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European Union emission inventory report 1990–2011 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
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
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
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
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)
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)
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 are provided as an official submission to the Executive Secretary of UNECE by the European Commission on behalf of the EU as a party. 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 a large number of 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 (see Figure ES.1).

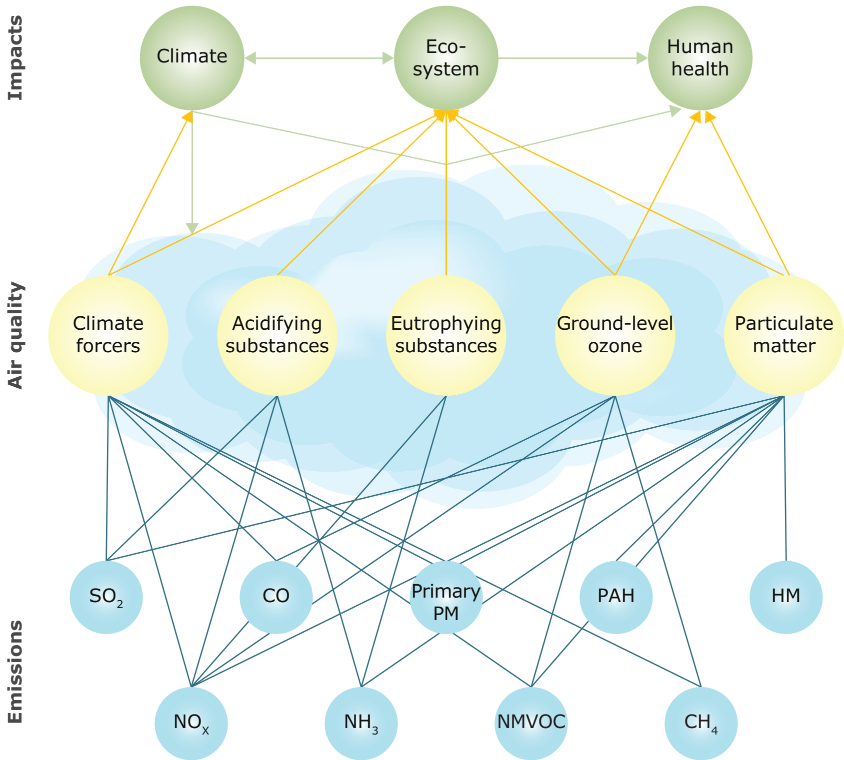
This report describes:

- the institutional arrangements and preparation processes that underpin the EU's emission inventory, methods and data sources for this report and the key category analyses (Chapter 1);
- emission trends for the EU-27 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, completeness, underestimations and planned and implemented improvements (Chapter 4).

Emissions data presented in this report are included as accompanying annexes and are also available for direct download through the EEA's data service ([1]) (EEA, 2013a).

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

Figure ES.1 Major air pollutants grouped in terms of impacts on human health, ecosystems and the climate



Note: The pollutants shown (left to right) are sulphur dioxide (SO_2), nitrogen oxides (NO_x), carbon monoxide (CO), ammonia (NH_3), primary particulate matter (PM), non-methane volatile organic compounds (NMVOC), polycyclic aromatic hydrocarbons (PAHs), methane (CH_4) and heavy metals (HMs).

Box ES.1 Main air pollutants and their effects on human health and the environment

Sulphur dioxide (SO_2)
SO_2 is emitted when fuels containing sulphur are burned. It contributes to acid deposition, the impacts of which can be significant: adverse effects on aquatic ecosystems in rivers and lakes, and damage to forests. Further, the formation of sulphate particles results in reflection of solar radiation, which leads to net cooling of the atmosphere.

Nitrogen oxides (NO_x)
NO_x are emitted during fuel combustion, as practiced by industrial facilities and the road transport sector. As with SO_2, NO_x contribute to acid deposition but also to eutrophication of soil and water. Of the chemical species that NO_x comprises, it is nitrogen dioxide (NO_2) that is associated with adverse effects on health: high concentrations cause inflammation of the airways and reduced lung function. NO_x also contribute to the formation of secondary inorganic particulate matter and tropospheric (ground-level) ozone (O_3) with associated climate effects.

Ammonia (NH_3)
NH_3, like NO_x, contributes to both eutrophication and acidification. The vast majority of NH_3 emissions — around 94% in Europe — come from the agricultural sector, in connection with activities and practices such as manure storage, slurry spreading and the use of synthetic nitrogenous fertilisers.

Non-methane volatile organic compounds (NMVOC)
NMVOC, important O_3 precursors, are emitted from a large number of sources including paint application, road transport, dry-cleaning and other solvent uses. Certain NMVOC species, such as benzene (C_6H_6) and 1,3-butadiene, are directly hazardous to human health. Biogenic NMVOC are emitted by vegetation, with amounts dependent on the species and on temperature.

Box ES.1 Main air pollutants and their effects on human health and the environment (cont.)

Particulate matter (PM)
In terms of potential to harm human health, PM is one of the most important pollutants; it penetrates into sensitive regions of the respiratory system. PM is emitted from many sources, and is a complex heterogeneous mixture comprising both primary and secondary PM; primary PM is the fraction of PM that is emitted directly into the atmosphere, whereas secondary PM forms in the atmosphere following the oxidation and transformation of precursor gases (mainly SO_2, NO_X, NH_3 and some volatile organic compounds (VOCs)). References to PM in this report are to primary PM.

Carbon monoxide (CO)
CO is produced as a result of fuel combustion. The road transport sector, businesses and households, and industry are important sources. Long-term exposure to low concentrations of CO can result in neurological problems and potential harm to unborn babies. CO can react with other pollutants to produce ground-level ozone. Elevated levels of ozone can cause respiratory health problems and can lead to premature mortality.

Polycyclic aromatic hydrocarbons (PAHs)/Benzo(a)pyrene (BaP)
PAHs are a large group of persistent organic pollutants (POPs) that contribute to different harmful effects in the environment and to human health. PAHs are released by combustion processes, as well as being emitted via evaporation from materials treated with creosote, mineral oils, pitch, etc. BaP is a specific PAH formed mainly from the burning of organic material such as wood, and from car exhaust fumes, especially from diesel vehicles. It is a known cancer-causing agent in humans. In Europe, BaP pollution is predominantly a problem in central and eastern Europe where domestic coal and wood burning is common.

Dioxins and furans (PCDD/Fs)
PCDDs and PCDFs are formed by the combustion of fuels and wastes, the processing of metals and the production of pulp and paper. Exposure to normal background levels of dioxins and furans is unlikely to cause health problems, although some PCDDs and PCDFs may cause cancer and may affect the unborn child in low concentrations. PCDDs and PCDFs are categorised as POPs, being persistent in the environment. Emissions to air will eventually be deposited on soil and/or waters. Livestock and wildlife can subsequently ingest them from soil and vegetation, with fish being susceptible to uptake from aquatic sediments.

Polychlorinated biphenyls (PCBs)
PCBs are used mainly as electrical insulating material in capacitors and transformers. The main source of releases has been from their manufacture and use, as well as during disposal of PCB-containing equipment. PCBs may cause cancer and can affect the unborn child. PCBs are toxic to wildlife, particularly aquatic organisms and bird predators of fish. They can cause serious reproductive and developmental problems and damage to the immune system. PCBs are categorised as POPs.

Hexachlorobenzene (HCB)
Before being banned, HCB was used as a fungicide on seeds; it is also used in the manufacture of chlorinated organic solvents. It is released to the environment as a by-product of coal burning, waste incineration and some metal processes. It has also been released through its use as a fungicide. The environment levels of HCB are not typically high enough to have significant health effects. However, HCB is classed as dangerous to the environment. The main concern for environmental releases is related to its persistence and ability to bioaccumulate in the food chain. High levels can build up in fish and marine mammals as well as in certain plants.

Hexachlorocyclohexane (HCH)
HCH is a family of organic compounds, the most common of which is gamma-HCH (lindane). Lindane has been used mainly as a timber insecticide. Releases of lindane to water damage insects and fish. It also accumulates in fish. Its ability to persist and accumulate in the environment means that lindane can travel long distances and have effects far from the point of emission. Emissions of HCH occur through its manufacture, use, storage and transport.

Heavy metals (HMs)
The HMs arsenic (As), cadmium (Cd), lead (Pb), mercury (Hg), chromium (Cr), copper (Cu), nickel (Ni), selenium (Se) and zinc (Zn) are emitted mainly as a result of various combustion processes and industrial activities, like metals works and smelters. As for BaP, HMs can reside in or be attached to PM. As well as polluting the air, HMs can be deposited on terrestrial or water surfaces, and subsequently build up in soils or sediments. HMs are persistent in the environment and may bioaccumulate in food chains.

EU-27 emission trends

Figure ES.2 presents the aggregated EU-27 emission trends of the main pollutants, particulates, HMs and POPs for the period from 1990 to 2011 ([2]).

Emission trend of main air pollutants between 1990 and 2011

Across the EU-27, the largest emission reduction of the main pollutants has been achieved for the acidifying pollutant SO_X. Emissions in 2011 were 82 % 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 (64 % reduction), NMVOC (59 % reduction) and NO_X (48 % reduction). In the road transport sector, emission reductions were achieved for these three pollutants, primarily through legislative measures requiring abatement of vehicle tailpipe emissions. NO_X emissions have dropped considerably in the electricity/energy generation sectors as a result of technical measures like 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, 2012a).

Box ES.2 Definition of the term 'emission trend' within this report

Emission trend(s)
Within this report, 'emission trend(s)' means increases and decreases of emission levels over time, i.e. the change of the emission data in the time series. The term 'emission trend(s)' is not used in a statistical respect.

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

Emission trend of main air pollutants between 2008 and 2010

Between 2008 and 2010, the main air pollutants decreased considerably (NO_X – 10 %, NMVOC – 8 %, SO_X – 19 % and NH_3 – 3 %). For NO_X, NMVOC and SO_X the greater decrease occurred between 2008 and 2009 (NO_X – 8 %, NMVOC – 8 %, SO_X – 14 %). The strong reduction observed between 2008 and 2009 did not continue between 2009 and 2010. These trends are influenced by economic developments, especially for those air pollutants resulting predominantly from energy production, industrial processes and road transport. The EU-27 gross domestic product (GDP) decreased between 2008 and 2009 by 6 %, while in the following year it increased by 4 % (Eurostat, 2013) ([3]). Other air pollutants stemming largely from the residential sector (like NMVOC, PM or CO) are less dependent on the economic situation; NH_3, likewise, is mainly the result of agricultural activities.

The Member States contributing — in absolute terms — most to the decrease of NO_X and NMVOC between the years 2008 and 2010 are France, Italy, Spain and the United Kingdom. Bulgaria, Greece and Romania contributed most to bringing down SO_X emissions between 2008 and 2010. This is mainly attributable to emission reductions from the energy sector (i.e. power plants) as a result of the economic downturn (EEA, 2012f).

Emission trend of main air pollutants between 2010 and 2011

Emissions of NO_X and SO_X dropped by 3.3 % and 0.1 %, respectively, between 2010 and 2011. NH_3 emissions increased by 0.4 %. NMVOC and CO

([2]) By 15 February each year, Member States must report emission data for years up until the current year, minus two. Thus by 15.02.2013, Member States were obliged to report for the years until 2011. Emission inventory data (both for air pollutants and greenhouse gases, GHGs) can typically only be compiled and reported by countries with around a 12-to-15-month delay. 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 performing QA/QC checks.

([3]) Eurostat data; GDP at market prices.

emissions decreased by 3.6 % and 7.0 % between 2010 and 2011 after increases in the previous year.

The reduction in NO_X emissions is mainly due to reductions reported in the United Kingdom, France and Germany. These countries reported in their informative inventory reports (IIRs) (Appendix 5), that NO_X emissions dropped from 1990 to 2011 thanks to stricter regulations and emission standards resulting in technical improvements and improved fuels, and to a decline in the use of solid and liquid fuels.

Between 2010 and 2011 NMVOC emissions decreased by 3.6 %, mainly due to emissions reductions in France, Germany and Greece. France, Germany and the United Kingdom reported in their IIRs (Appendix 5) that the decrease of NMVOC emissions from 1990 to 2011 is due to increasingly strict regulations and controls, resulting in more cars with catalytic converters, and reduced petrol consumption. Between 2010 and 2011 SO_X emissions decreased by 0.1 %. Poland, France and the United Kingdom reported the highest reductions.

Between 2010 and 2011, CO emissions decreased by 7.0 %, mainly due to reductions of emissions in France, Germany and Poland.

NH_3 emissions grew by 0.4 % between 2010 and 2011, with France and Germany reporting the highest increases. A total of 20 Member States reported a drop in these emissions, and 7 Member States noted an increase.

Emission trends of other air pollutants

Emissions for the main HMs (Pb, Cd, Hg), dioxins and furans, HCB, HCH 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 (in particular from industrial facilities). This has been achieved through improvements in abatement techniques for wastewater treatment and incinerators in metal refining and smelting industries, for instance; in some countries, it is due to the closure of older industrial facilities as a consequence of 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 which emissions remained stable over the years, reductions since 1990 are reported for additional HMs (As − 63 %, Cr − 74 %, Ni − 64 %, Se − 12 % and Zn − 42 %), and for total PAHs − 58 %, and the PAHs BaP − 45 %, benzo(b)fluoranthene (BbF) − 25 %, benzo(k)fluoranthene (BkF) − 19 % and indeno(1,2,3-cd)pyrene (IP) − 14 %.

TSPs have seen a reduction of 50 % from 1990. For PM_{10} and $PM_{2.5}$, the aggregated EU-27 emission reduction achieved since 2000 is 19 % and 20 %, respectively. The total emissions of PM dropped mainly due to the introduction or improvement of abatement measures across the energy, road transport, and industry sectors, coupled with other developments in industrial sectors such as fuel switching from high-sulphur–containing fuels to low-sulphur–containing fuels.

EU-27 key categories and main emission sources

EU-27 key categories are the individual sources that overall contributed most to 2011 emissions of pollutants, determined by a level assessment [4] for each of the main air pollutants, PMs, priority HMs and the POPs [5].

A total of 50 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 15 pollutants assessed.

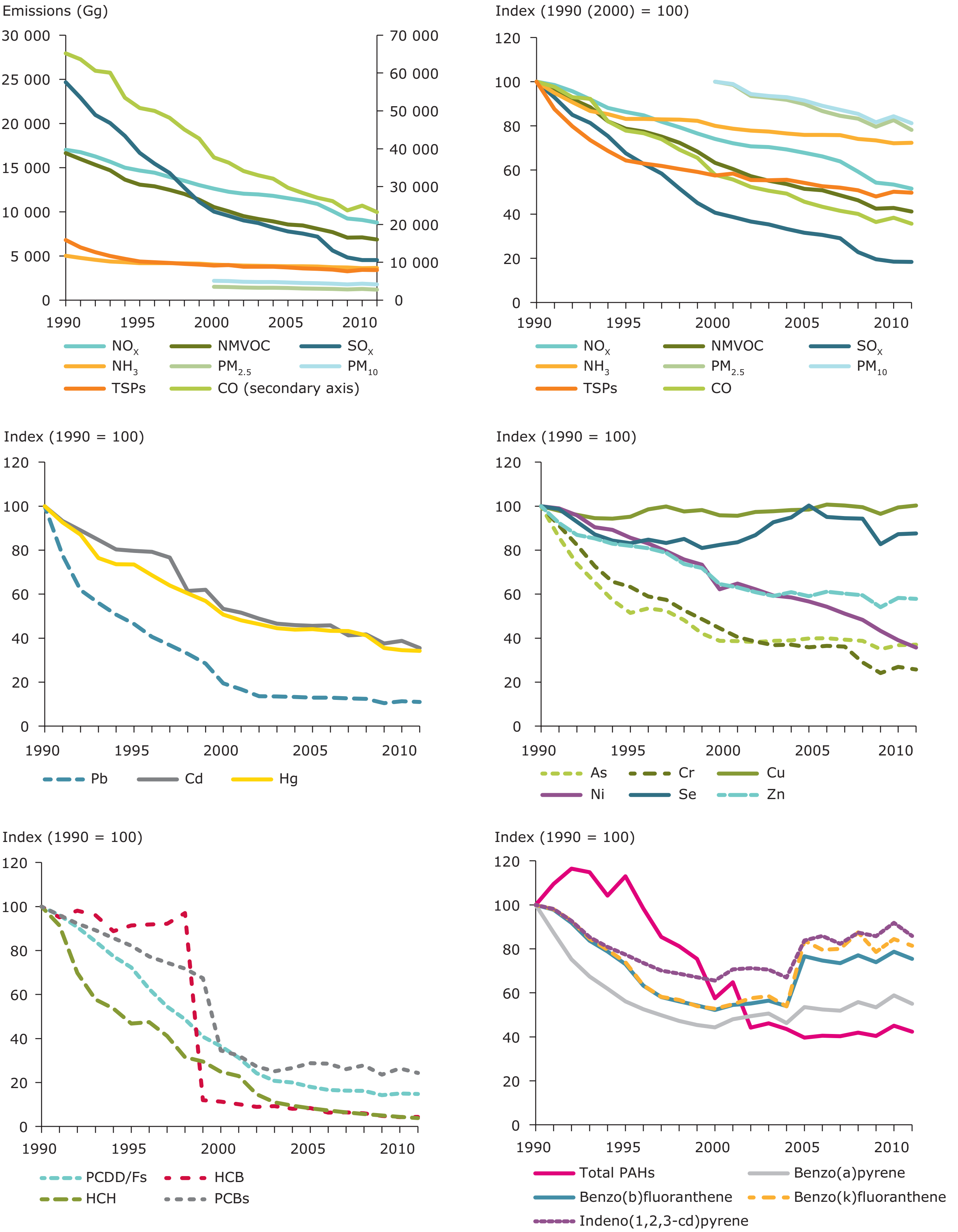
Figure ES.3 shows the share of EU-27 emissions by sector group. As observed in past years, each of the main air pollutants has one major source category: for NO_X this is road transport; for SO_X, energy production; for NH_3, agriculture; for NMVOC, solvent and product use; and for CO, commercial, institutional and households.

NO_X emissions from the road transport sector have decreased by 50 % since 1990. The road transport group is nevertheless a major source of the ozone precursors NO_X and CO in the EU; in 2011 it contributed 40 % and 26 % of total EU-27 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, while for CO,

(4) 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 together responsible for 80 % of the total emission of a given pollutant are classified as key categories (EMEP/EEA, 2009).

(5) NO_X, NMVOC, SO_X, NH_3, CO, $PM_{2.5}$, PM_{10}, Cd, Pb, Hg, PCBs, HCB, total PAHs, PCDD/Fs and HCH.

Figure ES.2 EU-27 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 only for the year 2000 and 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.

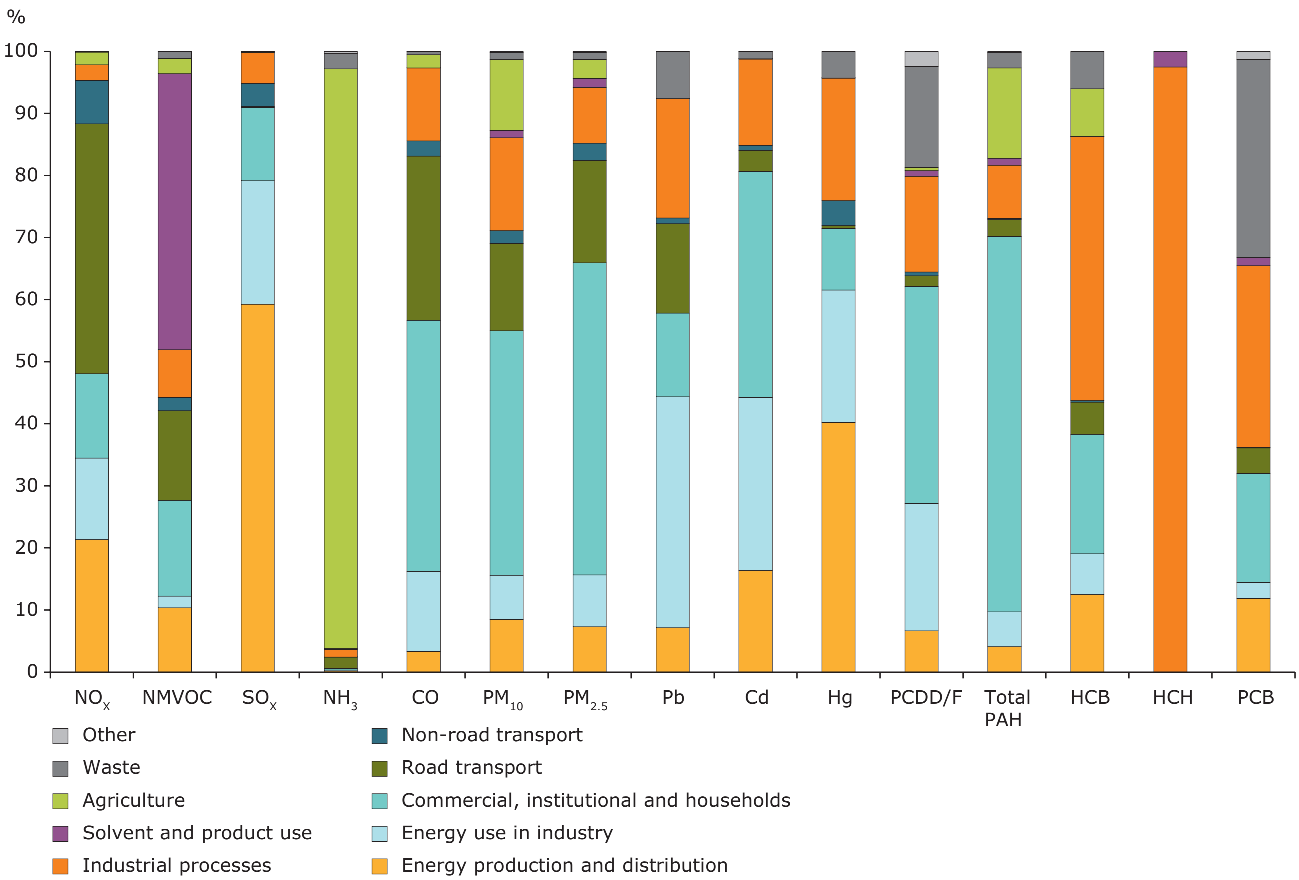
passenger cars alone contribute around 70 % (in 2011) of the emissions from the road transport sector.

The commercial, institutional and household sector emerged as 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.

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, Cd, Hg, HCB, PCDD/Fs, PM_{10}, $PM_{2.5}$, Pb, PCBs)
2 C 1 — Iron and steel production	10 times (CO, Cd, Hg, Pb, HCB, PCDD/Fs, PM_{10}, $PM_{2.5}$, PCBs, total PAHs)
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}, $PM_{2.5}$)
1 A 3 b i — Road transport: Passenger cars	6 times (NO_x, CO, NMVOC, PM_{10}, $PM_{2.5}$, HCB)

Figure ES.3 Share of EU-27 emissions of the main pollutants by sector group



The LRTAP Convention emission inventory report: changes in 2013 from 2012

The main difference between the 2012 LRTAP Convention emission inventory report and this year's report is the implementation of the recommendations of the Expert Review Team given in the framework of the Stage 3 review. This includes the following changes.

- The section on the general assessment of completeness (Section 1.8) was expanded. Figures on the completeness of reporting of NFR templates submitted by Member States (Figures 1.3 to 1.5) were extended; they now cover the years 1990, 2000, 2010 and 2011.

- Further, a new section on underestimations (Section 4.2) was included in the report. In this section, the use of the notation key 'NE' by Member States and its contribution to potential underestimation is analysed.

- Information on gap-filling and non-availability of data were included in the trend tables (Tables 2.3 to 2.28).

- Further, Table 1.8 on the effect of gap-filling on EU emission data was adjusted to the figures on completeness of reporting of NFR templates submitted by Member States (Figures 1.3 to 1.5), in order to render this information comparable.

- The section on quality assurance (QA), quality control (QC) and verification methods was extended (Section 1.6).

- The procedure of checking data submitted by Member States was described in detail (Section 1.6). This year, there was a greater focus on analysing the plausibility of sectoral trends.

- More explanatory information on trends and recalculations was provided (Chapters 2 and 3).

- This year, and for the first time, the quantitative uncertainty estimates provided by Member States are presented in this report (Table 1.13). For most pollutants, the data presented are a first indication of the range of uncertainty. Due to lack of information for all EU Member States, the data can not be considered as an uncertainty estimate for the EU-27 inventory.

Table ES.2 Changes in 2010 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)-fluoranthene	Benzo(k)-fluoranthene	Indeno-(1,2,3-cd)-pyrene	$PM_{2.5}$	PM_{10}
Type of change	↓	↓	↓	↓	→	→	→	→	↘	↓	↓

Note: Based on data submitted in 2012 and 2013.

→ 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 %.

Recalculations for the year 2010 made by Member States between the submission in 2012 and this year resulted in emission changes for all pollutants, although for NO_X, SO_X, NH_3, CO and Cu these are negligible. HCB and HCH changed the most; they decreased by 55 % and 33 % respectively, mostly due to changes in emission data of Spain.

In their IIRs (Appendix 5), Austria, Belgium, Bulgaria, Cyprus, Denmark, Estonia, Finland, France, Germany, Hungary, Ireland, Latvia, Lithuania, the Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden and the United Kingdom gave 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). 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) contains emission ceilings for 2010 and after that parties to the protocol must meet, for 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 has published its annual update of the NEC Directive Status Report (EEA, 2013b) in May 2013, which analyses the 2011 emission data for EU Member States reported under Directive 2001/81/EC, 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 in the Gothenburg Protocol.

Table ES.3 shows the aggregated emissions for the year 2011 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.

The compliance checking in this report is based on the reporting on the basis of fuel sold, except for Austria, Belgium, Ireland, Lithuania Luxemburg, the Netherlands and the United Kingdom. These countries may choose to use the national emission 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. NO_X is the only pollutant for which the 2011 emissions exceed the respective ceiling. For the remaining pollutants, the emissions in 2011 were below the respective pollutant ceilings.

Figure ES.4 shows whether the Gothenburg ceilings were met in 2011, for all EU Member States. Seven EU-15 Member States reported NO_X emissions higher than their ceilings in 2010, which resulted in non-achievement at EU-15 level. In 2011, only one country exceeded its NMVOC ceiling (Germany), and four (Denmark, Finland, Germany and Spain) exceeded their NH_3 ceiling. However, these Member State exceedances do not prevent the EU from achieving its NMVOC and NH_3 ceilings. It should also be noted that all new Member States (EU-12) have met their emission ceilings for all pollutants.

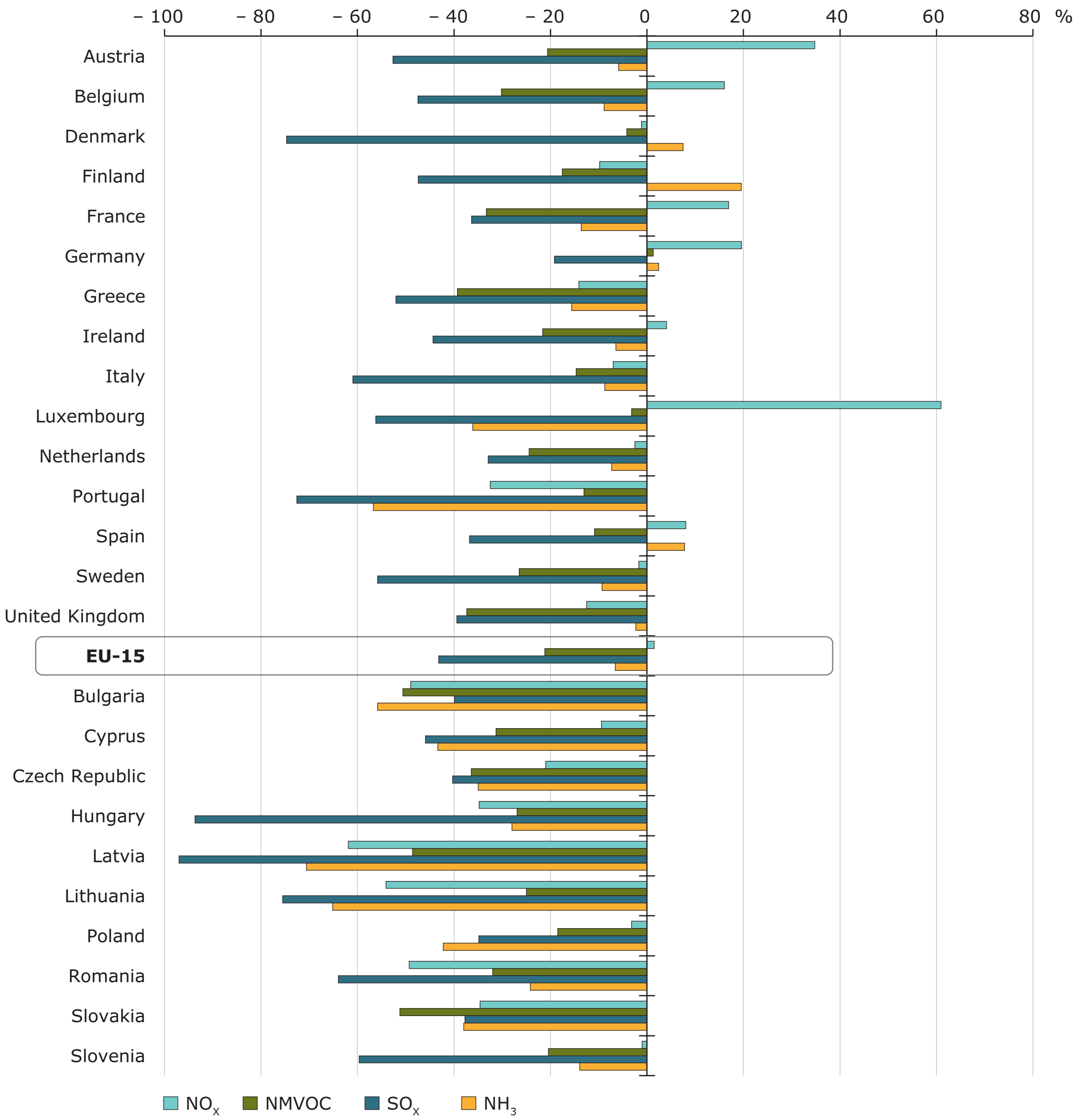
Table ES.3 Comparison of emissions reported for 2011 by EU-15 Member States, with EU emission ceilings specified in the UNECE Gothenburg Protocol

Pollutant	EU-15 emissions year 2011 (Gg)	European Union (EU-15) Gothenburg Protocol 2010 ceilings (Gg)	Difference (%)	Sum of individual EU-15 ceilings (Gg) ([a])
NO_X	6 771	6 671	2 %	6 648
NMVOC	5 202	6 600	– 21 %	6 600
SO_X	2 308	4 059	– 43 %	4 044
NH_3	2 923	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, Luxemburg, the Netherlands and the United Kingdom). For Spain, data for the compliance checks are national totals for the EMEP grid domain.

Figure ES.4 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, Lithuania, Luxemburg, the Netherlands and the United Kingdom). For Spain, data for the compliance checks are national totals for the EMEP grid domain.

Status of reporting by EU-27 Member States

In 2013, Member States were requested to report emission inventory data and an IIR. Table ES.4 below 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.

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*

Table ES.4 Status of reporting by Member States (as of 6 May 2013)

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
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			
Greece	x	x				x
Hungary	x	x	x			
Ireland	x	x	x			x
Italy	x	x				
Latvia	x	x	x			
Lithuania	x	x	x	x	x	x
Luxembourg	x	x				
Malta	x	x	x			
Netherlands	x	x	x			x
Poland	x	x	x			x
Portugal	x	x	x			
Romania	x	x	x			
Slovakia	x	x	x	x		x
Slovenia	x	x	x			x
Spain	x	x	x	x	x	x
Sweden	x	x	x			x
United Kingdom	x	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.

Transboundary Air Pollution) and the *EMEP/EEA air pollutant emission inventory guidebook — 2009)* (UNECE, 2009). 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. the Large Combustion Plants Directive (2001/80/EC), the Emissions Trading Scheme legislation (2009/29/EC) and the European Pollutant Release and Transfer Register (E-PRTR) Regulation (EC) No 166/2006).

Detailed information for the data sources used by Member States should be documented in the IIRs, if available. The level of detail containing this information varies widely across Member States, although the main data sources are official national statistics.

The sources for emission factors can differ depending on the tier method used. One main source for emission factors is that provided in the EMEP/EEA pollutant emission inventory guidebook (EMEP/EEA, 2009) mentioned above, but they can also be country or even plant specific. A survey on which emission factors are used by the Member States for all emission sources cannot be carried out, as the information is unavailable: while some countries report details on their methodologies, others do not. Detailed information can be found in the IIRs submitted by Member States; references to these reports are provided in Appendix 5.

Concerning emissions from transport, the reporting guidelines specify (Article IV, paragraph 15) how they 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.'

The difference between transport emissions estimated using the amount of fuel sold within a country and those estimated using the amount of fuel consumed in a country can be significant when 'tank tourism' occurs, i.e. where fuel purchased within a country is actually used outside the country and vice versa. 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 on this issue (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 additional a national total on the basis of fuel sold. But as there are no fuel sold data available for the categories, Netherlands' emission data based on fuel used were used to compile the EU inventory.

The methods used by Member States should be based on those described in the EMEP/EEA emission guidebook. On the whole, Member States follow this recommendation, which ensures that best available methods and knowledge are used for estimating national emissions, and inventories are improved continuously. Besides this, the technical review procedures set up by the EMEP Centre on Emission Inventories and Projections (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.

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, and was used from 2010 to 2013; 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-27 emission totals for these pollutants are not considered complete (i.e. they are underestimated).

Generally, there is less need for gap-filling of 2011 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 complete 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-27 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 2001 data and for certain pollutants such as HMs and POPs.

This report also contains several recommendations that may further improve the quality of the EU inventory 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 — 2009* (EMEP/EEA, 2009) when compiling their emission inventory data sets.

Further, Member States are encouraged to report — according to the reporting guidelines (UNECE, 2009) — their emission inventories on the basis of fuel sold for road transport.

Member States are encouraged to follow up on responding to requests by the EEA or ETC/ACM during the compilation of the EU-27 inventory by either resubmitting inventory data in NFR format or updating next years inventory with the 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 presents information on 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, underestimations and planned improvements (Chapter 4). EU-27 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. The more complete gap-filling process trialled in 2010 for the compilation of the EU inventory was refined in 2011. Nevertheless, for certain pollutants (i.e. PM, HMs and POPs), some Member States did not report data for any year, which meant that gap-filling techniques could not be applied. For these pollutants, the EU-27 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 2011 for the EU-27 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-27, showing the main emitting sectors for each pollutant.
- Annex D provides the gap-filled inventory of the EU-27, 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.

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) for both key stationary sources and for mobile sources of air pollution. For the EU, the emission reduction commitments in 2020 and beyond are 59 %, 42 %, 6 %, 28 % and 22 % from 2005 emission levels for SO_2, NO_X, NH_3, NMVOC and $PM_{2.5}$ respectively (UNECE, 2013). The European Commission is currently undertaking a review of EU air policy,

Table 1.1 The EU status of ratification 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).

building on the 2005 thematic strategy on air pollution and the Clean Air for Europe (CAFE) initiative (EC, 2005, EC, 2012). The review focuses on the effectiveness of existing policy and plans for the future. The College of Commissioners gave a mandate for a review in January 2011 (EC, 2012). The mandate focused on a number of immediate measures plus a requirement for a comprehensive review of EU's air policy by 2013 at the latest. In this context, the revision of the directive on sulphur content of bunker fuels (Directive 2012/33/EU) has been recently adopted. Further, the aforementioned revision of the UNECE Gothenburg Protocol (UNECE, 1999) establishing international controls on air pollution has been successfully negotiated. The recent communication CARS 2020: Action Plan for a competitive and sustainable automotive industry in Europe set a timeframe for the successful implementation of the Euro 6 vehicle standards in real-world driving conditions. As part of the EU air policy review, the revision of the Non-road Mobile Machinery legislation is scheduled for 2013 (EC, 2012).

The UNECE LRTAP Convention Executive Body approved 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 protocols. A summary of the reporting requirements is provided in Appendix 2 to this report.

In 2013, 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. Like last year, 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 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-27 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 emissions inventory data using an updated format: the European Monitoring and Evaluation Programme (EMEP) NFR09 format.

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

EU Member States also report their emissions of NO_X, NMVOC, sulphur dioxide (SO_2) and NH_3 under Directive 2001/81/EC known as the NEC Directive (EC, 2001) and emissions of NO_X, SO_2, NMVOC and CO under 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, 2013a).

Table 1.2 Overview of air emission reporting obligations in the EU, 2012–2013

Legal obligation	Emission reporting requirements	Annual reporting deadline for EU Member States	Annual international reporting deadline for the EU
LRTAP Convention	Emissions ([a]) of NO_X (as NO_2), NMVOC, SO_X (as SO_2), NH_3, CO, HMs, POPs ([b]) and PM	15 February 2013	30 April 2013
NEC Directive	Emissions of NO_X, NMVOC, SO_2 and NH_3	31 December 2012	n/a
EU Monitoring Mechanism/UNFCCC	Emissions ([c]) of CO_2, CH_4, N_2O, HFCs, PFCs, SF_6, NO_X, CO, NMVOC and SO_2	15 January 2013 to the European Commission and15 April 2013 to the UNFCCC	15 April 2013

Note: ([a]) 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.

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

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

Table 1.3 Major differences between reporting obligations of air pollutants under 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'.

NEC: NO_x, NMVOC, SO_2, NH_3.

LRTAP: NO_x, NMVOC, SO_x, NH_3, CO, HMs, POPs, PM.

UNFCCC: NO_x, NMVOC, SO_x, CO.

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.

LTO: Landing and take-off.

Table 1.2 provides an overview of these different reporting obligations for EU Member States.

The reporting obligations under the LRTAP Convention and NEC Directive have now largely been harmonised since the adoption of the updated reporting guidelines. As compared with the UNFCCC obligation, they differ 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 not significant for most Member States.

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 use the methodologies contained in the latest version of the EMEP/EEA air pollutant emission inventory guidebook — 2009 (EMEP/EEA, 2009).

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. The activities of the EEA include:

- overall coordination and management of the inventory compilation process;
- coordinating the 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 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.

In 2012, the EEA's *European Union emission inventory report 1990–2009 under the UNECE Convention on Long-range Transboundary Air Pollution (LRTAP)* (EEA, 2012f) was reviewed. A summary of the review recommendations for improvement is provided in Chapter 4.

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 ([6]) 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, 2013b). 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 is compiled into an EU total inventory. The European Commission formally submits the EU's emission inventory data 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.

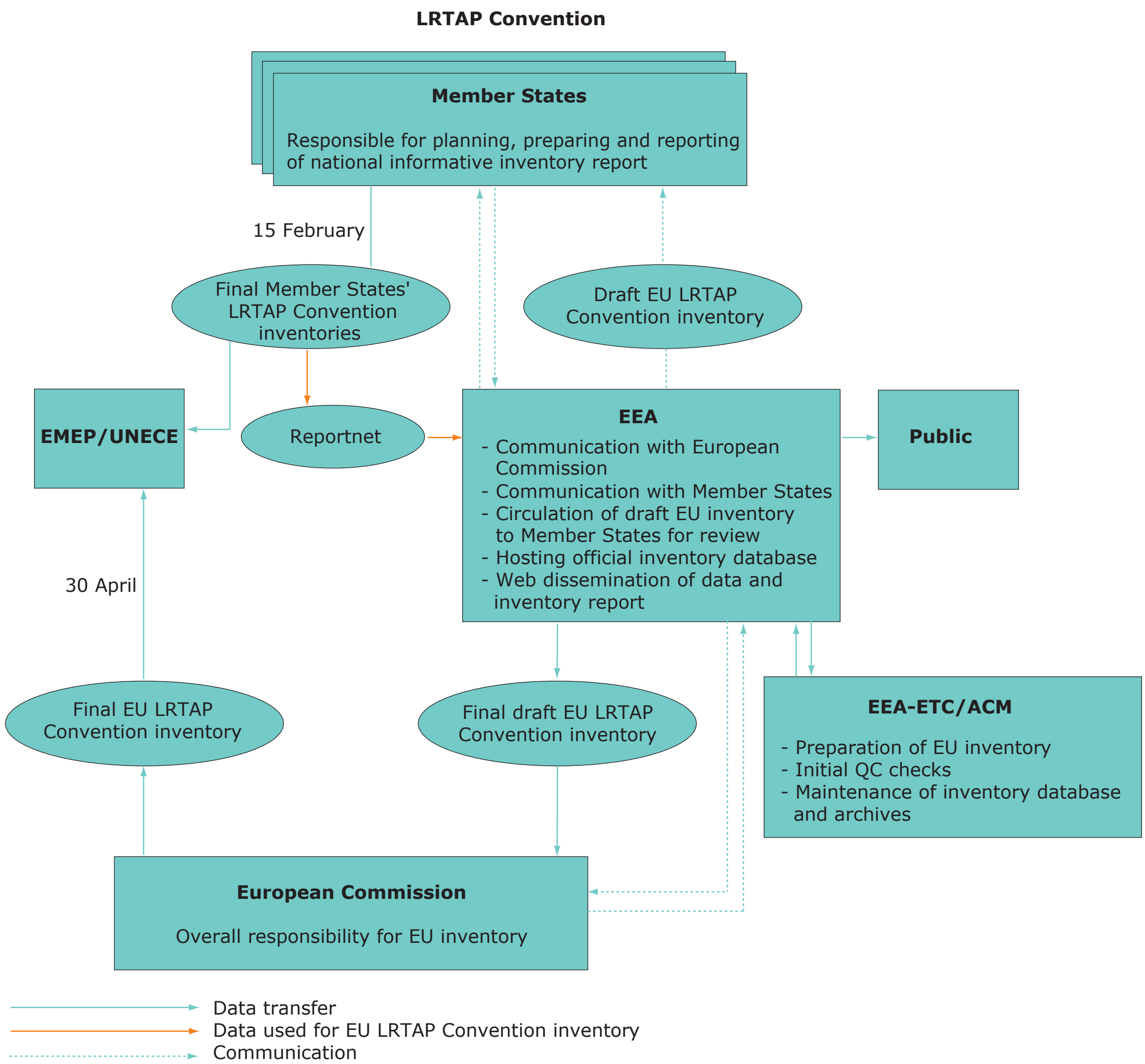
([6]) The current ETC/ACM was established by a contract between the lead organisation, the National Institute for Public Health and the Environment (RIVM, Rijksinstituut voor Volksgezondheid en Milieu), and the EEA in 2010. It works with 12 organisations and institutions across 10 European countries.

1.3 Inventory preparation process

No specific EU directive implements the LRTAP Convention's requirements to estimate air emissions and prepare 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 provision of data by Member States, receipt of the data on behalf of the European Commission and the EEA, and finally, the compiling of data, the gap-filling of missing data, and preparing of the actual inventory, by the EEA and its ETC/ACM. The inventory and accompanying documentation are subsequently made publicly available through the EEA website. Figure 1.1 presents a flowchart diagram illustrating the data flow that is used to compile the EU's LRTAP Convention emission inventory.

Figure 1.1 Data flow for compiling the EU 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 2013.

The updated reporting guidelines (UNECE, 2009) request that emissions data be provided by parties to the Convention using the NFR09 format. 26 of 27 Member States that submitted inventories used the new NFR09 reporting templates.

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. EMEP/EEA guidebook (EMEP/EEA, 2009))) used in the national inventory, specifying sources of default emission factors and methods, as well as an elaborated description of activity data sources where data differs from national statistics. The following two subsections summarise the information provided by Member States in their IIRs, thereby helping readers understand the basis of the EU inventory.

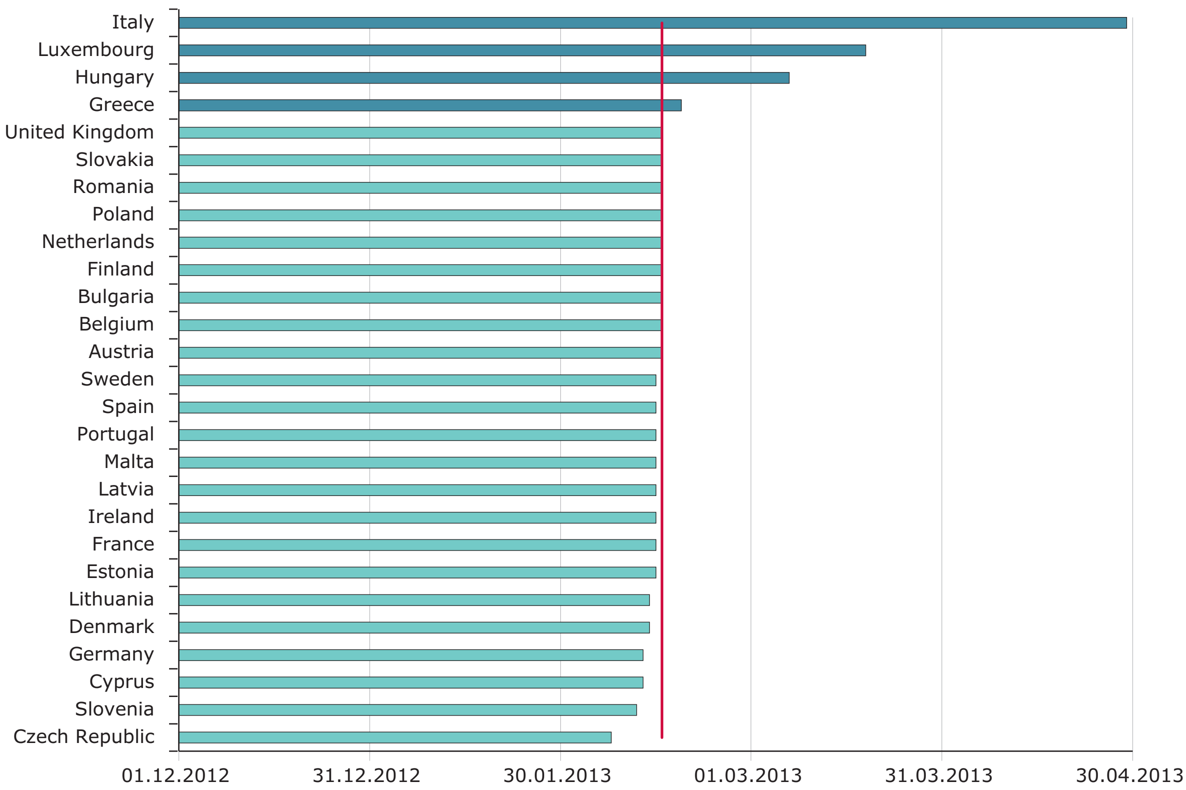
For detailed descriptions of methodologies and data sources, see the IIRs of Member States (references to the IIRs are provided in Appendix 5).

