)	1990–2012	
Germany	1990–2012	PCDD/Fs, HCB, PCBs: 1990–2012; HCH: 1990–1997	1990–2012 (Benzo(a)pyrene, Benzo(b)fluoranthene, Indeno(1,2,3–cd)pyrene, total PAHs)	
Greece				
Hungary	1990–2012	1990–2012	1990–2012	
Ireland	1990–2012	1990–2012 (PCDD/Fs, HCB, PCBs)	1990–2012	
Italy	1990–2012	1990–2012 (PCDD/Fs, HCB, PCBs)	1990–2012 (total PAHs)	
Latvia	1990–2012	1990–2012 (PCDD/Fs, HCB, PCBs)	1990–2012	
Lithuania	1990–2012	1990–2006; 2008–2012 (PCDD/Fs, HCB, PCBs)	1990–2006, 2008–2012	
Luxembourg				HMs: 2007
Malta	2000–2012	2010–2012 (PCDD/Fs, HCB, PCBs)	2010–2012	
Netherlands	1990–2012	PCDD/Fs, HCB: 1990–2012, PCBs: 1995, 1998, 2002, 2004, 2005	1990–2012	
Poland	1995–2012 (Pb, Cd, Hg, As, Cr, Cu, Ni, Zn)	1995–2012 (PCDD/Fs, HCB, PCBs)	1995–2012	
Portugal	1990–2012	1990–2012 (PCDD/Fs, HCB, PCBs)	1990–2012 (total PAHs)	
Romania	2005–2012	2005–2012 (PCDD/Fs, HCB, PCBs)	2005–2012	PCDD/Fs, HCB, PCB, PAHs: 2004
Slovakia	2000–2012	2000–2012(PCDD/Fs, HCB, PCBs)	2000–2012	
Slovenia	1990–2012 (Pb, Cd, Hg)	1990–2012 (PCDD/Fs, HCB, PCBs)	1990–2012	
Spain	1990–2012	PCDD/Fs, HCB, PCBs: 1990–2012; HCH: 1990–2002	1990–2012 (total PAHs)	
Sweden	1990–2012	1990–2012 (PCDD/Fs, HCB, PCBs)	1990–2012	
United Kingdom	1980–2012	1990–2012	1990–2012	

1.5.2 Main emission sources

Table 1.11 presents the EU-28 key categories, i.e. the individual sources that overall contributed most to 2012 emissions of pollutants, determined by a level assessment for each of the main air pollutants, PM, HMs and POPs. The additional HMs and POPs and TSPs are not considered in this subsection.

A total of 49 different emission inventory source categories were identified as being key categories for at least 1 pollutant. A number of emission categories were identified as being key categories for more than 1 of the 14 pollutants assessed. '1 A 4 b i — Residential: Stationary plants' and '1 A 1 a — Public electricity and heat production' were identified as being important emission sources for 13 and 11 pollutants, respectively. Similarly, '1 A 2 f i — Stationary combustion in manufacturing industries and construction: Other' was a key category for 9 pollutants, and the categories '2 C 1 — Iron and steel production' and '1 A 3 b i — Road transport: Passenger cars' were key categories for 8 and 7 pollutants, respectively.

Nine and eight key categories were identified for NO_X, and CO, respectively, and as expected for both these pollutants, all key categories are sectors involving fuel combustion or thermal processes. Six key categories were identified for SO_X (energy related, again), and NH_3 (all six from the 'Agriculture' sector). PM_{10}, $PM_{2.5}$ and NMVOC emission sources are more diverse, and thus larger numbers of source categories make up the key category threshold of 80 % of total emissions. For the PM pollutants, more than half of the key categories were energy related, while for NMVOC, high activity levels associated with solvents and product use were a key aspect.

Six key categories were identified for the HM Cd, and eight for Pb and Hg. Emissions from these key categories were all energy or industry related, resulting particularly from processes associated with metal production.

For the POPs, source categories from almost all sectors have been identified as key categories. On the whole, metal production was an important source of POP emissions. However, emissions from residential: stationary plants also contributed considerably to emissions of many of the POPs.

Several factors may influence the determination of key categories at EU-28 level. A Member State's use of the emission inventory notation key IE (see Appendix 1) means that emission estimates for one NFR sector can be included in those of a different sector. Also, the allocation of emissions to the (sub) sector 'Other' is applied differently among Member States, which might lead to inconsistencies. Due to such issues, the EU-28 KCA may not always accurately reflect the share of all main emission sources. It is also important to note that the results of a similar analysis of individual Member States will differ from the key sources determined for the EU-28.

Table 1.11 EU-28 KCA results for the year 2012: cumulative contribution of emission sources to total emissions of NO_x, NMVOC, SO_x, CO, NH_3, $PM_{2.5}$ and $PM_{10,}$ the HMs Cd, Pb, Hg, and the POPs PCBs, HCB, PCDD/Fs and total PAHs (in descending order)

NO_x key categories	(%)	(%) cumul.
1 A 1 a Public Electricity and Heat Production	19 %	19 %
1 A 3 b iii Road transport: Heavy duty vehicles	18 %	37 %
1 A 3 b i Road transport: Passenger cars	16 %	53 %
1 A 2 f i Stationary combustion in manufacturing industries and construction: Other	6 %	60 %
1 A 4 c ii Agriculture/Forestry/Fishing: Off-road vehicles and other machinery	6 %	65 %
1 A 3 b ii Road transport: Light duty vehicles	5 %	70 %
1 A 4 b i Residential: Stationary plants	5 %	75 %
1 A 3 d ii National navigation (Shipping)	3 %	78 %
1 A 4 a i Commercial/institutional: Stationary	2 %	81 %

SO_x key categories	(%)	(%) cumul.
1 A 1 a Public Electricity and Heat Production	50 %	50 %
1 A 4 b i Residential: Stationary plants	10 %	60 %
1 A 2 f i Stationary combustion in manufacturing industries and construction: Other	9 %	69 %
1 A 1 b Petroleum refining	6 %	75 %
1 A 2 a Stationary combustion in manufacturing industries and construction: Iron and steel	4 %	79 %
1 B 2 a iv Refining/storage	3 %	81 %

CO key categories	(%)	(%) cumul.
1 A 4 b i Residential: Stationary plants	37 %	37 %
1 A 3 b i Road transport: Passenger cars	17 %	55 %
2 C 1 Iron and steel production	8 %	63 %
1 A 2 a Stationary combustion in manufacturing industries and construction: Iron and steel	5 %	68 %
1 A 2 f i Stationary combustion in manufacturing industries and construction: Other	5 %	72 %
1 A 3 b iv Road transport: Mopeds & motorcycles	3 %	75 %
4 F Field burning of agricultural wastes	2 %	78 %
1 A 1 a Public Electricity and Heat Production	2 %	80 %

NMVOC key categories	(%)	(%) cumul.
1 A 4 b i Residential: Stationary plants	13 %	13 %
3 D 2 Domestic solvent use including fungicides	11 %	24 %
3 A 2 Industrial coating application	8 %	32 %
3 D 3 Other product use	7 %	40 %
3 A 1 Decorative coating application	6 %	46 %
1 A 3 b i Road transport: Passenger cars	5 %	51 %
3 C Chemical products	5 %	56 %
2 D 2 Food and drink	4 %	60 %
3 D 1 Printing	3 %	64 %
1 B 2 a iv Refining/storage	3 %	67 %
1 A 3 b iv Road transport: Mopeds & motorcycles	2 %	69 %
1 A 3 b v Road transport: Gasoline evaporation	2 %	72 %
3 B 1 Degreasing	2 %	74 %
1 B 2 a v Distribution of oil products	2 %	76 %
2 B 5 a Other chemical industry	2 %	78 %
1 B 2 b Natural gas	2 %	79 %
1 A 3 b iii Road transport: Heavy duty vehicles	1 %	81 %

NH_3 key categories	(%)	(%) cumul.
4 D 1 a Synthetic N-fertilizers	21 %	21 %
4 B 1 a Cattle dairy	20 %	40 %
4 B 1 b Cattle non-dairy	20 %	60 %
4 B 8 Swine	15 %	75 %
4 B 9 a Laying hens	4 %	79 %
4 D 2 c N-excretion on pasture range and paddock unspecified	3 %	82 %

Table 1.11 EU-28 KCA results for the year 2012: cumulative contribution of emission sources to total emissions of NO_x, NMVOC, SO_x, CO, NH_3, $PM_{2.5}$ and PM_{10}, the HMs Cd, Pb, Hg, and the POPs PCBs, HCB, PCDD/Fs and total PAHs (in descending order) (cont.)

$PM_{2.5}$ key categories	(%)	(%) cumul.
1 A 4 b i Residential: Stationary plants	49 %	49 %
1 A 1 a Public Electricity and Heat Production	5 %	54 %
1 A 3 b i Road transport: Passenger cars	4 %	58 %
1 A 2 f i Stationary combustion in manufacturing industries and construction: Other	4 %	63 %
1 A 4 c ii Agriculture/Forestry/Fishing: Off-road vehicles and other machinery	3 %	66 %
1 A 3 b iii Road transport: Heavy duty vehicles	3 %	69 %
1 A 3 b vi Road transport: Automobile tyre and brake wear	3 %	72 %
1 A 3 b ii Road transport: Light duty vehicles	2 %	74 %
1 A 3 b vii Road transport: Automobile road abrasion	2 %	76 %
1 A 4 c i Agriculture/Forestry/Fishing: Stationary	2 %	77 %
2 C 1 Iron and steel production	2 %	79 %
3 D 3 Other product use	1 %	80 %

PM_{10} key categories	(%)	(%) cumul.
1 A 4 b i Residential: Stationary plants	38 %	38 %
1 A 1 a Public Electricity and Heat Production	5 %	43 %
1 A 2 f i Stationary combustion in manufacturing industries and construction: Other	4 %	47 %
4 D 2 a Farm-level agricultural operations including storage, handling and transport of agricultural products	4 %	50 %
1 A 3 b vi Road transport: Automobile tyre and brake wear	4 %	54 %
2 G Other production, consumption, storage, transportation or handling of bulk products	3 %	57 %
1 A 3 b i Road transport: Passenger cars	3 %	60 %
1 A 3 b vii Road transport: Automobile road abrasion	2 %	63 %
4 B 8 Swine	2 %	65 %
1 A 4 c ii Agriculture/Forestry/Fishing: Off-road vehicles and other machinery	2 %	67 %
1 A 3 b iii Road transport: Heavy duty vehicles	2 %	70 %
4 B 9 b Broilers	2 %	72 %
2 A 6 Road paving with asphalt	2 %	74 %
2 A 7 a Quarrying and mining of minerals other than coal	2 %	76 %
2 A 7 b Construction and demolition	2 %	78 %
1 A 4 c i Agriculture/Forestry/Fishing: Stationary	2 %	79 %
1 A 3 b ii Road transport: Light duty vehicles	2 %	81 %

Cd key categories	(%)	(%) cumul.
1 A 4 b i Residential: Stationary plants	31 %	31 %
1 A 2 f i Stationary combustion in manufacturing industries and construction: Other	15 %	46 %
1 A 1 a Public Electricity and Heat Production	11 %	56 %
1 A 2 b Stationary combustion in manufacturing industries and construction: Non-ferrous metals	10 %	67 %
2 C 1 Iron and steel production	10 %	76 %
1 A 4 a i Commercial/institutional: Stationary	5 %	81 %

Pb key categories	(%)	(%) cumul.
1 A 2 b Stationary combustion in manufacturing industries and construction: Non-ferrous metals	21 %	21 %
2 C 1 Iron and steel production	16 %	37 %
1 A 2 f i Stationary combustion in manufacturing industries and construction: Other	12 %	49 %
1 A 4 b i Residential: Stationary plants	9 %	58 %
1 A 3 b vi Road transport: Automobile tyre and brake wear	9 %	66 %
6 C b Industrial waste incineration	7 %	74 %
1 A 1 a Public Electricity and Heat Production	6 %	79 %
1 A 3 b i Road transport: Passenger cars	5 %	84 %

Table 1.11 EU-28 KCA results for the year 2012: cumulative contribution of emission sources to total emissions of NO_x, NMVOC, SO_x, CO, NH_3, $PM_{2.5}$ and PM_{10}, the HMs Cd, Pb, Hg, and the POPs PCBs, HCB, PCDD/Fs and total PAHs (in descending order) (cont.)

Hg key categories	(%)	(%) cumul.
1 A 1 a Public Electricity and Heat Production	37 %	37 %
1 A 2 f i Stationary combustion in manufacturing industries and construction: Other	13 %	50 %
2 C 1 Iron and steel production	12 %	62 %
1 A 4 b i Residential: Stationary plants	5 %	67 %
1 A 4 a i Commercial/institutional: Stationary	4 %	71 %
2 B 5 a Other chemical industry	4 %	75 %
1 A 3 d ii National navigation (Shipping)	3 %	79 %
1 A 2 b Stationary combustion in manufacturing industries and construction: Non-ferrous metals	3 %	82 %

PCB key categories	(%)	(%) cumul.
6 C b Industrial waste incineration	24 %	24 %
2 F Consumption of POPs and heavy metals (e.g. electricial and scientific equipment)	23 %	47 %
1 A 4 b i Residential: Stationary plants	15 %	62 %
2 C 1 Iron and steel production	13 %	75 %
1 A 1 a Public Electricity and Heat Production	10 %	85 %

HCB key categories	(%)	(%) cumul.
1 A 4 b i Residential: Stationary plants	21 %	21 %
1 A 1 a Public Electricity and Heat Production	17 %	37 %
2 C 1 Iron and steel production	14 %	52 %
4 G Agriculture other	8 %	60 %
6 C b Industrial waste incineration	6 %	66 %
3 C Chemical products	5 %	71 %
1 A 3 b i Road transport: Passenger cars	4 %	75 %
1 A 2 b Stationary combustion in manufacturing industries and construction: Non-ferrous metals	4 %	79 %
2 C 5 a Copper production	3 %	83 %

Dioxine key categories	(%)	(%) cumul.
1 A 4 b i Residential: Stationary plants	42 %	42 %
2 C 1 Iron and steel production	12 %	54 %
1 A 2 f i Stationary combustion in manufacturing industries and construction: Other	7 %	61 %
6 C b Industrial waste incineration	5 %	66 %
1 A 2 a Stationary combustion in manufacturing industries and construction: Iron and steel	5 %	71 %
1 A 1 a Public Electricity and Heat Production	5 %	76 %
6 D Other waste	3 %	79 %
6 C e Small scale waste burning	3 %	82 %

Total PAH key categories	(%)	(%) cumul.
1 A 4 b i Residential: Stationary plants	64 %	64 %
4 F Field burning of agricultural wastes	14 %	78 %
1 A 2 b Stationary combustion in manufacturing industries and construction: Non-ferrous metals	2 %	80 %

Note: The codes and descriptions shown correspond to the UNECE emissions reporting nomenclature — the NFR.

The KCA of Pb, Hg and Cd do not take into account emissions from Greece, as these are only available as national totals. For $PM_{2.5}$, PM_{10}, TSPs, HMs and POPs, the EU-28 inventory for the calculation of the key categories was not considered complete (see Section 1.4.4 and Section 2.1).

1.6 Quality assurance (QA), quality control (QC) and verification methods

Member States are encouraged to use appropriate QA and QC procedures to ensure data quality and to verify and validate their emissions data. These procedures should be consistent with those described in the EMEP/EEA emission inventory guidebook (EMEP/EEA, 2013).

The main activities improving the quality of the EU inventory are the checks performed by the EEA's ETC/ACM on the status of each Member State's submission. In addition, the internal consistency of data tables submitted by Member States is checked prior to compiling the EU-28 tables. As with last year, more focus was placed on analysing the plausibility of sectoral trends. Member State data were checked at sectoral level: when outliers were found, the responsible categories were identified. When no explanation for a notable trend was found in the IIRs, Member States were contacted. The focus of the checks was on data that greatly affect EU-28 trends. External checks are also provided by Member States through an Eionet review before the EU-28 inventory is submitted to the secretariat of the LRTAP Convention.

Further, an important element in improving the quality of national and EU CLRTAP inventories is the annual meeting of the Task Force on Emission Inventories and Projections (TFEIP). In the framework of this expert meeting, quality issues concerning the emission reporting of Member States are discussed.

The agreed gap-filling procedures are one of the instruments used to assure and improve the quality of the EU inventory; gaps for sectoral emissions and total emissions for any year are analysed and gap-filled, where possible. This improves the key features of completeness, comparability and consistency over the years, and motivates Member States to report their data in the following reporting cycle (further details on gap-filling are available in Section 1.4.4).

All inventory documents (submissions, inventory master files, inventory reports, status reports and related correspondence) are archived electronically at the EEA–ETC/ACM Forum data portal. Revisions of data sets are recorded.

More detailed QA activities are performed by the EEA ETC/ACM and the EMEP CEIP in an annual review process (EMEP CEIP, 2014a). The review of Member State LRTAP Convention emission inventories is performed jointly with the review of those reported under the NEC Directive (EC, 2001). The technical review of inventories is carried out in three stages. Review Stages 1 and 2 include checks on timeliness, formats, consistency, accuracy, completeness and comparability of actual Member State inventory submissions. Test results, provided to Member States, are used to improve the quality of the national emission inventories. Summary results of the review (Stages 1 and 2) are published each year in a joint EMEP/EEA review report ([9]).

In 2008, CEIP, in cooperation with the EEA and Member States, started producing centralised reviews ([10]) of national inventories (Stage 3). In 2013, Bulgaria, France, Latvia, Sweden, Poland, Italy, Lithuania, Norway, Portugal and Romania were reviewed. The results are published in individual country-specific reports (EMEP CEIP, 2014b). The long-term goal of EMEP is to perform a centralised review every year of 10 LRTAP Convention parties, so that each party undergoes a detailed review approximately once every 5 years.

1.7 General uncertainty evaluation

Quantifying uncertainty in the EU LRTAP emission inventory calls for Member States to first provide detailed information on emission uncertainties. An analysis of the uncertainty evaluation performed in Member States shows that only 13 Member States (Croatia, Cyprus, Denmark, Finland, France, Germany, Ireland, Latvia, the Netherlands, Poland, Spain, Sweden and the United Kingdom) quantified their uncertainty in emissions in 2012. The pollutants considered and the assumptions behind the

([9]) A summary of the results of the Stage 1 and 2 review performed in 2012 will be published jointly by EMEP/EEA.
([10]) In cooperation with the EEA and TFEIP, CEIP selects countries to be reviewed and sets up an expert review team (ERT) from inventory experts nominated by countries to the EMEP roster. The ERT performs detailed reviews of submitted inventories and IIRs. The countries voluntarily reviewed for the first time within a Stage 3 review process were France, Norway, Portugal, and Sweden.

uncertainty analysis vary across Member States. Due to the small number of Member States providing an uncertainty estimate, the uncertainty of the EU-28 LRTAP inventory cannot be estimated.

1.8 General assessment of completeness

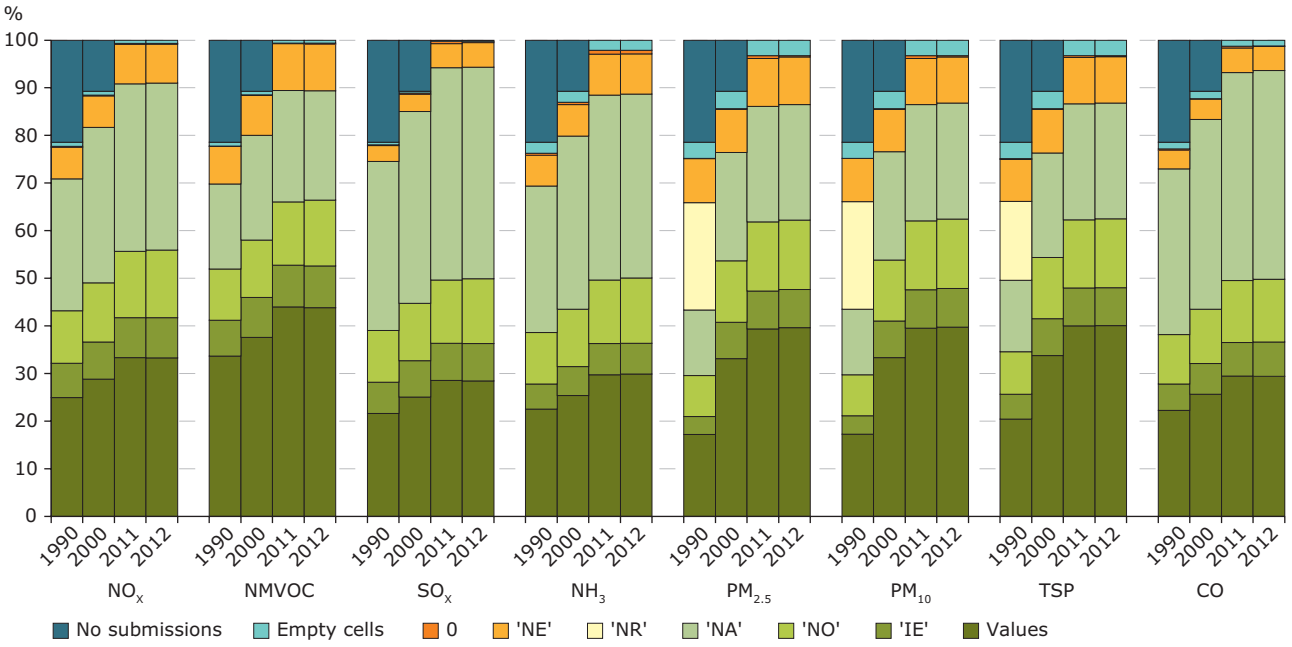
Completeness in this context means that estimates are reported for all pollutants, all relevant source categories, all years, and all territorial areas. The procedure for gap-filling carried out at Member State level is documented in Section 1.4.4. It also describes the quantitative contribution of gap-filling to emissions reported by Member States. Detailed results for the completeness of Member State submissions are provided in the Stage 1 review (EMEP CEIP, 2014b).

As seen in Appendix 3, Greece only reported data for the main pollutants and CO, and Luxembourg only reported data for the main pollutants and CO, TSPs and PMs. Slovenia and Austria reported all pollutants except the additional HMs. All other countries also submitted inventories for all pollutants, for at least several historical years. A total of 21 Member States reported activity data ([11]) for the complete time-series (1990–2012).

Figure 1.3 to Figure 1.5 inclusive show a simple compilation indicating completeness of reporting by Member States for the inventory years 1990, 2000, 2011 and 2012, based on the originally submitted NFR templates, i.e. before gap-filling. Only data submitted in 2014 without gap-filling were considered. The number of notation keys or values used for source categories in the NFR templates was accumulated over all Member States and is shown in percentage values. Figures 1.3 to 1.5 inclusive show that for all pollutants, there is better availability of data for more recent years.

EMEP emission reporting guidelines (UNECE, 2009) require parties to report data at least for the base year of the relevant protocol, and from the year of entry into force of that protocol, and up to the latest year (current year – 2) (see Table A2.1). So ideally, there should be no difference between the availability of data submission for 1990 and for

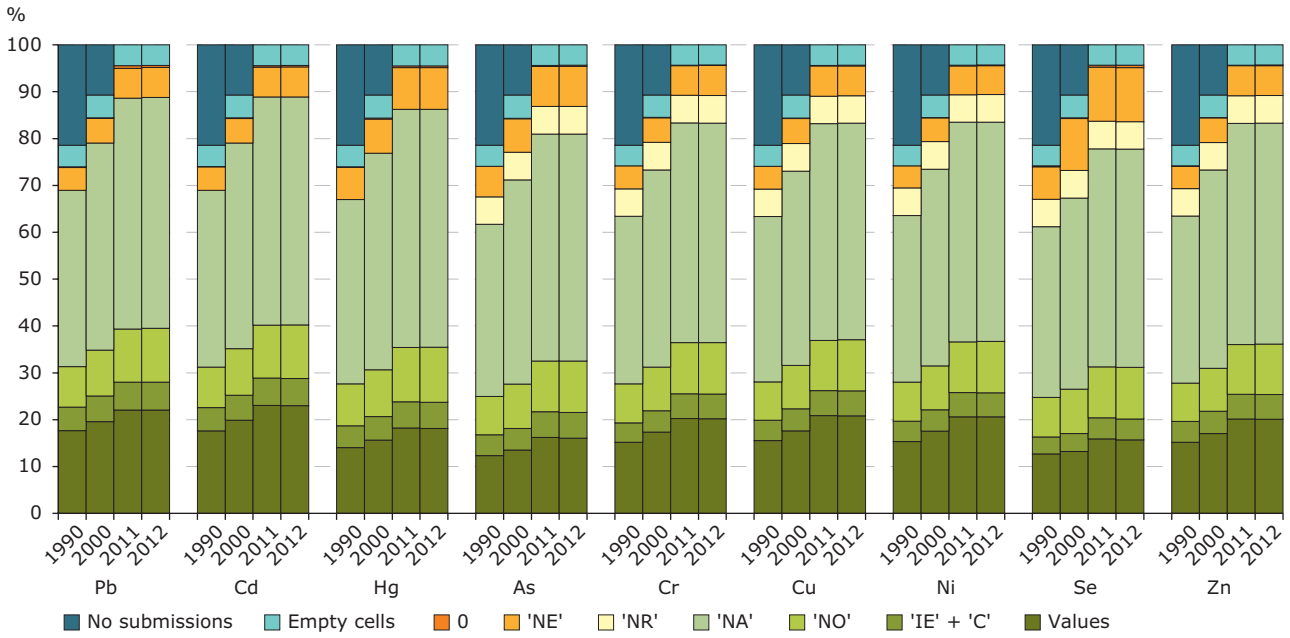
Figure 1.3 Completeness of reporting of NFR templates submitted by Member States for main pollutants, PM and CO



Note: NE – not estimated, NR – not relevant, NA – not applicable, NO – not occurring, IE – included elsewhere, C – confidential. Notation keys are further explained in Appendix 1.

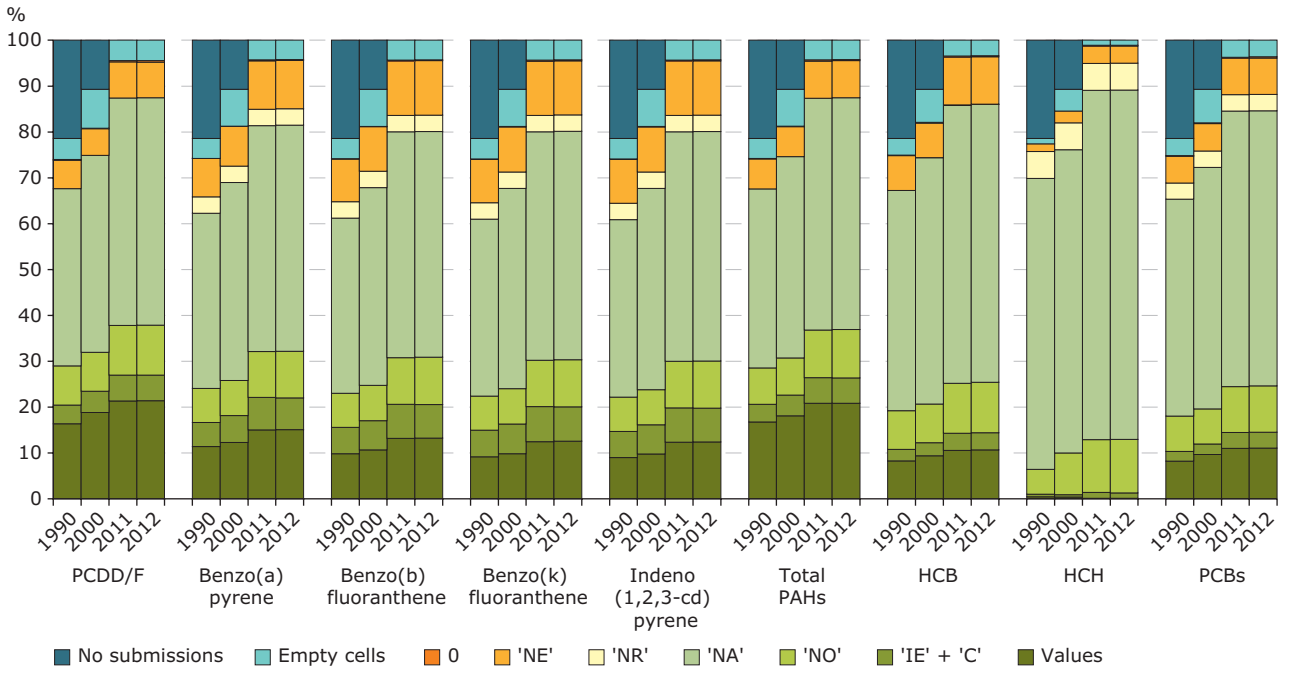
([11]) Reporting of activity data together with emissions is mandatory from 2009 onwards.

Figure 1.4 Completeness of reporting of NFR templates submitted by Member States for heavy metals



Note: NE – not estimated, NR – not relevant, NA – not applicable, NO – not occurring, IE – included elsewhere, C – confidential. Notation keys are further explained in Appendix 1.

Figure 1.5 Completeness of reporting of NFR templates submitted by Member States for POPs



Note: NE – not estimated, NR – not relevant, NA – not applicable, NO – not occurring, IE – included elsewhere, C – confidential. Notation keys are further explained in Appendix 1.

2012. Several Member States use the notation key NR for 1990, as parties to the LRTAP Convention are formally requested to report PM emissions only for the year 2000 and after.

On average in 2012, Member States used the notation key 'not applicable' (NA) for 46 % of the source categories (across all pollutants). The frequent use of the notation key NA is due to the fact that an air pollutant is only relevant for specific emission sources (e.g. NH_3 for agriculture). This makes it necessary to use the notation key NA for other sources. On average in 2012, Member States reported an emission value (maximum 44 % for NMVOC and minimum 0.1 % for HCH) for 22 % of the source categories (across all pollutants). The use of the NE notation key, the reporting of empty cells, '0', and in some circumstances the reporting of NR ([12]) are considered to constitute incomplete reporting. In 2012, 14 % of the data were reported incomplete (8 % reported as NE, 3 % empty cells, 0.2 % '0', and 2 % reported as NR). For the year 1990, 36 % of the data were reported incomplete. Reporting for the year 2012 is therefore much more comprehensive than for 1990.

1.9 Underestimations

The official reporting guidelines of the LRTAP Convention (UNECE, 2009) allow countries to report emissions as NE for those sectors where emissions are known to occur, but have not been estimated or reported.

Countries should separately report the reasons explaining why emissions are not estimated.

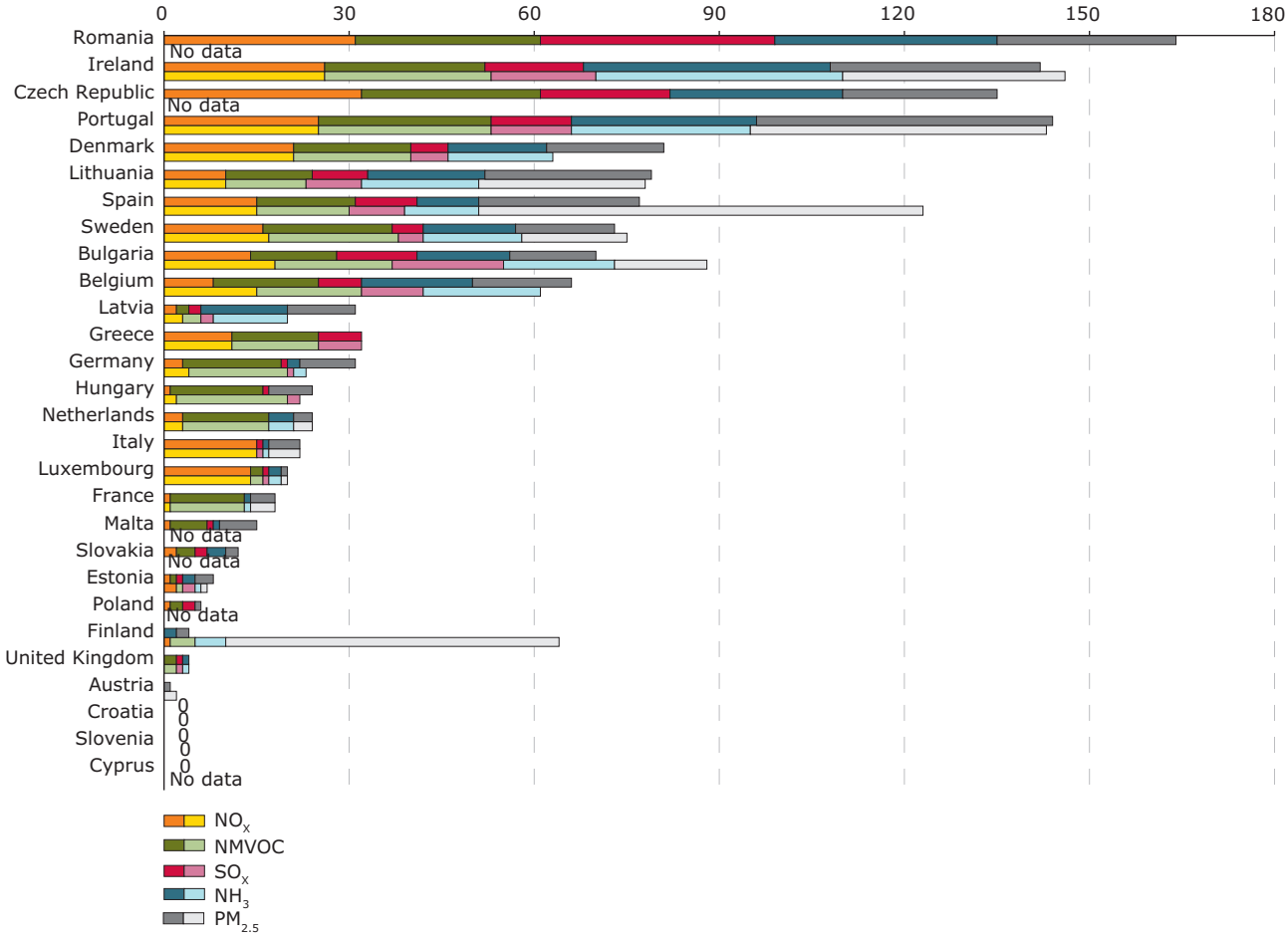
Concerning NE emissions, the *EMEP/EEA air pollutant emission inventory guidebook — 2013* (EMEP/EEA, 2013) recommends that the following points be included in an IIR:

- a list of sources not estimated in the inventory;
- a qualitative assessment of their importance, currently and in future;
- a description of intentions to calculate these in future, or an explanation of why there are no such plans.

Certain Member States used the notation key NE for many source categories (see Figure 1.6). Spain, for example, reported 72 source categories of $PM_{2.5}$ of the year 1990 as NE. A total of 10 Member States used NE for more than 60 source categories in the year 2012 (sum of the pollutants NO_X, NMVOC, SO_2, NH_3 and $PM_{2.5}$). In contrast, 8 Member States used NE only for up to 10 source categories in the year 2012. Some Member States, like Finland or Spain, show a considerably more complete inventory in 2012 as compared to 1990. But in most cases, the use of NE in reporting in 2012 is similar to its use in 1990. The categories '1 A 3 a i (i) — International aviation (LTO)', '6 C e — Small scale waste burning', '1 A 3 b vii — Road transport: Automobile road abrasion' and '6 C d — Cremation' show the highest numbers of the use of NE (across all pollutants and Member States). Within these categories, the notation key NE accounts for more than a quarter of the entries.

([12]) According to paragraph 9 of the Emission Reporting Guidelines, emission inventory reporting should cover all years from 1980 onwards if data are available. However, 'NR' (not relevant) is introduced to ease the reporting where emissions are not strictly required by the different protocols. Only in these circumstances can the reporting of NR be considered a correct and appropriate notation key.

Figure 1.6 Number of 'not estimated' source categories for the years 2012 (dark colours) and 1990 (light colours)



2 Trends and key categories of EU-28 pollutant emissions

The present EU-28 inventory provides emissions for all the main air pollutants, PM, 'priority' and 'additional' HMs and POPs, and additional reporting of the individual PAHs for which inventory reporting is required or recommended under the LRTAP Convention (UNECE, 1979).

The following sections of Chapter 2 provide a summary of the contributions made by each Member State to the EU-28 total emissions of NO_X, NMVOC, SO_X, NH_3, CO, $PM_{2.5}$, PM_{10}, TSPs, the HMs Pb, Cd, Hg, As, Cr, Cu, Ni, Se, Zn and the POPs: PCDD/Fs, total PAHs, BaP, BbF, BkF, IP, HCB, HCH and PCBs. For the five most important key categories, the past emission trend of the EU-28 is given.

2.1 Total EU-28 emission trends and progress towards UNECE Gothenburg Protocol 2010 emission ceilings

Past trends of the main air pollutants are presented in Figure 2.1 and Table 2.1. Emissions of all pollutants were lower in 2012 than in 1990 (or 2000 for PM).

For the main air pollutants, the largest reductions across the EU-28 (in percentage terms) since 1990 have been achieved for SO_X emissions (which decreased by 84 %), followed by CO (− 66 %), NMVOC (− 60 %), NO_X (− 51 %) and NH_3 (− 28 %). A substantial drop in emissions of HMs and POPs since 1990 has also been recorded. Emission changes compiled for the period from 2000 to 2012 indicate that both, $PM_{2.5}$ and PM_{10} emissions have fallen by 19 %.

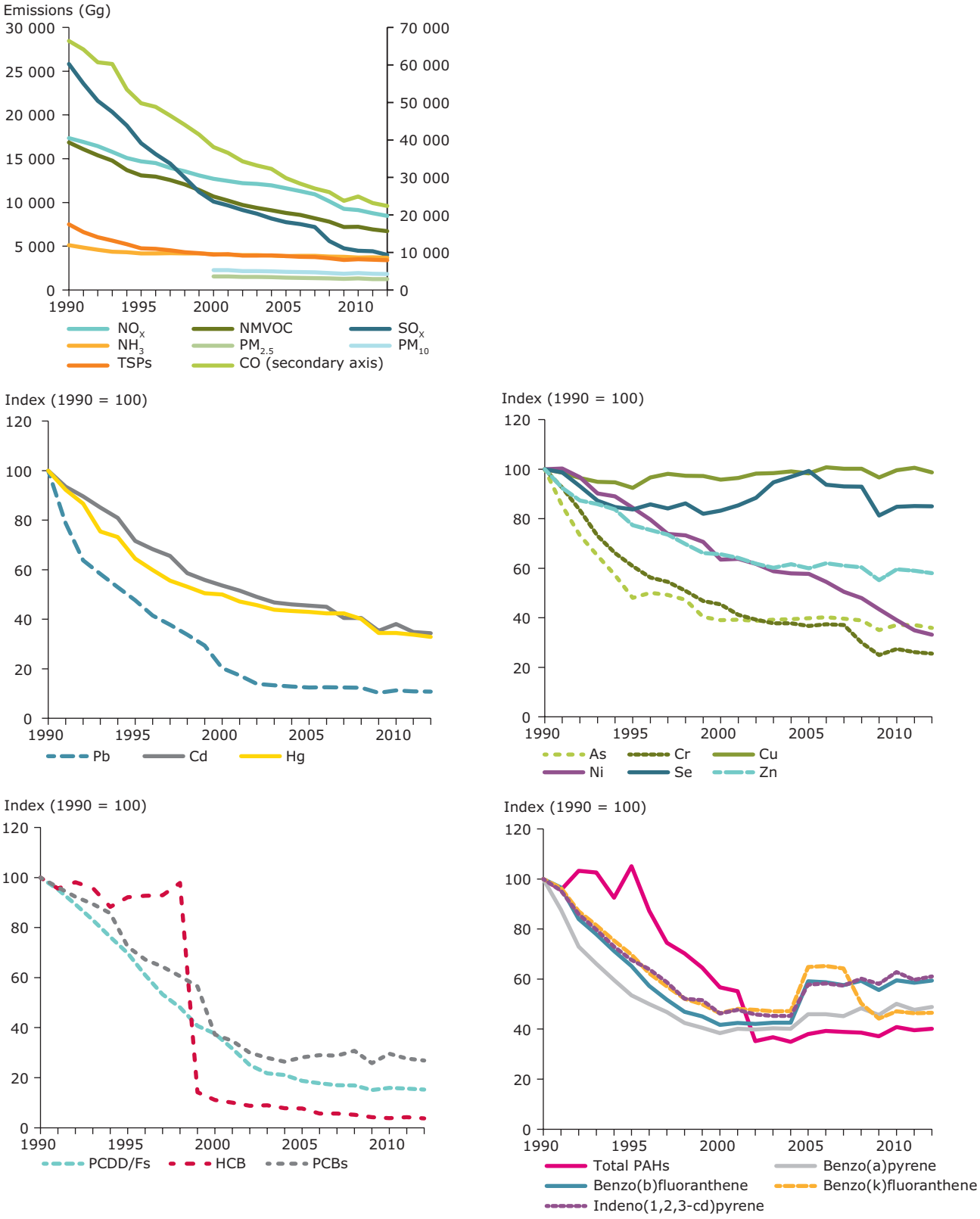
For various pollutants (e.g. PMs, HMs and POPs), some Member States did not report data, or reported the notation keys NE or NR for certain years or the whole time-series. In some cases, the data could not be gap-filled, and thus were not included in the EU-28 total. In such instances, the EU-28 emission totals for these pollutants are not considered complete. HCH is a case in point: due to sparse data availability, the EU total is incomplete and analysis could not be carried out. Data tables in Chapter 2 (Table 2.3 to Table 2.28 inclusive) show each Member State's reported emissions, thereby indicating instances where emissions of a certain pollutant are missing for all years.

The Gothenburg Protocol to the UNECE LRTAP Convention (UNECE, 1999) contains emission ceilings for the pollutants NO_X, NMVOC, SO_X and NH_3 that parties to the protocol must meet by 2010 and after. In their reporting to the LRTAP Convention, some Member States have submitted emission projections for the year 2015 and others up to 2050. Submitted data are available in Annex E of this report. This report does not provide further detailed analysis of projections reported by the countries in relation to the emission ceilings for 2010 in the Gothenburg Protocol to the LRTAP Convention. In June 2014, the EEA will publish its annual NEC Directive status report, which analyses, for the EU Member States, the emission data reported under the EU NEC Directive (EEA, 2014c). The NEC Directive contains EU Member State national emission ceilings that are either equal to or more ambitious than those set out in the Gothenburg Protocol.

Compliance checking in this report is based on reporting on the basis of fuel sold, except for Austria, Belgium, Ireland, Lithuania, Luxembourg, the Netherlands and the United Kingdom. These countries may choose to use the national emissions total calculated on the basis of fuel used in the geographic area of the party as a basis for compliance (see Section 1.4.2). For Spain, data for the compliance checks are the national totals for the EMEP grid domain.

In addition to ceilings for individual countries, the protocol also specifies ceilings for the EU, itself a party to the protocol. Table 2.2 sets out the emissions for the year 2012 reported by the EU-15 Member

Figure 2.1 EU-28 emission trends for the main air pollutants, PM, HMs and POPs



Note: Parties to the LRTAP Convention are formally requested to report emissions of PM for the year 2000 and after: emission trends can be shown for these years only. The indexed emissions are based on emissions in the year 2000 (= 100).

The drop in HCB emissions between the years 1998 and 1999 is attributable to a considerable reduction reported by the United Kingdom.

The increase of benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene and indeno(1,2,3-cd)pyrene emissions from 2004 to 2005 is caused by differences between gap-filled (up to 2004) data and submitted (from 2005 on) data of Romania.

Table 2.1 Total EU-28 emissions of the main air pollutants, HMs, POPs and PM

Pollutant	Unit	1990	1995	2000	2005	2006	2007	2008	2009	2010	2011	2012	Change 1990–2012	Change 2011–2012
NO_x	Gg	17 358	14 707	12 702	11 611	11 296	10 940	10 133	9 275	9 116	8 775	8 479	– 51 %	– 3.4 %
NMVOC	Gg	16 853	13 088	10 668	8 800	8 567	8 183	7 803	7 180	7 216	6 904	6 707	– 60 %	– 2.9 %
SO_x	Gg	25 835	16 766	10 103	7 733	7 529	7 188	5 573	4 769	4 484	4 434	4 005	– 84 %	– 9.7 %
NH_3	Gg	5 103	4 171	4 102	3 881	3 886	3 897	3 811	3 776	3 712	3 724	3 668	– 28 %	– 1.5 %
TSPs	Gg	7 492	4 760	4 030	3 877	3 777	3 750	3 633	3 432	3 504	3 455	3 404	– 55 %	– 1.5 %
CO	Gg	66 407	49 799	38 096	29 833	28 345	27 055	26 113	23 755	24 907	23 144	22 401	– 66 %	– 3.2 %
Pb	Mg	23 338	11 125	4 746	2 917	2 930	2 919	2 880	2 415	2 633	2 550	2 532	– 89 %	– 0.7 %
Cd	Mg	251	180	135	114	113	102	102	89	96	88	86	– 66 %	– 1.4 %
Hg	Mg	235	151	118	101	100	99	94	81	81	79	77	– 67 %	– 2.8 %
As	Mg	565	272	221	225	227	224	220	198	209	210	203	– 64 %	– 3.3 %
Cr	Mg	1 397	850	635	513	523	518	418	349	383	365	358	– 74 %	– 2.0 %
Cu	Mg	3 691	3 411	3 534	3 629	3 718	3 697	3 697	3 569	3 676	3 712	3 643	– 1 %	– 1.9 %
Ni	Mg	2 587	2 184	1 643	1 495	1 410	1 307	1 242	1 124	1 010	905	859	– 67 %	– 5.1 %
Se	Mg	265	222	221	263	249	247	246	216	225	226	226	– 15 %	– 0.1 %
Zn	Mg	11 899	9 215	7 819	7 143	7 384	7 268	7 182	6 572	7 088	7 022	6 908	– 42 %	– 1.6 %
PCDD/Fs	g I-Teq	11 628	8 113	4 376	2 183	2 066	1 979	1 961	1 752	1 850	1 824	1 771	– 85 %	– 2.9 %
Total PAHs	Mg	2 589	2 721	1 469	985	1 016	1 007	998	962	1 057	1 024	1 039	– 60 %	1.5 %
HCB	kg	5 287	4 871	586	410	298	301	276	225	204	223	195	– 96 %	– 12.5 %
HCH	kg	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE		
PCBs	kg	13 918	10 079	5 182	3 916	4 032	4 007	4 273	3 592	4 113	3 852	3 735	– 73 %	– 3.1 %
Benzo(a) pyrene	Mg	369	197	142	170	169	167	178	168	185	176	180	– 51 %	2.4 %
Benzo(b) fluoranthene	Mg	264	172	110	156	155	152	156	147	157	154	157	– 41 %	1.4 %
Benzo(k) fluoranthene	Mg	157	110	73	102	103	101	79	70	74	73	73	– 53 %	0.4 %
Indeno(1,2,3-cd)pyrene	Mg	175	118	81	101	102	100	105	101	110	104	107	– 39 %	2.3 %
													Change 2000–2012	**Change 2011–2012**
$PM_{2.5}$	Gg			1 542	1 417	1 378	1 345	1 321	1 268	1 312	1 246	1 242	– 19 %	– 0.3 %
PM_{10}	Gg			2 260	2 076	2 035	2 001	1 943	1 852	1 923	1 850	1 835	– 19 %	– 0.8 %

Note: Parties to the LRTAP Convention are formally requested to report emissions of PM for the year 2000 and after: emission trends can be shown for these years only.

Negative percentage values indicate that emissions have decreased.

Shaded cells indicate that data for these pollutants are complete (reported and gap-filled data): Member States have not used NE, NR, 0, or empty cells.

The 1990-to-2012 changes in emissions in Table 2.1 and subsequent tables (Table 2.2 to Table 2.28 inclusive) are expressed as 100 x $(E_{2012}–E_{1990})/E_{1990}$ (%), where E_{2012} and E_{1990} are 2012 and 1990 total emissions, respectively. The 2011-to-2012 changes in emissions are expressed as 100 x $(E_{2012}–E_{2011})/E_{2011}$ (%), where E_{2012} and E_{2011} are the 2012 and 2011 total emissions, respectively.