1.4.1 Data sources

The data source for the EU inventory is Member States' emission inventories. The data sources for these underlying inventories may vary across the different Member States, but should all follow the recommendations of the EMEP/EEA guidebook (EMEP/EEA, 2009). 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

Figure 1.2 Dates of first data submissions received from Member States (as of 6 May 2013)



widely across Member States, although the main data sources are official national statistics. Table 1.4 summarises commonly used data sources for the various sectors.

The sources for emission factors vary according to the tier method used. One main source for emission factors is that provided in the EMEP/EEA guidebook (EMEP/EEA, 2009), 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 can be found 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

The reporting guidelines (UNECE, 2009) specify in Article IV, paragraph 15, 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. The submissions of the Czech Republic, Greece, Ireland and Portugal, do not clearly state whether their road transport emissions are based on fuel sold or fuel used. Belgium is aware of the need to report transport emissions based on fuel sold and is working on this issue (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 additional a national total on the basis of fuel sold. But as there are no fuel sold data available for the categories, Netherlands' emission data based on fuel used were used to compile the EU inventory. Only CLRTAP submissions of Austria, the Czech Republic, Ireland, Lithuania, Luxembourg and the Netherlands report national totals in the NFR templates based on fuel used that differed from the emissions based on fuel sold. Table 1.5 shows, for these countries, the difference between total emissions for the year 2011 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 1.6 indicates that the COmputer Programme to calculate Emissions from Road Transportation (COPERT) (EMEP/EEA, 2009) is not used by all countries; moreover, where COPERT is used, different versions may be applied. The impact of using these different approaches on EU transport emissions has not been quantified.

Table 1.4 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 E-PRTR
Agriculture	National agricultural statistics, specific studies
Waste	Landfill databases, national studies, national statistics, information from municipalities

Table 1.5 Comparison of Member States' total emissions calculated on the basis of fuel sold and fuel consumed, 2011

Member States		NO_x	NMVOC	SO_x	NH_3	PM_{10}	$PM_{2.5}$	CO	Cd	Hg	Pb	Dioxin	Total PAH	HCB	HCH	PCB
		Gg	Gg	Gg	Gg	Gg	Gg	Gg	Mg	Mg	Mg	g	Mg	kg	kg	kg
Austria	National total	182.71	128.17	18.51	62.33	34.53	18.89	608.77	1.16	1.00	15.42	35.45	7.03	37.44	NR	NR
	National total (FU)	144.21	126.20	18.47	62.12	33.87	18.23	584.14	1.16	1.00	15.42	35.11	6.60	37.37	NR	NR
	Difference	− 21 %	− 2 %	0 %	0 %	− 2 %	− 3 %	− 4 %	0 %	0 %	0 %	− 1 %	− 6 %	0 %		
Czech Republic	National total	225.95	139.82	169.02	65.67	32.44	16.51	381.82	0.81	3.27	16.84	104.50	15.72	2.49	NE	23.93
	National total (FU)	234.10	143.42	169.04	65.75	33.09	17.09	400.67	0.81	3.27	16.88	104.64	15.74	2.49	NE	23.93
	Difference	4 %	3 %	0 %	0 %	2 %	4 %	5 %	0 %	0 %	0 %	0 %	0 %	0 %		0 %
Ireland	National total	70.55	43.63	23.39	108.68	12.11	7.80	127.01	0.33	0.35	16.53	14.98	2.49	1.17	NA	16.49
	National total (FU)	67.64	43.12	23.39	108.56	11.88	7.61	122.21	0.32	0.35	15.43	14.86	2.46	NA	NA	16.49
	Difference	− 4 %	− 1 %	0 %	0 %	− 2 %	− 2 %	− 4 %	− 1 %	0 %	− 7 %	− 1 %	− 1 %			0 %
Lithuania	National total	50.53	69.03	35.53	29.29	13.71	11.08	194.21	0.13	0.17	2.72	14.05	19.89	0.00	NE	12.38
	National total (FU)	50.53	69.03	35.53	29.29	13.71	11.08	194.21	0.46	0.30	2.75	14.05	19.89	NE	NE	12.38
	Difference	0 %	0 %	0 %	0 %	0 %	0 %	0 %	259 %	76 %	1 %	0 %	0 %			0 %
Luxembourg	National total	47.86	9.12	1.78	4.67	NE	NE	38.85	NR	NR	NR	0.99	0.84	0.38	0.00	1.56
	National total (FU)	17.70	8.71	1.75	4.47	0.00	0.00	20.42	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Difference	− 63 %	− 4 %	− 1 %	− 4 %			− 47 %				− 100 %	− 100 %	− 100 %		− 100 %
Netherlands	National total	277.92	145.07	33.58	NE	26.81	14.44	540.48	NE	NE	22.71	NE	NE	NE	NE	NE
	National total (FU)	259.41	144.37	33.55	118.66	28.63	14.09	529.28	1.12	0.82	28.32	31.31	3.84	1.59	NO	0.00
	Difference	7 %	0 %	0 %		− 6 %	2 %	2 %			− 19.8 %					

Table 1.6 Overview of methods used to calculate emissions from road transport

	Method used
Austria	GLOBEMI ([a])
Belgium	Flanders: MIMOSA ([b]) — EF of COPERT IV, v9.1 ([c]); Wallonia: COPERT IV, v9.1; Brussels Capital Region: COPERT IV, v8.1
Bulgaria	COPERT IV, v10
Cyprus	COPERT IV, v9.0
Czech Republic	Country-specific model
Denmark	COPERT IV
Estonia	COPERT IV, v9.1
Finland	LIISA ([d]), sub-model of LIPASTO ([e])
France	COPERT IV, v9.0
Germany	TREMOD, v5.2 ([f])
Greece	COPERT IV, v8.1
Hungary	COPERT IV, v9.0
Ireland	COPERT IV, v9.1
Italy	COPERT IV, v9
Latvia	COPERT IV
Lithuania	COPERT IV, v9.0
Luxembourg	GLOBEMI
Malta	Country-specific model
Netherlands	VERSIT+ ([g])
Poland	National approach
Portugal	COPERT IV, v9.0
Romania	COPERT IV
Slovakia	COPERT IV, v9.0
Slovenia	COPERT IV, v9.0
Spain	COPERT IV
Sweden	HBEFA 3.1 ([h])
United Kingdom	Country-specific model; NOX: COPERT IV, v8.1

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

([b]) MIMOSA: urban transport emission model/road emission model (Lewyckyj et al., 2004).

([c]) COPERT: Computer Programme to calculate Emissions from Road Transportation, based on EMEP/EEA guidebook methodology (EMEP/EEA, 2009).

([d]) LIISA: calculation model for the road transport sector emissions at VTT Technical Research Centre of Finland (Mäkelä et al., 2002, VTT, 2013a).

([e]) LIPASTO: calculation system for traffic exhaust emissions and energy consumption at VTT Technical Research Centre of Finland (VTT, 2013b).

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

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

([h]) HBEFA 3.1: The Handbook Emission Factors for Road Transport (INFRAS, 2013).

1.4.3 General methods

The methods used by Member States (Table 1.7) should follow those described in the EMEP/EEA emissions guidebook (EMEP/EEA, 2009). 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 role of Member States to submit full and accurate inventory data sets. However, as Table 1.9 and Table 1.10 indicate, Member State submissions contain various data gaps for particular pollutants or years in the time series. The most frequent problems observed are explained below.

- 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 NH3) 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 are 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 with Member State representatives in both 2008 and 2009 on approaches that would achieve more complete gap-filling of the

Table 1.7 Overview of methods used in Member States

Austria	Details on methodology provided in IIR (Austria's IIR, Table 4, p. 42), mostly country specific (CS). In a few cases, only default and literature data is used (e.g. in agricultural sector).
Belgium	Because the regions hold responsibility for preparing the emission inventories, concomitant methodologies have been developed by the three regions for compiling their inventory from basic data (Belgium's IIR, p. 13). Different institutions are responsible for the emission calculations, but all use EMEP/EEA methodology.
Bulgaria	National common methodology approved by the Ministry of Environment and Water (MoEW) in coordination with other ministries concerned. This national methodology (approved by Order RD 77/03.02.2006 of MoEW) is harmonised with the CORe INventory of AIR emissions (CORINAIR) methodology (third edition of EMEP/EEA guidebook) for calculation of the emissions according to the UNECE/CLRTAP. In 2011, the MoEW/Executive Environment Agency (ExEA) ran a project to update a common methodology for emissions inventory under UNECE/CLRTAR and UNFCCC (approved with Order RD 165 from 20.02.2013 of MoEW). The project aimed to harmonise the common methodology with the third edition of EMEP/EEA guidebook, 2009.
Cyprus	For the emission inventory, in general terms, Tier 2 methodology was used for key source sectors and Tier 1 for non-key source sectors. Apart from these, for the estimation of emissions from the transport sector, the COPERT 4 tool was used (Tier 3) (Cyprus' IIR, p. 17).
Czech Republic	No IIR available.
Denmark	Denmark's air emission inventories are based on the Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories (IPCC, 1997), the Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories, (IPCC, 2000), the CORINAIR methodology, and the EMEP/EEA guidebook (Denmark's IIR, p. 30).
Estonia	The emission inventory for the period of 1990–1999 is based on data pertaining to the large point sources and area sources. From 2000 to 2004, CollectER software was used to accumulate data (both point and area). In order to accumulate data on point sources, the Estonian Environment Information Centre created a new web-interface air emission data system for the point sources (OSIS) in 2004. At present, the EEIC uses the CollectER tool for the calculation of emissions from diffuse sources. Data on point sources (emissions and burnt fuel) are transferred from OSIS to CollectER. The national emission inventory data that are stored in the CollectER annual inventory databases are used for reporting (Estonia's IIR, p. 19–20).
Finland	The EMEP/EEA guidebook methodology as well as national methods are used in the preparation of emission inventories. Country-specific emission factors and compliance data reported by operators or emissions estimated by industrial associations are used whenever they provide better estimates of the national circumstances than the default values (Finland's IIR, p. 33).
France	A general description of the emission calculation is provided in Section 1.4, Généralités sur les méthodes et les sources de données utilises.
Germany	As a general rule, Germany uses country-specific process information and emission factors where available. Detailed information on tiers and emission factors is provided in the source-specific chapters.
Greece (Information from IIR 2012)	The EMEP/EEA guidebook, the CORINAIR guidebook, and the UNFCCC guidelines are used to compile the emission inventory for NO_x and SO_2. No information is available on methods used to calculate NMVOC and CO emissions.
Hungary	Different data sources are taken into account during preparation of NFR for activity data and emission factors as well. The data sources for activity data include: Hungarian Central Statistical Office (HCSO), National Energy Balance, activity data reported by companies for UNFCCC reporting (CRF) purposes and other international statistics (FAOStat, EUROSTAT), and EU ETS database (verified greenhouse gas emissions database at the National Inspectorate for Environment, Nature and Water). Emission factors used are taken from EMEP/EEA 2009 Guidebooks, Revised 1996 IPCC Guidebooks, IPCC 2000 Good Practice Guidebooks (Hungary's IIR, p. 11).
Ireland	The IIR shows how Ireland follows the guidelines for estimating and reporting of emission data in an attempt to ensure the transparency, accuracy, consistency, comparability and completeness of the reported emissions (Ireland's IIR, p. 1). Detailed information on methods used are available in Ireland's IIR.
Italy (Information from IIR 2012)	Methodologies are consistent with the EMEP/EEA guidebook, the revised 1996 and 2006 IPCC guidelines, and the IPCC good practice guidance document (EMEP/CORINAIR, 2007; EMEP/EEA, 2009; IPCC, 1997, 2000 and 2006). National emission factors are used as well as default emission factors from international guidebooks, when national data are not available. The development of national methodologies is supported by background documents (Italy's IIR, p. 15).
Latvia	Information on methods is available in the sectoral chapters of Latvia's IIR.
Lithuania	Methodologies are described in subsectors, and references to emission factors and activity data used are provided in Lithuania's IIR.
Luxembourg	No IIR available.
Malta	The methodology used in compiling the 2011 emissions was based on the EMEP/EEA guidebook (Malta's IIR, p. 7).

Table 1.7 Overview of methods used in Member States (cont.)

Netherlands	In general, two emission models are used in the Netherlands: one model for emissions from LPSs (bottom-up method), and one for emissions from diffuse sources (e.g. road transport and agriculture), which are calculated from activity data and emission factors from sectoral emission inventory studies in the Netherlands (Netherlands' IIR, p. 13).
Poland	Emission factors for the emission sources are mostly taken from the EMEP/EEA guidebook or national research. The sources of particular emission factors are given below in the sectoral chapters (Poland's IIR, p. 8).
Portugal	As far as possible, the inventory is compiledin accordance with the recommended methodologies from the EMEP/CORINAIR guidebook or the IPCC Guidelines. Default methods and emission factors used and the choice of Tier 1 or Tier 2 approach were dictated by individual case circumstances, the availability of proper background information and by national circumstances (Portugal's IIR, pp. 1–7).
Romania	The methodology for estimating and reporting emissions is consistent with the latest version of the EMEP/EEA guidebook (Romania's IIR, p. 5).
Slovakia	The emission inventory of NMVOC, HMs, POPs, PM and NH_3 is elaborated according to the EMEP/EEA Guidebook and in accordance with requirements of the respective working group for emission inventory (UNECE Task Force on Emission Inventory). Emissions of basic pollutants (SO_2, CO, NO_X and TSPs) are directly collected in the National Emission Information System (NEIS) based on national legislation for pollutants fees. TSP emissions are provided directly by operators of individual large and medium sources on the base of measurements or more precisely by calculation (in coincidence with the air protection legislation of the Slovak Republic). (Slovakia's IIR).
Slovenia	Slovenia's air emission inventory is based on EMEP/EEA methodology, but also on the 1996 IPCC Guidelines and the 2000 Good Practice Guidance. The emission factors used for emission calculations in the year 2011 were mainly taken from the EMEP/EEA guidebook (Slovenia's IIR, pp. 11–12).
Spain	The methodology for estimating and reporting emissions follows the EMEP/EEA guidebook. Emission factors are taken from the EMEP/EEA guidebook, or alternatively, country-specific emission factors are used.
Sweden	Sweden uses the Guidelines for estimating and reporting emission data for reporting to the Convention on Long-Range Transboundary Air Pollution and the EMEP/EEA guidebook as methodological guidance. Sweden also uses methodologies in accordance with the Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories (IPCC guidelines) and methods that are generally in line with the IPCC-NGGIP good practice guidance (Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories). Some parts of the methodologies are taken directly from the IPCC guidelines, the IPCC-NGGIP good practice guidance and the EMEP/EEA guidebook. (Sweden's IIR, p. 7).
United Kingdom	Detailed descriptions are available in the country's IIR. The British emission inventories are compiled according to international good practice guidance (EMEP/EEA and IPCC). Each year, the inventory is updated to include the latest data available. Improvements to the methodology are made and are backdated to ensure a consistent time-series. Methodological changes are made to take account of new data sources, or new guidance from EMEP-EEA, relevant work by the IPCC, new research, or specific research programmes sponsored by the Department for Environment, Food and Rural Affairs (Defra) or the Department for Energy and Climate Change (DECC) (United Kingdom's IIR, p. 31).

Note: Only information from Chapter 1 (on methods and data sources) of the national IIRs is reported. Some countries provide further relevant information in their sectoral chapters, but this is too detailed to be presented here.

Grey-shaded rows (Greece and Italy) denote IIRs submitted in 2012 (latest IIRs available).

EU emission inventory. At a meeting in September 2009 ([7]), Member State representatives agreed to trial an improved procedure in 2010. In accordance with this agreement, the gap-filling procedure used during the compilation of the EU's 2010, 2011 and 2012 emissions inventory was performed in accordance with 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, 2009).

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 2013.

2. For Member States that did not report complete data, emissions data reported in 2013 officially

([7]) 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.

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 2013 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 to fill any remaining gaps.

4. LRTAP Convention data submitted to EMEP/CEIP in 2013 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 6 are summarised as follows.

(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 five 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 five 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.

Further, gap-filling was applied only where either 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 applied.

Table 1.8 shows how gap-filling affects the total emissions at EU level. Generally, the need to gap-fill 2011 data is much lower than it was for 1990 data. For the main pollutants no gapfilling was necessary as all Member States reported data for 2011. It is remarkable that few Member States reported neither emission values nor notation key, or the notation key not estimated ('NE'); this incidence is highest for HCH, with 14 Member States reporting 'NE', 0 or empty cells. Generally the contribution of gap-filling is rather low.

Still, inventories for many pollutants cannot be considered complete because even if gap-filling with the notation key 'NE' or 0 — and in some cases the notation key 'NR' — is carried out, the respective inventory is still considered incomplete at EU level.

Table 1.9 and Table 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 a initial overview of 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 carried out.

Compared with previous years, the gap-filling procedure used from 2010 to 2013 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-27 emission totals for these pollutants are not considered complete (i.e. they are underestimated).

Table 1.8 Effect of gap-filling on EU emission data for the year 2011

Pollutant	Reporting of national totals in 2011								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 gapfilled with value	Number of Member States gapfilled with notation key	Effect on EU national total	EU-27 inventory complete?
NO_x	27	0	0	0	0	0	0	0	0	0	0 %	Yes
NMVOC	27	0	0	0	0	0	0	0	0	0	0 %	Yes
SO_x	27	0	0	0	0	0	0	0	0	0	0 %	Yes
NH_3	27	0	0	0	0	0	0	0	0	0	0 %	Yes
$PM_{2.5}$	25	0	0	0	0	0	0	2	0	1	0 %	No
PM_{10}	25	0	0	0	0	0	0	2	0	1	0 %	No
TSP	25	0	0	0	0	0	0	2	0	1	0 %	No
CO	27	0	0	0	0	0	0	0	0	0	0 %	Yes
Pb	25	0	0	0	0	0	0	2	1	1	18 %	No
Cd	25	0	0	0	0	0	0	2	1	1	3 %	No
Hg	25	0	0	0	0	0	0	2	1	1	16 %	No
As	23	0	2	0	0	0	0	2	1	1	2 %	No
Cr	23	0	2	0	0	0	0	2	1	1	3 %	No
Cu	23	0	2	0	0	0	0	2	1	1	0 %	No
Ni	23	0	2	0	0	0	0	2	1	1	11 %	No
Se ([a])	21	2	2	0	0	0	0	2	2	1	0 %	No
Zn	23	0	2	0	0	0	0	2	1	1	1 %	No
PCDD/Fs	25	0	0	0	0	0	0	2	1	0	0 %	No
Benzo(a)pyrene	19	2	1	0	0	3	0	2	1	0	0 %	No
Benzo(b)fluoranthene	19	2	1	0	0	3	0	2	1	0	0 %	No
Benzo(k)fluoranthene	18	2	1	0	0	3	1	2	1	0	0 %	No
Indeno(1,2,3-cd) pyrene	19	2	1	0	0	3	0	2	1	0	0 %	No
Total PAHs	25	0	0	0	0	0	0	2	1	0	0 %	No
HCB ([b])	24	1	0	0	0	0	0	2	2	0	0 %	No
HCH	2	6	2	6	3	0	5	3	1	1	0 %	No
PCBs ([c])	19	4	1	0	1	0	0	2	2	0	0 %	No

Note: The analysis refers only to the national total in 2011 for the entire territory.

([a]) During the gap-filling procedure, the reported notation key 'NE' of Finland was replaced by values arising from the sum of the categories.

([b]) During the gap-filling procedure, the reported notation key 'NE' of Lithuania was replaced by values arising from the sum of the categories.

([c]) During the gap-filling procedure, the reported notation key 'NO' of the Netherlands was replaced by values arising from extrapolation of values reported up to 2005.

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 2013 EU-27 inventory compilation (as of 6 May 2013)

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	1980–2011	1990, 1995, 2000–2011			
Belgium	1990, 2000, 2005–2011; 1988 (NMVOC)	2000, 2005–2011	1991–1999, 2001–2004		
Bulgaria	1990–2011	1990–2011			
Cyprus	1990–2011	2000–2011			
Czech Republic	2011	2011	1990–2010	2010 (NH_3)	NH_3, PM_{10}, TSP: 2001, 2009; $PM_{2.5}$: 2009
Denmark	1985–2011, SO_x: 1980–2011	2000–2011			
Estonia	1990–2011	$PM_{2.5}$, PM_{10}: 2000–2011; TSPs: 1990–2011			
Finland	NO_x, SO_x, NH_3: 1980–2011; NMVOC: 1987–2011; CO: 1990–2011	1990–2011			
France	NO_x, SO_x, NH_3, CO: 1980–2011, NMVOC: 1988–2011	1990–2011			
Germany	1990–2011	$PM_{2.5}$, PM_{10}: 1995–2011; TSP: 1990–2011			
Greece	1990–2011				
Hungary	2011	2011	1990–2010		NH_3: 2002, 2010; $PM_{2.5}$, PM_{10}, TSPs: 2002
Ireland	NO_x, NMVOC, SO_x: 1987, 1990–2011; NH_3, CO: 1990–2011	1990–2011			
Italy	1980–2011	1990–2011			
Latvia	1990–2011	2000–2011			
Lithuania	1990, 1995, 2000, 2005, 2007–2011	1990, 1995, 2000, 2005, 2007–2011	1991–1994, 1996–1999, 2001–2004, 2006		NH_3, TSPs: 2003–2004; $PM_{2.5}$, PM_{10}: 2004
Luxembourg	1990–2011				
Malta	2000–2011	2000–2011	1990–1999		
Netherlands	1990–2011	1990–2011			
Poland	2000–2011	2000–2011	NO_x, NMVOC, SO_x: 1990–1999, CO: 1990, 1992–1999		
Portugal	1990–2011	1990–2011			
Romania	2006–2011	2006–2011	1990–2005		
Slovakia	2000–2011	2000–2011	1990–1999		
Slovenia	NO_x, SO_x, CO: 1980–2011; NH_3: 1986–2011; NMVOC: 1990–2011	2000–2011			
Spain	1990–2011	2000–2011			
Sweden	1990–2011	1990–2011			
United Kingdom	1980–2011	1980–2011			

Table 1.10 Data sources of HMs (Pb, Cd, Hg, As, Cr, Cu, Ni, Se, Zn) and POPs (PCDD/Fs, total PAHs, BaP, BbF, BkF, IP, HCB, HCH and PCBs) emissions used for the 2013 EU-27 inventory compilation (as of 6 May 2013)

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	1985–2011 (Pb, Cd, Hg)	1985–2011 (PCDD/Fs, HCB)	1985–2011 (Total PAHs)	
Belgium	1990, 2000, 2005–2011	1990, 2000, 2005–2011 (PCDD/Fs, HCB, HCH)	1990, 2000, 2005–2011 (Total PAHs)	
Bulgaria	1990–2011	1990–2011 (PCDD/Fs, HCB, PCBs)	1990–2011	
Cyprus	1990–2011	1990–2011 (PCDD/Fs, HCB, PCBs)	1990–2011	
Czech Republic	2011	2011 (PCDD/Fs, HCB, PCBs)	2011	HMs, PCDD/Fs, PCBs, total PAHs: 2001, 2003–2006, 2009; HCB: 2003–2006, 2009; other PAHs: 2003–2006, 2009
Denmark	1990–2011	1990–2011 (PCDD/Fs, HCB)	1990–2011	
Estonia	1990–2011	1990–2011 (PCDD/Fs, HCB, PCBs)	1990–2011	
Finland	1990–2011 (Pb, Cd, Hg, As, Cr, Cu, Ni, Zn)	1990–2011 (PCDD/Fs, HCB, PCBs)	1990–2011 (Total PAHs)	
France	1990–2011	1990–2011 (PCDD/Fs, HCB, PCBs)	1990–2011	
Germany	1990–2011	PCDD/Fs, HCB, PCBs: 1990–2011; HCH: 1990–1997	1990–2011 (Benzo(a) pyrene, Benzo(b) fluoranthene, Indeno(1,2,3–cd)pyrene, total PAHs)	
Greece				
Hungary	2011	2011 (PCDD/Fs, HCB, PCBs)	2011	HMs, PCDD/Fs, HCB, PAHs: 2002–2007; PCBs: 2002–2003
Ireland	1990–2011	1990–2011 (PCDD/Fs, HCB, PCBs)	1990–2011	
Italy	1990–2011	1990–2011 (PCDD/Fs, HCB, PCBs)	1990–2011 (Total PAHs)	
Latvia	1990–2011	1990–2011 (PCDD/Fs, HCB, PCBs)	1990–2011	
Lithuania	1990, 1995, 2000, 2005, 2007–2011	1990, 1995, 2000, 2005, 2007–2011 (PCDD/Fs, PCBs)	1990, 1995, 2000, 2005, 2007–2011	2002–2004, 2006 (HMs, PCDD/Fs, PCBs, PAHs)
Luxembourg				2007 (HMs)
Malta	2000–2011	2010–2011 (PCDD/Fs, HCB, PCBs)	2010–2011	
Netherlands	1990–2011	PCDD/Fs, HCB: 1990–2011, PCBs: 1995, 1998, 2002, 2004, 2005	1990–2011	
Poland	2000–2011 (Pb, Cd, Hg, As, Cr, Cu, Ni, Zn)	2000–2011 (PCDD/Fs, HCB, PCBs)	2000–2011	
Portugal	1990–2011	1990–2011 (PCDD/Fs, HCB, PCBs)	1990–2011 (Total PAHs)	
Romania	2006–2011	2006–2011 (PCDD/Fs, HCB, PCBs)	2006–2011	2004 (PCDD/Fs, HCB, PCBs, PAHs)
Slovakia	2000–2011	2000–2011 (PCDD/Fs, HCB, PCBs)	2000–2011	
Slovenia	1990–2011 (Pb, Cd, Hg)	1990–2011 (PCDD/Fs, HCB, PCBs)	1990–2011	
Spain	1990–2011	PCDD/Fs, HCB: 1990–2011; HCH: 1990–2002	1990–2011 (Total PAHs)	
Sweden	1990–2011	1990–2011 (PCDD/Fs, HCB, PCBs)	1990–2011	
United Kingdom	1980–2011	1990–2011	1990–2011	

1.4.5 Gridded data

According to the revised reporting guidelines, parties within the geographical scope of EMEP should report gridded data every five years, commencing in 1990. Gridded data for the EU-27 were last submitted in 2012 (EEA, 2012f) and hence are not reported again this year. However, it should be noted that in 2013, Cyprus, Finland, Lithuania, Slovakia, Spain and the United Kingdom provided gridded data for one or several years (Table A3.1).

Further information concerning the last submission of EU-27 gridded data is provided in Annex F of the annual European Community emission inventory report 1990–2010 (EEA, 2012f).

At the 36th session of the EMEP Steering Body, changes to the EMEP grid were discussed. The EMEP Centres suggested increasing the spatial resolution of reported emissions, from a 50 × 50 km EMEP grid to 0.1 × 0.1 ° lat-long in a geographic coordinate system (WGS84) (EMEP CEIP, 2013c). The geographic area between 30 ° N–82 ° N latitude and 30 ° W–90 ° E longitude will be covered. Countries are invited to report using the new system as soon as possible (on a voluntary basis), but at the latest in 2017 (EMEP CEIP, 2013c). Further information on this topic can be found on the CEIP homepage online (EMEP CEIP, 2013c).

1.4.6 Large point sources

Parties within the geographical scope of EMEP are also required to provide data on LPSs every five years, commencing in 2000. LPS data for the EU-27 were last submitted in 2012 (EEA, 2012f) and hence are not reported again this year. However, it is noted that in 2013, Cyprus, Finland, Lithuania, Spain and the United Kingdom provided LPS data for one or several years (Table A3.1).

Further information concerning the last submission of EU-27 LPS data is provided in Annex G of the annual European Community emission inventory report 1990–2010 (EEA, 2012f).

1.5 Key category analyses

1.5.1 EU-27 key category analysis (KCA)

It is good practice to identify key inventory categories in a systematic and objective manner by performing a quantitative analysis 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, 2009)).

EU-27 key categories were determined using a level analysis of 2011 emissions for each pollutant (after any necessary gap-filling had been applied). 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, some 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-27 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 five EU-27 key categories in 2011, for each pollutant. A complete list of all EU-27 key categories for NO_X, NMVOC, SO_X, NH_3, $PM_{2.5}$, PM_{10}, TSPs and CO, HM (Pb, Cd, Hg, As, Cr, Cu, Ni, Se and Zn) and POP (PCDD/Fs, total PAHs, BaP, BbF, BkF, IP, HCB, HCH and PCBs) emissions is also given in the following subsection. Detailed KCA calculations are provided in Annex C to this report.

1.5.2 Main emission sources

Table 1.11 presents the EU-27 key categories, i.e. the individual sources that overall contributed most to 2011 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 50 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 15 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

Table 1.11 Results of KCA for the EU-27 for the year 2011: cumulative contribution of emission sources to total emissions of NO_x, NMVOC, SO_x, NH_3, CO, $PM_{2.5}$ and PM_{10}, the HMs Cd, Pb, Hg, and the POPs PCBs, HCB, total PAHs, PCDD/Fs and HCH (in descending order)

NO_x key categories	(%)	(%) cumul.
1 A 3 b iii Road transport: Heavy duty vehicles	19 %	19 %
1 A 1 a Public electricity and heat production	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	7 %	60 %
1 A 4 c ii Agriculture/Forestry/Fishing: Off-road vehicles and other machinery	5 %	66 %
1 A 3 b ii Road transport: Light duty vehicles	5 %	70 %
1 A 4 b i Residential: Stationary plants	4 %	75 %
1 A 3 d ii National navigation (Shipping)	4 %	78 %
1 A 2 f ii Mobile Combustion in manufacturing industries and construction	2 %	81 %

NMVOC key categories	(%)	(%) cumul.
1 A 4 b i Residential: Stationary plants	12 %	12 %
3 D 2 Domestic solvent use including fungicides	11 %	23 %
3 A 2 Industrial coating application	8 %	31 %
3 D 3 Other product use	7 %	38 %
3 A 1 Decorative coating application	6 %	44 %
1 A 3 b i Road transport: Passenger cars	6 %	50 %
3 C Chemical products	5 %	55 %
2 D 2 Food and drink	4 %	59 %
1 A 3 b iv Road transport: Mopeds & motorcycles	4 %	63 %
3 D 1 Printing	3 %	66 %
1 B 2 a iv Refining/storage	3 %	69 %
1 A 3 b v Road transport: Gasoline evaporation	3 %	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 A 3 d ii National navigation (Shipping)	2 %	80 %

SO_x key categories	(%)	(%) cumul.
1 A 1 a Public electricity and heat production	48 %	48 %
1 A 2 f i Stationary combustion in manufacturing industries and construction: Other	10 %	58 %
1 A 4 b i Residential: Stationary plants	9 %	67 %
1 A 1 b Petroleum refining	6 %	73 %
1 A 2 a Stationary combustion in manufacturing industries and construction: Iron and steel	4 %	77 %
1 A 3 d ii National navigation (Shipping)	3 %	80 %

CO key categories	(%)	(%) cumul.
1 A 4 b i Residential: Stationary plants	33 %	33 %
1 A 3 b i Road transport: Passenger cars	18 %	52 %
2 C 1 Iron and steel production	9 %	61 %
1 A 2 a Stationary combustion in manufacturing industries and construction: Iron and steel	5 %	66 %
1 A 2 f i Stationary combustion in manufacturing industries and construction: Other	5 %	71 %
1 A 3 b iv Road transport: Mopeds & motorcycles	4 %	75 %
1 A 1 a Public electricity and heat production	2 %	78 %
1 A 3 b iii Road transport: Heavy duty vehicles	2 %	80 %

NH_3 key categories	(%)	(%) cumul.
4 D 1 a Synthetic N-fertilisers	20 %	20 %
4 B 1 a Cattle dairy	20 %	40 %
4 B 1 b Cattle non-dairy	19 %	59 %
4 B 8 Swine	15 %	74 %
4 B 9 a Laying hens	4 %	78 %
4 D 2 c N-excretion on pasture range and paddock unspecified	3 %	82 %

Table 1.11 Results of KCA for the EU-27 for the year 2011: cumulative contribution of emission sources to total emissions of NO_X, NMVOC, SO_X, NH_3, CO, $PM_{2.5}$ and PM_{10}, the HMs Cd, Pb, Hg, and the POPs PCBs, HCB, total PAHs, PCDD/Fs and HCH (in descending order) (cont.)

$PM_{2.5}$ key categories	(%)	(%) cumul.
1 A 4 b i Residential: Stationary plants	44 %	44 %
1 A 1 a Public electricity and heat production	6 %	49 %
1 A 3 b i Road transport: Passenger cars	5 %	55 %
1 A 2 f i Stationary combustion in manufacturing industries and construction: Other	5 %	60 %
1 A 3 b iii Road transport: Heavy duty vehicles	4 %	63 %
1 A 4 c ii Agriculture/Forestry/Fishing: Off-road vehicles and other machinery	3 %	67 %
1 A 3 b vi Road transport: Automobile tyre and brake wear	3 %	69 %
1 A 3 b ii Road transport: Light duty vehicles	3 %	72 %
1 A 3 b vii Road transport: Automobile road abrasion	2 %	74 %
1 A 3 d ii National navigation (Shipping)	2 %	76 %
2 C 1 Iron and steel production	2 %	77 %
1 A 4 c i Agriculture/Forestry/Fishing: Stationary	2 %	79 %
3 D 3 Other product use	1 %	80 %

PM_{10} key categories	(%)	(%) cumul.
1 A 4 b i Residential: Stationary plants	34 %	34 %
1 A 1 a Public electricity and heat production	6 %	40 %
1 A 2 f i Stationary combustion in manufacturing industries and construction: Other	4 %	44 %
4 D 2 a Farm-level agricultural operations including storage, handling and transport of agricultural products	4 %	48 %
1 A 3 b vi Road transport: Automobile tyre and brake wear	4 %	52 %
1 A 3 b i Road transport: Passenger cars	3 %	55 %
2 G Other production, consumption, storage, transportation or handling of bulk products	3 %	58 %
1 A 3 b vii Road transport: Automobile road abrasion	3 %	60 %
4 B 8 Swine	3 %	63 %
1 A 3 b iii Road transport: Heavy duty vehicles	2 %	65 %
1 A 4 c ii Agriculture/Forestry/Fishing: Off-road vehicles and other machinery	2 %	68 %
4 B 9 b Broilers	2 %	70 %
2 A 7 b Construction and demolition	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 %
1 A 4 c i Agriculture/Forestry/Fishing: Stationary	2 %	78 %
1 A 3 b ii Road transport: Light duty vehicles	2 %	80 %
2 C 1 Iron and steel production	2 %	81 %

Cd key categories	(%)	(%) cumul.
1 A 4 b i Residential: Stationary plants	26 %	26 %
1 A 2 f i Stationary combustion in manufacturing industries and construction: Other	15 %	42 %
2 C 1 Iron and steel production	11 %	52 %
1 A 1 a Public electricity and heat production	10 %	63 %
1 A 2 b Stationary combustion in manufacturing industries and construction: Non-ferrous metals	9 %	72 %
1 A 4 c i Agriculture/Forestry/Fishing: Stationary	5 %	77 %
1 A 4 a i Commercial/institutional: Stationary	5 %	82 %

Pb key categories	(%)	(%) cumul.
1 A 2 b Stationary combustion in manufacturing industries and construction: Non-ferrous metals	20 %	20 %
2 C 1 Iron and steel production	17 %	36 %
1 A 2 f i Stationary combustion in manufacturing industries and construction: Other	12 %	49 %
1 A 3 b vi Road transport: Automobile tyre and brake wear	9 %	57 %
1 A 4 b i Residential: Stationary plants	8 %	66 %
6 C b Industrial waste incineration	7 %	73 %
1 A 1 a Public electricity and heat production	5 %	78 %
1 A 2 a Stationary combustion in manufacturing industries and construction: Iron and steel	4 %	83 %

Table 1.11 Results of KCA for the EU-27 for the year 2011: cumulative contribution of emission sources to total emissions of NO_X, NMVOC, SO_X, NH_3, CO, $PM_{2.5}$ and PM_{10}, the HMs Cd, Pb, Hg, and the POPs PCBs, HCB, total PAHs, PCDD/Fs and HCH (in descending order) (cont.)

Hg key categories	(%)	(%) cumul.
1 A 1 a Public electricity and heat production	36 %	36 %
2 C 1 Iron and steel production	13 %	49 %
1 A 2 f i Stationary combustion in manufacturing industries and construction: Other	13 %	62 %
1 A 4 b i Residential: Stationary plants	5 %	67 %
1 A 4 a i Commercial/institutional: Stationary	4 %	72 %
1 A 3 d ii National navigation (Shipping)	4 %	76 %
2 B 5 a Other chemical industry	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	27 %	27 %
1 A 4 b i Residential: Stationary plants	17 %	43 %
2 C 1 Iron and steel production	15 %	58 %
2 F Consumption of POPs and heavy metals (e.g. electricial and scientific equipment)	14 %	72 %
1 A 1 a Public electricity and heat production	11 %	83 %

HCB key categories	(%)	(%) cumul.
2 C 1 Iron and steel production	29 %	29 %
1 A 4 b i Residential: Stationary plants	16 %	44 %
1 A 1 a Public electricity and heat production	12 %	57 %
2 B 5 a Other chemical industry	8 %	65 %
4 G Agriculture other	8 %	73 %
6 C b Industrial waste incineration	4 %	77 %
1 A 3 b i Road transport: Passenger cars	4 %	81 %

Total PAH key categories	(%)	(%) cumul.
1 A 4 b i Residential: Stationary plants	58 %	58 %
4 F Field burning of agricultural wastes	15 %	72 %
2 C 1 Iron and steel production	4 %	76 %
2 C 3 Aluminum production	3 %	79 %
1 B 1 b Fugitive emission from solid fuels: Solid fuel transformation	3 %	81 %

Dioxine key categories	(%)	(%) cumul.
1 A 4 b i Residential: Stationary plants	32 %	32 %
2 C 1 Iron and steel production	14 %	46 %
1 A 2 f i Stationary combustion in manufacturing industries and construction: Other	9 %	55 %
1 A 2 a Stationary combustion in manufacturing industries and construction: Iron and steel	7 %	62 %
6 C b Industrial waste incineration	7 %	69 %
1 A 1 a Public electricity and heat production	5 %	75 %
6 D Other waste	4 %	78 %
6 C e Small scale waste burning	3 %	81 %

HCH key categories	(%)	(%) cumul.
2 F Consumption of POPs and heavy metals (e.g. electricial and scientific equipment)	97 %	97 %

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}, HMs and POPs, the EU-27 inventory for the calculation of the key categories was considered as not complete (see Section 1.4.4 and Section 2.1).

11 pollutants, respectively. Similarly, '2 C 1 — Iron and steel production' and '1 A 2 f i — Stationary combustion in manufacturing industries and construction: Other' were key categories for 10 and 9 pollutants, respectively.

For NO_X nine and for CO eight key categories were identified and, as would be expected for both these pollutants, all key categories are sectors involving fuel combustion or thermal processes. Six key categories were identified for SO_X (again energy related), 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 activities associated with solvents and product use are a key aspect.

Seven key categories were identified for the HM Cd, eight for Hg, and also for Pb. 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 all sectors (except 'Solvents and Product use') have been identified as key categories. Generally, metal production was an important source of POP emissions. However, emissions from residential households also contributed considerably to emissions of many of the POPs.

Several factors may influence the determination of key categories at the EU-27 level. A Member State's use of the emission inventory notation 'IE' ('included elsewhere' — 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-27 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-27.

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, 2009).

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-27 tables. This year, more focus was placed on analysing the plausibility of sectoral trends. Member State data were checked at sectoral level; if outliers were found, the responsible categories were identified. When no explanation for a notable trend was found in the IIRs, Member States were contacted ([8]). The focus of the checks was on data that greatly affect EU-27 trends. External checks are also provided by Member States through an Eionet review before the EU-27 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 Ambient Air Quality Expert Group. 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 instrument 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, if 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

([8]) Some Member States sent inventory data (single values for certain categories or also time series) in response. However, most of these data are not officially reported via CDR within this submission round and therefore not included in this years' EU inventory.

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, 2013a). 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 are provided to Member States and 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 centralised reviews ([10]) of national inventories (Stage 3). In 2012, Albania, Georgia, the European Community, Liechtenstein, Malta, Monaco, Republic of Moldova, Montenegro, Serbia and Turkey were reviewed. The results are published in individual country-specific reports (EMEP CEIP, 2013b). 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 (Table 1.13) of the uncertainty evaluation performed in Member States shows that only ten (Cyprus, Denmark, Finland, France, Germany, Ireland, Latvia, the Netherlands, Sweden and the United Kingdom) quantify their uncertainty in emissions. Member States use either a Tier 1 approach or a Monte Carlo analysis (Finland, Germany, the Netherlands and the United Kingdom). The pollutants considered and the assumptions behind the uncertainty analysis vary across Member States. Background information on the Member States' uncertainty evaluations is summarised in Table 1.12. A summary of the quantitative uncertainty estimates provided by the Member States is given in Table 1.13.

As only a third of the Member States report on their uncertainty, it is not possible to evaluate uncertainty overall at EU level. The data presented provide a first indication for which pollutants the uncertainty is the largest.

Table 1.12 Information on uncertainty evaluations at Member State level

Austria	To date, no quantitative uncertainty assessment for any of the pollutants or pollutant groups relevant to this report has been made. However, the quality of estimates for all relevant pollutants has been rated using qualitative indicators as suggested in Chapter 5 of the EMEP/EEA emission inventory guidebook 2009.
Belgium	For all emission measurements or estimations, a particular uncertainty can be determined that is inseparably related to the emission value. Nowadays, no uncertainties are estimated for the regional or Belgian emission values. However, since the Guidelines for Estimating and Reporting Emission Data under CLRTAP (ECE/EB.AIR/97) stipulate that uncertainty estimations have to be determined, Belgium will initiate a study to calculate uncertainty values related to the emissions reported for the NEC Directive and CLRTAP.
Bulgaria	The overall uncertainty is closely related to the emission sources data uncertainty (fuels, activities, processes, etc.) and to the emission factor uncertainty. For UNECE/CLRTAP, a quantitative estimate of inventory uncertainty for each source category and for the inventory in total will be presented in the next submission.
Cyprus	The uncertainties of the Cyprus emission inventory were evaluated for the first time in 2012. The uncertainty estimations are in accordance with the Tier 1 methodology described in the 2009 EMEP/EEA Guidebook.
Czech Republic	No IIR available.

([9]) A summary of the results of the stage one and two 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.

Table 1.12 Information on uncertainty evaluations at Member State level (cont.)

Denmark	The uncertainty estimates are based on the simple Tier 1 approach in the EMEP/CORINAIR Good Practice Guidance for LRTAP Emission Inventories. The uncertainty estimates are based on emission data for the base year and year 2010, and on uncertainties for activity rates and emission factors for each of the main selected nomenclature for reporting of air pollutants (SNAP) sectors. For PM, the year 2000 is considered the base year; for all other pollutants, 1990 is used as the base year. Uncertainty estimates include uncertainty of the total emissions as well as uncertainty of the trend.
Estonia	The uncertainty assessment has not yet been carried out in Estonia. Undertaking a quantitative uncertainty assessment is planned for the next submission.
Finland	The uncertainty analysis for 2011 emission data is carried out at NFR 3 level for the actual emission sources. The method was Monte Carlo simulation (Tier 2) using @Risk software. The uncertainties of the input parameters were estimated by experts compiling the inventories; those of the measured emissions were estimated by the competent authorities that supervise emission monitoring carried out at the individual plants. The emissions of some pollutants from certain sources are poorly understood (for instance some POP compounds from fuel combustion and industrial processes), and therefore, estimation of their uncertainty is very challenging at the moment.
France	The work undertaken in the national inventory system is currently focused on the Tier 1 method. Uncertainties are determined for each source type by considering the two parameters activity data and emission factors.
Germany	As a first approach for uncertainty analysis of the German inventory the results of a research project are presented. A quantitative uncertainty assessment for the current inventory should follow for all categories as soon as updated uncertainty data are available. The determination of uncertainty values for activity data, emission factors and emissions is implemented in every current and planned research project, so an informative uncertainty data set for a number of categories is expected in time. Available uncertainties of activity data from UNFCCC reporting and defaults of the EMEP/EEA guidebook and the IPCC good practice guidance will be used as well.
Greece (Information from IIR 2012)	No uncertainty analysis undertaken.
Hungary	A general uncertainty evaluation is one of the planned improvements. (Hungary's IIR, p.17)
Ireland	A semi-quantitative uncertainty analysis has been used to determine the overall emissions uncertainty for a number of pollutants for 2011 data. It uses a Tier 1 propagation of errors to obtain an uncertainty value for the total emissions. The results provide a good indication as to which sources are contributing the most to the overall uncertainty, and therefore serve to highlight areas for improvement (Ireland's IIR, p. 14).
Italy (Information from IIR 2012)	An overall uncertainty analysis for the Italian inventory related to the pollutants described in this report has not been assessed yet. Nevertheless, different studies on uncertainty have been carried out, and a quantitative assessment of the Italian GHG inventory is performed by the Tier 1 method defined in the IPCC good practice guidance (Italy's IIR, p. 22).
Latvia	The calculation of uncertainty estimates was carried out according to the Tier 1 method presented by the 2000 IPCC Good Practice Guidance. The Tier 1 method is based on emission estimates and uncertainty coefficients for activity data and emission factors (Latvia's IIR, p. 13).
Lithuania	Lithuania evaluated uncertainties only for the energy sector. The uncertainty in national fuel combustion is 2 %. The method was applied to evaluate the uncertainty of emission factors and activity data (Lithuania's IIR, p. 24).
Luxembourg	No IIR available.
Malta	For this submission, Malta did not perform a quantitative uncertainty assessment for any pollutants in the emission inventory.
Netherlands	Uncertainty estimates on national total emissions have been reported in the Dutch Environmental Balances since 2000 (PBL, 2009). These estimates were based on uncertainties per source category, using simple error propagation calculations (Tier 1). Most uncertainty estimates were based on the judgement of RIVM/PBL emission experts (Netherlands' IIR, p. 15).
Poland	The Polish inventory team is planning to implement a larger scope of uncertainty analysis for the CLRTAP inventory in the next submission. For the time being, information on uncertainties of activity data and emission factors is collected from sectoral experts and literature (Poland's IIR, p. 10).
Portugal	To date, the uncertainty analysis has been performed only for direct GHGs. It is planned to extend the assessment to the other emission estimates in the near future.
Romania	Not mentioned in Romania's IIR.
Slovakia	Not mentioned in Slovakia's IIR.
Slovenia	Uncertainty checks were not performed in 2009, but are foreseen for 2010 according to the QA/QC plan (Slovenia's IIR, p. 15).
Spain	A qualitative uncertainty analysis was carried out for all pollutants. Further, the uncertainty was estimated quantitatively for the main pollutants (SO_x, NO_x, NMVOC and NH_3). The qualitative and quantitative uncertainty analyses were conducted at SNAP level. The uncertainty estimates are based on the methods described in the EMEP/EEA guidebook.