For HCH, due to sparse data, the EU total is incomplete, and is therefore not estimated (NE).

The bases for the EU inventory shown in Table 2.1 and subsequent tables (Table 2.2 to Table 2.28 inclusive) are national total data of the entire territory, based on fuel sold. Data for Belgium, the Netherlands and the United Kingdom are based on fuel used. See Section 1.4.2 for further details.

Table 2.2 Comparison of emissions reported for 2012 by EU-15 Member States with emission ceilings for the EU specified in the UNECE Gothenburg Protocol

Pollutant	EU-15 emissions year 2012 (Gg)	European Union (EU-15) Gothenburg Protocol 2010 ceilings (Gg)	Difference (%)	Sum of individual EU-15 ceilings (Gg) ([a])
NO_X	6 489	6 671	– 3 %	6 648
NMVOC	5 056	6 600	– 23 %	6 600
SO_X	2 157	4 059	– 47 %	4 044
NH_3	2 916	3 129	– 7 %	3 128

Note: ([a]) Emission ceilings are also specified for individual EU-15 Member States. In some cases, the sum of these ceilings is different to the ceilings specified for the European Community (EU-15) as a whole.

Data for this comparison are based on a mix of fuel sold and fuel used (Austria, Belgium, Ireland, Luxembourg, the Netherlands and the United Kingdom). See Section 1.4.2 for more details. For Spain, data for the compliance checks are the national totals for the EMEP grid domain.

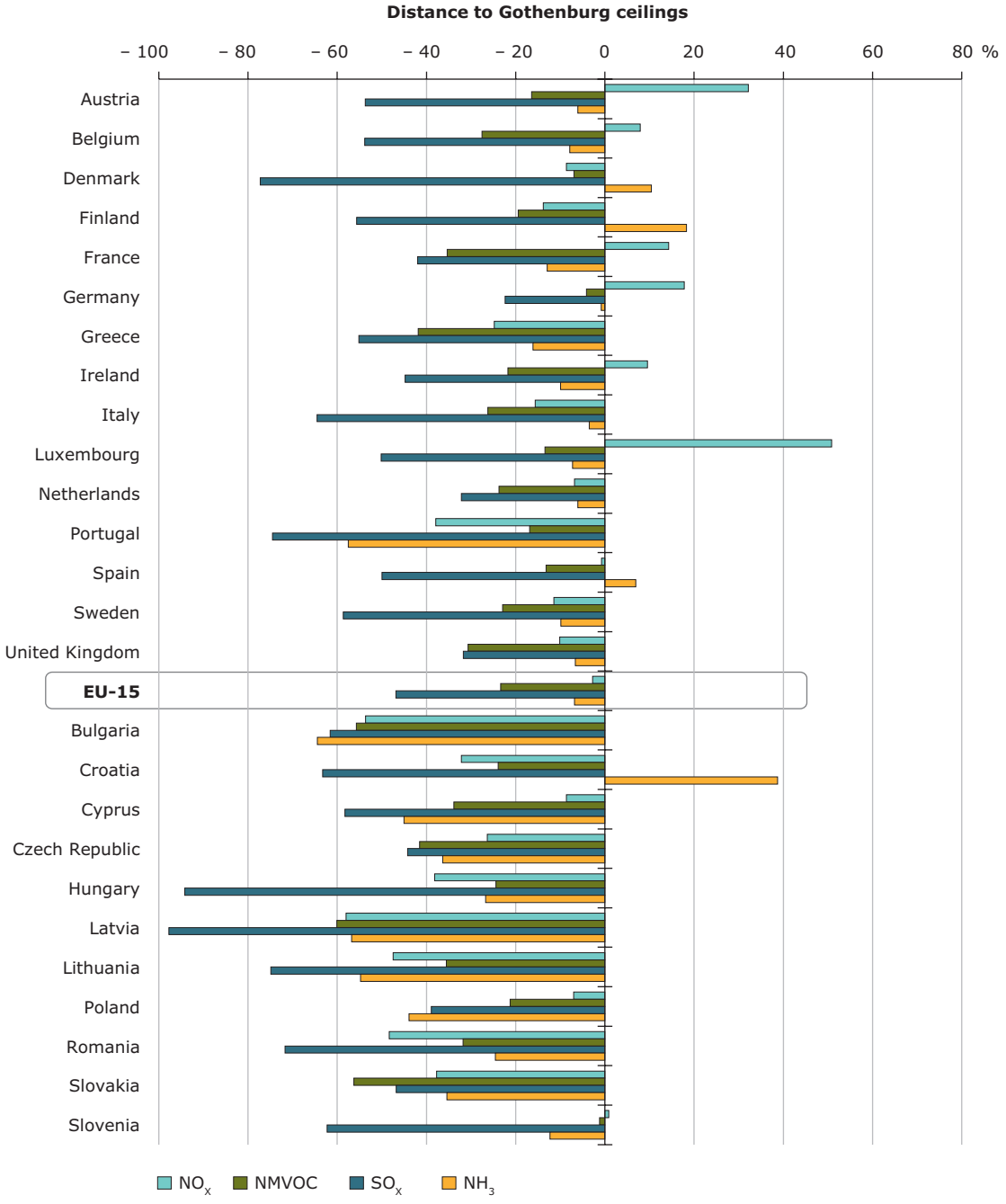
Belgium, Croatia, Denmark, France, Germany and Spain have already proposed data adjustments ([13]). However, these adjustments are pending approval and have not yet been considered for the EU inventory.

States, compared to the respective emission ceilings specified for the EU. For all pollutants, emissions in 2012 were below the respective pollutant ceilings.

Figure 2.2 shows whether EU Member States met the Gothenburg ceilings in 2012. Seven Member States (Austria, Belgium, France, Germany, Ireland, Luxembourg and Slovenia) reported NO_X emissions higher than their ceilings in 2010. Four countries exceeded their NH_3 ceiling (Croatia, Denmark, Finland and Spain). NMVOC and SO_X ceilings were met by all Member States. It should also be noted that most new Member States (i.e. EU-12) have met their emission ceilings for all pollutants, except Slovenia for NO_X and Croatia for NH_3.

([13]) In 2012, the Executive Body for the LRTAP Convention decided that adjustments to emission reduction commitments, or to inventories for the purposes of comparing total national emissions with them, may be applied in some circumstances (UNECE, 2012a).

Figure 2.2 Distance of Member State emissions 2012 to Gothenburg ceilings 2010



Note: Estonia and Malta do not have a Gothenburg ceiling.

Data for this comparison are based on a mix of fuel sold and fuel used (Austria, Belgium, Ireland, Lithuania, Luxembourg, the Netherlands and the United Kingdom). See Section 1.4.2 for further details. For Spain, data for the compliance checks are the national totals for the EMEP grid domain.

Belgium, Croatia, Denmark, France, Germany and Spain have already proposed data adjustments ([14]).

([14]) In 2012, the Executive Body for the LRTAP Convention decided that adjustments to emission reduction commitments, or to inventories for the purposes of comparing total national emissions with them, may be applied in some circumstances (UNECE, 2012a).

2.2 Nitrogen oxides (NO_x) emission trends and key categories

Between 1990 and 2012, NO_x emissions dropped in the EU-28 by 51 %. Between 2011 and 2012, the decrease was 3.4 %, mainly due to reductions reported in Italy, Greece and Spain (Table 2.3). The Member States that contributed most (i.e. more than 10 %) to NO_x emissions in 2012 were Germany, the United Kingdom, France and Spain.

France, Germany and the United Kingdom reported in their IIRs (Appendix 5), that from 1990 to 2012, NO_x emissions dropped thanks to stricter regulations and emission standards, resulting in technical improvements and improved fuels, and a decline in the use of solid and liquid fuels.

For Table 2.3 through Table 2.28, two EU-28 totals are given. The first corresponds to the sum of national totals officially reported by Member States. The second is the sum of the sectors of all Member States. A difference between these two EU totals arises when only national totals and no sectoral data are available.

Table 2.3 Member States' contributions to EU emissions of NO_x (Gg)

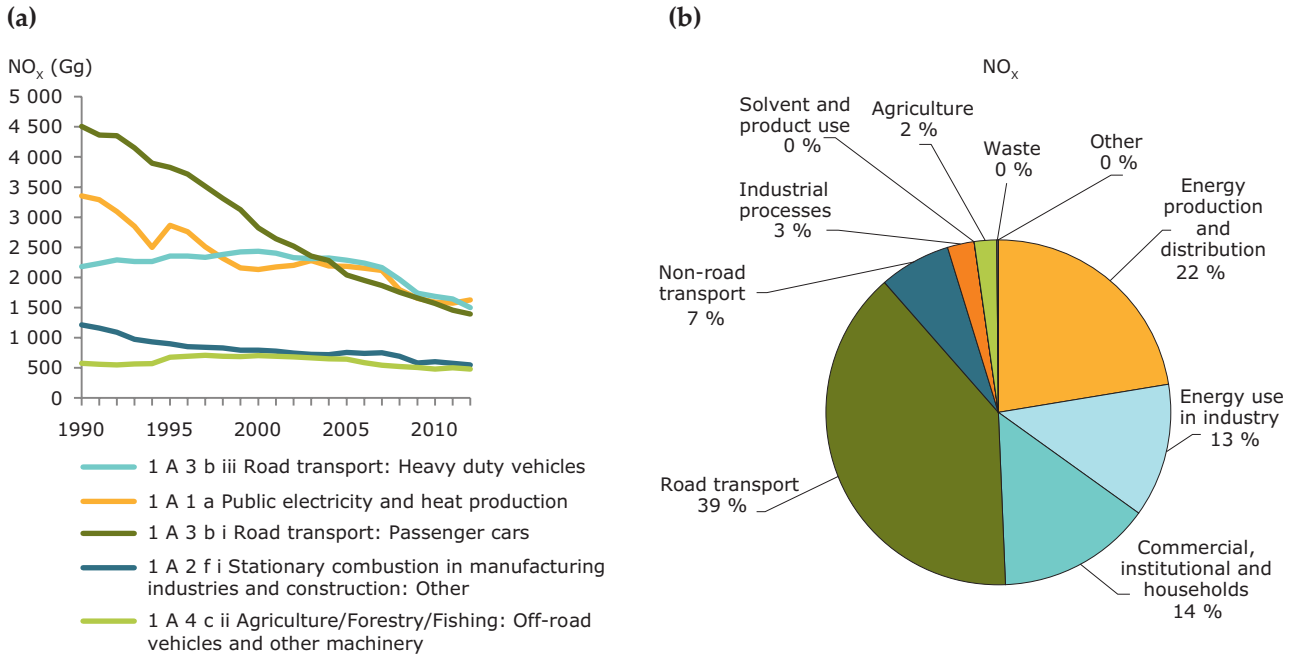
Member State	NO_x (Gg)											Change		Share in EU-28	
	1990	1995	2000	2005	2006	2007	2008	2009	2010	2011	2012	1990–2012	2011–2012	1990	2012
Austria	195	182	206	237	223	219	206	190	195	184	180	– 8 %	– 2.3 %	1.1 %	2.1 %
Belgium	372	349	318	290	277	267	236	210	218	204	195	– 48 %	– 4.3 %	2.1 %	2.3 %
Bulgaria	249	151	126	154	151	141	140	117	115	136	123	– 50 %	– 9.1 %	1.4 %	1.5 %
Croatia	95	66	74	81	82	85	83	75	68	65	59	– 38 %	– 9.3 %	0.5 %	0.7 %
Cyprus	16	18	21	20	20	20	20	20	18	21	21	34 %	1.2 %	0.1 %	0.2 %
Czech Republic	741	429	396	278	282	284	261	251	239	225	211	– 72 %	– 6.6 %	4.3 %	2.5 %
Denmark	277	270	208	186	186	173	155	137	132	125	116	– 58 %	– 7.3 %	1.6 %	1.4 %
Estonia	74	39	38	37	35	39	36	30	37	36	32	– 56 %	– 9.8 %	0.4 %	0.4 %
Finland	285	254	201	169	188	187	168	155	167	154	147	– 49 %	– 4.6 %	1.6 %	1.7 %
France	1 866	1 714	1 578	1 404	1 331	1 271	1 170	1 088	1 067	1 001	983	– 47 %	– 1.8 %	10.8 %	11.6 %
Germany	2 875	2 172	1 919	1 565	1 556	1 479	1 404	1 305	1 328	1 294	1 273	– 56 %	– 1.6 %	16.6 %	15.0 %
Greece	326	329	359	417	413	414	392	380	319	296	259	– 21 %	– 12.6 %	1.9 %	3.1 %
Hungary	248	196	199	165	168	163	160	154	152	137	122	– 51 %	– 10.8 %	1.4 %	1.4 %
Ireland	123	122	136	129	123	121	109	87	80	72	74	– 40 %	2.7 %	0.7 %	0.9 %
Italy	2 025	1 896	1 424	1 214	1 157	1 107	1 036	965	946	922	844	– 58 %	– 8.5 %	11.7 %	10.0 %
Latvia	84	49	41	42	42	42	38	35	36	31	35	– 58 %	12.0 %	0.5 %	0.4 %
Lithuania	137	69	58	62	64	62	63	57	60	56	58	– 58 %	3.7 %	0.8 %	0.7 %
Luxembourg	39	36	44	62	56	52	50	44	46	48	46	18 %	– 4.5 %	0.2 %	0.5 %
Malta	8	9	8	9	9	9	9	9	8	8	9	15 %	10.2 %	0.0 %	0.1 %
Netherlands	575	477	395	337	323	308	298	272	272	257	248	– 57 %	– 3.6 %	3.3 %	2.9 %
Poland	1 280	1 063	844	851	855	860	830	809	862	846	817	– 36 %	– 3.4 %	7.4 %	9.6 %
Portugal	233	265	262	256	235	231	205	193	178	169	161	– 31 %	– 4.7 %	1.3 %	1.9 %
Romania	457	341	283	309	298	272	270	230	218	223	226	– 51 %	1.5 %	2.6 %	2.7 %
Slovakia	226	179	107	102	96	96	94	84	89	85	81	– 64 %	– 5.0 %	1.3 %	1.0 %
Slovenia	61	59	51	48	49	50	55	47	46	47	45	– 26 %	– 2.5 %	0.4 %	0.5 %
Spain	1 341	1 412	1 398	1 421	1 367	1 355	1 167	1 033	955	949	921	– 31 %	– 3.0 %	7.7 %	10.9 %
Sweden	268	245	207	175	170	163	155	146	148	139	131	– 51 %	– 5.5 %	1.5 %	1.5 %
United Kingdom	2 882	2 315	1 801	1 592	1 539	1 473	1 322	1 151	1 117	1 045	1 062	– 63 %	1.6 %	16.6 %	12.5 %
EU-28 (a)	**17 358**	**14 707**	**12 702**	**11 611**	**11 296**	**10 940**	**10 133**	**9 275**	**9 116**	**8 775**	**8 479**	**– 51 %**	**– 3.4 %**	**100 %**	**100 %**
EU-28 (b)	17 358	14 707	12 702	11 611	11 296	10 940	10 133	9 275	9 116	8 775	8 479				

Note: (a) Sum of national totals as reported by Member States.
(b) Sum of sectors: differences arise when only national totals and no sectoral data are available.
Negative percentage values indicate that emissions have decreased.
Shaded cells denote gap-filled data. For more detailed information, see Annex D.

The categories '1 A 1 a — Public electricity and heat production', '1 A 3 b iii — Road transport: Heavy-duty vehicles' and '1 A 3 b i — Road transport: Passenger cars' were the most important key categories for NO_X emissions together making up 53 % of total emissions (see Figure 2.3). Of the top five key categories, the highest relative reductions in emissions between 1990 and 2012 were achieved in the third most important key category, '1 A 3 b i — Road transport: Passenger cars' (– 69.1 %) (see Figure 2.3(a)).

Figure 2.3(b) shows the contribution to total EU-28 emissions made by the aggregated sector groups. For NO_X, common important emission sources are the energy and transport sectors. Emission reductions from the 'Road transport' sector are primarily a result of fitting catalysts to vehicles (a move driven by the legislative 'Euro' standards) (EEA, 2014b). Nevertheless, the road transport sectors together represent the largest source of NO_X emissions, accounting for 39 % of total EU-28 emissions in 2012. The electricity/energy production sectors have also reduced their emissions, thanks to measures such as the introduction of combustion modification technologies (e.g. the use of low NO_X burners), implementation of flue-gas abatement techniques (e.g. NO_X scrubbers and SCR and SNCR techniques), and fuel switching from coal to gas (EEA, 2014b).

Figure 2.3 NO_X emissions in the EU-28: (a) trend in NO_X emissions from the five most important key categories, 1990–2012; (b) share of emissions by sector group, 2012



2.3 Non-methane volatile organic compound (NMVOC) emission trends and key categories

Between 1990 and 2012, NMVOC emissions dropped in the EU-28 by 60 %. Between 2011 and 2012, a decrease of 2.9 % was reported, and it is attributed mainly to reduced emissions in Italy, Germany and France (Table 2.4). In 2012, the Member States that contributed most (i.e. more than 10 %) to NMVOC emissions were Germany, Italy, the United Kingdom and France.

France, Germany and the United Kingdom reported in their IIRs (Appendix 5) that the decrease of NMVOC emissions from 1990 to 2012 is due to increasingly stricter regulations and controls, resulting in more cars with catalytic converters, and reduced petrol consumption.

The lower NMVOC emission values in Germany for 2008 and 2009 were a result of the economic crisis. In 2012, emissions were again approaching the 2008/2009 level (Appendix 5, Germany's IIR).

Table 2.4 Member State contributions to EU NMVOC emissions (Gg)

Member State	NMVOC (Gg)											Change		Share in EU-28	
	1990	1995	2000	2005	2006	2007	2008	2009	2010	2011	2012	1990–2012	2011–2012	1990	2012
Austria	274	223	176	165	175	162	152	124	135	129	136	– 50 %	5.4 %	1.6 %	2.0 %
Belgium	284	229	179	146	142	133	127	115	117	105	104	– 63 %	– 1.0 %	1.7 %	1.6 %
Bulgaria	620	144	88	85	90	84	83	90	90	91	82	– 87 %	– 9.9 %	3.7 %	1.2 %
Croatia	112	77	83	101	110	114	109	78	77	73	68	– 39 %	– 5.8 %	0.7 %	1.0 %
Cyprus	17	16	14	14	13	13	13	12	12	10	9	– 45 %	– 3.6 %	0.1 %	0.1 %
Czech Republic	311	215	244	182	179	174	166	151	151	136	129	– 59 %	– 5.5 %	1.8 %	1.9 %
Denmark	164	166	138	114	109	104	99	92	89	82	79	– 52 %	– 3.5 %	1.0 %	1.2 %
Estonia	70	50	45	40	38	39	37	35	35	33	34	– 52 %	1.8 %	0.4 %	0.5 %
Finland	257	218	166	136	131	129	118	111	116	106	105	– 59 %	– 0.8 %	1.5 %	1.6 %
France	2 591	2 166	1 742	1 261	1 145	1 021	929	830	817	738	711	– 73 %	– 3.6 %	15.4 %	10.6 %
Germany	3 067	1 769	1 372	1 124	1 113	1 051	997	912	1 024	981	954	– 69 %	– 2.8 %	18.2 %	14.2 %
Greece	268	258	264	220	230	219	228	212	185	159	152	– 43 %	– 4.3 %	1.6 %	2.3 %
Hungary	249	178	154	124	123	116	109	110	108	104	104	– 58 %	– 0.4 %	1.5 %	1.5 %
Ireland	81	76	69	57	56	54	52	49	46	45	43	– 47 %	– 3.1 %	0.5 %	0.6 %
Italy	1 924	1 959	1 514	1 204	1 164	1 111	1 053	981	936	916	855	– 56 %	– 6.7 %	11.4 %	12.7 %
Latvia	80	66	57	56	56	54	52	52	53	51	54	– 32 %	6.7 %	0.5 %	0.8 %
Lithuania	91	73	65	68	67	66	65	63	62	59	59	– 35 %	0.9 %	0.5 %	0.9 %
Luxembourg	19	18	13	13	12	12	10	10	9	9	9	– 55 %	– 6.3 %	0.1 %	0.1 %
Malta	6	8	3	3	4	3	3	3	3	3	3	– 49 %	4.9 %	0.0 %	0.0 %
Netherlands	482	341	238	172	164	162	160	149	150	149	146	– 70 %	– 1.9 %	2.9 %	2.2 %
Poland	831	680	575	575	628	614	637	617	653	638	630	– 24 %	– 1.3 %	4.9 %	9.4 %
Portugal	296	283	258	207	200	196	189	177	180	173	168	– 43 %	– 2.9 %	1.8 %	2.5 %
Romania	362	206	266	425	396	395	411	364	364	354	357	– 1 %	0.6 %	2.1 %	5.3 %
Slovakia	134	91	66	73	70	67	67	64	62	68	61	– 54 %	– 10.4 %	0.8 %	0.9 %
Slovenia	69	63	55	48	47	46	44	43	42	41	40	– 43 %	– 3.5 %	0.4 %	0.6 %
Spain	1 055	977	994	830	798	780	713	654	649	619	598	– 43 %	– 3.4 %	6.3 %	8.9 %
Sweden	359	277	222	198	194	191	187	188	188	189	186	– 48 %	– 1.8 %	2.1 %	2.8 %
United Kingdom	2 780	2 261	1 607	1 160	1 112	1 073	992	895	863	844	832	– 70 %	– 1.4 %	16.5 %	12.4 %
EU-28 (a)	**16 853**	**13 088**	**10 668**	**8 800**	**8 567**	**8 183**	**7 803**	**7 180**	**7 216**	**6 904**	**6 707**	**– 60 %**	**– 2.9 %**	**100 %**	**100 %**
EU-28 (b)	16 853	13 088	10 668	8 800	8 567	8 183	7 803	7 180	7 216	6 904	6 705				

Note: (a) Sum of national totals as reported by Member States.
(b) Sum of sectors: differences arise when only national totals and no sectoral data are available.
Negative percentage values indicate that emissions have decreased.
Shaded cells denote gap-filled data. For more detailed information, see Annex D.

The two categories '1 A 4 b i — Residential: Stationary plants' and '3 D 2 — Domestic solvent use including fungicides' were the most important key categories for NMVOC emissions, together making up 24 % of total emissions (Figure 2.4(a)). Among the top five key categories, the highest relative reductions in emissions between 1990 and 2012 were achieved in the fourth most important key category, '3 D 3 — Other product use' (– 51.8 %).

Figure 2.4(b) shows the contribution to total EU-28 emissions made by the aggregated sector groups. For NMVOC, important emission sources are 'Solvent and product use', 'Commercial, institutional and households' and 'Road transport'.

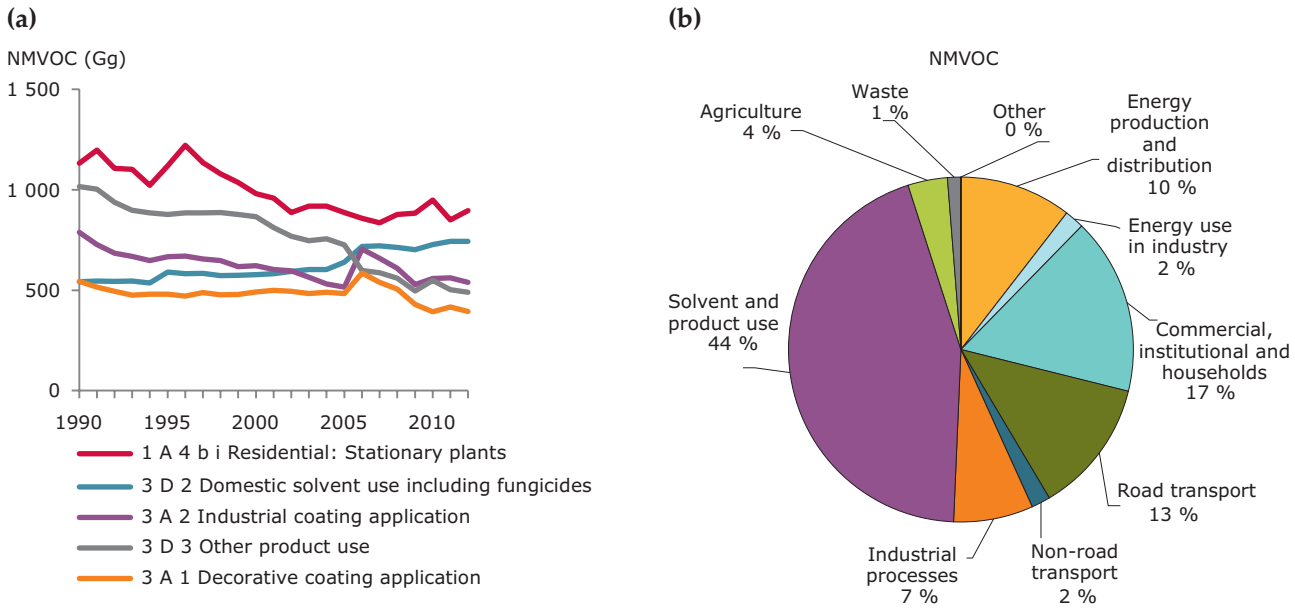
2.4 Sulphur oxides (SO_x) emission trends and key categories

Between 1990 and 2012, SO_x emissions dropped in the EU-28 by 84 %. Between 2011 and 2012, emissions decreased by 9.7 %, mainly due to reduced emissions in Bulgaria, Romania and Spain (see Table 2.5). The Member States that contributed most (i.e. more than 10 %) to SO_x emissions in 2012 were Poland, Germany, the United Kingdom and Spain.

In Spain, the decrease in SO_x emissions is clearly determined by the emissions reduction due to combustion in energy sector industries, whose emissions represent between 25.7 % (2010) and 78.1 % (2005) of all emissions for this gas. It is worth mentioning the sharp fall in emissions during 2008 and, to a lesser extent, 2009 and 2010, due to decreased activity at coal-fired power plants. 2012 saw an upturn in emissions due to the significant increase in coal consumption for electricity generation in power plants (Appendix 5, Spain's IIR).

An inspection of the time trends for some Member States reveals significant changes in emission reductions since 1990. Several Member States noted that large reductions of SO_x were achieved by installing desulphurisation plants (Denmark, the Netherlands, Poland, Slovenia and the United Kingdom). SO_x emissions were also brought down by using fuels with a lower sulphur content, and by fuel switching from fuels with high sulphur levels to low-sulphur fuels such as liquid and gaseous fuels (Belgium, Denmark, Estonia, France, Germany, Latvia, the Netherlands, Slovenia, Sweden and the United Kingdom) (Appendix 5, IIRs of Belgium Denmark, Estonia, France, Germany, Latvia, the Netherlands, Poland, Slovenia, Sweden and the United Kingdom).

Figure 2.4 NMVOC emissions in the EU-28: (a) trend in NMVOC emissions from the five most important key categories, 1990–2012; (b) share of emissions by sector group, 2012



Austria reported that the economic crisis caused emissions to drop sharply in 2009, but they increased slightly in 2010 when the economy recovered. From 2011 to 2012, emissions fell again (Appendix 5, Austria's IIR).

Cyprus noted that the increase observed in the SO_X emissions in 2010 and 2011 was due to the fact that the FGD Unit installed in Steam Turbine Unit 3 of the Vasilikos power station was not in operation from 20 January 2010. The decrease observed in the SO_X emissions in 2012 was attributed to the fact that the temporary internal combustion engine (ICE) engines installed were using diesel with a low sulphur content. (Appendix 5, Cyprus' IIR).

Table 2.5 Member State contributions to EU SO_x emissions (Gg)

Member State	SO_x (Gg)											Change		Share in EU-28	
	1990	1995	2000	2005	2006	2007	2008	2009	2010	2011	2012	1990–2012	2011–2012	1990	2012
Austria	74	48	32	27	28	25	22	17	19	18	17	– 77 %	– 4.3 %	0.3 %	0.4 %
Belgium	359	258	174	144	134	125	97	76	61	54	49	– 86 %	– 9.1 %	1.4 %	1.2 %
Bulgaria	1 100	1 295	861	776	763	819	569	440	387	515	329	– 70 %	– 36.1 %	4.3 %	8.2 %
Croatia	174	82	62	64	60	67	57	60	35	33	26	– 85 %	– 23.1 %	0.7 %	0.6 %
Cyprus	30	37	46	35	29	27	23	18	22	21	16	– 45 %	– 22.3 %	0.1 %	0.4 %
Czech Republic	1 876	1 095	264	219	211	217	174	173	170	164	158	– 92 %	– 3.5 %	7.3 %	3.9 %
Denmark	178	141	31	25	28	25	20	15	15	14	13	– 93 %	– 10.6 %	0.7 %	0.3 %
Estonia	274	116	97	76	70	88	69	55	83	73	41	– 85 %	– 44.2 %	1.1 %	1.0 %
Finland	263	99	79	69	84	83	70	59	67	61	51	– 80 %	– 15.7 %	1.0 %	1.3 %
France	1 305	972	633	460	434	424	359	311	288	246	232	– 82 %	– 5.7 %	5.1 %	5.8 %
Germany	5 282	1 705	638	460	471	454	454	407	430	424	427	– 92 %	0.8 %	20.4 %	10.7 %
Greece	476	540	496	541	533	538	445	426	265	262	245	– 49 %	– 6.6 %	1.8 %	6.1 %
Hungary	827	619	423	43	41	36	37	31	32	35	32	– 96 %	– 9.9 %	3.2 %	0.8 %
Ireland	182	161	140	72	61	55	45	32	26	25	23	– 87 %	– 5.9 %	0.7 %	0.6 %
Italy	1 799	1 326	753	405	382	339	284	232	214	194	177	– 90 %	– 8.3 %	7.0 %	4.4 %
Latvia	102	49	16	7	6	6	5	4	3	3	2	– 98 %	– 18.9 %	0.4 %	0.1 %
Lithuania	209	87	44	43	44	34	33	32	32	29	36	– 83 %	26.7 %	0.8 %	0.9 %
Luxembourg	15	9	3	2	3	2	2	2	2	2	2	– 87 %	13.3 %	0.1 %	0.1 %
Malta	16	27	24	11	11	12	11	8	8	8	8	– 51 %	– 2.3 %	0.1 %	0.2 %
Netherlands	192	129	73	64	64	61	51	37	34	34	34	– 82 %	0.9 %	0.7 %	0.8 %
Poland	3 210	2 255	1 451	1 217	1 292	1 229	1 007	868	936	898	853	– 73 %	– 4.9 %	12.4 %	21.3 %
Portugal	315	321	250	177	152	145	96	61	53	49	43	– 86 %	– 10.6 %	1.2 %	1.1 %
Romania	871	748	526	643	653	535	526	444	350	322	260	– 70 %	– 19.2 %	3.4 %	6.5 %
Slovakia	524	245	127	89	88	71	69	64	69	68	59	– 89 %	– 14.5 %	2.0 %	1.5 %
Slovenia	199	122	93	41	16	15	13	10	10	11	10	– 95 %	– 7.1 %	0.8 %	0.3 %
Spain	2 170	1 855	1 496	1 278	1 167	1 135	512	459	424	459	408	– 81 %	– 11.2 %	8.4 %	10.2 %
Sweden	105	69	42	36	36	32	30	29	32	29	28	– 74 %	– 4.9 %	0.4 %	0.7 %
United Kingdom	3 709	2 357	1 230	709	667	588	491	398	415	386	427	– 88 %	10.7 %	14.4 %	10.7 %
EU-28 (a)	**25 835**	**16 766**	**10 103**	**7 733**	**7 529**	**7 188**	**5 573**	**4 769**	**4 484**	**4 434**	**4 005**	**– 84 %**	**– 9.7 %**	**100 %**	**100 %**
EU-28 (b)	25 835	16 766	10 103	7 733	7 529	7 188	5 573	4 769	4 484	4 434	4 005				

Note: (a) Sum of national totals as reported by Member States.
(b) Sum of sectors: differences arise when only national totals and no sectoral data are available.
Negative percentage values indicate a decrease of emissions.
Shaded cells denote gap-filled data. For more detailed information, see Annex D.

Category '1 A 1 a — Public electricity and heat production' is the most important key category for SO_X emissions, making up 50 % of total SO_X emissions (Figure 2.5(a)). Among the top five key categories, the highest relative reductions in emissions between 1990 and 2012 were achieved in the third most important key category, '1 A 2 f i — Stationary combustion in manufacturing industries and construction: Other' (− 86.0 %), the most important key category, '1 A 1 a — Public electricity and heat production' (− 83.9 %), and the fourth most important key category, '1 A 1 b — Petroleum refining' (− 76.5 %).

For these main emitting sources, the emissions reduction since 1990 has been achieved by combining several measures: switching fuel in energy-related sectors away from high-sulphur solid and liquid fuels to low-sulphur fuels such as natural gas; fitting FGD abatement technology in industrial facilities; and the impact of EU directives relating to the sulphur content of certain liquid fuels (EEA, 2014d).

Figure 2.5(b) shows the contribution to total EU-28 emissions made by the aggregated sector groups. For SO_X, common important emission sources are the energy sectors.

2.5 Ammonia (NH_3) emission trends and key categories

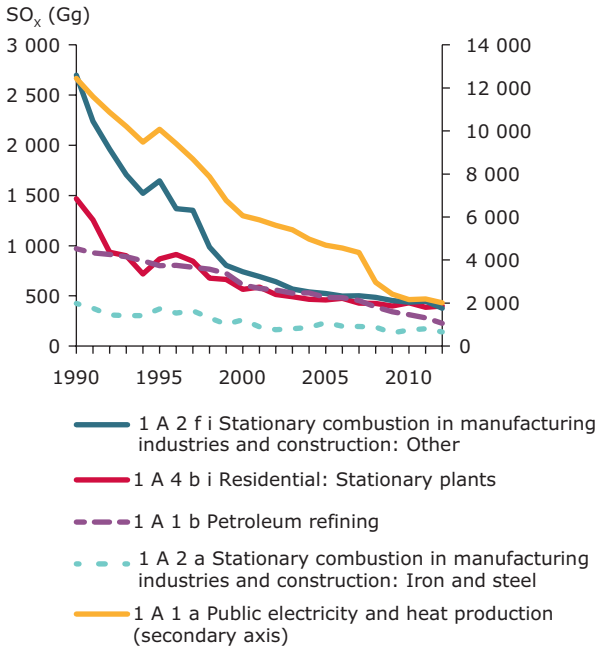
Between 1990 and 2012, NH_3 emissions dropped in the EU-28 by 28 %. Between 2011 and 2012, emissions decreased by 1.5 %, mainly due to emission reductions in France and Germany (see Table 2.6). The Member States that contributed most (i.e. more than 10 %) to NH_3 emissions in 2012 were France, Germany, Italy and Spain.

France reported that its NH_3 emissions decreased constantly between 1980 and 2012, despite the peaks in 2008 and 2011: this was a result of France's particular economic situation (Appendix 5, France's IIR).

Germany explained that the overall emission trend for NH_3 follows agricultural emissions. The decrease of NH_3 emissions in the year 1991 is due to a reduced livestock population following German reunification, while no explicit trend is discernible for the years since then (Appendix 5, Germany's IIR).

Figure 2.5 SO_x emissions in the EU-28: (a) trend in SO_x emissions from the five most important key categories, 1990–2012; (b) share of emissions by sector group, 2012

(a)



(b)

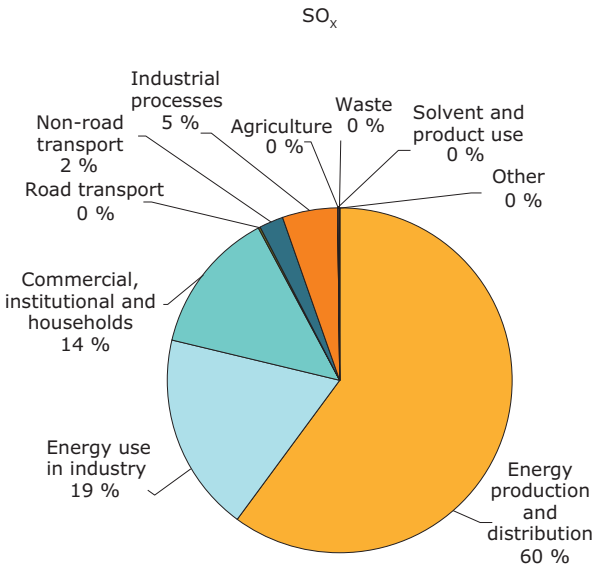


Table 2.6 Member State contributions to EU NH_3 emissions (Gg)

Member State	NH_3 (Gg)											Change		Share in EU-28	
	1990	1995	2000	2005	2006	2007	2008	2009	2010	2011	2012	1990–2012	2011–2012	1990	2012
Austria	65	71	65	63	63	63	63	63	63	62	62	– 5 %	– 0.1 %	1.3 %	1.7 %
Belgium	121	117	86	72	72	69	69	69	69	68	68	– 44 %	0.1 %	2.4 %	1.8 %
Bulgaria	113	58	42	48	51	53	52	43	42	40	38	– 66 %	– 5.1 %	2.2 %	1.0 %
Croatia	58	43	43	44	44	44	42	40	41	41	42	– 28 %	1.0 %	1.1 %	1.1 %
Cyprus	5	6	6	6	6	6	5	5	5	5	5	– 6 %	– 3.0 %	0.1 %	0.1 %
Czech Republic	156	86	74	68	63	60	58	73	69	66	64	– 59 %	– 2.1 %	3.1 %	1.7 %
Denmark	125	109	97	88	84	83	82	78	79	78	76	– 39 %	– 1.8 %	2.4 %	2.0 %
Estonia	25	11	10	10	10	10	11	10	10	10	11	– 56 %	4.6 %	0.5 %	0.3 %
Finland	39	36	36	38	38	38	38	37	38	37	37	– 5 %	– 1.1 %	0.8 %	1.0 %
France	706	684	725	686	684	686	715	700	691	721	679	– 4 %	– 5.8 %	13.8 %	18.2 %
Germany	697	598	600	572	568	566	567	574	549	560	545	– 22 %	– 2.6 %	13.7 %	14.6 %
Greece	85	74	71	68	66	68	65	62	64	62	61	– 28 %	– 0.6 %	1.7 %	1.6 %
Hungary	146	82	86	78	78	78	70	67	67	67	66	– 55 %	– 2.3 %	2.9 %	1.8 %
Ireland	107	112	114	110	110	107	108	109	108	104	105	– 2 %	0.9 %	2.1 %	2.8 %
Italy	468	448	449	416	412	420	409	393	379	381	404	– 14 %	6.3 %	9.2 %	10.9 %
Latvia	48	18	15	17	17	18	18	18	19	18	19	– 60 %	4.9 %	0.9 %	0.5 %
Lithuania	83	36	31	39	40	41	37	37	38	37	38	– 54 %	3.7 %	1.6 %	1.0 %
Luxembourg	8	9	8	7	7	7	7	7	7	7	7	– 13 %	– 2.3 %	0.2 %	0.2 %
Malta	2	2	2	2	2	2	2	2	2	2	2	– 19 %	– 0.6 %	0.0 %	0.0 %
Netherlands	355	208	162	143	144	143	131	129	127	125	120	– 66 %	– 4.0 %	7.0 %	3.2 %
Poland	508	316	284	272	287	291	286	274	271	271	263	– 48 %	– 3.0 %	10.0 %	7.0 %
Portugal	64	59	61	50	48	49	48	47	48	48	46	– 28 %	– 3.4 %	1.2 %	1.2 %
Romania	300	217	206	199	196	202	186	186	160	159	159	– 47 %	– 0.1 %	5.9 %	4.3 %
Slovakia	65	40	32	29	27	27	25	25	25	24	25	– 61 %	4.1 %	1.3 %	0.7 %
Slovenia	22	20	21	19	19	20	19	19	19	18	18	– 21 %	– 1.6 %	0.4 %	0.5 %
Spain	335	317	400	379	397	401	370	378	391	381	380	13 %	– 0.2 %	6.6 %	10.2 %
Sweden	55	64	59	56	55	53	52	50	52	52	51	– 7 %	– 0.7 %	1.1 %	1.4 %
United Kingdom	342	328	319	302	299	292	279	279	281	282	277	– 19 %	– 1.7 %	6.7 %	7.4 %
EU-28 (a)	**5 103**	**4 171**	**4 102**	**3 881**	**3 886**	**3 897**	**3 811**	**3 776**	**3 712**	**3 724**	**3 668**	**– 28 %**	**– 1.5 %**	**100 %**	**100 %**
EU-28 (b)	5 103	4 171	4 102	3 881	3 886	3 897	3 811	3 776	3 712	3 724	3 667				

Note: (a) Sum of national totals as reported by Member States.
(b) Sum of sectors: differences arise when only national totals and no sectoral data are available.
Negative percentage values indicate that emissions have decreased.
Shaded cells denote gap-filled data. For more detailed information, see Annex D.

Categories '4 D 1 a — Synthetic N-fertilisers', '4 B 1 a — Cattle dairy' and '4 B 1 b — Cattle non-dairy' are the most important key categories for NH_3 emissions, jointly making up 60 % of total NH_3 emissions (see Figure 2.6(a)). Among the top five key categories, the highest relative reduction in emissions between 1990 and 2012 was achieved in the fourth most important key category, '4 B 8 — Swine' (– 40.7 %).

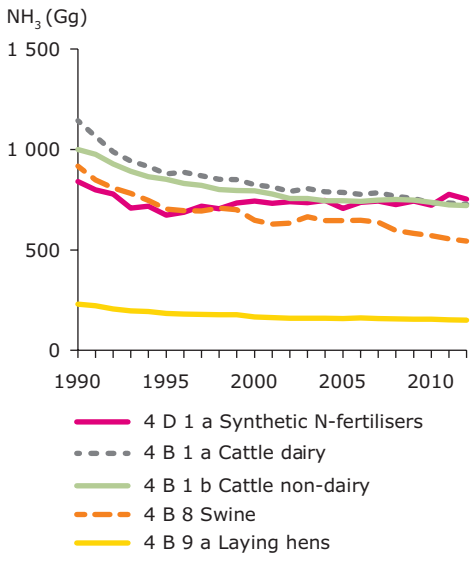
Figure 2.6(b) shows the contribution to total EU-28 emissions made by the aggregated sector groups. A single sector group, 'Agriculture', is responsible for most (93 %) of the NH_3 emissions in the EU-28. The fall in NH_3 emissions in the agricultural sector is due to the combination of reduced livestock numbers across Europe (especially cattle), changes in the handling and management of organic manures and the decreased use of nitrogenous fertilisers (EEA, 2014e).

2.6 Fine particulate matter ($PM_{2.5}$) emission trends and key categories

Between 2000 and 2012, $PM_{2.5}$ emissions dropped in the EU-28 by 19 %. Between 2011 and 2012, the decrease was 0.3 %, mainly due to reduced emissions in Estonia and Spain (see Table 2.7). The Member States that contributed most (i.e. more than 10 %) to $PM_{2.5}$ emissions in 2012 were France, Poland and Italy. Greece did not report $PM_{2.5}$ emissions for any year, and thus data for Greece could not be gap-filled. The EU-28 total is therefore underestimated.

Figure 2.6 **NH_3 emissions in the EU-28: (a) trend in NH_3 emissions from the five most important key categories, 1990–2012; (b) share of emissions by sector group, 2012**

(a)



(b)

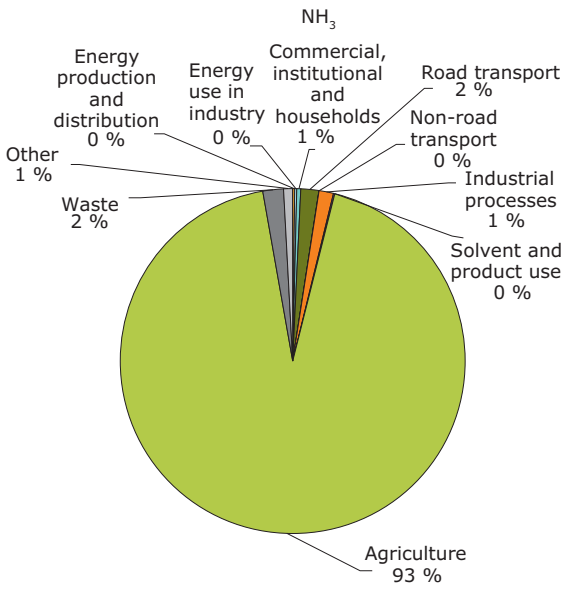


Table 2.7 Member State contributions to EU $PM_{2.5}$ emissions (Gg)

Member State	$PM_{2.5}$ (Gg)									Change		Share in EU-28	
	2000	2005	2006	2007	2008	2009	2010	2011	2012	2000–2012	2011–2012	2000	2012
Austria	23	22	21	20	20	19	20	19	19	– 17 %	– 0.3 %	1.5 %	1.5 %
Belgium	40	36	36	34	35	32	36	29	32	– 21 %	9.9 %	2.6 %	2.6 %
Bulgaria	22	27	28	26	27	25	27	29	29	31 %	0.6 %	1.5 %	2.4 %
Croatia	9	11	11	10	10	10	9	10	10	3 %	– 1.7 %	0.6 %	0.8 %
Cyprus	4	3	3	3	3	2	2	2	2	– 56 %	– 10.4 %	0.3 %	0.1 %
Czech Republic	24	21	22	21	21	19	20	20	20	– 17 %	– 0.8 %	1.6 %	1.6 %
Denmark	23	26	27	31	29	26	27	24	23	– 3 %	– 4.5 %	1.5 %	1.8 %
Estonia	21	20	15	20	20	19	23	26	17	– 20 %	– 35.5 %	1.4 %	1.4 %
Finland	42	41	45	37	36	38	41	37	37	– 10 %	0.3 %	2.7 %	3.0 %
France	311	246	228	212	206	196	200	174	181	– 42 %	4.0 %	20.2 %	14.5 %
Germany	148	125	123	117	113	109	119	113	112	– 25 %	– 1.1 %	9.6 %	9.0 %
Greece	NE	NE	NE	NE	NE	NE	NE	NE	NE				
Hungary	41	27	29	27	25	28	30	31	30	– 26 %	– 3.8 %	2.6 %	2.4 %
Ireland	11	11	10	10	10	9	8	8	8	– 30 %	0.8 %	0.7 %	0.6 %
Italy	170	142	138	139	135	126	130	127	126	– 26 %	– 0.5 %	11.0 %	10.2 %
Latvia	25	29	29	29	28	30	29	26	28	12 %	7.9 %	1.6 %	2.3 %
Lithuania	20	23	24	24	25	24	24	24	25	24 %	2.7 %	1.3 %	2.0 %
Luxembourg	3	4	4	3	3	3	3	3	3	– 20 %	– 1.4 %	0.2 %	0.2 %
Malta	1	1	1	1	1	1	1	1	1	– 16 %	– 1.2 %	0.1 %	0.1 %
Netherlands	24	19	18	18	17	15	15	14	13	– 47 %	– 7.8 %	1.6 %	1.0 %
Poland	139	141	140	138	135	129	143	136	137	– 1 %	1.0 %	9.0 %	11.1 %
Portugal	76	69	65	63	61	58	57	57	56	– 27 %	– 2.8 %	4.9 %	4.5 %
Romania	82	106	101	107	123	117	120	109	113	37 %	3.7 %	5.3 %	9.1 %
Slovakia	23	37	32	28	28	27	27	29	29	27 %	0.4 %	1.5 %	2.3 %
Slovenia	15	16	16	16	15	16	16	17	17	15 %	1.1 %	1.0 %	1.4 %
Spain	98	94	92	91	82	81	77	75	72	– 27 %	– 4.1 %	6.4 %	5.8 %
Sweden	29	30	29	29	28	28	29	28	27	– 6 %	– 5.2 %	1.9 %	2.2 %
United Kingdom	117	93	91	89	86	80	82	78	77	– 34 %	– 1.3 %	7.6 %	6.2 %
EU-28 (a)	**1 542**	**1 417**	**1 378**	**1 345**	**1 321**	**1 268**	**1 312**	**1 246**	**1 242**	**– 19 %**	**– 0.3 %**	**100 %**	**100 %**
EU-28 (b)	1 542	1 417	1 378	1 345	1 321	1 268	1 312	1 246	1 242				

Note: (a) Sum of national totals as reported by Member States.

(b) Sum of sectors: differences arise when only national totals and no sectoral data are available.

Parties to the LRTAP Convention are formally requested to report emissions of PM for the year 2000 and after.

Negative percentage values indicate that emissions have decreased.

Light-grey shaded cells denote gap-filled data. For more detailed information, see Annex D.

Dark-grey shaded cells indicate that no emission values are available. See Appendix 1 for an explanation of the notation keys reported by Member States.

Domestic fuel use in '1 A 4 b i — Residential: Stationary plants' is the most important key category for $PM_{2.5}$ emissions, making up 49 % of total $PM_{2.5}$ emissions (Figure 2.7(a)). Among the top five key categories, the highest relative reductions in emissions between 2000 and 2012 were achieved in the fifth most important key category, '1 A 4 c ii Agriculture/Forestry/Fishing: Off-road vehicles and other machinery (− 49.6 %)', and the second and third most important key category, '1 A 1 a Public electricity and heat production' and '1 A 3 b i Road transport: Passenger cars (both − 45.7 %). In contrast to the other four top key categories, the most important key category, '1 A 4 b i — Residential: Stationary plants', increased since 2000 (13.6 %).

Figure 2.7(b) shows the contribution to total EU-28 emissions made by the aggregated sector groups. The 'Commercial, institutional and households' sector group is a major source of $PM_{2.5}$, and also of PM_{10}, total PAHs, PCDD/Fs and PCBs.

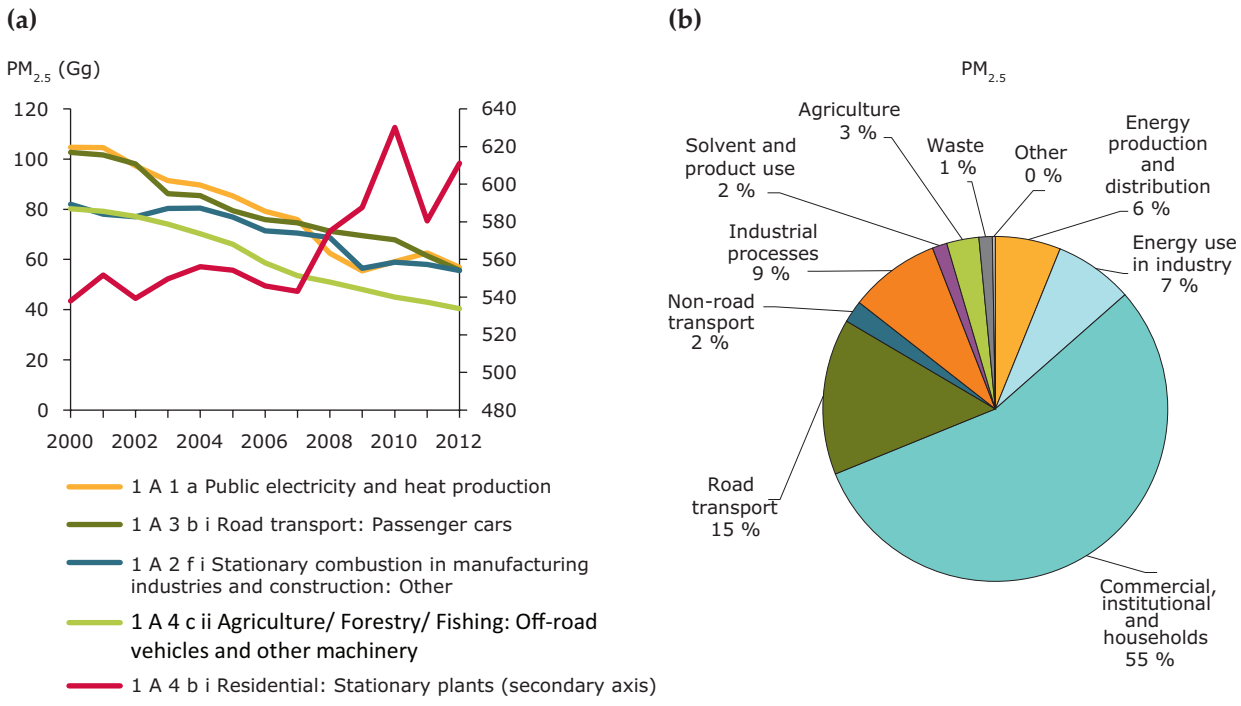
2.7 Coarse particulate matter (PM_{10}) emission trends and key categories

Between 2000 and 2012, PM_{10} emissions in the EU-28 dropped by 19 %. Between 2010 and 2012, the decrease was 0.8 %, mainly due to reductions of emissions in Estonia (see Table 2.8). The Member States that contributed most (i.e. more than 10 %) to PM_{10} emissions in 2012 were France, Poland and Germany. Greece did not report PM_{10} emissions for any year, and thus data for Greece could not be gap-filled. The EU-28 total is therefore underestimated.

The decrease of PM_{10} emissions in France (1990–2012), is mainly due to changes of activity in industrial sectors (steel and coal mining, in particular) (France's IIR).

As for $PM_{2.5}$, '1 A 4 b i — Residential: Stationary plants' is the most important key category for

Figure 2.7 **$PM_{2.5}$ emissions in the EU-28: (a) trend in $PM_{2.5}$ emissions from the five most important key categories, 1990–2012; (b) share of emissions by sector group, 2012**



Note: Parties to the LRTAP Convention are formally requested to report emissions of PM for the year 2000 and after.

Table 2.8 Member State contributions to EU PM_{10} emissions (Gg)

Member State	PM_{10} (Gg)									Change		Share in EU-28	
	2000	2005	2006	2007	2008	2009	2010	2011	2012	2000–2012	2011–2012	2000	2012
Austria	39	38	36	36	36	34	35	34	34	– 12 %	– 0.4 %	1.7 %	1.9 %
Belgium	52	45	46	43	43	39	43	36	39	– 26 %	8.0 %	2.3 %	2.1 %
Bulgaria	36	45	47	47	46	39	41	45	44	23 %	– 2.0 %	1.6 %	2.4 %
Croatia	14	18	18	17	17	16	15	15	15	5 %	– 3.3 %	0.6 %	0.8 %
Cyprus	6	5	4	4	4	4	4	3	3	– 54 %	– 10.6 %	0.3 %	0.2 %
Czech Republic	42	34	35	35	35	32	37	34	34	– 18 %	– 0.1 %	1.9 %	1.9 %
Denmark	30	33	34	38	35	33	33	30	28	– 5 %	– 4.8 %	1.3 %	1.6 %
Estonia	37	27	20	29	25	23	32	42	21	– 44 %	– 49.8 %	1.7 %	1.1 %
Finland	58	57	64	52	49	52	55	51	50	– 13 %	– 1.7 %	2.6 %	2.7 %
France	419	344	325	307	298	284	288	261	270	– 35 %	3.4 %	18.5 %	14.7 %
Germany	261	224	223	218	211	203	220	219	217	– 17 %	– 1.3 %	11.6 %	11.8 %
Greece	NE	NE	NE	NE	NE	NE	NE	NE	NE				
Hungary	65	43	44	42	40	42	43	44	43	– 34 %	– 3.6 %	2.9 %	2.3 %
Ireland	17	17	16	16	15	13	13	12	13	– 27 %	4.9 %	0.8 %	0.7 %
Italy	199	172	168	169	165	154	158	155	153	– 23 %	– 1.2 %	8.8 %	8.3 %
Latvia	29	36	35	36	35	36	35	33	36	22 %	7.8 %	1.3 %	1.9 %
Lithuania	22	24	25	24	25	25	25	25	25	15 %	2.8 %	1.0 %	1.4 %
Luxembourg	5	10	10	16	12	10	10	8	10	81 %	19.9 %	0.2 %	0.5 %
Malta	1	2	2	2	2	2	1	1	1	– 2 %	– 1.2 %	0.1 %	0.1 %
Netherlands	39	33	32	32	31	29	28	28	27	– 32 %	– 5.2 %	1.7 %	1.4 %
Poland	266	271	278	269	264	253	283	261	266	0 %	1.9 %	11.8 %	14.5 %
Portugal	100	99	90	87	86	83	78	77	73	– 26 %	– 4.7 %	4.4 %	4.0 %
Romania	106	126	117	128	138	132	134	124	128	21 %	3.2 %	4.7 %	7.0 %
Slovakia	45	42	37	32	31	31	30	32	32	– 27 %	0.6 %	2.0 %	1.8 %
Slovenia	20	20	20	20	18	19	19	20	20	2 %	0.3 %	0.9 %	1.1 %
Spain	141	134	130	130	115	112	108	106	102	– 27 %	– 4.0 %	6.2 %	5.6 %
Sweden	41	43	42	42	41	39	41	40	38	– 5 %	– 4.3 %	1.8 %	2.1 %
United Kingdom	170	135	134	132	125	115	117	112	113	– 34 %	0.3 %	7.5 %	6.2 %
EU-28 (a)	**2 260**	**2 076**	**2 035**	**2 001**	**1 943**	**1 852**	**1 923**	**1 850**	**1 835**	**– 19 %**	**– 0.8 %**	**100 %**	**100 %**
EU-28 (b)	2 260	2 076	2 035	2 001	1 943	1 852	1 923	1 850	1 835				

Note: (a) Sum of national totals as reported by Member States.

(b) Sum of sectors: differences arise when only national totals and no sectoral data are available.

Parties to the LRTAP Convention are formally requested to report emissions of PM for the year 2000 and after.

Negative percentage values indicate that emissions have decreased.

Light-grey shaded cells denote gap-filled data. For more detailed information, see Annex D.

Dark-grey shaded cells indicate that no emission values are available. See Appendix 1 for an explanation of the notation keys reported by Member States.

PM_{10} emissions, accounting for 38 % of total PM10 emissions (see Figure 2.8(a)). Among the top five key categories, the highest relative reductions in emissions between 1990 and 2012 were achieved in the second most important key category, '1 A 1 a — Public electricity and heat production', (– 52.7 %) (Figure 2.8(a)) and the third most important key category, '1 A 2 f i — Stationary combustion in manufacturing industries and construction: Other' (– 35.1 %). Emissions of the other top five key categories increased.

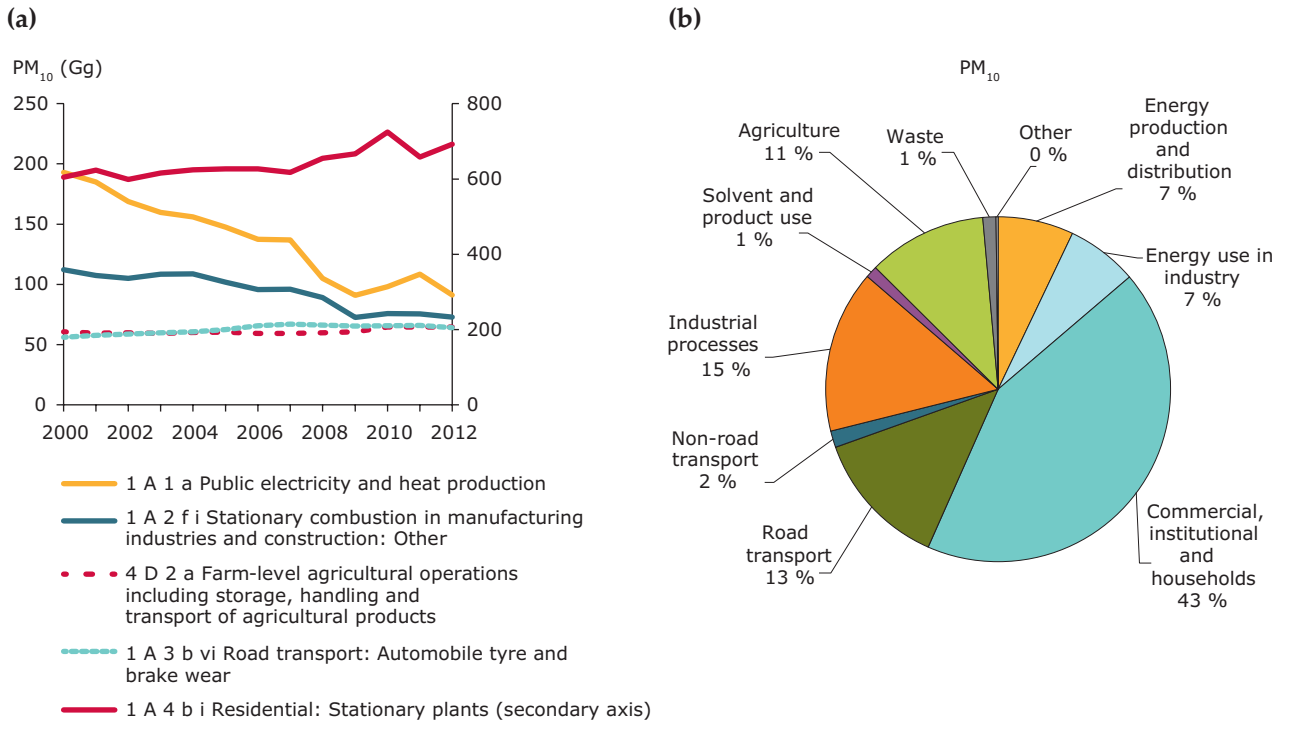
Figure 2.8(b) shows the contribution to total EU-28 emissions made by the aggregated sector groups. The 'Commercial, institutional and households' sector group is a very significant source of PM_{10}, and likewise of $PM_{2.5}$, total PAHs, PCDD/Fs and PCBs.

2.8 Total suspended particulate (TSP) emission trends

Between 1990 and 2012, TSP emissions in the EU-28 dropped by 55 %. Between 2011 and 2012, emissions decreased by 1.5 %, mainly due to emissions reductions in Estonia, Bulgaria and Portugal (Table 2.9). The Member States that contributed most (i.e. more than 10 %) to TSP emissions in 2012 were France and Poland. Greece did not report TSP emissions for any year, and thus data for Greece could not be gap-filled. The EU-28 total is therefore underestimated.

The decrease of TSP emissions from Estonia between 1990 and 2012 was due to enhanced efficiency of combustion devices and cleaning installations (especially in oil-shale power plants and cement factories), as well as a drop in electricity production. The significant reduction of TSP emissions in 2012 as compared to 2011 was mainly due to the decrease in electricity production and also to the correction of the operation of electric precipitators on power units in the same power plant (Appendix 5, Estonia's IIR).

Figure 2.8 **PM_{10} emissions in the EU-28: (a) trend in PM_{10} emissions from the five most important key categories, 1990–2012; (b) share of emissions by sector group, 2012**



Note: Parties to the LRTAP Convention are formally requested to report emissions of PM for the year 2000 and after.

Table 2.9 Member State contributions to EU TSP emissions (Gg)

Member State	TSPs (Gg)											Change		Share in EU-28	
	1990	1995	2000	2005	2006	2007	2008	2009	2010	2011	2012	1990–2012	2011–2012	1990	2012
Austria	63	63	63	63	61	61	62	59	60	59	59	– 5 %	– 0.5 %	0.8 %	1.7 %
Belgium	90	82	77	68	68	63	63	53	58	50	54	– 40 %	7.9 %	1.2 %	1.6 %
Bulgaria	82	111	82	128	130	140	125	95	97	111	97	19 %	– 12.7 %	1.1 %	2.8 %
Croatia	27	18	22	34	33	33	35	31	28	28	27	0 %	– 6.1 %	0.4 %	0.8 %
Cyprus	17	14	11	7	7	7	7	6	6	5	4	– 76 %	– 12.1 %	0.2 %	0.1 %
Czech Republic	640	202	57	64	68	67	64	62	61	57	56	– 91 %	– 0.9 %	8.5 %	1.7 %
Denmark	32	35	38	42	42	46	43	40	41	38	36	11 %	– 4.9 %	0.4 %	1.1 %
Estonia	279	135	75	38	29	37	32	29	38	49	27	– 90 %	– 45.4 %	3.7 %	0.8 %
Finland	37	38	78	87	99	79	73	76	80	76	74	> 100 %	– 2.6 %	0.5 %	2.2 %
France	1 238	1 146	1 081	987	958	924	905	876	882	860	879	– 29 %	2.1 %	16.5 %	25.8 %
Germany	1 884	417	377	323	323	315	307	291	316	321	316	– 83 %	– 1.6 %	25.1 %	9.3 %
Greece	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE				
Hungary	206	196	187	169	169	167	163	164	160	166	163	– 21 %	– 1.6 %	2.7 %	4.8 %
Ireland	34	31	29	28	26	26	25	22	21	21	22	– 35 %	6.7 %	0.5 %	0.6 %
Italy	285	285	244	215	212	213	208	194	199	196	193	– 32 %	– 1.3 %	3.8 %	5.7 %
Latvia	24	29	33	47	46	50	50	44	43	46	50	> 100 %	8.0 %	0.3 %	1.5 %
Lithuania	28	20	22	27	29	28	30	26	26	26	27	– 3 %	2.8 %	0.4 %	0.8 %
Luxembourg	379	159	6	11	11	17	12	10	10	8	10	– 97 %	19.1 %	5.1 %	0.3 %
Malta	3	4	5	6	6	6	6	6	1	2	2	– 44 %	– 1.4 %	0.0 %	0.0 %
Netherlands	91	69	46	40	39	39	38	34	34	34	31	– 66 %	– 7.2 %	1.2 %	0.9 %
Poland	678	553	426	430	440	430	422	409	449	423	428	– 37 %	1.1 %	9.0 %	12.6 %
Portugal	143	194	216	251	211	200	201	201	171	163	149	4 %	– 8.5 %	1.9 %	4.4 %
Romania	248	242	244	257	228	272	268	234	252	248	239	– 4 %	– 3.7 %	3.3 %	7.0 %
Slovakia	290	106	57	53	46	40	37	36	36	38	38	– 87 %	1.0 %	3.9 %	1.1 %
Slovenia	28	26	25	26	25	25	23	24	23	25	24	– 14 %	– 0.7 %	0.4 %	0.7 %
Spain	204	203	203	195	188	188	169	163	159	158	153	– 25 %	– 3.2 %	2.7 %	4.5 %
Sweden	64	57	47	50	50	49	48	46	48	47	45	– 29 %	– 3.8 %	0.9 %	1.3 %
United Kingdom	400	326	279	233	233	229	220	202	207	202	203	– 49 %	0.3 %	5.3 %	6.0 %
EU-28 ([a])	**7 492**	**4 760**	**4 030**	**3 877**	**3 777**	**3 750**	**3 633**	**3 432**	**3 504**	**3 455**	**3 404**	**– 55 %**	**– 1.5 %**	**100 %**	**100 %**
EU-28 ([b])	7 492	4 760	4 030	3 877	3 777	3 750	3 633	3 432	3 504	3 455	3 404				

Note: ([a]) Sum of national totals as reported by Member States.

([b]) Sum of sectors: differences arise when only national totals and no sectoral data are available.

Negative percentage values indicate that emissions have decreased.

Light-grey shaded cells denote gap-filled data. For more detailed information, see Annex D.

Dark-grey shaded cells indicate that no emission values are available. See Appendix 1 for an explanation of the notation keys reported by Member States.

2.9 Carbon monoxide (CO) emission trends and key categories

Between 1990 and 2012, CO emissions dropped in the EU-28 by 66 %. Between 2011 and 2012, the decrease was 3.2 %, and was mainly due to emission reductions in France, Italy and United Kingdom (Table 2.10). The Member States that contributed most (i.e. more than 10 %) to CO emissions in 2012 were Germany, France and Poland.

In France, the reduction of CO between 1990 and 2012 was mainly due to the introduction of catalytic converters in gasoline-powered vehicles (since 1993) and the diesel fleet. Improvements in vehicles for more than 20 years were already very noticeable, even before 1990. This explains the decrease in emissions of carbon monoxide between 1980 and 2012 in the 'Road transport' sector (Appendix 5, France's IIR).

Table 2.10 Member State contributions to EU CO emissions (Gg)

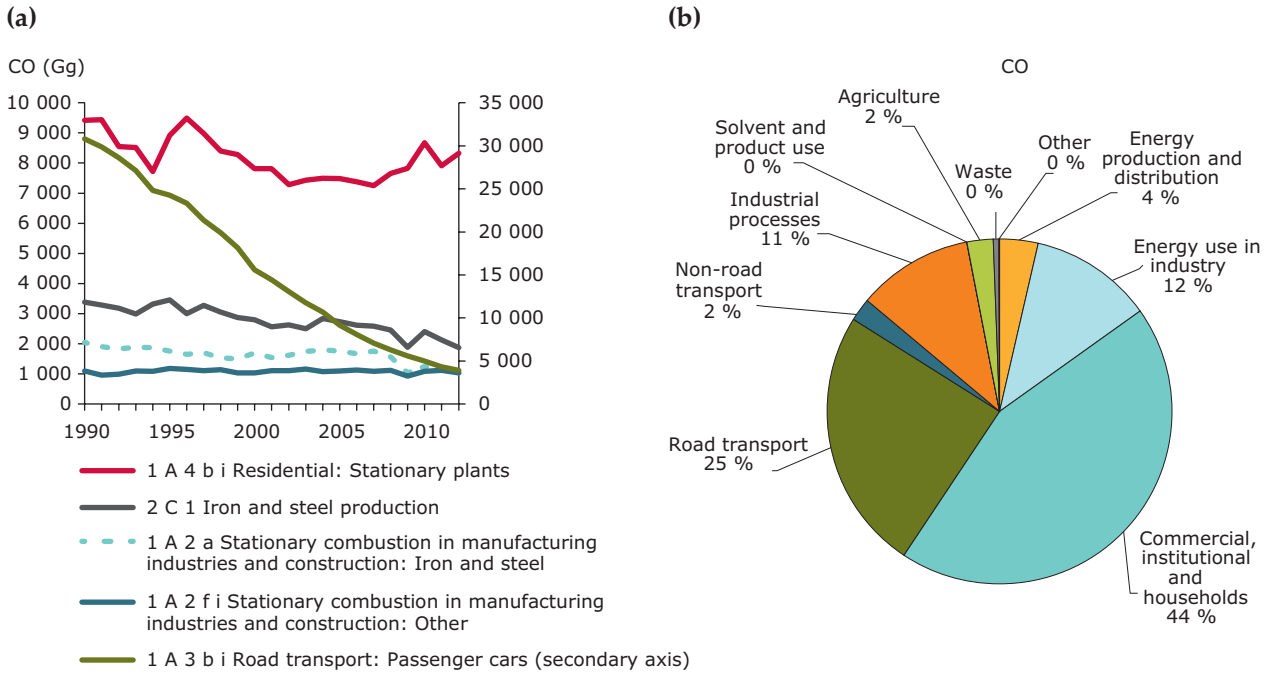
Member State	CO (Gg)											Change		Share in EU-28	
	1990	1995	2000	2005	2006	2007	2008	2009	2010	2011	2012	1990–2012	2011–2012	1990	2012
Austria	1 436	1 274	959	814	774	722	685	638	642	606	609	– 58 %	0.6 %	2.2 %	2.7 %
Belgium	1 321	1 015	900	757	663	664	669	441	533	425	392	– 70 %	– 7.6 %	2.0 %	1.8 %
Bulgaria	731	510	371	350	362	308	285	249	273	286	283	– 61 %	– 1.0 %	1.1 %	1.3 %
Croatia	574	395	441	355	355	332	289	286	278	285	279	– 51 %	– 2.1 %	0.9 %	1.2 %
Cyprus	53	45	34	26	24	24	23	21	19	18	17	– 68 %	– 7.1 %	0.1 %	0.1 %
Czech Republic	1 030	897	643	511	484	509	439	403	402	361	342	– 67 %	– 5.2 %	1.6 %	1.5 %
Denmark	731	652	490	461	453	463	442	415	408	372	360	– 51 %	– 3.1 %	1.1 %	1.6 %
Estonia	227	197	183	158	144	163	167	168	172	148	162	– 28 %	9.8 %	0.3 %	0.7 %
Finland	723	624	611	530	507	501	486	465	485	455	453	– 37 %	– 0.5 %	1.1 %	2.0 %
France	10 631	9 093	6 530	5 236	4 723	4 450	4 273	3 802	4 205	3 501	3 200	– 70 %	– 8.6 %	16.0 %	14.3 %
Germany	12 432	6 600	4 844	3 667	3 587	3 484	3 396	3 015	3 456	3 298	3 300	– 73 %	0.1 %	18.7 %	14.7 %
Greece	1 132	953	921	720	736	681	621	591	525	492	450	– 60 %	– 8.5 %	1.7 %	2.0 %
Hungary	1 227	791	680	469	494	454	410	423	418	404	375	– 69 %	– 7.0 %	1.8 %	1.7 %
Ireland	402	314	248	187	179	169	157	150	137	126	118	– 71 %	– 6.1 %	0.6 %	0.5 %
Italy	6 970	6 970	4 657	3 156	2 892	2 673	2 553	2 262	2 326	2 267	2 113	– 70 %	– 6.8 %	10.5 %	9.4 %
Latvia	381	286	222	207	200	189	176	188	182	156	161	– 58 %	3.2 %	0.6 %	0.7 %
Lithuania	452	287	218	217	215	200	200	195	201	183	187	– 59 %	2.5 %	0.7 %	0.8 %
Luxembourg	489	281	93	64	56	56	47	41	43	42	43	– 91 %	2.6 %	0.7 %	0.2 %
Malta	24	30	1	1	1	1	1	31	11	12	12	– 50 %	0.9 %	0.0 %	0.1 %
Netherlands	1 145	943	792	683	674	655	658	607	605	583	561	– 51 %	– 3.8 %	1.7 %	2.5 %
Poland	7 406	3 452	2 655	2 765	2 765	2 678	2 706	2 641	2 938	2 801	2 818	– 62 %	0.6 %	11.2 %	12.6 %
Portugal	782	787	658	463	431	409	393	368	362	337	304	– 61 %	– 9.8 %	1.2 %	1.4 %
Romania	1 239	901	1 302	1 257	1 128	1 128	1 228	1 118	1 105	1 014	1 033	– 17 %	1.9 %	1.9 %	4.6 %
Slovakia	515	423	300	272	273	249	245	208	221	227	221	– 57 %	– 2.6 %	0.8 %	1.0 %
Slovenia	336	301	213	181	171	163	159	156	153	160	159	– 53 %	– 0.7 %	0.5 %	0.7 %
Spain	3 660	3 164	2 704	2 140	2 119	2 110	1 994	1 927	2 000	1 987	1 924	– 47 %	– 3.1 %	5.5 %	8.6 %
Sweden	1 278	1 123	815	661	622	609	597	596	575	552	546	– 57 %	– 1.1 %	1.9 %	2.4 %
United Kingdom	9 081	7 493	5 613	3 526	3 315	3 012	2 815	2 351	2 230	2 050	1 978	– 78 %	– 3.5 %	13.7 %	8.8 %
EU-28 (a)	**66 407**	**49 799**	**38 096**	**29 833**	**28 345**	**27 055**	**26 113**	**23 755**	**24 907**	**23 144**	**22 401**	**– 66 %**	**– 3.2 %**	**100 %**	**100 %**
EU-28 (b)	66 407	49 799	38 096	29 833	28 345	27 055	26 113	23 755	24 907	23 144	22 401				

Note: (a) Sum of national totals as reported by Member States.
(b) Sum of sectors: differences arise when only national totals and no sectoral data are available.
Negative percentage values indicate that emissions have decreased.
Shaded cells denote gap-filled data. For more detailed information, see Annex D.

'1 A 4 b i — Residential: Stationary plants' and '1 A 3 b i — Road transport: Passenger cars' were the most important key categories for CO emissions, jointly accounting for 55 % of total CO emissions. Among the top five key categories, the highest relative reductions in emissions between 1990 and 2012 were achieved in the second most important key category, '1 A 3 b i — Road transport: Passenger cars' (– 87.3 %) (see Figure 2.9(a)).

Figure 2.9(b) shows the contribution to total EU-28 emissions made by the aggregated sector groups. For CO, common important emission sources are 'Commercial, institutional and households' and 'Road transport'.

Figure 2.9 CO emissions in the EU-28: (a) trend in CO emissions from the five most important key categories, 1990–2012; (b) share of emissions by sector group, 2012



2.10 Lead (Pb) emission trends and key categories

Between 1990 and 2012, Pb emissions dropped in the EU-28 by 89 %. Between 2011 and 2012, emissions decreased by 0.7 %, mainly due to reduced emissions in Italy, Croatia and the Netherlands (see Table 2.11). The Member States that contributed most (i.e. more than 10 %) to Pb emissions in 2012 were Poland, Greece and Italy. However, it should to be noted that Greece only reported an emission value once (for 1996) that has been used to gap-fill all the other years including 2012. Likewise, Luxembourg once reported a notation key NR for Pb emissions, which was used to gap-fill all missing years. Therefore, the EU-28 total is underestimated.

Table 2.11 Member State contributions to EU Pb emissions (Mg)

Member State	Pb (Mg)											Change		Share in EU-28	
	1990	1995	2000	2005	2006	2007	2008	2009	2010	2011	2012	1990–2012	2011–2012	1990	2012
Austria	219	16	12	14	14	14	15	13	15	15	15	– 93 %	– 0.6 %	0.9 %	0.6 %
Belgium	237	172	106	75	72	63	73	34	43	32	32	– 86 %	0.0 %	1.0 %	1.3 %
Bulgaria	321	333	267	127	128	118	225	112	106	119	117	– 63 %	– 1.8 %	1.4 %	4.6 %
Croatia	536	323	274	51	47	43	39	35	29	26	19	– 97 %	– 29.6 %	2.3 %	0.7 %
Cyprus	36	42	44	29	29	30	31	31	31	31	28	– 22 %	– 8.1 %	0.2 %	1.1 %
Czech Republic	269	180	108	47	43	44	39	40	26	17	23	– 91 %	37.7 %	1.2 %	0.9 %
Denmark	127	25	19	17	16	13	14	13	13	12	12	– 91 %	– 3.1 %	0.5 %	0.5 %
Estonia	205	85	36	35	31	40	35	28	39	38	34	– 84 %	– 11.9 %	0.9 %	1.3 %
Finland	338	67	45	22	25	22	20	18	23	22	19	– 94 %	– 14.9 %	1.4 %	0.7 %
France	4 591	1 827	297	183	176	172	158	134	144	134	138	– 97 %	2.4 %	19.7 %	5.4 %
Germany	2 057	685	425	345	340	331	192	169	187	183	185	– 91 %	1.4 %	8.8 %	7.3 %
Greece	470	470	470	470	470	470	470	470	470	470	470	0 %	0.0 %	2.0 %	18.6 %
Hungary	59	29	24	8	8	7	10	8	7	8	8	– 87 %	– 3.0 %	0.3 %	0.3 %
Ireland	125	81	21	23	22	22	22	19	17	17	16	– 88 %	– 5.1 %	0.5 %	0.6 %
Italy	4 415	2 029	945	281	289	312	301	228	260	269	258	– 94 %	– 4.2 %	18.9 %	10.2 %
Latvia	96	60	6	4	4	5	4	4	4	4	4	– 96 %	0.1 %	0.4 %	0.1 %
Lithuania	151	92	7	5	3	6	6	5	5	5	5	– 97 %	– 2.5 %	0.6 %	0.2 %
Luxembourg	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR				
Malta	0	1	1	1	1	1	1	1	3	6	13	> 100 %	> 100 %	0.0 %	0.5 %
Netherlands	331	154	28	30	31	36	31	32	38	23	16	– 95 %	– 28.8 %	1.4 %	0.6 %
Poland	1 372	642	524	529	562	551	543	496	561	544	554	– 60 %	1.7 %	5.9 %	21.9 %
Portugal	559	765	51	96	115	135	191	157	211	183	179	– 68 %	– 2.4 %	2.4 %	7.1 %
Romania	222	184	148	107	103	106	91	56	62	61	56	– 75 %	– 7.4 %	1.0 %	2.2 %
Slovakia	99	79	89	73	74	62	63	43	59	59	58	– 41 %	– 1.5 %	0.4 %	2.3 %
Slovenia	350	200	47	16	17	17	18	16	17	17	16	– 95 %	– 5.2 %	1.5 %	0.6 %
Spain	2 753	942	576	208	206	203	201	179	185	184	186	– 93 %	1.0 %	11.8 %	7.3 %
Sweden	358	38	27	15	15	15	13	13	13	12	11	– 97 %	– 1.9 %	1.5 %	0.4 %
United Kingdom	3 042	1 604	150	107	88	80	73	64	62	59	61	– 98 %	3.4 %	13.0 %	2.4 %
EU-28 (a)	**23 338**	**11 125**	**4 746**	**2 917**	**2 930**	**2 919**	**2 880**	**2 415**	**2 633**	**2 550**	**2 532**	**– 89 %**	**– 0.7 %**	**100 %**	**100 %**
EU-28 (b)	22 868	10 655	4 276	2 447	2 460	2 449	2 410	1 945	2 163	2 080	2 062				

Note: (a) Sum of national totals as reported by Member States.

(b) Sum of sectors: differences arise when only national totals and no sectoral data are available.

Negative percentage values indicate that emissions have decreased.

Light-grey shaded cells denote gap-filled data. For more detailed information, see Annex D.

Dark-grey shaded cells indicate that no emission values are available. See Appendix 1 for an explanation of the notation keys reported by Member States.

The categories '1 A 2 b — Stationary Combustion in manufacturing industries and construction: Non-ferrous metals', '2 C 1 — Iron and steel production' and '1 A 2 f i — Stationary combustion in manufacturing industries and construction: Other' were the most important key categories for Pb emissions, together making up 49 % of total Pb emissions (see Figure 2.10(a)).

The largest relative reductions in emissions between 1990 and 2012 were from the third most important key category, '1 A 2 f i — Stationary combustion in manufacturing industries and construction: Other' (− 71.7 %), the second most important category, '2 C 1 — Iron and steel production' (− 64.7 %), and the fourth most important key category, '1 A 4 b i — Residential: Stationary plants' (− 59.2 %). The fifth most important key category, '1 A 3 b vi — Road transport: Automobile tyre and brake wear', increased since 1990 by + 15.9 %.

The high increase of Pb emissions of the category '2 C 1 — Iron and steel production' from 1994 to 1995, and likewise the decrease from 2007 to 2008 is mainly caused by data reported from Germany.

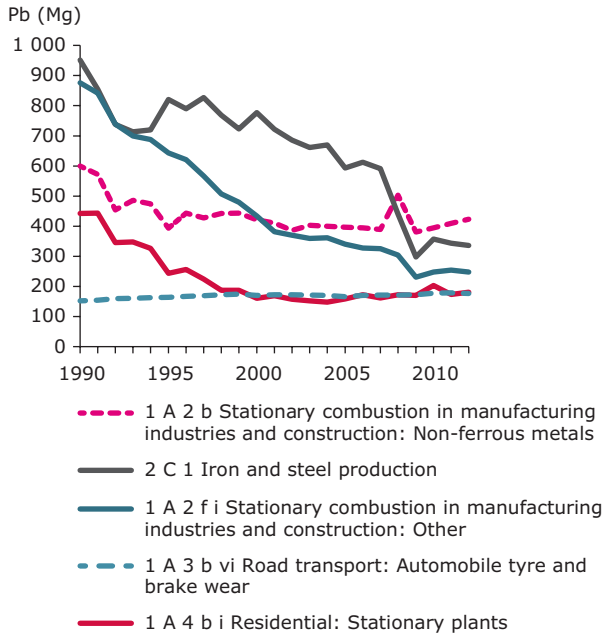
The peak of Pb emissions in the category '1 A 2 b — Stationary Combustion in manufacturing industries and construction: Non-ferrous metals' in the year 2008 was mainly due to high emissions reported from Bulgaria for this year.

Much progress has been made since the early 1990s in reducing certain point-source emissions of Pb (e.g. emissions from industrial facilities). This has been achieved through improvements in abatement technologies for wastewater treatment and incinerators, for example, and in metal refining and smelting industries. Some countries have also closed older industrial facilities as a consequence of economic restructuring (EEA, 2014f).

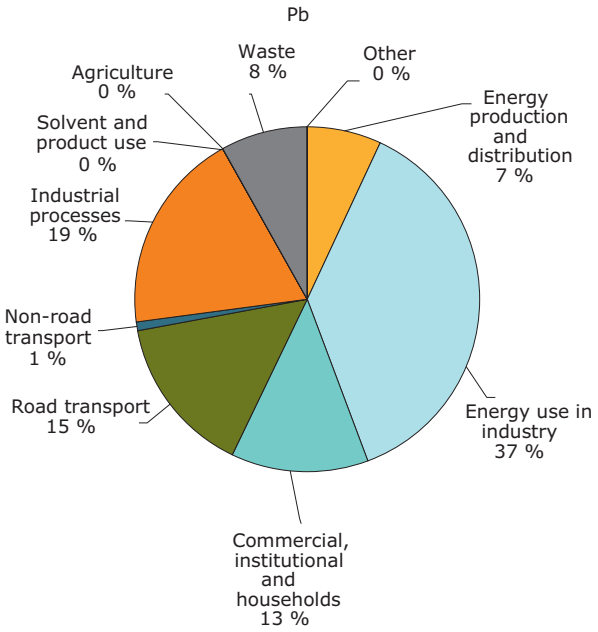
Figure 2.10(b) shows the contribution to total EU-28 emissions made by the aggregated sector groups. For Pb, common important emission sources are the sectors 'Energy use in industry', 'Industrial processes' 'Road transport' and 'Commercial, institutional and households'.

Figure 2.10 Pb emissions in the EU-28: (a) trend in Pb emissions from the five most important key categories, 1990–2012; (b) share of emissions by sector group, 2012

(a)



(b)



2.11 Cadmium (Cd) emission trends and key categories

Between 1990 and 2012, Cd emissions decreased by 66 % in the EU-28. Between 2011 and 2012, they dropped by 1.4 % (Table 2.12), mainly due to emission reductions in the United Kingdom, Italy and Portugal. The Member States that contributed most (i.e. more than 10 %) to Cd emissions in 2012 were Poland and Spain. Greece only reported an emission value once (for 1996) that has been used to gap-fill all the other years including 2012. Luxembourg only reported a notation key once, NR for Cd emissions, which was used to gap-fill all other years. The EU-28 total is therefore underestimated.

Table 2.12 Member State contributions to EU Cd emissions (Mg)

Member State	Cd (Mg)											Change		Share in EU-28	
	1990	1995	2000	2005	2006	2007	2008	2009	2010	2011	2012	1990–2012	2011–2012	1990	2012
Austria	1.6	1.0	0.9	1.1	1.1	1.1	1.1	1.1	1.2	1.2	1.2	– 24 %	3.7 %	0.6 %	1.4 %
Belgium	6.6	5.4	3.2	2.9	3.0	2.8	3.1	2.4	3.0	2.7	2.5	– 62 %	– 9.0 %	2.6 %	2.9 %
Bulgaria	5.2	3.6	3.5	2.9	2.8	2.5	3.2	2.2	1.9	2.1	2.0	– 61 %	– 5.9 %	2.1 %	2.3 %
Croatia	1.3	0.9	0.6	0.6	0.6	0.5	0.5	0.5	0.4	0.4	0.4	– 71 %	– 10.1 %	0.5 %	0.4 %
Cyprus	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	62 %	10.7 %	0.0 %	0.1 %
Czech Republic	4.3	3.6	2.9	3.1	3.2	2.9	3.8	3.4	0.9	0.8	1.0	– 78 %	17.6 %	1.7 %	1.1 %
Denmark	1.0	0.5	0.4	0.3	0.2	0.2	0.2	0.2	0.2	0.2	0.2	– 80 %	– 3.5 %	0.4 %	0.2 %
Estonia	4.4	2.0	0.6	0.6	0.5	0.7	0.6	0.5	0.7	0.7	0.6	– 87 %	– 11.7 %	1.8 %	0.7 %
Finland	6.3	1.7	1.3	1.3	1.3	1.0	1.2	1.2	1.4	1.3	1.3	– 79 %	0.9 %	2.5 %	1.5 %
France	20.2	17.6	13.8	6.0	4.5	4.1	4.1	2.8	2.7	2.6	2.5	– 88 %	– 1.8 %	8.0 %	2.9 %
Germany	17.2	11.6	10.5	7.5	7.2	6.6	5.7	5.0	5.6	5.5	5.6	– 68 %	1.4 %	6.8 %	6.5 %
Greece	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	0 %	0.0 %	1.2 %	3.5 %
Hungary	3.2	2.4	2.1	0.8	0.8	0.8	0.6	0.5	0.5	0.5	0.5	– 85 %	– 8.7 %	1.3 %	0.5 %
Ireland	0.9	1.0	1.1	0.8	0.7	0.6	0.6	0.5	0.4	0.3	0.3	– 62 %	– 3.7 %	0.3 %	0.4 %
Italy	10.1	9.4	8.8	8.1	8.3	8.9	8.7	7.0	6.8	7.1	6.7	– 34 %	– 5.7 %	4.0 %	7.7 %
Latvia	0.5	0.6	0.5	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	35 %	10.2 %	0.2 %	0.7 %
Lithuania	0.6	0.5	0.5	0.6	0.6	0.5	0.5	0.5	0.5	0.5	0.6	– 11 %	4.0 %	0.2 %	0.6 %
Luxembourg	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR				
Malta	0.2	0.4	0.5	0.6	0.6	0.6	0.6	0.6	0.0	0.0	0.0	– 92 %	– 0.2 %	0.1 %	0.0 %
Netherlands	2.1	1.1	0.9	1.7	1.9	1.7	1.9	1.8	2.5	1.1	0.8	– 62 %	– 28.0 %	0.8 %	0.9 %
Poland	91.6	58.1	35.8	35.2	38.0	36.4	37.0	35.1	42.1	37.7	38.7	– 58 %	2.7 %	36.5 %	44.9 %
Portugal	6.0	6.2	6.0	6.5	5.5	5.7	5.4	3.7	4.1	2.8	2.4	– 59 %	– 13.1 %	2.4 %	2.8 %
Romania	4.5	4.0	3.6	3.1	3.1	3.6	3.1	2.0	2.2	2.3	2.0	– 55 %	– 11.7 %	1.8 %	2.3 %
Slovakia	9.7	10.4	9.1	6.2	6.1	1.4	1.4	1.1	1.4	1.3	1.3	– 87 %	2.7 %	3.9 %	1.5 %
Slovenia	0.6	0.4	0.4	0.4	0.4	0.4	0.5	0.4	0.4	0.4	0.4	– 36 %	– 7.0 %	0.2 %	0.4 %
Spain	25.2	22.9	18.6	16.1	15.0	11.6	11.3	10.0	9.8	9.2	9.1	– 64 %	– 1.7 %	10.0 %	10.5 %
Sweden	2.3	0.7	0.5	0.5	0.5	0.6	0.5	0.5	0.5	0.5	0.5	– 77 %	0.3 %	0.9 %	0.6 %
United Kingdom	22.7	11.0	5.8	3.6	3.5	2.8	2.6	2.3	2.4	2.6	2.1	– 91 %	– 19.7 %	9.0 %	2.4 %
EU-28 (a)	**251.2**	**179.8**	**134.7**	**114.3**	**113.0**	**101.9**	**101.8**	**88.8**	**95.7**	**87.5**	**86.3**	**– 66 %**	**– 1.4 %**	**100 %**	**100 %**
EU-28 (b)	248.2	176.8	131.7	111.3	110.0	98.9	98.8	85.8	92.7	84.5	83.3				

Note: (a) Sum of national totals as reported by Member States.

(b) Sum of sectors: differences arise when only national totals and no sectoral data are available.

Negative percentage values indicate that emissions have decreased.

Light-grey shaded cells denote gap-filled data. For more detailed information, see Annex D.

Dark-grey shaded cells indicate that no emission values are available. See Appendix 1 for an explanation of the notation keys reported by Member States.

'1 A 4 b i — Residential: Stationary plants' was the most important key category for Cd emissions, making up 31 % of total Cd emissions (see Figure 2.11(a)). Among the top five key categories, the highest relative reductions in emissions between 1990 and 2012 were achieved from the second most important key category, '1 A 2 f i — Stationary combustion in manufacturing industries and construction: Other' (− 81.6 %), and the third most important key category, '1 A 1 a —Public electricity and heat production' (− 72.6 %).

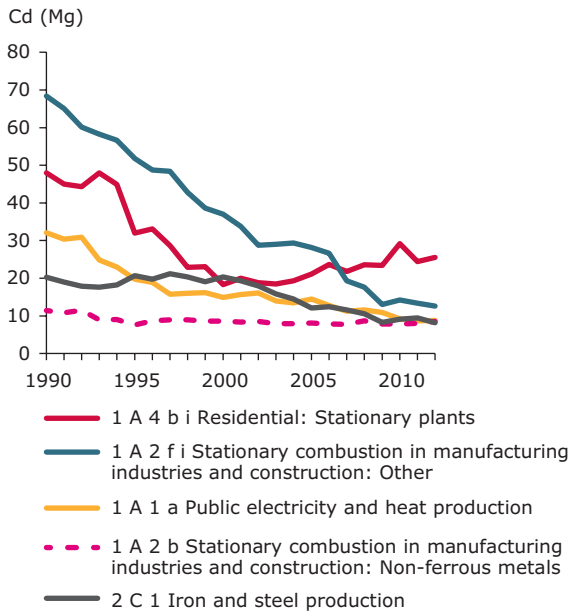
The peak of Cd emissions of the category '1 A 4 b i — Residential: Stationary plants' in the year 2010 is mainly caused by high emissions reported from Poland for this year.

As is the case for Pb, industrial sources of Cd emissions have decreased since the early 1990s overall, reflecting improved abatement technologies for combustion facilities and in the metal refining and smelting industries (EEA, 2014f).

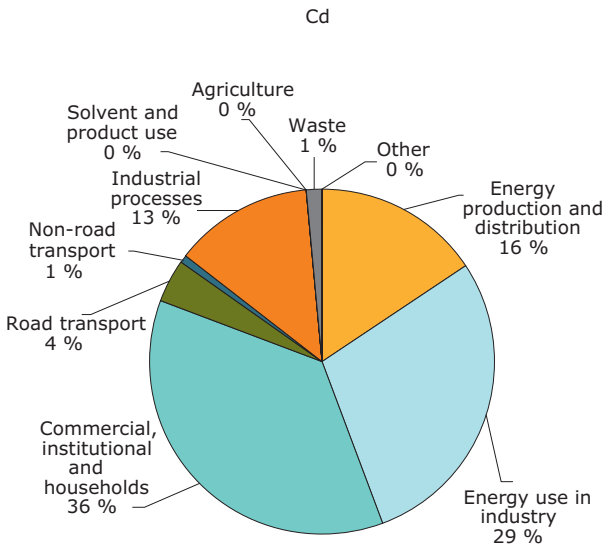
Figure 2.11(b) shows the contribution to total EU-28 emissions made by the aggregated sector groups. For Cd, common important emission sources are the energy sectors and the 'Commercial, institutional and households' sector.

Figure 2.11 Cd emissions in the EU-28: (a) trend in Cd emissions from the five most important key categories, 1990–2012; (b) share of emissions by sector group, 2012

(a)



(b)



2.12 Mercury (Hg) emission trends and key categories

Between 1990 and 2012, Hg emissions dropped by 67 % in the EU-28. Between 2011 and 2012, the decrease was 2.8 % (see Table 2.13), mainly due to reduced emissions in Romania, France and Italy. The Member States that contributed most (i.e. more than 10 %) to Hg emissions in 2012 were Greece, Germany, Poland and Italy. Greece only reported an emission value once (for 1996): this has been used to gap-fill all the other years, including 2012. Luxembourg only reported the notation key NR for Hg emissions once, and it was used to gap-fill all other years. The EU-28 total is therefore underestimated.