Table 1.12 Information on uncertainty evaluations at Member State level (cont.)

Sweden	Uncertainties in the Swedish emissions inventory reported to the CLRTAP were evaluated for the first time in 2003, and covered the emissions in 1990 and 2001. In order to prioritise efforts and resources in subsequent years, expert judgements mainly of the inventory staff, together with IPCC references on uncertainties in activity data and emission factors, have been the basis for the IPCC Tier 1 uncertainty evaluation. In 2009, Swedish Environmental Emissions Data (SMED) conducted a study to provide transparent uncertainty estimates of national emissions for the Swedish reporting to the CLRTAP of the submission 2010 in accordance with the Tier 1 methodology described in the 2009 EMEP/EEA guidebook.
United Kingdom	Evaluation of uncertainty is carried out by a Monte Carlo uncertainty assessment. Quantitative estimates of the uncertainties in emission inventories are based on calculations made using a direct simulation technique, which corresponds to the methodology proposed in draft guidance produced by the UNECE Taskforce on Emission Inventories.

Note: Grey-shaded rows (Greece and Italy) denote IIRs submitted in 2012 (latest IIRs available).

Table 1.13 Uncertainty estimates provided by Member States

Member State	Pollutant	Level uncertainty (%)	Trend uncertainty (%)
Cyprus ([a])	NO_X	11.61	9.85
	VOCs	29.67	10.46
	SO_2	9.24	4.94
	NH_3	79.69	34.45
	$PM_{2.5}$	38.38	8.25
	PM_{10}	36.02	11.03
	TSPs	46.28	18.04
	CO	32.78	4.4
	Pb	18.17	3.74
	Cd	81.73	43.79
	Hg	158.64	13.77
	PCDDs/PCDFs	90.91	46.95
	PAHs	207.57	76.55
	HCB	192.66	83.53
	PCBs	169.67	136.56
Denmark ([b])	SO_2	16	±1.1
	NO_X	39	±7
	NMVOC	23	±10
	CO	41	±14
	NH_3	29	±16
	TSPs	246	±60
	PM_{10}	287	±73
	$PM_{2.5}$	349	±89
	As	183	±26
	Cd	330	±52
	Cr	253	±32
	Cu	934	±91
	Hg	135	±10
	Ni	446	±55
	Ld	611	±23
	Se	187	±13
	Zn	729	±268

Table 1.13 Uncertainty estimates provided by Member States (cont.)

Member State	Pollutant	Level uncertainty (%)	Trend uncertainty (%)
	PCDDs/PCDFs	669	±195
	Benzo(b)fluoranthene	916	±108
	Benzo(k)fluoranthene	910	±160
	Benzo(a)pyrene	941	±93
	Indeno(1,2,3– c,d)pyrene	931	±81
	HCB	717	±55
Finland ([c])	NO_x	13 (lower), 15 (upper)	
	SO_2	5 (lower), 5 (upper)	
	NMVOC	26 (lower), 27 (upper)	
	CO	31 (lower), 37 (upper)	
	NH_3	52 (lower), 62 (upper)	
	PM	26 (lower), 27 (upper)	
	Pb	22 (lower), 23 (upper)	
	Cd	21 (lower), 21 (upper)	
	Hg	29 (lower), 29 (upper)	
	As	28 (lower), 28 (upper)	
	Cr	25 (lower), 26 (upper)	
	Cu	74 (lower), 75 (upper)	
	Ni	15 (lower), 16 (upper)	
	Zn	29 (lower), 29 (upper)	
	HCH	78 (lower), 171 (upper)	
	PCDDs/PCDFs	40 (lower), 53 (upper)	
	PCBs	60 (lower), 101 (upper)	
France	NO_x	10	
	NMVOC	45	
	SO_2	5 or lower	
	CO	45	
	PM	140	
	PCDDs/PCDFs	110	
	PAHs	70	
	CO_2	5 or lower	
	HMs	5 or lower	
Germany ([d])	PM_{10}	minus 16/plus 23	
	$PM_{2.5}$	minus 15/plus 19	
	NO_x	minus 10/plus 23	
	SO_2	minus 9/plus 9	
	NMVOC	minus 10/plus 12	
	NH_3	minus 13/plus 13	
Ireland	NO_x	14.1	3.4
	NMVOC	52.6	27.2
	SO_2	8.5	0.7
	NH_3	43.0	6.1
	PM_{10}	41.3	13.7
	CO	22.0	2.0

Table 1.13 Uncertainty estimates provided by Member States (cont.)

Member State	Pollutant	Level uncertainty (%)	Trend uncertainty (%)
Latvia	NO_x	73.9	42.09
	NMVOC	84.52	80.53
	SO_2	87.69	14.79
	NH_3	91.49	25.82
	CO	100.29	73.57
Netherlands (e)	NO_x	plus/minus 15	
	SO_2	plus/minus 6	
	NH_3	plus/minus 17	
Sweden	As	74	10
	Cd	46	9
	CO	24	10
	Cr	31	4
	Cu	68	8
	PCDDs/PCDFs	113	180
	Hg	112	5
	NH_3	32	14
	Ni	29	6
	NMVOC	16	8
	NOX	13	2
	PAHs 1–4	715	154
	Pb	11	0
	$PM_{2.5}$	15	5
	PM_{10}	17	5
	Se	19	8
	SO_2	11	2
	TSPs	11	4
	Zn	190	53
United Kingdom	CO	– 20 to +30	
	PM_{10}	– 20 to +50	
	$PM_{2.5}$	– 20 to +50	
	$PM_{1.0}$	– 20 to +50	
	$PM_{0.1}$	– 20 to +50	
	Black smoke	– 30 to +50	
	SO_2	+/– 4	
	NO_x	+/– 10	
	NMVOC	+/– 10	
	NH_3	+/– 20	
	As	+/– > 50	
	Cd	– 30 to + > 50	
	Cr	– 50 to + > 50	
	Cu	+/– > 50	
	Ld	– 30 to +40	
	Hg	– 30 to +50	
	Ni	– 40 to + > 50	
	Se	– 30 to +40	
	Zn	– 40 to + > 50	
	Benzo(a)pyrene	+/– > 50	
	PCDDs/PCDFs	+/– > 50	

Table 1.13 Uncertainty estimates provided by Member States (cont.)

Member State	Pollutant	Level uncertainty (%)	Trend uncertainty (%)
	PCBs	+/– > 50	
	HCH	+/– > 50	
	HCB	+/– > 50	

Note: ([a]) The uncertainty analysis was done for 2011 data using as a base year 1990.

([b]) The uncertainty analysis was done for 2010 data using as a base year 1990. For particulate matter, the year 2000 is considered as the base year.

([c]) Plant specific uncertainty estimates for aggregated NFR categories reported by plants; detailed uncertainty estimates for activity data and emission factors reported. For the analysis, uncertainty of the base year emissions as well as the current year are taken: Base years are for SO_2, CO, NH_3 1980; for NO_x 1987; for NMVOC 1988; for HMs 1990; for POPs 1994; and for TSPs 2000.

([d]) The uncertainty assessment is based on emissions of the year 2005.

([e]) The uncertainty assessment is based on emissions of the year 2000.

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 is given in the Stage 1 review (EMEP CEIP, 2013b).

The Czech Republic and, Hungary only reported 2011 emission data under the LRTAP Convention in 2013 (Table A3.2). As Appendix 3 illustrates, Greece and Luxembourg only reported data for the main pollutants and CO. 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 19 Member States reported activity data ([11]) for the complete time-series (1990–2011).

Figures 1.3 to 1.5 show a simple compilation for completeness of reporting by Member States for the inventory years 1990, 2000, 2010 and 2011, based on the originally submitted NFR templates, i.e. before gap-filling. Only data submitted in 2013 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 show that for all pollutants, there is better availability of data for more recent years.

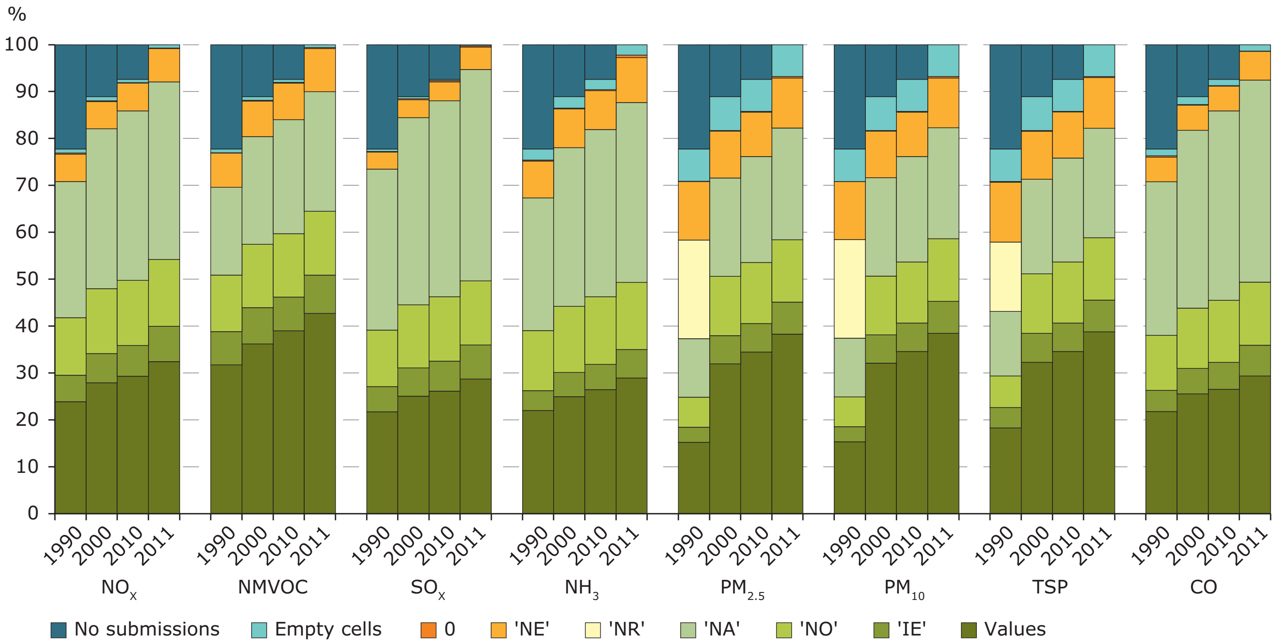
EMEP emission reporting guidelines (UNECE, 2009) define that parties report at least data for the base year of the relevant protocol, and from the year of entry into force of that protocol, and up to the latest year (current year – 2) (Table A2.1). So ideally, there should be no difference between the availability of data submission for 1990 and for 2011. 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 years 2000 and after. On average in 2011, Member States used the notation key 'not applicable' ('NA') for 45 % of the source categories (across all pollutants).

The frequent use of this 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' 'NA' for other sources. On average in 2011, Member States report for 22 % of the source categories (across all pollutants) an emission value (maximum 43 % for NMVOC and minimum 0.1 % for HCH). The use of the notation key 'not estimated' ('NE'), the reporting of empty cells, '0', and in some circumstances the reporting of 'NR' ([12]) are considered to constitute incomplete reporting. In 2011, 16 % of the data were reported incomplete (9 % reported as 'NE', 4 % empty cells, 0.3 % '0' and 3 % reported as 'NR').

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

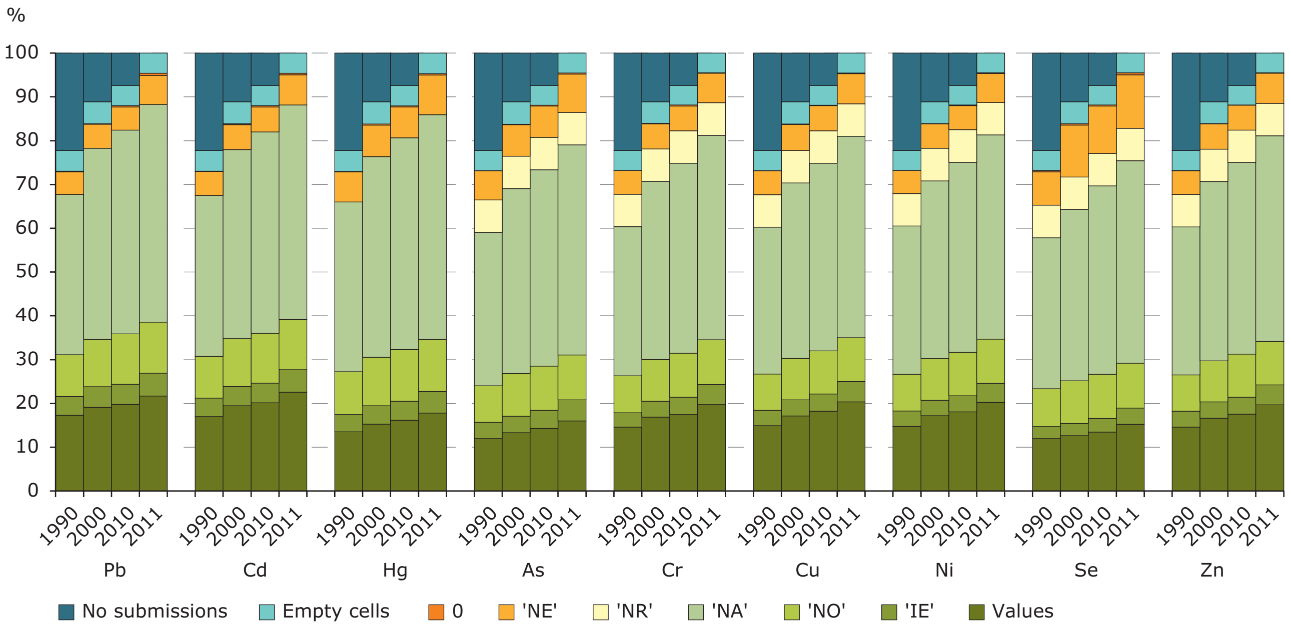
([12]) According to paragraph 9 inof the Emission Reporting Guidelines, emission inventory reporting should cover all years from 1980 onwards if data are available. However, 'NR' 'NR' (not relevant) is introduced to ease the reporting where emissions are not strictly required by the different protocols.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

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



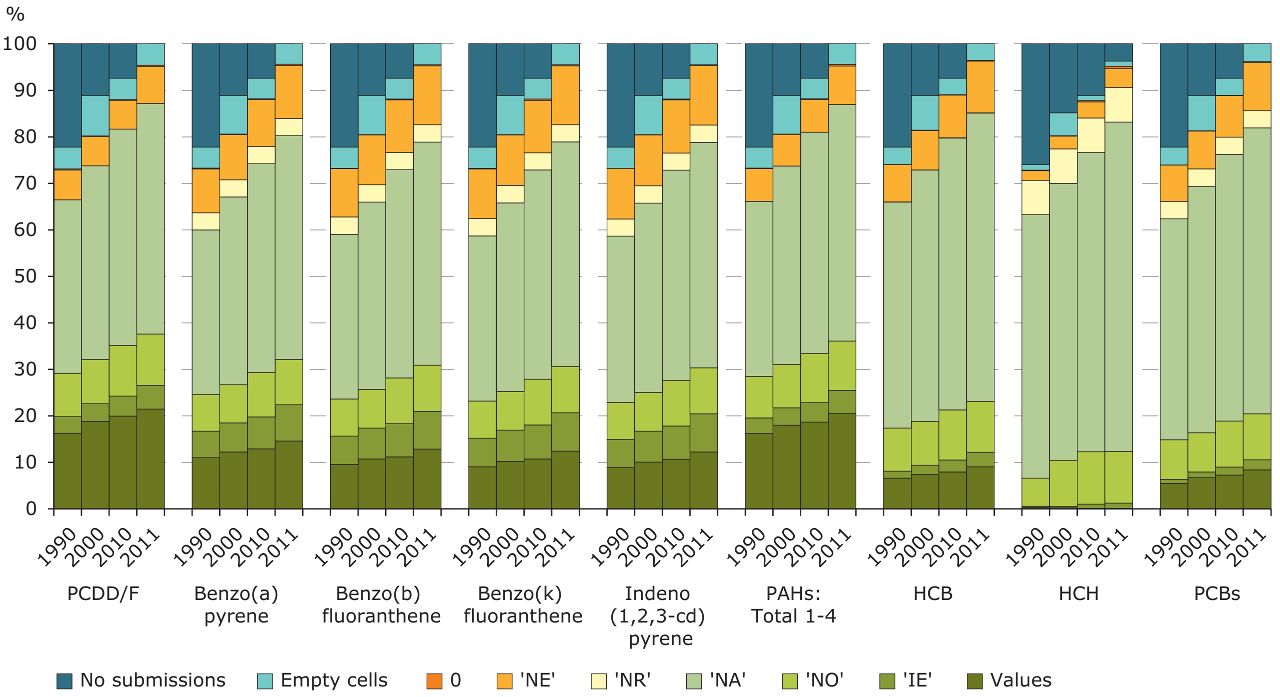
Note: 'NE' — not estimated, 'NR' — not relevant, 'IE' — included elsewhere, 'NA' — not applicable, 'NO' — not occurring. Notation keys are further explained in Appendix 1.

Figure 1.4 Completeness of reporting of NFR templates submitted by Member States for Heavy Metalsmain HMs



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

2 Trends and key categories of EU-27 pollutant emissions

The present EU-27 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-27 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-27 is given.

2.1 Total EU-27 emission trends and progress toward 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 except Cu (+ 0.3 %) were lower in 2011 than in 1990 (or 2000 for PM). For the main air pollutants, the largest reductions across the EU-27 (in percentage terms) since 1990 have been achieved for SO_X emissions (which decreased by 82 %), followed by CO (– 64 %), NMVOC (– 59 %), NO_X (– 48 %) and NH_3 (– 28 %). Substantial decreases in emissions of HMs and POPs have also been recorded since 1990. Emission changes compiled for the period from 2000 to 2011 indicate that $PM_{2.5}$ emissions have fallen by 20 % and PM_{10} emissions by 19 %.

For certain pollutants (e.g. PMs, HMs and POPs), some Member States did not report data, or reported the notation keys 'NE' or 'NR' for some years or the whole time-series. In some cases, the data could not be gap-filled, and thus were not included in the EU-27 total. In such instances, the EU-27 emission totals for these pollutants are not considered complete. Data tables in Chapter 2 (Tables 2.3 to 2.28) show the reported emissions by each Member State, thereby indicating instances where emissions of a certain pollutant are missing for all years.

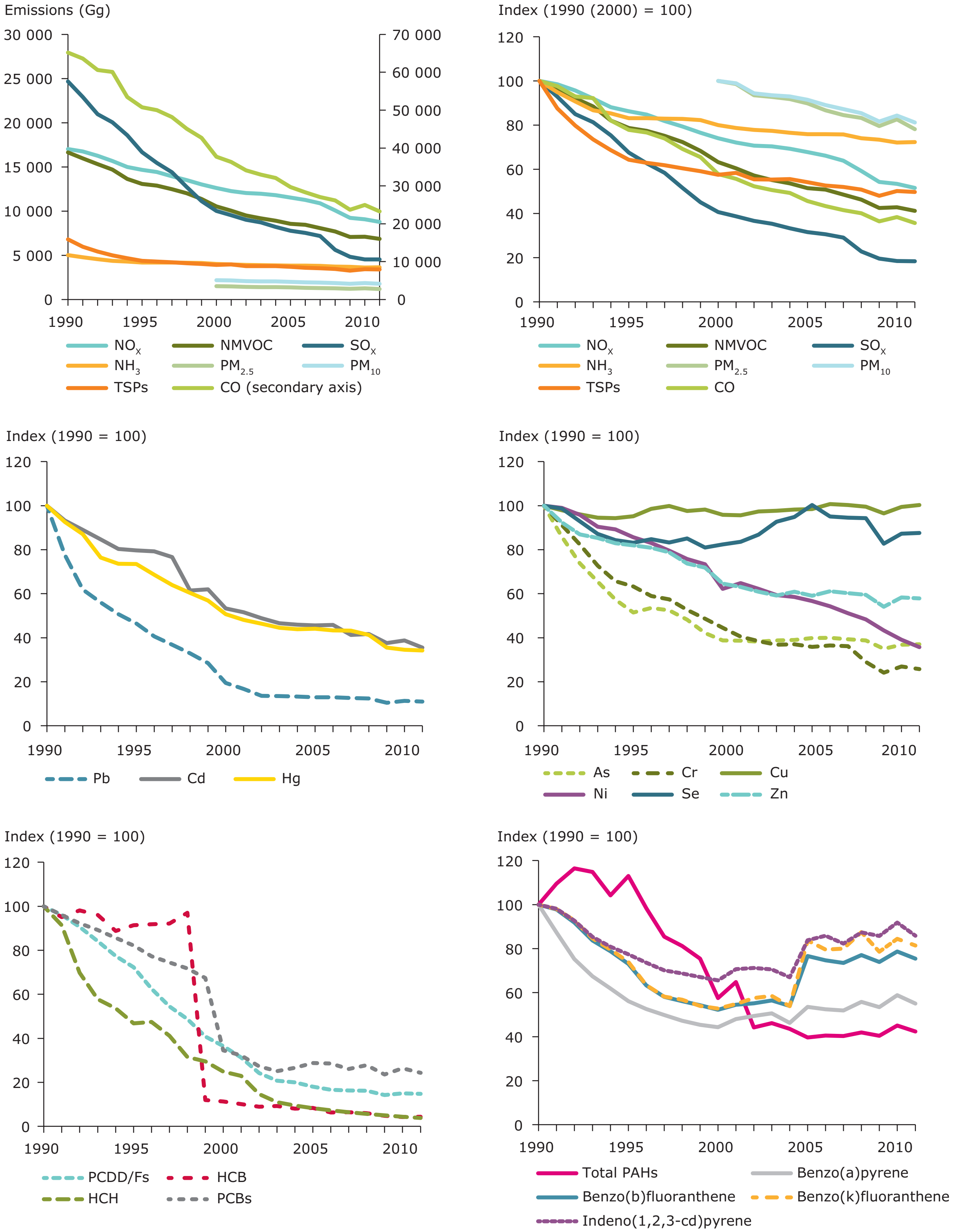
The Gothenburg Protocol to the UNECE LRTAP Convention (UNECE, 1999) contains emission ceilings for the pollutants NO_X, NMVOC, SO_X and NH_3 that parties to the protocol must meet by 2010 and after. Under the reporting to the LRTAP Convention, some Member States have submitted emission projections for the year 2015, and some 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 2013, 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, 2013b). The NEC Directive contains national emission ceilings that, for the EU Member States, are either equal to or more ambitious than those set out in the Gothenburg Protocol.

The compliance checking in this report is based on the reporting on the basis of fuel sold, except for Austria, Belgium, Ireland, Lithuania Luxemburg, the Netherlands and the United Kingdom. These countries may choose to use the national emission 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 national totals for the EMEP grid domain.

In addition to the ceilings for individual countries, the protocol also specifies ceilings for the EU which itself is a party to the protocol. Table 2.2 shows the emissions for the year 2011 reported by the EU-15 Member States in comparison to the respective emission ceilings specified for the EU. Only for NO_X are the 2011 emissions above the level of the ceiling; for the remaining pollutants, the emissions in 2011 were below the respective pollutant ceilings.

Figure 2.2 shows whether the Gothenburg ceilings were met in 2011 in the EU Member States. Seven Member States reported NO_X emissions higher than their ceilings in 2010. Only one country exceeded its NMVOC ceiling in 2011 (Germany), and four (Denmark, Finland, Germany and Spain) exceeded their NH_3 ceiling. It should also be noted that all new Member States ('EU-12') have met their emission ceilings for all pollutants.

Figure 2.1 EU-27 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 only for the year 2000 and after. Hence emission trends can only be shown for these years; the indexed emissions are based on emissions in the year 2000 (= 100).

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

Table 2.1 Total EU-27 emissions of the main air pollutants, HMs, POPs and PM

Pollutant	Unit	1990	1995	2000	2005	2006	2007	2008	2009	2010	2011	Change 1990–2011	Change 2010–2011
NO_x	Gg	17 022	14 678	12 601	11 542	11 253	10 880	10 077	9 225	9 084	8 780	– 48 %	– 3.3 %
NMVOC	Gg	16 633	13 085	10 520	8 556	8 446	8 066	7 689	7 067	7 107	6 848	– 59 %	– 3.6 %
SO_x	Gg	24 681	16 663	10 019	7 782	7 538	7 179	5 610	4 824	4 540	4 537	– 82 %	– 0.1 %
NH_3	Gg	5 027	4 181	4 022	3 814	3 814	3 810	3 720	3 690	3 621	3 635	– 28 %	0.4 %
TSPs	Gg	6 804	4 377	3 913	3 685	3 581	3 539	3 454	3 261	3 411	3 381	– 50 %	– 0.9 %
CO	Gg	65 203	50 756	37 715	29 696	28 272	27 013	26 137	23 698	24 985	23 232	– 64 %	– 7.0 %
Pb	Mg	23 214	10 798	4 516	3 015	3 005	2 935	2 887	2 423	2 635	2 541	– 89 %	– 3.6 %
Cd	Mg	254	202	136	116	116	105	106	95	99	90	– 64 %	– 8.4 %
Hg	Mg	231	170	117	102	100	100	95	82	80	79	– 66 %	– 1.2 %
As	Mg	565	291	219	225	226	222	219	198	208	209	– 63 %	0.7 %
Cr	Mg	1 393	881	620	499	508	503	403	336	375	359	– 74 %	– 4.3 %
Cu	Mg	3 771	3 590	3 613	3 715	3 800	3 782	3 754	3 637	3 751	3 782	0 %	0.8 %
Ni	Mg	2 621	2 244	1 631	1 485	1 423	1 341	1 266	1 137	1 024	937	– 64 %	– 8.5 %
Se	Mg	267	222	220	268	254	253	252	221	234	234	– 12 %	0.3 %
Zn	Mg	11 604	9 517	7 492	6 848	7 098	6 992	6 910	6 272	6 768	6 711	– 42 %	– 0.8 %
PCDD/Fs	g I-Teq	11 196	8 091	4 082	2 025	1 862	1 831	1 812	1 596	1 679	1 656	– 85 %	– 1.3 %
Total PAHs	Mg	2 596	2 934	1 493	1 028	1 051	1 047	1 088	1 050	1 170	1 098	– 58 %	– 6.1 %
HCB	kg	5 197	4 750	591	438	330	336	313	248	224	228	– 96 %	2.1 %
HCH	kg	179 205	83 838	44 665	14 799	13 033	11 490	10 132	8 937	7 885	6 960	– 96 %	– 11.7 %
PCBs	kg	13 300	10 934	4 600	3 828	3 807	3 468	3 699	3 142	3 518	3 231	– 76 %	– 8.1 %
Benzo(a) pyrene	Mg	325	182	144	174	171	169	181	174	191	179	– 45 %	– 6.3 %
Benzo(b) fluoranthene	Mg	208	152	109	160	156	153	160	154	164	157	– 25 %	– 4.1 %
Benzo(k) fluoranthene	Mg	96	71	51	80	77	77	84	76	81	78	– 19 %	– 3.6 %
Indeno(1,2,3-cd)pyrene	Mg	125	97	82	105	107	103	109	107	115	107	– 14 %	– 6.5 %
												Change 2000–2011	Change 2010–2011
$PM_{2.5}$	Gg			1 476	1 356	1 307	1 275	1 256	1 200	1 245	1 179	– 20 %	– 5.3 %
PM_{10}	Gg			2 184	1 996	1 945	1 905	1 864	1 781	1 841	1 771	– 19 %	– 3.8 %

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

Negative percentage values indicate that emissions have decreased.

Shaded cells mean that data for these pollutants are complete (reported and gap-filled data), which means the use of neither the notation keys 'NE' or 'NR', 0 nor empty cells are used by the Member States.

The 1990 to 2011 changes of emissions in Table 2.1 and subsequent tables (Table 2.2 to Table 2.28) are expressed as 100 x (E_{2011} – E_{1990}) / E_{1990} (%), where E_{2011} and E_{1990} are 2011 and 1990 total emissions, respectively. The 2010 to 2011 changes of emissions are expressed as 100 x (E_{2011} – E_{2010}) / E_{2010} (%), where E_{2011} and E_{2010} are the 2011 and 2010 total emissions, respectively.

Basis for the EU inventory shown in Table 2.1 and subsequent tables (Table 2.2 to Table 2.28) 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 explanations.

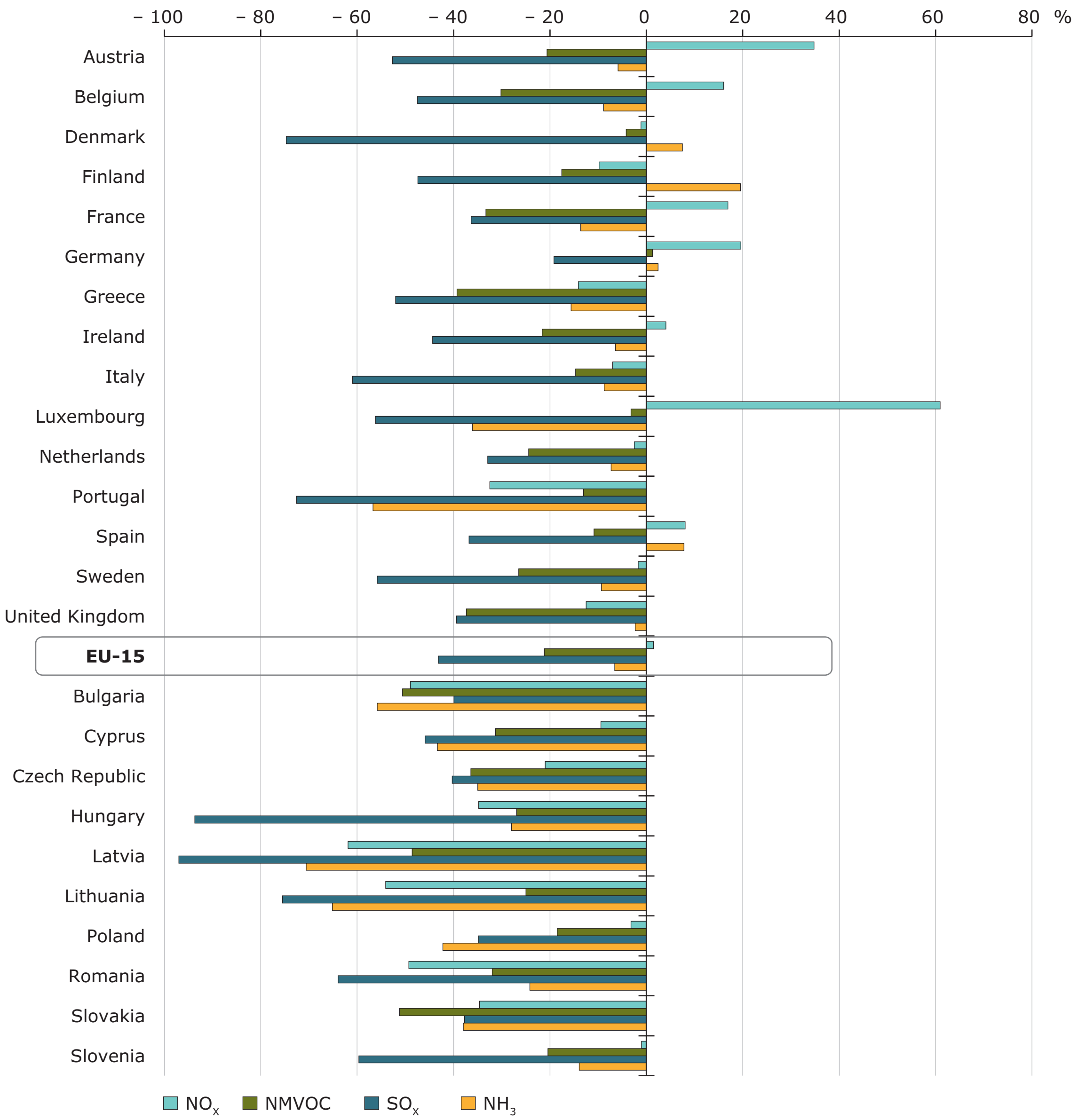
Table 2.2 Comparison of emissions reported for 2011 by EU-15 Member States with emission ceilings for the EU specified in the UNECE Gothenburg Protocol

Pollutant	EU-15 emissions year 2011 (Gg)	European Union (EU-15) Gothenburg Protocol 2010 ceilings (Gg)	Difference (%)	Sum of individual EU-15 ceilings (Gg) ([a])
NO_x	6 771	6 671	2 %	6 648
NMVOC	5 202	6 600	– 21 %	6 600
SO_x	2 308	4 059	– 43 %	4 044
NH_3	2 923	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, Luxemburg, the Netherlands and the United Kingdom). See Section 1.4.2 for explanation. For Spain, data for the compliance checks are national totals for the EMEP grid domain.

Figure 2.2 Distance of Member State emissions 2011 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, Luxemburg, the Netherlands and the United Kingdom). See Section 1.4.2 for explanation. For Spain, data for the compliance checks are national totals for the EMEP grid domain.

2.2 Nitrogen oxides (NO_x) emission trends and key categories

Between 1990 and 2011, NO_x emissions decreased in the EU-27 by 48 %. Between 2010 and 2011, the decrease was 3.3 %, mainly due to reductions reported in the United Kingdom, France and Germany (Table 2.3). The Member States that contributed most (more than 10 %) to the emissions of NO_x in 2011 were Germany, the United Kingdom, Spain, France and Italy.

France, Germany and the United Kingdom reported in their IIRs (Appendix 5), that NO_x emissions dropped from 1990 to 2011 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-27 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-27	
	1990	1995	2000	2005	2006	2007	2008	2009	2010	2011	1990–2011	2010–2011	1990	2011
Austria	195	182	206	238	223	217	204	189	193	183	– 7 %	– 5.4 %	1.1 %	2.1 %
Belgium	401	388	330	292	274	264	239	208	221	210	– 48 %	– 4.8 %	2.4 %	2.4 %
Bulgaria	249	151	126	154	151	141	141	117	115	136	– 45 %	18.3 %	1.5 %	1.5 %
Cyprus	17	19	22	21	21	22	20	20	18	21	24 %	15.6 %	0.1 %	0.2 %
Czech Republic	741	429	396	278	282	284	261	251	239	226	– 70 %	– 5.3 %	4.4 %	2.6 %
Denmark	278	271	205	186	188	174	156	137	134	126	– 55 %	– 6.0 %	1.6 %	1.4 %
Estonia	74	39	38	37	35	39	36	30	37	36	– 52 %	– 3.0 %	0.4 %	0.4 %
Finland	323	279	201	169	188	187	168	155	166	153	– 53 %	– 7.9 %	1.9 %	1.7 %
France	1 842	1 705	1 582	1 410	1 338	1 271	1 180	1 099	1 075	1 005	– 45 %	– 6.5 %	10.8 %	11.5 %
Germany	2 875	2 175	1 924	1 575	1 561	1 483	1 406	1 307	1 332	1 293	– 55 %	– 2.9 %	16.9 %	14.7 %
Greece	326	329	359	417	413	414	392	379	319	295	– 9 %	– 7.3 %	1.9 %	3.4 %
Hungary	8	185	185	203	202	185	169	154	152	129	> 100 %	– 15.0 %	0.0 %	1.5 %
Ireland	123	122	135	127	123	120	109	87	79	71	– 42 %	– 10.6 %	0.7 %	0.8 %
Italy	2 022	1 896	1 424	1 213	1 158	1 117	1 051	982	950	930	– 54 %	– 2.1 %	11.9 %	10.6 %
Latvia	65	39	36	37	38	38	34	32	34	32	– 51 %	– 6.6 %	0.4 %	0.4 %
Lithuania	137	87	54	58	60	69	55	54	58	51	– 63 %	– 12.6 %	0.8 %	0.6 %
Luxembourg	39	37	45	62	56	52	50	44	46	48	24 %	4.5 %	0.2 %	0.5 %
Malta	8	9	8	9	9	9	9	9	8	8	4 %	– 3.2 %	0.0 %	0.1 %
Netherlands	566	472	394	337	324	309	300	277	274	259	– 54 %	– 5.4 %	3.3 %	3.0 %
Poland	1 280	1 120	862	860	891	868	830	791	863	851	– 34 %	– 1.5 %	7.5 %	9.7 %
Portugal	226	257	259	259	238	232	209	197	186	176	– 22 %	– 5.4 %	1.3 %	2.0 %
Romania	533	377	307	307	295	272	270	230	218	222	– 58 %	1.7 %	3.1 %	2.5 %
Slovakia	226	179	107	102	96	96	94	84	89	85	– 62 %	– 4.0 %	1.3 %	1.0 %
Slovenia	59	57	49	46	47	48	53	45	45	45	– 25 %	– 0.3 %	0.3 %	0.5 %
Spain	1 271	1 327	1 359	1 398	1 349	1 348	1 167	1 053	975	1 013	– 20 %	3.9 %	7.5 %	11.5 %
Sweden	269	246	209	178	175	169	161	151	153	145	– 46 %	– 5.2 %	1.6 %	1.7 %
United Kingdom	2 868	2 298	1 777	1 570	1 518	1 453	1 315	1 145	1 107	1 033	– 64 %	– 6.6 %	16.9 %	11.8 %
EU-27 (a)	**17 022**	**14 678**	**12 601**	**11 542**	**11 253**	**10 880**	**10 077**	**9 225**	**9 084**	**8 780**	**– 48 %**	**– 3.3 %**	**100 %**	**100 %**
EU-27 (b)	17 022	14 678	12 601	11 542	11 253	10 880	10 077	9 225	9 084	8 780				

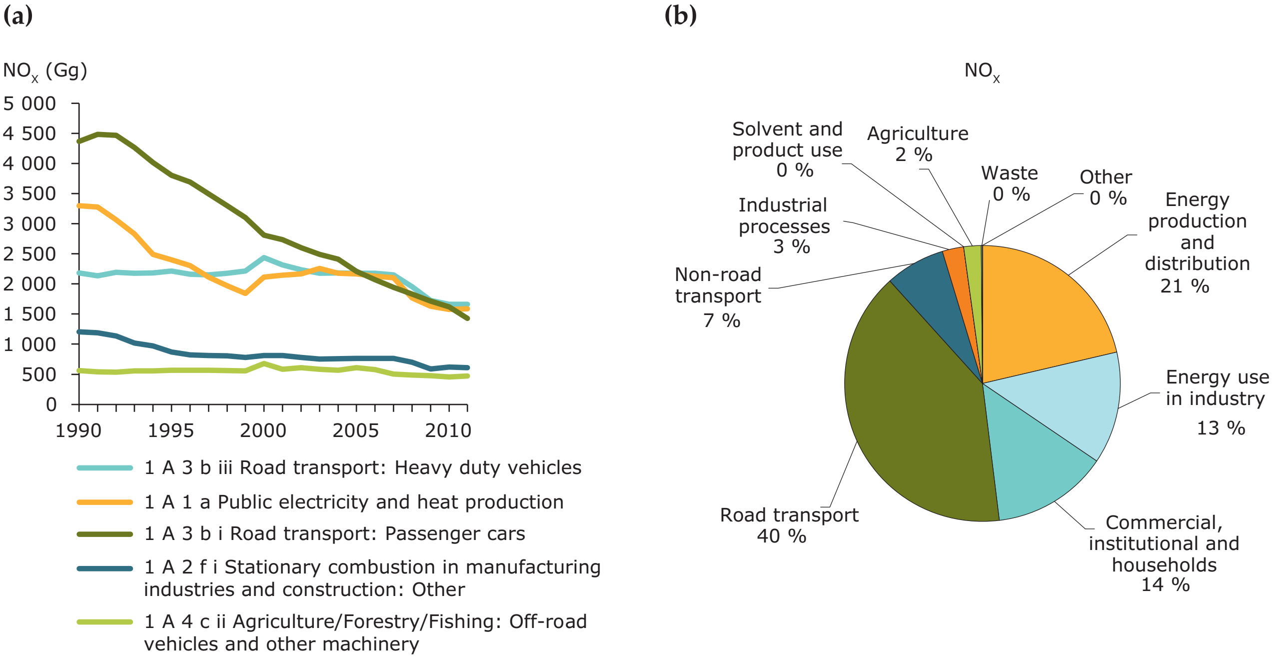
Note: (a) Sum of national totals as reported by Member States.

(b) Sum of sectors.

Negative percentage values indicate that emissions have decreased.

Shaded cells indicate gap-filled data. For more detailed information, see Annex D.

Figure 2.3 NO_x emissions in the EU-27: (a) trend in NO_x emissions from the five most important key categories, 1990–2011; (b) share of emissions by sector group, 2011



The categories '1 A 3 b iii — Road transport: Heavy duty vehicles', '1 A 1 a — Public electricity and heat production' and '1 A 3 b i — Road transport: Passenger cars' were the most important key categories for NO_x emissions (Figure 2.3). Of the top five key categories, the highest relative reductions in emissions between 1990 and 2011 were achieved in the third most important key category, '1 A 3 b i — Road transport: Passenger cars' (– 67.3 %) (Figure 2.3).

Figure 2.3 shows the contribution to total EU-27 emissions made by the aggregated sector groups. For NO_x, common important emission sources are the energy and transport sectors. The emission reductions from the road transport sector have primarily been achieved as a result of fitting catalysts to vehicles (driven by the legislative 'Euro' standards) (EEA, 2012a). Nevertheless, the road transport sectors together represent the largest source of NO_x emissions, accounting for 40 % of total EU-27 emissions in 2011. In the electricity/energy production sectors, reductions have also occurred, in these instances as a result of measures like 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, 2012a).

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

Between 1990 and 2011, NMVOC emissions dropped in the EU-27 by 59 %. Between 2010 and 2011, a decrease of 3.6 % was reported, mainly due to reduction of emissions in France, Germany and Greece (Table 2.4). In 2011, the Member States that contributed most (more than 10 %) to emissions of NMVOC in 2011 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 2011 is due to increasingly stricter regulations and controls, resulting in more cars with catalytic converters, and reduced petrol consumption.

The Bulgarian NIR (NIR of Bulgaria, 2013) explains that between 1993 and 1995, the NMVOC emissions trend shows a notable decline mainly due to the economic crisis. The production in many plants in Bulgaria decreased and thus the metal degreasing and paint application activities declined.

Germany's emissions declined between 1990 and 1995 due to a strong reduction of NMVOC emission factors (Low Density Polyethylene (PE-LD)) that occurred between 1994 and 1995 (Appendix 5, Germany's IIR). The lower NMVOC emission values in Germany for 2008 and 2009 are a result of the economic crisis. In 2011, emissions are close to the 2008 level again (Appendix 5, Germany's IIR).

The three categories '1 A 4 b i — Residential: Stationary plants', '3 D 2 — Domestic solvent use including fungicides' and '3 A 2 — Industrial coating application' were the most important key categories for NMVOC emissions, together making up 31 % of total emissions (Figure 2.4). Among the top five key categories, the highest relative reductions in emissions between 1990 and 2011 were achieved in the fourth most important key category '3 D 3 — Other product use' (– 52.9 %). Figure 2.4 shows the contribution to total EU-27 emissions made by the aggregated sector groups. For NMVOC, important emission sources are 'solvent and product use', 'commercial, institutional and households' and road transport.