Table 2.13 Member State contributions to EU Hg emissions (Mg)

Member State	Hg (Mg)											Change		Share in EU-28	
	1990	1995	2000	2005	2006	2007	2008	2009	2010	2011	2012	1990–2012	2011–2012	1990	2012
Austria	2.1	1.2	0.9	1.0	1.0	1.0	1.0	0.9	1.0	1.0	1.0	– 53 %	0.5 %	0.9 %	1.3 %
Belgium	11.7	3.1	3.3	2.5	2.3	3.4	3.9	2.0	2.0	2.0	1.7	– 86 %	– 14.6 %	5.0 %	2.2 %
Bulgaria	2.4	1.9	1.5	1.6	1.7	1.5	1.4	1.0	0.9	0.9	0.8	– 68 %	– 17.2 %	1.0 %	1.0 %
Croatia	1.5	0.4	0.6	0.8	0.7	0.8	0.8	0.7	0.8	0.8	0.7	– 49 %	– 2.3 %	0.6 %	1.0 %
Cyprus	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.1	0.1	0.1	– 15 %	– 2.5 %	0.1 %	0.2 %
Czech Republic	7.5	7.4	3.8	3.8	3.8	3.9	4.1	4.3	3.5	3.2	3.0	– 60 %	– 6.4 %	3.2 %	3.9 %
Denmark	3.1	2.4	1.0	0.8	0.6	0.6	0.6	0.5	0.4	0.4	0.3	– 90 %	– 20.5 %	1.3 %	0.4 %
Estonia	1.1	0.6	0.5	0.5	0.5	0.7	0.6	0.4	0.6	0.6	0.6	– 51 %	– 12.2 %	0.5 %	0.7 %
Finland	1.1	0.7	0.6	0.8	1.0	0.8	0.8	0.8	0.9	0.7	0.8	– 33 %	16.9 %	0.5 %	1.0 %
France	24.7	20.3	11.5	6.5	6.4	4.9	4.7	4.3	4.6	4.6	4.1	– 83 %	– 11.1 %	10.5 %	5.3 %
Germany	32.2	17.4	16.3	13.0	12.6	12.1	10.8	9.8	10.2	10.1	10.4	– 68 %	2.2 %	13.7 %	13.4 %
Greece	13.0	13.0	13.0	13.0	13.0	13.0	13.0	13.0	13.0	13.0	13.0	0 %	0.0 %	5.5 %	16.8 %
Hungary	2.6	1.9	1.6	0.7	0.7	0.7	0.7	0.6	0.6	0.6	0.6	– 77 %	0.7 %	1.1 %	0.8 %
Ireland	0.9	0.8	0.7	0.9	0.8	0.8	0.8	0.5	0.4	0.4	0.4	– 51 %	12.2 %	0.4 %	0.5 %
Italy	11.7	10.4	9.3	10.0	10.2	10.8	10.4	8.5	8.7	8.9	8.4	– 28 %	– 5.7 %	5.0 %	10.9 %
Latvia	0.3	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	– 69 %	– 1.7 %	0.1 %	0.1 %
Lithuania	1.1	0.5	0.2	0.5	0.4	0.3	0.2	0.1	0.2	0.3	0.4	– 66 %	14.9 %	0.5 %	0.5 %
Luxembourg	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR				
Malta	0.3	0.4	0.5	0.6	0.6	0.6	0.6	0.6	0.0	0.0	0.0	– 98 %	7.7 %	0.1 %	0.0 %
Netherlands	3.5	1.4	1.0	0.9	0.8	0.7	0.6	0.6	0.5	0.6	0.5	– 84 %	– 12.3 %	1.5 %	0.7 %
Poland	33.3	13.0	10.7	10.1	10.4	10.2	10.1	9.6	10.1	10.0	10.2	– 69 %	2.6 %	14.2 %	13.3 %
Portugal	3.4	3.6	3.3	2.8	2.4	2.2	2.1	2.0	1.7	1.6	1.6	– 52 %	2.1 %	1.4 %	2.1 %
Romania	10.2	9.3	8.3	7.4	7.2	10.3	8.0	5.0	5.1	5.0	4.3	– 58 %	– 13.4 %	4.3 %	5.6 %
Slovakia	12.8	4.3	6.1	3.0	3.5	2.6	2.8	1.1	1.4	1.2	1.3	– 90 %	7.0 %	5.4 %	1.7 %
Slovenia	0.6	0.5	0.5	0.5	0.5	0.5	0.5	0.4	0.5	0.4	0.4	– 39 %	– 14.2 %	0.3 %	0.5 %
Spain	14.4	16.0	12.8	11.0	10.0	9.1	8.2	7.0	6.7	6.4	6.3	– 57 %	– 2.9 %	6.1 %	8.1 %
Sweden	1.5	0.9	0.7	0.6	0.5	0.5	0.5	0.5	0.5	0.5	0.4	– 70 %	– 6.1 %	0.6 %	0.6 %
United Kingdom	37.9	19.9	8.4	7.4	7.6	7.1	6.9	6.6	6.5	5.9	5.8	– 85 %	– 2.6 %	16.1 %	7.5 %
EU-28 (a)	**234.9**	**151.4**	**117.5**	**100.9**	**99.6**	**99.5**	**94.3**	**81.0**	**81.1**	**79.5**	**77.3**	**– 67 %**	**– 2.8 %**	**100 %**	**100 %**
EU-28 (b)	221.9	138.4	104.5	87.9	86.6	86.5	81.3	68.0	68.1	66.5	64.3				

Note: (a) Sum of national totals as reported by Member States.

(b) Sum of sectors: differences arise when only national totals and no sectoral data are available.

Negative percentage values indicate that emissions have decreased.

Light-grey shaded cells denote gap-filled data. For more detailed information, see Annex D.

Dark-grey shaded cells indicate that no emission values are available. See Appendix 1 for an explanation of the notation keys reported by Member States.

France reported that mercury could be reduced by curtailing the use of mercury in products and in waste treatment (incineration) processes (Appendix 5, France's IIR).

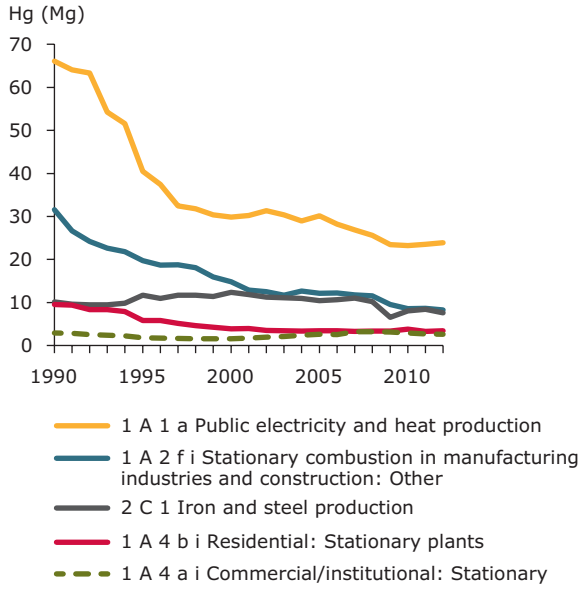
'1 A 1 a — Public electricity and heat production', '1 A 2 f i — Stationary combustion in manufacturing industries and construction: Other' and '2 C 1 — Iron and steel production' were the most important key categories for Hg emissions, making up 62 % of total Hg emissions (see Figure 2.12(a)). Among the top five key categories, the highest relative reductions in emissions between 1990 and 2012 was achieved by the second most important key category, '1 A 2 f i — Stationary combustion in manufacturing industries and construction: Other' (− 73.7 %). The fourth most important key category, '1 A 4 b i — Residential: Stationary plants' (− 64.1 %), and the most important key category, '1 A 1 a — Public electricity and heat production' (− 63.8 %), also show high emission reductions.

Emissions from categories '1 A 1 a — Public electricity and heat production' and '1 A 2 f i — Stationary combustion in manufacturing industries and construction: Other' have decreased considerably since 1990, partly reflecting a general decline of coal use across Europe, following on from fuel switching (EEA, 2014f).

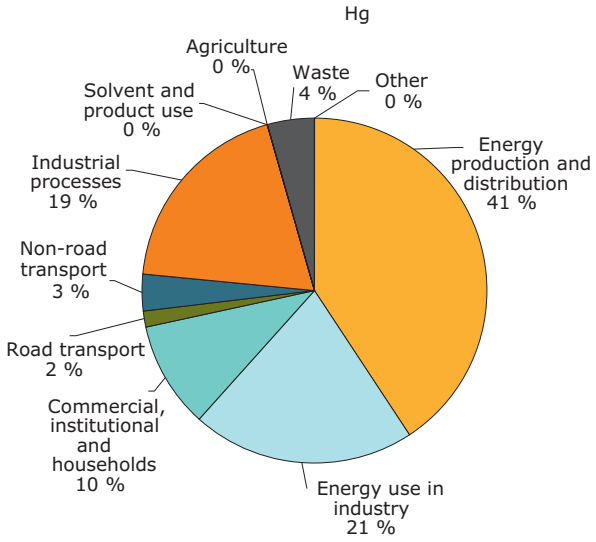
Figure 2.12(b) shows the contribution to total EU-28 emissions made by the aggregated sector groups. For Hg, important emission sources are the energy sectors and the sector 'Industrial processes'.

Figure 2.12 Hg emissions in the EU-28: (a) trend in Hg emissions from the five most important key categories, 1990–2012; (b) share of emissions by sector group, 2012

(a)



(b)



2.13 Arsenic (As) emission trends

Between 1990 and 2012, As emissions in the EU-28 dropped by 64 %. Between 2011 and 2012, emissions decreased by 3.3 %, mainly due to reduced emissions in Slovakia, Italy and Romania (see Table 2.14). The Member States that contributed most (i.e. more than 10 %) to As emissions in 2012 were Italy and Poland. Greece only reported an emission value once (for 1996) that has been used to gap-fill all the other years including 2012. Austria and Slovenia reported the whole time-series of their arsenic emissions as NR. Luxembourg once reported arsenic emissions as NR, and this notation key was used to gap-fill all other years. The EU-28 total is therefore underestimated.

Table 2.14 Member State contributions to EU As emissions (Mg)

Member State	As (Mg)											Change		Share in EU-28	
	1990	1995	2000	2005	2006	2007	2008	2009	2010	2011	2012	1990–2012	2011–2012	1990	2012
Austria	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR				
Belgium	6.7	6.6	4.7	3.5	3.4	4.3	3.7	2.5	2.4	2.1	1.9	– 72 %	– 8.8 %	1.2 %	0.9 %
Bulgaria	19.0	14.7	7.3	15.5	15.7	13.7	13.9	13.5	11.8	14.0	12.5	– 34 %	– 10.8 %	3.4 %	6.2 %
Croatia	9.3	1.8	1.3	1.2	1.3	1.3	1.1	1.1	0.8	0.6	0.6	– 94 %	– 8.9 %	1.6 %	0.3 %
Cyprus	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.1	0.2	0.2	38 %	6.2 %	0.0 %	0.1 %
Czech Republic	2.4	2.3	3.4	4.0	2.6	2.6	3.4	4.6	3.0	3.2	3.2	36 %	– 0.1 %	0.4 %	1.6 %
Denmark	1.3	0.8	0.8	0.5	0.5	0.5	0.4	0.3	0.3	0.3	0.3	– 76 %	– 10.0 %	0.2 %	0.2 %
Estonia	18.9	10.1	8.6	9.2	8.6	11.1	9.4	7.6	11.0	10.9	9.6	– 49 %	– 11.8 %	3.3 %	4.7 %
Finland	33.2	3.5	4.3	2.7	2.8	2.7	2.9	2.7	3.7	3.4	2.9	– 91 %	– 15.0 %	5.9 %	1.4 %
France	17.2	17.1	15.3	11.4	11.1	11.0	11.8	7.5	7.5	6.5	6.4	– 63 %	– 3.0 %	3.1 %	3.1 %
Germany	80.2	6.5	5.6	5.7	6.0	5.9	5.6	5.2	5.3	5.1	5.1	– 94 %	1.6 %	14.2 %	2.5 %
Greece	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	0 %	0.0 %	0.7 %	2.0 %
Hungary	4.2	3.5	3.3	1.4	1.4	1.5	1.5	1.2	1.3	1.3	1.1	– 73 %	– 9.6 %	0.7 %	0.6 %
Ireland	4.5	3.9	3.1	3.1	3.0	3.0	2.9	2.5	2.3	2.2	2.2	– 52 %	– 0.2 %	0.8 %	1.1 %
Italy	36.6	26.8	45.0	39.9	40.9	41.4	42.0	42.2	44.7	46.2	44.6	22 %	– 3.5 %	6.5 %	22.0 %
Latvia	0.3	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	– 64 %	29.0 %	0.1 %	0.1 %
Lithuania	0.6	0.3	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	– 60 %	22.1 %	0.1 %	0.1 %
Luxembourg	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR				
Malta	0.1	0.2	0.2	0.3	0.3	0.3	0.3	0.3	0.1	0.0	0.0	– 67 %	0.0 %	0.0 %	0.0 %
Netherlands	1.5	1.0	1.1	1.5	0.7	1.1	0.8	0.8	0.8	1.2	1.1	– 28 %	– 13.6 %	0.3 %	0.5 %
Poland	82.1	53.7	40.4	44.1	46.1	43.6	43.5	41.7	46.5	43.5	43.7	– 47 %	0.6 %	14.5 %	21.6 %
Portugal	2.8	2.9	2.8	2.7	2.2	2.0	1.9	1.7	1.4	1.3	1.4	– 49 %	12.3 %	0.5 %	0.7 %
Romania	20.5	17.8	15.1	12.3	12.5	13.8	12.4	8.5	8.8	9.2	7.6	– 63 %	– 16.8 %	3.6 %	3.8 %
Slovakia	146.9	38.6	9.0	23.2	26.5	23.6	23.4	17.2	21.8	22.8	19.6	– 87 %	– 14.1 %	26.0 %	9.7 %
Slovenia	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR				
Spain	16.1	16.6	19.9	19.5	17.9	16.9	16.0	15.0	14.2	14.6	16.7	4 %	14.9 %	2.9 %	8.3 %
Sweden	5.6	1.5	0.8	0.9	0.9	1.1	0.8	0.9	0.9	0.9	0.9	– 84 %	3.8 %	1.0 %	0.4 %
United Kingdom	50.9	37.1	24.2	18.0	18.3	18.4	17.9	16.5	16.3	16.1	16.8	– 67 %	4.7 %	9.0 %	8.3 %
EU-28 (a)	**564.9**	**271.7**	**220.7**	**225.2**	**227.4**	**224.3**	**220.1**	**197.9**	**209.4**	**209.8**	**202.8**	**– 64 %**	**– 3.3 %**	**100 %**	**100 %**
EU-28 (b)	560.9	267.7	216.7	221.2	223.4	220.3	216.1	193.9	205.4	205.8	198.8				

Note: (a) Sum of national totals as reported by Member States.

(b) Sum of sectors: differences arise when only national totals and no sectoral data are available.

Negative percentage values indicate that emissions have decreased.

Light-grey shaded cells denote gap-filled data. For more detailed information, see Annex D.

Dark-grey shaded cells indicate that no emission values are available. See Appendix 1 for an explanation of the notation keys reported by Member States.

2.14 Chromium (Cr) emission trends

Between 1990 and 2012, Cr emissions in the EU-28 dropped by 74 %. Between 2011 and 2012, emissions decreased by 2.0 %, mainly due to reduced emissions in Italy, Sweden and Romania (see Table 2.15). The Member States that contributed most (i.e. more than 10 %) to Cr emissions in 2012 were Germany, Italy and Poland. Greece only reported an emission value once (for 1996): this was used to gap-fill all the other years including 2012. Austria and Slovenia reported the whole time-series of their chromium emissions as NR. Luxembourg once reported chromium emissions as NR, and this notation key was used to gap-fill all other years. The EU-28 total is therefore underestimated.

Table 2.15 Member State contributions to EU Cr emissions (Mg)

Member State	Cr (Mg)											Change		Share in EU-28	
	1990	1995	2000	2005	2006	2007	2008	2009	2010	2011	2012	1990–2012	2011–2012	1990	2012
Austria	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR				
Belgium	33	28	19	17	19	20	19	10	13	12	11	– 67 %	– 5.2 %	2.4 %	3.1 %
Bulgaria	21	11	8	10	12	9	9	6	5	6	5	– 74 %	– 9.6 %	1.5 %	1.5 %
Croatia	5	4	2	2	2	2	2	2	1	1	1	– 80 %	– 17.4 %	0.4 %	0.3 %
Cyprus	0	0	0	0	0	0	0	0	0	0	0	29 %	– 0.3 %	0.0 %	0.1 %
Czech Republic	29	21	12	14	13	12	12	15	19	13	16	– 46 %	18.8 %	2.1 %	4.3 %
Denmark	6	3	1	1	1	1	1	1	1	1	1	– 87 %	– 8.7 %	0.4 %	0.2 %
Estonia	18	10	8	9	8	10	9	7	10	10	9	– 51 %	– 11.5 %	1.3 %	2.5 %
Finland	29	22	28	18	23	27	25	15	22	18	18	– 37 %	3.3 %	2.1 %	5.1 %
France	392	188	103	44	42	33	32	26	26	23	24	– 94 %	6.0 %	28.0 %	6.8 %
Germany	189	126	130	124	130	133	58	51	56	57	57	– 70 %	– 1.1 %	13.6 %	15.8 %
Greece	10	10	10	10	10	10	10	10	10	10	10	0 %	0.0 %	0.7 %	2.8 %
Hungary	19	12	12	11	11	12	12	8	10	10	9	– 55 %	– 10.9 %	1.4 %	2.4 %
Ireland	9	8	7	5	5	5	5	4	4	4	4	– 58 %	– 2.3 %	0.6 %	1.0 %
Italy	92	74	51	59	60	62	60	49	52	53	50	– 46 %	– 5.7 %	6.6 %	13.9 %
Latvia	1	1	1	1	1	1	1	1	1	1	1	6 %	7.8 %	0.1 %	0.4 %
Lithuania	2	1	1	1	1	1	1	1	1	1	1	– 34 %	3.3 %	0.1 %	0.3 %
Luxembourg	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR				
Malta	1	1	1	1	2	2	1	1	1	1	1	> 100 %	0.0 %	0.0 %	0.4 %
Netherlands	12	8	5	4	4	4	4	4	4	4	4	– 69 %	1.3 %	0.8 %	1.0 %
Poland	155	76	47	41	44	43	44	41	49	46	46	– 70 %	0.0 %	11.1 %	12.8 %
Portugal	13	14	14	14	12	12	12	11	11	10	10	– 19 %	– 1.1 %	0.9 %	2.9 %
Romania	66	54	42	28	28	28	23	14	15	15	13	– 80 %	– 9.2 %	4.7 %	3.7 %
Slovakia	77	12	8	6	6	5	5	4	4	4	4	– 94 %	2.1 %	5.5 %	1.2 %
Slovenia	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR				
Spain	34	38	41	42	40	39	37	32	31	30	29	– 16 %	– 4.2 %	2.5 %	8.1 %
Sweden	23	12	7	10	11	13	10	3	5	6	5	– 79 %	– 21.9 %	1.7 %	1.4 %
United Kingdom	161	115	77	40	37	33	32	30	30	29	28	– 82 %	– 2.1 %	11.5 %	8.0 %
EU-28 (a)	**1 397**	**850**	**635**	**513**	**523**	**518**	**423**	**349**	**383**	**365**	**358**	**– 74 %**	**– 2.0 %**	**100 %**	**100 %**
EU-28 (b)	1 387	840	625	503	513	508	413	339	373	355	348				

Note: (a) Sum of national totals as reported by Member States.

(b) Sum of sectors: differences arise when only national totals and no sectoral data are available.

Negative percentage values indicate that emissions have decreased.

Light-grey shaded cells denote gap-filled data. For more detailed information, see Annex D.

Dark-grey shaded cells indicate that no emission values are available. See Appendix 1 for an explanation of the notation keys reported by Member States.

2.15 Copper (Cu) emission trends

Between 1990 and 2012, Cu emissions in the EU-28 dropped by 1.3 %. Between 2011 and 2012, emissions decreased by 1.9 %, mainly due to reduced emissions from Germany, Italy and Romania (see Table 2.16). The Member State that contributed most (i.e. more than 10 %) to Cu emissions in 2012 was Germany. Greece only reported an emission value once (for 1996): this has been used to gap-fill all the other years including 2012. Austria and Slovenia reported the whole time-series of their copper emissions as NR. Luxembourg reported copper emissions as NR once, and this notation key was used to gap-fill all other years. The EU-28 total is therefore underestimated.

Table 2.16 Member State contributions to EU Cu emissions (Mg)

Member State	Cu (Mg)											Change		Share in EU-28	
	1990	1995	2000	2005	2006	2007	2008	2009	2010	2011	2012	1990–2012	2011–2012	1990	2012
Austria	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR				
Belgium	38.5	39.3	37.0	33.9	33.3	32.1	32.5	28.6	30.4	29.7	29.0	– 25 %	– 2.5 %	1.0 %	0.8 %
Bulgaria	103.0	74.3	56.0	97.5	101.6	79.1	88.2	92.9	82.4	96.6	93.5	– 9 %	– 3.2 %	2.8 %	2.6 %
Croatia	8.9	5.8	6.8	7.5	7.9	8.4	8.4	8.2	7.5	7.4	7.2	– 19 %	– 2.6 %	0.2 %	0.2 %
Cyprus	1.3	1.7	2.2	2.4	2.4	2.5	2.6	2.5	2.4	2.4	2.3	74 %	– 5.7 %	0.0 %	0.1 %
Czech Republic	23.7	19.5	17.2	20.1	18.1	17.8	16.4	17.4	23.5	18.3	17.2	– 27 %	– 5.9 %	0.6 %	0.5 %
Denmark	33.0	37.6	40.2	42.8	44.3	46.7	45.8	44.6	44.1	44.3	43.0	30 %	– 2.9 %	0.9 %	1.2 %
Estonia	10.1	5.1	3.7	4.5	4.4	5.0	4.6	4.0	4.9	4.8	4.5	– 56 %	– 6.7 %	0.3 %	0.1 %
Finland	157.2	88.8	78.5	60.4	63.0	61.4	58.8	58.0	62.7	58.0	57.4	– 63 %	– 1.1 %	4.3 %	1.6 %
France	247.5	243.0	245.0	247.2	249.4	240.9	240.7	238.7	241.8	242.6	242.8	– 2 %	0.1 %	6.7 %	6.7 %
Germany	1 702	1 824	2 011	2 038	2 075	2 097	2 089	2 047	2 091	2 132	2 097	23 %	– 1.6 %	46.1 %	57.6 %
Greece	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0	0 %	0.0 %	0.4 %	0.4 %
Hungary	23.9	14.6	13.5	12.9	19.1	18.8	44.7	31.8	23.6	22.2	19.8	– 17 %	– 11.0 %	0.6 %	0.5 %
Ireland	16.5	16.9	22.0	25.2	26.3	27.2	26.1	23.5	21.8	21.1	20.3	23 %	– 3.9 %	0.4 %	0.6 %
Italy	136.4	147.3	143.2	148.1	149.9	151.1	147.6	131.6	134.1	137.0	126.6	– 7 %	– 7.6 %	3.7 %	3.5 %
Latvia	4.9	3.5	3.6	5.0	5.5	6.2	5.8	5.2	5.4	4.7	4.6	– 7 %	– 3.4 %	0.1 %	0.1 %
Lithuania	11.5	5.8	5.3	6.8	7.4	8.2	8.4	7.1	7.7	8.0	8.0	– 30 %	0.9 %	0.3 %	0.2 %
Luxembourg	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR				
Malta	0.6	0.7	0.8	0.9	1.1	0.9	0.8	0.8	26.9	26.9	26.9	> 100 %	0.0 %	0.0 %	0.7 %
Netherlands	37.2	38.5	39.6	41.5	42.1	41.6	43.0	44.9	46.9	46.4	45.1	21 %	– 2.9 %	1.0 %	1.2 %
Poland	599.4	385.2	331.9	365.2	379.0	358.1	351.5	331.6	362.1	350.8	347.8	– 42 %	– 0.8 %	16.2 %	9.5 %
Portugal	21.8	27.7	36.8	37.6	37.0	36.3	35.8	34.8	34.2	31.5	30.5	40 %	– 3.2 %	0.6 %	0.8 %
Romania	23.2	20.3	18.7	17.4	30.6	32.9	33.0	29.7	29.0	28.7	22.8	– 2 %	– 20.6 %	0.6 %	0.6 %
Slovakia	102.4	49.0	22.6	38.6	44.9	43.9	44.6	33.8	47.0	56.0	51.4	– 50 %	– 8.2 %	2.8 %	1.4 %
Slovenia	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR				
Spain	130.4	153.2	222.5	243.3	243.3	247.1	237.2	230.9	222.9	215.0	223.3	71 %	3.9 %	3.5 %	6.1 %
Sweden	97.6	83.2	73.1	49.3	50.0	53.2	51.7	50.0	50.7	51.5	50.6	– 48 %	– 1.7 %	2.6 %	1.4 %
United Kingdom	145.9	111.9	88.7	70.0	68.6	66.9	65.7	57.5	59.2	62.2	56.9	– 61 %	– 8.4 %	4.0 %	1.6 %
EU-28 (a)	**3 691**	**3 411**	**3 534**	**3 629**	**3 718**	**3 697**	**3 697**	**3 569**	**3 676**	**3 712**	**3 643**	**– 1.3 %**	**– 1.9 %**	**100 %**	**100 %**
EU-28 (b)	3 677	3 397	3 520	3 615	3 704	3 683	3 683	3 555	3 662	3 698	3 629				

Note: (a) Sum of national totals as reported by Member States.

(b) Sum of sectors: differences arise when only national totals and no sectoral data are available.

Negative percentage values indicate that emissions have decreased.

Light-grey shaded cells denote gap-filled data. For more detailed information, see Annex D.

Dark-grey shaded cells indicate that no emission values are available. See Appendix 1 for an explanation of the notation keys reported by Member States.

2.16 Nickel (Ni) emission trends

Between 1990 and 2012, Ni emissions in the EU-28 dropped by 67 %. Between 2011 and 2012, emissions decreased by 5.1 %, mainly due to reductions reported in France, Spain and Portugal (see Table 2.17). The Member States that contributed most (i.e. more than 10 %) to Ni emissions in 2012 were Poland, Spain, Greece and Germany. Greece only reported an emission value once (for 1996): this was used to gap-fill all the other years including 2012. Austria and Slovenia reported the whole time-series of their nickel emissions as NR. Luxembourg reported once nickel emissions as NR, and this notation key was used for gap-filling all other years. The EU-28 total is therefore underestimated.

France reported that Ni emissions decreased due to structural changes in energy consumption and lower energy consumption in some sectors (electricity, coal, steel production, etc.) (see Appendix 5, France's IIR).

In Bulgaria, Ni emissions in 2000 were much lower than in the years before and after, due to the decrease of Ni emissions from primary copper production (Comment received from Bulgaria in 2012).

Table 2.17 Member State contributions to EU Ni emissions (Mg)

Member State	Ni (Mg)											Change		Share in EU-28	
	1990	1995	2000	2005	2006	2007	2008	2009	2010	2011	2012	1990–2012	2011–2012	1990	2012
Austria	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR				
Belgium	78.5	77.1	36.3	28.6	29.0	26.0	20.3	10.8	10.4	9.4	6.2	– 92 %	– 33.8 %	3.0 %	0.7 %
Bulgaria	28.6	23.2	7.6	23.2	23.8	24.9	20.6	21.3	18.9	22.4	20.5	– 28 %	– 8.3 %	1.1 %	2.4 %
Croatia	37.2	32.8	19.0	17.7	17.4	15.7	13.1	13.3	9.1	8.5	6.7	– 82 %	– 21.1 %	1.4 %	0.8 %
Cyprus	7.9	9.9	13.1	14.7	13.8	14.0	14.6	12.8	9.0	10.7	11.2	41 %	4.0 %	0.3 %	1.3 %
Czech Republic	27.1	18.6	15.9	17.2	18.0	18.7	10.9	24.2	13.5	11.3	9.2	– 66 %	– 18.4 %	1.0 %	1.1 %
Denmark	20.9	15.7	8.4	7.7	8.2	6.4	5.9	5.3	5.4	4.7	4.5	– 78 %	– 5.2 %	0.8 %	0.5 %
Estonia	27.4	10.5	6.6	6.5	5.8	6.8	6.0	4.9	6.7	6.5	5.7	– 79 %	– 12.1 %	1.1 %	0.7 %
Finland	63.1	34.0	33.6	26.9	25.4	22.3	21.0	18.4	22.1	19.8	18.6	– 71 %	– 6.5 %	2.4 %	2.2 %
France	288.5	230.1	190.5	145.8	137.5	113.0	104.6	106.7	93.1	73.4	60.4	– 79 %	– 17.7 %	11.2 %	7.0 %
Germany	268.0	154.2	112.4	128.2	139.9	128.3	118.2	105.7	104.1	91.8	92.6	– 65 %	0.8 %	10.4 %	10.8 %
Greece	101	101	101	101	101	101	101	101	101	101	101	0 %	0.0 %	3.9 %	11.8 %
Hungary	64.7	60.7	38.7	10.7	10.8	10.7	11.1	10.2	9.5	9.6	7.9	– 88 %	– 16.9 %	2.5 %	0.9 %
Ireland	41.3	51.3	67.2	65.9	59.4	58.5	53.9	33.8	28.3	21.5	22.6	– 45 %	5.5 %	1.6 %	2.6 %
Italy	121.5	111.8	103.3	109.0	106.6	103.8	101.3	102.1	38.1	36.9	33.9	– 72 %	– 8.2 %	4.7 %	3.9 %
Latvia	8.9	5.4	1.6	0.9	0.6	0.6	0.5	0.6	0.5	0.5	0.4	– 95 %	– 8.5 %	0.3 %	0.1 %
Lithuania	41.5	19.2	10.5	8.7	6.8	6.2	5.4	5.3	4.6	4.2	4.9	– 88 %	18.6 %	1.6 %	0.6 %
Luxembourg	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR				
Malta	8.3	12.7	16.6	20.6	20.8	21.4	19.5	19.5	6.1	0.7	0.7	– 91 %	0.0 %	0.3 %	0.1 %
Netherlands	75.7	87.0	19.2	11.2	10.4	9.7	9.5	3.4	2.2	2.5	2.2	– 97 %	– 11.5 %	2.9 %	0.3 %
Poland	370.0	242.2	165.7	155.2	160.6	154.1	152.6	148.0	170.7	151.5	148.1	– 60 %	– 2.2 %	14.3 %	17.2 %
Portugal	101.6	102.5	90.3	82.6	60.6	55.8	51.6	41.4	35.9	30.2	26.1	– 74 %	– 13.8 %	3.9 %	3.0 %
Romania	113.0	91.9	70.8	50.0	46.7	44.3	35.6	27.7	23.6	26.1	23.7	– 79 %	– 9.2 %	4.4 %	2.8 %
Slovakia	72.4	33.2	23.0	22.9	22.8	20.5	19.2	18.1	18.7	17.6	17.3	– 76 %	– 1.5 %	2.8 %	2.0 %
Slovenia	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR				
Spain	263.5	324.5	303.3	288.2	243.2	214.5	211.8	182.4	169.8	149.0	138.5	– 47 %	– 7.0 %	10.2 %	16.1 %
Sweden	32.4	32.8	19.7	19.2	19.4	15.5	14.0	14.9	17.5	13.3	11.5	– 65 %	– 13.7 %	1.3 %	1.3 %
United Kingdom	324.3	301.4	169.2	132.1	121.0	114.1	119.3	91.9	91.8	81.7	84.5	– 74 %	3.4 %	12.5 %	9.8 %
EU-28 (a)	**2 587**	**2 184**	**1 643**	**1 495**	**1 410**	**1 307**	**1 242**	**1 124**	**1 010**	**905**	**859**	**– 67 %**	**– 5.1 %**	**100 %**	**100 %**
EU-28 (b)	2 486	2 083	1 542	1 394	1 309	1 206	1 141	1 023	909	804	758				

Note: (a) Sum of national totals as reported by Member States.

(b) Sum of sectors: differences arise when only national totals and no sectoral data are available.

Negative percentage values indicate that emissions have decreased.

Light-grey shaded cells denote gap-filled data. For more detailed information, see Annex D.

Dark-grey shaded cells indicate that no emission values are available. See Appendix 1 for an explanation of the notation keys reported by Member States.

2.17 Selenium (Se) emission trends

Between 1990 and 2012, Se emissions in the EU-28 dropped by 15 %. Between 2011 and 2012, emissions decreased by 0.1 %, mainly due to reduced emissions in Romania. (see Table 2.18). The Member States that contributed most (i.e. more than 10 %) to Se emissions in 2012 were Spain, the United Kingdom, and Portugal. Greece only reported an emission value once (for 1996), and this has been used to gap-fill all the other years including 2012. Austria and Slovenia reported the whole time-series of their Se emissions as NR. Luxembourg reported Se emissions as NR once, and this notation key was used to gap-fill all other years. Poland reported its Se emissions as NE. The EU-28 total is therefore underestimated.

The high emissions in 2005 of Se in Belgium in the category '1 A 2 f i' is caused by one glass plant in Wallonia. The plant gives these annual emissions based on measurements and the concentration of Se was very high in 2005 (Comment received from Belgium in 2014). Also, the increase in 2010 in Belgium is mainly due to a particular company in the glass industry in Wallonia (Comment received from Belgium in 2012).

Table 2.18 Member State contributions to EU Se emissions (Mg)

Member State	Se (Mg)											Change		Share in EU-28	
	1990	1995	2000	2005	2006	2007	2008	2009	2010	2011	2012	1990–2012	2011–2012	1990	2012
Austria	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR				
Belgium	6.3	7.8	7.7	28.5	13.3	15.1	9.8	8.4	11.3	3.8	3.3	– 48 %	– 13.7 %	2.4 %	1.4 %
Bulgaria	41.0	12.4	5.2	13.4	16.2	16.0	19.9	17.2	17.3	20.0	18.9	– 54 %	– 5.5 %	15.5 %	8.4 %
Croatia	0.4	0.3	0.2	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.2	– 43 %	– 8.6 %	0.2 %	0.1 %
Cyprus	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	68 %	20.6 %	0.0 %	0.1 %
Czech Republic	8.4	8.4	8.4	8.8	8.0	7.0	6.8	9.8	8.1	8.3	8.3	– 2 %	– 0.1 %	3.2 %	3.7 %
Denmark	4.9	4.5	2.9	2.0	2.0	2.1	1.9	1.5	1.8	1.5	1.2	– 75 %	– 15.5 %	1.9 %	0.6 %
Estonia	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	> 100 %	5.8 %	0.0 %	0.0 %
Finland	0.0	0.0	0.0	0.0	0.1	0.1	0.3	0.6	0.6	0.2	0.2	> 100 %	0.0 %	0.0 %	0.1 %
France	14.9	15.1	15.3	14.5	14.5	14.1	13.3	11.9	12.1	12.0	11.5	– 23 %	– 4.0 %	5.6 %	5.1 %
Germany	3.4	3.7	3.8	4.1	4.1	4.0	3.9	3.8	3.7	3.6	3.5	2 %	– 2.4 %	1.3 %	1.5 %
Greece	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0 %	0.0 %	0.1 %	0.1 %
Hungary	7.5	6.8	6.8	0.4	0.5	0.5	0.5	0.4	0.4	0.4	0.4	– 95 %	– 9.0 %	2.8 %	0.2 %
Ireland	2.9	3.3	4.1	4.2	3.8	3.8	3.5	2.5	2.2	2.0	2.3	– 21 %	13.8 %	1.1 %	1.0 %
Italy	9.4	9.7	10.5	11.8	11.8	11.9	11.7	10.0	10.6	11.0	10.7	14 %	– 2.8 %	3.5 %	4.7 %
Latvia	0.4	0.3	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	– 81 %	4.0 %	0.2 %	0.0 %
Lithuania	0.2	0.1	0.1	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	– 41 %	– 5.1 %	0.1 %	0.1 %
Luxembourg	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR				
Malta	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	2.1	> 100 %	> 100 %	0.0 %	0.9 %
Netherlands	0.4	0.3	0.5	2.6	0.8	1.0	2.5	0.9	1.5	0.8	0.8	> 100 %	– 0.9 %	0.1 %	0.4 %
Poland	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE				
Portugal	12.2	16.9	23.3	26.5	28.5	30.9	31.4	29.1	30.1	30.4	31.1	> 100 %	2.4 %	4.6 %	13.8 %
Romania	16.5	16.2	16.0	15.8	17.7	18.0	18.0	15.1	14.6	17.2	13.9	– 15 %	– 19.2 %	6.2 %	6.2 %
Slovakia	8.7	9.0	6.8	8.5	9.6	9.5	10.4	8.0	11.4	10.6	11.0	26 %	3.4 %	3.3 %	4.9 %
Slovenia	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR				
Spain	49.8	57.1	75.2	84.5	83.0	80.7	80.1	68.3	70.4	72.4	71.2	43 %	– 1.7 %	18.8 %	31.6 %
Sweden	0.6	0.7	0.6	0.7	0.7	0.7	0.7	0.7	0.8	0.7	0.7	16 %	– 0.6 %	0.2 %	0.3 %
United Kingdom	77.0	49.0	32.8	36.1	33.3	30.3	30.8	26.5	27.1	30.1	33.8	– 56 %	12.1 %	29.0 %	15.0 %
EU-28 ([a])	**265.2**	**222.0**	**220.7**	**263.4**	**248.7**	**246.6**	**246.4**	**215.6**	**225.0**	**225.8**	**225.5**	**– 15 %**	**– 0.1 %**	**100 %**	**100 %**
EU-28 ([b])	265.0	221.8	220.5	263.2	248.5	246.4	246.2	215.4	224.8	225.6	225.3				

Note: ([a]) Sum of national totals as reported by Member States.

([b]) Sum of sectors: differences arise when only national totals and no sectoral data are available.

Negative percentage values indicate that emissions have decreased.

Light-grey shaded cells denote gap-filled data. For more detailed information, see Annex D.

Dark-grey shaded cells indicate that no emission values are available. See Appendix 1 for an explanation of the notation keys reported by Member States.

2.18 Zinc (Zn) emission trends

Between 1990 and 2012, Zn emissions in the EU-28 dropped by 42 %. Between 2011 and 2012, emissions decreased by 1.6 %, mainly due to reductions reported in Spain, Italy and the United Kingdom (see Table 2.19). The Member States that contributed most (i.e. more than 10 %) to Zn emissions in 2012 were Germany, Poland and Italy. Greece only reported an emission value once (for 1996): this was used to gap-fill all the other years including 2012. Austria and Slovenia reported the whole time-series of their zinc emissions as NR. Luxembourg reported zinc emissions as NR once, and this notation key was used to gap-fill all other years. The EU-28 total is therefore underestimated.

Table 2.19 Member State contributions to EU Zn emissions (Mg)

Member State	Zn (Mg)											Change		Share in EU-28	
	1990	1995	2000	2005	2006	2007	2008	2009	2010	2011	2012	1990–2012	2011–2012	1990	2012
Austria	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR				
Belgium	225	185	178	128	127	132	126	86	110	102	90	– 60 %	– 12.0 %	1.9 %	1.3 %
Bulgaria	220	151	290	172	193	163	183	156	148	171	160	– 27 %	– 6.0 %	1.8 %	2.3 %
Croatia	14	9	10	11	11	11	11	11	11	11	11	– 25 %	– 4.3 %	0.1 %	0.2 %
Cyprus	4	5	6	7	7	7	8	7	6	6	6	58 %	– 0.1 %	0.0 %	0.1 %
Czech Republic	395	283	184	166	171	168	150	137	114	85	99	– 75 %	15.2 %	3.3 %	1.4 %
Denmark	59	58	46	47	47	47	49	48	47	45	43	– 27 %	– 4.6 %	0.5 %	0.6 %
Estonia	105	58	45	49	44	56	49	40	56	55	49	– 54 %	– 11.1 %	0.9 %	0.7 %
Finland	591	342	91	135	138	126	131	134	161	133	140	– 76 %	5.4 %	5.0 %	2.0 %
France	2 220	1 418	1 011	578	602	548	533	504	512	503	520	– 77 %	3.2 %	18.7 %	7.5 %
Germany	1 698	1 709	1 879	1 888	1 918	1 941	1 935	1 903	1 955	1 981	1 955	15 %	– 1.3 %	14.3 %	28.3 %
Greece	52	52	52	52	52	52	52	52	52	52	52	0 %	0.0 %	0.4 %	0.8 %
Hungary	66	45	41	31	30	27	30	30	31	31	33	– 49 %	6.1 %	0.6 %	0.5 %
Ireland	45	46	50	21	21	21	20	18	17	16	16	– 64 %	– 1.8 %	0.4 %	0.2 %
Italy	959	946	909	982	1 053	1 058	1 036	761	905	977	928	– 3 %	– 5.1 %	8.1 %	13.4 %
Latvia	25	26	22	27	27	27	25	28	28	25	28	9 %	8.8 %	0.2 %	0.4 %
Lithuania	25	18	18	19	21	21	21	20	20	20	20	– 20 %	2.3 %	0.2 %	0.3 %
Luxembourg	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR				
Malta	0	1	1	1	1	1	1	1	10	11	9	> 100 %	– 19.1 %	0.0 %	0.1 %
Netherlands	223	144	93	86	87	84	84	89	108	105	106	– 53 %	0.6 %	1.9 %	1.5 %
Poland	3 092	1 948	1 423	1 448	1 547	1 486	1 488	1 405	1 599	1 514	1 545	– 50 %	2.0 %	26.0 %	22.4 %
Portugal	69	76	92	94	95	96	100	91	89	93	91	32 %	– 1.4 %	0.6 %	1.3 %
Romania	186	154	122	91	85	84	80	60	63	62	66	– 64 %	6.0 %	1.6 %	1.0 %
Slovakia	105	68	68	65	70	65	64	47	57	58	60	– 42 %	4.0 %	0.9 %	0.9 %
Slovenia	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR				
Spain	260	292	376	412	420	422	410	381	388	395	343	32 %	– 13.2 %	2.2 %	5.0 %
Sweden	200	159	120	142	153	154	158	156	173	159	162	– 19 %	1.9 %	1.7 %	2.3 %
United Kingdom	1 060	1 020	691	492	462	471	437	407	427	410	377	– 64 %	– 7.9 %	8.9 %	5.5 %
EU-28 (a)	**11 899**	**9 215**	**7 819**	**7 143**	**7 384**	**7 268**	**7 182**	**6 572**	**7 088**	**7 022**	**6 908**	**– 42 %**	**– 1.6 %**	**100 %**	**100 %**
EU-28 (b)	11 847	9 163	7 767	7 091	7 332	7 216	7 130	6 520	7 036	6 970	6 856				

Note: (a) Sum of national totals as reported by Member States.

(b) Sum of sectors: differences arise when only national totals and no sectoral data are available.

Negative percentage values indicate that emissions have decreased.

Light-grey shaded cells denote gap-filled data. For more detailed information, see Annex D.

Dark-grey shaded cells indicate that no emission values are available. See Appendix 1 for an explanation of the notation keys reported by Member States.

2.19 Dioxin and furan (PCDD/F) emission trends and key categories

Between 1990 and 2012, PCDD/F emissions dropped in the EU-28 by 85 %. Between 2011 and 2012, the decrease was 2.9 % (see Table 2.20), mainly due to reductions reported in the Czech Republic, Italy and France. The Member States that contributed most (i.e. more than 10 %) to PCDD/F emissions in 2012 were Poland, Italy and the United Kingdom. Greece did not report PCDD/F emissions for any year, and thus data were not gap-filled. The EU-28 total is therefore underestimated.

The decrease of dioxin emissions in France (1990–2012) is due to regulations limiting emissions, especially in the field of waste incineration, industrial energy processes (steel and metallurgy) and combustion in manufacturing (Appendix 5, France's IIR). The drop in dioxin emissions during the 1995-to-1997 period is due to improvements in sinter plants (Comment received from France in 2013).

Table 2.20 Member State contributions to EU PCDD/F emissions (g I-TEQ)

Member State	PCDD/Fs (g I-TEQ)											Change		Share in EU-28	
	1990	1995	2000	2005	2006	2007	2008	2009	2010	2011	2012	1990–2012	2011–2012	1990	2012
Austria	160.8	58.6	52.1	43.0	39.8	38.4	38.5	35.7	39.8	34.9	37.6	– 77 %	7.5 %	1.4 %	2.1 %
Belgium	542.3	362.3	113.5	56.6	53.0	53.6	65.6	47.5	51.9	45.1	51.7	– 90 %	14.7 %	4.7 %	2.9 %
Bulgaria	74.0	96.5	111.7	112.1	149.0	92.9	75.8	46.7	44.5	52.6	59.2	– 20 %	12.5 %	0.6 %	3.3 %
Croatia	154.6	83.3	98.8	91.1	91.7	78.6	82.7	87.8	98.3	117.1	123.3	– 20 %	5.3 %	1.3 %	7.0 %
Cyprus	1.8	2.0	2.1	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	– 68 %	1.1 %	0.0 %	0.0 %
Czech Republic	1 252	1 135	743.8	178.6	174.8	168.6	150.3	140.5	129.1	104.5	45.0	– 96 %	– 57.0 %	10.8 %	2.5 %
Denmark	67.2	48.8	32.1	25.2	25.5	29.2	28.1	25.7	25.8	23.9	22.9	– 66 %	– 4.4 %	0.6 %	1.3 %
Estonia	5.7	4.5	3.4	3.4	2.8	4.9	5.2	4.9	5.5	5.4	4.0	– 30 %	– 27.0 %	0.0 %	0.2 %
Finland	36.9	37.0	33.7	11.8	12.4	11.9	14.4	10.6	14.7	13.0	13.8	– 63 %	6.0 %	0.3 %	0.8 %
France	1 746	1 684	515.1	192.6	119.8	116.8	103.0	88.4	98.8	92.0	81.2	– 95 %	– 11.8 %	15.0 %	4.6 %
Germany	747.4	229.5	151.7	68.9	70.8	70.9	71.8	62.0	70.1	64.2	66.6	– 91 %	3.7 %	6.4 %	3.8 %
Greece	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE				
Hungary	119.3	65.7	51.3	37.7	38.9	33.9	32.7	42.3	44.3	43.5	42.2	– 65 %	– 3.0 %	1.0 %	2.4 %
Ireland	26.4	25.2	22.8	23.1	23.0	16.1	16.3	15.8	15.6	15.0	15.0	– 43 %	0.3 %	0.2 %	0.8 %
Italy	458.4	442.1	361.5	282.5	291.0	304.4	294.0	220.2	228.1	234.8	221.9	– 52 %	– 5.5 %	3.9 %	12.5 %
Latvia	27.1	29.0	28.3	32.4	31.6	30.8	29.0	31.2	30.7	31.8	31.9	17 %	0.3 %	0.2 %	1.8 %
Lithuania	25.6	17.8	19.8	22.5	23.9	22.4	23.7	23.6	24.7	23.9	24.2	– 5 %	1.5 %	0.2 %	1.4 %
Luxembourg	46.3	31.2	5.7	1.6	1.5	1.4	1.3	1.2	1.1	1.0	0.9	– 98 %	– 10.4 %	0.4 %	0.0 %
Malta	8.6	8.6	8.6	8.6	8.6	8.6	8.6	8.6	8.6	1.0	1.0	– 88 %	6.9 %	0.1 %	0.1 %
Netherlands	742.6	66.2	29.7	28.3	27.3	27.4	30.2	28.6	30.2	30.2	23.3	– 97 %	– 22.9 %	6.4 %	1.3 %
Poland	529.1	370.9	278.0	281.2	279.1	272.5	274.0	261.0	280.5	275.6	277.6	– 48 %	0.7 %	4.6 %	15.7 %
Portugal	54.2	50.8	46.2	34.4	33.3	32.3	31.1	30.7	28.8	30.1	29.3	– 46 %	– 2.6 %	0.5 %	1.7 %
Romania	3 073	2 063	1 053	174.3	120.0	131.0	152.0	141.9	156.6	163.2	168.6	– 95 %	3.3 %	26.4 %	9.5 %
Slovakia	168.6	149.5	127.9	59.3	53.5	50.0	46.2	32.2	46.5	42.9	48.9	– 71 %	13.8 %	1.4 %	2.8 %
Slovenia	15.6	12.0	11.2	10.3	10.4	10.0	10.3	10.2	10.3	10.8	10.5	– 32 %	– 2.2 %	0.1 %	0.6 %
Spain	180.5	156.9	125.6	117.0	121.0	126.0	120.9	113.8	118.9	122.4	119.8	– 34 %	– 2.1 %	1.6 %	6.8 %
Sweden	60.0	39.9	33.1	38.9	37.9	36.1	38.1	37.2	41.9	38.7	37.8	– 37 %	– 2.3 %	0.5 %	2.1 %
United Kingdom	1 304	842.4	315.3	246.8	225.1	209.4	216.2	203.0	204.6	205.5	212.4	– 84 %	3.4 %	11.2 %	12.0 %
EU-28 (a)	**11 628**	**8 113**	**4 376**	**2 183**	**2 066**	**1 979**	**1 961**	**1 752**	**1 850**	**1 824**	**1 771**	**– 85 %**	**– 2.9 %**	**100 %**	**100 %**
EU-28 (b)	11 628	8 113	4 376	2 182	2 066	1 979	1 961	1 752	1 850	1 824	1 771				

Note: (a) Sum of national totals as reported by Member States.
(b) Sum of sectors: differences arise when only national totals and no sectoral data are available..
Negative percentage values indicate that emissions have decreased.
Light-grey shaded cells denote gap-filled data. For more detailed information, see Annex D.
Dark-grey shaded cells indicate that no emission values are available.

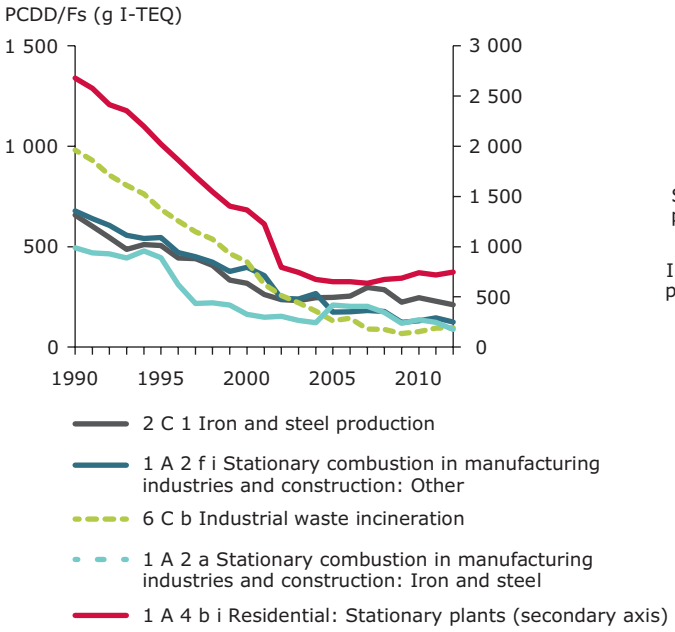
'1 A 4 b i — Residential: Stationary plants' and '2 C 1 — Iron and steel production' were the most important key categories for PCDD/F emissions, together making up 54 % of total PCDD/F emissions (see Figure 2.13(a)). Among the top five key categories, the highest relative reductions in emissions between 1990 and 2012 was achieved in the fourth most important key category, '6 C b — Industrial waste incineration' (− 90.3 %), and the fifth most important key category, '1 A 2 a — Stationary combustion in manufacturing industries and construction: Iron and steel'(− 82.1 %). The third most important key category, '1 A 2 f i — Stationary combustion in manufacturing industries and construction: Other'(− 81.6 %), also saw high reductions.

The steep drop of dioxin in the category '1 A 4 b i — Residential: Stationary plants' between 2001 and 2002 is caused by data reported from the Czech Republic. In 2002, a new set of emission factors based on the actual measurements results was used for the new POP emission inventories. Recalculation of the emission factors is planned (Comment received from Czech Republic in 2013).

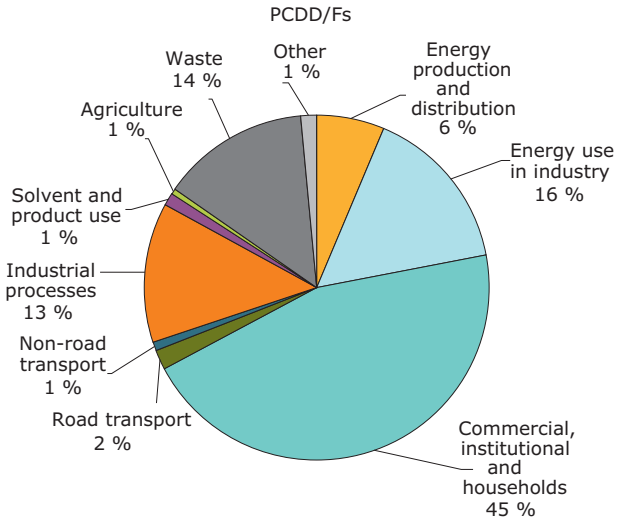
Figure 2.13(b) shows the contribution to total EU-28 emissions made by the aggregated sector groups. The 'Commercial, institutional and households' sector group is an important source of PCDD/Fs, and also of $PM_{2.5}$, PM_{10}, total PAHs, and PCBs.

Figure 2.13 PCDD/F emissions in the EU-28: (a) trend in PCDD/F emissions from the five most important key categories, 1990–2012; (b) share of emissions by sector group, 2012

(a)



(b)



2.20 Total polycyclic aromatic hydrocarbon (PAH) emission trends and key categories

Between 1990 and 2012, total PAH emissions dropped in the EU-28 by 60 %. Between 2011 and 2012, they rose by 1.5 %, mainly a result of increased emissions in Germany (see Table 2.21). The Member States that contributed most (i.e. more than 10 %) to total PAH emissions in 2012 were Spain, Germany, Poland and Romania. Greece did not report PAH emissions for any year, and thus data were not gap-filled. The EU-28 total is therefore underestimated.

Table 2.21 Member State contributions to EU total PAH emissions (Mg)

Member State	Total PAHs (Mg)											Change		Share in EU-28	
	1990	1995	2000	2005	2006	2007	2008	2009	2010	2011	2012	1990–2012	2011–2012	1990	2012
Austria	16.9	9.4	8.2	8.9	8.0	7.9	7.8	7.4	8.1	7.0	7.5	– 55 %	8.1 %	0.7 %	0.7 %
Belgium	83.6	75.3	49.3	43.1	41.9	43.7	41.5	34.3	37.9	36.2	34.5	– 59 %	– 4.9 %	3.2 %	3.3 %
Bulgaria	49.7	66.0	56.8	55.3	56.6	46.4	37.4	25.8	29.3	31.9	31.9	– 36 %	0.0 %	1.9 %	3.1 %
Croatia	19.6	8.4	10.3	9.7	10.0	8.6	9.9	9.1	11.0	12.7	11.9	– 40 %	– 6.8 %	0.8 %	1.1 %
Cyprus	4.7	4.1	2.9	2.3	2.0	1.7	1.4	1.3	1.1	1.1	1.1	– 77 %	0.0 %	0.2 %	0.1 %
Czech Republic	751.6	1 357	487.6	24.2	17.1	16.4	19.3	15.3	17.1	19.1	19.5	– 97 %	1.9 %	29.0 %	1.9 %
Denmark	4.8	5.4	6.3	8.4	8.9	10.2	9.6	8.8	9.0	7.9	7.7	61 %	– 3.3 %	0.2 %	0.7 %
Estonia	12.2	14.5	12.6	12.6	11.7	13.2	14.0	15.1	16.3	14.2	15.0	23 %	5.0 %	0.5 %	1.4 %
Finland	16.8	17.3	14.4	13.3	13.4	13.3	14.9	15.7	17.7	15.9	17.2	2 %	8.3 %	0.7 %	1.7 %
France	40.4	39.2	29.7	22.9	20.3	18.9	18.9	18.6	19.8	16.8	18.2	– 55 %	8.5 %	1.6 %	1.8 %
Germany	374.1	163.0	156.1	144.1	150.4	144.8	157.7	166.0	206.3	177.6	190.9	– 49 %	7.5 %	14.5 %	18.4 %
Greece	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE				
Hungary	98.3	45.0	29.3	26.7	29.5	27.1	22.6	25.1	28.1	30.7	30.0	– 70 %	– 2.5 %	3.8 %	2.9 %
Ireland	6.4	4.1	3.0	2.7	2.7	2.6	2.7	2.8	2.7	2.5	2.4	– 62 %	– 1.1 %	0.2 %	0.2 %
Italy	79.7	83.9	51.9	57.0	58.7	62.9	62.9	55.2	61.1	64.0	63.2	– 21 %	– 1.3 %	3.1 %	6.1 %
Latvia	17.0	15.3	14.6	15.2	14.8	14.2	13.7	15.2	15.0	12.1	12.4	– 27 %	2.1 %	0.7 %	1.2 %
Lithuania	19.3	8.8	9.2	10.5	11.4	11.2	11.4	11.1	11.8	11.7	11.8	– 39 %	0.4 %	0.7 %	1.1 %
Luxembourg	1.3	0.9	0.9	0.9	0.9	1.0	1.1	0.9	0.8	0.8	0.8	– 34 %	0.0 %	0.0 %	0.1 %
Malta	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	– 21 %	– 0.9 %	0.0 %	0.0 %
Netherlands	20.1	9.8	3.8	3.8	3.6	4.2	4.5	4.0	3.7	3.8	3.5	– 82 %	– 8.3 %	0.8 %	0.3 %
Poland	159.2	211.3	148.4	156.4	169.1	166.0	139.0	131.5	148.2	142.5	144.4	– 9 %	1.3 %	6.1 %	13.9 %
Portugal	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	– 2 %	– 0.3 %	0.0 %	0.0 %
Romania	274.3	182.5	90.7	131.9	124.4	127.9	151.7	132.8	136.3	127.0	129.0	– 53 %	1.5 %	10.6 %	12.4 %
Slovakia	29.0	14.9	13.4	19.2	18.2	18.2	18.3	17.8	18.3	19.0	19.2	– 34 %	1.0 %	1.1 %	1.8 %
Slovenia	16.1	14.7	14.2	12.4	12.2	11.9	11.9	12.4	12.2	13.2	13.3	– 18 %	0.7 %	0.6 %	1.3 %
Spain	272.5	261.6	226.2	174.6	201.8	207.7	198.0	212.8	223.1	232.8	230.7	– 15 %	– 0.9 %	10.5 %	22.2 %
Sweden	16.8	16.5	14.0	17.9	18.7	18.0	18.5	13.8	13.4	13.9	13.6	– 19 %	– 2.2 %	0.6 %	1.3 %
United Kingdom	204.7	92.5	15.0	10.4	9.3	8.9	8.9	8.7	9.0	9.2	9.5	– 95 %	2.8 %	7.9 %	0.9 %
EU-28 (a)	**2 589**	**2 721**	**1 469**	**985**	**1 016**	**1 007**	**998**	**962**	**1 057**	**1 024**	**1 039**	**– 60 %**	**1.5 %**	**100 %**	**100 %**
EU-28 (b)	2 589	2 721	1 469	985	1 016	1 007	998	962	1 057	1 024	1 039				

Note: (a) Sum of national totals as reported by Member States.
(b) Sum of sectors: differences arise when only national totals and no sectoral data are available.
Negative percentage values indicate that emissions have decreased.
Light-grey shaded cells denote gap-filled data. For more detailed information, see Annex D.
Dark-grey shaded cells indicate that no emission values are available.

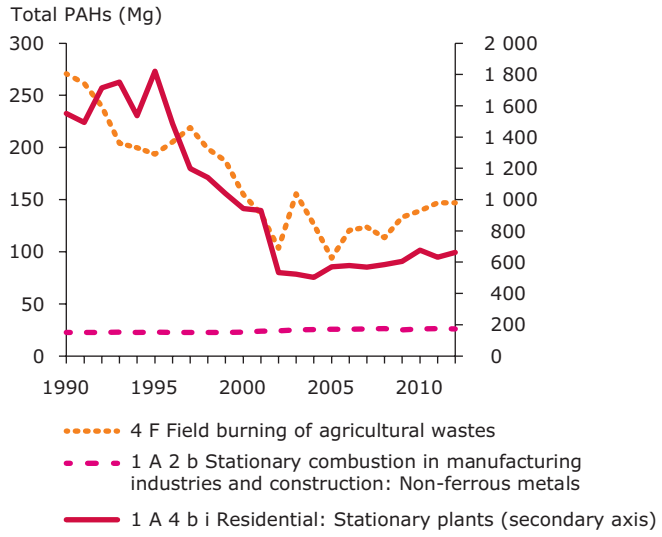
'1 A 4 b i — Residential: Stationary plants' was the most important key category for these emissions, making up 64 % of total PAH emissions (see Figure 2.14(a)). Among the key categories, the highest relative reductions in emissions between 1990 and 2012 were achieved in the most important key category, '1 A 4 b i Residential: Stationary plants' (– 57.4 %).

Emissions from these sources have declined overall since 1990 thanks to less residential use of coal, improvements in abatement technologies for metal refining and smelting, and stricter regulations on emissions from the 'Road transport' sector (EEA, 2014g).

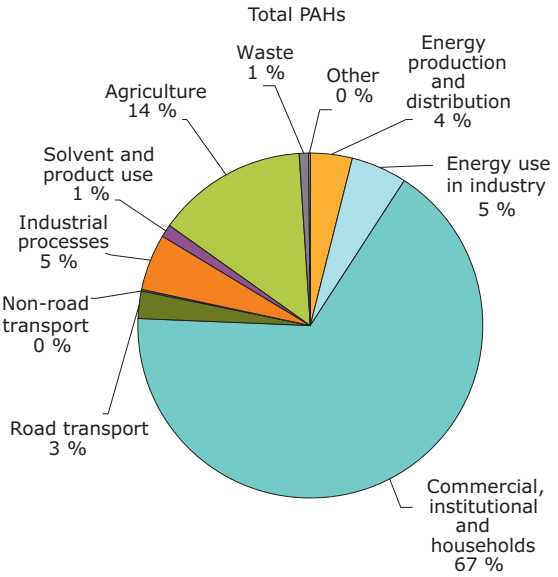
Figure 2.14(b) shows the contribution to total EU-28 emissions made by the aggregated sector groups. The 'Commercial, institutional and households' sector group is a very important source of total PAHs, as well as of $PM_{2.5}$, PM_{10}, PCDD/Fs, and PCBs.

Figure 2.14 Total PAH emissions in the EU-28: (a) trend in total PAH emissions from the five most important key categories, 1990–2012; (b) share of emissions by sector group, 2012

(a)



(b)



2.21 Benzo(a)pyrene (BaP) emission trends

Between 1990 and 2012, BaP emissions in the EU-28 dropped by 51 %. Between 2011 and 2012, they increased by 2.4 %, mainly due to increased emissions in Germany and Romania (see Table 2.22).

The Member States that contributed most (i.e. more than 10 %) to BaP emissions in 2012 were Poland, Romania and Germany. Austria reported the whole time-series of its BaP emissions as NR, Belgium, Italy and Portugal as NE, and Finland and Spain as IE. Greece did not report any data or notation keys. The EU-28 total is therefore underestimated.

Table 2.22 Member State contributions to EU BaP emissions (Mg)

Member State	Benzo(a)pyrene (Mg)											Change		Share in EU-28	
	1990	1995	2000	2005	2006	2007	2008	2009	2010	2011	2012	1990–2012	2011–2012	1990	2012
Austria	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR				
Belgium	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE				
Bulgaria	7.9	6.2	6.6	7.6	8.1	7.4	7.6	7.1	8.1	8.9	9.0	13 %	0.4 %	2.2 %	5.0 %
Croatia	4.8	2.2	2.6	2.5	2.5	2.1	2.2	2.3	2.7	3.2	3.4	– 29 %	5.9 %	1.3 %	1.9 %
Cyprus	1.2	1.0	0.7	0.6	0.5	0.4	0.4	0.3	0.3		0.3	– 76 %		0.3 %	0.2 %
Czech Republic	10.9	9.7	8.6	8.3	5.9	5.7	7.9	4.7	5.1	5.3	5.6	– 49 %	3.8 %	3.0 %	3.1 %
Denmark	1.5	1.7	2.0	2.7	2.9	3.3	3.1	2.9	2.9	2.5	2.5	69 %	– 3.3 %	0.4 %	1.4 %
Estonia	3.6	4.4	3.8	3.8	3.8	3.9	4.2	4.5	4.9	4.3	4.5	23 %	5.0 %	1.0 %	2.5 %
Finland	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE				
France	11.5	11.1	8.3	6.3	5.6	5.2	5.2	5.1	5.5	4.6	5.0	– 56 %	9.4 %	3.1 %	2.8 %
Germany	138.3	47.6	30.3	23.1	24.3	22.9	25.5	27.0	33.7	29.4	31.6	– 77 %	7.5 %	37.5 %	17.5 %
Greece	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE				
Hungary	28.4	13.4	8.9	7.9	8.9	8.2	7.0	7.7	8.6	9.4	9.2	– 68 %	– 2.4 %	7.7 %	5.1 %
Ireland	3.4	2.1	1.5	1.4	1.3	1.3	1.4	1.4	1.4	1.2	1.2	– 64 %	– 1.6 %	0.9 %	0.7 %
Italy	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE				
Latvia	5.6	5.4	5.3	5.4	5.3	5.0	4.8	5.4	5.3	4.1	4.2	– 25 %	3.2 %	1.5 %	2.3 %
Lithuania	5.7	2.8	3.1	3.5	3.8	3.7	3.8	3.7	3.9	3.9	3.9	– 31 %	0.4 %	1.5 %	2.2 %
Luxembourg	0.4	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	– 31 %	0.0 %	0.1 %	0.1 %
Malta	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	– 13 %	0.0 %	0.0 %	0.0 %
Netherlands	5.2	2.9	1.3	1.4	1.2	1.3	1.3	1.3	1.2	1.2	1.2	– 77 %	– 3.4 %	1.4 %	0.7 %
Poland	63.2	49.3	36.1	38.1	41.2	41.0	41.6	39.1	44.6	43.3	43.5	– 31 %	0.6 %	17.1 %	24.1 %
Portugal	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE				
Romania	2.8	2.8	4.9	39.1	36.7	37.7	44.4	39.0	40.0	37.1	37.8	> 100 %	1.8 %	0.8 %	21.0 %
Slovakia	3.0	3.3	3.7	5.3	4.9	5.0	5.1	5.1	5.0	5.3	5.4	80 %	1.1 %	0.8 %	3.0 %
Slovenia	4.7	4.2	4.1	3.6	3.5	3.4	3.4	3.6	3.5	3.8	3.8	– 18 %	0.7 %	1.3 %	2.1 %
Spain	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE				
Sweden	5.2	5.2	4.4	5.5	5.7	5.5	5.7	4.5	4.3	4.5	4.4	– 16 %	– 2.4 %	1.4 %	2.4 %
United Kingdom	61.4	21.7	5.2	3.3	3.1	3.2	3.3	3.1	3.3	3.5	3.5	– 94 %	1.5 %	16.7 %	1.9 %
EU-28 (a)	**368.8**	**197.4**	**141.7**	**169.6**	**169.4**	**166.8**	**178.3**	**168.2**	**184.7**	**175.9**	**180.2**	**– 51 %**	**2.4 %**	**100 %**	**100 %**
EU-28 (b)	368.8	197.4	141.7	169.6	169.4	166.8	178.3	168.2	184.7	175.9	180.2				

Note: (a) Sum of national totals as reported by Member States.

(b) Sum of sectors: differences arise when only national totals and no sectoral data are available.

Negative percentage values indicate that emissions have decreased.

Light-grey shaded cells denote gap-filled data. For more detailed information, see Annex D.

Dark-grey shaded cells indicate that no emission values are available. See Appendix 1 for an explanation of the notation keys reported by Member States.

2.22 Benzo(b)fluoranthene (BbF) emission trends

Between 1990 and 2012, BbF emissions in the EU-28 decreased by 41 %. Between 2011 and 2012, they rose by 1.4 %, mainly due to emission increases in Poland, Romania and France (see Table 2.23). The Member States that contributed most (i.e. more than 10 %) to BbF emissions in 2012 were Poland and Romania. Austria reported the whole time-series of its BbF emissions as NR, Belgium, Italy and Portugal as NE, and Finland and Spain as IE. Greece did not report any data or notation keys. The EU-28 total is therefore underestimated.

Table 2.23 Member State contributions to EU BbF emissions (Mg)

Member State	Benzo(b)fluoranthene (Mg)											Change		Share in EU-28	
	1990	1995	2000	2005	2006	2007	2008	2009	2010	2011	2012	1990–2012	2011–2012	1990	2012
Austria	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR				
Belgium	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE				
Bulgaria	10.8	8.3	7.8	8.8	9.4	8.6	8.7	8.0	9.3	10.3	10.3	– 5 %	0.1 %	4.1 %	6.6 %
Croatia	5.9	2.9	3.5	3.3	3.3	2.8	2.9	3.1	3.5	4.3	4.5	– 24 %	5.8 %	2.2 %	2.9 %
Cyprus	1.2	1.1	0.8	0.6	0.6	0.5	0.4	0.4	0.3	0.3	0.3	– 74 %	0.4 %	0.5 %	0.2 %
Czech Republic	8.3	8.3	8.3	7.0	5.0	4.8	2.7	4.7	5.3	6.5	6.6	– 20 %	1.7 %	3.1 %	4.2 %
Denmark	1.5	1.8	2.1	2.8	3.0	3.4	3.2	3.0	3.0	2.7	2.6	70 %	– 2.9 %	0.6 %	1.7 %
Estonia	4.3	4.8	4.2	4.3	3.9	4.4	4.6	5.0	5.5	4.8	5.0	16 %	4.7 %	1.6 %	3.2 %
Finland	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE				
France	13.3	12.9	9.7	7.4	6.6	6.1	6.1	6.0	6.5	5.5	5.9	– 56 %	8.7 %	5.1 %	3.8 %
Germany	2.0	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	– 96 %	– 0.2 %	0.8 %	0.1 %
Greece	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE				
Hungary	37.7	16.0	9.9	9.3	10.0	8.9	7.5	8.3	9.2	10.1	9.8	– 74 %	– 3.0 %	14.3 %	6.3 %
Ireland	0.4	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	– 31 %	5.7 %	0.2 %	0.2 %
Italy	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE				
Latvia	6.1	5.0	4.5	4.8	4.8	4.6	4.4	4.9	4.8	3.9	4.0	– 35 %	2.1 %	2.3 %	2.6 %
Lithuania	8.0	3.2	3.1	3.6	4.0	3.9	4.0	3.8	4.1	4.1	4.1	– 48 %	0.3 %	3.0 %	2.6 %
Luxembourg	0.5	0.3	0.3	0.3	0.3	0.3	0.4	0.3	0.3	0.3	0.3	– 39 %	0.0 %	0.2 %	0.2 %
Malta	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	> 100 %	> 100 %	0.0 %	0.1 %
Netherlands	8.0	3.2	1.2	1.2	1.2	1.5	1.6	1.4	1.2	1.3	1.1	– 86 %	– 13.1 %	3.0 %	0.7 %
Poland	65.8	51.5	37.6	39.6	42.4	41.6	41.7	39.7	44.4	43.1	43.8	– 33 %	1.6 %	25.0 %	28.0 %
Portugal	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE				
Romania	0.4	0.3	0.2	43.7	40.9	42.1	49.7	43.2	44.4	41.5	42.1	> 100 %	1.4 %	0.2 %	26.9 %
Slovakia	4.2	4.3	4.5	7.0	6.6	6.6	6.6	6.5	6.6	6.9	7.0	67 %	0.9 %	1.6 %	4.5 %
Slovenia	6.2	5.5	5.3	4.6	4.5	4.4	4.5	4.7	4.6	4.9	5.0	– 19 %	0.7 %	2.3 %	3.2 %
Spain	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE				
Sweden	2.7	2.5	2.3	3.8	4.8	3.9	3.9	0.3	0.4	0.4	0.3	– 87 %	– 8.4 %	1.0 %	0.2 %
United Kingdom	76.3	39.3	4.2	3.4	3.1	3.0	2.9	2.9	3.0	3.1	3.3	– 96 %	5.3 %	28.9 %	2.1 %
EU-28 (a)	**263.5**	**171.8**	**109.9**	**155.8**	**154.8**	**151.8**	**156.2**	**146.7**	**156.8**	**154.3**	**156.6**	**– 41 %**	**1.4 %**	**100 %**	**100 %**
EU-28 (b)	263.5	171.8	109.9	155.8	154.8	151.8	156.2	146.7	156.8	154.3	156.6				

Note: (a) Sum of national totals as reported by Member States.

(b) Sum of sectors: differences arise when only national totals and no sectoral data are available.

Negative percentage values indicate that emissions have decreased.

Light-grey shaded cells denote gap-filled data. For more detailed information, see Annex D.

Dark-grey shaded cells indicate that no emission values are available. See Appendix 1 for an explanation of the notation keys reported by Member States.

2.23 Benzo(k)fluoranthene (BkF) emission trends

Between 1990 and 2012, BkF emissions in the EU-28 decreased by 53 %. Between 2011 and 2012, they rose by 0.4 %, mainly due to increased emissions in France (see Table 2.24).The Member States that contributed most (i.e. more than 10 %) to BkF emissions in 2012 were Romania and Poland. Austria reported the whole time-series of its BkF emissions as NR, Belgium, Italy and Portugal as NE, and Finland and Spain as IE. Germany reported its emissions as 0, and Greece did not report any data or notation keys. The EU-28 total is therefore underestimated.

Table 2.24 Member State contributions to EU BkF emissions (Mg)

Member State	Benzo(k)fluoranthene (Mg)											Change		Share in EU-28	
	1990	1995	2000	2005	2006	2007	2008	2009	2010	2011	2012	1990–2012	2011–2012	1990	2012
Austria	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR				
Belgium	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE				
Bulgaria	4.6	3.6	4.0	4.6	4.9	4.5	4.6	4.4	5.0	5.4	5.4	19 %	0.5 %	2.9 %	7.4 %
Croatia	2.4	1.0	1.2	1.1	1.1	1.0	1.0	1.1	1.2	1.4	1.5	– 38 %	5.8 %	1.6 %	2.1 %
Cyprus	1.2	1.0	0.7	0.5	0.5	0.4	0.3	0.3	0.3	0.3	0.3	– 79 %	– 0.6 %	0.8 %	0.3 %
Czech Republic	3.3	3.3	3.3	3.3	2.3	2.2	4.3	2.1	2.3	2.9	2.7	– 18 %	– 4.8 %	2.1 %	3.7 %
Denmark	0.6	0.7	0.8	1.1	1.2	1.3	1.3	1.2	1.2	1.1	1.0	71 %	– 2.8 %	0.4 %	1.4 %
Estonia	2.2	2.6	2.3	2.2	2.1	2.4	2.5	2.7	2.9	2.5	2.7	21 %	5.5 %	1.4 %	3.7 %
Finland	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE				
France	8.4	8.3	6.3	4.9	4.4	4.1	4.1	4.0	4.2	3.6	3.8	– 54 %	7.7 %	5.4 %	5.3 %
Germany	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0			0.0 %	0.0 %
Greece	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE				
Hungary	16.4	7.7	5.1	4.6	5.1	4.7	4.0	4.5	5.0	5.5	5.4	– 67 %	– 2.4 %	10.4 %	7.3 %
Ireland	0.2	0.1	0.1	0.2	0.2	0.2	0.2	0.1	0.1	0.1	0.1	– 15 %	4.3 %	0.1 %	0.2 %
Italy	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE				
Latvia	2.4	2.0	1.8	1.9	1.9	1.8	1.7	1.9	1.9	1.5	1.5	– 36 %	2.1 %	1.5 %	2.1 %
Lithuania	2.9	1.2	1.2	1.4	1.5	1.5	1.5	1.5	1.6	1.6	1.6	– 46 %	0.5 %	1.9 %	2.2 %
Luxembourg	0.2	0.2	0.2	0.1	0.2	0.2	0.2	0.1	0.1	0.1	0.1	– 35 %	– 0.1 %	0.1 %	0.2 %
Malta	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	> 100 %	> 100 %	0.0 %	0.2 %
Netherlands	4.0	2.2	0.7	0.6	0.6	0.7	0.8	0.7	0.6	0.6	0.6	– 85 %	– 7.3 %	2.6 %	0.8 %
Poland	65.9	51.6	37.7	39.7	42.6	41.8	12.9	10.9	12.5	12.4	12.4	– 81 %	– 0.5 %	41.9 %	16.9 %
Portugal	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE				
Romania	0.4	0.3	0.2	28.5	27.7	28.3	33.7	28.2	29.0	27.6	27.6	> 100 %	– 0.2 %	0.3 %	37.7 %
Slovakia	1.8	1.9	2.1	2.9	2.8	2.8	2.8	2.6	2.8	2.8	2.9	61 %	1.3 %	1.1 %	3.9 %
Slovenia	2.3	2.1	2.0	1.8	1.7	1.7	1.7	1.7	1.7	1.8	1.8	– 21 %	0.6 %	1.5 %	2.5 %
Spain	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE				
Sweden	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	– 18 %	– 8.7 %	0.1 %	0.2 %
United Kingdom	37.8	19.8	3.1	2.3	1.7	1.4	1.4	1.4	1.4	1.4	1.5	– 96 %	4.5 %	24.0 %	2.0 %
EU-28 (a)	**157.3**	**109.7**	**72.9**	**102.0**	**102.6**	**101.1**	**79.2**	**69.5**	**74.0**	**72.9**	**73.2**	**– 53 %**	**0.4 %**	**100 %**	**100 %**
EU-28 (b)	157.3	109.7	72.9	102.0	102.6	101.1	79.2	69.5	74.0	72.9	73.2				

Note: (a) Sum of national totals as reported by Member States.

(b) Sum of sectors: differences arise when only national totals and no sectoral data are available.

Negative percentage values indicate that emissions have decreased.

Light-grey shaded cells denote gap-filled data. For more detailed information, see Annex D.

Dark-grey shaded cells indicate that no emission values are available. See Appendix 1 for an explanation of the notation keys reported by Member States.

2.24 Indeno(1,2,3-cd)pyrene (IP) emission trends

Between 1990 and 2012, IP emissions in the EU-28 fell by 39 %. Between 2011 and 2012, emissions rose by 2.3 %, mainly due to increases reported in Poland and Romania (see Table 2.25). The Member States that contributed most (i.e. more than 10 %) to IP emissions in 2012 were Poland and Romania. Austria reported the whole time-series of its IP emissions as NR, Belgium, Italy and Portugal as NE, and Finland and Spain as IE. Greece did not report any data or notation keys. The EU-28 total is therefore underestimated.

Table 2.25 Member State contributions to EU indeno(1,2,3-cd)pyrene emissions (Mg)

Member State	Indeno(1,2,3-cd)pyrene (Mg)											Change		Share in EU-28	
	1990	1995	2000	2005	2006	2007	2008	2009	2010	2011	2012	1990–2012	2011–2012	1990	2012
Austria	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR				
Belgium	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE				
Bulgaria	4.1	3.3	4.0	4.6	4.9	4.6	4.7	4.5	5.1	5.5	5.6	35 %	0.7 %	2.4 %	5.2 %
Croatia	3.2	1.6	1.9	1.8	1.8	1.5	1.6	1.7	1.9	2.3	2.4	– 24 %	5.8 %	1.8 %	2.3 %
Cyprus	1.1	1.0	0.7	0.5	0.5	0.4	0.3	0.3	0.2	0.2	0.2	– 78 %	– 0.3 %	0.7 %	0.2 %
Czech Republic	10.2	8.7	7.1	5.6	3.9	3.8	4.4	3.6	4.4	4.4	4.5	– 56 %	2.1 %	5.9 %	4.2 %
Denmark	1.2	1.2	1.3	1.8	1.9	2.2	2.0	1.8	1.9	1.6	1.6	33 %	– 4.0 %	0.7 %	1.5 %
Estonia	2.1	2.7	2.4	2.3	2.0	2.5	2.7	2.9	3.1	2.7	2.8	37 %	5.3 %	1.2 %	2.6 %
Finland	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE				
France	7.1	6.9	5.4	4.2	3.8	3.5	3.5	3.5	3.7	3.1	3.4	– 52 %	7.9 %	4.1 %	3.2 %
Germany	0.7	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	– 95 %	– 0.5 %	0.4 %	0.0 %
Greece	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE				
Hungary	15.7	7.9	5.4	4.9	5.5	5.2	4.1	4.6	5.2	5.7	5.6	– 65 %	– 2.0 %	9.0 %	5.2 %
Ireland	2.5	1.5	1.0	0.9	0.9	0.9	0.9	0.9	0.9	0.8	0.8	– 69 %	– 3.4 %	1.4 %	0.7 %
Italy	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE				
Latvia	2.8	2.9	2.8	2.9	2.8	2.7	2.6	2.9	2.8	2.3	2.3	– 18 %	3.5 %	1.6 %	2.2 %
Lithuania	2.9	1.6	1.8	2.0	2.1	2.1	2.1	2.1	2.2	2.1	2.2	– 26 %	0.4 %	1.7 %	2.0 %
Luxembourg	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	– 25 %	0.0 %	0.1 %	0.2 %
Malta	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	> 100 %	> 100 %	0.0 %	0.2 %
Netherlands	2.8	1.4	0.6	0.6	0.6	0.7	0.8	0.7	0.6	0.7	0.6	– 79 %	– 8.9 %	1.6 %	0.6 %
Poland	81.8	58.9	37.1	39.1	42.9	41.6	42.8	41.7	46.7	43.8	44.7	– 45 %	2.2 %	46.9 %	42.0 %
Portugal	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE				
Romania	0.2	0.1	0.1	20.6	19.1	19.9	23.8	22.4	23.0	20.8	21.6	> 100 %	3.6 %	0.1 %	20.2 %
Slovakia	2.9	3.0	3.1	4.1	3.9	3.8	3.8	3.6	3.8	4.0	4.0	38 %	0.6 %	1.7 %	3.7 %
Slovenia	3.0	2.8	2.8	2.4	2.4	2.3	2.3	2.5	2.4	2.6	2.6	– 12 %	0.7 %	1.7 %	2.5 %
Spain	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE				
Sweden	0.7	0.6	0.6	0.9	1.1	0.9	0.9	0.1	0.1	0.1	0.1	– 83 %	– 8.2 %	0.4 %	0.1 %
United Kingdom	29.2	11.7	2.5	1.4	1.3	1.3	1.4	1.3	1.3	1.2	1.2	– 96 %	– 2.0 %	16.7 %	1.1 %
EU-28 (a)	**174.5**	**118.0**	**80.6**	**100.8**	**101.7**	**100.1**	**105.0**	**101.3**	**109.5**	**104.2**	**106.5**	**– 39 %**	**2.3 %**	**100 %**	**100 %**
EU-28 (b)	174.5	118.0	80.6	100.8	101.7	100.1	105.0	101.3	109.5	104.2	106.5				

Note: (a) Sum of national totals as reported by Member States.

(b) Sum of sectors: differences arise when only national totals and no sectoral data are available.

Negative percentage values indicate that emissions have decreased.

Light-grey shaded cells denote gap-filled data. For more detailed information, see Annex D.

Dark-grey shaded cells indicate that no emission values are available. See Appendix 1 for an explanation of the notation keys reported by Member States.

2.25 Hexachlorobenzene (HCB) emission trends and key categories

Between 1990 and 2012, HCB emissions in the EU-28 fell by 96 %. Between 2011 and 2012, the decrease was 12.5 %, mainly due to reductions in Finland, Belgium and Bulgaria (see Table 2.26). The Member States that contributed most (i.e. more than 10 %) to HCB emissions in 2012 were Austria, Belgiumand the United Kingdom. Greece did not report HCB emissions for any year, and thus data were not gap-filled. The EU-28 total is therefore underestimated.

The strong emissions drop in France between 1990 and 1995 is mainly due to a change in the emission factor from the activity of secondary aluminium fusion. Since 1994, this activity has used substitution products that no longer emit HCB. From 1990 to 1992, the emission factor was 5 g/Mg; it decreased by 50 % in 1993, and has been null since 1994 (Comment received from France in 2013).

Finland reported that the emissions trend is dominated by fluctuations in the 'Industrial processes' sector (Appendix 5, Finland's IIR).

Table 2.26 Member State contributions to EU HCB emissions (kg)

Member State	HCB (kg)											Change		Share in EU-28	
	1990	1995	2000	2005	2006	2007	2008	2009	2010	2011	2012	1990–2012	2011–2012	1990	2012
Austria	92.0	53.1	44.3	45.5	41.9	40.8	41.3	38.2	43.5	37.4	41.5	– 55 %	10.7 %	1.7 %	21.2 %
Belgium	68.0	191.6	43.9	28.2	31.0	29.3	28.6	24.9	27.1	40.9	28.3	– 58 %	– 31.0 %	1.3 %	14.5 %
Bulgaria	23.0	24.7	19.9	20.9	25.6	23.4	26.6	22.8	19.1	21.7	16.6	– 28 %	– 23.7 %	0.4 %	8.5 %
Croatia	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	– 12 %	4.8 %	0.0 %	0.1 %
Cyprus	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	– 80 %	– 5.4 %	0.0 %	0.0 %
Czech Republic	4.5	4.7	4.8	4.7	3.7	3.9	3.7	2.7	2.7	2.5	2.9	– 36 %	18.2 %	0.1 %	1.5 %
Denmark	26.8	7.8	5.6	3.8	3.7	3.6	3.3	2.7	2.8	2.6	2.4	– 91 %	– 7.3 %	0.5 %	1.2 %
Estonia	0.1	0.1	0.1	0.2	0.1	0.1	0.1	0.2	0.2	0.2	0.2	> 100 %	4.2 %	0.0 %	0.1 %
Finland	41.2	40.6	44.1	38.6	42.8	44.8	25.5	33.7	16.2	33.2	17.0	– 59 %	– 48.9 %	0.8 %	8.7 %
France	1 200	75.5	50.5	19.3	14.2	14.5	14.9	15.4	15.7	16.0	16.6	– 99 %	4.2 %	22.7 %	8.5 %
Germany	5.3	4.5	4.5	3.0	3.1	3.1	3.2	3.3	3.7	3.5	3.6	– 33 %	2.7 %	0.1 %	1.8 %
Greece	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE				
Hungary	1.8	2.0	2.1	2.0	2.0	1.7	1.9	1.8	2.2	2.1	2.1	17 %	– 2.7 %	0.0 %	1.1 %
Ireland	40.2	40.4	0.5	1.3	1.2	1.2	1.2	1.2	1.2	1.2	1.2	– 97 %	0.7 %	0.8 %	0.6 %
Italy	42.9	37.9	24.4	21.0	27.2	26.4	26.2	15.5	13.5	13.7	13.5	– 69 %	– 1.9 %	0.8 %	6.9 %
Latvia	0.2	0.3	0.2	0.3	0.3	0.3	0.2	0.3	0.3	0.3	0.3	76 %	6.7 %	0.0 %	0.2 %
Lithuania	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	4 %	9.5 %	0.0 %	0.1 %
Luxembourg	0.2	1.1	2.1	1.2	1.0	0.8	0.7	0.6	0.5	0.4	0.3	58 %	– 17.8 %	0.0 %	0.2 %
Malta	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3 %	0.0 %	0.0 %	0.0 %
Netherlands	44.7	0.6	1.0	1.0	1.1	1.0	1.1	1.5	1.4	1.6	1.7	– 96 %	5.8 %	0.8 %	0.9 %
Poland	62.1	9.6	8.8	9.7	9.5	11.0	11.0	11.1	13.1	12.6	13.2	– 79 %	4.6 %	1.2 %	6.7 %
Portugal	1.9	2.0	1.5	0.9	0.9	0.9	0.8	1.3	0.6	0.8	0.9	– 51 %	20.5 %	0.0 %	0.5 %
Romania	99.3	64.3	29.4	2.5	1.2	1.5	1.7	1.7	1.8	1.7	1.9	– 98 %	5.9 %	1.9 %	0.9 %
Slovakia	2.8	2.5	2.7	1.7	1.2	1.4	1.3	1.0	1.0	1.2	1.0	– 63 %	– 11.6 %	0.1 %	0.5 %
Slovenia	46.4	37.2	38.0	0.3	0.4	0.4	0.5	0.4	0.5	0.6	0.6	– 99 %	3.8 %	0.9 %	0.3 %
Spain	326.3	149.9	180.1	135.0	21.4	32.4	30.8	13.6	4.0	4.4	4.3	– 99 %	– 2.2 %	6.2 %	2.2 %
Sweden	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	– 40 %	– 33.9 %	0.0 %	0.0 %
United Kingdom	3 156	4 120	76.9	68.5	64.2	58.5	51.1	31.7	32.6	24.2	25.1	– 99 %	3.5 %	59.7 %	12.8 %
EU-28 ([a])	**5 287**	**4 871**	**585.6**	**409.7**	**297.9**	**301.5**	**276.1**	**225.5**	**204.0**	**223.1**	**195.3**	**– 96 %**	**– 12.5 %**	**100 %**	**100 %**
EU-28 ([b])	5 287	4 871	585.6	409.7	297.9	301.5	276.1	225.5	204.0	223.1	195.3				

Note: ([a]) Sum of national totals as reported by Member States.
([b]) Sum of sectors: differences arise when only national totals and no sectoral data are available.
Negative percentage values indicate that emissions have decreased.
Light-grey shaded cells denote gap-filled data. For more detailed information, see Annex D.
Dark-grey shaded cells indicate that no emission values are available.

Belgium stated that the jump in HCB emissions from 1990 to 1995 can be explained by (much) higher amounts of burned sludge. From 1999 to 2000 the dip originates from a much lower emission factor (from 0.5 g/ton to 0,002 g/tonne). Due to the introduction of a new methodology to estimate HCB emissions in 2013, only values were available for some years (1990, 1995, 2000, all years from 2005 on). The methodology will be refined to estimate the emissions in the intervening years, the increase during the period 1995-1999 will remain, but will be less abrupt (Comment received from Belgium in 2014).

'1 A 4 b i — Residential: Stationary plants', '1 A 1 a — Public electricity and heat production' and '2 C 1 — Iron and steel production' were the most important key categories for HCB emissions, accounting for 52 % of total HCB emissions (see Figure 2.15(a)). Among the top five key categories, the highest relative reductions in emissions between 1990 and 2012 were achieved in the fourth most important key category, '4 G — Agriculture other' (− 91.3 %), and in the fifth most important key category, '6 C b — Industrial waste incineration' (− 86.1 %).

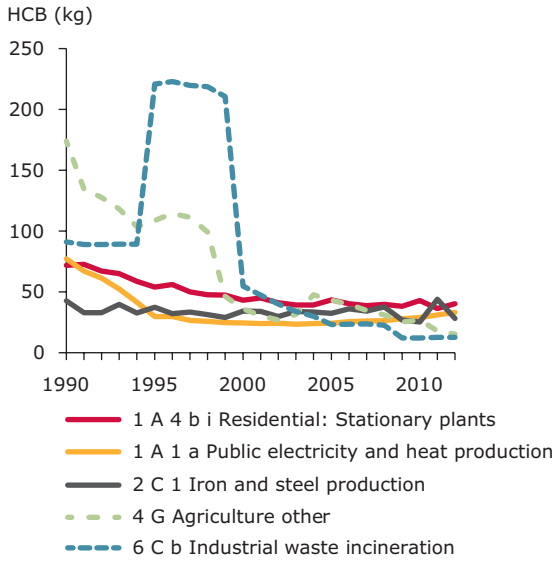
The huge emission peak from 1995 to 1999 in the category '6 C b — Industrial waste incineration' was caused by the high emissions levels reported from Belgium.

Data reported from the United Kingdom are responsible for the emission decreases from 1990 to 1991 and from 1998 to 1999 in the category '4 G — Agriculture other'.

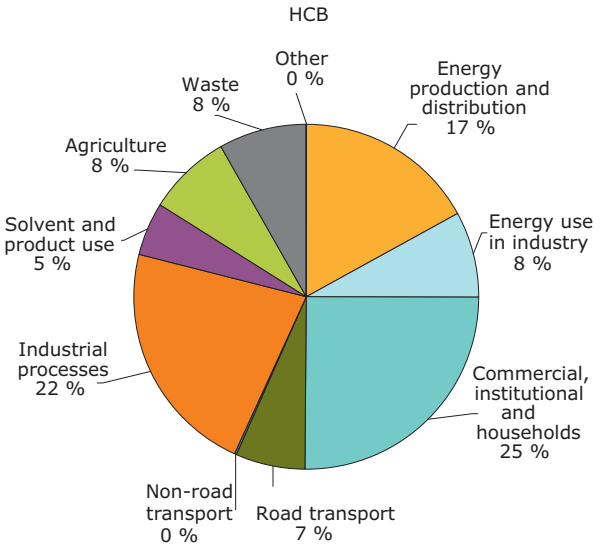
Figure 2.15(b) shows the contribution to total EU-28 emissions made by the aggregated sector groups. For HCB, the most important emission source is the 'Commercial, institutional and households' sector group.

Figure 2.15 HCB emissions in the EU-28: (a) trend in HCB emissions from the five most important key categories, 1990–2012; (b) share of emissions by sector group, 2012

(a)



(b)



2.26 Hexachlorocyclohexane (HCH) emission trends and key categories

Several Member States did not report HCH emissions or a notation key for any years, and thus the data could not be gap-filled. The EU-28 total is therefore far from complete. Due to sparse data availability, the EU total is incomplete and analysis could not be carried out. The data available are presented in Table 2.27.

Table 2.27 Member State contributions to EU HCH emissions (kg)

Member State	HCH (kg)											Change		Share in EU-28	
	1990	1995	2000	2005	2006	2007	2008	2009	2010	2011	2012	1990–2012	2011–2012	1990	2012
Austria	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR				
Belgium	19 481	14 670	3 514	170	171	172	173	174	175	176	177	– 99 %	0.6 %		
Bulgaria	0	0	0	0	0	0	0	0	0	0	0				
Croatia	5 850	7 744	4 900	NA	NA	NA	NA	NA	NA	NA	NA				
Cyprus	0	0	0	0	0	0	0	0	0	0	0				
Czech Republic	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE				
Denmark	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE				
Estonia	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA				
Finland	0	0	0	0	0	0	0	0	0	0	0				
France	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA				
Germany	60 200	13 100	NA	NA	NA	NA	NA	NA	NA	NA	NA				
Greece	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE				
Hungary	9 281	1 650	18	9	7	6	4	2	1	1	0				
Ireland	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA				
Italy	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA				
Latvia	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA				
Lithuania	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE				
Luxembourg	0	0	0	0	0	0	0	0	0	0	0				
Malta															
Netherlands	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO				
Poland	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO				
Portugal	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE				
Romania	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA				
Slovakia	0	0	0	0	0	0	0	0	0	0	0				
Slovenia	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR				
Spain	9 194	9 538	11 250	NE	NE	NE	NE	NE	NE	NE	NE				
Sweden	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO				
United Kingdom	100 378	59 392	33 232	14 620	12 856	11 313	9 955	8 761	7 709	6 784	5 970	– 94 %	– 12.0 %		
EU-28 (a)															
EU-28 (b)															

Note: (a) Sum of national totals as reported by Member States.

(b) Sum of sectors: differences arise when only national totals and no sectoral data are available.

Negative percentage values indicate that emissions have decreased.

Light-grey shaded cells denote gap-filled data. For more detailed information, see Annex D.

Dark-grey shaded cells indicate that no emission values are available. See Appendix 1 for an explanation of the notation keys reported by Member States.