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

Member State	NMVOC (Gg)										Change		Share in EU-27	
	1990	1995	2000	2005	2006	2007	2008	2009	2010	2011	1990–2011	2010–2011	1990	2011
Austria	274	223	175	165	175	161	151	123	134	128	– 53 %	– 4.6 %	1.6 %	1.9 %
Belgium	314	268	188	145	139	129	120	107	107	101	– 68 %	– 6.0 %	1.9 %	1.5 %
Bulgaria	620	144	87	86	90	84	84	91	91	91	– 85 %	0.2 %	3.7 %	1.3 %
Cyprus	18	17	15	14	14	14	13	12	12	10	– 45 %	– 17.6 %	0.1 %	0.1 %
Czech Republic	311	215	244	182	179	174	166	151	151	140	– 55 %	– 7.3 %	1.9 %	2.0 %
Denmark	164	166	139	114	109	104	99	92	88	81	– 50 %	– 7.4 %	1.0 %	1.2 %
Estonia	70	50	45	40	38	39	37	35	35	33	– 53 %	– 5.5 %	0.4 %	0.5 %
Finland	239	203	168	136	131	129	118	111	117	107	– 55 %	– 8.0 %	1.4 %	1.6 %
France	2 602	2 174	1 723	1 231	1 118	997	912	816	805	734	– 72 %	– 8.8 %	15.6 %	10.7 %
Germany	3 132	1 809	1 395	1 147	1 135	1 072	1 018	931	1 057	1 008	– 68 %	– 4.6 %	18.8 %	14.7 %
Greece	268	258	264	220	230	219	228	212	185	158	– 41 %	– 14.2 %	1.6 %	2.3 %
Hungary	54	153	149	157	163	145	148	116	98	100	86 %	1.8 %	0.3 %	1.5 %
Ireland	84	79	70	56	55	53	50	47	45	44	– 48 %	– 3.4 %	0.5 %	0.6 %
Italy	1 925	1 958	1 514	1 253	1 225	1 174	1 115	1 057	1 003	989	– 49 %	– 1.4 %	11.6 %	14.4 %
Latvia	102	67	65	73	74	83	74	61	66	70	– 31 %	5.8 %	0.6 %	1.0 %
Lithuania	94	85	77	87	76	77	71	68	71	69	– 26 %	– 3.0 %	0.6 %	1.0 %
Luxembourg	19	16	12	12	11	11	10	10	9	9	– 51 %	3.2 %	0.1 %	0.1 %
Malta	6	8	3	3	4	3	3	3	3	3	– 51 %	19.4 %	0.0 %	0.0 %
Netherlands	477	338	233	169	160	157	155	146	145	144	– 70 %	– 0.6 %	2.9 %	2.1 %
Poland	831	769	574	572	630	611	634	615	654	652	– 22 %	– 0.3 %	5.0 %	9.5 %
Portugal	289	279	255	206	199	193	186	174	176	176	– 39 %	– 0.3 %	1.7 %	2.6 %
Romania	412	223	268	311	396	396	412	366	365	356	– 14 %	– 2.6 %	2.5 %	5.2 %
Slovakia	134	91	66	73	70	67	67	64	62	68	– 49 %	9.4 %	0.8 %	1.0 %
Slovenia	65	59	48	40	40	38	36	35	35	32	– 51 %	– 8.4 %	0.4 %	0.5 %
Spain	1 075	995	1 022	815	788	770	707	641	639	615	– 43 %	– 3.7 %	6.5 %	9.0 %
Sweden	359	278	224	198	195	192	189	184	183	177	– 51 %	– 3.1 %	2.2 %	2.6 %
United Kingdom	2 696	2 160	1 496	1 049	1 002	973	886	799	771	752	– 72 %	– 2.5 %	16.2 %	11.0 %
EU-27 (a)	**16 633**	**13 085**	**10 520**	**8 556**	**8 446**	**8 066**	**7 689**	**7 067**	**7 107**	**6 848**	**– 59 %**	**– 3.6 %**	**100 %**	**100 %**
EU-27 (b)	16 620	13 076	10 514	8 552	8 442	8 063	7 686	7 064	7 104	6 845				

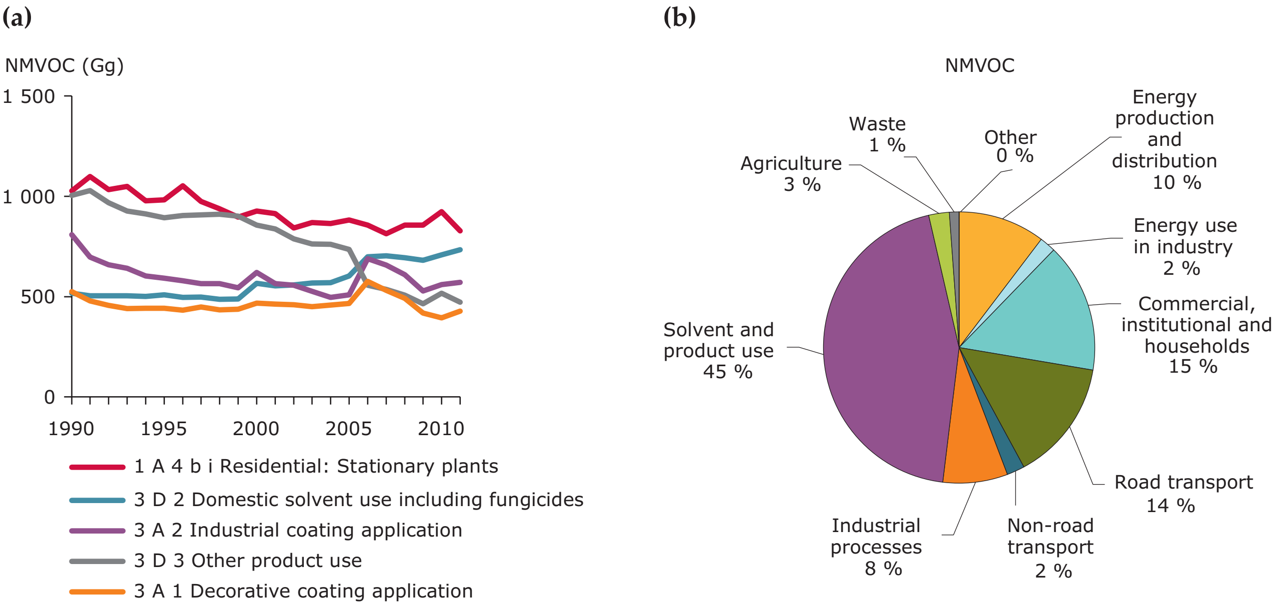
Note: (a) Sum of national totals as reported by Member States.

(b) Sum of sectors.

Negative percentage values indicate that emissions have decreased.

Shaded cells denote gap-filled data. For more detailed information, see Annex D.

Figure 2.4 NMVOC emissions in the EU-27: (a) trend in NMVOC emissions from the five most important key categories, 1990–2011; (b) share of emissions by sector group, 2011



2.4 Sulphur oxides (SO_x) emission trends and key categories

Between 1990 and 2011, SO_x emissions decreased in the EU-27 by 82 %. Between 2010 and 2011, the emissions decreased by 0.1 %, mainly due to reductions of emissions in Poland, France and the United Kingdom (Table 2.5). The Member States that contributed most (more than 10 %) to the emissions of SO_x in 2011 were Poland, Spain and Germany.

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 the use of fuels with lower content of sulphur, 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).

Austria mentioned that since the large emission reduction (between 2008 and 2009) as a result of the crisis in 2009, emissions are increasing again in 2010 and 2011 reflecting the recovery of the economy (Appendix 5, Austria's IIR). Cyprus noted that the increase observed in the SO_x emissions in 2010 and 2011 is due to the fact that the FGD Unit installed in the Steam Turbine Unit 3 of the Vasilikos power station was not in operation from 20 January 2010 (Appendix 5, Cyprus' IIR). Estonia stated that the decline of its SO_x emissions from 1990 to 2011 is mainly caused by the decline in energy production, as the result of a restructuring of the economy (Appendix 5, Estonia's IIR).

Category '1 A 1 a — Public electricity and heat production' is the most important key category for SO_x emissions, making up 48 % of total SO_x emissions.

Among the top five key categories, the highest relative reductions in emissions between 1990 and 2011 were achieved in the second most important key category '1 A 2 f i — Stationary combustion in manufacturing industries and construction: Other' (– 82.3 %), the most important key category '1 A 1 a — Public electricity and heat production' (– 81.3 %)

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

Member State	SO_x (Gg)										Change		Share in EU-27	
	1990	1995	2000	2005	2006	2007	2008	2009	2010	2011	1990–2011	2010–2011	1990	2011
Austria	74	48	32	27	28	24	22	18	19	19	– 75 %	– 1.8 %	0.3 %	0.4 %
Belgium	363	261	174	145	135	126	98	77	64	56	– 85 %	– 13.1 %	1.5 %	1.2 %
Bulgaria	1 100	1 295	861	776	763	819	569	440	387	515	– 53 %	32.9 %	4.5 %	11.3 %
Cyprus	33	41	50	38	32	30	23	18	22	21	– 35 %	– 4.4 %	0.1 %	0.5 %
Czech Republic	1 876	1 095	264	219	211	217	174	173	170	169	– 91 %	– 0.8 %	7.6 %	3.7 %
Denmark	178	140	31	24	28	26	20	15	15	14	– 92 %	– 6.1 %	0.7 %	0.3 %
Estonia	274	116	97	76	70	88	69	55	83	73	– 73 %	– 12.6 %	1.1 %	1.6 %
Finland	263	99	79	69	84	83	70	59	67	61	– 77 %	– 8.6 %	1.1 %	1.3 %
France	1 302	968	630	463	436	425	360	311	287	255	– 80 %	– 11.4 %	5.3 %	5.6 %
Germany	5 292	1 718	653	477	487	469	469	419	444	445	– 92 %	0.1 %	21.4 %	9.8 %
Greece	476	540	496	540	533	538	445	425	265	262	– 45 %	– 1.2 %	1.9 %	5.8 %
Hungary	7	701	487	140	115	91	98	82	30	35	> 100 %	16.7 %	0.0 %	0.8 %
Ireland	182	161	140	71	61	55	46	32	26	23	– 87 %	– 10.7 %	0.7 %	0.5 %
Italy	1 799	1 325	752	405	383	339	284	233	215	195	– 89 %	– 9.2 %	7.3 %	4.3 %
Latvia	105	49	16	7	6	6	5	4	3	3	– 97 %	– 1.3 %	0.4 %	0.1 %
Lithuania	209	91	54	44	38	39	27	30	38	36	– 83 %	– 6.7 %	0.8 %	0.8 %
Luxembourg	15	9	3	3	3	2	2	2	2	2	– 88 %	– 20.4 %	0.1 %	0.0 %
Malta	16	27	24	11	11	12	11	8	8	8	– 50 %	– 2.4 %	0.1 %	0.2 %
Netherlands	192	130	73	64	64	61	51	38	34	34	– 82 %	– 1.3 %	0.8 %	0.7 %
Poland	3 210	2 376	1 445	1 233	1 311	1 223	1 001	867	950	910	– 72 %	– 4.2 %	13.0 %	20.1 %
Portugal	160	170	124	86	79	79	74	57	53	47	– 71 %	– 13.0 %	0.6 %	1.0 %
Romania	839	715	529	673	653	535	526	444	350	331	– 61 %	– 5.5 %	3.4 %	7.3 %
Slovakia	524	245	127	89	88	71	69	64	69	68	– 87 %	– 1.3 %	2.1 %	1.5 %
Slovenia	199	122	93	41	16	15	13	10	10	11	– 95 %	11.2 %	0.8 %	0.2 %
Spain	2 182	1 795	1 513	1 323	1 215	1 209	565	519	488	539	– 75 %	10.5 %	8.8 %	11.9 %
Sweden	105	69	42	36	36	32	30	29	32	30	– 72 %	– 6.4 %	0.4 %	0.7 %
United Kingdom	3 708	2 357	1 230	700	650	568	489	395	407	379	– 90 %	– 6.9 %	15.0 %	8.3 %
EU-27 ([a])	**24 681**	**16 663**	**10 019**	**7 782**	**7 538**	**7 179**	**5 610**	**4 824**	**4 540**	**4 537**	**– 82 %**	**– 0.1 %**	**100 %**	**100 %**
EU-27 ([b])	24 681	16 663	10 019	7 782	7 538	7 179	5 610	4 824	4 540	4 537				

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

([b]) Sum of sectors.

Negative percentage values indicate a decrease of emissions.

Shaded cells denote gap-filled data. For more detailed information, see Annex D.

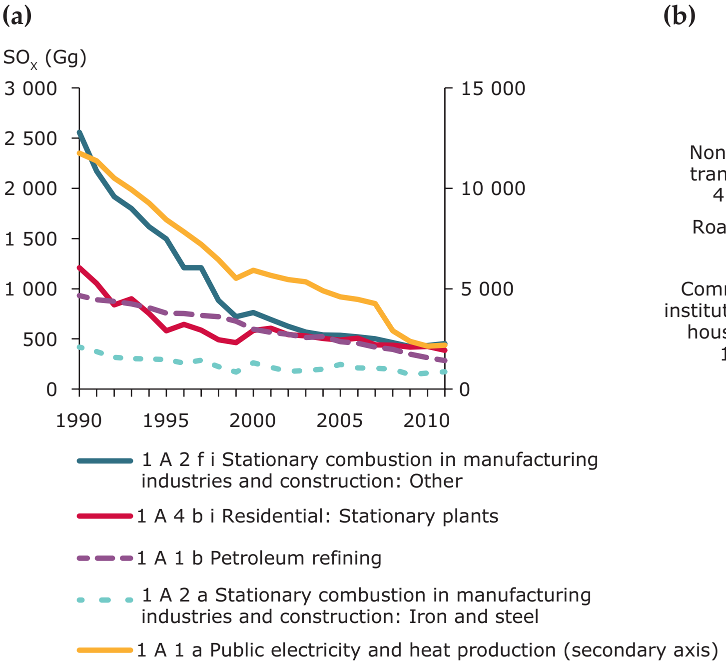
and the fourth most important key category '1 A 1 b — Petroleum refining' (– 69.4 %).

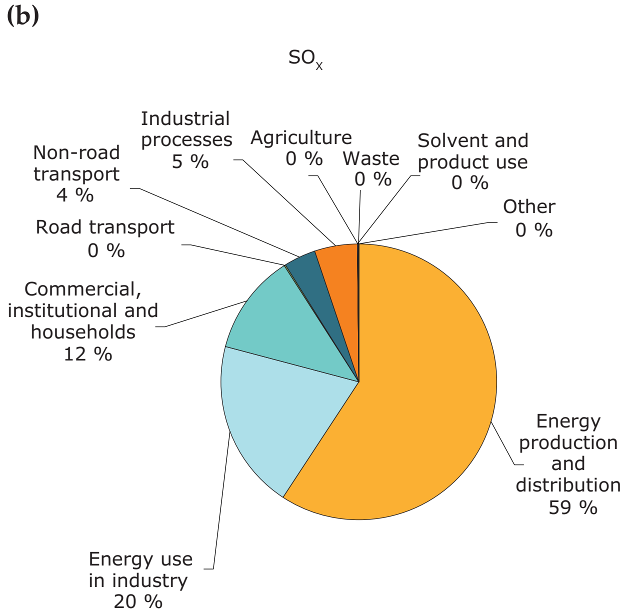
The data dip of the category '1 A 4 b i — Residential: Stationary plants' of the year 1995 is due to low emission data reported from the Czech Republic ([13]).

For these main emitting sources, emissions reduction since 1990 has been achieved as a result of a combination of 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 European Union directives relating to the sulphur content of certain liquid fuels (EEA, 2012b).

Figure 2.5 shows the contribution to total EU-27 emissions made by the aggregated sector groups. For SO_X, common important emission sources are the energy sectors.

Figure 2.5 SO_x emissions in the EU-27: (a) trend in SO_x emissions from the five most important key categories, 1990–2011; (b) share of emissions by sector group, 2011





([13]) The Czech Republic has already sent corrected data in personal communication with the ETC/ACM. However, as these data are not officially reported via CDR within this submission round, they are not included in this years' EU inventory.

2.5 Ammonia (NH_3) emission trends and key categories

Between 1990 and 2011, NH_3 emissions decreased in the EU-27 by 28 %. Between 2010 and 2011, emissions increased by 0.4 %, mainly due to emission increases in France and Germany (Table 2.6). The Member States that contributed most (more than 10 %) to the emissions of NH_3 in 2011 were France, Germany, Spain and Italy.

France reported that its NH_3 emissions decreased constantly since 2000, despite the peaks in 2008 and 2011, resulting from 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 emission 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).

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

Member State	NH_3 (Gg)										Change		Share in EU-27	
	1990	1995	2000	2005	2006	2007	2008	2009	2010	2011	1990–2011	2010–2011	1990	2011
Austria	65	71	65	63	63	63	63	63	63	62	– 5 %	– 1.4 %	1.3 %	1.7 %
Belgium	120	115	86	71	71	68	67	67	68	67	– 44 %	– 0.4 %	2.4 %	1.9 %
Bulgaria	133	76	52	58	59	62	62	52	51	48	– 64 %	– 5.9 %	2.6 %	1.3 %
Cyprus	5	6	6	6	6	6	5	5	5	5	– 3 %	– 6.9 %	0.1 %	0.1 %
Czech Republic	156	86	74	68	63	60	58	73	69	66	– 58 %	– 4.3 %	3.1 %	1.8 %
Denmark	114	99	91	83	80	79	77	75	75	74	– 35 %	– 1.1 %	2.3 %	2.0 %
Estonia	25	11	10	10	10	10	11	10	10	10	– 58 %	1.2 %	0.5 %	0.3 %
Finland	39	36	36	38	38	38	38	37	38	37	– 4 %	– 1.3 %	0.8 %	1.0 %
France	682	661	700	657	654	654	674	659	649	674	– 1 %	3.9 %	13.6 %	18.5 %
Germany	706	605	608	579	575	572	572	579	552	563	– 20 %	2.1 %	14.1 %	15.5 %
Greece	85	74	71	68	66	68	65	62	64	62	– 27 %	– 4.3 %	1.7 %	1.7 %
Hungary	124	77	71	80	81	71	69	68	65	65	– 48 %	– 0.9 %	2.5 %	1.8 %
Ireland	107	112	114	110	110	107	108	109	108	109	1 %	1.0 %	2.1 %	3.0 %
Italy	468	448	449	416	411	420	410	393	379	382	– 18 %	0.8 %	9.3 %	10.5 %
Latvia	48	16	13	16	16	16	16	17	17	13	– 73 %	– 25.5 %	1.0 %	0.4 %
Lithuania	84	37	27	41	35	38	30	30	30	29	– 65 %	– 2.4 %	1.7 %	0.8 %
Luxembourg	5	6	6	5	5	5	5	5	5	5	– 15 %	– 1.6 %	0.1 %	0.1 %
Malta	2	2	2	2	2	2	2	2	2	2	– 18 %	0.4 %	0.0 %	0.0 %
Netherlands	355	208	161	141	141	140	127	125	122	119	– 67 %	– 2.6 %	7.1 %	3.3 %
Poland	508	380	280	270	285	289	285	273	271	270	– 47 %	– 0.2 %	10.1 %	7.4 %
Portugal	64	59	61	50	48	49	47	47	47	47	– 27 %	– 1.0 %	1.3 %	1.3 %
Romania	300	217	206	199	196	202	186	186	160	159	– 47 %	– 0.4 %	6.0 %	4.4 %
Slovakia	65	40	32	29	27	27	25	25	25	24	– 63 %	– 3.0 %	1.3 %	0.7 %
Slovenia	21	19	20	19	18	19	18	18	18	17	– 18 %	– 3.7 %	0.4 %	0.5 %
Spain	335	317	400	379	397	401	369	378	391	383	14 %	– 2.1 %	6.7 %	10.5 %
Sweden	55	64	59	56	55	53	52	50	52	52	– 6 %	– 0.1 %	1.1 %	1.4 %
United Kingdom	354	337	323	304	303	292	279	281	286	290	– 18 %	1.6 %	7.0 %	8.0 %
EU-27 (a)	**5 027**	**4 181**	**4 022**	**3 814**	**3 814**	**3 810**	**3 720**	**3 690**	**3 621**	**3 635**	**– 28 %**	**0.4 %**	**100 %**	**100 %**
EU-27 (b)	5 027	4 181	4 022	3 814	3 814	3 810	3 720	3 690	3 623	3 635				

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

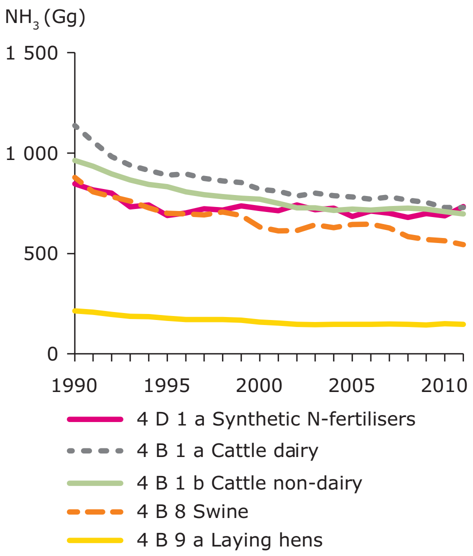
(b) Sum of sectors: differences arise when only national totals and no sectoral data are available.

Negative percentage values indicate that emissions have decreased.

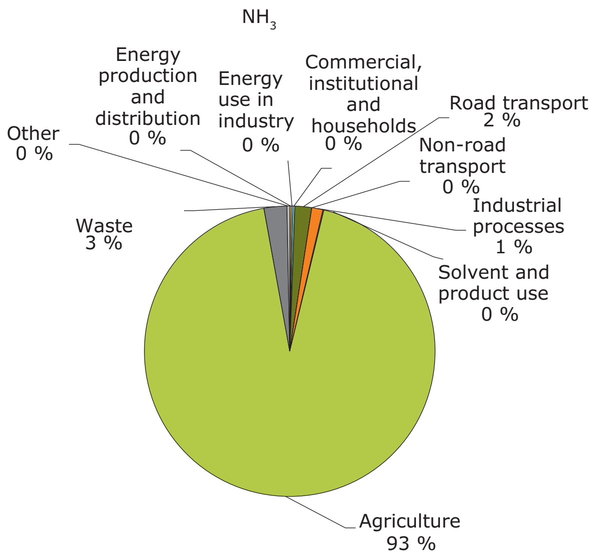
Shaded cells denote gap-filled data. For more detailed information, see Annex D.

Figure 2.6 NH_3 emissions in the EU-27: (a) trend in NH_3 emissions from the five most important key categories, 1990–2011; (b) share of emissions by sector group, 2011

(a)



(b)



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 59 % of total NH_3 emissions (Figure 2.6). Among the top five key categories, the highest relative reduction in emissions between 1990 and 2011 was achieved in the fourth most important key category, '4 B 8 — Swine' (– 38.1 %).

Figure 2.6 shows the contribution to total EU-27 emissions made by the aggregated sector groups. A single sector group, agriculture, is responsible for the vast majority (93 %) of NH_3 emissions in the EU-27. 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, 2012c).

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

Between 2000 and 2011, $PM_{2.5}$ emissions decreased in the EU-27 by 20 %. Between 2010 and 2011, the decrease was 5.3 %, mainly due to emissions reductions in France, Romania and Poland (Table 2.7). The Member States that contributed most (more than 10 %) to the emissions of $PM_{2.5}$ in 2011 were France, Poland and Italy. Greece and Luxembourg did not report $PM_{2.5}$ emissions for any year, and thus data for Greece could not be gap-filled. Luxembourg once reported a notation key 'NE', which was used to gap-fill all missing years. The EU-27 total is therefore underestimated.

Domestic fuel use in the residential category '1 A 4 b i — Residential: Stationary plants' is the most important key category for $PM_{2.5}$ emissions, making up 44 % of total $PM_{2.5}$ emissions (Figure 2.7).

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

Member State	$PM_{2.5}$ (Gg)								Change		Share in EU-27	
	2000	2005	2006	2007	2008	2009	2010	2011	2000–2011	2010–2011	2000	2011
Austria	23	22	21	20	20	19	20	19	– 16 %	– 4.4 %	1.5 %	1.6 %
Belgium	33	24	24	22	21	16	17	17	– 48 %	– 2.4 %	2.2 %	1.4 %
Bulgaria	22	27	28	26	27	25	27	29	30 %	6.7 %	1.5 %	2.5 %
Cyprus	4	3	3	3	3	2	2	2	– 50 %	– 12.3 %	0.3 %	0.2 %
Czech Republic	29	21	22	21	21	20	20	17	– 43 %	– 15.9 %	2.0 %	1.4 %
Denmark	23	26	27	30	28	26	26	23	2 %	– 10.9 %	1.5 %	2.0 %
Estonia	21	20	15	20	20	19	23	26	25 %	13.6 %	1.4 %	2.2 %
Finland	39	36	37	34	38	38	41	37	– 5 %	– 8.9 %	2.6 %	3.1 %
France	309	242	225	209	204	194	198	173	– 44 %	– 12.9 %	20.9 %	14.7 %
Germany	148	125	123	117	113	109	117	111	– 25 %	– 5.0 %	10.1 %	9.4 %
Greece												
Hungary	26	31	29	21	23	28	32	31	21 %	– 2.9 %	1.7 %	2.6 %
Ireland	11	11	10	10	10	9	8	8	– 31 %	– 7.5 %	0.8 %	0.7 %
Italy	170	143	140	140	137	129	131	128	– 24 %	– 2.2 %	11.5 %	10.9 %
Latvia	23	27	27	26	26	28	27	25	6 %	– 10.2 %	1.6 %	2.1 %
Lithuania	9	9	9	10	9	9	10	11	26 %	11.4 %	0.6 %	0.9 %
Luxembourg	NE	NE	NE	NE	NE	NE	NE	NE				
Malta	1	1	1	1	1	1	1	1	– 15 %	11.6 %	0.1 %	0.1 %
Netherlands	24	19	18	18	17	16	15	14	– 42 %	– 5.6 %	1.6 %	1.2 %
Poland	142	146	147	141	135	130	146	139	– 2 %	– 4.7 %	9.6 %	11.8 %
Portugal	71	55	51	50	48	46	45	44	– 38 %	– 1.2 %	4.8 %	3.7 %
Romania	82	106	101	107	123	117	120	109	32 %	– 8.9 %	5.6 %	9.2 %
Slovakia	23	37	32	28	28	27	27	29	26 %	6.9 %	1.5 %	2.4 %
Slovenia	15	15	16	16	15	16	17	15	4 %	– 8.3 %	1.0 %	1.3 %
Spain	98	96	92	94	85	79	77	76	– 22 %	– 1.8 %	6.6 %	6.4 %
Sweden	28	29	29	29	28	27	28	29	2 %	0.7 %	1.9 %	2.4 %
United Kingdom	103	84	82	80	76	70	70	67	– 35 %	– 4.5 %	7.0 %	5.7 %
EU-27 ([a])	**1 476**	**1 356**	**1 307**	**1 275**	**1 256**	**1 200**	**1 245**	**1 179**	**– 20 %**	**– 5.3 %**	**100 %**	**100 %**
EU-27 ([b])	1 508	1 356	1 307	1 275	1 256	1 200	1 245	1 179				

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

([b]) Sum of sectors.

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

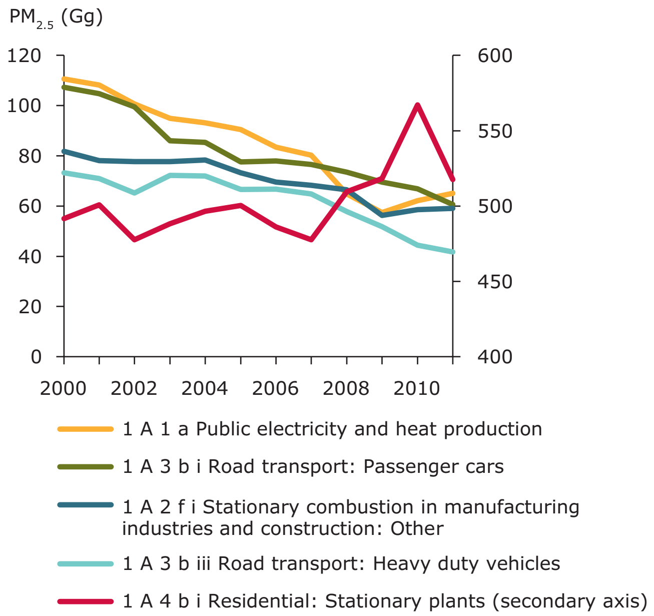
Negative percentage values indicate thatthat emissions have decreased.

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

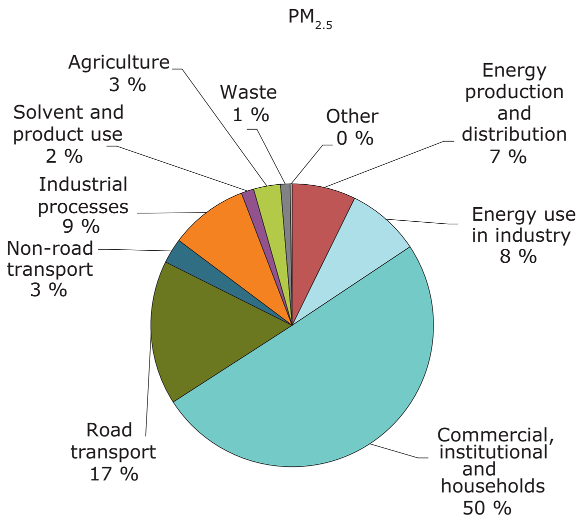
Dark-grey shaded cells indicate that no emission values are available. See Appendix 1 for an explanation of the notation keys reported by Member States.

Figure 2.7 $PM_{2.5}$ emissions in the EU-27: (a) trend in $PM_{2.5}$ emissions from the five most important key categories, 1990–2011; (b) share of emissions by sector group, 2011

(a)



(b)



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

Among the top five key categories, the highest relative reductions in emissions between 2000 and 2011 were achieved in the third most important key category, '1 A 3 b i — Road transport: Passenger cars' (– 43.6 %), and the second most important key category, '1 A 3 b iii — Road transport: Heavy duty vehicles' (– 43.0 %). 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 (5.3 %).

Figure 2.7 shows the contribution to total EU-27 emissions made by the aggregated sector groups. The 'commercial, institutional and households' sector group is a major source of $PM_{2.5}$, same as for PM_{10}, total PAHs, PCDD/Fs and PCBs.

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

Between 2000 and 2011, PM_{10} emissions in the EU-27 decreased by 19 %. Between 2010 and 2011, the decrease was 3.8 %, mainly due to reductions of emissions in France, Poland and Romania (Table 2.8). The Member States that contributed most (more than 10 %) to the emissions of PM_{10} in 2011 were France, Poland and Germany. Greece and Luxembourg did not report PM_{10} emissions for any year, and thus data for Greece could not be gap-filled. Luxembourg once reported a notation key 'NE', which was used to gap-fill all missing years. The EU-27 total is therefore underestimated.

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

Member State	PM_{10} (Gg)								Change		Share in EU-27	
	2000	2005	2006	2007	2008	2009	2010	2011	2000–2011	2010–2011	2000	2011
Austria	39	38	36	36	36	35	35	35	– 11 %	– 1.9 %	1.8 %	1.9 %
Belgium	45	34	33	30	29	23	24	24	– 47 %	– 2.4 %	2.0 %	1.3 %
Bulgaria	35	45	47	47	46	39	41	45	26 %	8.0 %	1.6 %	2.5 %
Cyprus	6	5	4	4	4	4	4	3	– 48 %	– 12.1 %	0.3 %	0.2 %
Czech Republic	47	34	35	35	35	36	37	32	– 31 %	– 12.3 %	2.2 %	1.8 %
Denmark	29	32	33	37	34	32	32	29	1 %	– 8.8 %	1.3 %	1.7 %
Estonia	37	27	20	29	25	23	32	42	12 %	31.2 %	1.7 %	2.4 %
Finland	54	50	52	48	52	52	55	51	– 6 %	– 7.8 %	2.5 %	2.9 %
France	414	338	319	301	294	280	284	260	– 37 %	– 8.2 %	19.0 %	14.7 %
Germany	261	224	223	218	212	203	211	209	– 20 %	– 1.3 %	12.0 %	11.8 %
Greece												
Hungary	47	52	48	36	38	48	46	44	– 6 %	– 4.4 %	2.2 %	2.5 %
Ireland	17	17	16	16	15	13	13	12	– 30 %	– 5.6 %	0.8 %	0.7 %
Italy	199	173	169	171	166	156	159	156	– 22 %	– 1.7 %	9.1 %	8.8 %
Latvia	27	33	32	33	32	33	33	31	17 %	– 4.8 %	1.2 %	1.7 %
Lithuania	10	10	11	12	12	11	13	14	32 %	9.5 %	0.5 %	0.8 %
Luxembourg	NE	NE	NE	NE	NE	NE	NE	NE				
Malta	1	2	2	2	2	2	1	1	– 1 %	9.0 %	0.1 %	0.1 %
Netherlands	39	33	32	32	31	29	29	29	– 27 %	– 0.2 %	1.8 %	1.6 %
Poland	257	265	274	262	256	247	279	257	0 %	– 7.6 %	11.8 %	14.5 %
Portugal	98	85	76	73	73	70	65	63	– 35 %	– 3.6 %	4.5 %	3.6 %
Romania	106	126	117	128	138	132	134	124	17 %	– 7.6 %	4.8 %	7.0 %
Slovakia	45	42	37	32	31	31	30	32	– 28 %	6.4 %	2.0 %	1.8 %
Slovenia	20	20	20	20	18	19	20	19	– 6 %	– 6.5 %	0.9 %	1.0 %
Spain	141	136	131	133	118	110	108	107	– 24 %	– 1.0 %	6.4 %	6.0 %
Sweden	40	42	41	41	40	39	40	40	2 %	0.0 %	1.8 %	2.3 %
United Kingdom	170	134	133	130	126	115	116	113	– 33 %	– 3.0 %	7.8 %	6.4 %
EU-27 ([a])	**2 184**	**1 996**	**1 945**	**1 905**	**1 864**	**1 781**	**1 841**	**1 771**	**– 19 %**	**– 3.8 %**	**100 %**	**100 %**
EU-27 ([b])	2 184	1 996	1 945	1 905	1 864	1 781	1 841	1 771				

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

([b]) Sum of sectors.

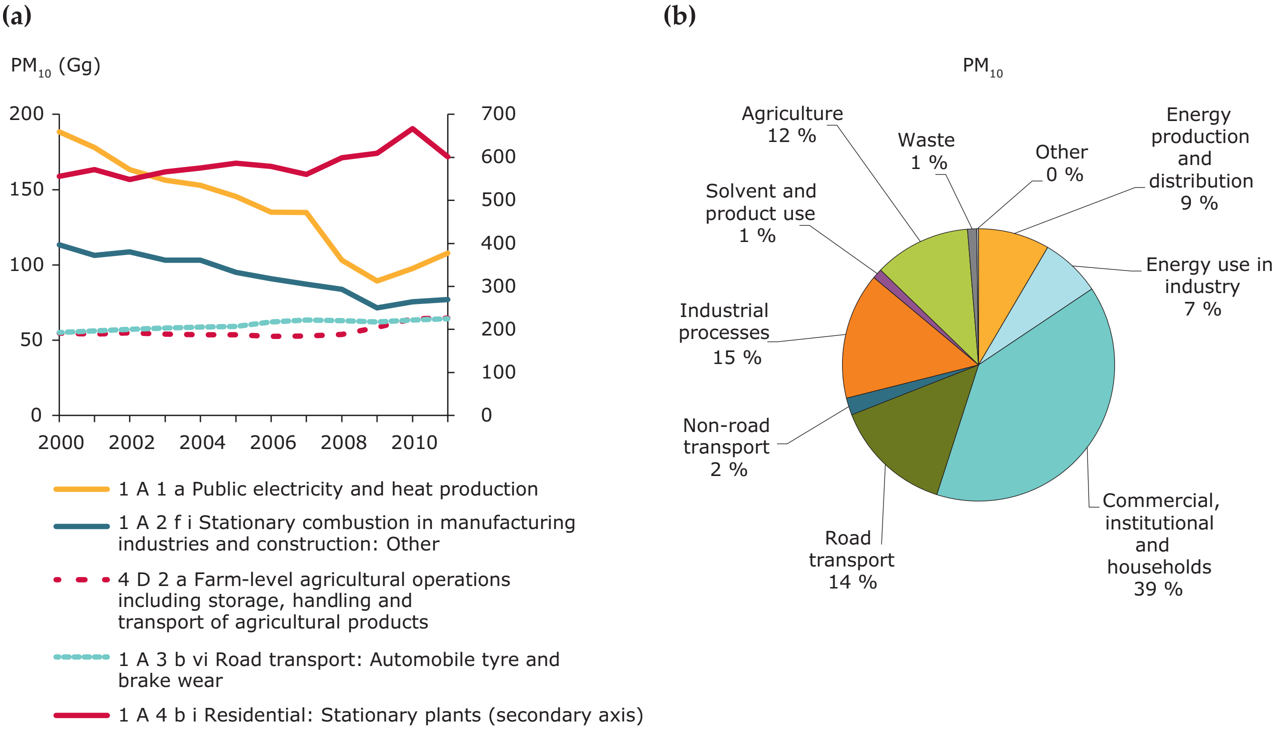
Parties to the LRTAP Convention are formally requested to report emissions of PM only for the years 2000 and after.

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.

Figure 2.8 PM_{10} emissions in the EU-27: (a) trend in PM_{10} emissions from the five most important key categories, 1990–2011; (b) share of emissions by sector group, 2011



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

As for $PM_{2.5}$, the residential category '1 A 4 b i — Residential: Stationary plants' is the most important key category for PM_{10} emissions, accounting for 34 % of total PM_{10} emissions (Figure 2.8). Among the top five key categories, the highest relative reductions in emissions between 1990 and 2011 were achieved in the second most important key category, '1 A 1 a — Public electricity and heat production' (– 42.7 %) (Figure 2.8) and the third most important key category '1 A 2 f i — Stationary combustion in manufacturing industries and construction: Other' (– 32.1 %). The emissions of the other top five key categories increased.

Figure 2.8 shows the contribution to total EU-27 emissions made by the aggregated sector groups. The 'commercial, institutional and households' sector group is a veryvery 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 2011, TSP emissions in the EU-27 decreased by 50 %. Between 2010 and 2011, emissions decreased by 0.9 %, mainly due to reductions of emissions in Poland (Table 2.9). The Member States that contributed most (more than 10 %) to the emissions of TSPs in 2011 were France and Poland. Greece and Luxembourg did not report TSP emissions for any year, and thus data for Greece could not be gap-filled. Luxembourg once reported a notation key 'NE', which was used to gap-fill all missing years. The EU-27 total is therefore underestimated.

The decrease of TSP emissions from Estonia between 1990 and 2011 is due to enhanced efficiency of combustion devices and cleaning installations (especially in oil-shale power plants and cement factories), as well as decrease drop in electricity production. The significant growth of TSP emissions in 2010 and 2011 compared to 2009 is the result of increasing electricity production and also as a result of bad operation of electric precipitators on two power units of power plants (Appendix 5, Estonia's IIR).

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

Member State	TSPs (Gg)										Change		Share in EU-27	
	1990	1995	2000	2005	2006	2007	2008	2009	2010	2011	1990–2011	2010–2011	1990	2011
Austria	63	63	63	63	61	61	62	59	60	60	– 4 %	– 0.6 %	0.9 %	1.8 %
Belgium	84	78	78	66	65	61	58	47	48	48	– 44 %	– 1.6 %	1.2 %	1.4 %
Bulgaria	82	111	82	128	130	140	125	96	98	111	36 %	13.3 %	1.2 %	3.3 %
Cyprus	17	14	11	7	7	7	7	6	6	5	– 72 %	– 13.7 %	0.255 %	0.1 %
Czech Republic	640	202	57	64	68	67	64	62	61	57	– 91 %	– 6.8 %	9.4 %	1.7 %
Denmark	32	34	37	41	42	46	43	40	41	38	19 %	– 7.2 %	0.5 %	1.1 %
Estonia	277	134	75	37	28	36	32	28	38	49	– 82 %	31.3 %	4.1 %	1.5 %
Finland	29	27	72	75	81	73	78	76	80	75	> 100 %	– 5.9 %	0.4 %	2.2 %
France	1 236	1 143	1 081	981	956	922	916	877	881	878	– 29 %	– 0.4 %	18.2 %	26.0 %
Germany	1 884	417	376	322	322	314	307	290	299	300	– 84 %	0.3 %	27.7 %	8.9 %
Greece														
Hungary	197	155	129	90	83	60	64	80	166	167	– 15 %	0.9 %	2.9 %	5.0 %
Ireland	34	31	29	28	26	26	25	22	21	21	– 39 %	– 4.6 %	0.5 %	0.6 %
Italy	285	285	244	216	212	214	209	196	200	197	– 31 %	– 1.2 %	4.2 %	5.8 %
Latvia	23	27	31	44	43	47	47	41	41	44	90 %	8.3 %	0.34 %	1.3 %
Lithuania	26	15	11	13	15	14	13	14	16	17	– 35 %	9.3 %	0.4 %	0.5 %
Luxembourg	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE				
Malta	3	4	5	6	6	6	6	6	1	2	– 43 %	10.2 %	0.04 %	0.0 %
Netherlands	90	68	46	40	39	39	38	35	34	34	– 62 %	0.4 %	1.3247 %	1.0 %
Poland	442	423	406	417	430	416	408	399	440	414	– 6 %	– 5.9 %	6.5 %	12.2 %
Portugal	130	187	224	235	195	183	185	186	156	148	14 %	– 4.9 %	1.9 %	4.4 %
Romania	251	244	247	257	231	272	268	234	252	248	– 1 %	– 1.5 %	3.7 %	7.3 %
Slovakia	290	106	57	53	46	40	37	36	36	38	– 87 %	6.1 %	4.3 %	1.1 %
Slovenia	28	27	25	26	25	25	23	24	25	23	– 18 %	– 5.2 %	0.4 %	0.7 %
Spain	201	202	204	195	189	193	172	161	160	159	– 21 %	– 0.9 %	3.0 %	4.7 %
Sweden	60	55	45	48	48	48	47	44	47	47	– 22 %	– 0.1 %	0.881 %	1.4 %
United Kingdom	399	325	279	233	232	228	221	202	207	202	– 49 %	– 2.1 %	5.9 %	6.0 %
EU-27 (a)	**6 804**	**4 377**	**3 913**	**3 685**	**3 581**	**3 539**	**3 454**	**3 261**	**3 411**	**3 381**	**– 50 %**	**– 0.9 %**	**100 %**	**100 %**
EU-27 (b)	6 804	4 377	3 913	3 685	3 581	3 539	3 454	3 261	3 411	3 381				

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

(b) Sum of sectors.

Negative percentage values indicate that emissions have decreased.

Light-grey shaded cells indicate 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 2011, CO emissions decreased in the EU-27 by 64 %. Between 2010 and 2011, the decrease was 7.0 %, mainly due to reductions of emissions in France, Germany and Poland (Table 2.10). The Member States that contributed most (more than 10 %) to the emissions of CO in 2011 were France, Germany, Poland and Italy.