2.27 Polychlorinated biphenyl (PCB) emission trends and key categories

Between 1990 and 2012, PCB emissions dropped in the EU-28 by 73 %. Between 2011 and 2012, the decrease was 3.1 %, mainly due to reductions reported in Belgium, the United Kingdom and Portugal (see Table 2.28). The Member States that contributed most (i.e. with a share higher than 10 %) to the emissions of PCBs in 2012 were Portugal, Poland, the United Kingdom and Croatia. Austria reported the whole time-series of its PCB emissions as NR and Greece did not report emissions for any year. The EU-28 total is therefore underestimated.

The 2010 peak in PCB emissions in Portugal is due to an increase in waste incineration (Portugal's IIR, 2012).

The much higher emission data of Belgium in the years 2010 and 2011 is explained by very high emissions for the sector '2 A 1' in 2010 and 2011

Table 2.28 Member State contributions to EU PCB emissions (kg)

Member State	PCBs (kg)											Change		Share in EU-28	
	1990	1995	2000	2005	2006	2007	2008	2009	2010	2011	2012	1990–2012	2011–2012	1990	2012
Austria	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR				
Belgium	111.7	93.7	95.5	72.8	83.8	66.9	67.9	15.1	96.1	58.2	9.8	– 91 %	– 83.1 %	0.8 %	0.3 %
Bulgaria	6.2	5.2	3.8	4.0	4.2	4.5	4.3	3.3	4.2	4.7	5.0	– 19 %	6.8 %	0.0 %	0.1 %
Croatia	485.8	469.4	442.6	437.5	437.4	437.5	437.9	435.2	435.6	435.1	432.5	– 11 %	– 0.6 %	3.5 %	11.6 %
Cyprus	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	– 20 %	27.8 %	0.0 %	0.0 %
Czech Republic	772.9	622.9	474.1	82.3	88.8	48.1	43.2	33.4	24.1	25.7	34.0	– 96 %	32.0 %	5.6 %	0.9 %
Denmark	110.7	40.2	39.1	42.5	43.4	45.2	44.2	39.8	42.0	42.7	41.6	– 62 %	– 2.6 %	0.8 %	1.1 %
Estonia	10.2	9.2	7.1	8.9	8.1	8.0	9.1	9.7	10.9	9.8	9.6	– 6 %	– 2.1 %	0.1 %	0.3 %
Finland	314.5	292.8	228.5	180.5	184.1	174.2	161.9	150.0	156.2	156.6	153.6	– 51 %	– 1.9 %	2.3 %	4.1 %
France	181.5	159.5	107.0	75.7	73.2	69.2	67.6	59.4	61.3	55.2	58.4	– 68 %	5.9 %	1.3 %	1.6 %
Germany	1 672	1 537	1 072	194.0	210.5	211.4	219.4	198.0	233.0	233.6	236.1	– 86 %	1.1 %	12.0 %	6.3 %
Greece	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE				
Hungary	37.2	20.0	17.0	18.0	19.0	19.5	19.0	15.3	17.3	17.5	16.0	– 57 %	– 8.8 %	0.3 %	0.4 %
Ireland	68.0	63.3	57.5	43.4	41.6	20.3	19.9	17.8	17.3	16.6	17.0	– 75 %	2.5 %	0.5 %	0.5 %
Italy	286.1	297.6	261.8	274.6	281.6	281.6	274.7	202.4	201.1	216.7	216.5	– 24 %	– 0.1 %	2.1 %	5.8 %
Latvia	4.3	1.1	0.5	0.6	0.6	0.7	0.7	0.5	0.7	0.7	0.6	– 86 %	– 19.6 %	0.0 %	0.0 %
Lithuania	6.2	1.8	0.6	1.9	1.8	2.4	1.8	1.2	1.5	1.7	4.0	– 36 %	> 100 %	0.0 %	0.1 %
Luxembourg	73.1	73.1	47.0	6.2	5.2	4.1	3.1	1.8	1.6	1.6	1.6	– 98 %	0.3 %	0.5 %	0.0 %
Malta	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3 %	0.0 %	0.0 %	0.0 %
Netherlands	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	– 100 %	0.0 %	0.0 %	0.0 %
Poland	2 425	927.5	581.5	617.2	673.9	664.7	681.6	660.9	748.4	727.8	734.9	– 70 %	1.0 %	17.4 %	19.7 %
Portugal	64.7	71.9	85.2	358.5	475.3	592.3	929.1	732.8	1 061	896.5	868.3	> 100 %	– 3.1 %	0.5 %	23.2 %
Romania	134.7	87.1	39.5	223.6	193.7	216.0	201.4	59.4	75.3	66.5	52.9	– 61 %	– 20.5 %	1.0 %	1.4 %
Slovakia	66.7	40.0	36.7	32.6	32.4	33.0	32.5	28.8	32.3	32.2	33.8	– 49 %	4.9 %	0.5 %	0.9 %
Slovenia	416.6	290.1	213.3	136.4	124.1	100.8	95.8	82.9	76.9	59.0	52.5	– 87 %	– 11.0 %	3.0 %	1.4 %
Spain	24.2	26.9	34.2	39.5	42.5	42.7	41.5	32.7	35.4	33.3	29.1	20 %	– 12.6 %	0.2 %	0.8 %
Sweden	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	– 41 %	– 33.5 %	0.0 %	0.0 %
United Kingdom	6 645	4 949	1 338	1 065	1 007	963.7	916.5	811.8	780.4	760.4	726.9	– 89 %	– 4.4 %	47.7 %	19.5 %
EU-28 (a)	13 918	10 079	5 182	3 916	4 032	4 007	4 273	3 592	4 113	3 852	3 735	– 73 %	– 3.1 %	100 %	100 %
EU-28 (b)	13 918	10 079	5 182	3 916	4 032	4 007	4 273	3 592	4 113	3 852	3 735				

Note: (a) Sum of national totals as reported by Member States.

(b) Sum of sectors: differences arise when only national totals and no sectoral data are available.

Negative percentage values indicate that emissions have decreased.

Light-grey shaded cells denote gap-filled data. For more detailed information, see Annex D.

Dark-grey shaded cells indicate that no emission values are available. See Appendix 1 for an explanation of the notation keys reported by Member States.

due to one operator in Wallonia. The emissions are directly calculated by the operators on the basis of PCB measurement at the stack (4 measurement/year). In 2010 and at the beginning of 2011, the PCB stack measurement in one plant were very high due to the use of an alternative raw material containing high concentrations of PCB. When the source of PCB was found at the end of 2011, the raw material was withdrawn and the PCB concentration at the stack returned to normal. Further, there were declines of PCB emissions in the sector '2 C 1' from 2008 to 2009 and 2011 to 2012. These emission reductions are mainly caused by the closure of the two last sinter plants in Wallonia. The first one closed in 2008 and the last one in 2011 (Comment received from Belgium in 2014).

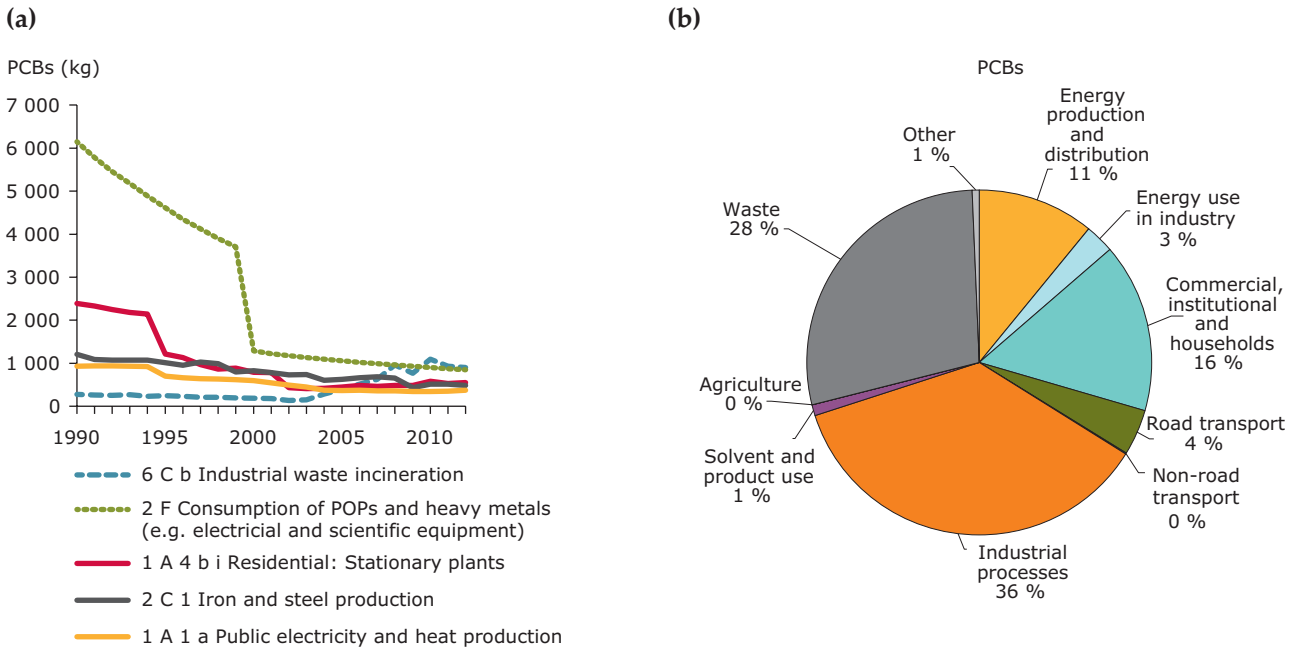
'6 C b — Industrial waste incineration' and '2 F — Consumption of POPs and heavy metals (e.g. electrical and scientific equipment)' were the most important key categories for PCB emissions, together making up 47 % of total PCB emissions (see Figure 2.17(a)). Among the top five key categories, the highest relative reductions in emissions between 1990 and 2012 were achieved in the second most important key category, '2 F — Consumption of POPs and heavy metals (e.g. electrical and scientific equipment)' (− 86.2 %) (see Figure 2.16(a)).

The large decrease in emissions from '2 F — Consumption of POPs and heavy metals (e.g. electrical and scientific equipment)' between 1999 and 2000 is due to reductions reported by the United Kingdom. For this country, the key emission source for PCBs has historically been the use of PCBs as a heat-transfer fluid in dielectric equipment. Older equipment was subject to leakage during 'in-use' lifetime, and these leaks are where the United Kingdom provides estimates for emissions to air. The original estimates were based on assumed stockpiles of in-use equipment around 1990 (usage in new equipment was banned around 1986), after which the in-use equipment reached end of life, and was replaced by non-PCB alternatives. In terms of the year 2000 milestone, the EU set a target in 1996 (Directive 96/59/EC (EC, 1996)) to remove all dielectric equipment containing PCBs with a fill size > 5 kg to hazardous waste facilities. This accounts for a 90 % decline in the stockpile and emissions. There is high uncertainty attached to these estimates. (Comment received from United Kingdom in 2013).

The steep drop in emissions in the category '1 A 4 b i — Residential: Stationary plants' from 1994 to 1995 is caused by differences between data reported from Poland in 2014 and gap-filled data.

Figure 2.16(b) shows the contribution to total EU-28 emissions made by the aggregated sector groups. For PCBs, common important emission sources are 'Industrial processes', 'Waste' and the 'Commercial, institutional and households' sector group — as is the case for $PM_{2.5}$, PM_{10}, total PAHs, and PCDD/Fs.

Figure 2.16 PCB emissions from key categories in the EU-28: (a) trend in PCB emissions from the five most important key categories, 1990–2012; (b) share of emissions by sector group, 2012



3 Sectoral analysis and emission trends for key pollutants

Chapter 3 sets out emission trends and detailed methodologies of the key pollutants, aggregated into the following main sector groups:

- Energy production and distribution
- Energy use in industry
- Industrial processes
- Solvent and product use
- Commercial, institutional and households (energy use)
- Road transport
- Non-road transport
- Agriculture
- Waste.

A conversion chart showing how each of the individual NFR source categories was included in each of the aggregated sector groups is provided in Appendix 4 of this report (Table A4.1).

3.1 Sectoral analysis and emission trends for 'Energy production and distribution'

The 'Energy production and distribution' sector grouping comprises emissions from a number of activities that employ fuel combustion to produce energy products and electricity, for instance. It is an important source of many pollutants, especially SO_X. Despite considerable past reductions, this sector group still contributes 60 % of the total EU-28 emissions of this pollutant.

The sector is an important source of SO_X, Hg and NO_X. Poland, the United Kingdom and Bulgaria contributed most (in absolute terms) to the emissions of SO_X in this sector in the year 2012. For Hg, Germany and Poland reported the highest emissions. The United Kingdom, Germany and Poland contributed most to NO_X emissions.

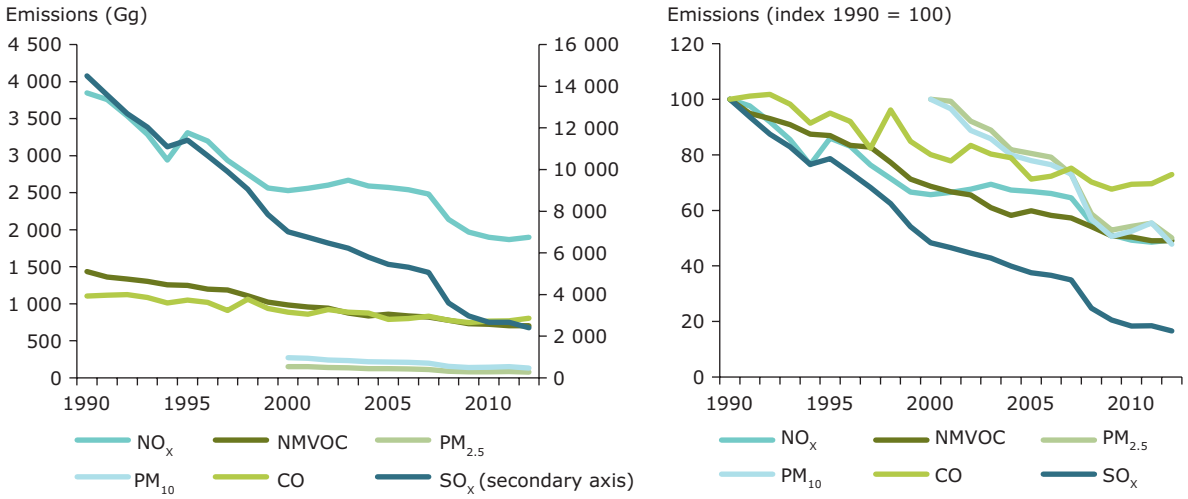
For emissions of the main pollutants (see Figure 3.1), the highest absolute and relative reduction within this sector group was for SO_X (− 83 %) between 1990 and 2012. For $PM_{2.5}$ and PM_{10}, a notable relative decrease of 50 % and 52 %, respectively, has occurred within this sector group since 2000.

The low emission data of NO_X in 1994 is mainly caused by gap-filled data from the Czech Republic and emission data from Poland starting in 1995. The emission increase of CO from 1997 to 1998 is mainly caused by gap-filled data from Romania.

Of the three main HMs, lead shows the highest emission reduction in absolute and relative terms (− 76 %) (see Figure 3.2 (a)). For emissions of POPs, the highest relative reduction was seen in PCDD/Fs (− 96 %) (see Figure 3.2(b)).

The emission decrease of PCBs from 1994 to 1995 is caused by differences of gap-filled (up to 1994) and submitted (from 1995 onwards) data of Poland.

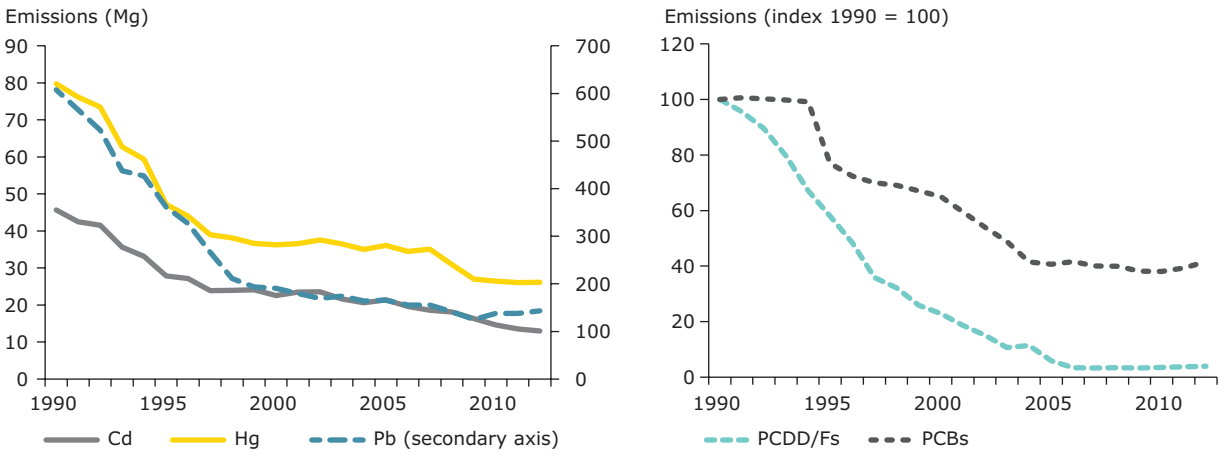
Figure 3.1 **EU-28 emission trends in the sector 'Energy production and distribution' for NO_X, NMVOC, SO_X and CO (in Gg) between 1990 and 2012 (index year 1990 = 100), and for PM_{10} and $PM_{2.5}$ between 2000 and 2012 (index year 2000 = 100)**



Note: Notes: For PM, data from Greece could not be gap-filled as values were not reported for any year. To enable presentation of provisional EU-28 emission trends, the emissions have been aggregated without including data from this country.

Parties to the LRTAP Convention are formally requested to report emissions of PM for the year 2000 and after.

Figure 3.2 **EU-28 emission trends in the sector group 'Energy production and distribution' for the HMs Pb, Cd and Hg, and for POPs (PCDD/Fs and PCBs) between 1990 and 2012 (index year 1990 = 100)**



Note: Notes: For the HMs, data for Luxembourg were gap-filled with the notation key NR. For Greece, no sectoral data were available. To enable presentation of provisional EU-28 emission trends, the emissions have been aggregated without including emission data for these Member States.

For POPs, data from one or more Member States could not be gap-filled as values were not reported for any years. To enable presentation of provisional emission trends, in these instances emissions have been aggregated without including data for all the EU-28 Member States.

Table 3.1 Overview of methods and data used by Member States to calculate emissions from 'Energy production and distribution'

Member State	AD	EF	M
Austria	Energy balance, ETS data, steam boiler database, direct information from industry or associations of industry	PS/CS/D	T2,T3
Belgium	Regional energy balances, annual industrial reports	CS/D	T1,T2
Bulgaria	Plant operator data, energy balance	D/CS	T1,T2
Croatia	National energy balance	PS/D	T1, T2
Cyprus	Energy balance, plant data	D	T2
Denmark	Danish energy statistics	CS/PS	T2, T3
Estonia	Plant data, energy balance	PS/CS/D	T1, T3
Finland	Plant data, ETS, national energy statistics	CS/PS/D	T2, T3
France	Plant data, national statistics, energy balance	CS, PS	T3
Germany	National statistics (energy balance)	CS	T2
Greece	Energy balance, ETS data, public power corporation	PS	T2,T3
Hungary	National energy statistics, plant data	D/CS/PS	T1, T2, T3
Ireland	National Energy balance, detailed national energy consumption disaggregated by economic sector and fuel, ETS data	D, PS	T3
Italy	Energy balance, national electricity producers, national industry corporation, national statistics, European Emissions Trading Scheme	D, CS	T1, T2
Latvia	National energy statistics	D	T1
Lithuania	National energy statistics, plant data (annual emission questionnaires)	D/CS	T1, T2
Malta	Plant data, energy statistics	D	T1, T2
Netherlands	Annual environmental reports (AERs) from individual facilities	PS	T3
Poland	Energy statistics, statistical yearbook, OECD Energy Balance for Poland	D/PS	T1, T3
Portugal	LPS survey, LCP survey, national reports, energy balance, national statistics	D/CS	T2
Romania	Data from Large Combustion Plants Directive (2001/80/EC)	D	T1
Slovakia	Energy statistics, database of stationary sources	PS, D	T1, T3
Slovenia	Annual energy statistics	CS	T2
Spain	Plant data, Eurostat data	D, CS	T1, T2, T3
Sweden	Quarterly fuel statistics, ETS, industrial statistics	CS	T2, T3
United Kingdom	Plant data, energy statistics	CS	T3, T2

Note: AD: activity data; EF: emission factor; M: method; CS: country specific; D: default value; PS: plant specific; T: tier method.
Table 3.1 only provides an indication of the methods used on the aggregated sector level; for details, the respective IIRs should be consulted. The level of detail in information on methods used varies widely across Member States.
Member States that did not provide an IIR are not included in Table 3.1.
Grey font denotes IIRs submitted in 2012 or 2013 (latest IIRs available).

3.2 Sectoral analysis and emission trends for 'Energy use in industry'

The 'Energy use in industry' sector is an important source for Pb and Cd. Poland, Spain and Italy contributed most (in absolute terms) to the emissions of Pb and Cd in this sector in the year 2012.

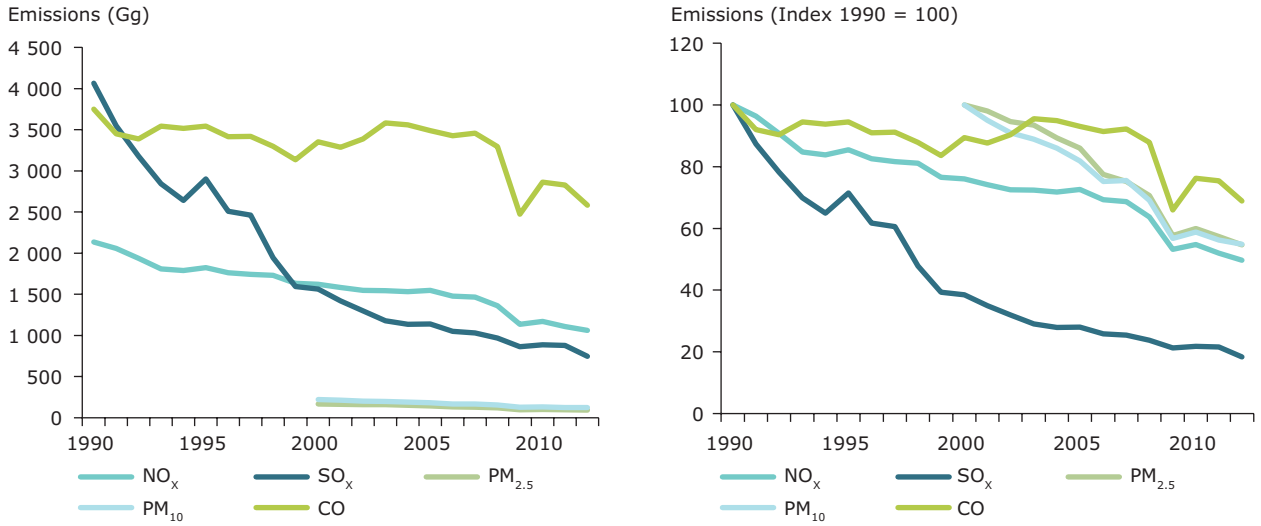
Energy use (fuel combustion) in industry is an important source of many pollutants. For the main pollutants, the highest absolute and relative reduction (− 82 %) between 1990 and 2012 occurred for SO_x (see Figure 3.3).

For the three HMs, Hg shows the highest emission reduction in relative terms (− 76 %) (see Figure 3.4(a)). Cd and Pb decreased similarly to Hg in relative terms (− 73 % and − 56 %, respectively). The emissions peak of lead in 2008 is mainly caused by data of the category '1 A 2 b — Stationary combustion in manufacturing industries and construction: Non-ferrous metals' reported from Bulgaria.

For POPs, only the PCDD/Fs are important pollutants in the sector group 'Energy use in industry'. Trends of these pollutants are presented in Figure 3.4(b).

The PCDD/F emissions peak from 1994 to 1995 is due to data from France. Category '1 A 2 b — Stationary Combustion in manufacturing industries and construction: Non-ferrous metals' was affected due to the set-up of a new Zn production plant (second fusion) during the year 1993. Since 1998, however, this plant has used emission reduction equipment (Comment received from France in 2013).

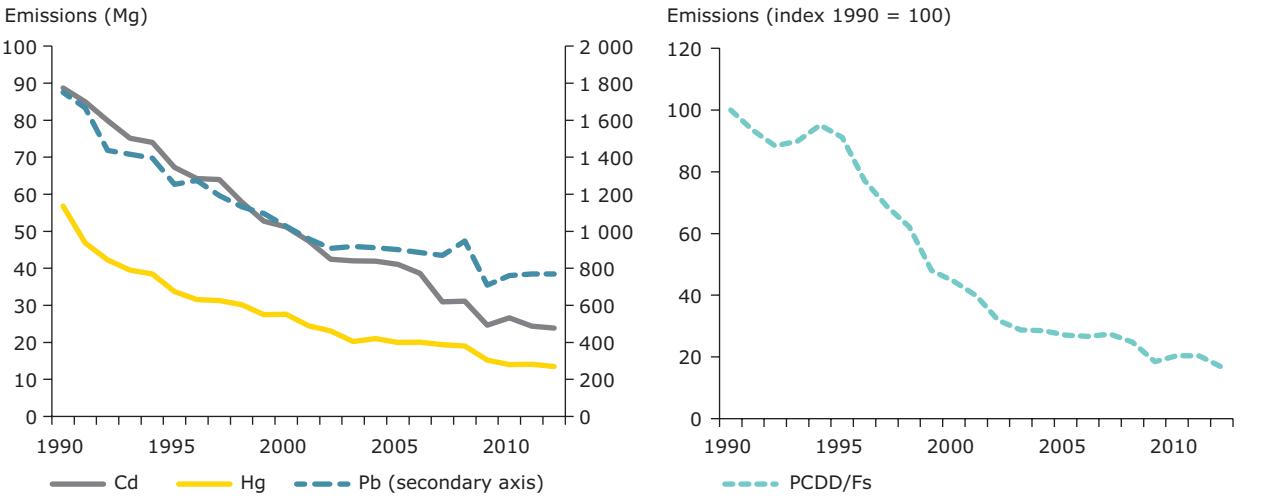
Figure 3.3 EU-28 emission trends in the sector group 'Energy use in industry' for NO_X, SO_X and CO (in Gg) between 1990 and 2012 (index year 1990 = 100), and for PM_{10} and $PM_{2.5}$ between 2000 and 2012 (index year 2000 = 100)



Note: For PM, data from Greece could not be gap-filled, as values were not reported for any year. To enable presentation of provisional EU-28 emission trends, emissions have been aggregated without including data from this Member State.

Parties to the LRTAP Convention are formally requested to report emissions of PM for the year 2000 and after.

Figure 3.4 EU-28 emission trends in the sector group 'Energy use in industry' for the HMs Pb, Cd and Hg, and for PCDD/Fs between 1990 and 2012 (index year 1990 = 100)



Note: For the HMs, data for Luxembourg were gap-filled with the notation key NR. For Greece, no sectoral data were available. To enable presentation of provisional EU-28 emission trends, the emissions have been aggregated without including emission data for this Member State.

For PCDD/Fs, data from Greece could not be gap-filled as values were not reported for any years. To enable presentation of provisional emission trends, in these instances emissions have been aggregated without including data for all the EU-28 Member States.

Table 3.2 Overview of methods and data used by Member States to calculate emissions from 'Energy use in industry'

Member State	AD	EF	M
Austria	Energy balance, ETS data, steam boiler database, direct information from industry or associations of industry	PS/CS	T2, T3
Belgium	Regional energy balances, plant data	CS/D	T1, T2
Bulgaria	Plant operator data, energy balance	D/CS	T2
Croatia	National energy balance	PS/D	T1, T2
Cyprus	National statistics (questionnaires)	D	T1, T2
Denmark	Danish energy statistics	CS/PS	T2, T3
Estonia	Plant data, energy balance	PS/CS/D	T1, T3
Finland	Plant data, national energy statistics	CS/PS	T2, T3
France	Energy balance, survey, plant data	CS	T2, T3
Germany	National statistics (energy balance)	CS	T2
Greece	Energy balance, ETS data	D	T1
Hungary	National energy statistics, plant data	D, CS	T1, T2, T3
Ireland	National Energy balance, detailed national energy consumption disaggregated by economic sector and fuel, ETS data	CS	T2, T3
Italy	Energy balance	D, CS	T1, T2
Latvia	National energy statistics	D	T1
Lithuania	National energy statistics, plant data (annual emission questionnaires)	D/CS	T1
Malta	Energy statistics	D	T1
Netherlands	Environmental reports from plants, energy statistics	CS/PS	T3
Poland	Energy statistics, statistical yearbook, OECD Energy Balance for Poland	D/CS	T1, T3
Portugal	LPS, LCP, EPER/PCIP, energy balances	D/CS	T2
Romania	Energy statistics, database	PS, D	T1, T2
Slovakia	Energy statistics, database of stationary sources	PS	T1, T3
Slovenia	National energy statistics	D	T1
Spain	Plant data, national fuel balance	D/CS	T2,T3
Sweden	Quarterly fuel statistics, industrial energy statistics, ETS (all data at plant level)	CS	T1, T2
United Kingdom	Plant data, energy statistics	CS	T1, T3

Note: AD: activity data; EF: emission factor; M: method; CS: country specific; D: default value; PS: plant specific; T: tier method.
Table 3.2 only provides an indication of the methods used at the aggregated sector level; for details, the respective IIRs should be consulted. The level of detail in information on methods used varies widely across Member States.
Member States that did not provide an IIR are not included in Table 3.2.
Grey font denotes IIRs submitted in 2012 or 2013 (latest IIRs available).

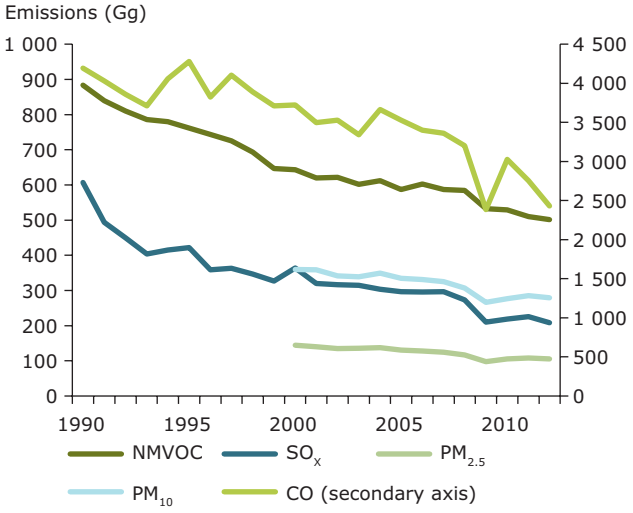
3.3 Sectoral analysis and emission trends for 'Industrial processes'

The 'Industrial processes' sector grouping refers to emissions from industrial sources other than those arising from fuel combustion within the industrial sector. This sector group is the most important sector for PCB and HCB emissions, and makes important contributions to emissions of CO, PM, HMs and POPs. Of all the countries that reported data, the United Kingdom, Italy and Germany contributed most to PCB emissions, and Bulgaria, Belgium and Finland contributed most to HCB emissions in the 'Industrial processes' sector in the year 2012. Past emission trends of the relevant main pollutants are shown in Figure 3.5.

The peak in CO emissions in 1995 is attributable to data from category '2 C 1 — Iron and steel production', reported by France. These emissions of CO from category 2 C 1 fluctuate over the years, depending on the amount of blast furnace gas that is produced, reused or flared. These amounts depend on the operating conditions and the feasibility for iron and steel or collieries plants of reusing blast furnace gas that is continuously produced. This may fluctuate a great deal from one year to another, resulting in different peaks (1995, 2004 and 2010) or decreases (1992, 2001 and 2009) (Comment received from France in 2013).

'Industrial processes' make a considerable contribution to the total EU-28 emissions of HMs,

Figure 3.5 **EU-28 emission trends in the sector group 'Industrial processes' for NMVOC, SO_x and CO (in Gg) between 1990 and 2012 (index year 1990 = 100), for PM_{10} and $PM_{2.5}$ between 2000 and 2012**



Note: For PM, data from Greece could not be gap-filled as values were not reported for any year. To enable presentation of provisional EU-28 emission trends, the emissions have been aggregated without including data for this Member State.

Parties to the LRTAP Convention are formally requested to report emissions of PM for the year 2000 and after.

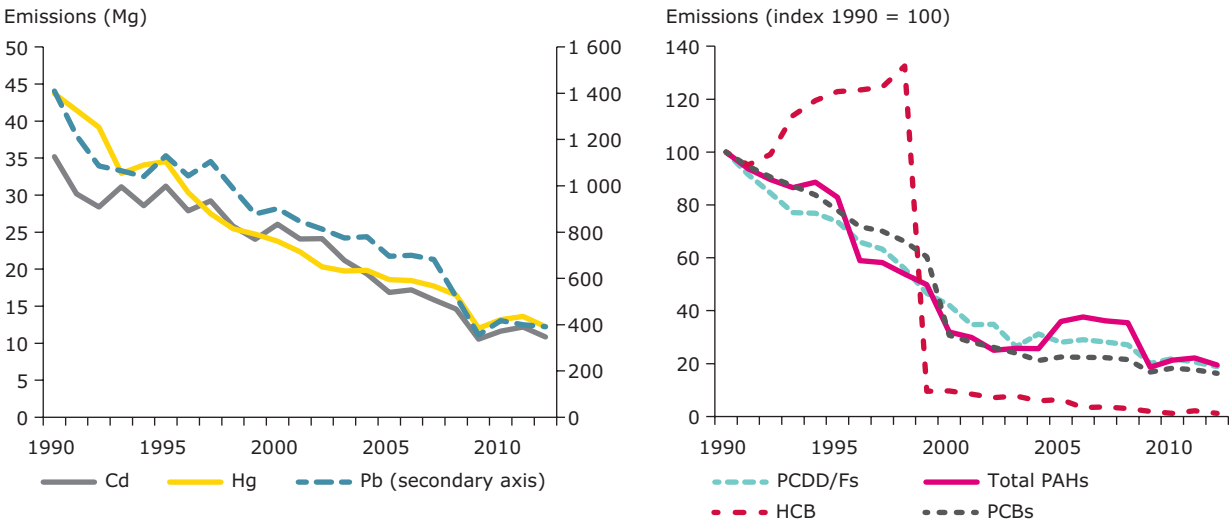
despite considerable reductions since 1990. Past emission trends for these pollutants are shown in Figure 3.6(a). Lead shows the highest relative and absolute emission reduction between 1990 and 2012 (– 72 %).

For POPs, the highest relative reduction between 1990 and 2012 occurred for HCB (– 99 %) (Figure 3.6(b)).

This considerable change in HCB emissions is mainly caused by an increase in '2 C 3 — Aluminium production' in the United Kingdom until 1998. Historically within the United Kingdom, hexachloroethane (HCE) has been used as a cover gas within the secondary aluminium industry. When HCE was manufactured, it was contaminated with HCB and pentachlorobenzene. Van der Most (1992) quotes the emission factor for HCB within HCE as 5 g/t of HCE used. In 1999, the use of HCE for this application was banned in the United Kingdom, and the emissions ceased (Comment received from United Kingdom in 2011).

The steep drop in PCBs from 1999 to 2000 is caused by emission data of the category '2 F — Consumption of POPs and heavy metals (e.g. electrical and scientific equipment)' reported from the United Kingdom.

Figure 3.6 **EU-28 emission trends in the sector group 'Industrial processes' for the HMs Pb, Cd, Hg, and for the POPs (PCDD/Fs, total PAHs, HCB, HCH and PCBs) between 1990 and 2012 (index year 1990 = 100)**



Note: For the HMs, data for Luxembourg were gap-filled with the notation key NR. For Greece, no sectoral data were available. To enable presentation of provisional EU-28 emission trends, the emissions have been aggregated without including emission data for this Member State.

For POPs, data from several Member States could not be gap-filled as values were not reported for any years. To enable presentation of provisional emission trends, in these instances emissions have been aggregated without including data for all the EU-28 Member States.

Table 3.3 Overview of methods and data used by Member States to calculate emissions from 'Industrial processes'

Member State	AD	EF	M
Austria	National production statistics, Austrian foreign trade statistics, ETS, direct information from industry and associations	CS/PS	T2, T3
Belgium	Production figures, mainly directly originating from the industrial plant	PS/CS/D	T2, T3
Bulgaria	National production statistics, national registers (E-PRTR and ETS, national studies)	D/CS	T1, T2
Croatia	National statistics, plant data	D	T1, T2
Cyprus	National statistics (production and fuel), plant data	D	T1, T2
Denmark	Environmental Reports from plants, Statistics Denmark	PS/D	T1, T3
Estonia	Plant data, national statistics	PS/D	T3, T2, T1
Finland	National and plant-specific data, national statistics, statistics from industry	CS/PS	T2, T3
France	National production data, plant data	CS	T2, T3
Germany	German Statistical Office (DESTATIS), branch association publications	CS	T1, T2
Greece	National statistics, industrial production data, ETS data	D, PS	T1
Hungary	National energy statistics	D, PS	T1, T2, T3
Ireland	Industrial production data, ETS data	PS/CS/D	T2
Italy	National statistics, industrial associations, plant data	D, CS, PS	T2
Latvia	National statistics, plant data	D/PS	T1, T2, T3
Lithuania	National production data, plant data	D	T1
Malta	Trade data, production data	D/CS	T1
Netherlands	National statistics, environmental reports from plants	PS/CS	T3
Poland	Statistical Yearbook of Industry, Statistical Yearbook of Poland, Production of industrial goods, Import/export data	D/CS	T1, T3
Portugal	Production data, plant data (LPS, LCP), energy balance	CS	T1, T3
Romania	Production data	D/CS	T1, T2
Slovakia	Production data	D/CS/PS	T1
Slovenia	National statistics (production and consumption), plant data	D/CS/PS	T2
Spain	Data from industrial associations, plant data	D/PS	T1, T3
Sweden	Production statistics, environmental reports	PS/CS/D	T2
United Kingdom	National statistics, production data, trade associations	D/CS/PS	T2

Note: AD: activity data; EF: emission factor; M: method; CS: country specific; D: default value; PS: plant specific; T: tier method.
Table 3.3 only provides an indication of the methods used on the aggregated sector level; for details, the respective IIRs should be consulted. The level of detail in information on methods used varies widely across Member States.
Member States that did not provide an IIR are not included in Table 3.3.
Grey font denotes IIRs submitted in 2012 or 2013 (latest IIRs available).

The decrease of total PAHs from 1994 to 1996 is also caused by data reported from the United Kingdom. The increase of total PAH emissions from 2004 to 2005 is caused by differences of gap-filled data (up to 2004) and submitted (from 2005 onwards) data of Romania.

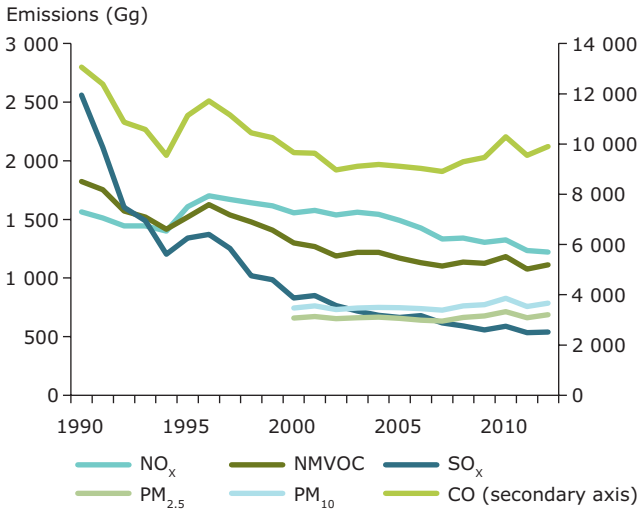
3.4 Sectoral analysis and emission trends for 'Commercial, institutional and households'

As indicated earlier in Chapter 2, emissions arising from fuel combustion by commercial and institutional facilities and households make an important contribution to total emissions of many pollutants.

The 'Commercial, institutional and households' sector is an important source for PAHs, PCDD/Fs, $PM_{2.5}$, PM_{10}, Cd and CO. Germany, Poland and Romania contributed most (in absolute terms) to the emissions of total PAHs in this sector in the year 2012. For $PM_{2.5}$ and for PM_{10}, Poland, Romania and France reported the highest emissions. Poland, France and Germany contributed most to CO emissions, and Poland to Cd and PCDD emissions.

For the main pollutants, the highest relative reduction between 1990 and 2012 for the sector grouping was again seen in SO_X (– 79 %). By contrast, PM emissions have changed little since 2000 (see Figure 3.7).

Figure 3.7 **EU-28 emission trends in the sector group 'Commercial, institutional and households' for NO_x, NMVOC, SO_x, and CO (in Gg) between 1990 and 2012, and for PM_{10} and $PM_{2.5}$ between 2000 and 2012**



Note: For PM, data from Greece could not be gap-filled as values were not reported for any year. To enable presentation of provisional EU-28 emission trends, the emissions have been aggregated without including data for this Member State.

Parties to the LRTAP Convention are formally requested to report emissions of PM for the year 2000 and after.

The emission increase of CO, NO_x, SO_x and NMVOC from 1994 to 1995 is mainly caused by differences of gap-filled (up to 1994) and submitted (from 1995 onwards) data of Poland.

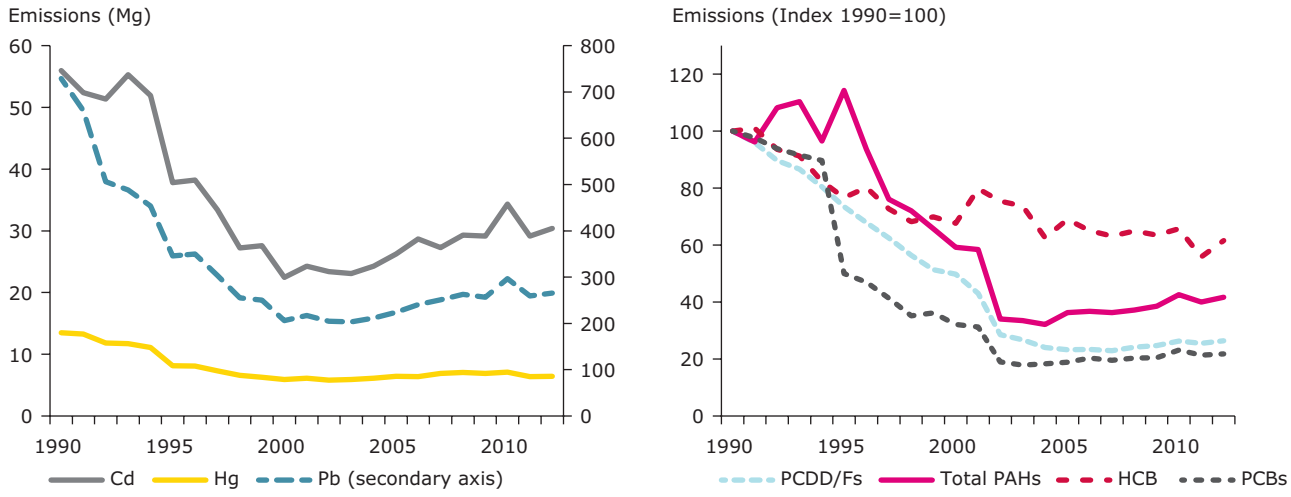
Of the three HMs in the sector 'Commercial, institutional and households', Pb shows the highest emission reduction in absolute and relative terms (– 64 %) (see Figure 3.8(a)).

The decreases of Cd in the years 1994 to 1995 and the peak in 2010 are mainly caused by data of the category '1 A 4 b i — Residential: Stationary plants' reported from Poland. Poland stated, that this is a result of higher hard coal consumption in the category '1 A 4 b i' (Comment received from Poland in 2014).

For POPs relevant to the 'Commercial, institutional and households' sector, the highest relative reduction occurred for PCBs (– 78 %) (see Figure 3.8(b)).

The emission decrease of PCBs from 1994 to 1995 is caused by differences of gap-filled data (up to 1994) and submitted data (from 1995 onwards) of Poland.

Figure 3.8 **EU-28 emission trends in the sector group 'Commercial, institutional and households' for the HMs Pb, Cd and Hg, for POPs (PCDD/Fs, total PAHs, HCB and PCBs) between 1990 and 2012 (index year 1990 = 100)**



Note: For the HMs, data for Luxembourg were gap-filled with the notation key NR. For Greece, no sectoral data were available. To enable presentation of provisional EU-28 emission trends, the emissions have been aggregated without including emission data for this Member State.

For POPs, data from one or more Member States could not be gap-filled as values were not reported for any years. To enable presentation of provisional emission trends, in these instances emissions have been aggregated without including data for all the EU-28 Member States.

Table 3.4 Overview of methods and data used by Member States to calculate emissions from commercial, institutional and household combustion

Member State	AD	EF	M
Austria	Energy balance, ETS data, steam boiler database, plant data	CS	T2
Belgium	Regional energy balances	D/CS	T2
Bulgaria	National statistics	D	T1
Croatia	National energy balance	D	T1
Cyprus	Energy balance	D	T1
Denmark	Danish energy statistics	CS/D	T2
Estonia	Energy balance	PS/CS/D	T1, T3
Finland	National energy statistics	CS	T2
France	National statistics, energy balance	D/CS	T2
Germany	National statistics	CS	T1, T2, T3
Greece	Energy balance, Public Gas Corporation	D	T1
Hungary	National statistics	CS	T1, T2
Ireland	Energy balance	CS	T2, T3
Italy	National energy balance	D, PS	T2
Latvia	National energy statistics	D	T1
Lithuania	National energy statistics	D/CS	T1
Malta	Energy statistics	D	T1
Netherlands	Energy statistics	CS	T2, T3
Poland	Energy statistics, emission data from plants	D/CS	T1, T3
Portugal	Energy balances	D/CS	T2
Romania	National statistics	D	T1
Slovakia	Energy balances, consumption of fuel	PS	T1, T3
Slovenia	National energy statistics	D	T1
Spain	National statistics	D/CS	T1, T2
Sweden	Official statistical reports	CS	T1, T2
United Kingdom	Fuel consumption statistics	D/CS	T1, T2

Note: AD: activity data; EF: emission factor; M: method; CS: country specific; D: default value; PS: plant specific; T: tier method.
Table 3.4 only provides an indication of methods used at aggregated sector level; for details, the respective IIR should be consulted. The amount of information on methods used varies widely across Member States.
Member States that did not provide an IIR are not included in Table 3.4.
Grey font denotes IIRs submitted in 2012 or 2013 (latest IIRs available).

3.5 Sectoral analysis and emission trends for 'Road transport'

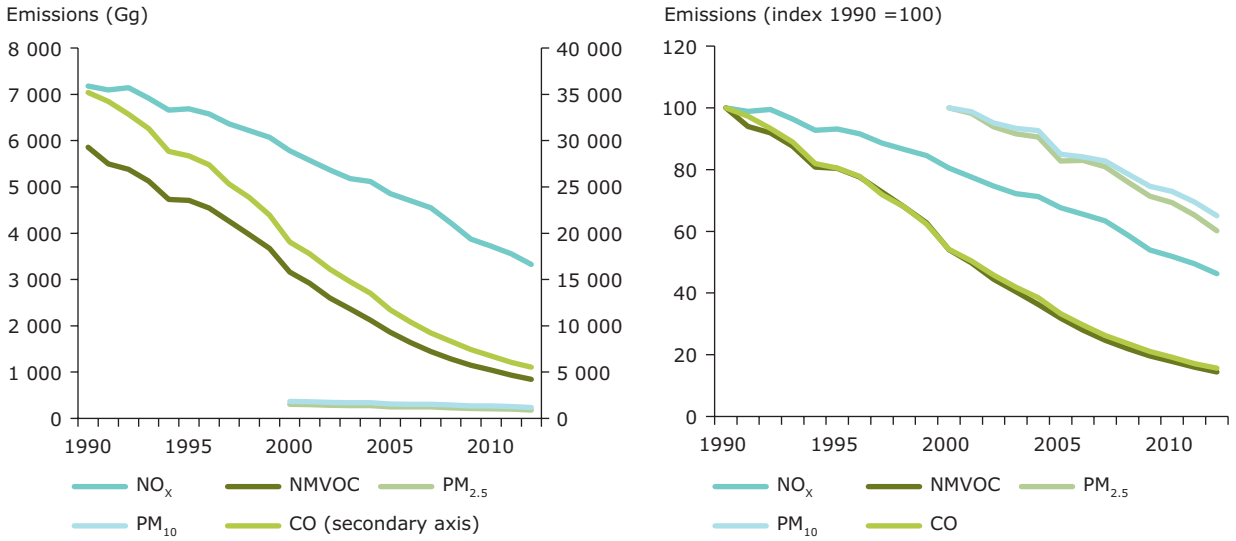
As noted earlier, the individual NFR sources that make up the 'Road transport' sector group together contribute considerably to emissions of a number of pollutants, including NO_X, NMVOC, CO, $PM_{2.5}$, PM_{10}, Pb and certain POPs. Figure 3.9 shows the past emission trends for these pollutants in this sector.

France, Germany and Italy contributed most (in absolute terms) to NO_X emissions in the 'Road transport' sector in the year 2012. For CO, Germany, Italy and Poland reported the highest emissions.

For the 'Road transport' sector, the main HM is Pb, showing a high relative emission reduction (– 98 %) between 1990 and 2012 (see Figure 3.10(a)). However, over the past years, little progress has been made in reducing emissions further; total emissions of Pb have remained largely constant. The promotion of unleaded petrol within the EU and in other EEA member countries through a combination of fiscal and regulatory measures has been a success story. For example, EU Member States have completely phased out the use of leaded petrol, a goal regulated by Directive 98/70/EC relating to the quality of petrol and diesel fuels (EC, 1998). Nevertheless, the 'Road transport' sector remains an important source of Pb, contributing around 15 % of total Pb emissions in the EU-28.

Of the POPs, HCB and PCBs are the most important in the 'Road transport' sector group. Trends of past emissions for these pollutants are shown in Figure 3.10(b). Only a few countries (the Czech

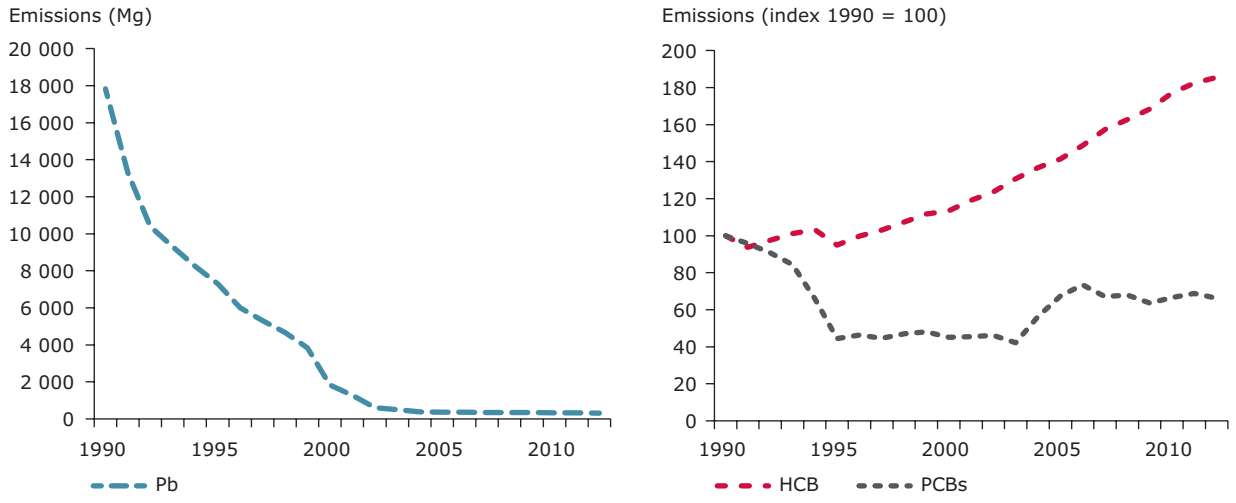
Figure 3.9 **EU-28 emission trends in the sector group 'Road transport' for NO_x, NMVOC and CO (in Gg) between 1990 and 2012 (index year 1990 = 100), and for PM_{10} and $PM_{2.5}$ between 2000 and 2012 (index year 2000 = 100)**



Note: For PM, data from Greece could not be gap-filled as values were not reported for any year. To enable presentation of provisional EU-28 emission trends, the emissions have been aggregated without including data for this Member State. Parties to the LRTAP Convention are formally requested to report emissions of PM only for the year 2000 and after.

Republic, Denmark, Finland, Luxembourg, Poland and Slovakia) provided PCB emission values for the 'Road transport' sector. The emissions drop from 1993 to 1994 is due to data reported from Denmark, and the decrease from 1994 to 1995 is due to the gap-filling of data before the year 1995 from Poland. Subsequent emission increases from 2003 to 2006 are reported mainly by Poland and the Czech Republic. The increase in HCB emissions is mainly caused by increasing emission data of the 'Road transport' sector reported by France.

Figure 3.10 **EU-28 emission trends in the sector group 'Road transport' for the priority HM Pb, and for HCB and PCBs between 1990 and 2012 (index year 1990 = 100)**



Note: For the HMs, data for Luxembourg was gap-filled with the notation key NR. For Greece, no sectoral data were available. For POPs, data from one or more Member States could not be gap-filled as values were not reported for any years. To enable presentation of provisional EU-28 emission trends, the emissions have been aggregated without including emission data for these Member States.

Table 3.5 Overview of methods and data used by Member States to calculate emissions from 'Road transport'

Member State	AD	M
Austria	Energy balance	GLOBEMI ([a])
Belgium	Regional energy balances	COPERT IV, v10.0 ([b]) (Tier 3 methodology)
Bulgaria	Energy balance, statistics vehicle fleet	COPERT IV, v10.0 (Tier 2 methodology)
Croatia	National energy balance	COPERT IV, v10.0 (Tier 2/3 method)
Cyprus	National statistics	COPERT IV, v9.1 (Tier 3 methodology)
Denmark	Transport and Statistics Denmark	COPERT IV (Tier 2 methodology)
Estonia	Estonian Road Administration, Statistics Estonia	COPERT IV, v9.0 (Tier 3 methodology)
Finland	National statistics	LIISA ([c]) (sub-model of LIPASTO ([d])) (Tier 3 methodology)
France	National statistics	COPERT IV, v10.0 (Tier 3 methodology)
Germany	National statistics (energy balance and official oil data)	TREMOD, v5.4 ([e])
Greece	Energy balance, national statistics	COPERT IV, v7.1
Hungary	National statistics, fuel statistics	COPERT IV, v9.1
Ireland	Energy balance, Road transport statistics from the National Car Testing (NCT) Service	COPERT IV, v10.0 (Tier 3 methodology)
Italy	National statistics	COPERT IV, v10.0
Latvia	National statistics	COPERT IV (Tier 3 methodology)
Lithuania	National statistics	COPERT IV, v10.0
Malta	National statistics	Customised model (basic Tier 3 methodology)
Netherlands	National statistics	VERSIT+ ([f])
Poland	Motor Transport Institute with estimations based on energy statistics	Country-specific model
Portugal	Energy balances, road statistics	COPERT IV, v9.0
Romania	Romanian Auto Registry, fuel statistics	COPERT IV
Slovakia	Fuel sold data from national statistics	COPERT IV, v9.0
Slovenia	National statistics	COPERT IV, v9.0
Spain	National and international statistics	COPERT IV (Tier 3 methodology)
Sweden	National statistics	HBEFA 3.1 ([g]) (Tier 2)
United Kingdom	National statistics	Country-specific model, NO_x: COPERT IV, v10.0

Note: ([a]) GLOBEMI: global emission model (Hausberger, 1998).

([b]) COPERT: Computer Programme to calculate Emissions from Road Transportation, based on EMEP/EEA guidebook methodology (EMEP/EEA, 2013).

([c]) LIISA: calculation model for the Road transport sector emissions at VTT Technical Research Centre of Finland (Mäkelä et al., 2002, VTT, 2014a).

([d]) LIPASTO: calculation system for traffic exhaust emissions and energy consumption at VTT Technical Research Centre of Finland (VTT, 2014b).

([e]) TREMOD: Transport Emission Estimation Model (Knörr et al., 2011).

([f]) VERSIT+: TNO state-of-the art road traffic emission model. 'Verkeerssituatie' means 'traffic situation' in Dutch (Smit et al., 2006, 2007).

([g]) HBEFA 3.1: The Handbook Emission Factors for Road Transport (INFRAS, 2014).

AD: activity data; M: method.Table 3.5 only provides an indication of methods used at aggregated sector level; for details, the respective IIRs should be consulted. The amount of information on methods used varies widely across Member States. Member States that did not provide an IIR are not included in Table 3.5.

Grey font denotes IIRs submitted in 2012 or 2013 (latest IIRs available).

3.6 Sectoral analysis and emission trends for 'Non-road transport'

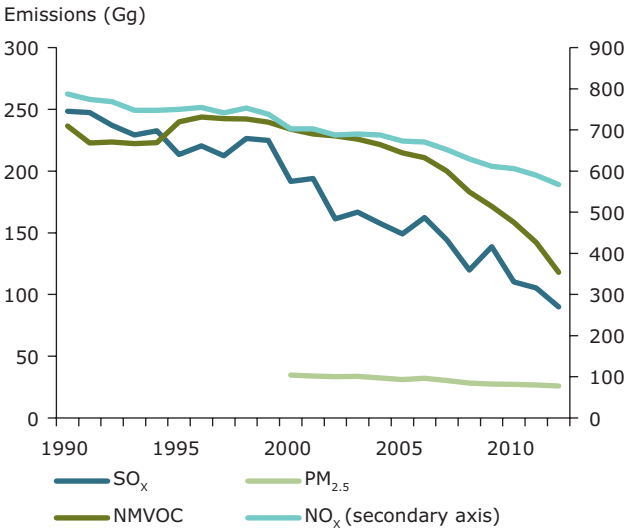
NO_X is an important pollutant in the "Non-road transport" sector group. Italy, the United Kingdom and Spain contributed most (in absolute terms) to NO_X emissions in 2012.

Little progress has been made since 1990 in reducing emissions from NO_X (see Figure 3.11). For the main pollutants, the highest relative reduction between 1990 and 2012 occurred for SO_X (− 64 %).

The 'Non-road transport' sector group does not contribute a great deal to HM and POP emissions. Trends of pollutants from these two groups of substances are therefore not shown.

Emissions from international/domestic aviation and shipping are reported as a simple sum of the emissions from each of the Member States. Thus emissions from international/domestic aviation and shipping are not divided into those occurring within the EU and those that cross the geographical boundary of the EU. However, the guidelines (UNECE, 2009) define international emissions as those which start in one country and finish in another. Thus the reporting is in compliance with the guidelines.

Figure 3.11 EU-28 emission trends in the sector group 'Non-road transport' for NO_X, NMVOC and SO_X (in Gg) between 1990 and 2012 (index year 1990 = 100), and for $PM_{2.5}$ between 2000 and 2012



Note: For PM, data from Greece could not be gap-filled as values were not reported for any year. To enable presentation of provisional EU-28 emission trends, the emissions have been aggregated without including data for this Member State.

Parties to the LRTAP Convention are formally requested to report emissions of PM for the year 2000 and after.

Table 3.6 Overview of methods and data used by Member States to calculate emissions from 'Non-road transport'

Member State	AD	EF	M
Austria	Energy balance	CS	T2, T3
Belgium	Regional energy balances, airport statistics	D/CS	T1, T2
Bulgaria	Eurostat energy balance	CS/D	T1
Croatia	National energy balance, Statistical yearbooks	D	T1
Cyprus	National statistics	D	T2
Denmark	Danish Civil Aviation Agency, ferry data, energy statistics from DEA	D/CS	T1, T2
Estonia	Data of 7 Estonian airports, aviation fuel sale statistics, energy statistics	D	T1, T2
Finland	National statistics	CS	T3
France	French Civil Aviation Authority	D/CS	T3
Germany	National statistics	D/CS	T1, T2, T3
Greece	Civil Aviation Organization, national statistics, energy balance	D	IPCC Tier 2a
Hungary	National statistics	CS	T1, T2, T3
Ireland	Irish Aviation Authority, fuel consumption data	D	T3a
Italy	Statistical yearbooks,, national energy balance	D	T1, T3
Latvia	National statistics	D	T1, T2
Lithuania	National statistics	D/CS	T1, T2
Malta	Aviation statistics	D	T1
Netherlands	National statistics	CS	T2 (railways), T3 (aviation, navigation)
Poland	Eurostat database, energy statistics, Statistical Yearbook	CS (ITS survey)	T2
Portugal	Energy balances, road statistics	CS	T1, T2b, T3
Romania	National statistics	D	T1
Slovakia	Transport statistics, fuel consumption	D	T1
Slovenia	Energy statistics	D	T1
Spain	National energy statistics, association data, national statistics, data from train operators	D	T1, T2
Sweden	National statistics	D/CS	T1, T2, T3
United Kingdom	Transport statistics	CS/D	T2, T3

Note: AD: activity data; EF: emission factor; M: method; CS: country specific; D: default value; T: tier method.

Table 3.6 only provides an indication of the methods used on the aggregated sector level; for details, the respective IIRs should be consulted. The level of detail in information on methods used varies widely across Member States.

Member States that did not provide an IIR are not included in Table 3.6.

Grey font indicates IIRs submitted in 2012 or 2013 (latest IIRs available).

3.7 Sectoral analysis and emission trends for 'Solvent and product use'

The only considerable, significant emissions from this sector group are NMVOC. Germany, Italy and the United Kingdom contributed most (in absolute terms) to NMVOC emissions in the year 2012.

Between 1990 and 2012, NMVOC emissions decreased by 42 % in the EU-28 (see Figure 3.12).

Figure 3.12 EU-28 emission trends in the sector group 'Solvent and product use' NMVOC (in Gg) between 1990 and 2012

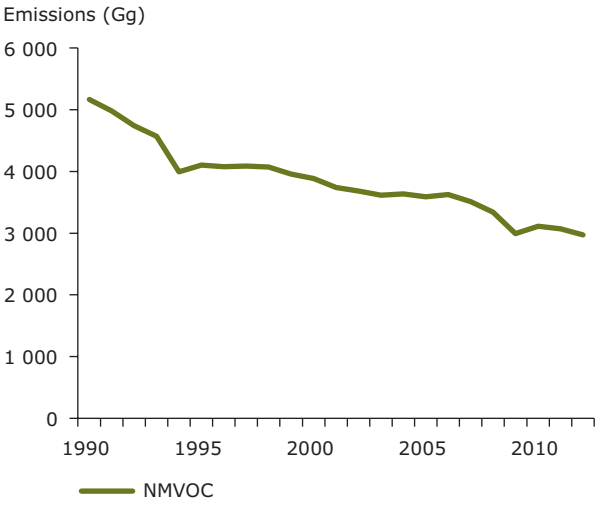


Table 3.7 Overview of methods and data used by Member States to calculate emissions from solvents

Member State	AD	EF	M
Austria	Statistics for trade and services, Austrian foreign trade statistics, structural business statistics, surveys	CS	T2
Belgium	National studies	CS	T3
Bulgaria	National production statistics, national VOC register	D	T2
Croatia	National statistics	D	T1, T2
Cyprus	National statistics	D	T1, T2
Denmark	Statistics Denmark, Nordic Substances in Preparations in Nordic Countries (SPIN) database	CS	T2
Estonia	Web-based air emissions data system for point sources (OSIS), Statistics Estonia	D/PS	T1, T3
Finland	Plant data, national sales statistics, surveys to operators, data from industrial associations	PS, CS	T1, T2
France	Plant data, trade statistics (production, import, export)	D/CS	T1, T2
Germany	Foreign trade statistics, industry statistics	CS	T2
Greece	National statistics	D	T1
Hungary	National statistics	D	T1, T2
Ireland	Sales statistics, national statistics	D, CS	T1, T3
Italy	National statistics	D, CS	T1
Latvia	National statistics, Chemical Register (from 2005 onwards)	D, CS	T2
Lithuania	National statistics	D	T1
Malta	Trade data	D	T1
Netherlands	National sales statistics, annual reports by branch organisations	CS	T2
Poland	Official production statistics	D/CS	T1
Portugal	Energy balance, production data, industrial survey	D	T1, T2
Romania	National statistics	D	T1, T2
Slovakia	Production and trade data	CS (literature)	T1
Slovenia	National statistics on production and consumption	D	T1
Spain	Data from industrial associations, plant-specific data	D/PS	T2,T3
Sweden	Products register	CS	T2
United Kingdom	Solvent consumption data	CS/PS	T2

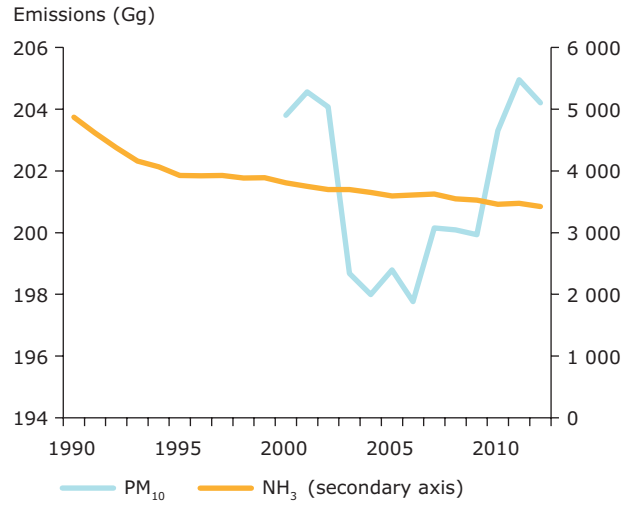
Note: AD: activity data; EF: emission factor; M: method; CS: country specific; D: default value; PS: plant specific; T: tier method.
Table 3.7 only provides an indication of the methods used on the aggregated sector level; for details, the respective IIR should be consulted. The level of detail in information on methods used varies widely across Member States.
Member States that did not provide an IIR are not included in Table 3.7.
Grey font denotes IIRs submitted in 2012 or 2013 (latest IIRs available).

3.8 Sectoral analysis and emission trends for 'Agriculture'

As noted earlier, the 'Agriculture' sector group is particularly important for NH_3 emissions: it is responsible for the vast majority of such emissions in the EU-28. France, Germany and Italy contributed most (in absolute terms) to emissions of NH_3 in the year 2012.

Agricultural emissions of NH_3 have decreased by 30 % since 1990 (see Figure 3.13). The sector also contributes around 11 % of PM_{10} emissions; these emissions increased by 0.2 % between 2000 and 2012.

Figure 3.13 EU-28 emission trends in the sector group 'Agriculture' for NH_3 (in Gg) between 1990 and 2012 (index year 1990 = 100), and for PM_{10} between 2000 and 2012



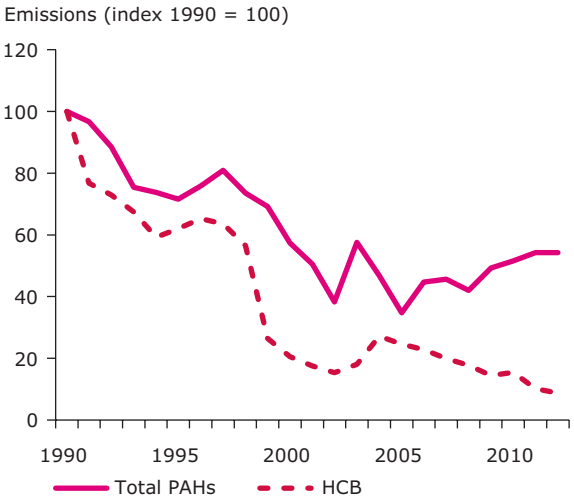
Note: For PM, data from Greece could not be gap-filled as values were not reported for any year. To enable presentation of provisional EU-28 emission trends, the emissions have been aggregated without including data for this Member State.

Parties to the LRTAP Convention are formally requested to report emissions of PM for the year 2000 and after.

For the POPs, this sector contributes considerably to emissions of total PAHs and HCB. Trends of past emissions for these pollutants are shown in Figure 3.14.

The drop in HCB emissions from 1990 to 1991 and from 1998 to 1999 is mainly caused by emission data reported from the United Kingdom. The emission trend of total PAHs is largely influenced by data of the category '2 F — Field burning of agricultural wastes', reported by Spain.

Figure 3.14 EU-28 emission trends in the sector group 'Agriculture' for POPs (total PAHs, HCB and HCH) between 1990 and 2012 (index year 1990 = 100)



Note: For POPs, data from Greece could not be gap-filled as values were not reported for any years. To enable presentation of provisional emission trends, in these instances emissions have been aggregated without including data for all the EU-28 Member States.

Table 3.8 Overview of methods and data used by Member States to calculate emissions from 'Agriculture'

Member State	AD	EF	M
Austria	National agricultural statistics, national studies, direct information from agricultural association	CS/D	T1, T2, T3
Belgium	Statistics Belgium (Statbel)	CS/D	T2, T3
Bulgaria	National agriculture statistics	D	T1
Croatia	National statistics	D	T1
Cyprus	National statistics	D	T1
Denmark	National agricultural statistics	CS/D	T2
Estonia	National statistics	D	T1
Finland	National agricultural statistics, Yearbook of Farm Statistics	CS/D	T3
France	Agricultural statistics	CS	T2
Germany	National and regional agricultural statistics	D/CS	T1, T2, T3
Greece	National statistics, fertiliser production data	D	T1
Hungary	National statistics	D, CS	T1, T3
Ireland	National studies, national agricultural statistics, housing survey	D, CS	T2
Italy	National statistics, international statistics, category association statistics	D	T1, T2
Latvia	National statistics	D/CS	T1, T2
Lithuania	Department of Statistics	D	T1
Malta	National statistics, trade statistics	D	T1, T2 (for 4D)
Netherlands	National agricultural statistics	D/CS	T2, T3
Poland	Statistical yearbooks, Agriculture Yearbook	D/CS	T1
Portugal	Agricultural statistics, agriculture survey	D/CS	T1, T2
Romania	Agricultural statistics, FAOSTAT statistical data	D	T1
Slovakia	National statistics	D	T1
Slovenia	National statistics	D/CS	T2, T1
Spain	National statistics (Statistical Yearbook), Husbandry Survey	D	T2
Sweden	Official statistical reports, field investigation, Farm register	D/CS	T2
United Kingdom	Census statistics, fertiliser sales data, literature	CS	T2, T3 (model)

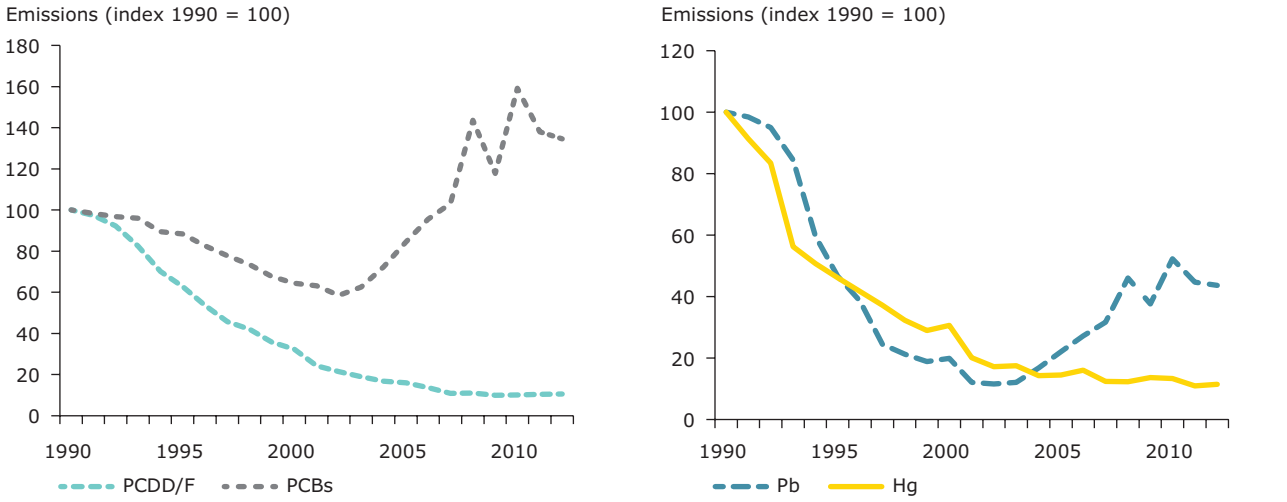
Note: AD: activity data; EF: emission factor; M: method; CS: country specific; D: default value; PS: plant specific; T: tier method.
Table 3.8 only provides an indication of the methods used on the aggregated sector level; for details, the respective IIRs should be consulted. The level of detail in information on methods used varies widely across Member States.
Member States that did not provide an IIR are not included in Table 3.8.
Grey font denotes IIRs submitted in 2012 or 2013 (latest IIRs available).

3.9 Sectoral analysis and emission trends for 'Waste'

The 'Waste' sector group is an important source of certain pollutants, including PCBs and PCDD/Fs. Figure 3.15 shows the past emission trends for PCBs and dioxin.

The strong PCB and Pb emission increases starting in 2003, and the dips and jumps in the time series from 2003 to 2012 are due to reported data from Portugal for category '6 C b — Industrial waste incineration'. Portugal explained that the emission trends for industrial incineration follow the tendencies of the activity data. The final disposal of industrial waste includes waste landfilling, incineration, export (e.g. dangerous waste) and recycling. The extreme differences across years for the amounts of industrial waste incinerated can be explained, at least partially, by the variation in annual market demand for residues (Comment received from Portugal in 2013).

Figure 3.15 EU-28 emission trends in the sector group 'Waste' for POPs (PCDD/FsF and PCBs), and the HMs Pb and Hg between 1990 and 2012 (index year 1990 = 100)



Note: For Pb and Hg, data for Luxembourg were gap-filled with the notation key NR. Also for Greece, no sectoral data were available. For POPs, data from one or more Member States could not be gap-filled as values were not reported for any years. To enable presentation of provisional EU-28 emission trends, the emissions have been aggregated without including emission data for all the EU-28 Member States.

Table 3.9 Overview of methods and data used by Member States to calculate emissions from 'Waste'

Member State	AD	EF	M
Austria	National reports, national database on landfills	CS	T2
Belgium	Plant data, national statistics	CS/D	T1, T2
Bulgaria	National statistics, national studies	D	T1
Croatia	National statistics	D	T1, T2
Cyprus	National statistics	D	T1, T2
Denmark	National statistics	D/CS	T1, T2
Estonia	Plant data, Statistics Estonia, Estonian Rescue Service and waste management system	PS/D	T1, T2, T3
Finland	National statistics, plant data, Water and Sewage Works Register	CS	T2
France	National waste statistics, plant data	D/CS	T1, T2
Germany	National statistics — German Statistical Office (DESTATIS)	D/CS	T1
Greece	National statistics	D	T1
Hungary	National statistics	D, CS	T1, T2, T3
Ireland	National waste reports, plant data	CS, D	T1,T2
Italy	National waste statistics	D	T2 (IPCC)
Latvia	National statistics, waste database	D/CS	T1, T2
Lithuania	National statistics (data available from 1991)	D	T1
Malta	Plant data	D	T1, T2
Netherlands	National statistics, branch reports, plant data	CS	T2
Poland	Environment and statistical yearbook, domestic case study, branch information, Municipal infrastructure	D/CS	T1
Portugal	Waste statistics	D	T2
Romania	National waste database	D	T1, T2
Slovakia	National database of waste	D/CS	T1
Slovenia	National statistics, plant data	D	T2 (IPCC)
Spain	National statistics/studies, data from associations, questionnaires	D/CS	T2
Sweden	National statistics, facilities' annual environmental reports	D/CS	T1, T2
United Kingdom	Plant data, literature, surveys, disposal statistics	CS, PS	T1, T3

Note: AD: activity data; EF: emission factor; M: method; CS: country specific; D: default value; PS: plant specific; T: tier method.
Table 3.9 only provides an indication of the methods used on the aggregated sector level; for details, the respective IIR should be consulted. The level of detail in information on methods used varies widely across Member States.
Member States that did not provide an IIR are not included in Table 3.9.
Grey font indicates IIRs submitted in 2012 or 2013 (latest IIRs available).

4 Recalculations and implemented and planned improvements

4.1 Recalculations

4.1.1 Recalculations

Recalculations are changes made to past emission estimates (for one or more years) in order to eliminate errors or to incorporate additional factors or data. The EMEP/EEA guidebook (EMEP/EEA, 2009) stipulates that from a country perspective, it is considered good practice to change or refine data and/or methods when:

- available data have changed;
- the previously used method is not consistent with good practice for a certain category;
- an emissions source category has become a key category;
- the previously used method is inadequate to reflect mitigation activities in a transparent manner;
- the capacity (resources) for inventory preparation has increased;
- new inventory methods become available;
- the correction of errors is necessary.

It is important and necessary to identify inventory recalculations and to understand their origin, in order to evaluate officially reported emissions data properly. The reasons for Member States reporting different numbers in one year compared to an earlier year are often not documented.

Table 4.1 shows a comparison of EU-27 (i.e. without Croatia) total emissions submitted in 2013 against those submitted in 2014. It should be noted that for some Member States, recalculations might reflect changes in compilation methods (gap-filling) rather than 'true' recalculations performed by the countries themselves.

The high recalculations of cadmium, mercury and PCBs in 1995 is caused by differences in data from Poland submitted in 2014, compared with gap-filled data from the 2013 inventory.

There are high recalculations of benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene and indeno(1,2,3-cd)pyrene. These are ascribable to differences between the gap-filled 2014 inventory compared with gap-filled data from the 2013 inventory from Poland (1990), and to differences in data from Poland submitted in 2014, compared with gap-filled data from the 2013 inventory (1995). The high recalculation of benzo(k)fluoranthene emissions is due to recalculations in the category '1 A 4 b i — Residential: Stationary plants' of data submitted by Poland. Poland will repeat the recalculations of PAH emissions in the category 1 A 4 b i for the next submission to improve consistency of the trend (Comment received from Poland in 2014).

The differences in $PM_{2.5}$ emissions are caused by recalculations from Belgium, Lithuania, Portugal and the United Kingdom.

Under the revised reporting guidelines (UNECE, 2009), all countries should submit explanatory IIRs which should include details of any recalculations made. Information on the Member States' IIRs is listed in Appendix 5. Some Member States provide very detailed explanations and justifications for their recalculations of parts or the whole time-series (e.g. methodological improvements, revisions of emission factors, reallocations, revisions of activity data, and corrections of errors). Others, however, do not explain the rationale behind recalculations, despite having submitted IIRs.

Austria provided detailed information on its recalculations: they were carried out due to updates of activity data and improvements of methodologies and emission factors (Appendix 5, Austria's IIR).

Belgium provided detailed information on its recalculations. The notation keys for the NEC pollutants (NO_X, NMVOC, SO_X and NH_3) and

the other LRTAP pollutants (CO, PM, HMs, POPs) were revised. Reducing the use of the NE notation key was the subject of special attention. For the 'Road transport' sector, much effort was put into harmonising the modelling between the three regions (Flanders, Wallonia and Brussels). Additionally, emissions of PCBs were included in the data reporting. As a result of the in-country review in September 2012 of the Belgium inventory, and for the sake of coherence with this inventory, the off-road emissions of the following sectors were reallocated as follows: 'Industry and building' to 1A2fii; 'Airports, harbours, trans-shipment companies' to 1A3e (formerly in 1A4aii); 'Households' to 1A4bii; 'Forestry and green areas' to 1A4cii; and 'Defence' to 1A5b. Wood consumption from the residential sector was updated, based on the Eurostat survey (Appendix 5, Belgium's IIR).

Bulgaria reported that a recalculation for the entire time-series has been prepared for NH_3 for NFR 4B8 'Swine' due to the implementation of default Tier 1 emission factors, in line with the *EMEP/EEA air pollutant emission inventory guidebook — 2009* (EMEP/EEA, 2009). For 2009, 2010 and 2011, activity data for NFR 3A2 'Industrial coating application (SNAP 060107 – Wood)' were recalculated due to the update of the revised default emission factors, in line with the *EMEP/EEA air pollutant emission inventory guidebook — 2009*. For 'Industrial processes', based on the recommendations of the ERT set in the report from the Stage 3 in-depth review for some categories/pollutants, which are not well developed in the national methodology, EFs from EMEP/CORINAIR Emission Inventory Guidebook 2009 were applied, in order to improve the inventory (Appendix 5, Bulgaria's IIR).

Table 4.1 Comparison of data submitted in 2013 and 2014 by Member States (relative data, EU-27 national total without Croatia)

Pollutant	Unit	1990	1995	2000	2005	2006	2007	2008	2009	2010	2011
NO_x	Gg	1 %	0 %	0 %	0 %	0 %	0 %	0 %	0 %	0 %	– 1 %
NMVOC	Gg	1 %	– 1 %	1 %	2 %	0 %	0 %	0 %	0 %	0 %	0 %
SO_x	Gg	4 %	0 %	0 %	– 1 %	– 1 %	– 1 %	– 2 %	– 2 %	– 2 %	– 3 %
NH_3	Gg	0 %	– 1 %	1 %	1 %	1 %	1 %	1 %	1 %	1 %	1 %
TSPs	Gg	10 %	8 %	2 %	4 %	5 %	5 %	4 %	4 %	2 %	1 %
CO	Gg	1 %	– 3 %	0 %	– 1 %	– 1 %	– 1 %	– 1 %	– 1 %	– 1 %	– 2 %
Pb	Mg	– 2 %	0 %	– 1 %	– 5 %	– 4 %	– 2 %	– 2 %	– 2 %	– 1 %	– 1 %
Cd	Mg	– 2 %	– 12 %	– 1 %	– 2 %	– 3 %	– 3 %	– 4 %	– 7 %	– 3 %	– 4 %
Hg	Mg	1 %	– 11 %	0 %	– 2 %	– 1 %	– 1 %	– 2 %	– 2 %	0 %	0 %
As	Mg	– 2 %	– 7 %	0 %	– 1 %	0 %	0 %	0 %	– 1 %	0 %	0 %
Cr	Mg	0 %	– 4 %	2 %	2 %	2 %	3 %	3 %	3 %	2 %	1 %
Cu	Mg	– 2 %	– 5 %	– 2 %	– 2 %	– 2 %	– 2 %	– 2 %	– 2 %	– 2 %	– 2 %
Ni	Mg	– 3 %	– 4 %	0 %	– 1 %	– 2 %	– 4 %	– 3 %	– 2 %	– 2 %	– 4 %
Se	Mg	– 1 %	0 %	0 %	– 2 %	– 2 %	– 3 %	– 2 %	– 3 %	– 4 %	– 4 %
Zn	Mg	2 %	– 3 %	4 %	4 %	4 %	4 %	4 %	5 %	5 %	4 %
PCDD/Fs	g I-Teq	2 %	– 1 %	5 %	3 %	6 %	4 %	4 %	4 %	4 %	3 %
Total PAHs	Mg	– 1 %	– 8 %	– 2 %	– 5 %	– 4 %	– 5 %	– 9 %	– 9 %	– 11 %	– 8 %
HCB	kg	2 %	3 %	– 1 %	– 7 %	– 10 %	– 10 %	– 12 %	– 9 %	– 9 %	– 2 %
PCBs	kg	1 %	– 12 %	3 %	– 9 %	– 6 %	3 %	4 %	0 %	5 %	6 %
Benzo(a)pyrene	Mg	12 %	7 %	– 3 %	– 4 %	– 2 %	– 2 %	– 3 %	– 4 %	– 5 %	– 4 %
Benzo(b) fluoranthene	Mg	24 %	11 %	– 2 %	– 4 %	– 3 %	– 3 %	– 4 %	– 7 %	– 7 %	– 4 %
Benzo(k) fluoranthene	Mg	61 %	53 %	41 %	25 %	33 %	30 %	– 7 %	– 9 %	– 10 %	– 9 %
Indeno(1,2,3-cd)pyrene	Mg	37 %	20 %	– 4 %	– 5 %	– 7 %	– 4 %	– 5 %	– 7 %	– 6 %	– 5 %
				2000	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**
$PM_{2.5}$	Gg			2 %	4 %	5 %	5 %	4 %	5 %	5 %	5 %
PM_{10}	Gg			3 %	3 %	4 %	4 %	3 %	3 %	4 %	4 %

Cyprus stated that some methodological improvements were made to the national emissions inventory. This resulted in recalculations of the time series from 2008 through 2011, in order to improve emission data accuracy (Appendix 5, Cyprus' IIR).

Denmark provided detailed information on its recalculations. Considerable work was put into improving the inventory. The submission includes recalculated inventories for the whole time-series. The reasons for recalculation are updated activity data, new data, an improved calculation method, correction of errors and updated emission factors (Appendix 5, Denmark's IIR).

Estonia provided detailed information on its recalculations from 1990 to 2011. The reasons for recalculating are correction of emissions, additional emissions, update of activity data, correction of errors, correction of emission factors and correction of calculations (Appendix 5, Estonia's IIR).

Finland provided detailed information on recalculations. The time series has been recalculated for several subcategories (not including the energy sector). Once the energy sector has been recalculated, the entire time-series (1990–2010) will be reported. At present, ad hoc checking of basic data, methods and underlying assumptions is being carried out, and remains to be checked systematically once recalculations are complete. The reallocation of emissions will be carried out as well. No actual recalculations were made in Finland's IIR; some emission figures of previous years were corrected in the NFR tables to reflect changes in activity data, changes in data reported

Table 4.2 Overview of Member State recalculations contributing most to EU recalculations

Pollutant	Countries contributing most to recalculations at EU level
NO_x	BE: 1990, 1995, FI: 1990; HU: 1990; 2005–2006; LU: 1990–2010; PL 1995; 2006; RO 1990; 1995; ES 1990–2000; 2011
NMVOC	BE: 1990, 1995; FR: 2005; 2006; DE: 1990, 1995; 2010; 1011; HU:1990; 2005–2008; IT: 2005–2011; LV: 2007; PL: 1995; RO: 1990; 2005; ES: 2000; UK:1990–2011
SO_x	HU: 1990–2009; PL: 1995; PT: 1990–2007; RO: 1990, 1995; 2005; ES: 1995, 2005–2011
NH_3	FR: 2000–2011; PL: 1995
$PM_{2.5}$	BE: 2005–2011; LT: 1990–2011; PT: 2005–2011; UK: 2000; CZ: 2000
PM_{10}	BE: 2005–2011; PT: 2005–2011
TSPs	HU: 1995–2009; PL: 1990–1995
CO	BE: 1990, 1995; 2005–2011; FR: 1990–2005, 2010–2011; HU: 1990–2000; 2008–2010; IT: 2005–2011; LV: 1990–2011; NL: 1995–2011, PL: 1995, 2005–2011; PT: 1990–2011; RO: 1995–2005; ES: 2005–2011; UK: 1995–2000, 2009; 2011
Pb	BE, FR: 1990, 1995; HU: 1990, 1995; 2005–2008; LT, PL: 1995; PT: 2005–2006; UK: 1990, 1995
Cd	PL: 1995
Hg	PL: 1995
As	PL: 1995
Cr	PL: 1995
Cu	IT, NL: 1990–2011; PL: 1995
Ni	LT: 1990, 1995; PL: 1995; ES: 2011
Se	UK: 1990–2011
Zn	FR, DE, IT, UK: 1990–2011; HU: 1990; 2000–2009; PL: 1995; PT: 1990–2000
PCDD/Fs	BE, PL: 1995; BG: 2000–2008, 2011; HU: 1990, 1995; 2005–2009; PT: 1990–2000; RO: 2011; SK: 2000; UK: 1990–2009, 2011
Total PAHs	BE: 1990–1995; BG: 1995–2006; HU: 1990; IT: 2000–2007; PL: 1995–2007; PT: 1990–2011
Benzo(a)pyrene	PL: 1990
Benzo(b)fluoranthene	PL: 1990
Benzo(k)fluoranthene	PL: 1990–2007
Indeno(1,2,3-cd)pyrene	PL: 1990
HCB	BE: 1990–2000, 2011; NT: 1990; PL: 1995; ES: 1995–2011
HCH	BE: 1990–2000
PCBs	PL: 1995; 2009; PT: 2000–2006, 2011

by the plants or errors found in previous years. The altered figures are coloured red in the NFR tables. (Appendix 5, Finland's IIR).

France noted that several recalculations of methodology and statistics were applied (Appendix 5, France's IIR).

Germany provided detailed information. Recalculations were undertaken in Germany for the following reasons: revision of activity, revision of the entire model, newly implemented emission factors, revision of emission factors and reallocation of activity data and emissions (Appendix 5, Germany's IIR).

Greece stated that in the 2011 submission, a recalculation of the whole time-series of the road transport sector was carried out (1987-2009) with more accurate and up-to-date input data and with the same methodological approach (COPERT IV version 7.1). The whole emissions database is now coherent and credible in terms of input data used and calculation method applied (Appendix 5, Greece's IIR, p. 8).

Ireland provided detailed information on its recalculations. The reasons for recalculating are revised activity data, revised emission factors, error correction, methodological changes and revised proxy data (Appendix 5, Ireland's IIR).

Italy stated that in the 2014 submission different recalculations have been performed in the energy sector. The main update within the sector fuel combustion regarded the 1A4 category. Emissions from Non industrial stationary combustion have been recalculated for 2010 and 2011. Concerning mobile fuel combustion (1A3) the upgraded version of COPERT 4, v.10.0 with a check of some parameters relevant to national circumstances, has been used for the road transport sector. Activity data for maritime navigation have been updated for 2010 and 2011 resulting in a decrease of emissions from this category. Activity data for secondary aluminium, lime, and fine ceramic have been updated for 2011 as well as the SO_x emission factor for paper production for the same year resulting in a minor recalculation of emissions (Appendix 5, Italy's IIR, p. 61–61).

Latvia provided detailed information on recalculations. Recalculations were carried out because of updates of activity data, updates of emission factors in the 2013 EMEP/EEA guidebook, additional emissions and methodological changes. Changes following the Stage 3 in-depth review in 2013 are as follows: municipal waste consumption is now reported in 1A2f, and the emission factors for manufacturing industries and construction are now taken from the waste sector (Latvia's IIR, p. 17).

Lithuania applied some renewals in its calculations, based on an in-depth review of emission inventories submitted under the UNECE LRTAP Convention and the NEC Directive. Activity data and sulphur/lead content in fuels were corrected for the years 1990 to 2013. Emission factors were reviewed and corrected. Most of the activity data within all sectors were corrected according to the national greenhouse gas emission inventory reports — CRF. NMVOC emissions were evaluated based on Tier 1 (Appendix 5, Lithuania's IIR).

The **Netherlands** stated that compared to the 2013 submission, several methodological changes were implemented in the Pollutant Release and Transfer (PRTR) system: fuel emissions in the 'Road transport' sector were recalculated based on the updated VERSIT+ LD model; PM emissions from tyre and brake wear were recalculated on the basis of new emission factors; a new model was used to calculate the nitrogen flows in agriculture; and errors in the calculation of HCB emissions were corrected for the period from 1990 to 1995 (Appendix 5, the Netherlands' IIR).

Poland reported that comprehensive recalculations of data from 1995 were carried out in 2014 (also following the report for the Stage 3 in-depth review of emission inventories), which enabled the preparation of inventory files (Annex IV) for the entire trend, from 1995 through 2012. Reported emissions under the NEC Directive in December 2013 differ slightly from data submitted to the LRTAP Convention in February 2014, due to corrections of statistical activity data (Appendix 5, Poland's IIR).

Portugal provided detailed information on its recalculations. Since the last submission, the recalculations made were mainly due to updates of background information and methodological revisions in line with recommendations issued during the CLRTAP inventory reviews (CLRTAP Stage 3 in-depth review) and other inventory review processes under the UNFCCC and the EC (Appendix 5, Portugal's IIR).

Romania noted that emissions from road transportation were recalculated for the years 2006 to 2012 using COPERT 4 software. For 2005, no recalculations were made, due to a lack of reliable mileage information. Notable differences

from previous submissions (reporting years between 2005 and 2012) are ascribable to the inclusion of two new activities, 1 B 2 c 'Venting and flaring', and 2 A 6 'Road paving with asphalt', as well as updated activity data for NFR 6 A 'Solid waste disposal on land' (Appendix 5, Romania's IIR).

Slovakia provided detailed information on its recalculations. Due to changes and updates of activity data, major recalculations of NO_X, SO_2, TSP, $PM_{2.5}$, PM_{10} and CO emissions were reported in the energy sector, and in sectors 2 A 7 and 2 G. NMVOC emissions were recalculated owing to updated activity data and the correction of numerical errors in the sectors '1 A 3 dii National navigation' and '1 B 2 a iv Refining/storage' in 2011. NMVOC, HM and POP emissions resulting from sectors 6 C a, 6 C b and 6 C d (only referring to POP emissions) were recalculated for the year 2011, due to updated activity data (Appendix 5, Slovakia's IIR).

Slovenia provided detailed information on its recalculations. The most important recalculations of emissions for the 2014 submission were applied to the 'Agriculture' sector. NO_X and NMVOC emissions from the 'Agriculture' sector were calculated and reported for the first time. Additional important recalculations were made in the energy sector. The national inventory was completed with emissions resulting from consumption of waste biomass, other waste and biogas. Some minor recalculations were also made in the 'Waste' and 'Industrial processes' sectors (Appendix 5, Slovenia's IIR).

Spain provided detailed information on its recalculations. The main reasons for recalculating are changes in estimation methods, updated activity data, error correction in the 'Questionnaire of Large Point Sources', revisions of the basic statistics of the 'Agriculture' sector and revision of the energy balance (Appendix 5, Spain's IIR).

Sweden provided detailed information on its recalculations. The reasons are reallocation of emissions, revisions and updates of activity data, corrected emissions, correction of the calculation model and updates of methodology (Appendix 5, Sweden's IIR).

The **United Kingdom** provided detailed information on recalculations made since its last CLRTAP submission. Reasons for the recalculations are improved emission estimates and new or additional sources (Appendix 5, the United Kingdom's IIR).

A summary of the individual recalculations reported by Member States is presented in the annual joint EMEP/EEA inventory review report (EMEP/EEA, 2014). This report is available from the CEIP website in July of each year (EMEP CEIP, 2014b).

4.1.2 Emission changes of Member States due to review improvements

The EMEP CEIP has also been assigned the task of reviewing the submitted emissions, in order to assist the parties in improving the quality of national inventories. These yearly reviews shall help Member States to prepare and improve their inventories. Member States compile their individual emission estimates and submit their inventories together with their IIRs.

The Stage 1 review — an automated test — is carried out every year to assess timeliness, completeness and format. The Stage 2 review assesses recalculations, KCA, inventory comparison, trends and time series. Stage 3 is an in-depth review carried out by experts nominated by the parties. Each year, a review of 10 parties' inventories is foreseen.

In 2013, the following countries were reviewed: Bulgaria, France, Latvia, Sweden, Poland, Italy, Lithuania, Portugal and Romania, as well as Norway. Some Member States refer explicitly to improvements in response to the reviews undertaken in their IIRs.

4.2 Planned and implemented improvements

The EEA and ETC/ACM have noted that the main future challenge for EU Member States remains one of improving the quality of data submissions, in order to obtain more complete and timely UNECE LRTAP Convention emission inventories. Improvements cannot be implemented at EU level alone; the development and prioritisation of reliable and timely inventory reporting systems in the Member States themselves is also needed.

Improvements to the quality of Member States' inventories are facilitated through the joint EMEP/EEA annual review of inventory data. The review of data reported under the LRTAP Convention is performed jointly with the review of data reported by Member States under the NEC Directive. Since 2009, a centralised Stage 3 review process has been in place that aims to review inventories from 10 countries annually. The reviews are performed by two teams of emission experts. Member States are encouraged to nominate reviewers for the EMEP

roster of emission review experts; nomination process details are available on the CEIP website. In 2012, the EU emission inventory report (1990–2010) under the UNECE LRTAP Convention was reviewed (EEA, 2012).