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

Member State	CO (Gg)										Change		Share in EU-27	
	1990	1995	2000	2005	2006	2007	2008	2009	2010	2011	1990–2011	2010–2011	1990	2011
Austria	1 436	1 274	958	814	774	722	684	638	645	609	– 58 %	– 5.6 %	2.2 %	2.6 %
Belgium	1 356	1 055	897	720	623	621	617	383	468	387	– 71 %	– 17.3 %	2.1 %	1.7 %
Bulgaria	731	510	370	350	361	308	285	254	275	285	– 61 %	3.5 %	1.1 %	1.2 %
Cyprus	56	48	36	28	26	25	23	21	19	18	– 68 %	– 7.6 %	0.1 %	0.1 %
Czech Republic	1 030	897	643	511	484	509	439	403	402	382	– 63 %	– 5.1 %	1.6 %	1.6 %
Denmark	732	654	493	468	461	473	454	426	419	383	– 48 %	– 8.7 %	1.1 %	1.6 %
Estonia	227	197	183	158	144	163	167	168	172	148	– 35 %	– 14.1 %	0.3 %	0.6 %
Finland	721	623	610	530	507	501	486	465	485	455	– 37 %	– 6.2 %	1.1 %	2.0 %
France	11 040	9 381	6 581	5 209	4 701	4 431	4 277	3 802	4 276	3 584	– 68 %	– 16.2 %	16.9 %	15.4 %
Germany	12 405	6 604	4 860	3 703	3 625	3 525	3 442	3 060	3 504	3 314	– 73 %	– 5.4 %	19.0 %	14.3 %
Greece	1 131	953	921	719	736	680	621	589	525	491	– 57 %	– 6.3 %	1.7 %	2.1 %
Hungary	21	545	499	490	502	478	479	473	478	396	> 100 %	– 17.2 %	0.0 %	1.7 %
Ireland	402	314	252	191	182	171	158	151	139	127	– 68 %	– 8.9 %	0.6 %	0.5 %
Italy	6 971	6 970	4 657	3 270	3 039	2 838	2 721	2 477	2 516	2 464	– 65 %	– 2.1 %	10.7 %	10.6 %
Latvia	455	347	288	282	277	266	249	269	257	226	– 50 %	– 12.0 %	0.7 %	1.0 %
Lithuania	499	259	237	190	202	208	177	169	209	194	– 61 %	– 7.2 %	0.8 %	0.8 %
Luxembourg	484	286	93	64	57	53	44	38	39	39	– 92 %	– 0.4 %	0.74 %	0.2 %
Malta	24	30	1	1	1	1	1	31	11	12	– 51 %	6.9 %	0.04 %	0.1 %
Netherlands	1 124	915	744	632	622	602	604	552	551	529	– 53 %	– 4.0 %	1.7 %	2.3 %
Poland	7 406	4 547	2 633	2 649	2 857	2 739	2 769	2 715	3 052	2 916	– 61 %	– 4.5 %	11.4 %	12.6 %
Portugal	833	832	701	507	474	445	428	397	389	372	– 55 %	– 4.3 %	1.3 %	1.6 %
Romania	1 238	956	1 373	1 432	1 129	1 128	1 228	1 118	1 105	1 014	– 18 %	– 8.2 %	1.9 %	4.4 %
Slovakia	515	423	300	272	273	249	245	208	221	227	– 56 %	2.8 %	0.8 %	1.0 %
Slovenia	336	301	213	178	169	163	159	155	161	148	– 56 %	– 7.8 %	0.5 %	0.6 %
Spain	3 669	3 159	2 682	2 109	2 084	2 067	1 937	1 753	1 839	1 797	– 51 %	– 2.3 %	5.6 %	7.7 %
Sweden	1 278	1 126	825	668	628	616	607	606	586	570	– 55 %	– 2.7 %	2.0 %	2.5 %
United Kingdom	9 083	7 552	5 664	3 552	3 335	3 031	2 838	2 377	2 241	2 145	– 76 %	– 4.3 %	13.9 %	9.2 %
EU-27 ([a])	**65 203**	**50 756**	**37 715**	**29 696**	**28 272**	**27 013**	**26 137**	**23 698**	**24 985**	**23 232**	**– 64 %**	**– 7.0 %**	**100 %**	**100 %**
EU-27 ([b])	65 203	50 756	37 715	29 696	28 272	27 013	26 137	23 698	24 985	23 232				

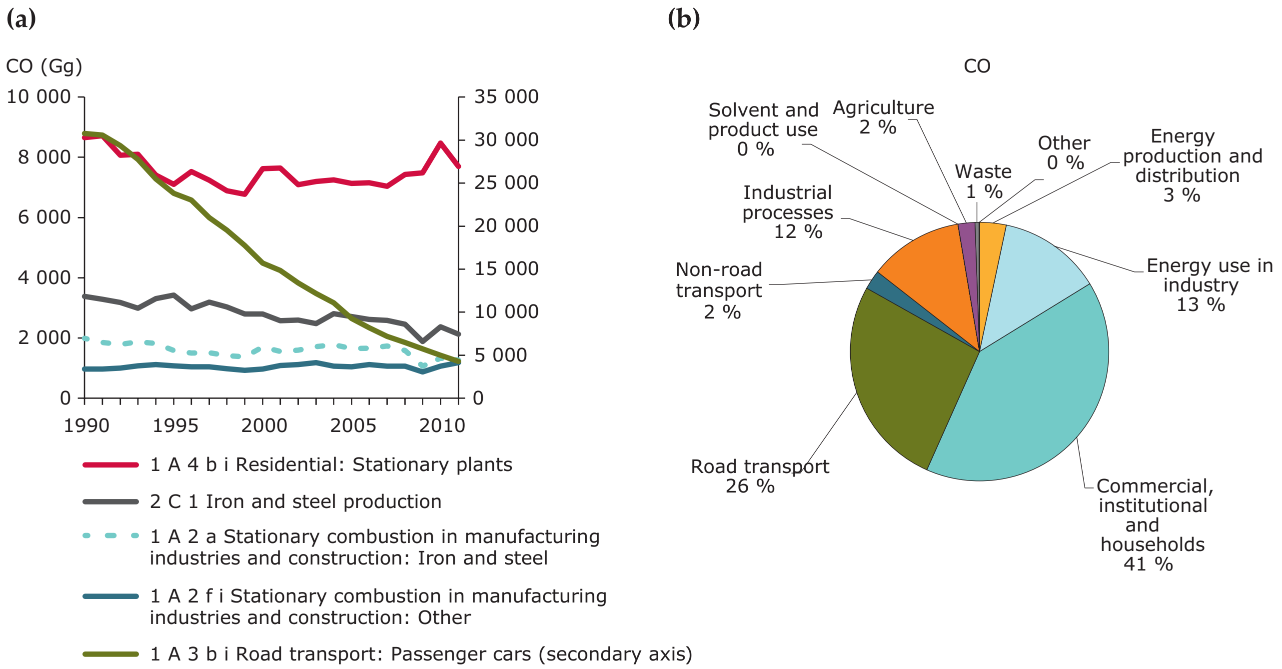
Note: ([a]) Sum of national totals as reported by Member States.

([b]) Sum of sectors.

Negative percentage values indicate that emissions have decreased.

Shaded cells denote gap-filled data. For more detailed information, see Annex D.

Figure 2.9 CO emissions in the EU-27: (a) trend in CO emissions from the five most important key categories, 1990–2011; (b) share of emissions by sector group, 2011



'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 52 % of total CO emissions. Among the top five key categories, the highest relative reductions in emissions between 1990 and 2011 were achieved in the second most important key category, '1 A 3 b i — Road transport: Passenger cars' (– 86.1 %) (Figure 2.9).

Figure 2.9 shows the contribution to total EU-27 emissions made by the aggregated sector groups. For CO, common important emission sources are 'commercial, institutional and households' and road transport.

2.10 Lead (Pb) emission trends and key categories

Between 1990 and 2011, Pb emissions decreased in the EU27 by 89 %. Between 2009 and 2011, emissions decreased by 3.6 %, mainly due to reductions of emissions in Portugal, Poland and the Netherlands (Table 2.11). The Member States that contributed most (more than 10 %) to the emissions of Pb in 2011 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 2011. Likewise, Luxembourg once reported a notation key 'NR' for Pb emissions, which was used to gap-fill all missing years. Therefore, the EU-27 total is underestimated.

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 (Figure 2.10).

The largest relative reductions in emissions between 1990 and 2011 were from the third most important key category, '1 A 2 f i — Stationary combustion in manufacturing industries and construction: Other' (– 69.5 %), the second most important category '2 C 1 — Iron and steel production' (– 61.4 %) and the fifth most important key category '1 A 4 b i — Residential: Stationary plants' (– 56.4 %). The fourth most important key category '1 A 3 b vi — Road transport: Automobile tyre and brake wear' increased since 1990 by + 14.4 %.

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

Member State	Pb (Mg)										Change		Share in EU-27	
	1990	1995	2000	2005	2006	2007	2008	2009	2010	2011	1990–2011	2010–2011	1990	2011
Austria	219	16	12	14	14	14	15	13	15	15	– 93 %	0.4 %	0.9 %	0.6 %
Belgium	468	259	103	76	71	62	72	32	43	33	– 93 %	– 21.6 %	2.0 %	1.3 %
Bulgaria	321	333	267	127	128	118	225	112	107	120	– 63 %	12.1 %	1.4 %	4.7 %
Cyprus	36	42	44	29	29	30	31	31	31	31	– 15 %	– 2.8 %	0.2 %	1.2 %
Czech Republic	269	180	108	47	43	44	39	40	26	17	– 94 %	– 35.7 %	1.2 %	0.7 %
Denmark	125	23	17	15	14	12	11	10	10	10	– 92 %	– 0.9 %	0.5 %	0.4 %
Estonia	205	85	36	35	31	40	35	28	39	38	– 81 %	– 1.5 %	0.9 %	1.5 %
Finland	338	67	45	22	25	22	20	18	23	22	– 94 %	– 6.2 %	1.5 %	0.9 %
France	4 305	1 484	293	178	170	166	152	127	137	128	– 97 %	– 6.7 %	18.5 %	5.0 %
Germany	2 075	693	433	352	348	338	199	174	194	190	– 91 %	– 2.1 %	8.9 %	7.5 %
Greece	470	470	470	470	470	470	470	470	470	470	0 %	0.0 %	2.0 %	18.5 %
Hungary	663	130	42	38	37	35	36	32	17	9	– 99 %	– 43.7 %	2.9 %	0.4 %
Ireland	125	81	21	23	22	22	22	19	18	17	– 87 %	– 5.8 %	0.5 %	0.7 %
Italy	4 415	2 029	945	281	289	312	301	228	260	277	– 94 %	6.9 %	19.0 %	10.9 %
Latvia	92	63	10	8	9	9	8	8	8	5	– 94 %	– 35.9 %	0.4 %	0.2 %
Lithuania	149	11	6	6	6	7	4	3	3	3	– 98 %	– 4.2 %	0.6 %	0.1 %
Luxembourg	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR				
Malta	0	1	1	1	1	1	1	1	3	6	> 100 %	70.2 %	0.0 %	0.2 %
Netherlands	336	159	33	36	36	42	36	37	44	28	– 92 %	– 35.0 %	1.4 %	1.1 %
Poland	1 372	937	534	541	576	563	557	512	578	559	– 59 %	– 3.4 %	5.9 %	22.0 %
Portugal	567	787	73	193	185	146	193	158	212	172	– 70 %	– 18.7 %	2.4 %	6.8 %
Romania	222	184	148	107	103	106	91	56	62	61	– 73 %	– 2.2 %	1.0 %	2.4 %
Slovakia	99	79	89	73	74	62	63	43	59	59	– 40 %	– 0.2 %	0.4 %	2.3 %
Slovenia	350	200	47	16	17	17	18	16	17	17	– 95 %	– 1.1 %	1.5 %	0.7 %
Spain	2 749	920	565	207	206	204	202	179	185	184	– 93 %	– 0.7 %	11.8 %	7.2 %
Sweden	355	37	26	15	14	14	13	12	13	11	– 97 %	– 11.1 %	1.5 %	0.4 %
United Kingdom	2 887	1 529	149	107	88	79	73	63	61	59	– 98 %	– 4.1 %	12.4 %	2.3 %
EU-27 ([a])	**23 214**	**10 798**	**4 516**	**3 015**	**3 005**	**2 935**	**2 887**	**2 423**	**2 635**	**2 541**	**– 89 %**	**– 3.6 %**	**100 %**	**100 %**
EU-27 ([b])	22 744	10 328	4 046	2 545	2 535	2 465	2 417	1 953	2 165	2 071				

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

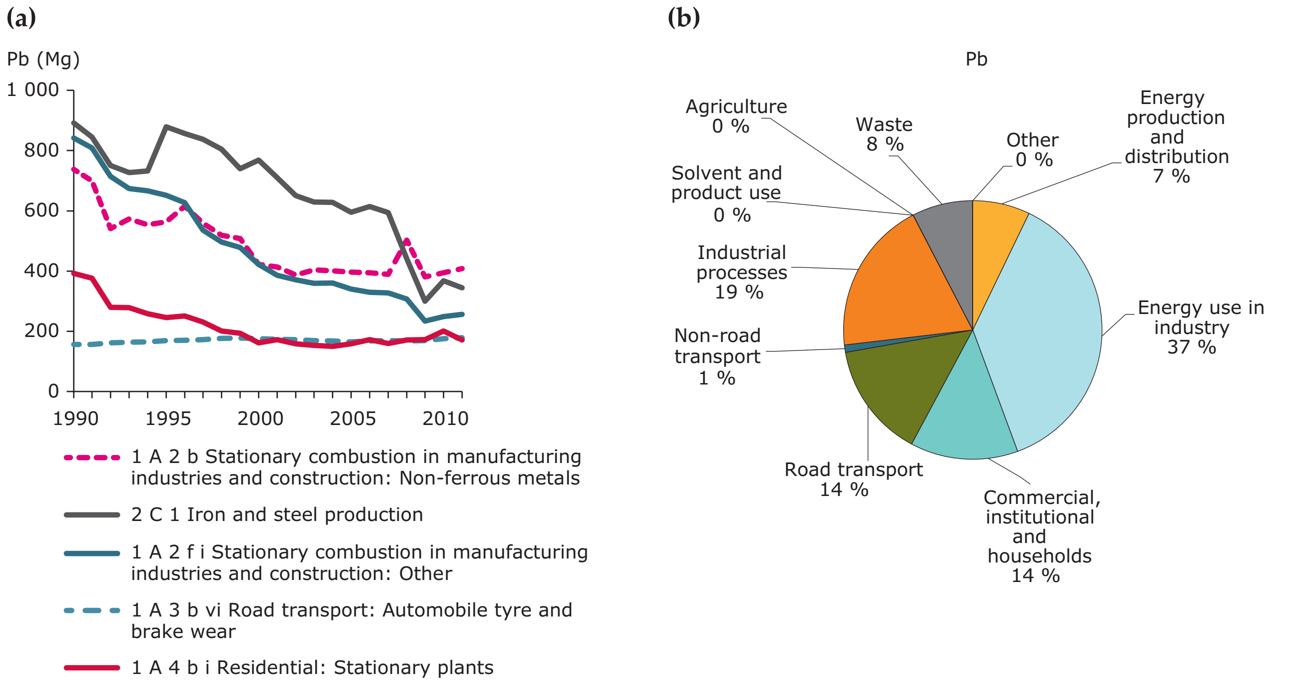
([b]) Sum of sectors: differences arise when only national totals and no sectoral data are available.

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.

Figure 2.10 Pb emissions in the EU-27: (a) trend in Pb emissions from the five most important key categories, 1990–2011; (b) share of emissions by sector group, 2011



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

The peak of Pb emissions of the category '1 A 2 b — Stationary Combustion in manufacturing industries and construction: Non-ferrous metals' in the year 2008 is mainly caused by 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, 2012d).

Figure 2.10 shows the contribution to total EU-27 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' use.

2.11 Cadmium (Cd) emission trends and key categories

Between 1990 and 2011, Cd emissions decreased by 64 % in the EU-27. Between 2010 and 2011, they decreased by 8.4 % (Table 2.12), mainly due to reductions of emissions in Poland. The Member States that contributed most (more than 10 %) to the emissions of Cd in 2011 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 2011. Luxembourg only reported a notation key once, 'NR' for Cd emissions, which was used to gap-fill all other years. The EU-27 total is therefore underestimated.

Categories '1 A 4 b i — Residential: Stationary plants' and '1 A 2 f i — Stationary combustion in manufacturing industries and construction: Other' were the most important key categories for Cd emissions, making up 42 % of total Cd emissions (Figure 2.11). Among the top five key categories, the highest relative reductions in emissions between 1990 and 2011 were achieved from the second most important key category '1 A 2 f i — Stationary combustion in manufacturing industries and construction: Other' (– 80.5 %), and the fourth most

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

Member State	Cd (Mg)										Change		Share in EU-27	
	1990	1995	2000	2005	2006	2007	2008	2009	2010	2011	1990–2011	2010–2011	1990	2011
Austria	2	1	1	1	1	1	1	1	1	1	– 27 %	– 2.0 %	0.6 %	1.3 %
Belgium	7	5	3	3	3	3	3	2	3	3	– 65 %	– 6.7 %	2.8 %	2.8 %
Bulgaria	5	4	3	3	3	3	3	2	2	2	– 59 %	13.3 %	2.1 %	2.4 %
Cyprus	0	0	0	0	0	0	0	0	0	0	46 %	3.3 %	0.0 %	0.1 %
Czech Republic	4	4	3	3	3	3	4	3	1	1	– 81 %	– 8.2 %	1.7 %	0.9 %
Denmark	1	0	0	0	0	0	0	0	0	0	– 80 %	1.0 %	0.4 %	0.2 %
Estonia	4	2	1	1	1	1	1	0	1	1	– 85 %	– 1.9 %	1.7 %	0.7 %
Finland	6	2	1	1	1	1	1	1	1	1	– 79 %	– 6.5 %	2.5 %	1.5 %
France	20	18	14	6	4	4	4	3	3	3	– 88 %	– 6.9 %	8.0 %	2.8 %
Germany	17	11	10	7	7	6	5	5	5	5	– 69 %	– 2.5 %	6.8 %	5.9 %
Greece	3	3	3	3	3	3	3	3	3	3	0 %	0.0 %	1.2 %	3.3 %
Hungary	6	4	3	2	2	1	2	3	1	1	– 87 %	– 2.3 %	2.2 %	0.8 %
Ireland	1	1	1	1	1	1	1	0	0	0	– 61 %	– 27.8 %	0.3 %	0.4 %
Italy	10	9	9	8	8	9	9	7	7	7	– 27 %	7.5 %	4.0 %	8.1 %
Latvia	0	0	0	0	0	0	0	0	0	0	– 50 %	– 29.5 %	0.1 %	0.2 %
Lithuania	3	2	1	0	0	0	0	0	0	0	– 96 %	– 26.1 %	1.3 %	0.1 %
Luxembourg	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR				
Malta	0	0	0	1	1	1	1	1	0	0	– 92 %	– 53.8 %	0.1 %	0.0 %
Netherlands	2	1	1	2	2	2	2	2	3	1	– 46 %	– 55.3 %	0.8 %	1.2 %
Poland	92	83	39	39	43	41	42	41	47	42	– 55 %	– 11.1 %	36.0 %	46.1 %
Portugal	4	5	5	5	5	5	5	3	4	2	– 45 %	– 34.6 %	1.7 %	2.7 %
Romania	4	4	4	3	3	4	3	2	2	2	– 49 %	1.7 %	1.8 %	2.5 %
Slovakia	10	10	9	6	6	1	1	1	1	1	– 87 %	– 12.0 %	3.8 %	1.4 %
Slovenia	1	0	0	0	0	0	0	0	0	0	– 33 %	– 4.6 %	0.2 %	0.4 %
Spain	25	21	17	16	15	12	11	10	10	10	– 62 %	– 2.8 %	9.8 %	10.6 %
Sweden	2	1	1	1	1	1	1	1	1	1	– 77 %	– 1.5 %	0.9 %	0.6 %
United Kingdom	23	11	6	4	4	3	3	2	2	3	– 88 %	9.6 %	9.1 %	3.0 %
EU-27 (a)	**254**	**202**	**136**	**116**	**116**	**105**	**106**	**95**	**99**	**90**	**– 64 %**	**– 8.4 %**	**100 %**	**100 %**
EU-27 (b)	251	199	133	113	113	102	103	92	96	87				

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

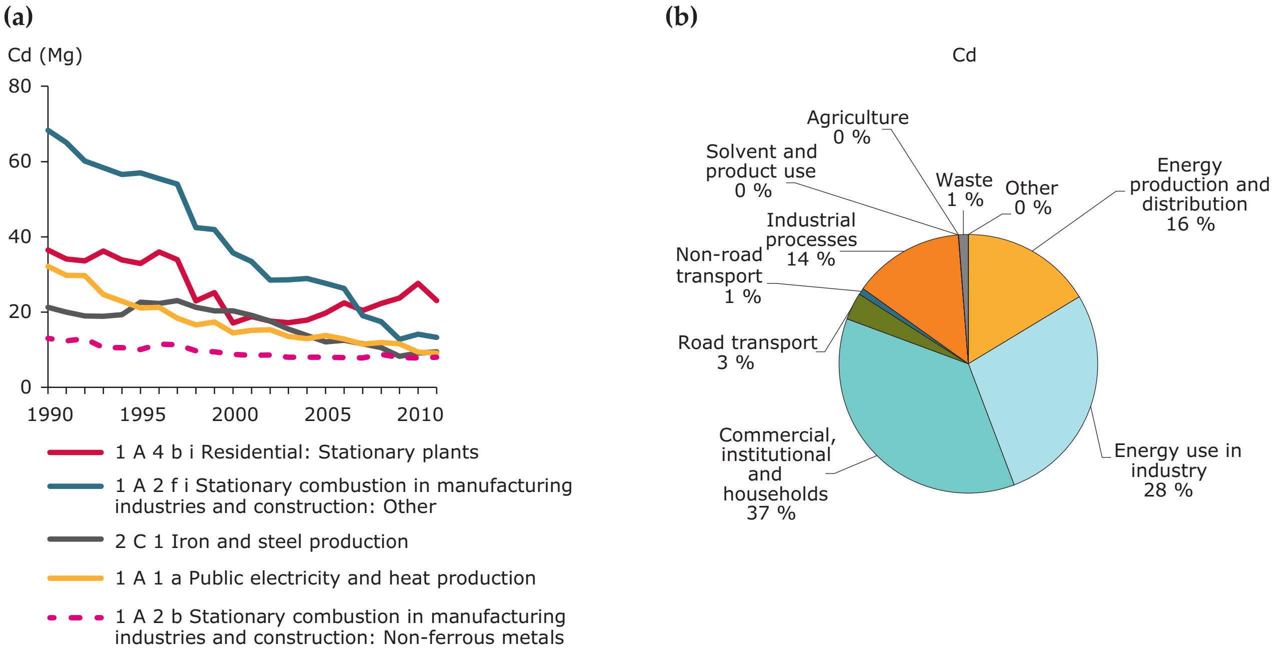
(b) Sum of sectors: differences arise when only national totals and no sectoral data are available.

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.

Figure 2.11 Cd emissions in the EU-27: (a) trend in Cd emissions from the five most important key categories, 1990–2011; (b) share of emissions by sector group, 2011



important key category '1 A 1 a —Public electricity and heat production' (– 71.7 %) (Figure 2.11).

As was the case for Pb, industrial sources of Cd emissions have in general decreased since the early 1990s, reflecting improved abatement technologies for combustion facilities and in the metal refining and smelting industries (EEA, 2012d).

Figure 2.11 shows the contribution to total EU-27 emissions made by the aggregated sector groups. For Cd, common important emission sources are the energy sectors, and the 'Commercial, institutional and households' sector.

2.12 Mercury (Hg) emission trends and key categories

Between 1990 and 2011, Hg emissions decreased by 66 % in the EU-27. Between 2010 and 2011, the decrease was 1.2 % (Table 2.13). The Member States that contributed most (more than 10 %) to the emissions of Hg in 2011 were Greece, Poland, Germany and Italy. Greece only reported an emission value once (for 1996) that has been used to gap-fill all the other years including 2011. Luxembourg only reported the notation key 'NR' for Hg emissions once, and it was used to gap-fill all other years. The EU-27 total is therefore underestimated.

Categories '1 A 1 a — Public electricity and heat production' and '2 C 1 — Iron and steel production' were the most important key categories for Hg emissions, making up 49 % of total Hg emissions (Figure 2.12). Among the top five key categories, the highest relative reductions in emissions between 1990 and 2011 was achieved by the third most important key category, '1 A 2 f i — Stationary combustion in manufacturing industries and construction: Other' (– 69.8 %). The most important key category '1 A 1 a — Public electricity and heat production' (– 65.1 %) and the fourth most important key category '1 A 4 b i — Residential: Stationary plants' (–63.0 %) show also high emission reductions (Figure 2.12).

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 as a result of fuel switching (Figure 2.12) (EEA, 2012d).

Figure 2.12 shows the contribution to total EU-27 emissions made by the aggregated sector groups. For Hg, important emission sources are the energy sectors and the sector 'Industrial processes'.

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

Member State	Hg (Mg)										Change		Share in EU-27	
	1990	1995	2000	2005	2006	2007	2008	2009	2010	2011	1990–2011	2010–2011	1990	2011
Austria	2	1	1	1	1	1	1	1	1	1	– 53 %	– 0.5 %	0.9 %	1.3 %
Belgium	7	4	3	2	2	3	4	2	2	2	– 73 %	– 8.3 %	2.9 %	2.4 %
Bulgaria	2	2	1	2	2	2	1	1	1	1	– 61 %	7.0 %	1.1 %	1.2 %
Cyprus	0	0	0	0	0	0	0	0	0	0	– 13 %	1.7 %	0.1 %	0.2 %
Czech Republic	8	7	4	4	4	4	4	4	3	3	– 57 %	– 6.1 %	3.3 %	4.1 %
Denmark	3	2	1	1	1	1	1	1	0	0	– 87 %	– 10.7 %	1.3 %	0.5 %
Estonia	1	1	1	1	1	1	1	0	1	1	– 44 %	0.0 %	0.5 %	0.8 %
Finland	1	1	1	1	1	1	1	1	1	1	– 43 %	– 24.0 %	0.5 %	0.8 %
France	25	20	12	6	7	5	5	4	5	5	– 81 %	2.6 %	10.7 %	6.0 %
Germany	29	14	14	12	11	11	10	9	9	9	– 67 %	0.8 %	12.6 %	12.0 %
Greece	13	13	13	13	13	13	13	13	13	13	0 %	0.0 %	5.6 %	16.5 %
Hungary	6	5	4	4	3	3	3	3	1	1	– 87 %	5.2 %	2.7 %	1.0 %
Ireland	1	1	1	1	1	1	1	0	0	0	– 60 %	– 19.1 %	0.4 %	0.4 %
Italy	11	10	9	10	10	11	10	8	9	9	– 20 %	5.6 %	5.0 %	11.6 %
Latvia	0	0	0	0	0	0	0	0	0	0	– 67 %	5.6 %	0.1 %	0.1 %
Lithuania	3	2	1	0	0	0	0	1	0	0	– 95 %	– 22.1 %	1.5 %	0.2 %
Luxembourg	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR				
Malta	0	0	0	1	1	1	1	1	0	0	– 98 %	– 59.2 %	0.1 %	0.0 %
Netherlands	4	1	1	1	1	1	1	1	1	1	– 77 %	28.4 %	1.5 %	1.0 %
Poland	33	32	11	10	10	10	10	10	10	10	– 70 %	– 0.9 %	14.4 %	12.7 %
Portugal	4	4	3	3	3	2	2	2	2	2	– 44 %	– 0.2 %	1.5 %	2.5 %
Romania	10	9	8	7	7	10	8	5	5	5	– 51 %	– 3.0 %	4.4 %	6.3 %
Slovakia	13	4	6	3	3	3	3	1	1	1	– 91 %	– 13.6 %	5.5 %	1.5 %
Slovenia	1	0	1	0	1	1	1	0	0	0	– 30 %	– 6.6 %	0.3 %	0.6 %
Spain	14	14	12	11	10	9	8	7	7	7	– 52 %	0.1 %	6.1 %	8.5 %
Sweden	2	1	1	1	1	1	1	1	1	1	– 65 %	0.3 %	0.7 %	0.7 %
United Kingdom	38	20	8	7	7	7	7	6	6	6	– 85 %	– 10.9 %	16.3 %	7.1 %
EU-27 ([a])	**231**	**170**	**117**	**102**	**100**	**100**	**95**	**82**	**80**	**79**	**– 66 %**	**– 1.2 %**	**100 %**	**100 %**
EU-27 ([b])	218	157	104	89	87	87	82	69	67	66				

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

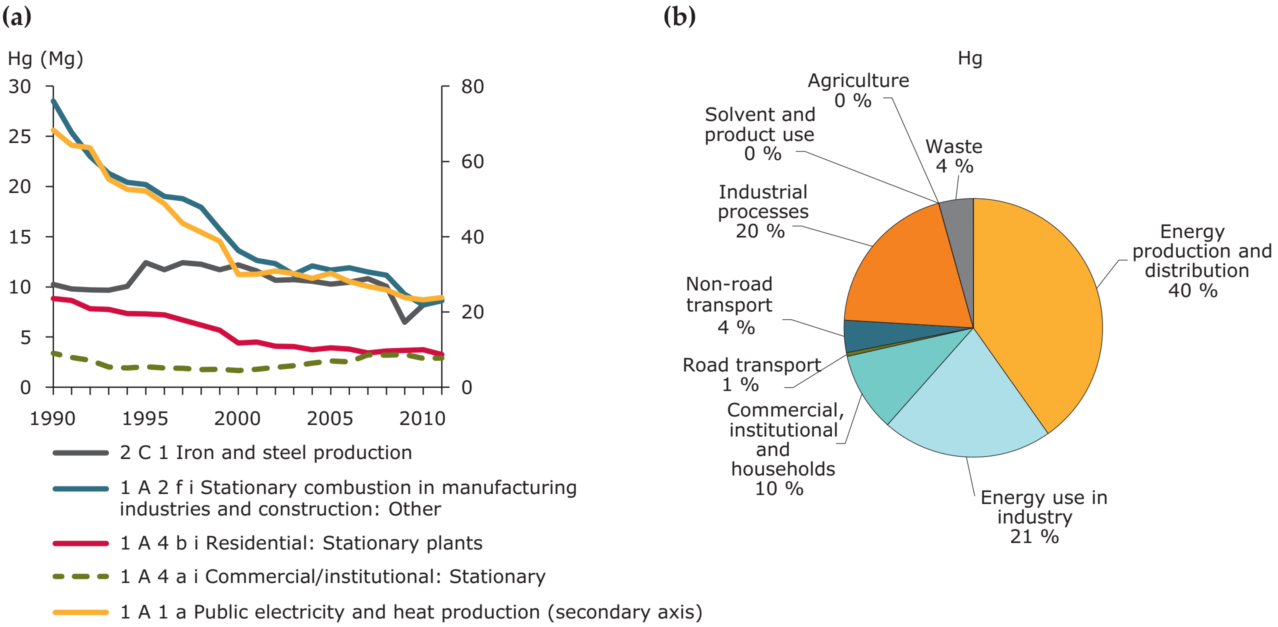
([b]) Sum of sectors: differences arise when only national totals and no sectoral data are available.

Negative percentage values indicate that emissions have decreased.

Light-grey shaded cells indicate 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.

Figure 2.12 Hg emissions in the EU-27: (a) trend in Hg emissions from the five most important key categories, 1990–2011; (b) share of emissions by sector group, 2011



2.13 Arsenic (As) emission trends

Between 1990 and 2011, As emissions in the EU-27 decreased by 63 %. Between 2010 and 2011, emissions increased by 0.7 %, mainly due to increases of emissions in Bulgaria, Italy and Slovakia. The main reductions were reported by Poland and France (Table 2.14). The Member States that contributed most (more than 10 %) to the emissions of As in 2011 were Italy, Poland and Slovakia. Greece only reported an emission value once (for 1996) that has been used to gap-fill all the other years including 2011. 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-27 total is therefore underestimated.

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

Member State	As (Mg)										Change		Share in EU-27	
	1990	1995	2000	2005	2006	2007	2008	2009	2010	2011	1990–2011	2010–2011	1990	2011
Austria	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR				
Belgium	7	7	5	3	3	4	4	2	2	2	– 70 %	– 12.7 %	1.2 %	1.0 %
Bulgaria	19	15	7	15	16	14	14	13	12	14	– 26 %	18.9 %	3.4 %	6.7 %
Cyprus	0	0	0	0	0	0	0	0	0	0	30 %	21.8 %	0.0 %	0.1 %
Czech Republic	2	2	3	4	3	3	3	5	3	3	39 %	8.7 %	0.4 %	1.6 %
Denmark	1	1	1	0	0	0	0	0	0	0	– 76 %	5.9 %	0.2 %	0.2 %
Estonia	19	10	9	9	9	11	9	8	11	11	– 42 %	– 0.8 %	3.3 %	5.2 %
Finland	33	3	4	3	3	3	3	3	4	3	– 90 %	– 8.9 %	5.9 %	1.6 %
France	17	17	15	11	11	11	12	7	7	7	– 62 %	– 12.4 %	3.0 %	3.1 %
Germany	82	8	6	7	7	7	6	6	6	6	– 93 %	– 2.2 %	14.5 %	2.9 %
Greece	4	4	4	4	4	4	4	4	4	4	0 %	0.0 %	0.7 %	1.9 %
Hungary	16	9	6	6	5	4	4	4	2	2	– 85 %	1.5 %	2.8 %	1.2 %
Ireland	4	4	3	3	3	3	3	2	2	2	– 52 %	– 8.3 %	0.8 %	1.0 %
Italy	37	27	45	40	41	41	42	42	45	46	26 %	3.6 %	6.5 %	22.1 %
Latvia	0	0	0	0	0	0	0	0	0	0	– 62 %	– 5.9 %	0.1 %	0.1 %
Lithuania	2	1	0	0	0	0	0	0	0	0	– 87 %	– 8.8 %	0.3 %	0.1 %
Luxembourg	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR				
Malta	0	0	0	0	0	0	0	0	0	0	– 67 %	– 67.7 %	0.0 %	0.0 %
Netherlands	1	1	1	2	1	1	1	1	1	1	– 16 %	45.3 %	0.3 %	0.6 %
Poland	82	73	40	44	46	44	44	42	47	44	– 47 %	– 6.3 %	14.5 %	20.8 %
Portugal	2	3	3	2	2	2	2	2	2	1	– 41 %	– 5.8 %	0.4 %	0.7 %
Romania	20	18	15	12	12	14	12	8	9	9	– 55 %	4.4 %	3.6 %	4.4 %
Slovakia	147	39	9	23	27	24	23	17	22	23	– 84 %	4.7 %	26.0 %	10.9 %
Slovenia	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR				
Spain	16	16	20	19	18	17	16	15	15	15	– 7 %	3.6 %	2.9 %	7.2 %
Sweden	6	2	1	1	1	1	1	1	1	1	– 84 %	0.5 %	1.0 %	0.4 %
United Kingdom	46	32	20	14	14	14	14	13	13	13	– 71 %	0.7 %	8.1 %	6.4 %
EU-27 ([a])	**565**	**291**	**219**	**225**	**226**	**222**	**219**	**198**	**208**	**209**	**– 63 %**	**0.7 %**	**100 %**	**100 %**
EU-27 ([b])	561	287	215	221	222	218	215	194	204	205				

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 indicate 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 2011, Cr emissions in the EU-27 decreased by 74 %. Between 2010 and 2011, emissions decreased by 4.3 %, mainly due to reductions of emissions in the Czech Republic, Finland and France (Table 2.15). The Member States that contributed most (more than 10 %) to the emissions of Cr in 2011 were Germany, Italy and Poland. Greece only reported an emission value once (for 1996) that has been used to gap-fill all the other years including 2011. Austria and Slovenia reported the whole time-series of their chromium emissions as 'NR'. Luxembourg reported once chromium emissions as 'NR', and this notation key was used to gap-fill all other years. The EU-27 total is therefore underestimated.

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

Member State	Cr (Mg)										Change		Share in EU-27	
	1990	1995	2000	2005	2006	2007	2008	2009	2010	2011	1990–2011	2010–2011	1990	2011
Austria	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR				
Belgium	33	27	18	17	18	19	18	9	14	12	– 64 %	– 12.2 %	2.4 %	3.3 %
Bulgaria	21	11	8	10	12	10	10	7	5	6	– 71 %	10.7 %	1.5 %	1.7 %
Cyprus	0	0	0	0	0	0	0	0	0	0	31 %	0.0 %	0.0 %	0.1 %
Czech Republic	29	21	12	14	13	12	12	15	19	13	– 55 %	– 29.9 %	2.1 %	3.6 %
Denmark	6	3	1	1	1	1	1	1	1	1	– 85 %	– 0.6 %	0.4 %	0.2 %
Estonia	18	10	8	9	8	10	9	7	10	10	– 45 %	– 1.2 %	1.3 %	2.8 %
Finland	29	22	28	18	23	27	20	15	22	18	– 39 %	– 18.9 %	2.1 %	4.9 %
France	391	188	102	43	41	32	31	25	26	23	– 94 %	– 12.6 %	28.1 %	6.3 %
Germany	188	124	128	123	129	132	57	50	55	56	– 70 %	1.4 %	13.5 %	15.6 %
Greece	10	10	10	10	10	10	10	10	10	10	0 %	0.0 %	0.7 %	2.8 %
Hungary	16	11	8	8	7	6	7	6	11	11	– 35 %	– 0.6 %	1.2 %	2.9 %
Ireland	9	8	7	5	5	5	5	4	4	4	– 57 %	– 7.3 %	0.6 %	1.0 %
Italy	93	75	52	60	61	63	61	50	52	54	– 42 %	3.1 %	6.7 %	15.0 %
Latvia	2	1	1	1	1	1	1	1	1	1	– 57 %	– 20.1 %	0.1 %	0.2 %
Lithuania	13	4	2	1	1	1	1	1	1	1	– 95 %	– 19.9 %	0.9 %	0.2 %
Luxembourg	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR				
Malta	1	1	1	1	2	2	1	1	1	1	> 100 %	– 3.8 %	0.0 %	0.3 %
Netherlands	10	7	3	2	2	2	2	1	2	2	– 85 %	– 9.9 %	0.7 %	0.4 %
Poland	155	118	47	41	44	43	44	41	49	46	– 70 %	– 6.4 %	11.1 %	12.8 %
Portugal	10	11	12	12	11	11	11	10	10	10	1 %	– 6.8 %	0.7 %	2.7 %
Romania	66	54	42	28	28	28	23	14	15	15	– 78 %	– 0.2 %	4.8 %	4.1 %
Slovakia	77	12	8	6	6	5	5	4	4	4	– 95 %	0.1 %	5.5 %	1.2 %
Slovenia	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR				
Spain	35	38	41	42	40	39	37	32	31	31	– 10 %	0.2 %	2.5 %	8.7 %
Sweden	23	12	7	10	11	13	10	3	5	6	– 73 %	26.8 %	1.7 %	1.8 %
United Kingdom	159	114	74	37	34	30	29	27	27	26	– 84 %	– 3.7 %	11.4 %	7.2 %
EU-27 (a)	**1 393**	**881**	**620**	**499**	**508**	**503**	**403**	**336**	**375**	**359**	**– 74 %**	**– 4.3 %**	**100 %**	**100 %**
EU-27 (b)	1 383	871	610	489	498	493	393	326	365	349				

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 indicate 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 2011, Cu emissions in the EU-27 increased by 0.3 %. Between 2010 and 2011, emissions increased by 0.8 %, mainly due to increases in emissions from Germany, Bulgaria and Slovakia. The main reduction was reported by Poland and Spain (Table 2.16). The Member State that contributed most (more than 10 %) to the emissions of Cu in 2011 was Germany. Greece only reported an emission value once (for 1996) that has been used to gap-fill all the other years including 2011. 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-27 total is therefore underestimated.

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

Member State	Cu (Mg)										Change		Share in EU-27	
	1990	1995	2000	2005	2006	2007	2008	2009	2010	2011	1990–2011	2010–2011	1990	2011
Austria	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR				
Belgium	61	56	57	55	54	53	55	50	47	46	– 24 %	– 1.4 %	1.6 %	1.2 %
Bulgaria	103	74	56	98	102	79	89	93	83	97	– 6 %	17.0 %	2.7 %	2.6 %
Cyprus	1	2	2	2	2	3	3	2	2	2	85 %	– 0.4 %	0.0 %	0.1 %
Czech Republic	24	20	17	20	18	18	16	17	24	18	– 23 %	– 22.0 %	0.6 %	0.5 %
Denmark	33	38	40	43	44	46	46	45	44	45	35 %	0.7 %	0.9 %	1.2 %
Estonia	10	5	4	4	4	5	5	4	5	5	– 52 %	– 1.1 %	0.3 %	0.1 %
Finland	157	89	78	60	63	61	59	58	63	58	– 63 %	– 7.4 %	4.2 %	1.5 %
France	237	238	233	229	230	224	223	222	225	226	– 5 %	0.3 %	6.3 %	6.0 %
Germany	1 694	1 817	2 005	2 032	2 069	2 091	2 083	2 042	2 086	2 124	25 %	1.8 %	44.9 %	56.2 %
Greece	14	14	14	14	14	14	14	14	14	14	0 %	0.0 %	0.4 %	0.4 %
Hungary	31	19	19	22	21	21	22	21	28	22	– 28 %	– 20.9 %	0.8 %	0.6 %
Ireland	16	17	22	25	26	27	26	23	22	21	28 %	– 3.5 %	0.4 %	0.6 %
Italy	184	200	200	209	210	213	208	191	190	194	5 %	1.9 %	4.9 %	5.1 %
Latvia	6	4	4	5	6	6	6	5	6	6	– 2 %	– 3.1 %	0.2 %	0.1 %
Lithuania	13	24	4	5	12	10	6	5	6	6	– 57 %	– 5.7 %	0.3 %	0.1 %
Luxembourg	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR				
Malta	1	1	1	1	1	1	1	1	27	27	> 100 %	0.2 %	0.0 %	0.7 %
Netherlands	69	70	71	75	76	76	78	80	82	82	18 %	0.2 %	1.8 %	2.2 %
Poland	599	465	332	365	379	358	351	333	362	351	– 41 %	– 3.0 %	15.9 %	9.3 %
Portugal	21	28	37	38	37	37	36	35	35	32	49 %	– 7.8 %	0.6 %	0.8 %
Romania	23	20	19	17	31	33	33	30	29	28	23 %	– 1.6 %	0.6 %	0.8 %
Slovakia	102	49	23	39	45	44	45	34	47	56	– 45 %	19.3 %	2.7 %	1.5 %
Slovenia	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR				
Spain	132	151	221	244	244	248	238	231	223	215	63 %	– 3.5 %	3.5 %	5.7 %
Sweden	98	83	74	51	51	54	53	51	52	53	– 46 %	1.8 %	2.6 %	1.4 %
United Kingdom	142	108	81	62	60	59	59	50	51	55	– 62 %	6.8 %	3.8 %	1.4 %
EU-27 (a)	**3 771**	**3 590**	**3 613**	**3 715**	**3 800**	**3 782**	**3 754**	**3 637**	**3 751**	**3 782**	**0.3 %**	**0.8 %**	**100 %**	**100 %**
EU-27 (b)	3 757	3 576	3 599	3 701	3 786	3 768	3 740	3 623	3 737	3 768				

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 indicate 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 2011, Ni emissions in the EU-27 decreased by 64 %. Between 2010 and 2011, emissions decreased by 8.5 %, mainly due to reductions reported in Poland, France and Ireland (Table 2.17). Ireland explained, that large reductions occurred in the pet coke usage (mainly in the cement sector) (source: comment received from Ireland in 2013).

The Member States that contributed most (more than 10 %) to the emissions of Ni in 2011 were Spain, Germany, Greece and Poland. Greece only reported an emission value once (for 1996) that has been used to gap-fill all the other years including 2011. 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-27 total is therefore underestimated.

In Bulgaria, the Ni emissions in 2000 are much lower than in the years before and after due to the decrease of Ni emissions from the primary copper production (source: 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-27	
	1990	1995	2000	2005	2006	2007	2008	2009	2010	2011	1990–2011	2010–2011	1990	2011
Austria	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR				
Belgium	90	78	37	29	29	26	21	11	12	10	– 89 %	– 18.4 %	3.4 %	1.0 %
Bulgaria	29	23	8	23	24	25	21	21	19	22	– 21 %	18.4 %	1.1 %	2.4 %
Cyprus	8	10	13	15	14	14	15	13	9	11	36 %	20.9 %	0.3 %	1.2 %
Czech Republic	27	19	16	17	18	19	11	24	13	11	– 58 %	– 16.3 %	1.0 %	1.2 %
Denmark	21	15	8	7	8	6	5	5	5	4	– 80 %	– 13.3 %	0.8 %	0.4 %
Estonia	27	11	7	7	6	7	6	5	7	6	– 76 %	– 2.6 %	1.0 %	0.7 %
Finland	63	34	34	27	25	22	21	18	22	20	– 69 %	– 10.0 %	2.4 %	2.1 %
France	288	230	190	155	145	118	108	103	93	76	– 74 %	– 17.9 %	11.0 %	8.1 %
Germany	273	157	114	130	142	130	120	107	106	101	– 63 %	– 4.4 %	10.4 %	10.8 %
Greece	101	101	101	101	101	101	101	101	101	101	0 %	0.0 %	3.9 %	10.8 %
Hungary	42	51	39	23	21	21	22	22	9	9	– 78 %	1.8 %	1.6 %	1.0 %
Ireland	41	51	67	63	57	62	54	32	30	19	– 54 %	– 36.2 %	1.6 %	2.0 %
Italy	123	114	105	111	109	106	103	104	40	39	– 68 %	– 2.1 %	4.7 %	4.2 %
Latvia	23	12	5	4	4	3	3	3	3	3	– 87 %	– 10.0 %	0.9 %	0.3 %
Lithuania	117	54	23	13	12	14	7	8	6	5	– 96 %	– 20.8 %	4.5 %	0.5 %
Luxembourg	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR				
Malta	8	13	17	21	21	21	20	20	6	1	– 91 %	– 88.1 %	0.3 %	0.1 %
Netherlands	75	87	19	11	10	9	9	3	2	2	– 97 %	15.1 %	2.9 %	0.2 %
Poland	370	312	166	155	161	154	152	149	171	152	– 59 %	– 11.0 %	14.1 %	16.2 %
Portugal	86	91	84	75	59	55	53	43	39	32	– 63 %	– 19.7 %	3.3 %	3.4 %
Romania	113	92	71	50	47	44	36	28	24	26	– 77 %	10.4 %	4.3 %	2.8 %
Slovakia	72	33	23	23	23	21	19	18	19	18	– 76 %	– 5.9 %	2.8 %	1.9 %
Slovenia	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR				
Spain	269	325	299	278	251	237	230	202	190	183	– 32 %	– 3.4 %	10.3 %	19.6 %
Sweden	32	33	20	19	19	15	14	14	17	14	– 58 %	– 20.1 %	1.2 %	1.4 %
United Kingdom	321	299	167	129	118	110	114	83	83	73	– 77 %	– 12.4 %	12.3 %	7.8 %
EU-27 (a)	**2621**	**2244**	**1631**	**1485**	**1423**	**1341**	**1266**	**1137**	**1024**	**937**	**– 64 %**	**– 8.5 %**	**100 %**	**100 %**
EU-27 (b)	2 520	2 143	1 530	1 384	1 322	1 240	1 165	1 036	923	836				

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 indicate 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 2011, Se emissions in the EU-27 decreased by 12 %. Between 2010 and 2011, emissions increased by 0.3 %, mainly due to increases of emissions in Bulgaria, Romania and Spain. The increase in 2010 in Belgium is mainly due to a particular company in the glass industry in Wallonia (source: comment received from Belgium in 2012). The main reduction was reported by Belgium (Table 2.18). The Member States that contributed most (more than 10 %) to the emissions of Se in 2011 were Spain, the United Kingdom and Portugal. Greece only reported an emission value once (for 1996) that has been used to gap-fill all the other years including 2011. 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-27 total is therefore underestimated.

The peak in 2005 of Se emissions in Belgium in 2005 originated in the Walloon region. One of the main sources of Se in the Walloon region is the glass sector. Each plant reports their emissions annually (calculated from measurements). In 2003 and 2005, the concentrations of Se were very high in one glass plant. The concentrations depends on the type of glass production during the measurements (source: comment received from Belgium in 2013).

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

Member State	Se (Mg)										Change		Share in EU-27	
	1990	1995	2000	2005	2006	2007	2008	2009	2010	2011	1990–2011	2010–2011	1990	2011
Austria	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR				
Belgium	7	8	8	29	13	15	10	9	12	4	– 47 %	– 67.8 %	2.6 %	1.6 %
Bulgaria	41	12	5	13	16	16	20	17	17	20	– 51 %	15.7 %	15.3 %	8.5 %
Cyprus	0	0	0	0	0	0	0	0	0	0	40 %	33.2 %	0.0 %	0.0 %
Czech Republic	8	8	8	9	8	7	7	10	8	8	– 1 %	1.7 %	3.1 %	3.5 %
Denmark	5	4	3	2	2	2	2	1	2	1	– 75 %	– 22.4 %	1.8 %	0.5 %
Estonia	0	0	0	0	0	0	0	0	0	0	> 100 %	– 14.6 %	0.0 %	0.0 %
Finland	0	0	0	0	0	0	0	1	0	0	> 100 %	– 56.1 %	0.0 %	0.1 %
France	15	15	15	14	14	14	13	12	12	12	– 19 %	– 0.8 %	5.5 %	5.1 %
Germany	3	4	4	4	4	4	4	4	4	4	5 %	– 2.0 %	1.3 %	1.5 %
Greece	0	0	0	0	0	0	0	0	0	0	0 %	0.0 %	0.1 %	0.1 %
Hungary	3	3	2	1	1	1	1	1	4	4	26 %	2.5 %	1.2 %	1.8 %
Ireland	3	3	4	4	4	4	4	2	2	2	– 35 %	– 17.6 %	1.1 %	0.8 %
Italy	10	10	11	12	12	12	12	10	11	11	17 %	3.1 %	3.6 %	4.8 %
Latvia	0	0	0	0	0	0	0	0	0	0	– 75 %	– 1.1 %	0.1 %	0.0 %
Lithuania	2	0	0	0	0	0	0	0	0	0	– 97 %	– 33.6 %	0.6 %	0.0 %
Luxembourg	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR				
Malta	0	0	0	0	0	0	0	0	0	0	> 100 %	39.9 %	0.0 %	0.0 %
Netherlands	0	0	0	3	1	1	3	1	2	1	> 100 %	– 47.1 %	0.1 %	0.3 %
Poland	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE				
Portugal	12	17	23	27	28	31	31	29	30	30	> 100 %	1.1 %	4.6 %	13.0 %
Romania	16	16	16	16	18	18	18	15	15	17	5 %	17.7 %	6.2 %	7.4 %
Slovakia	9	9	7	9	10	9	10	8	11	11	22 %	– 7.2 %	3.3 %	4.5 %
Slovenia	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR				
Spain	50	57	75	84	83	81	80	68	71	73	47 %	3.4 %	18.6 %	31.1 %
Sweden	1	1	1	1	1	1	1	1	1	1	18 %	– 10.5 %	0.2 %	0.3 %
United Kingdom	82	54	38	41	39	36	36	31	32	35	– 58 %	8.5 %	30.6 %	14.8 %
EU-27 (a)	**267**	**222**	**220**	**268**	**254**	**253**	**252**	**221**	**234**	**234**	**– 12 %**	**0.3 %**	**100 %**	**100 %**
EU-27 (b)	267	222	220	268	254	253	252	221	233	234				

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 indicate 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 2011, Zn emissions in the EU-27 decreased by 42 %. Between 2010 and 2011, emissions decreased by 0.8 %, mainly due to reductions reported in Poland, the Czech Republic and Finland (Table 2.19). The Member States that contributed most (more than 10 %) to the emissions of Zn in 2011 were Germany, Poland and Italy. Greece only reported an emission value once (for 1996) that has been used to gap-fill all the other years including 2011. 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-27 total is therefore underestimated.

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

Member State	Zn (Mg)										Change		Share in EU-27	
	1990	1995	2000	2005	2006	2007	2008	2009	2010	2011	1990–2011	2010–2011	1990	2011
Austria	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR				
Belgium	231	182	173	120	119	123	117	76	103	99	– 57 %	– 4.4 %	2.0 %	1.5 %
Bulgaria	219	151	287	174	193	164	185	158	151	173	– 21 %	14.4 %	1.9 %	2.6 %
Cyprus	4	5	6	7	7	7	8	7	6	6	63 %	10.1 %	0.0 %	0.1 %
Czech Republic	395	283	184	166	171	168	150	137	114	86	– 78 %	– 24.8 %	3.4 %	1.3 %
Denmark	52	50	38	38	38	40	39	37	37	37	– 28 %	– 0.1 %	0.4 %	0.6 %
Estonia	105	58	45	49	44	56	49	40	56	55	– 48 %	– 1.9 %	0.9 %	0.8 %
Finland	591	342	91	135	138	126	131	134	161	133	– 77 %	– 17.1 %	5.1 %	2.0 %
France	2 166	1 364	959	511	538	483	468	433	443	441	– 80 %	– 0.4 %	18.7 %	6.6 %
Germany	1 599	1 603	1 770	1 789	1 819	1 844	1 840	1 809	1 861	1 885	18 %	1.3 %	13.8 %	28.1 %
Greece	52	52	52	52	52	52	52	52	52	52	0 %	0.0 %	0.4 %	0.8 %
Hungary	97	70	79	79	86	88	91	63	42	33	– 66 %	– 22.7 %	0.8 %	0.5 %
Ireland	45	46	50	21	21	21	20	18	17	16	– 63 %	– 5.8 %	0.4 %	0.2 %
Italy	929	911	873	946	1 017	1 023	1 002	728	871	948	2 %	8.9 %	8.0 %	14.1 %
Latvia	21	13	13	16	16	16	15	15	16	12	– 43 %	– 26.2 %	0.2 %	0.2 %
Lithuania	9	9	3	3	5	4	3	3	4	3	– 66 %	– 16.9 %	0.1 %	0.0 %
Luxembourg	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR				
Malta	0	1	1	1	1	1	1	1	10	11	2536 %	2.6 %	0.0 %	0.2 %
Netherlands	221	142	91	83	85	81	81	87	105	103	– 53 %	– 2.5 %	1.9 %	1.5 %
Poland	3 092	2 580	1 423	1 448	1 547	1 486	1 488	1 413	1 599	1 517	– 51 %	– 5.1 %	26.6 %	22.6 %
Portugal	38	44	53	79	82	83	88	79	79	83	118 %	5.2 %	0.3 %	1.2 %
Romania	186	154	122	91	85	84	80	60	63	61	– 67 %	– 3.3 %	1.6 %	0.9 %
Slovakia	105	68	68	65	70	65	64	47	57	58	– 45 %	2.5 %	0.9 %	0.9 %
Slovenia	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR				
Spain	258	278	369	413	420	423	411	381	389	393	52 %	1.0 %	2.2 %	5.8 %
Sweden	200	159	120	143	154	155	159	157	174	161	– 20 %	– 7.1 %	1.7 %	2.4 %
United Kingdom	990	951	621	419	389	397	368	338	359	346	– 65 %	– 3.6 %	8.5 %	5.2 %
EU-27 (a)	**11 604**	**9 517**	**7 492**	**6 848**	**7 098**	**6 992**	**6 910**	**6 272**	**6 768**	**6 711**	**– 42 %**	**– 0.8 %**	**100 %**	**100 %**
EU-27 (b)	11 552	9 465	7 440	6 796	7 046	6 940	6 858	6 220	6 716	6 659				

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 indicate 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 2011, PCDD/F emissions dropped in the EU-27 by 85 %. Between 2010 and 2011, the decrease was 1.3 % (The decrease of emissions of dioxine in France at the period 1995-1997 is due to improvements in sinter plants (source: comment received from France in 2013).

Table 2.20), mainly due to reductions reported in the Czech Republic, Romania and the United Kingdom.

The Member States that contributed most (more than 10 %) to the emissions of PCDD/Fs in 2011 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-27 total is therefore underestimated.

The decrease of emissions of dioxine in France at the period 1995-1997 is due to improvements in sinter plants (source: 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-27	
	1990	1995	2000	2005	2006	2007	2008	2009	2010	2011	1990–2011	2010–2011	1990	2011
Austria	161	59	52	43	40	38	39	35	40	35	– 78 %	– 11.4 %	1.4 %	2.1 %
Belgium	548	481	115	53	49	49	60	41	43	40	– 93 %	– 8.0 %	4.9 %	2.4 %
Bulgaria	59	81	68	73	75	67	51	38	42	94	59 %	> 100 %	0.5 %	5.7 %
Cyprus	2	2	2	1	1	1	1	1	1	1	– 69 %	– 0.9 %	0.0 %	0.0 %
Czech Republic	1 252	1 135	744	179	175	169	150	141	129	105	– 92 %	– 19.0 %	11.2 %	6.3 %
Denmark	67	51	32	26	25	29	28	26	26	24	– 64 %	– 6.7 %	0.6 %	1.5 %
Estonia	6	5	3	3	3	5	5	5	6	5	– 4 %	– 1.8 %	0.1 %	0.3 %
Finland	37	43	30	10	11	11	14	10	15	13	– 65 %	– 11.6 %	0.3 %	0.8 %
France	1 745	1 684	515	192	119	116	102	88	98	92	– 95 %	– 6.7 %	15.6 %	5.5 %
Germany	747	229	152	69	71	71	72	62	70	63	– 92 %	– 9.5 %	6.7 %	3.8 %
Greece														
Hungary	172	95	74	92	92	85	88	75	44	48	– 72 %	7.8 %	1.5 %	2.9 %
Ireland	26	25	23	23	23	16	16	16	16	15	– 43 %	– 4.0 %	0.2 %	0.9 %
Italy	458	442	362	283	291	305	294	221	228	242	– 47 %	6.0 %	4.1 %	14.6 %
Latvia	27	29	26	30	30	30	28	31	30	27	2 %	– 9.3 %	0.2 %	1.6 %
Lithuania	20	12	11	11	11	11	11	11	13	14	– 31 %	4.6 %	0.2 %	0.8 %
Luxembourg	46	31	6	2	2	1	1	1	1	1	– 98 %	– 12.0 %	0.4 %	0.1 %
Malta	9	9	9	9	9	9	9	9	9	1	– 89 %	– 88.7 %	0.1 %	0.1 %
Netherlands	743	69	30	38	27	27	30	29	30	31	– 96 %	3.6 %	6.6 %	1.9 %
Poland	529	515	264	265	261	253	256	247	273	269	– 49 %	– 1.3 %	4.7 %	16.2 %
Portugal	14	14	12	9	9	9	9	9	8	9	– 36 %	6.0 %	0.1 %	0.5 %
Romania	3 073	2 063	1 053	174	120	131	152	142	147	136	– 96 %	– 7.8 %	27.4 %	8.2 %
Slovakia	169	150	99	73	67	63	58	45	60	52	– 69 %	– 13.6 %	1.5 %	3.1 %
Slovenia	16	12	11	10	10	10	10	10	11	10	– 36 %	– 7.0 %	0.1 %	0.6 %
Spain	172	146	119	112	114	120	115	101	109	112	– 35 %	3.2 %	1.5 %	6.8 %
Sweden	60	40	33	39	38	36	38	37	42	39	– 35 %	– 7.1 %	0.5 %	2.3 %
United Kingdom	1 038	670	238	208	188	168	175	166	188	178	– 83 %	– 5.2 %	9.3 %	10.7 %
EU-27 (a)	**11 196**	**8 091**	**4 082**	**2 025**	**1 862**	**1 831**	**1 812**	**1 596**	**1 679**	**1 656**	**– 85 %**	**– 1.3 %**	**100 %**	**100 %**
EU-27 (b)	11 196	8 091	4 082	2 024	1 862	1 831	1 812	1 596	1 679	1 656				

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

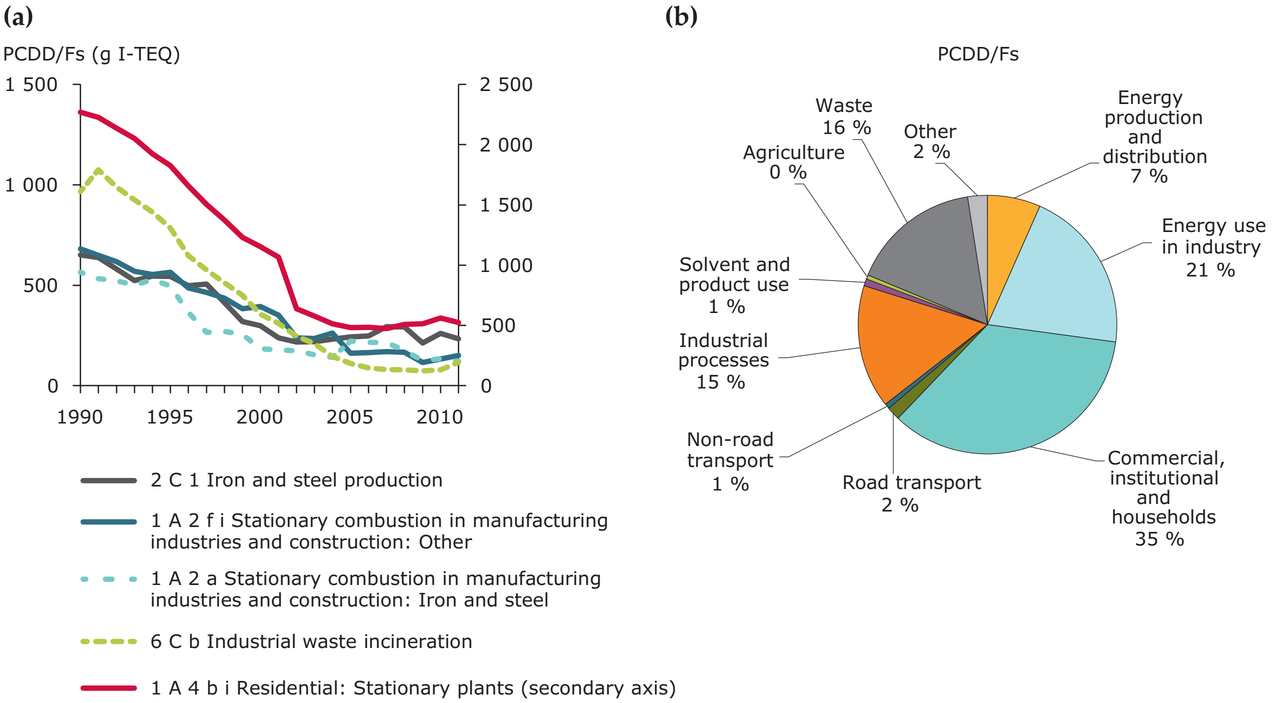
(b) Sum of sectors.

Negative percentage values indicate that emissions have decreased.

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

Dark-grey shaded cells indicate that no emission values are available.

Figure 2.13 PCDD/F emissions in the EU-27: (a) trend in PCDD/F emissions from the five most important key categories, 1990–2011; (b) share of emissions by sector group, 2011



'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 46 % of total PCDD/F emissions (Figure 2.13). Among the top five key categories, the highest relative reductions in emissions between 1990 and 2011 was achieved in the fifth most important key category, '6 C b — Industrial waste incineration' (– 87.8 %). The fourth most important key category, '1 A 2 a — Stationary combustion in manufacturing industries and construction: Iron and steel' (– 78.3 %) and the third most important key category, '1 A 2 f i —Stationary combustion in manufacturing industries and construction: Other'(– 78.0 %) show also high reductions (Figure 2.13).

The strong decrease 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 has been used for the new POPs emission inventories assembling. The recalculation of emission factors is planned (source: comment received from the Czech Republic in 2013).

Figure 2.13 shows the contribution to total EU-27 emissions made by the aggregated sector groups. The 'Commercial, institutional and households' sector group is an important source of PCDD/Fs, as well as of $PM_{2.5}$, PM_{10}, total PAHs, and PCBs.

2.20 Polycyclic aromatic hydrocarbon (total PAH) emission trends and key categories

Between 1990 and 2011, total PAH emissions decreased in the EU-27 by 58 %. Between 2010 and 2011, the decrease was 6.1 %, mainly due to reductions reported in Germany, Hungary and Romania (Table 2.21). The Member States that contributed most (more than 10 %) to the emissions of total PAHs in 2011 were Spain, Germany, Poland and Romania. Greece did not report PAH emissions for any year, and thus data were not gap-filled. The EU-27 total is therefore underestimated.

The PAH emissions of Belgium of the years 1990, 2000, 2005–2011 are much lower than in other years. Belgium explained that in the 2013 submission, the results of a new study on the emission inventory of

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

Member State	Total PAHs (Mg)										Change		Share in EU-27	
	1990	1995	2000	2005	2006	2007	2008	2009	2010	2011	1990–2011	2010–2011	1990	2011
Austria	17	9	8	9	8	8	8	7	8	7	– 58 %	– 13.3 %	0.7 %	0.6 %
Belgium	125	274	60	53	52	54	51	43	46	46	– 63 %	– 0.7 %	4.8 %	4.2 %
Bulgaria	27	21	22	26	27	25	27	25	28	30	9 %	7.7 %	1.1 %	2.7 %
Cyprus	5	4	3	2	2	2	1	1	1	1	– 77 %	1.7 %	0.2 %	0.1 %
Czech Republic	752	1 357	488	24	17	16	19	15	17	16	– 98 %	– 8.1 %	29.0 %	1.4 %
Denmark	8	9	11	15	16	19	17	16	16	14	91 %	– 12.1 %	0.3 %	1.3 %
Estonia	12	14	13	13	12	13	14	15	16	14	17 %	– 12.9 %	0.5 %	1.3 %
Finland	17	19	14	13	13	13	15	16	18	16	– 6 %	– 10.6 %	0.6 %	1.4 %
France	40	39	30	24	21	20	20	20	22	19	– 53 %	– 12.9 %	1.6 %	1.7 %
Germany	374	163	156	144	150	145	158	166	206	177	– 53 %	– 14.1 %	14.4 %	16.1 %
Greece														
Hungary	48	26	19	23	23	13	15	22	44	31	– 36 %	– 29.2 %	1.9 %	2.8 %
Ireland	6	4	3	3	3	3	3	3	3	2	– 61 %	– 8.4 %	0.2 %	0.2 %
Italy	78	82	80	84	86	89	87	67	82	88	14 %	7.9 %	3.0 %	8.1 %
Latvia	26	29	28	29	29	28	27	30	30	24	– 11 %	– 20.5 %	1.0 %	2.1 %
Lithuania	24	16	17	19	16	19	20	20	20	20	– 17 %	– 2.1 %	0.9 %	1.8 %
Luxembourg	1	1	1	1	1	1	1	1	1	1	– 34 %	– 0.2 %	0.0 %	0.1 %
Malta	0	0	0	0	0	0	0	0	0	0	– 20 %	– 20.5 %	0.0 %	0.0 %
Netherlands	20	10	4	4	4	4	4	4	4	4	– 81 %	3.6 %	0.8 %	0.3 %
Poland	159	237	123	129	140	138	140	133	149	144	– 10 %	– 3.8 %	6.1 %	13.1 %
Portugal	50	44	46	51	53	51	59	55	59	52	5 %	– 11.7 %	1.9 %	4.8 %
Romania	274	182	91	132	124	128	152	133	136	127	– 54 %	– 6.8 %	10.6 %	11.6 %
Slovakia	29	15	13	19	18	18	18	18	18	19	– 34 %	4.3 %	1.1 %	1.7 %
Slovenia	16	15	14	12	12	12	12	12	13	12	– 26 %	– 9.0 %	0.6 %	1.1 %
Spain	267	255	222	169	196	202	192	203	209	210	– 21 %	0.5 %	10.3 %	19.1 %
Sweden	17	16	14	18	19	18	19	14	13	14	– 14 %	8.0 %	0.6 %	1.3 %
United Kingdom	203	91	14	10	9	8	9	9	9	9	– 96 %	3.0 %	7.8 %	0.8 %
EU-27 (a)	**2 596**	**2 934**	**1 493**	**1 028**	**1 051**	**1 047**	**1 088**	**1 050**	**1 170**	**1 098**	**– 58 %**	**– 6.1 %**	**100 %**	**100 %**
EU-27 (b)	2 596	2 934	1 493	1 028	1 051	1 047	1 088	1 050	1 170	1 098				

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

(b) Sum of sectors.

Negative percentage values indicate that emissions have decreased.

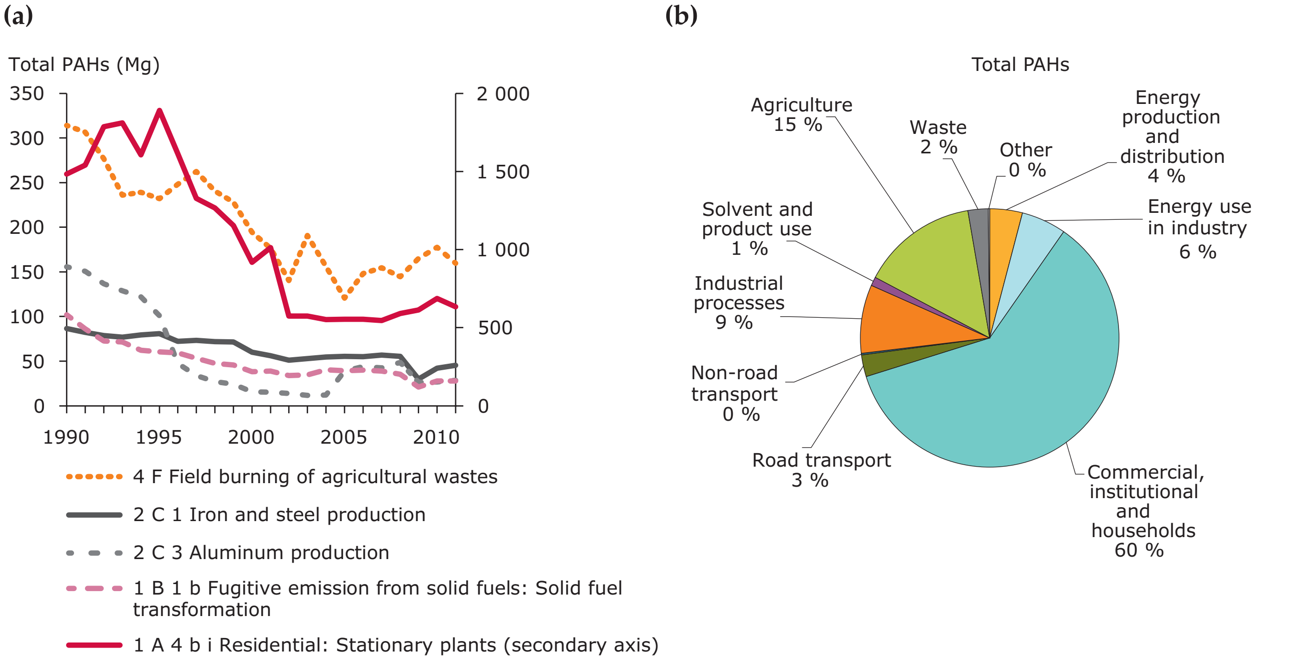
Light-grey shaded cells indicate gap-filled data. For more detailed information, see Annex D.

Dark-grey shaded cells indicate that no emission values are available.

POPs was included (only for the years mentioned above). The greatest difference is that in previous submissions, total PAHs were reported. For certain sectors, this included other (and more) PAHs than the four mentioned in the NFR templates (e.g. naphtalene). Since the last submission, only the total of the four EMEP PAHs has been reported. Belgium intends to report the whole time-series in the next submission (source: comment received from Belgium in 2013).

'1 A 4 b i — Residential: Stationary plants' was the most important key category for these emissions, making up 58 % of total PAH emissions (Figure 2.14). Among the top five key categories, the highest relative reductions in emissions between 1990 and 2011 were achieved in the fourth most important key category, '2 C 3 — Aluminium production' (– 81.6 %) (Figure 2.14).

Figure 2.14 Total PAH emissions in the EU-27: (a) trend in total PAH emissions from the five most important key categories, 1990–2011; (b) share of emissions by sector group, 2011



Dips and jumps in the time series from 1990 to 2002 of the category '1 A 4 b i — Residential: Stationary plants' are caused by data reported from the Czech Republic. In 2002 a new set of emission factors based on the actual measurements results has been used for the new POPs emission inventories assembling. The recalculation of emission factors is planned (source: comment received from the Czech Republic in 2013).

The emission peaks in 1997 and 2003 of the category '4 F — Field burning of agricultural wastes' are mainly caused by data reported from Spain.

Emissions from these sources have in general declined since 1990 as a result of 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, 2012e).

Figure 2.14 shows the contribution to total EU-27 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.

2.21 Benzo(a)pyrene (BaP) emission trends

Between 1990 and 2011, BaP emissions in the EU-27 decreased by 45 %. Between 2010 and 2011, emissions decreased by 6.3 %, mainly due to reductions reported in Germany, Romania and Latvia (Table 2.22). The Member States that contributed most (more than 10 %) to the emissions of BaP in 2011 were Poland, Romania and Germany. Austria reported the whole time-series of its BaP emissions as 'NR', Belgium and Portugal as not estimated ('NE'), and Finland, Italy and Spain as included elsewhere ('IE'). Greece did not report any data or notation keys. The EU-27 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-27	
	1990	1995	2000	2005	2006	2007	2008	2009	2010	2011	1990–2011	2010–2011	1990	2011
Austria	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR				
Belgium	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE				
Bulgaria	8	6	7	8	8	7	8	7	8	9	12 %	7.6 %	2.4 %	5.0 %
Cyprus	1	1	1	1	1	0	0	0	0	0	– 76 %	1.8 %	0.4 %	0.2 %
Czech Republic	11	10	9	8	6	6	8	5	5	4	– 61 %	– 15.6 %	3.4 %	2.4 %
Denmark	2	3	3	4	5	6	5	5	5	4	> 100 %	– 12.0 %	0.7 %	2.4 %
Estonia	4	4	4	4	4	4	4	5	5	4	17 %	– 13.0 %	1.1 %	2.4 %
Finland	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE				
France	11	11	8	6	6	5	6	6	6	5	– 55 %	– 13.8 %	3.5 %	2.9 %
Germany	138	48	30	23	24	23	25	27	34	29	– 79 %	– 13.3 %	42.5 %	16.3 %
Greece														
Hungary	14	8	6	7	7	4	4	6	9	9	– 30 %	8.9 %	4.2 %	5.3 %
Ireland	3	2	2	1	1	1	1	1	1	1	– 63 %	– 8.5 %	1.0 %	0.7 %
Italy	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE				
Latvia	8	9	9	9	9	9	8	10	9	7	– 11 %	– 23.8 %	2.5 %	4.0 %
Lithuania	7	5	5	6	4	6	6	6	6	6	– 18 %	– 1.5 %	2.2 %	3.3 %
Luxembourg	0	0	0	0	0	0	0	0	0	0	– 31 %	– 0.2 %	0.1 %	0.1 %
Malta	0	0	0	0	0	0	0	0	0	0	– 13 %	– 13.4 %	0.0 %	0.0 %
Netherlands	5	3	1	1	1	1	1	1	1	1	– 76 %	0.6 %	1.6 %	0.7 %
Poland	35	36	37	38	42	41	42	39	45	43	23 %	– 3.0 %	10.8 %	24.2 %
Portugal	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE				
Romania	3	3	5	39	37	38	44	39	40	37	> 100 %	– 7.2 %	0.9 %	20.7 %
Slovakia	3	3	4	5	5	5	5	5	5	5	78 %	5.8 %	0.9 %	3.0 %
Slovenia	5	4	4	4	4	3	3	4	4	3	– 26 %	– 9.0 %	1.4 %	1.9 %
Spain	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE				
Sweden	5	5	4	5	6	6	6	4	4	5	– 10 %	7.7 %	1.6 %	2.6 %
United Kingdom	61	21	5	3	3	3	3	3	3	3	– 94 %	4.3 %	18.7 %	1.9 %
EU-27 ([a])	**325**	**182**	**144**	**174**	**171**	**169**	**181**	**174**	**191**	**179**	**– 45 %**	**– 6.3 %**	**100 %**	**100 %**
EU-27 ([b])	325	182	144	174	171	169	181	174	191	179				

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

([b]) Sum of sectors.

Negative percentage values indicate that emissions have decreased.

Light-grey shaded cells indicate 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 2011, BbF emissions in the EU-27 decreased by 25 %. Between 2010 and 2011, emissions decreased by 4.1 %, mainly due to reductions reported in Romania, Latvia and Poland (Table 2.23). The Member States that contributed most (more than 10 %) to the emissions of BbF in 2011 were Poland and Romania. Austria reported the whole time-series of its BbF emissions as 'NR', Belgium and Portugal as not estimated ('NE'), and Finland, Italy and Spain as included elsewhere ('IE'). Greece did not report any data or notation keys. The EU-27 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-27	
	1990	1995	2000	2005	2006	2007	2008	2009	2010	2011	1990–2011	2010–2011	1990	2011
Austria	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR				
Belgium	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE				
Bulgaria	11	8	8	9	9	9	9	8	9	10	– 6 %	8.3 %	5.2 %	6.5 %
Cyprus	1	1	1	1	1	0	0	0	0	0	– 74 %	2.5 %	0.59 %	0.2 %
Czech Republic	8	8	8	7	5	5	3	5	5	5	– 38 %	– 4.3 %	4.0 %	3.3 %
Denmark	2	3	3	5	5	6	5	5	5	4	91 %	– 12.0 %	1.1 %	2.9 %
Estonia	4	5	4	4	4	4	5	5	5	5	11 %	– 12.8 %	2.1 %	3.0 %
Finland	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE				
France	13	13	10	8	7	6	7	7	7	6	– 54 %	– 13.4 %	6.4 %	3.9 %
Germany	2	0	0	0	0	0	0	0	0	0	– 96 %	– 0.5 %	0.96 %	0.1 %
Greece														
Hungary	15	9	6	8	8	5	5	8	9	10	– 33 %	9.2 %	7.3 %	6.5 %
Ireland	0	0	0	0	0	0	0	0	0	0	– 33 %	– 7.6 %	0.2 %	0.2 %
Italy	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE				
Latvia	9	9	9	9	9	9	9	10	9	8	– 14 %	– 18.3 %	4.31 %	4.9 %
Lithuania	8	5	6	6	4	6	6	6	7	6	– 23 %	– 2.3 %	4.0 %	4.1 %
Luxembourg	0	0	0	0	0	0	0	0	0	0	– 39 %	– 0.2 %	0.2 %	0.2 %
Malta	0	0	0	0	0	0	0	0	0	0	– 20 %	– 20.2 %	0.01 %	0.0 %
Netherlands	8	3	1	1	1	1	2	1	1	1	– 84 %	6.7 %	3.8 %	0.8 %
Poland	35	36	36	39	42	41	42	40	45	43	23 %	– 2.9 %	17.0 %	27.7 %
Portugal	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE				
Romania	0	0	0	44	41	42	50	43	44	42	> 100 %	– 6.4 %	0.2 %	26.4 %
Slovakia	4	4	4	7	7	7	7	6	7	7	66 %	5.4 %	2.0 %	4.4 %
Slovenia	6	6	5	5	5	4	4	5	5	4	– 27 %	– 9.2 %	3.0 %	2.9 %
Spain	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE				
Sweden	3	3	2	4	5	4	4	0	0	0	– 86 %	2.7 %	1.3 %	0.2 %
United Kingdom	76	39	4	3	3	3	3	3	3	3	– 96 %	4.1 %	36.3 %	2.0 %
EU-27 (a)	**208**	**152**	**109**	**160**	**156**	**153**	**160**	**154**	**164**	**157**	**– 25 %**	**– 4.1 %**	**100 %**	**100 %**
EU-27 (b)	208	152	109	160	156	153	160	154	164	157				

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

(b) Sum of sectors.

Negative percentage values indicate that emissions have decreased.

Light-grey shaded cells indicate 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 2011, BkF emissions in the EU-27 decreased by 19 %. Between 2010 and 2011, emissions decreased by 3.6 % (Table 2.24). The Member States that contributed most (more than 10 %) to the emissions of BkF in 2011 were Romania and Poland. Austria reported the whole time-series of its BkP emissions as 'NR', Belgium and Portugal as not estimated ('NE'), and Finland, Italy and Spain as included elsewhere ('IE'). Germany reported its emissions as '0', and Greece did not report any data or notation keys. The EU-27 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-27	
	1990	1995	2000	2005	2006	2007	2008	2009	2010	2011	1990–2011	2010–2011	1990	2011
Austria	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR				
Belgium	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE				
Bulgaria	5	4	4	5	5	5	5	4	5	5	18 %	7.4 %	4.8 %	6.9 %
Cyprus	1	1	1	1	0	0	0	0	0	0	– 79 %	1.0 %	1.2 %	0.3 %
Czech Republic	3	3	3	3	2	2	4	2	2	2	– 26 %	7.3 %	3.4 %	3.1 %
Denmark	1	2	2	3	3	3	3	3	3	3	100 %	– 12.8 %	1.3 %	3.2 %
Estonia	2	3	2	2	2	2	3	3	3	3	15 %	– 12.8 %	2.3 %	3.2 %
Finland	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE				
France	9	8	6	5	5	5	5	5	5	4	– 50 %	– 11.7 %	8.9 %	5.5 %
Germany	0	0	0	0	0	0	0	0	0	0				
Greece														
Hungary	8	4	3	4	3	2	2	3	5	6	– 35 %	8.9 %	8.8 %	7.1 %
Ireland	0	0	0	0	0	0	0	0	0	0	– 17 %	– 4.7 %	0.2 %	0.2 %
Italy	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE				
Latvia	5	5	5	5	5	5	5	5	5	4	– 8 %	– 18.7 %	4.8 %	5.4 %
Lithuania	4	3	3	4	3	4	4	4	4	4	– 15 %	– 2.1 %	4.6 %	4.7 %
Luxembourg	0	0	0	0	0	0	0	0	0	0	– 35 %	– 0.5 %	0.2 %	0.2 %
Malta	0	0	0	0	0	0	0	0	0	0	– 12 %	– 12.3 %	0.0 %	0.0 %
Netherlands	4	2	1	1	1	1	1	1	1	1	– 84 %	2.5 %	4.2 %	0.8 %
Poland	11	12	12	13	14	14	13	11	13	13	16 %	– 0.5 %	11.4 %	16.2 %
Portugal	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE				
Romania	0	0	0	28	28	28	34	28	29	28	> 100 %	– 4.9 %	0.4 %	35.3 %
Slovakia	2	2	2	3	3	3	3	3	3	3	59 %	0.4 %	1.9 %	3.6 %
Slovenia	2	2	2	2	2	2	2	2	2	2	– 28 %	– 7.5 %	2.4 %	2.1 %
Spain	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE				
Sweden	0	0	0	0	0	0	0	0	0	0	– 10 %	2.3 %	0.2 %	0.2 %
United Kingdom	38	20	3	2	2	1	1	1	1	1	– 96 %	2.0 %	39.1 %	1.8 %
EU-27 ([a])	**96**	**71**	**51**	**80**	**77**	**77**	**84**	**76**	**81**	**78**	**– 19 %**	**– 3.6 %**	**100 %**	**100 %**
EU-27 ([b])	96	71	51	80	77	77	84	76	81	78				

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

([b]) Sum of sectors.

Negative percentage values indicate that emissions have decreased.

Light-grey shaded cells indicate 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 2011, IP emissions in the EU-27 fell by 14 %. Between 2010 and 2011, emissions decreased by 6.5 %, mainly due to reductions reported in Poland, Romania and Latvia (Table 2.25). The Member States that contributed most (more than 10 %) to the emissions of IP in 2011 were Poland and Romania. Austria reported the whole time-series of its IP emissions as 'NR', Belgium and Portugal as not estimated ('NE'), and Finland, Italy and Spain as included elsewhere ('IE'). Greece did not report any data or notation keys. The EU-27 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-27	
	1990	1995	2000	2005	2006	2007	2008	2009	2010	2011	1990–2011	2010–2011	1990	2011
Austria	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR				
Belgium	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE				
Bulgaria	4	3	4	5	5	5	5	5	5	6	34 %	7.0 %	3.3 %	5.1 %
Cyprus	1	1	1	1	0	0	0	0	0	0	– 78 %	1.4 %	0.9 %	0.2 %
Czech Republic	10	9	7	6	4	4	4	4	4	4	– 62 %	– 12.0 %	8.2 %	3.6 %
Denmark	2	2	2	3	3	4	4	3	3	3	72 %	– 12.0 %	1.4 %	2.8 %
Estonia	2	3	2	2	2	3	3	3	3	3	30 %	– 13.0 %	1.6 %	2.5 %
Finland	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE				
France	7	7	5	4	4	4	4	4	4	4	– 50 %	– 12.0 %	5.6 %	3.3 %
Germany	1	0	0	0	0	0	0	0	0	0	– 95 %	– 0.1 %	0.6 %	0.0 %
Greece														
Hungary	11	6	4	4	5	3	3	5	5	6	– 49 %	9.1 %	9.0 %	5.3 %
Ireland	2	2	1	1	1	1	1	1	1	1	– 67 %	– 9.1 %	2.0 %	0.8 %
Italy	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE				
Latvia	5	6	5	6	6	5	5	6	6	4	– 8 %	– 20.5 %	3.9 %	4.2 %
Lithuania	4	3	3	4	5	4	4	4	4	4	– 8 %	– 2.5 %	3.3 %	3.6 %
Luxembourg	0	0	0	0	0	0	0	0	0	0	– 25 %	– 0.2 %	0.2 %	0.2 %
Malta	0	0	0	0	0	0	0	0	0	0	– 8 %	– 8.5 %	0.0 %	0.0 %
Netherlands	3	1	1	1	1	1	1	1	1	1	– 77 %	4.8 %	2.3 %	0.6 %
Poland	36	37	37	39	43	42	43	42	47	44	22 %	– 6.2 %	29.0 %	41.2 %
Portugal	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE				
Romania	0	0	0	21	19	20	24	22	23	21	> 100 %	– 9.3 %	0.1 %	19.4 %
Slovakia	3	3	3	4	4	4	4	4	4	4	37 %	3.1 %	2.3 %	3.7 %
Slovenia	3	3	3	2	2	2	2	2	3	2	– 20 %	– 10.0 %	2.4 %	2.2 %
Spain	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE				
Sweden	1	1	1	1	1	1	1	0	0	0	– 81 %	1.8 %	0.5 %	0.1 %
United Kingdom	29	12	2	1	1	1	1	1	1	1	– 96 %	– 1.4 %	23.4 %	1.2 %
EU-27 (a)	**125**	**97**	**82**	**105**	**107**	**103**	**109**	**107**	**115**	**107**	**– 14 %**	**– 6.5 %**	**100 %**	**100 %**
EU-27 (b)	125	97	82	105	107	103	109	107	115	107				

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

(b) Sum of sectors.

Negative percentage values indicate that emissions have decreased.

Light-grey shaded cells indicate 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 2011, HCB emissions decreased in the EU-27 by 96 %. Between 2010 and 2011, the increase was 2.1 %, mainly due to emission growth in Finland. The main reductions were reported by the United Kingdom and Austria (Table 2.26). The Member States that contributed most (more than 10 %) to the emissions of HCB in 2011 were Spain, Austria, Finland and the United Kingdom. Greece did not report HCB emissions for any year, and thus data were not gap-filled. The EU-27 total is therefore underestimated.

The strong emission drop in France between 1990 and 1995 is mainly due to the change of the emission factor from the activity of secondary aluminium

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

Member State	HCB (kg)										Change		Share in EU-27	
	1990	1995	2000	2005	2006	2007	2008	2009	2010	2011	1990–2011	2010–2011	1990	2011
Austria	92	53	44	45	42	41	41	38	44	37	– 59 %	– 13.9 %	1.8 %	16.4 %
Belgium	19	8	18	16	16	16	16	10	11	11	– 43 %	– 5.5 %	0.4 %	4.7 %
Bulgaria	23	25	20	21	25	23	26	23	19	22	– 4 %	14.9 %	0.4 %	9.6 %
Cyprus	0	0	0	0	0	0	0	0	0	0	– 79 %	– 0.6 %	0.0 %	0.0 %
Czech Republic	5	5	5	5	4	4	4	3	3	2	– 45 %	– 7.6 %	0.1 %	1.1 %
Denmark	3	2	1	0	1	1	1	1	1	1	– 82 %	– 5.9 %	0.1 %	0.3 %
Estonia	0	0	0	0	0	0	0	0	0	0	> 100 %	– 13.9 %	0.0 %	0.1 %
Finland	41	40	43	37	43	44	26	34	16	33	– 19 %	> 100 %	0.8 %	14.5 %
France	1 200	76	51	19	14	15	15	15	16	16	– 99 %	0.5 %	23.1 %	6.9 %
Germany	5	4	4	3	3	3	3	3	4	3	– 36 %	– 5.6 %	0.1 %	1.5 %
Greece														
Hungary	7	4	4	6	7	7	9	6	1	2	– 68 %	83.1 %	0.1 %	1.0 %
Ireland	40	40	0	1	1	1	1	1	1	1	– 97 %	0.5 %	0.8 %	0.5 %
Italy	43	38	24	21	27	26	26	15	13	14	– 67 %	7.0 %	0.8 %	6.2 %
Latvia	0	0	0	0	0	0	0	0	0	0	81 %	4.2 %	0.0 %	0.1 %
Lithuania	0	0	0	0	0	0	0	0	0	0	91 %	10.8 %	0.0 %	0.0 %
Luxembourg	0	1	2	1	1	1	1	1	1	0	92 %	– 27.5 %	0.0 %	0.2 %
Malta	0	0	0	0	0	0	0	0	0	0	3 %	3.3 %	0.0 %	0.0 %
Netherlands	1	1	1	1	1	1	1	1	1	2	> 100 %	14.1 %	0.0 %	0.7 %
Poland	62	51	9	10	9	11	11	11	13	13	– 80 %	– 3.8 %	1.2 %	5.5 %
Portugal	1	1	1	0	0	0	0	1	0	0	– 83 %	0.0 %	0.0 %	0.1 %
Romania	99	64	29	3	1	1	2	2	2	2	– 98 %	– 6.8 %	1.9 %	0.7 %
Slovakia	3	3	2	2	1	1	1	1	1	1	– 57 %	21.6 %	0.1 %	0.5 %
Slovenia	46	37	38	0	0	0	0	0	0	0	– 99 %	5.5 %	0.9 %	0.2 %
Spain	350	178	217	179	69	80	77	50	44	42	– 88 %	– 3.3 %	6.7 %	18.6 %
Sweden	0	0	0	0	0	0	0	0	0	0	– 12 %	7.2 %	0.0 %	0.0 %
United Kingdom	3 156	4 120	77	68	64	58	51	32	32	24	– 99 %	– 25.7 %	60.7 %	10.5 %
EU-27 (a)	**5 197**	**4 750**	**591**	**438**	**330**	**336**	**313**	**248**	**224**	**228**	**– 96 %**	**2.1 %**	**100 %**	**100 %**
EU-27 (b)	5 197	4 750	591	438	330	336	313	248	224	228				

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

fusion. Since 1994, this activity has used substitution products that no longer emit HCB. From 1990 to 1992, the emission factor is 5 g/Mg; it decreased by 50 % in 1993, and has been null since 1994 (source: comment received from France in 2013).

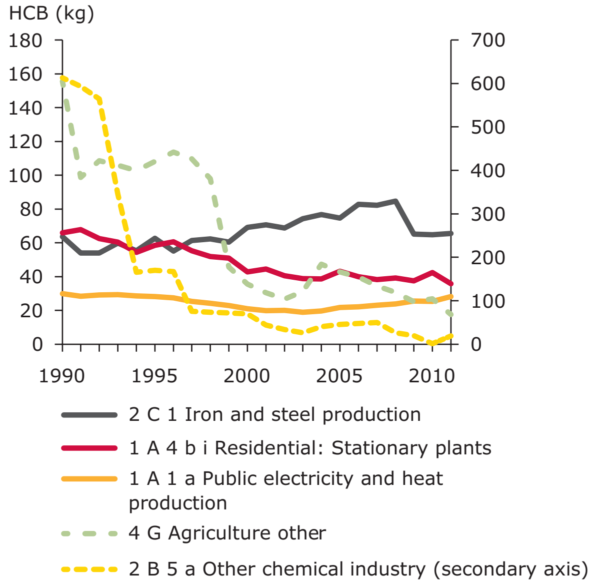
'2 C 1 — Iron and steel production' was the most important key category for HCB emissions, accounting for 29 % of total HCB emissions (Figure 2.15). Among the top five key categories, the highest relative reductions in emissions between 1990 and 2011 were achieved in the fourth most important key category, '2 B 5 a — Other chemical industry' (– 96.9 %) and the fifth most important key category '4 G — Agriculture other' (– 88.7 %) (Figure 2.15).

The drops in HCB emissions of the years 1992 to 1994 and 1996 to 1997 of the category '2 B 5 a — Other chemical industry' are due to considerable emission reductions reported by the United Kingdom. Data reported by the United Kingdom are also the reason for emission decreases of the category '4 G — Agriculture other' of the years 1990 to 1991 and 1998 to 2002.

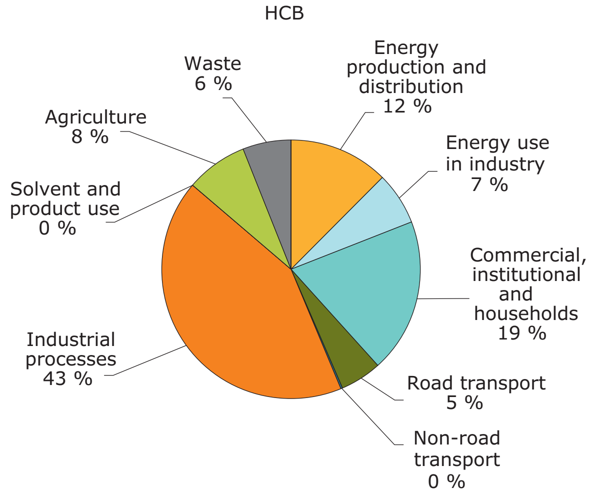
Figure 2.15 shows the contribution to total EU-27 emissions made by the aggregated sector groups. For HCB, the most important emission source is the 'industrial processes' sector group.

Figure 2.15 HCB emissions in the EU-27: (a) trend in HCB emissions from the five most important key categories, 1990–2011; (b) share of emissions by sector group, 2011

(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-27 total is therefore far from complete. The available data are presented in Table 2.27.