4.2.1 Improvements at EU level

Planned improvements

- Further progress concerning **completeness of reporting**: despite clear progress having been made in recent years in terms of the completeness of reporting, a complete set of emission inventory data for air pollutants is still not available for all Member States, as was noted earlier in this report. Further, for certain pollutants (including PM, HMs and POPs), data could not be fully gap-filled, because emission values for some Member States had not been not reported in any years.

- **Updating of emission data** by Member States, for past years too: a further issue identified by the ETC/ACM concerns the use of data submitted several years ago in the gap-filling procedure. In a number of cases, because countries have not since resubmitted corrected or updated data sets, inconsistencies are unavoidably introduced into the EU-28 inventory. The quality of the EU's inventory will thus be enhanced if the consistency and completeness of Member States' submissions improves. Such improvements would facilitate reliable trend analysis and inform policy.

- **Review current gap-filling procedures** to ensure that gap-filling procedures use the best approach, reflecting real emissions: the improved inventory gap-filling procedure performed in 2011 and continued in 2012 has helped develop a more complete EU emission inventory, but there is room for improvement (e.g. by including manual changes into the procedure).

- **Reducing the need for gap-filling**: this can be achieved if Member States report complete time-series as far as possible, and also if the data have been already provided in earlier submissions under the LRTAP. Current gap-filling procedures first use submissions received in the actual reporting years under various reporting mechanisms, and then use older LRTAP submissions.

- **More explanatory information** on trends and recalculations could be provided if such information is contained in the IIRs received.

- Further research on **outliers in Member State emission data** will help ensure that real emissions are reflected: a comparison of Member States' shares in the EU-28 total reveals extraordinarily high shares in some instances, e.g. for TSPs in France (26 %), for Cd in Poland (45 %), for Cu in Germany (58 %), for Se in Spain (32 %), for Zn in Germany (28 %), for BbF in Poland (28 %) and Romania (27 %), for BkF in Romania (38 %) and for IP in Poland (42 %). Future investigation could determine whether these high shares reflect true emissions, or whether they are ascribable to incomplete reporting (or underestimates) of other Member States.

- More attention to **data quality**: in several submissions from Member States and due to the gap-filling procedure, values of $PM_{2.5}$ exceed PM_{10} values — which should be impossible. Changes in the gap-filling results and improved Member State emission data should solve these problems.

Improvements undertaken in 2014

- Trend explanations were further elaborated.

- High emission shares were further investigated where possible, and explanations for remarkable trends provided.

- A table on the effect of gap-filling on EU emission data was included for the year 1990 (Table 1.8).

- Information on underestimations was provided in the introduction (Chapter 1), and a new figure on the number of source categories that are NE for the year 2012 was included (Figure 1.6).

- Information on Member States' adjustments is included in Chapter 1.

- The gap-filled inventory was improved by manual corrections for $PM_{2.5}$ and PM_{10}.

Improvement in reporting at Member State level

- Timely submission: this year, four Member States did not report on time, as occurred last year, too.

- Completeness: in 2012, Luxembourg and Malta did not submit any data. In 2013, all Member States submitted data, same as this year. Greece reported data only for the main pollutants and CO. Several Member States submitted data that did not cover entire time-series from 1990 to 2012.

- Basis of emissions from transport: according to the reporting guidelines (UNECE, 2009), all Member States should calculate and report emissions from road vehicle transport on the basis of the fuel sold. Only for compliance checks, Austria, Belgium, Ireland, Lithuania, Luxemburg, the Netherlands and the United Kingdom may choose to use the national emission total calculated on the basis of fuel used. This year again, two Member States (Belgium and the United Kingdom) submitted no data based on fuel sold, and one Member State (the Netherlands) reported only a national total on the basis of fuel sold, but no fuel sold data for the categories.

- Format of reporting: the updated reporting guidelines (UNECE, 2009) require that all parties to the LRTAP Convention report emissions using the new NFR09 reporting format for their 2012 submissions. As in 2013, all EU Member States except Italy used the preferred template.

4.2.2 Improvements at Member State level

Improvements at Member State level also automatically improve the EU inventory. For this reason, it is a point of interest to note which countries have improvements planned. An overview of these is provided in Table 4.3. However, that is not easy to gain a systematic overview of the situation overall, as Member States provide varying degrees of information.

Table 4.3 Overview of improvements planned at Member State level

Austria	Required methodological changes and planned improvements are described in the corresponding sector analysis chapters (Austria's IIR, p. 25).
Belgium	In the Flemish region, the following improvements are planned: Fine tuning the emissions of polyurethane processing and of polystyrene foam processing; estimation of tetrachloromethane of production of solvents. In Wallonia, the following improvements are planned: • to evaluate the implementation of recommendations coming from the EMEP/EEA Guidebook 2013 for the next submission in sectors IP and 'Agriculture'; • revision of the emissions for Wood paint application and Other industrial paint application; • revision of the emissions for non-chlorinated solvents for Metal degreasing,Dry cleaning and Other industrial cleaning; • revision of the emissions for Polyester processing, Polyvinylchloride processing, Polyurethane processing, Polystyrene processing; • estimation of the emissions for Textile finishing; • estimation of the emissions for Glass wool enduction, Mineral wool enduction and Fat, edible and non-edible oil extraction and • estimation of the emissions for the years from 1990 to 2000 for Preservation of wood.
Bulgaria	The Bulgarian National Inventory System (BGNIS) plans that the same team responsible for dealing with the GHG inventory will be responsible for preparation of UNECE/CLRTAP inventory. Thus any differences with the UNFCCC report will be eliminated. Planned improvements: application of higher tier method for estimation of emissions; incorporation of ETS and E-PRTR data bases into emission inventory in NFR sector 1 Energy and NFR sector 2 'Industrial processes'; incorporation of data, provided by branch business associations; revision of activity data in NFR sector 4 'Agriculture' in accordance with Agrostatistic data of the Ministry of Agriculture and Food (Bulgaria's IIR, p. 82).
Croatia	• Supplement emission calculation for missing pollutants for the sub-sector 1 A 1 a* • Improve inventory for the sub-sector 1 A 1 b* • Supplement the calculation of certain pollutant (Hg and As) emissions from 1 A 3 b that were not estimate* • Report energy consumption from sector 1 A 2 on disaggregated level instead of reporting them all in sub-sector 1 A 2 fi** • Supplement the activity data for lime production with the lime quantities produced in the Croatian sugar factories for the whole observed trend** • The NMVOC emission factor harmonization according to EMEP/EEA guidebook** • Harmonize currently used emission factors for activities in sector 3 C* • Improve inventory for the sub-sector 3 D 2 and apply the Tier 2 approach* • Collect activity data necessary for Tier 2 NH_3 emission calculation for all activities in sub-sectors 4 B and 4 D, and for Tier 1 PM_{10} and $PM_{2.5}$ emissions calculation for activities in 4 D* • Harmonize commonly used emission factors for sector 6 C d and complete emission calculation with new ones proposed in accordance with EMEP/EEA Guidebook 2013 • Collect required activity data for emission calculation from activities: sludge spreading compost and production from waste* * Improvements are planned in one of the next inventories/reports. ** Improvements are planned in the next report (Croatia's IIR, p. 31–32).

Table 4.3 Overview of improvements planned at Member State level (cont.)

Cyprus	In the 2014 IIR, there are no planned improvements reported.
Czech Republic	No IIR available.
Denmark	The inventories are still being improved through work to increase the number of LPSs, e.g. power plants, included in the databases as individual point sources. Such an inclusion makes it possible to use plant-specific data for emissions available, e.g. in annual environmental reports from the plants in question (Denmark's IIR, p. 331). Improvements and additions are continuously being implemented due to the comprehensiveness and complexity of the use and application of solvents in industries and households (Denmark's IIR, p. 334). Sector-specific planned improvements are described in the relevant sectoral chapters (Denmark's IIR, p. 14, 331).
Estonia	Source-specific planned improvements are listed in Estonia's IIR.
Finland	Sector-specific improvement needs are set out in Table 14.3 of Finland's IIR. Further, the source-specific planned improvements are described in the sectoral chapters.
France	In general, an emission inventory is always improvable. This is especially the case for the underlying approach used in the inventory compilation for substances included in the LRTAP Convention. Diverse investigations have been launched and are planned within this context. • Conduct research to improve accuracy especially for key categories • Undertake measures to determine uncertainties • Reduce the number of non-considered or poorly determined pollutants (specification of hazardous air pollutants (HAPs) from certain sources, emissions of fine particles, heavy metals, etc.) It is still foreseen to improve the estimation from the heating boilers in the residential sector, which could strongly influence NOX emissions • Keep on splitting the energy consumption in the industry • Adopt the recent developments of EMEP/EEA (use the new COPERT split for vehicles) • Strengthen all activities aiming at a better QA and QC of the system, especially towards the implementation of procedures and tools, cooperation with experts from different fields, the maintenance of the ISO 9001 certification system, etc. (France's IIR, p. 101).
Germany	Planned improvements for the overall inventory are: update of projections (data and text) and to work on completing the POP inventory. Improvements listed for individual source categories are as follows: consideration of exhaust particulate-matter emissions from gasoline consumption in off-road mobile sources based on the EMEP/EEA guidebook 2013 (NFRs 1.A.2.f ii, 1.A.4.b ii, 1.A.4.c ii, 1.A.5.b); revision of the estimation and reporting of POP emissions for several off-road mobile sources based on the EMEP/EEA guidebook 2013 (NFRs 1.A.2.f ii; 1.A.3.c, d ii; 1.A.4.b ii, c ii; 1.A.5.b); implementation of data derived from the model (still under construction) for the estimation of emissions from maritime transport (1.A.3.d, 1.A.4.c iii).
Greece	In the 2014 IIR, there are no planned improvements reported.
Hungary (Information from IIR 2013)	• Further improvement of the coordination with E-PRTR reporting and within LAIR reporting process; • quantitative uncertainty analysis; • submission of entire time-series from 1990; • improvement of QA/QC actions, application of the same processes as by the UNFCCC annual emission inventory reporting; • use of CollectER software; • application of the updated Guidebook expected in 2013.
Ireland	The source-specific planned improvements are described in the sectoral chapters of Ireland's IIR.
Italy	For the energy sector, a major progress concerns the management of the information system. Here, data collected in the framework of different obligations, Large Combustion Plant, E-PRTR and Emissions Trading, are gathered together to highlight the main information discrepancies and to detect potential errors. Further progress will regard the aviation and maritime sectors, where the annual estimations on the basis of detailed databases on flights and ships movements will be improved. Further work is planned to update/change emission factors for the heavy metals (Italy's IIR, p. 61).
Latvia	Planned improvements are listed in the IIR (p. 136) and mainly concern activity data for the sectors Energy as well as Solvent and Other Product Use.
Lithuania	Source-specific planned improvements are listed in the sectoral chapters. The reported improvements comprise uncertainty analyses for the sectors Transport (railway transport, water navigation, off-road transport, gas transport) and 'Industrial processes' (organic chemicals and food production).
Luxembourg	No IIR available.
Malta (Infromation from IIR 2013)	There is the possibility of updating the time series with respect to HM emissions (Malta's IIR, p. 20).

Table 4.3 Overview of improvements planned at Member State level (cont.)

Netherlands	For the coming submission, the following improvements are envisaged: General: During the compilation process of inventory reports, activities are initiated for future improvements. In next submission all missing HCB emission sources will be included, where possible. (Netherland's IIR, p. 89) Transport: A study has been initiated to derive improved specific fuel consumption figures for passenger cars using fuel consumption figures from the EU type approval procedure and research by TNO on differences between type approval and real-world fuel consumption for different vehicles types. This should improve the bottom-up fuel consumption estimates used to calculate SO_2 emissions and heavy metals. Further TNO will perform a study on the impact of non-compliance on emissions from 'Road transport'. With emission factors of modern vehicles decreasing rapidly due to the further tightening of EU emission standards, the impact of non-compliance on total emissions becomes a major factor in determining emission totals. The difference between fuel used and fuel sold for 'Road transport' in the Netherlands will be also a subject of study in the coming years, in order to improve the fuel sold emissions totals. Industry: Incomplete TSP and Cd time series will be repaired, where possible, in future submissions. Agriculture: NO emissions from the application of animal manure and manure produced on pasture as well as NO emissions from the application of synthetic fertiliser were assessed, but these are reported as a memo items under the category of natural emissions (11C). This categorisation will be reconsidered as soon as emission ceilings also account for this new emission source. An uncertainty analysis of NH_3 emissions calculated by the NEMA model is foreseen for the next inventory report.
Poland	The planned programme of improvement is focused on the following tasks: verification of NMVOC emissions from the solvents use; gathering additional activity data to include new emission sources (e.g. venting and flaring; use of fireworks); developing more detailed uncertainty evaluation for air emission pollutants; further methodology development by applying higher tier of estimation methodology (especially for key categories). Emission data for large point sources (LPSs), reported in 2012 in an aggregated form due to statistical confidentiality will be prepared on an individual basis for next submission based on data reported to the national database (Poland's IIR, p. 5, 124).
Portugal	A detailed explanation of the sectoral future improvements is presented in each source-specific sub-chapter. A synthesis of the main development priorities are: further development of country-specific emissions factors for combustion in energy industries and development of the uncertainty analysis (Portugal's IIR, p. 13).
Romania	Improvements are planned in sector Energy: 1.A.3.c Railways: collecting fleet data by locomotive type for applying Tier 2 emissions estimation. 1.A.3.d.ii National navigation (Shipping): collecting navigating fleet data by engine type and fuel for applying Tier 2 emissions estimation. 1.A.4.a.i and 1.A.4.b.i Commercial/Institutional/Residential: collecting specific fuel consumption data by fuel type and sector at county level detail, for applying Tier 2 emissions estimation. 1.A.4.c.ii Agriculture/Forestry/Fishing: collecting specific data for machinery and internal combustion equipment from economic operators/institutions, for applying Tier 2 emissions estimation. 1.B.2.a Oil: gasoline distribution data is being collected, at county level. After validating with the Energy Balance, it could be used for a better estimation of NMVOC emissions arising from this source. 1.B.2.b Natural gas: natural gas extraction data is being collected, at county level. After validating with the Energy Balance, it could be used for a better estimation of NMVOC emissions.
Slovakia	No information on planned improvements.
Slovenia	Planned improvements relate to the subcategories Public electricity and heat production (1A1a), Stationary Combustion in manufacturing industries and construction (1A2a – 1A2fi), Fugitive emissions from solid fuels (1B1a), Residential: Stationary plants (1A4bi), International aviation (1A3a i (i)), Fugitive emissions from solid fuels (1B1a) and Municipal waste incineration (6Cc). (Slovenia's IIR, p. 187).
Spain	The most important areas of improvement are: • harmonising the inventory with other registries (e.g. PRTR); • continuing with the systematic review of emission factors, as per the EMEP/EEA Guidebook (2009 and 2013 editions); • quantitative estimation of uncertainty and improvements in the methodology for identifying key categories; • assumption of tasks for the development of a finer grid for the territorial breakdown of emissions inventory; • continuing with the revision of the inventory of persistent organic compounds. Improvements at sectoral level are also listed in Chapter 11.3. Improvement plans.
Sweden	All relevant data are under constant review. For future submissions, a number of actions are planned in order to improve the quality of the inventory for the energy sector, where appropriate (Sweden's IIR, p. 79). For the other sectors, there are no major improvements planned for the next submission.
United Kingdom	A number of improvements to the inventory are planned, although it is anticipated that not all improvements will be incorporated into the next version of the inventory. In general a number of changes will be made to the British inventory system to ensure consistency with the 2006 IPCC Good Practice Guidance, which will actually have a beneficial impact on some aspects of the non-GHG inventory. Planned improvements are relevant for NFR sectors 1, 2, 3, 4 and 6 (United Kingdom's IIR, pp. 201–203).

Note: Grey font denotes IIRs submitted in 2012 or 2013 (latest IIRs available).

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Appendix 1 Notation keys

Where methodological or data gaps in inventories exist, information on these gaps should be presented in a transparent manner. Parties should clearly indicate the sources not considered in their inventories, albeit included in the *EMEP/EEA air pollutant emission inventory guidebook —2013* (EMEP/EEA, 2013), and explain the reason for the exclusion. Similarly, each party should indicate if part of its territory has been excluded, and explain the reason for this. In addition, each party should use the notations presented below to fill the blanks in all the tables of the NFR inventory. This approach facilitates assessment of the completeness of emission data reports. The notations are as follows ([15]).

NO 'Not occurring' is used where an emissions source or process does not exist within a country.

NE 'Not estimated' is used where emissions occur, but have not been estimated or reported. Where 'NE' is used in an inventory, the party should indicate why emissions could not be estimated.

NA 'Not applicable' is used where a source exists, but relevant emissions are considered never to occur.

IE 'Included elsewhere' is used for emissions that are estimated and included in the inventory, but are not presented separately for the respective source. Where IE is used, the party should indicate where in the inventory the emissions from the displaced source category have been included, and should give the reasons for deviating from the expected category.

C 'Confidential' is used for emissions that are aggregated and included elsewhere in the inventory, because reporting at a disaggregated level could lead to the disclosure of confidential information. Where 'C' is used in an inventory, reference should be made to the protocol provision that authorises such practice.

NR 'Not relevant'. According to Article III, paragraph 9 in the emission reporting guidelines, emission inventory reporting should cover all years from 1980 onwards if data are available. However, 'NR' is introduced to ease the reporting where emissions are not strictly required by the different protocols, e.g. for some parties, this includes emissions of NMVOC prior to 1988.

If a party estimates emissions from country-specific sources, it should explicitly describe which source categories these are, as well as which methodologies, emission factors and activity data have been used for their estimation.

([15]) Further explanation and guidance concerning the use of these notation codes may be found in the EMEP emission reporting guidelines (UNECE, 2009).

Appendix 2 LRTAP Convention emission reporting programme for 2014

Emission data should be submitted to the EMEP CEIP by **15 February 2014**. IIRs should reach the centre no later than **15 March 2014**. Table A2.1 below summarises information contained in the revised emission reporting guidelines (UNECE, 2009).

Table A2.1 Summary of the information requested in the EMEP emission reporting guidelines

Description of contents	Pollutant(s)	Reporting years ([a])
Yearly: minimum (and **additional)**		
A. National totals		
1. Main pollutants	NO_X, NMVOC, SO_X, NH_3, CO	1980–2012
2. Particulate matter	$PM_{2.5}$, PM_{10}, TSPs	2000–2012
3. Heavy metals	Pb, Cd, Hg (As, Cr, Cu, Ni, Se, Zn)	1990–2012
4. Persistent organic pollutants	([b])	1990–2012
B. Sector emissions		
1. Main pollutants	NO_X, NMVOC, SO_X, NH_3, CO	1980–2012
2. Particulate matter	$PM_{2.5}$, PM_{10}, TSPs	2000–2012
3. Heavy metals	Pb, Cd, Hg (As, Cr, Cu, Ni, Se, Zn)	1990–2012
4. Persistent organic pollutants	([b])	1990–2012
C. Activity data	**Liquid fuels, solid fuels, gaseous fuels, biomass, other fuels, other activity**	**1990–2012**
5-yearly: minimum reporting		
D. Gridded data in the EMEP 50 × 50 km² grid (GNFR aggregated sectors) ([c])	**Main pollutants, PM, Pb, Cd, Hg, PAHs, HCH, HCB, PCBs, PCDD/Fs**	**2000 (optional), 2005 and 2010**
E. Emissions from large point sources (LPSs)	**Main pollutants, PM, HMs, PCDD/Fs, PAHs, HCB, HCH, PCBs**	**2000 (optional), 2005 and 2010**
F. Projected emissions and activity data		
1. National projections with measures	See Annex IV, Table IV 2A -WM in the emission reporting guidelines	2015, 2020, 2030 and 2050 and target years specified in protocols
2. National projections with additional measures	See Annex IV, Table IV 2A WAM in the emission reporting guidelines	2015, 2020, 2030 and 2050 and target years specified in protocols
3. National projected activity data with measures	See Annex IV, Table IV 2B-WM in the emission reporting guidelines	2015, 2020, 2030 and 2050 and target years specified in protocols
4. National projected activity data with additional measures	See Annex IV, Table IV 2BWAM in the emission reporting guidelines	2015, 2020, 2030 and 2050 and target years specified in protocols
5-yearly: additional reporting for review and assessment purposes		
VOC speciation/Height distribution/Temporal distribution		Parties are encouraged to review the information used for modelling at http://www.ceip.at/webdab-emission-database/emissions-as-used-in-emep-models/ (accessed 20 March 2014)
Land-use data/Mercury breakdown		
Percentage of toxic congeners of PCDD/F emissions		
Pre-1990 emissions of PAHs, HCB, PCDD/Fs and PCBs		
Information on natural emissions		

Note: ([a]) As a minimum, data for the base year of the relevant protocol and from the year of entry into force of that protocol and up to the latest year (current year – 2) should be reported.

([b]) Hexachlorobenzene (HCB), hexachlorocyclohexane (HCH), polychlorinated biphenyls (PCBs), dioxins/furans (PCDD/Fs), polycyclic aromatic hydrocarbons (PAHs) (see revised emission reporting guidelines).

([c]) NFR Aggregation for Gridding and LPSs.

Reporting format

Each party should use the reporting format set out in Annex IV of the reporting guidelines (UNECE, 2009) for its annual submissions. The information should be formally submitted to the CEIP, with notification to the UNECE secretariat, preferably in electronic form. The reporting format, including the NFR, is a standardised format for reporting estimates of emissions — i.e. the NFR format — including activity data, projected activity data, projected emissions and other relevant information. The reporting format aims to facilitate electronic submissions to simplify the processing of emissions information and the preparation of useful technical analyses and synthesis documentation.

The reporting format covers:

- national annual emissions and national annual sector emissions using NFR09 (Annex IV, Table 1);
- total and aggregated sector emissions for reporting emissions of NO_X, NMVOC, sulphur, NH_3, PM, CO, Pb, Cd, Hg, PCDD/Fs, PAHs, HCB, HCH and PCBs, for the EMEP grid squares of 50 km × 50 km and emissions from LPSs (Annex IV, Tables IV 3A gridded and IV 3B LPSs);
- for the years 2015, 2020, 2030 and 2050, projected activity data and projected national total emissions of sulphur, NO_X, NH_3 and NMVOC to be reported for the source categories listed in Annex IV (2A-WM, 2BWM, 2A-WaM, 2BWaM).

Table A2.2 European Union — country grouping

EU-9	refers to the 9 Member States, up to 31 December 1980: Belgium (BE), Denmark (DK), France (FR), Germany (DE), Ireland (IE), Italy (IT), Luxembourg (LU), Netherlands (NL), and United Kingdom (UK)
EU-12	refers to the 12 Member States, up to 31 December 1994: EU-9 Member States plus Greece (GR), Portugal (PT) and Spain (ES)
EU-15	refers to the 15 Member States, up to 30 April 2003: EU-12 Member States plus Austria (AT), Finland (FI), and Sweden (SE)
EU-27	refers to the 27 Member States up to 30 June 2013: EU-15 Member States plus Bulgaria (BG), Cyprus (CY), Czech Republic (CZ), Estonia (EE), Hungary (HU), Latvia (LV), Lithuania (LT), Malta (MT), Poland (PL), Romania (RO) Slovakia (SK), and Slovenia (SI)
EU-28	refers to the 28 Member States, from 1 July 2013: EU-27 Member States plus Croatia (HR)

Appendix 3 Status of reporting

Table A3.1 Member State inventory submissions 2014: date received by the EEA, years covered and information provided (cut-off date: 12 May 2014)

	Annual reporting						Minimum 5 year reporting		
Member State	**Submission date (a)**	**Date of resubmission and/or additional information**	**NFR template**	**Other format**	**IIR 2014**	**Activity data (b)**	**Projections**	**Gridded data**	**LPS emissions**
Austria	13.02.2014		2009-1		13.03.2014, 25.04.2014	1980–2012	2015, 2020, 2030	np	np
Belgium	15.02.2014		2009-1		14.03.2014	1990–2012	2015, 2020, 2030	np	np
Bulgaria	14.02.2014	06.03.2014	2009-1		14.03.2014	1990–2012	2015, 2020	np	np
Croatia	14.02.2014		2009-1		13.03.2014, 31.03.2014	1990–2012	2015, 2020	2010	2012
Cyprus	14.02.2014		2009-1		14.03.2014	2008–2012	2015, 2020, 2030, 2050	2012	2012
Czech Republic	15.02.2014	03.03.2014, 26.03.2014	2009-1		np	2011, 2012	np	np	np
Denmark	13.02.2014		2009-1		14.03.2014	1980–2012	2015, 2020, 2030	np	np
Estonia	12.02.2014	07.03.2014	2009-1		14.03.2014	1990–2012	2015, 2020	np	np
Finland	14.02.2014	28.02.2014	2009-1		14.03.2014	1990–2012	2015, 2020, 2030	2012	2012
France	14.02.2014		2009-1		14.03.2014	1980–2012	2015, 2020	np	np
Germany	11.02.2014		2009-1		11.02.2014	1990–2012	2015, 2020, 2030	np	np
Greece	26.02.2014	12.03.2014	2009-1		25.04.2014	np	2015, 2020	np	np
Hungary	18.02.2014	12.05.2014	2009-1		np	1990–2012	np	np	np
Ireland	14.02.2014		2009-1		14.03.2014	1990–2012	np	np	np
Italy	26.02.2014	06.03.2014	2008-1		15.04.2014	1990–2012	np	np	np
Latvia	15.02.2014	15.03.2014	2009-1		17.03.2014	1990–2012	2015, 2020, 2030	np	np
Lithuania	10.02.2014		2009-1		12.03.2014	1990–2012	2015, 2020, 2030	2005, 2010	2010
Luxembourg	09.05.2014		2009-1		np	1990–2012	np	np	np
Malta	14.02.2014		2009-1		np	2000–2012	np	np	np
Netherlands	13.02.2014		2009-1		14.03.2014	1990–2012	2020, 2030	np	np
Poland	10.02.2014	10.03.2014	2009-1		10.03.2014	1995–2012	np	np	np
Portugal	14.02.2014	27.03.2014	2009-1		15.03.2014, 27.03.2014	1990–2012	np	np	np
Romania	14.02.2014	14.03.2014	2009-1		14.03.2014	1989, 2005–2012	2015, 2020, 2030	np	np
Slovakia	14.02.2014		2009-1		11.03.2014	2000–2012	2015, 2020, 2030, 2050	np	np
Slovenia	07.02.2014		2009-1		12.03.2014	1990–2012	2015, 2020, 2030	np	np
Spain	14.02.2014		2009-1	Level 1 (1980–1989)	14.03.2014	1990–2012	2015, 2020, 2030	1990–2012	1990–2012
Sweden	13.02.2014		2009-1		13.02.2014	1990–2012	np	np	np
United Kingdom	14.02.2014	19.03.2014	2009-1		14.03.2014	1990–2012	2015, 2020, 2030	np	np

Note: (a) Refers to the first submission of inventory data to the CDR; submission of other data is possible at later dates.
(b) Activity data reported in 2014.
IIR: informative inventory report; np: not provided.
Red coloured dates means that data were submitted after the formal deadline for submissions (15 February).

Table A3.2 Member States' LRTAP Convention submissions of 2014 (as of 12 May 2014)

Member State	NO_x, NMVOC, SO_x, NH_3, CO	$PM_{2.5}$, PM_{10}	TSP ([b])	Pb, Cd, Hg	Additional HMs ([a])	POPs (PCDD/F, PAHs, HCB, HCH, PCBs)
Austria	1980–2012	1990–2012	1990–2012	1985–2012	np	1985–2012
Belgium	1990–2012	2000–2012	2000–2012	1990–2012	1990–2012	1990–2012
Bulgaria	1990–2012	1990–2012	1990–2012	1990–2012	1990–2012	1990–2012
Cyprus	2008–2012	2008–2012	2008–2012	2008–2012	2008–2012	2008–2012
Czech Republic	2011, 2012	2011, 2012	2011, 2012	2011, 2012	2011, 2012	2011, 2012
Denmark	1980–2012	2000–2012	2000–2012	1990–2012	1990–2012	1990–2012
Estonia	1990–2012	2000–2012	1990–2012	1990–2012	1990–2012	1990–2012
Finland	1980–2012	2000–2012	2000–2012	1990–2012	1990–2012	1990–2012
France	1980–2012	1990–2012	1990–2012	1990–2012	1990–2012	1990–2012
Germany	1990–2012	1995–2012	1990–2012	1990–2012	1990–2012	1990–2012
Greece	1987, 1990–2012	np	np	np	np	np
Hungary	1990–2012	2000–2012	2000–2012	1990–2012	1990–2012	1990–2012
Ireland	1987, 1990–2012	1990–2012	1990–2012	1990–2012	1990–2012	1990–2012
Italy	1980–2012	1990–2012	1990–2012	1990–2012	1990–2012	1990–2012
Latvia	1990–2012	2000–2012	2000–2012	1990–2012	1990–2012	1990–2012
Lithuania	1990–2012	1990–2012	1990–2012	1990–2012	1990–2012	1990–2012
Luxembourg	1990–2012	1990–2012	1990–2012	np	np	np
Malta	2000–2012	2000–2012	2000–2012	2000–2012	2000–2012	2010–2012
Netherlands	1990–2012	1990–2012	1990–2012	1990–2012	1990–2012	1990–2012
Poland	1995–2012	1995–2012	1995–2012	1995–2012	1995–2012	1995–2012
Portugal	1990–2012	1990–2012	1990–2012	1990–2012	1990–2012	1990–2012
Romania	2005–2012	2005–2012	2005–2012	2005–2012	2005–2012	1989, 2005–2012
Slovakia	2000–2012	2000–2012	2000–2012	2000–2012	2000–2012	2000–2012
Slovenia	1980–2012	2000–2012	2000–2012	1990–2012	np	1990–2012
Spain	1990–2012	2000–2012	2000–2012	1990–2012	1990–2012	1990–2012
Sweden	1990–2012	1990–2012	1990–2012	1990–2012	1990–2012	1990–2012
United Kingdom	1980–2012	1980–2012	1980–2012	1980–2012	1980–2012	1990–2012

Note: ([a]) HMs: heavy metals. Reporting of additional HMs is not mandatory.
([b]) TSPs: total suspended particulates. Reporting of TSPs is not required if a Member State reports PM emissions.

Appendix 4 Conversion chart for aggregated sector groups

To enable the presentation of sectoral emission trends (Chapter 3), individual NFR source categories for the EU-28 inventory were aggregated into the following main sector groups:

- Energy production and distribution
- Energy use in industry
- Industrial processes
- Solvent and product use
- Commercial, institutional and households (energy use)
- Road transport
- Non-road transport
- Agriculture
- Waste.

A conversion chart showing which of the individual NFR source categories was included in each of the aggregated sector groups is provided in Table A5.1.

Table A4.1 Conversion chart for aggregated sector groups

NFR Code	Full name	EEA aggregated sector name
1 A 1 a	1 A 1 a Public electricity and heat production	Energy production and distribution
1 A 1 b	1 A 1 b Petroleum refining	Energy production and distribution
1 A 1 c	1 A 1 c Manufacture of solid fuels and other energy industries	Energy production and distribution
1 A 2 a	1 A 2 a Stationary combustion in manufacturing industries and construction: Iron and steel	Energy use in industry
1 A 2 b	1 A 2 b Stationary combustion in manufacturing industries and construction: Non-ferrous metals	Energy use in industry
1 A 2 c	1 A 2 c Stationary combustion in manufacturing industries and construction: Chemicals	Energy use in industry
1 A 2 d	1 A 2 d Stationary combustion in manufacturing industries and construction: Pulp, paper and print	Energy use in industry
1 A 2 e	1 A 2 e Stationary combustion in manufacturing industries and construction: Food processing, beverages and tobacco	Energy use in industry
1 A 2 f i	1 A 2 f i Stationary combustion in manufacturing industries and construction: Other (Please specify in your IIR)	Energy use in industry
1 A 2 f ii	1 A 2 f ii Mobile Combustion in manufacturing industries and construction: (Please specify in your IIR)	Energy use in industry
1 A 3 a ii (i)	1 A 3 a ii (i) Civil aviation (Domestic, LTO)	Non-road transport
1 A 3 a i (i)	1 A 3 a i (i) International aviation (LTO)	Non-road transport
1 A 3 b i	1 A 3 b i Road transport: Passenger cars	Road transport
1 A 3 b ii	1 A 3 b ii Road transport: Light duty vehicles	Road transport
1 A 3 b iii	1 A 3 b iii Road transport: Heavy-duty vehicles	Road transport
1 A 3 b iv	1 A 3 b iv Road transport: Mopeds and motorcycles	Road transport
1 A 3 b v	1 A 3 b v Road transport: Gasoline evaporation	Road transport
1 A 3 b vi	1 A 3 b vi Road transport: Automobile tyre and brake wear	Road transport
1 A 3 b vii	1 A 3 b vii Road transport: Automobile road abrasion	Road transport
1 A 3 c	1 A 3 c Railways	Non-road transport
1 A 3 d i (ii)	1 A 3 d i (ii) International inland waterways	Non-road transport
1 A 3 d ii	1 A 3 d ii National navigation (Shipping)	Non-road transport
1 A 3 e	1 A 3 e Pipeline compressors	Energy production and distribution
1 A 4 a i	1 A 4 a i Commercial/institutional: Stationary	Commercial, institutional and households
1 A 4 a ii	1 A 4 a ii Commercial/institutional: Mobile	Commercial, institutional and households

Table A4.1 Conversion chart for aggregated sector groups (cont.)

NFR Code	Full name	EEA aggregated sector name
1 A 4 b i	1 A 4 b i Residential: Stationary plants	Commercial, institutional and households
1 A 4 b ii	1 A 4 b ii Residential: Household and gardening (mobile)	Commercial, institutional and households
1 A 4 c i	1 A 4 c i Agriculture/forestry/fishing: Stationary	Commercial, institutional and households
1 A 4 c ii	1 A 4 c ii Agriculture/forestry/fishing: Off-road vehicles and other machinery	Commercial, institutional and households
1 A 4 c iii	1 A 4 c iii Agriculture/forestry/fishing: National fishing	Non-road transport
1 A 5 a	1 A 5 a Other stationary (including military)	Commercial, institutional and households
1 A 5 b	1 A 5 b Other, Mobile (including military, land-based and recreational boats)	Commercial, institutional and households
1 B 1 a	1 B 1 a Fugitive emission from solid fuels: Coal mining and handling	Energy production and distribution
1 B 1 b	1 B 1 b Fugitive emission from solid fuels: Solid fuel transformation	Energy production and distribution
1 B 1 c	1 B 1 c Other fugitive emissions from solid fuels	Energy production and distribution
1 B 2 a i	1 B 2 a i Exploration, production, transport	Energy production and distribution
1 B 2 a iv	1 B 2 a iv Refining/storage	Energy production and distribution
1 B 2 a v	1 B 2 a v Distribution of oil products	Energy production and distribution
1 B 2 b	1 B 2 b Natural gas	Energy production and distribution
1 B 2 c	1 B 2 c Venting and flaring	Energy production and distribution
1 B 3	1 B 3 Other fugitive emissions from geothermal energy production, peat and other energy extraction not included in 1 B 2	Energy production and distribution
2 A 1	2 A 1 Cement production	Industrial processes
2 A 2	2 A 2 Lime production	Industrial processes
2 A 3	2 A 3 Limestone and dolomite use	Industrial processes
2 A 4	2 A 4 Soda ash production and use	Industrial processes
2 A 5	2 A 5 Asphalt roofing	Industrial processes
2 A 6	2 A 6 Road paving with asphalt	Industrial processes
2 A 7 a	2 A 7 a Quarrying and mining of minerals other than coal	Industrial processes
2 A 7 b	2 A 7 b Construction and demolition	Industrial processes
2 A 7 c	2A 7 c Storage, handling and transport of mineral products	Industrial processes
2 A 7 d	2 A 7 d Other mineral products (Please specify the sources included/ excluded in the notes column to the right)	Industrial processes
2 B 1	2 B 1 Ammonia production	Industrial processes
2 B 2	2 B 2 Nitric acid production	Industrial processes
2 B 3	2 B 3 Adipic acid production	Industrial processes
2 B 4	2 B 4 Carbide production	Industrial processes
2 B 5 a	2 B 5 a Other chemical industry (Please specify the sources included/ excluded in the notes column to the right)	Industrial processes
2 B 5 b	2 B 5 b Storage, handling and transport of chemical products (Please specify the sources included/excluded in the notes column to the right)	Industrial processes
2 C 1	2 C 1 Iron and steel production	Industrial processes
2 C 2	2 C 2 Ferroalloys production	Industrial processes
2 C 3	2 C 3 Aluminium production	Industrial processes
2 C 5 a	2 C 5 a Copper production	Industrial processes
2 C 5 b	2 C 5 b Lead production	Industrial processes
2 C 5 c	2 C 5 c Nickel production	Industrial processes
2 C 5 d	2 C 5 d Zinc production	Industrial processes
2 C 5 e	2 C 5 e Other metal production (Please specify the sources included/ excluded in the notes column to the right)	Industrial processes
2 C 5 f	2 C 5 f Storage, handling and transport of metal products (Please specify the sources included/excluded in the notes column to the right)	Industrial processes
2 D 1	2 D 1 Pulp and paper	Industrial processes
2 D 2	2 D 2 Food and drink	Industrial processes

Table A4.1 Conversion chart for aggregated sector groups (cont.)

NFR Code	Full name	EEA aggregated sector name
2 D 3	2 D 3 Wood processing	Industrial processes
2 E	2 E Production of POPs	Industrial processes
2 F	2 F Consumption of POPs and heavy metals (e.g. electrical and scientific equipment)	Industrial processes
2 G	2 G Other production, consumption, storage, transportation or handling of bulk products (Please specify the sources included/excluded in the notes column to the right)	Industrial processes
3 A 1	3 A 1 Decorative coating application	Solvent and product use
3 A 2	3 A 2 Industrial coating application	Solvent and product use
3 A 3	3 A 3 Other coating application (Please specify the sources included/ excluded in the notes column to the right)	Solvent and product use
3 B 1	3 B 1 Degreasing	Solvent and product use
3 B 2	3 B 2 Dry cleaning	Solvent and product use
3 C	3 C Chemical products	Solvent and product use
3 D 1	3 D 1 Printing	Solvent and product use
3 D 2	3 D 2 Domestic solvent use including fungicides	Solvent and product use
3 D 3	3 D 3 Other product use	Solvent and product use
4 B 1 a	4 B 1 a Cattle dairy	Agriculture
4 B 1 b	4 B 1 b Cattle non-dairy	Agriculture
4 B 2	4 B 2 Buffalo	Agriculture
4 B 3	4 B 3 Sheep	Agriculture
4 B 4	4 B 4 Goats	Agriculture
4 B 6	4 B 6 Horses	Agriculture
4 B 7	4 B 7 Mules and asses	Agriculture
4 B 8	4 B 8 Swine	Agriculture
4 B 9 a	4 B 9 a Laying hens	Agriculture
4 B 9 b	4 B 9 b Broilers	Agriculture
4 B 9 c	4 B 9 c Turkeys	Agriculture
4 B 9 d	4 B 9 d Other poultry	Agriculture
4 B 13	4 B 13 Other	Agriculture
4 D 1 a	4 D 1 a Synthetic N-fertilisers	Agriculture
4 D 2 a	4 D 2 a Farm-level agricultural operations including storage, handling and transport of agricultural products	Agriculture
4 D 2 b	4 D 2 b Off-farm storage, handling and transport of bulk agricultural products	Agriculture
4 D 2 c	4 D 2 c N-excretion on pasture range and paddock unspecified (Please specify the sources included/excluded in the notes column to the right)	Agriculture
4 F	4 F Field burning of agricultural wastes	Agriculture
4 G	4 G Agriculture other (c)	Agriculture
6 A	6 A Solid waste disposal on land	Waste
6 B	6 B Wastewater handling	Waste
6 C a	6 C a Clinical waste incineration (d)	Waste
6 C b	6 C b Industrial waste incineration (d)	Waste
6 C c	6 C c Municipal waste incineration (d)	Waste
6 C d	6 C d Cremation	Waste
6 C e	6 C e Small scale waste burning	Waste
6 D	6 D Other waste (e)	Waste
7 A	7 A Other (included in national total for entire territory)	Other

Note: LTO: Landing/take-off.

Appendix 5 Member State informative inventory reports (IIRs)

Table A5.1 List of submitted IIRs including source and date of submission (cut-off date 12 May 2014)

Country code	Title of informative inventory report	Source	Date of submission
AT	Austria's IIR 2014. Submission under the UNECE Convention on Long-range Transboundary Air Pollution	http://cdr.eionet.europa.eu/at/un/CLRTAP_AT/envuyb_cw/AT_IIR2014.pdf/manage_document	13.3.2014 25.4.2014
BE	IIR on Belgium's annual submission of air emission data reported in February 2014 under the Convention on Long-Range Transboundary Air Pollution (CLRTAP)	http://cdr.eionet.europa.eu/be/un/UNECE_CLRTAP_BE/envuynhcq/IIR_BE_2014.docx/manage_document	15.3.2014
BG	Bulgarian IIR National Emissions Inventory for year 2012. 2014 Submission under the UNECE Convention on Long-Range Transboundary Air Pollution (CLRTAP/EMEP)	http://cdr.eionet.europa.eu/bg/un/copy_of_UNECE_CLRTAP_BG/envuymy4g/BG-IIR_2014_15_March_2014.pdf	15.3.2014
CY	Cyprus IIR 2012	http://cdr.eionet.europa.eu/cy/un/UNECE_CLRTAP_CY/envuylxra/20140314-CyprusInformativeInventoryReport2012.pdf	14.3.2014
CZ	No IIR available		
DE	IIR DE 2014. German IIR	http://iir-de.wikidot.com/start	24.2.2014
DK	Annual Danish IIR to UNECE. Emission inventories from the base year of the protocols to year 2012	http://cdr.eionet.europa.eu/dk/Air_Emission_Inventories/Submission_EMEP_UNECE/envuyltzq/Danish_Informative_Inventory_Report_2014.pdf	14.3.2014
EE	Estonian IIR 1990-2012. Submitted under the Convention on Long-Range Transboundary Air Pollution (CLRTAP)	http://cdr.eionet.europa.eu/ee/un/UNECE_CLRTAP_EE/envuyku2w/Estonian_IIR_2014.pdf/manage_document	14.3.2014
ES	Inventario de Emisiones de España Años 1990-2012. Submission to the Secretariat of the Geneva Convention and EMEP Programme	http://cdr.eionet.europa.eu/es/un/UNECE_CLRTAP_ES/envuymkxg/SPAIN_INVENTORY_TO_CLRTAP-EMEP_Submission_2014__IIR_.zip/manage_document	14.3.2014
FI	Air Pollutant Emissions in Finland 1990–2012. IIR to the UNECE CLRTAP, 14th March 2014	http://cdr.eionet.europa.eu/fi/un/UNECE_CLRTAP_FI/envuylxpw/FI_IIR2014_14March2014_Part1.pdf/manage_document http://cdr.eionet.europa.eu/fi/un/UNECE_CLRTAP_FI/envuylxpw/FI_IIR2014_14March2014_Part2.pdf/manage_document	14.3.2014
FR	Inventaire des émissions de polluants atmosphériques en France au titre de la convention sur la pollution atmosphérique transfrontalière à longue distance et de la directive Européenne relative aux plafonds d'émissions nationaux (NEC)	http://cdr.eionet.europa.eu/fr/eu/colqhxdtq/envuyl6cw/UNECE_mars2014.pdf	14.3.2014
GB	UK IIR (1980 to 2012)	http://cdr.eionet.europa.eu/gb/un/cols3f2jg/envuyhs4q/UK_IIR_2014_Final.pdf/manage_document	13.3.2014
GR	Informative Inventory Report 2014. Greece. Submitted under the Convention on Long-Range Transboundary Air Pollution	http://cdr.eionet.europa.eu/gr/un/colpovzow/envu1ordw/2014_IIR_GR.pdf/manage_document	25.4.2014
HR	Republic of Croatia IIR for 2012	http://cdr.eionet.europa.eu/hr/un/UNECE_CLRTAP_HR/coluygkq/envuzlqaw/INFORMATIVE_INVENTORY_REPORT_CROATIA_2014_resubmission.pdf	13.3.2014 31.3.2014

Table A5.1 List of submitted IIRs including source and date of submission (cut-off date 12 May 2014) (cont.)

Country code	Title of informative inventory report	Source	Date of submission
HU	No IIR available		
IE	Ireland IIR 2014. Air Pollutant Emissions in Ireland 1990-2012 reported to the Secretariat of the UN/ECE Convention on Long-range Transboundary Air Pollution (CLRTAP)	http://cdr.eionet.europa.eu/ie/un/coluv4fsg/coluv4frw/coluv4hrq/envuylnba/Ireland_IIR_2014_FINAL.pdf/manage_document	14.3.2014
IT	Italian Emission Inventory 1990-2012. Informative Inventory Report 2014	http://groupware.sinanet.isprambiente.it/reportnet/library/ae1sclrtapsandsnecsdata/ae-1-clrtap-data-2014/iir-2014-italy	15.4.2014
LV	Latvia's IIR 1990 – 2012	http://cdr.eionet.europa.eu/lv/un/copy_of_colqhgwdg/envuyzega/Latvia_IIR_2014.pdf/manage_documen	17.3.2014
LT	Lithuania's National Inventory Report 2014. Emission Inventories 1990-2012	http://cdr.eionet.europa.eu/lt/un/UNECE_CLRTAP_LT/envuyaz3a/IIR_2012_.doc/manage_document	12.3.2014
LU	No IIR available		
MT	No IIR available		
NL	Emissions of transboundary air pollutants in the Netherlands 1990-2012. IIR 2014	http://cdr.eionet.europa.eu/nl/eu/colqt3lza/envuyhfuq/NL_IIR_2014.pdf/manage_document	14.3.2014
PL	Poland's IIR 2014. Submission under UN ECE Convention on Long-range Transboundary Air Pollution (CLRTAP)	http://cdr.eionet.europa.eu/pl/un/EMEP%20emissions%20data/envux1yea/IIR_Poland_2014.pdf/manage_document	10.3.2014
PT	Portuguese IIR 1990-2012 submitted under the UNECE Convention on Long-range Transboundary Air Pollution (CLRTAP)	http://cdr.eionet.europa.eu/pt/un/UNECE_CLRTAP_PT/envuzqfya/IIR_global_20140325.pdf/manage_document	15.3.2014 27.3.2014
RO	Romania's IIR 2014. Submission under UNECE Convention on Long-range Transboundary Air Pollution (CLRTAP)	http://cdr.eionet.europa.eu/ro/un/UNECE_CLRTAP_RO/envuymdua/RO_IIR_2014.docx/manage_document	14.3.2014
SE	IIR Sweden 2014. Submitted under the Convention on Long-Range Transboundary Air Pollution (CLRTAP)	http://cdr.eionet.europa.eu/se/un/colqgyzla/envuvic5a/IIR_submission_2014_SE__2014-02-12_.pdf	13.2.2014
SI	IIR 2014 for Slovenia. Submission under the UNECE Convention on Long-Range Transboundary Air Pollution (CLRTAP)	http://cdr.eionet.europa.eu/si/un/UNECE_CLRTAP_SI/coluvs2hw/envuybbnw/IIR_2014_Slovenia.pdf/manage_document	12.3.2014
SK	Slovak Republic: IIR 2014 Under the Convention on Long-range Transboundary Air Pollution (CLRTAP)	http://cdr.eionet.europa.eu/sk/un/UNECE_CLRTAP_SK/envux8oia/IIR_Slovakia_2014_Final.pdf/manage_document	11.3.2014

European Environment Agency

European Union emission inventory report 1990–2012 under the UNECE Convention on Long-range Transboundary Air Pollution (LRTAP)

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