There was only one key category for HCH emissions, '2 F — Consumption of POPs and heavy metals (e.g. electrical and scientific equipment)', which contributed 97 % to total HCH emissions. High relative reductions in emissions between 1990 and 2011 were achieved in this key category (– 88.6 %) (Figure 2.16). The data for category '2 F — Consumption of POPs and heavy metals

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

Member State	HCH (kg)										Change		Share in EU-27	
	1990	1995	2000	2005	2006	2007	2008	2009	2010	2011	1990–2011	2010–2011	1990	2011
Austria	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR				
Belgium	162	165	167	170	171	172	173	174	175	176	9 %	0.8 %	0.1 %	2.5 %
Bulgaria	0	0	0	0	0	0	0	0	0	0				
Cyprus	0	0	0	0	0	0	0	0	0	0				
Czech Republic	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE				
Denmark	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE				
Estonia	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE				
Finland	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA				
France	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA				
Germany	60 200	13 100	NA	NA	NA	NA	NA	NA	NA	NA			33.6 %	
Greece														
Hungary	9 281	1 650	19	10	8	7	5	3	2	0				
Ireland	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA				
Italy	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA				
Latvia	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA				
Lithuania	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE				
Luxembourg	0	0	0	0	0	0	0	0	0	0				
Malta	0	0	0	0	0	0	0	0	0	0				
Netherlands	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO				
Poland	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO				
Portugal	0	0	0	0	0	0	0	0	0	0				
Romania	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA				
Slovakia	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE				
Slovenia	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR				
Spain	9 194	9 538	11 250	NE	NE	NE	NE	NE	NE	NE			5.1 %	
Sweden	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO				
United Kingdom	100 368	59 386	33 229	14 619	12 854	11 312	9 954	8 760	7 709	6 784	– 93 %	– 12.0 %	56.0 %	97.5 %
EU-27 (a)	**179 205**	**83 838**	**44 665**	**14 799**	**13 033**	**11 490**	**10 132**	**8 937**	**7 885**	**6 960**	**– 96 %**	**– 11.7 %**	**100 %**	**100 %**
EU-27 (b)	169 924	82 188	44 646	18 665	16 902	15 360	14 004	12 810	11 760	10 837				

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.

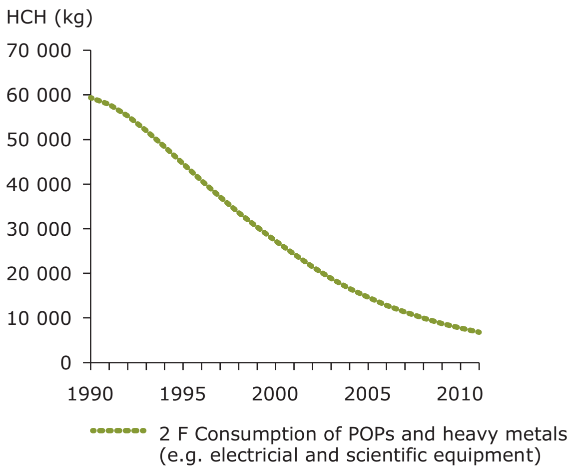
Negative percentage values indicate that emissions have decreased.

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

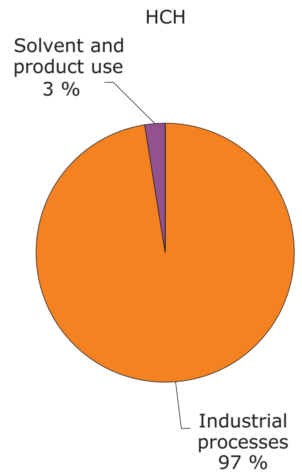
Dark-grey shaded cells indicate that no emission values are available. See Appendix 1 for an explanation of the notation keys reported by Member States.

Figure 2.16 HCH emissions in the EU-27: (a) trend in HCH emissions from the five most important key categories, 1990–2011; (b) share of emissions by sector group, 2011

(a)



(b)



(e.g. electrical and scientific equipment)' were only based on data reported by a single Member State (the United Kingdom). The EU-27 total cannot therefore be considered to be a very reliable figure.

Figure 2.16 shows the contribution to total EU-27 emissions made by the aggregated sector groups. For HCH, the sector 'industrial processes and agriculture' contributes the majority of emissions.

2.27 Polychlorinated biphenyl (PCB) emission trends and key categories

Based on the limited data available, it is estimated that between 1990 and 2011, PCB emissions decreased in the EU-27 by 76 %. Between 2010 and 2011, the decrease was 8.1 %, mainly due to reductions reported in Portugal, the United Kingdom and Slovenia (Table 2.28). The Member States that contributed most (share higher than 10 %) to the emissions of PCBs in 2011 were Portugal, the United Kingdom and Poland. Several Member States did not report any PCB emissions, and data could not be gap-filled. The EU-27 total is therefore underestimated.

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

Categories '6 C b — Industrial waste incineration' and '1 A 4 b i — Residential: Stationary plants' were the most important key categories for PCB emissions, together making up 43 % of total PCB emissions (Figure 2.17).

Among the top five key categories, the highest relative reductions in emissions between 1990 and 2011 were achieved in the fourth most important key category, '2 F — Consumption of POPs and heavy metals (e.g. electrical and scientific equipment)' (– 92.1 %) (Figure 2.17).

The strong decrease of PCBs 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 has been used for the new POPs emission inventories assembling. The recalculation of emission factors is planned (source: comment received from the Czech Republic in 2013).

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. The 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 time the in-use equipment reaches end of life and is 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 of > 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).

This year, to review the trend, the United Kingdom has gone back and carried out additional research. Under the PCB regulations, it is a requirement for the United Kingdom's Environment Agency to keep a register of all PCBs containing dielectric equipment — this is a difficult task, as the original

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

Member State	PCBs (kg)										Change		Share in EU-27	
	1990	1995	2000	2005	2006	2007	2008	2009	2010	2011	1990–2011	2010–2011	1990	2011
Austria	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR				
Belgium	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE				
Bulgaria	6	5	4	4	4	4	4	3	4	5	– 25 %	10.5 %	0.0 %	0.1 %
Cyprus	0	0	0	0	0	0	0	0	0	0	– 56 %	– 2.0 %	0.0 %	0.0 %
Czech Republic	773	623	474	82	89	48	43	33	24	24	– 97 %	– 0.7 %	5.8 %	0.7 %
Denmark	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE				
Estonia	10	9	7	9	8	8	9	10	11	10	– 3 %	– 10.2 %	0.1 %	0.3 %
Finland	314	284	221	174	177	164	156	148	156	157	– 50 %	0.3 %	2.4 %	4.8 %
France	180	159	106	74	72	67	66	58	60	54	– 70 %	– 9.6 %	1.4 %	1.7 %
Germany	1 672	1 536	1 071	194	210	211	218	198	232	225	– 87 %	– 3.0 %	12.6 %	7.0 %
Greece														
Hungary	151	113	102	84	75	66	57	48	19	18	– 88 %	– 1.5 %	1.1 %	0.6 %
Ireland	68	63	58	43	42	20	20	18	17	16	– 76 %	– 4.9 %	0.5 %	0.5 %
Italy	286	298	262	275	282	282	275	202	201	219	– 23 %	9.2 %	2.2 %	6.8 %
Latvia	4	1	1	1	1	1	1	1	1	1	– 73 %	10.1 %	0.0 %	0.0 %
Lithuania	17	12	12	25	26	29	0	9	3	12	– 27 %	> 100 %	0.1 %	0.4 %
Luxembourg	73	73	47	6	5	4	3	2	2	2	– 98 %	0.7 %	0.5 %	0.0 %
Malta	0	0	0	0	0	0	0	0	0	0	3 %	3.3 %	0.0 %	0.0 %
Netherlands	0	0	0	0	0	0	0	0	0	0	– 100 %	0.0 %	0.0 %	0.0 %
Poland	2 425	2 323	563	607	662	655	673	692	742	725	– 70 %	– 2.4 %	18.2 %	22.4 %
Portugal	63	69	39	809	810	592	929	732	1 061	829	> 100 %	– 21.9 %	0.5 %	25.6 %
Romania	135	87	39	224	194	216	201	59	75	67	– 51 %	– 11.6 %	1.0 %	2.1 %
Slovakia	67	40	33	34	34	35	34	31	34	33	– 50 %	– 2.1 %	0.5 %	1.0 %
Slovenia	429	302	225	125	113	103	97	82	77	57	– 87 %	– 26.3 %	3.2 %	1.7 %
Spain	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE				
Sweden	0	0	0	0	0	0	0	0	0	0	– 14 %	6.5 %	0.0 %	0.0 %
United Kingdom	6 627	4 936	1 334	1 058	1 003	961	913	816	799	778	– 88 %	– 2.6 %	49.8 %	24.1 %
EU-27 (a)	**13 300**	**10 934**	**4 600**	**3 828**	**3 807**	**3 468**	**3 699**	**3 142**	**3 518**	**3 231**	**– 76 %**	**– 8.1 %**	**100 %**	**100 %**
EU-27 (b)	13 300	10 934	4 600	3 828	3 807	3 468	3 699	3 142	3 518	3 231				

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

(b) Sum of sectors.

Negative percentage values indicate that emissions have decreased.

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

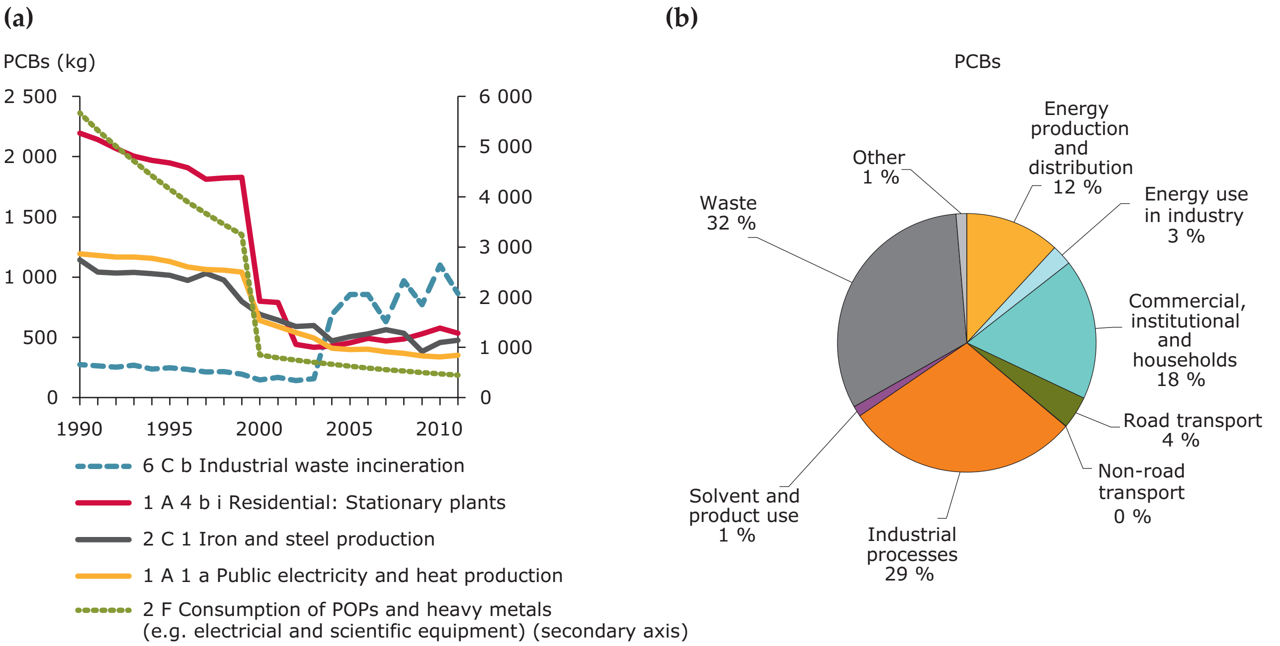
Dark-grey shaded cells indicate that no emission values are available. See Appendix 1 for an explanation of the notation keys reported by Member States.

equipment is not always marked to show that it contains PCBs. Discussions with the agency showed that while the size of the decline is broadly correct, the emission change is more gradual. The phase-out began sooner than expected, with equipment removal starting in 1997 and ending in 2001 (approximately 18 % per annum between 1997 and 2001). These changes have not yet been included in the United Kingdom's inventory (source: comment received from the United Kingdom in 2013).

Dips and jumps of emissions in the category '6 C b — Industrial waste incineration' of the years 2003 to 2011 are mainly due to data reported by Portugal. Portugal explained that the emission trends for industrial incineration follow the tendencies of the activity data. Data on quantities of industrial waste incinerated present a break in time series before and after 2003, and register high fluctuations from year to year too. The final disposal of industrial waste includes waste landfill, incineration, export (e.g. dangerous waste) and recycling. The high differences among years for the amounts of industrial waste incinerated can be explained, at least partially, by the variation of fluxes to other destinies as a result of annual market demand of residues (source: comment received from Portugal in 2013).

Figure 2.17 shows the contribution to total EU-27 emissions made by the aggregated sector groups. For PCBs, common important emission sources are waste and industrial processes, and the 'Commercial, institutional and households' sector group — as is the case for $PM_{2.5}$, PM_{10}, total PAHs, and PCDD/Fs.

Figure 2.17 PCB emissions from key categories in the EU-27: (a) trend in PCB emissions from the five most important key categories, 1990–2011; (b) share of emissions by sector group, 2011



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).

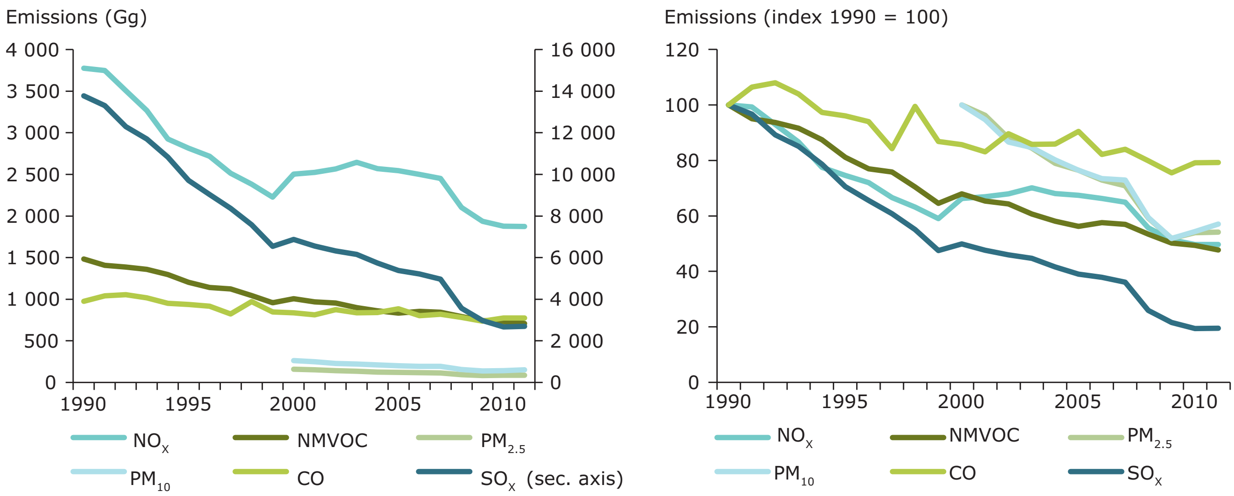
3.1 Sectoral analysis and emission trends for 'Energy production and distribution'

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 59 % of the total EU-27 emissions of this pollutant.

The sector is an important source of SO_X, Hg and NO_X. Poland, Bulgaria and Romania contributed most (in absolute terms) to the emissions of SO_X in this sector in the year 2011 (Appendix 4). For Hg, Poland and Germany and Poland reported the highest emissions. Germany, the United Kingdom and Poland contributed most to the emissions of NO_X.

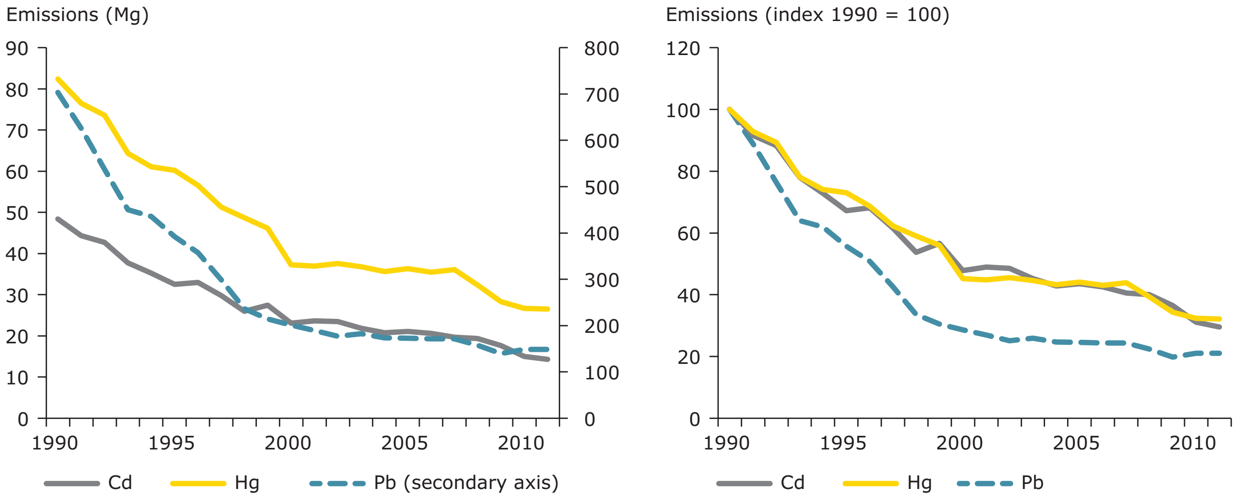
For emissions of the main pollutants (Figure 3.1), the highest absolute and relative reduction within this

Figure 3.1 EU-27 emission trends in the sector 'Energy production and distribution' for NO_X, NMVOC, SO_X and CO (in Gg) between 1990 and 2011 (index year 1990 = 100), and for PM_{10} and $PM_{2.5}$ between 2000 and 2011 (index year 2000 = 100)



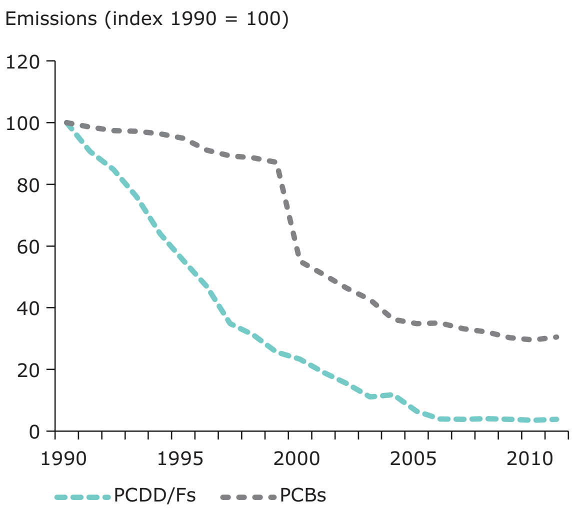
Note: For PM, data from Greece could not be gap-filled as values were not reported for any year. To enable presentation of provisional EU-27 emission trends, the emissions have been aggregated without including data for this Member State.
Parties to the LRTAP Convention are formally requested to report emissions of PM for the year 2000 and after.

Figure 3.2 EU-27 emission trends in the sector group 'Energy production and distribution' for the HMs Pb, Cd and Hg between 1990 and 2011 (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.To enable presentation of provisional EU-27 emission trends, the emissions have been aggregated without including emission data for this Member State.

Figure 3.3 EU-27 emission trends in the sector group 'Energy production and distribution' for POPs (PCDD/Fs and PCBs) between 1990 and 2011 (index year 1990 = 100)



Note: 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-27 Member States.

sector group was for SO_X (– 80 %) between 1990 and 2011. For $PM_{2.5}$, a notable relative decrease of 46 % has occurred within this sector group since 2000.

Of the three main HMs, lead shows the highest emission reduction in absolute and relative terms (– 79 %) (Figure 3.2). For emissions of POPs, the highest relative reduction was seen in PCDD/Fs (– 96 %) (Figure 3.3).

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 2011 (Appendix 4).

Energy use (fuel combustion) in industry is an important source of many pollutants. For the main pollutants, the highest absolute and relative reduction (– 77 %) between 1990 and 2009 occurred for SO_X (Figure 3.4).

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, national studies, plant data	PS/CS/D	T2/T3
Belgium	Regional energy balances, annual industrial reports	CS/D	T2
Bulgaria	National statistics, Eurostat energy balance	D/CS	T1/T2
Cyprus	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 energy statistics	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	Energy balance	D, PS	T2,T3
Italy	Energy balance, national electricity producers, European Emissions Trading Scheme	D, CS	T2
Latvia	National energy statistics	D	T1
Lithuania	National energy statistics	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, energy balance	D/PS	T1, T3
Portugal	LPS survey, LCP survey, national report, energy balance, national statistics	D/CS	T2
Romania	Data from Large Combustion Plants Directive (2001/80/EC)	D	T1
Slovakia	Energy statistics, database	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	CS	T2, T3
United Kingdom	Plant data, energy statistics	CS	T3, T2

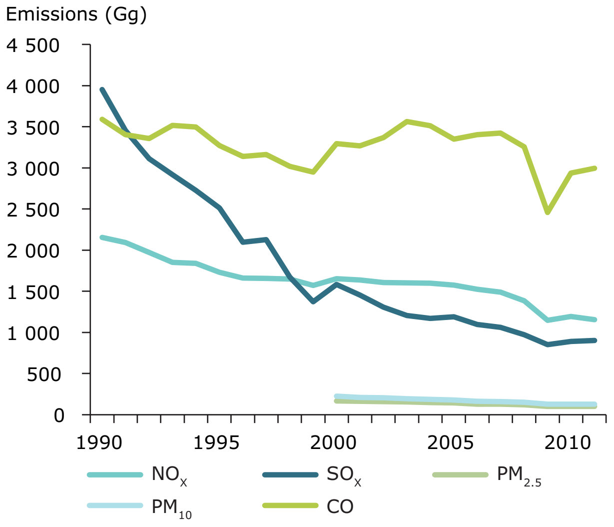
Note: AD: activity data; EF: emission factor; M: method; CS: country-specific; D: default value; PS: plant specific; T: tier method.

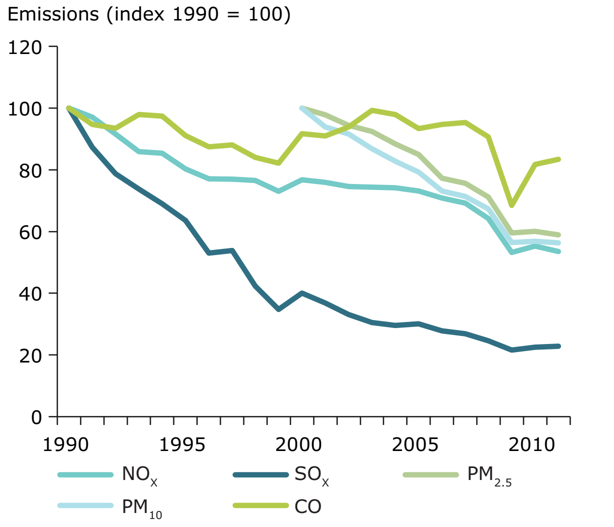
Table 3.1 only provides an indication of the methods used on the aggregated sector level; for details, the respective IIRs should be consulted. The level of detail in information on methods used varies widely across Member States.

Member States that did not provide an IIR are not included in Table 3.1.

Grey-shaded rows (Greece and Italy) denote IIRs submitted in 2012 (latest IIRs available).

Figure 3.4 EU-27 emission trends in the sector group 'Energy use in industry' for NO_x, SO_x and CO (in Gg) between 1990 and 2011 (index year 1990 = 100), and for PM_{10} and $PM_{2.5}$ between 2000 and 2011 (index year 2000 = 100)

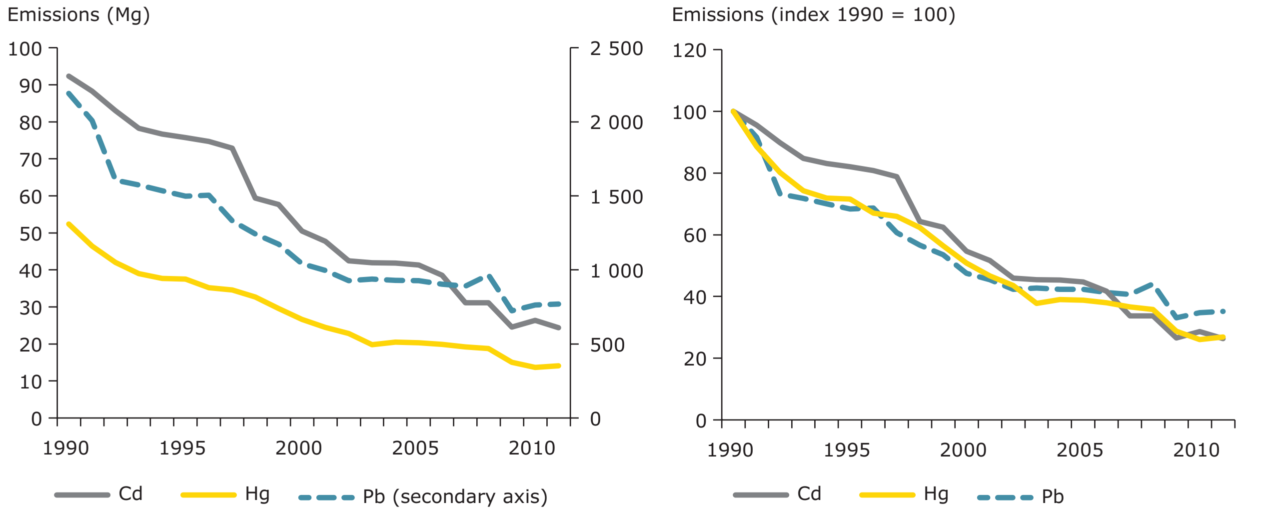




Note: For PM, data from Greece could not be gap-filled, as values were not reported for any year. To enable presentation of provisional EU-27 emission trends , emissions have been aggregated without including data for this Member State.

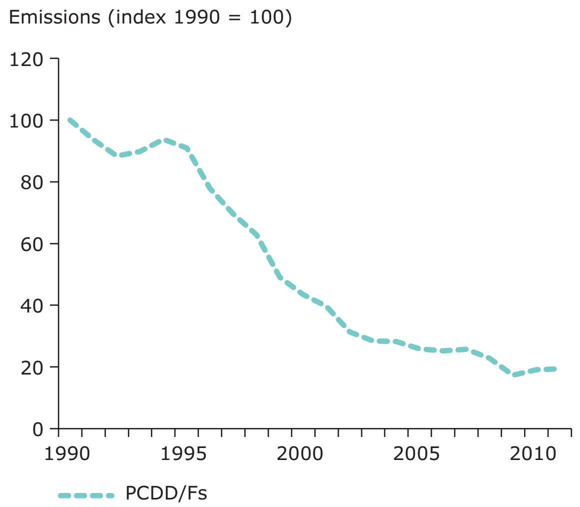
Parties to the LRTAP Convention are formally requested to report emissions of PM for the year 2000 and after.

Figure 3.5 **EU-27 emission trends in the sector group 'Energy use in industry' for the HMs Pb, Cd and Hg between 1990 and 2011 (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. To enable presentation of provisional EU-27 emission trends , the emissions have been aggregated without including emission data for this Member State.

Figure 3.6 **EU-27 emission trend in the sector group 'Energy use in industry' for PCDD/Fs between 1990 and 2011 (index year 1990 = 100)**



Note: For POPs, data from one or 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-27 Member States.

For the three HMs, Pb shows the highest emission reduction in absolute terms (– 1 422 Mg, – 65 %) (Figure 3.5). Cd and Hg decreased similarly to Pb in relative terms (– 74 % and – 73 %, respectively).

For POPs, only PCDD/Fs is an important pollutant in the sector group 'Energy use in industry'. Trends of this pollutant is given in Figure 3.6.

The PCDD/F emissions peak from 1994 to 1997 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 arrival of a new Zn production plant (second fusion) during the year 1993. Since 1998, however, this plant has used emission reduction equipment (source: comment received from France in 2013).

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, national studies, plant data	PS/CS	T2, T3
Belgium	Regional energy balances, plant data	CS/D	T1, T2
Bulgaria	National statistics, Eurostat energy balance	D	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	D	T1
Hungary	National energy statistics, plant data	D, CS	T1, T2, T3
Ireland	Energy balance	CS	T2
Italy	Energy balance	D/CS	T2
Latvia	National energy statistics	D	T1
Lithuania	National energy statistics	D/CS	T1
Malta	Energy statistics	D	T1
Netherlands	Environmental reports from plants, energy statistics	CS/PS	T3
Poland	Energy statistics	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	PS	T1, T3
Slovenia	National energy statistics	D	T1
Spain	Plant data	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-shaded rows (Greece and Italy) denote IIRs submitted in 2012 (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 HCB and HCH and HCB emissions, and makes important contributions to emissions of CO, PM, HMs and POPs. Of all the countries that reported data, Spain contributed most (in absolute terms) to HCB emissions in the 'Industrial processes' sector in the year 2011 (Appendix 4). Past emission trends of the relevant main pollutants are shown in Figure 3.7.

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 the 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 to reuse blast furnace gas that is continuously produced. This may fluctuate strongly from one year to another, resulting in different peaks (1995, 2004, 2010) or decreases (1992, 2001, 2009) (source: comment received from France in 2013).

The peak in CO emissions in 1997 has been traced back to an error in the source data from the United Kingdom's Pollution Inventory. This error will be addressed in the next inventory submission of the United Kingdom (source: comment received from the United Kingdom in 2013).

The peak in NMVOC emissions in 2004 is ascribable to data in category '2 A 6 — Road paving with asphalt' reported by Latvia. A sharp increase of bitumen mixtures use was observed; this was because of the large number of road paving works undertaken before Latvia's accession to the EU, and after, when EU financial instruments became available (Appendix 5, Latvia's IIR).

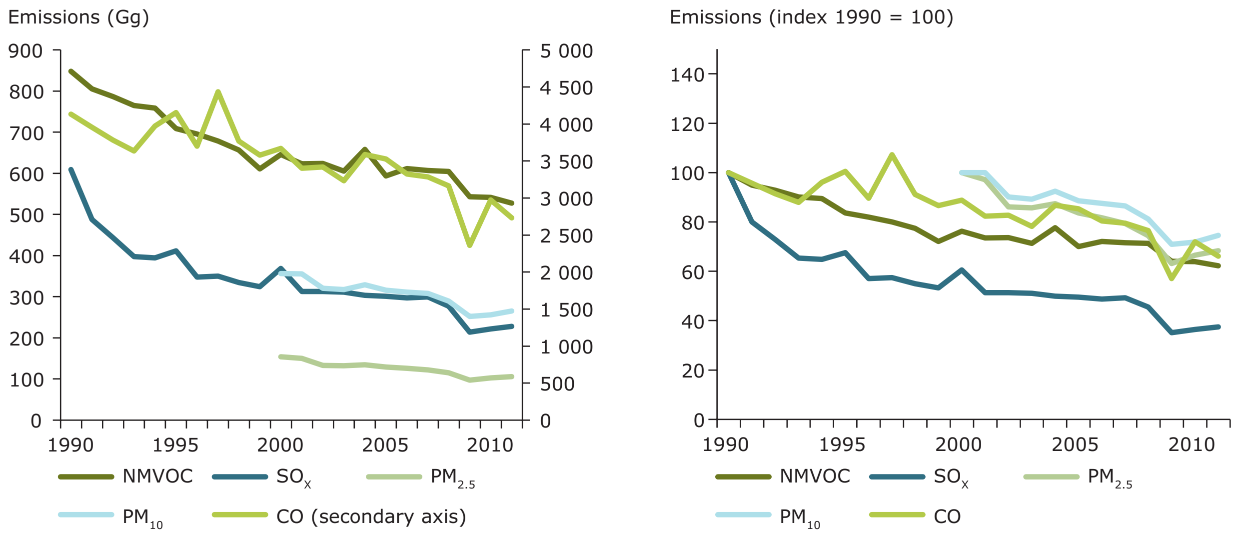
The peak in NMVOC emissions in 2008 is due to data from category '2 A 6 — Road paving with asphalt' reported by Greece, and is caused by a spike in bitumen use in 2008. After 2008, the economic crisis affected Greece, and bitumen use in construction was reduced (source: comment received by Greece in 2013).

The strong decreases in $PM_{2.5}$ and PM_{10} emissions between 2001 and 2002 are attributable to data from category '2 C 1 — Iron and steel production' reported by Portugal. Only secondary steel production occurred in Portugal from 2002 onwards. Differences will always appear between emissions in the period from 1990 to 2001 and emissions from 2002 onwards, because the production process is completely different from 2002 onwards (source: comment received from Portugal in 2013).

Industrial processes make a considerable contribution to the total EU-27 emissions of HMs, despite considerable reductions since 1990. Past emission trends for these pollutants are shown in Figure 3.8. Lead shows the highest absolute Hgand relative emission reduction between 1990 and 2011 (– 71 %).

For POPs, the highest relative reduction between 1990 and 2011 occurred for HCB (– 97 %), although the emission trend was far from consistent, increasing until 1998, then falling abruptly in 1999 and remaining fairly constant since (Figure 3.9). This considerable change is mainly caused by a reported increase in HCB emissions from '2 C 3 — Aluminium production' in the United Kingdom until 1998. Subsequently, the country reported 'not applicable' for this category. 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.

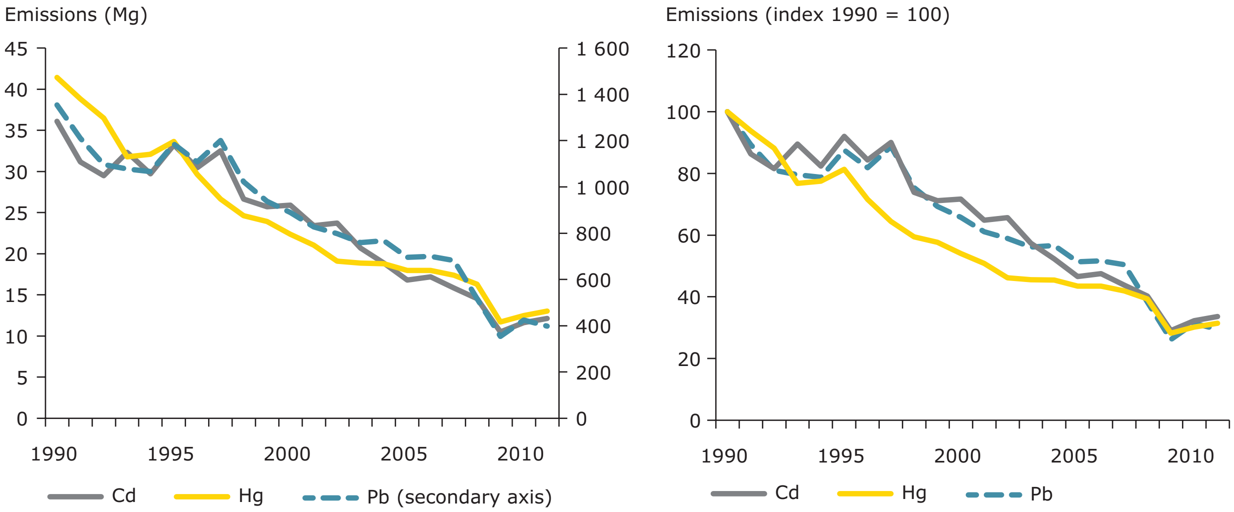
Figure 3.7 EU-27 emission trends in the sector group 'Industrial processes' for NMVOC, SO_x and CO (in Gg) between 1990 and 2011 (index year 1990 = 100), for PM_{10} and $PM_{2.5}$ between 2000 and 2011 (index year 2000 = 100)



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-27 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.

Figure 3.8 EU-27 emission trends in the sector group 'Industrial processes' for the HMs Pb, Cd, Hg between 1990 and 2011 (index year 1990 = 100)



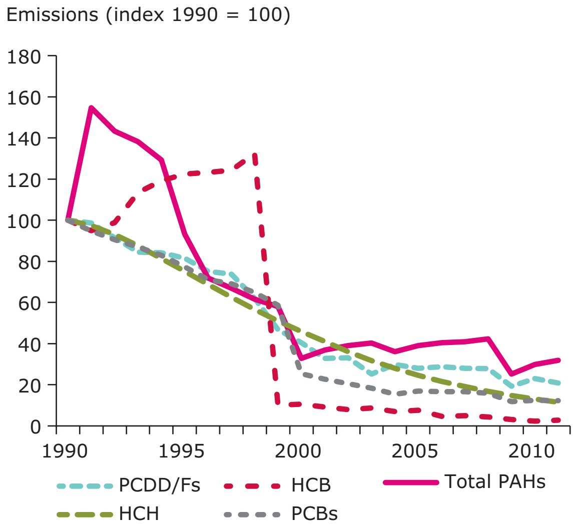
Note: For the HMs, data for Luxembourg was gap-filled with the notation key 'NR'. Also for Greece, no sectoral data were available. To enable presentation of provisional EU-27 emission trends, the emissions have been aggregated without including emission data for this Member State.

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 to cease (source: comment received from the United Kingdom in 2011).

The high increase of total PAHs from 1990 to 1991, and the decreases 1994 to 1995 and 1999 to 2000 are mainly caused by data reported from Belgium.

A similar high reduction was observed for PCB emissions (– 88 %). The large drop in PCB emissions between 1999 and 2000 is due to reductions reported by the United Kingdom (see Section 2.27).

Figure 3.9 EU-27 emission trends in the sector group 'Industrial processes' for the POPs (PCDD/Fs, total PAHs, HCB, HCH and PCBs) between 1990 and 2011 (index year 1990 = 100)



Note: For POPs, data from one or 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-27 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
Cyprus	National statistics, 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, industry sector	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	Industrial production data	D	T1
Hungary	National energy statistics	D, PS	T1, T2, T3
Ireland	Industrial production data	PS/CS/D	T2,T3
Italy	National statistics and industrial associations, plant data	D/CS	T2
Latvia	National statistics, plant data	D	T1, T2
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	Official production statistics, statistical yearbook of industry	D/PS	T1, T3
Portugal	Production data, plant data, energy balance	CS	T1, T3
Romania	Production data	D/CS	T1, T2
Slovakia	Production data	D/CS/PS	T1
Slovenia	National statistics, plant data	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	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-shaded rows (Greece and Italy) denote IIRs submitted in 2012 (latest IIRs available).

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

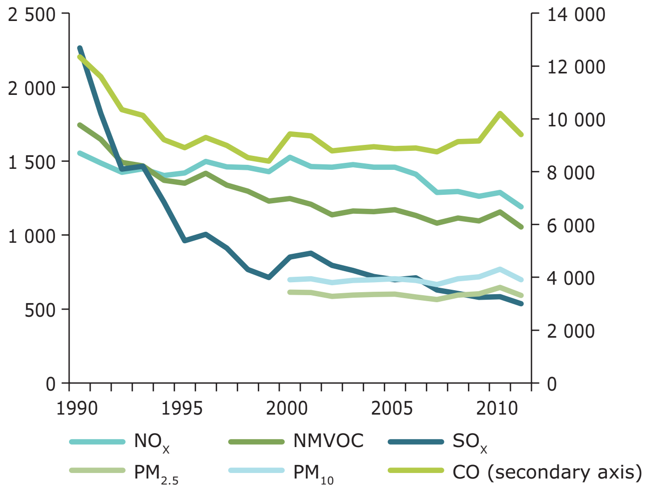
As indicated earlier in Chapter 2, emissions arising from fuel combustion by commercial and institutional facilities and households make an importanta contribution to total emissions of many pollutants.

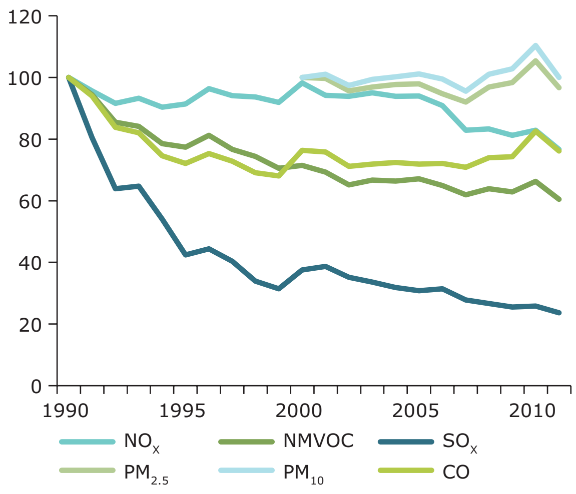
The 'Commercial, institutional and households' sector is an important source for PAHs, $PM_{2.5}$, PM_{10}, Cd and CO. Germany and Poland contributed most (in absolute terms) to the emissions of total PAHs in this sector in the year 2011 (Appendix 4). For $PM_{2.5}$, Italy and Romania, and for PM_{10}, Poland, Italy and Romania and France, reported the highest emissions. Poland, France and Germany contributed most to the emissions of CO, and Poland to the emissions of Cd.

For the main pollutants, the highest relative reduction between 1990 and 2011 for the sector grouping was again seen in SO_X (– 76 %). In contrast, PM emissions have changed little since 2000 (Figure 3.10).

Of the three HMs in the sector 'commercial, institutional and households', Pb shows the highest emission reduction in absolute and relative terms (– 61 %) (Figure 3.11).

Figure 3.10 EU-27 emission trends in the sector group 'Commercial, institutional and households' for NO_x, NMVOC, SO_x, and CO (in Gg) between 1990 and 2011 (index year 1990 = 100), and for PM_{10} and $PM_{2.5}$ between 2000 and 2011 (index year 2000 = 100)

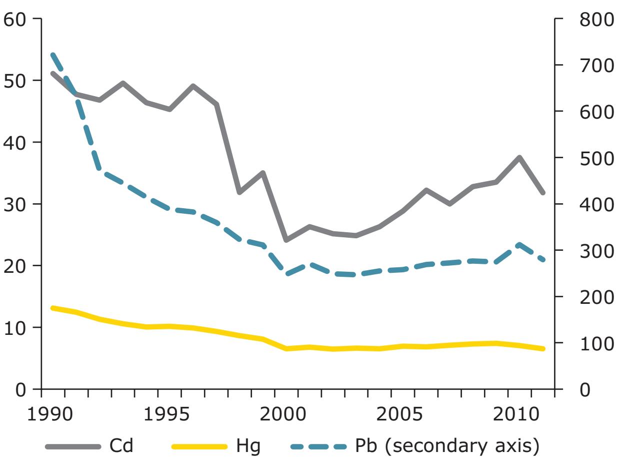


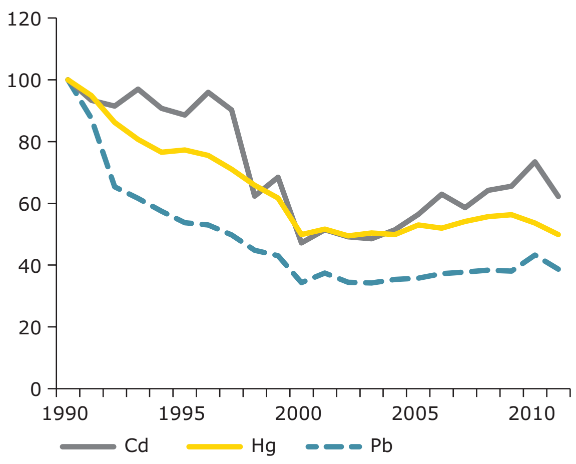


Note: For PM, data from Greece could not be gap-filled as values were not reported for any year. To enable presentation of provisional EU-27 emission trends , the emissions have been aggregated without including data for this Member State.

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

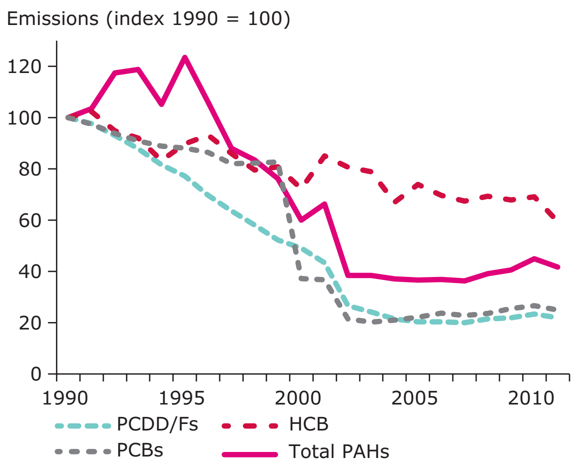
Figure 3.11 EU-27 emission trends in the sector group 'Commercial, institutional and households' for the HMs Pb, Cd and Hg between 1990 and 2011 (index year 1990 = 100)





Note: For the HMs, data for Luxembourg was gap-filled with the notation key 'NR'. Also for Greece, no sectoral data were available. To enable presentation of provisional EU-27 emission trends, the emissions have been aggregated without including emission data for this Member State.

Figure 3.12 EU-27 emission trends in the sector group 'Commercial, institutional and households' for POPs (PCDD/Fs, total PAHs, HCB and PCBs) between 1990 and 2011 (index year 1990 = 100)



Note: For POPs, data from one or 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-27 Member States.

The decreases of Cd in the years 1997 to 1998 and 1999 to 2000, and the peak in 2010 are mainly caused by data reported from Poland.

For POPs relevant to the 'Commercial, institutional and households' sector, the highest relative reduction occurred for PCDD/Fs (– 78 %) (Figure 3.12). Dips and jumps of total PAHs between 1990 and 2002, and the strong decreases of dioxin, total PAHs and PCBs between 2001 and 2002 are caused by data reported from the Czech Republic. In 2002 a new set of emission factors based on the actual measurements results has been used for the new POPs emission inventories assembling. The recalculation of emission factors is planned (source: comment received from the Czech Republic in 2013). The strong decrease of PCB emissions between 1999 and 2000 arised due to the gap-filling of data before the year 2000 from Poland.

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, national studies, plant data	CS	T2
Belgium	Regional energy balances	D/CS	T2
Bulgaria	National statistics	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	D	T1
Hungary	National statistics	CS	T1, T2
Ireland	Energy balance	CS	T2
Italy	Energy balance	D	T1, 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 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 3.4.

Grey-shaded rows (Greece and Italy) denote IIRs submitted in 2012 (latest IIRs available).

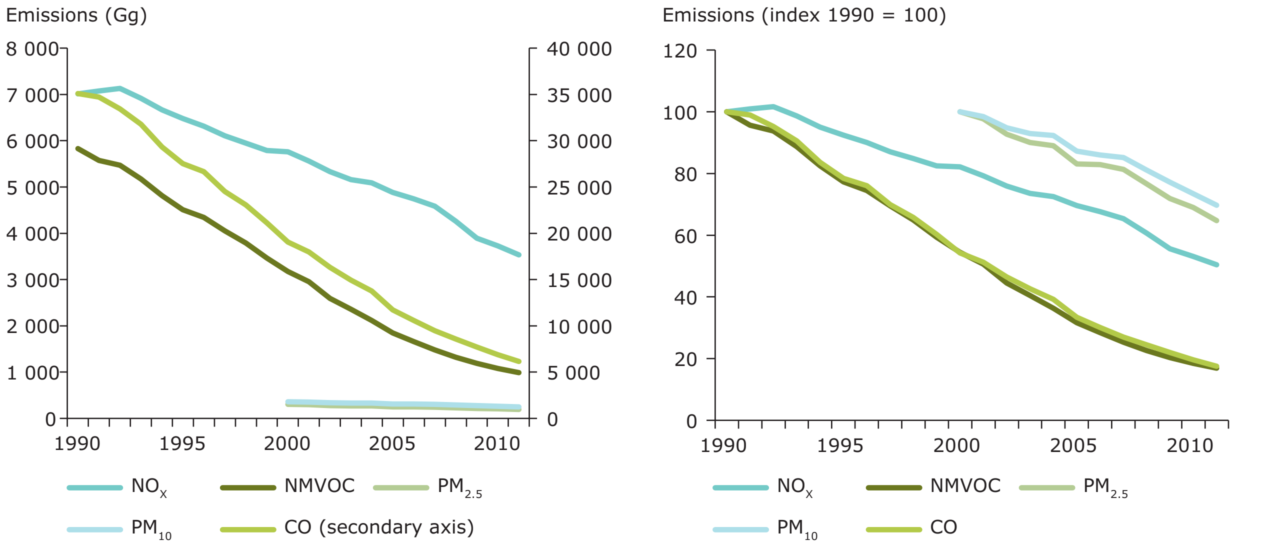
3.5 Sectoral analysis and emission trends for 'Road transport'

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 3.13 shows the past emission trends for these pollutants in this sector.

France, Italy and Germany contributed most (in absolute terms) to NO_X emissions in the road transport sector in the year 2011 (Appendix 4). For CO, Germany, Italy and the United Kingdom reported the highest emissions.

For the 'road transport' sector, the main HM is Pb, showing a high relative emission reduction (– 98 %) between 1990 and 2011 (Figure 3.14). 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 that was regulated by Directive 98/70/EC (EC, 1998). Nevertheless, the road transport sector remains an important source of Pb, contributing around 14 % of total Pb emissions in the EU-27.

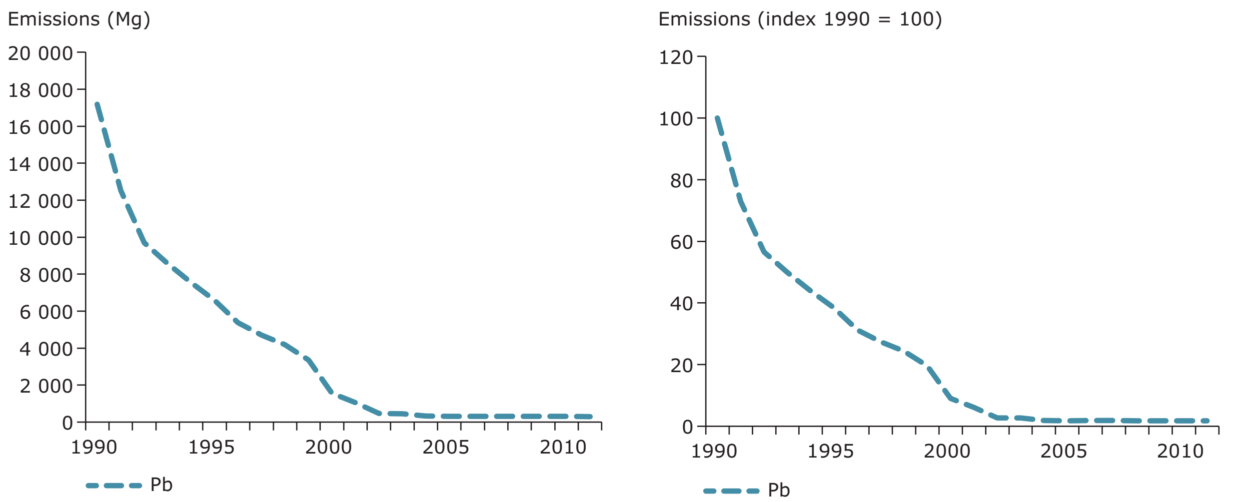
Figure 3.13 EU-27 emission trends in the sector group 'Road transport' for NO_X, NMVOC and CO (in Gg) between 1990 and 2011 (index year 1990 = 100), and for PM_{10} and $PM_{2.5}$ between 2000 and 2011 (index year 2000 = 100)



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-27 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.

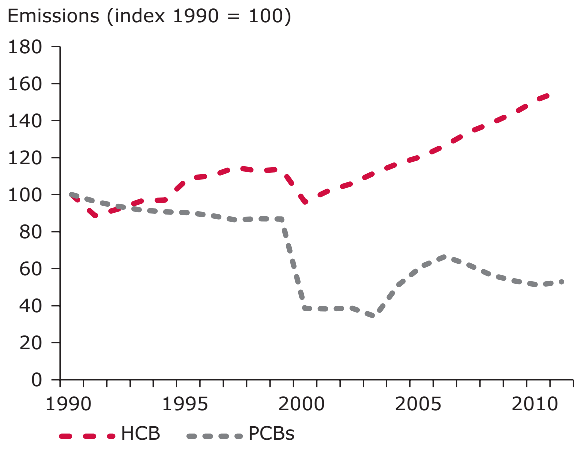
Figure 3.14 EU-27 emission trends in the sector group 'Road transport' for the priority HM Pb between 1990 and 2011 (index year 1990 = 100)



Note: For Pb, data for Luxembourg were gap-filled with the notation key 'NR'. Also for Greece, no sectoral data were available.

To enable presentation of provisional EU-27 emission trends. the emissions have been aggregated without including emission data for this Member State.

Figure 3.15 EU-27 emission trends in the sector group 'Road transport' for HCB and PCBs between 1990 and 2011 (index year 1990 = 100)



Note: For POPs, data from one or 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-27 Member States.

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 3.15. Only a few countries (the Czech Republic, Finland, Hungary, Lithuania, Luxembourg, Poland and Slovakia) reported PCB emission values for the road transport sector. The emission drop in the years 1999 to 2000 due to the gap-filling of data before the year 2000 from Poland. Subsequent emission increases in the years 2003 to 2006 are reported mainly by the Czech Republic. The increase of HCB emissions is mainly caused by increasing emission data of the road transport sector reported by France.

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	ARTEMIS, v2.1
Belgium	Regional energy balances	COPERT 4 (Tier 3 methodology)
Bulgaria	Energy balance, Statistics vehicle fleet	COPERT 4 (Tier 2 methodology)
Cyprus	National statistics	COPERT 4 (Tier 3 methodology)
Denmark	Transport and Statistics Denmark	Internal model similar to COPERT 4 (Tier 2 methodology)
Estonia	Estonian Road Administration, Statistics Estonia	COPERT 4 (Tier 3 methodology)
Finland	National statistics	LIISA (sub-model of LIPASTO)
France	National statistics	COPERT 4 (Tier 3 methodology)
Germany	National statistics	TREMOD, v5.03
Greece	Number and type of vehicles, fuel consumption	COPERT 4
Hungary	National statistics, fuel statistics	COPERT 4
Ireland	Energy balance	COPERT 4
Italy	Energy balance	COPERT 4
Latvia	National statistics	COPERT 4
Lithuania	National statistics	COPERT 4
Malta	National statistics	Customised model (basic Tier 3 methodology)
Netherlands	National statistics	VERSIT+
Poland	Motor Transport Institute with estimations based on energy statistics	Country-specific model
Portugal	Energy balances, road statistics	COPERT 4
Romania	Romanian Auto Registry, fuel statistics	COPERT 4
Slovakia	Fuel sold data from national statistics	COPERT 4
Slovenia	National statistics	COPERT 4
Spain	National and international statistics	COPERT 4 (Tier 3 methodology)
Sweden	National statistics	HBEFA 3.1 (Tier 2)
United Kingdom	National statistics	COPERT 4

Note: AD: activity data; M: method;

Table 3.5 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 3.5.

Grey-shaded rows (Greece and Italy) denote IIRs submitted in 2012 (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. Spain, Italy and the United KingdomItaly contributed most (in absolute terms) to the emissions of NO_X in the year 2011 (Appendix 4).

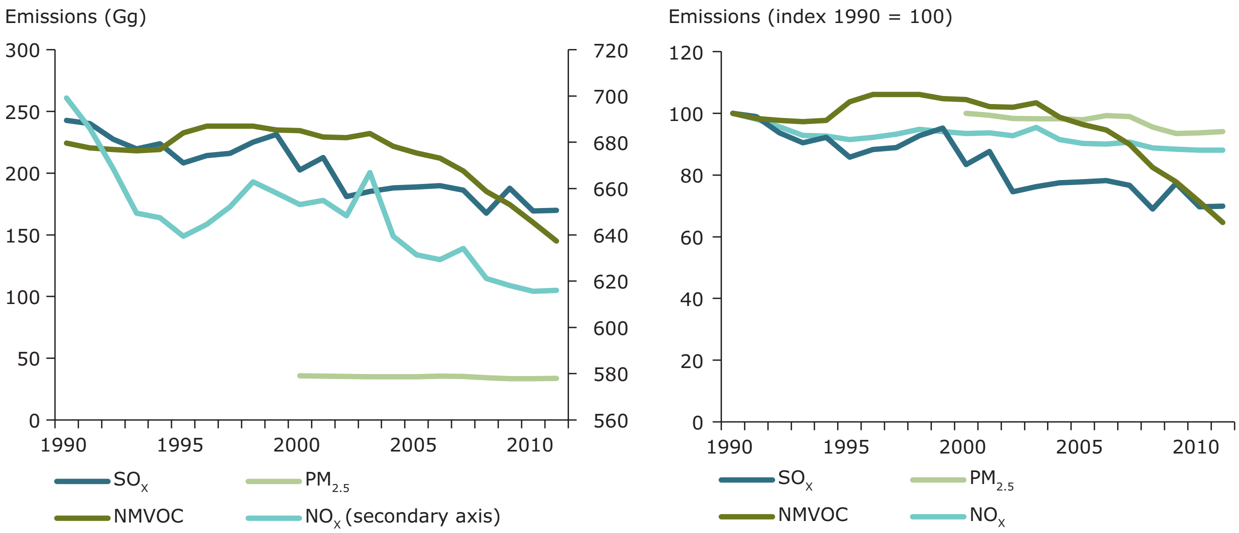
Little progress has been made since 1990 in reducing emissions from NO_X (Figure 3.16). For the main pollutants, the highest relative reduction between 1990 and 2011 occurred for NMVOC (– 35 %).

The NO_X emission peak in 2003 is mainly caused by data reported from Hungary.

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.

The 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 3.16 EU-27 emission trends in the sector group 'Non-road transport' for NO_x, NMVOC and SO_x (in Gg) between 1990 and 2011 (index year 1990 = 100), and for $PM_{2.5}$ between 2000 and 2011 (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-27 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
Cyprus	National statistics	D	T2
Denmark	Danish Civil Aviation Agency, ferry data, energy statistics from DEA	D/CS	T1, T2
Estonia	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	D	IPCC Tier 2a
Hungary	National statistics	CS	T1, T2, T3
Ireland	Irish Aviation Authority, fuel consumption data	D	T3a
Italy	Italian Civil Aviation Authority, energy balance	not specified	not specified
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		
Slovenia	Energy statistics	D	T1
Spain	National energy statistics, association data, national statistics, data from train operators	D	T1
Sweden	National statistics	D/CS	T1, T2, T3
United Kingdom	Transport statistics	CS/D	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-shaded rows (Greece and Italy) indicate IIRs submitted in 2012 (latest IIRs available).

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

The only considerablesignificant emissions from this sector group are NMVOC. Germany, Italy and Spain contributed most (in absolute terms) to NMVOC emissions in the year 2011 (Appendix 4).

Between 1990 and 2009, NMVOC emissions decreased by 40 % in the EU-27 (Figure 3.17).

Figure 3.17 EU-27 emission trends in the sector group 'Solvent and product use' NMVOC (in Gg) between 1990 and 2011 (index year 1990 = 100)

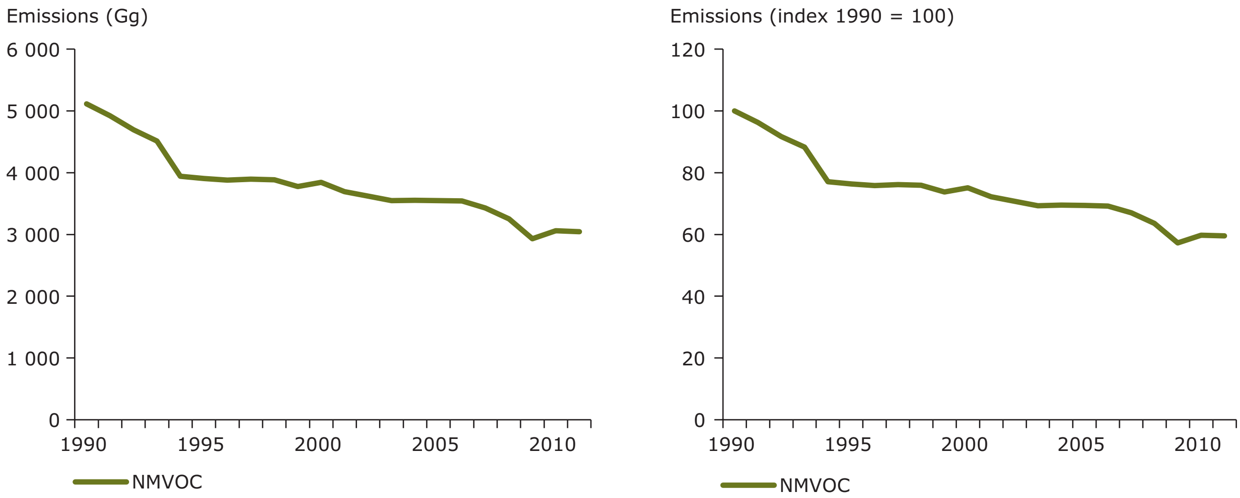


Table 3.7 Overview of methods and data used by Member States to calculate emissions from solvents

Member State	AD	EF	M
Austria	Statistics for trade and services, foreign trade statistics, structural business statistics, surveys	CS	T2
Belgium	National studies	CS	T3
Bulgaria	National Statistical Institute, national VOC register	D	T1
Cyprus	National statistics	D	T1, T2
Denmark	Nordic SPIN (Substances in Preparations in Nordic Countries) database	CS	T2
Estonia	Web-based air emissions data system for point sources (OSIS), Statistics Estonia	PS/D	T1, T3
Finland	Plant data, sales data, 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	Industry data, international statistics	D, CS	T1
Latvia	National statistics, expert judgement	D	T1 (1990–2001), T2 (2002–2011)
Lithuania	Not estimated		
Malta	Trade data	D	T1
Netherlands	National paint sales statistics, paint imports	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

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

Member State	AD	EF	M
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-shaded rows (Greece and Italy) denote IIRs submitted in 2012 (latest IIRs available).

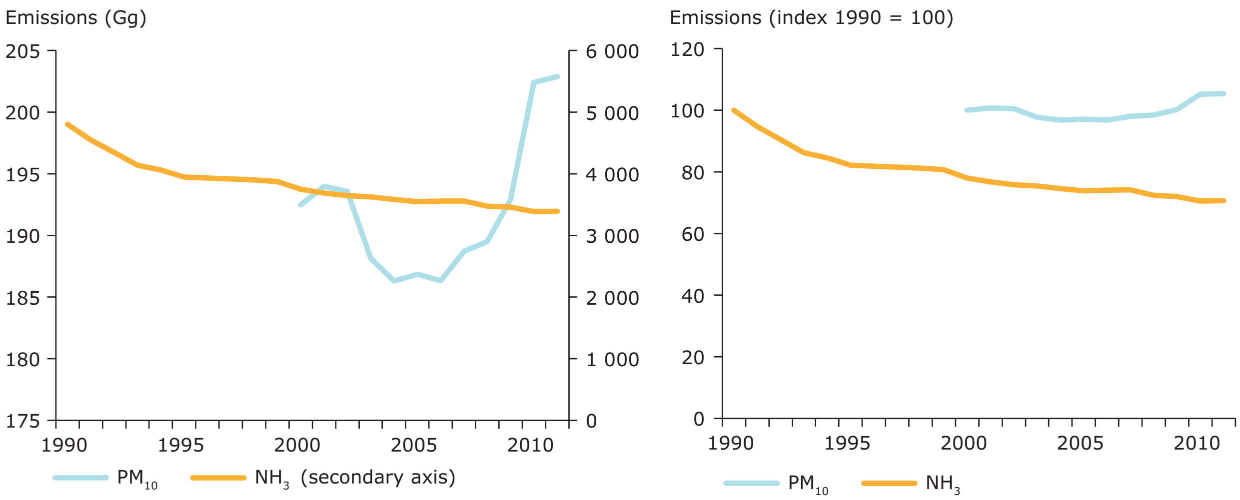
3.8 Sectoral analysis and emission trends for 'Agriculture'

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-27. France and Germany contributed most (in absolute terms) to emissions of NH_3 in the year 2011 (Appendix 4).

Agricultural emissions of NH_3 have decreased by 29 % since 1990 (Figure 3.18). The sector also contributes around 12 % of PM_{10} emissions; these emissions increased between 2000 and 2011 by 5 %.

The 'Agriculture' sector group does not contribute considerably to emissions of HMs. For the POPs, this sector contributes considerably to emissions of PAHs and HCB. Trends of past emissions for these pollutants

Figure 3.18 EU-27 emission trends in the sector group 'Agriculture' for NH_3 (in Gg) between 1990 and 2011 (index year 1990 = 100), and for PM_{10} between 2000 and 2011 (index year 2000 = 100)

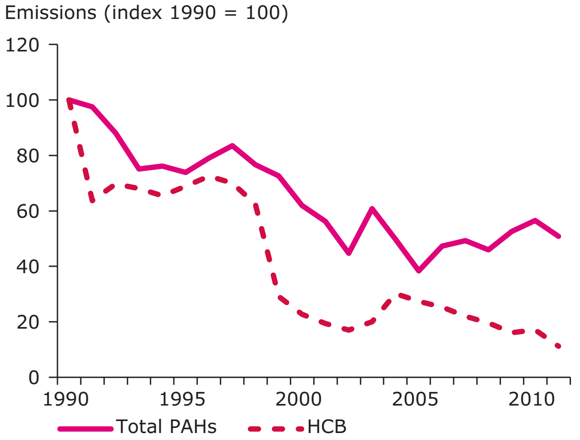


Note: For PM, data from Greece could not be gap-filled as values were not reported for any year. To enable presentation of provisional EU-27 emission trends, the emissions have been aggregated without including data for this Member State.

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

are shown in The emission decreases of HCB from 1990 to 1991 and 1998 to 2001 are mainly caused by emission data reported from the United Kingdom. The emission peaks of total PAHs in the years 1997 and 2003 are mainly caused by data reported from Spain (Figure 3.19). The emission decreases of HCB from 1990 to 1991 and 1998 to 2001 are mainly caused by emission data reported from the United Kingdom. The emission peaks of total PAHs in the years 1997 and 2003 are mainly caused by data reported from Spain.

Figure 3.19 EU-27 emission trends in the sector group 'Agriculture' for POPs (total PAHs, HCB and HCH) between 1990 and 2011 (index year 1990 = 100)



Note: For POPs, data from one or 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-27 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 report on water protection, national studies, direct information from agricultural association	CS/D	T1
Belgium	Statistics Belgium (Statbel)	CS	T2, T3
Bulgaria	National Statistical Institute	D	T1
Cyprus	National statistics	D	T1
Denmark	National agricultural statistics	CS/D	T2
Estonia	National statistics	D	T1
Finland	National statistics	CS/D	T3
France	Agricultural statistics	CS	T2
Germany	National and regional 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 statistics	D, CS	T2
Italy	National statistics	D	T1 (4B), T1/2 (4D)
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 statistics	D/CS	T2, T3
Poland	Statistical yearbooks	D/CS	T1
Portugal	Agricultural statistics, production statistics	D/CS	T1, T2
Romania	Agricultural statistics	D	T1
Slovakia	National statistics	D	T1
Slovenia	National statistics	D/CS	T2, T1
Spain	National statistics	D	T2
Sweden	Official statistical reports, field investigation	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.

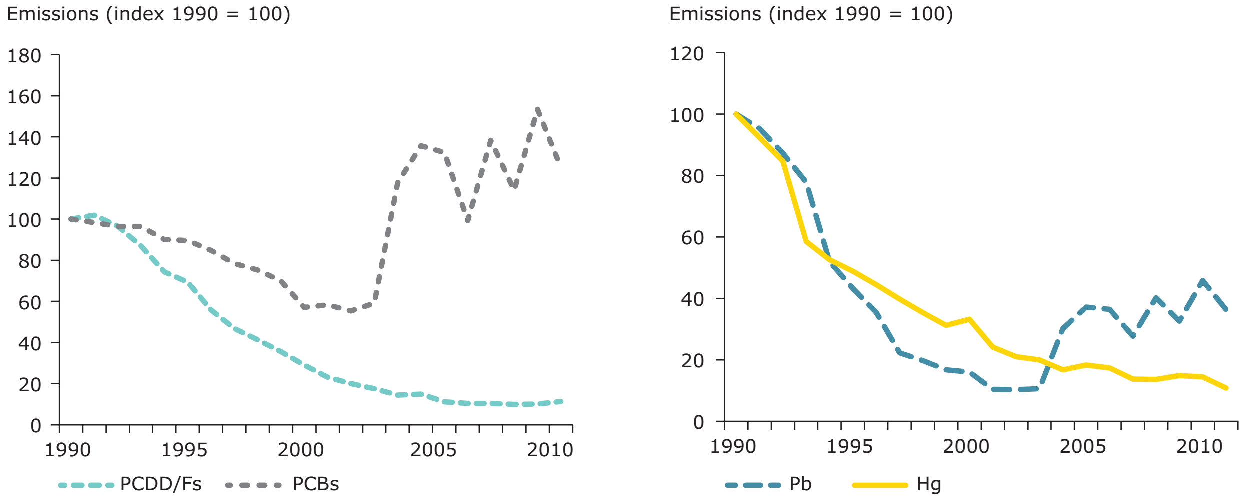
Grey-shaded rows (Greece and Italy) denote IIRs submitted in 2012 (latest IIRs available).

3.9 Sectoral analysis and emission trends for 'Waste'

The 'Waste' sector group is an important source of certain pollutants, including PCBs, PCDD/Fs, Pb and Hg. Figure 3.20 shows the past emission trends for PCBs and dioxin.

The strong PCB and Pb emission increases in 2004 and the dips and jumps in the time series from 2004 to 2011 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. Data on quantities of industrial waste incinerated present a break in time series before and after 2003, and register high fluctuations from year to year, too. The final disposal of industrial waste includes waste landfill, incineration, export (e.g. dangerous waste) and recycling. The high 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 (source: comment received from Portugal in 2013).

Figure 3.20 EU-27 emission trends in the sector group 'Waste' for POPs (PCDD/FsF and PCBs) and the HMs Pb and Hg between 1990 and 2011 (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. To enable presentation of provisional EU-27 emission trends, the emissions have been aggregated without including emission data for this Member State.

For POPs, data from one or 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-27 Member States.

The interannual variation of PCBs is mainly due to emission data reported by Portugal.

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 landfill, sewage plant inventory	CS	T2
Belgium	Plant data, national statistics	CS/D	T1, T2
Bulgaria	National Statistical Institute, national studies	D	T1
Cyprus	National statistics	D	T1, T2
Denmark	National statistics	D	T1
Estonia	Plant data, statistics Estonia, Estonian Rescue Service and waste management system	PS/D	T1, T3
Finland	National statistics, plant data	CS	T2 (IPCC)
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	T2
Italy	National waste cadastre	D	T2 (IPCC)
Latvia	National statistics, waste database	D/CS	T1, T2
Lithuania	National statistics (data available from 1991)		
Malta	Plant data	D	T1, T2
Netherlands	National statistics, branch reports	CS	T2
Poland	Environment and statistical yearbook, domestic case study, branch information	D/CS	T1
Portugal	Waste statistics	D	T2
Romania	National waste database	D	T1, T2
Slovakia	National waste database	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	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-shaded rows (Greece and Italy) indicate IIRs submitted in 2012 (latest IIRs available).

4 Recalculations, underestimations, 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 total emissions submitted in 2012 against those submitted in 2013. It should be noted that for some Member States, the recalculations might reflect changes in compilation methods (gap-filling) rather than 'true' recalculations performed by the countries themselves.

The high recalculations for total PAHs are due to much lower emission data reported in 2013 by Belgium and Portugal. Much lower emission data were also reported for HCB in 2013 by Spain, which causes the high recalculations of this pollutant. The large recalculation for HCH are because last year emission values from Spain were gap-filled for all years, but this year Spain explained that there are no HCH emissions since the year 2003 (source: comment received by Spain in 2013). The high recalculations for PCBs of the years 2000, 2005 and 2006 are because of new data submitted by Poland.

Under the revised reporting guidelines (UNECE, 2009), all countries should submit explanatory IIRs which should include details of recalculations made. Information on the IIRs of the Member States 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). But others do not explain the rationale behind recalculations, despite having submitted IIRs.

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

Belgium provides detailed information on recalculations. The notation keys for NO_X, NMVOC, SO_X and NH_3 have been revised. Belgium reported that in the 2013 submission, recalculations were made for 1990 (base year for all pollutants, except PM), 2000 (base year for PM) and from 2005 to 2010. The periods from 1991 to 1999 and from 2001 to 2004 could not be recalculated due to the amountas this would necessitate a great deal of manual work. Currently, a new data warehouse is being developed in the Flemish region. This will lead to an improvement in consistency and completeness of the whole time-series of the national inventory (Appendix 5, Belgium's IIR).

Table 4.1 Comparison of data submitted in 2012 and 2013 by Member States (relative data, EU-27 national total)

Pollutant	Unit	1990	1995	2000	2005	2006	2007	2008	2009	2010
NO_x	Gg	– 1 %	0 %	0 %	0 %	0 %	– 1 %	– 1 %	– 1 %	– 1 %
NMVOC	Gg	– 1 %	– 1 %	– 2 %	– 3 %	– 2 %	– 3 %	– 3 %	– 4 %	– 4 %
SO_x	Gg	– 1 %	– 1 %	– 2 %	– 1 %	– 1 %	– 1 %	– 2 %	– 1 %	– 1 %
NH_3	Gg	0 %	0 %	0 %	0 %	0 %	0 %	0 %	1 %	1 %
TSPs	Gg	– 1 %	– 3 %	– 4 %	– 5 %	– 5 %	– 5 %	– 4 %	– 5 %	– 5 %
CO	Gg	– 1 %	0 %	– 3 %	0 %	– 1 %	– 2 %	– 2 %	– 2 %	0 %
Pb	Mg	0 %	0 %	– 2 %	1 %	0 %	1 %	3 %	4 %	3 %
Cd	Mg	– 1 %	– 2 %	– 10 %	– 8 %	– 4 %	– 3 %	– 2 %	0 %	– 4 %
Hg	Mg	1 %	0 %	– 11 %	– 10 %	– 7 %	– 7 %	– 7 %	– 7 %	– 8 %
As	Mg	0 %	0 %	– 5 %	– 2 %	– 1 %	0 %	0 %	1 %	1 %
Cr	Mg	0 %	0 %	– 6 %	– 3 %	– 1 %	– 2 %	– 2 %	– 1 %	– 1 %
Cu	Mg	– 1 %	– 1 %	– 3 %	– 2 %	– 2 %	– 2 %	– 1 %	0 %	– 1 %
Ni	Mg	0 %	– 1 %	– 6 %	– 5 %	0 %	– 1 %	2 %	2 %	– 4 %
Se	Mg	– 4 %	– 6 %	– 6 %	– 5 %	– 3 %	– 3 %	– 2 %	– 3 %	– 4 %
Zn	Mg	0 %	0 %	– 10 %	0 %	– 2 %	– 2 %	1 %	2 %	2 %
PCDD/Fs	g I-Teq	– 1 %	0 %	– 3 %	– 10 %	– 13 %	– 12 %	– 12 %	– 12 %	– 12 %
Total PAHs	Mg	– 14 %	– 6 %	– 18 %	– 23 %	– 22 %	– 22 %	– 21 %	– 20 %	– 19 %
HCB	kg	– 3 %	– 4 %	– 33 %	– 40 %	– 49 %	– 49 %	– 51 %	– 50 %	– 55 %
HCH	kg	0 %	0 %	0 %	– 21 %	– 23 %	– 25 %	– 28 %	– 30 %	– 33 %
PCBs	kg	0 %	0 %	– 27 %	– 30 %	– 29 %	1 %	1 %	2 %	1 %
Benzo(a)pyrene	Mg	– 2 %	– 7 %	– 11 %	– 3 %	– 4 %	– 1 %	1 %	2 %	1 %
Benzo(b) fluoranthene	Mg	– 3 %	– 9 %	– 13 %	– 5 %	– 6 %	– 3 %	1 %	2 %	0 %
Benzo(k) fluoranthene	Mg	– 2 %	– 6 %	– 9 %	0 %	– 2 %	1 %	2 %	2 %	1 %
Indeno(1,2,3-cd)pyrene	Mg	– 13 %	– 18 %	– 21 %	– 12 %	– 8 %	– 9 %	– 3 %	– 2 %	– 5 %
				2000	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**
$PM_{2.5}$	Gg			– 4 %	– 5 %	– 6 %	– 7 %	– 7 %	– 7 %	– 7 %
PM_{10}	Gg			– 5 %	– 6 %	– 6 %	– 7 %	– 6 %	– 7 %	– 7 %

Bulgaria reported that revision of emission factors in accordance with the EMEP/EEA Guidebook 2009 (EMEP/EEA, 2009) has been carried out for several categories of the NFR sector 'Industrial processes'. For the 2013 submission, a recalculation for the entire time-series is being prepared for transport, with the implementation of COPERT IV, version 10. For 2010, activity data for solvents have been recalculated with data updates from the National Statistical Institute (Appendix 5, Bulgaria's IIR).

Cyprus stated that some methodological improvements were made to the national emissions inventory. This led to recalculations of the complete time series from 1990 to 2010. The aim was to improve the accuracy of the emission data (Appendix 5, Cyprus' IIR).

Denmark provides detailed information on recalculations. Considerable work has been carried out to improve the inventory. The submission includes recalculated inventories for the whole time-series. The reasons are reallocation of emissions, updated use of category distribution keys, updated activity data and new data, improved calculation methods, correction of errors, updated emission factors and the extension of time series (Appendix 5, Denmark's IIR).

Estonia provides detailed information on recalculations from 1990 to 2010. The reasons are correction of emissions, additional emissions, correction of pollutant emission factors, updated emission factors, correction of activity data, correction of statistical fuel consumption and

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

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

correction of point-source emissions (Appendix 5, Estonia's IIR).

Finland provides detailed information on recalculations. Recalculations of air pollutant time-series are already finalised in several subcategories; the reporting of a fully recalculated time-series is still pending due to the ongoing work to recalculate the energy sector emissions. When the recalculations are complete, differences between the data reported earlier and the recalculated emissions will be explained in the IIR for that submission (Appendix 5, Finland's IIR).

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

Germany provides 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).

Hungary made no recalculations but stated that complete time series and recalculations will be submitted gradually in the next submissions (Appendix 5, Hungary's IIR).

Ireland provides detailed information on recalculations. Reasons for the recalculations are new emission factors, revised emissions, methodological changes, and revised data. (Appendix 5, Ireland's IIR).

Latvia reported that for the 2012 submission, recalculations were carried out mainly because of updates of activity data (for energy and transport), and to address errors found in the NFRs after quality checks and errors found by international experts. Further, emission factors were updated according to the guidebook (EMEP/EEA, 2009) (Latvia's IIR, p. 17).

For **Lithuania**, some renewals in calculations were applied. A new COPERT version for road transport emissions was applied, activity data were corrected, and the sulphur/lead content in fuels was estimated. The NMVOC emissions in the industry sector were recalculated for the 1990-to-2010 period (Appendix 5, Lithuania's IIR).

The **Netherlands** stated that compared to the 2012 submission, methodological changes were made only for the transport sector: only emissions in the transport sector were recalculated. The NO_x emissions of diesel passenger cars and light duty trucks in the 2008-to-2010 period have been recalculated in this year's submission using adjusted emission factors for Euro 5 vehicles. Further, in this year's submission, emissions from so-called 'old-timers' were recalculated using new annual mileages derived by Statistics Netherlands (Appendix 5, Netherlands's IIR).

Poland reported that in 2013, broad recalculations of data from 2000 have been completed, thereby greatly improving completeness and consistency of the emission inventory. The emission inventory of air pollutants — though generally complete — still requires recalculations (of data before 2000) and further improvements (Appendix 5, Poland's IIR).

Portugal provides detailed information on recalculations. The recalculations made since the last submission result mainly from the update/ revision of activity data for industrial wastewater (revision of activity data on industrial production time series, revision of treatment types, new information), waste incineration and industrial waste (revision of quantities of waste incinerated). Quantities of Municipal Solid Wastes incinerated for 2007–2010 have been corrected (error correction) (Appendix 5, Portugal's IIR).

Romania notes the following concerning its recalculations: Notable are as follows: notable differences from the last submissions (reporting years from 2006 to 2011) are due 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'. Also, data from the energy balances from the National Institute of Statistics were updated, resulting in different production data for the industry sector (Appendix 5, Romania's IIR).

Slovakia provides detailed information on recalculations. The major recalculations of NMVOC, HM and POPs emissions were performed in the waste sector as the result of the QA/QC activity in an improving process of transparency, accuracy and consistency of the emission inventory. Recalculations are completed back to 2000 for the 2013's submission under the CLRTAP (Appendix 5, Slovakia's IIR).

Slovenia provides detailed information on recalculations. The most important recalculations of emissions for 2013 submission were in the 'Road transport' sector. Emissions of all pollutants were recalculated for the whole period due to a new version of COPERT 4 that was used (i.e. version 9.0 instead of version 6.1 that was previously applied). Some minor recalculations were also performed in the 'Waste' sector (Appendix 5, Slovenia's IIR).

Spain provides detailed information on recalculations. The main reasons for recalculations are the revisions of the energy balance, of the 'Questionnaire of Important Point Sources', of the basic statistics of the agriculture sector, and changes in the emission factors. (Appendix 5, Spain's IIR).

Sweden provides detailed information on recalculations. The reasons are reallocation of emissions, revisions of activity data, updated activity data, corrected emissions, correction of the calculation model or correction of calculation errors (Appendix 5, Sweden's IIR).

The **United Kingdom** provides detailed information on recalculations undertaken since their 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. This report is available from the CEIP website in July of each year (EMEP CEIP, 2013b).

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 2011, the following countries were reviewed: EU Member States the Czech Republic, Estonia, Greece, Luxembourg and Slovenia, as well as Belarus, Croatia, the former Yugoslav Republic of Macedonia, Iceland and Ukraine. Some Member States refer explicitly to improvements in response to the reviews undertaken in their IIRs.

4.2 Underestimations

The official reporting guidelines of the LRTAP Convention (UNECE, 2009) allow countries to report emissions as 'not estimated' ('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. The *EMEP/EEA air pollutant emission inventory guidebook — 2009* (EMEP/EEA, 2009) recommends the following points concerning 'NE' emissions as elements to 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.

A simple assessment was made in national emission inventories of the underestimation that may occur due to use of the notation key 'NE' by Member States. The main intention of the analysis is to encourage Member States to review source categories reported as 'NE', and to provide estimates in future, especially where these sources may add considerably to the currently reported national totals.

In assessing the importance of source categories reported as 'NE', for each NFR source category, the median of the emissions of all Member States (excluding those reporting 'NE' for the respective category) was calculated. In the next step, the share (in percentage terms) of each category to the mean national total (i.e. the aggregated total of the median emissions of each category) was calculated. Source categories reported as 'NE' in national inventories were then assumed to contribute as much to the national total of the Member State as the share by the same source category. The potential underestimated emissions arising from use of the 'NE' notation key were provided as a percentage value for each Member State (see Table 4.3).

The method is acknowledged to be a simple tool; nevertheless, it does provide an initial indication of situations where underestimations might have occurred, so these can then be investigated in more detail.

Some Member States used the notation key 'NE' for a considerable number of source categories. Portugal, for example, reported 49 source categories of TSPs to be 'NE'. In contrast, some Member States like Estonia, France and the United Kingdom used 'NE' only for up to 10 source categories per pollutant or for no source categories at all (Cyprus).

Of the 26 Member States that made use of the notation key 'NE', 20 provided reasons for using it in their data submissions under the LRTAP Convention submissions. However, the information made available in this way varied somewhat in its informative value.

Table 4.3 shows, for the sources reported as 'NE', the estimated underestimation of these sources. Generally, the potential underestimation is low for all pollutants. Nevertheless, there are a few cases where the potential underestimation is above 50 % (categories that have a major contribution in the high underestimation by non-reporting of the Member State are listed in parentheses):

- Czech Republic: Cu (1 A 3 b vi)
- Finland: Se (1 A 1 a, 1 A 2 f i and 1 A 4 b i)
- Luxembourg: CO (1 A 4 b i and 1 A 3 b i)

Table 4.3 Potential underestimation of emissions by Member States

	Potential underestimation of emissions (%)																										
	Austria	Belgium	Bulgaria	Cyprus	Czech Republic	Denmark	Estonia	Finland	France	Germany	Greece	Hungary	Ireland	Italy	Latvia	Lithuania	Luxembourg	Malta	Netherlands	Poland	Portugal	Romania	Slovakia	Slovenia	Spain	Sweden	United Kingdom
NO_x	0	0	15	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0
NMVOC	0	0	5	0	0	1	0	0	0	0	3	0	5	0	2	18	0	9	0	0	0	1	0	0	0	0	0
SO_x	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0
NH_3	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	1	1	0
$PM_{2.5}$	0	0	6	0	3	0	0	0	0	0	(e)	1	3	0	0	3	(e)	0	0	0	6	1	0	0	1	1	0
PM_{10}	0	2	8	0	0	2	0	0	0	0	(e)	4	12	1	1	6	(e)	1	0	0	15	4	0	0	2	1	0
TSPs	0	2	27	0	0	2	0	0	0	0	(e)	19	31	2	2	25	(e)	2	0	0	35	23	0	0	3	6	0
CO	0	0	9	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pb	0	0	0	0	9	0	0	0	0	2	(e)	0	0	0	0	0	(e)	0	0	0	9	0	0	0	9	0	0
Cd	0	0	0	0	1	0	0	0	0	9	(e)	0	0	0	0	0	(e)	7	0	0	1	0	0	0	0	8	0
Hg	0	0	0	0	0	0	0	0	0	0	(e)	0	0	0	0	0	(e)	45	0	0	0	0	0	0	0	0	0
As	(a)	0	0	0	0	0	0	0	0	5	(e)	0	0	0	0	0	(e)	0	0	0	0	0	0	(a)	0	0	0
Cr	(a)	0	0	0	9	0	0	0	0	10	(e)	0	0	0	0	0	(e)	7	0	0	9	0	0	(a)	0	7	0
Cu	(a)	0	0	0	85	1	0	0	0	7	(e)	0	0	0	0	0	(e)	6	0	0	86	0	0	(a)	0	7	0
Ni	(a)	0	0	0	1	0	0	0	0	13	(e)	0	0	0	0	0	(e)	3	0	0	1	0	0	(a)	0	3	0
Se	(a)	0	0	0	2	0	0	97	0	15	(e)	0	0	0	0	0	(e)	51	0	(f)	4	0	0	(a)	2	5	0
Zn	(a)	0	0	0	22	0	0	0	0	15	(e)	0	0	0	0	0	(e)	12	0	0	22	0	0	(a)	0	12	0
PCDD/Fs	0	0	0	0	3	13	0	0	0	0	(e)	0	0	0	0	0	1	3	0	0	0	0	0	0	0	0	0
Total PAHs	0	0	0	0	0	0	0	0	0	0	(e)	0	0	0	0	0	0	1	0	0	98	0	0	0	0	0	0
HCB	0	43	0	0	0	0	0	0	0	0	(e)	0	40	0	0	0	3	97	0	0	3	0	0	0	3	61	0
PCBs	(a)	(b)	0	0	0	(b)	0	0	0	0	(e)	0	0	0	0	0	0	81	0	0	74	0	0	0	(b)	82	0
Benzo(a) pyrene	(a)	(b)	0	0	0	0	0	(c)	0	0	(e)	0	0	(c)	0	0	0	0	0	0	(f)	0	0	0	(g)	0	0
Benzo(b) fluoranthene	(a)	(b)	0	0	0	0	0	(c)	0	0	(e)	0	0	(c)	0	0	0	2	0	0	(f)	0	0	0	(g)	99	0
Benzo(k) fluoranthene	(a)	(b)	0	0	0	0	0	(c)	0	(d)	(e)	0	0	(c)	0	0	0	0	0	0	(f)	0	0	0	(g)	98	0
Indeno(1,2,3-cd)pyrene	(a)	(b)	0	0	0	0	0	(c)	0	0	(e)	0	0	(c)	0	0	0	0	0	0	(f)	0	0	0	(g)	99	0

Note: For HCH it wasn't possible to calculate the median because to less Member States reported data.
Orange marked values are underestimations higher than 50 %, Green marking means that no data are available:
(a) 'NR' was given for all categories and the national total.
(b) Reported NFR form consisted of a mix of notation keys ('NE', 'NA' and 'NO'). The national total was reported as 'NE'.
(c) Reported NFR form consisted of a mix of notation keys ('IE', 'NA' and 'NO'). The national total was reported as 'IE'.
(d) Reported NFR form consisted of a mix of notation keys ('IE', 'NE', 'NA''IE' and 'NO'). The national total was reported as 0 or 'IE'.
(e) No data for categories or National Total reported.
(f) 'NE' was given for all categories and the National Total.
(g) Reported NFR form consisted a mix of notation keys ('IE', 'NE', 'NA' and 'NO'). The National Total was reported as 'IE'.
For an explanation of the notation keys see Appendix 1.

- Malta: Se (1 A 2 f i and 1 A 4 b i); HCB (1 A 1 a and 1 A 4 b i); PCBs (1 A 4 b i, 1 A 2 f i and 1 A 1 a)
- Portugal: Cu (1 A 3 b vi); total PAHs (1 A 4 b i); PCBs (1 A 4 b i and 1 A 2 f i)
- Sweden: HCB (1 A 1 a); PCBs (1 A 4 b i, 1 A 2 f i and 1 A 1 a); BbF (1 A 4 b i); BkF (1 A 4 b i); IP (1 A 4 b i).

Finland does not have an inventory for selenium, because it is not a HM that is obligatory to be reported. However, in the NFR tables, Finland included Se emission values reported by the plants according to their environmental permits. Therefore, the national total emissions for Se for all years is 'NE', and only single values in the energy and industrial processes sectors can be found, as well as calculated estimates for NFR '4 F — Field burning of agricultural wastes' across the time series (source: comment received from Finland in 2013).

Malta reported (as additional information to the data submission for the respective pollutants and categories) that activity data exist, but no emission factors can be found in the guidelines.

Sweden stated in its IIR that PCB is only estimated for '1 A 3 d ii — National navigation (Shipping)' and '1 A 4 c iii — Agriculture/Forestry/Fishing: National fishing', and HCB is only estimated for '1 A 3 d ii — National navigation (Shipping)'. Other possible sources are not estimated due to lack of emission factors. For sources where PAH-4 is estimated, usually BaP is estimated separately — but not always so for the other specified PAH substances, due to lack of information. As a consequence, the four specified PAH species are reported as 'NA' in the national total, since a sum of the incomplete reporting would be misleading. Since several sources of PAH-4 are missing as well, the national total of PAH-4 is reported as 'NA' as well (Appendix 5, Sweden's IIR).

The high underestimations described above indicate how category '1 A 4 b i — Residential: Stationary plants' often contributes greatly to underestimation of the emissions. In the EMEP/EEA emissions guidebook (EMEP/EEA, 2009), default Tier 1 emission factors are provided for this category for most pollutants. However, no emission factor is given for the use of natural gas (and derived gases) and 'other' liquid fuels for NH_3, and for Se by using 'other' liquid fuels, and for all fuel types for total PAHs.

4.3 Planned and implemented improvements

The EEA-ETC/ACM has noted that the main future challenge for EU Member States remains to improve the quality of data submissions, particularly 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 (Directive 2001/81/EC). 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; details on the nomination process are available on the CEIP website. In 2012, the EU emission inventory report (1990–2010) under the UNECE LRTAP Convention was reviewed (EEA, 2012f).

Summary of the most important recommendations for improvements to the party by the Expert Review Team (ERT) (Stage 3 in-depth review), and the improvements undertaken or planned in response to these recommendations

All recommendations of the ERT are provided in the '*Report for the Stage 3 in-depth review of emission inventories submitted under the UNECE LRTAP Convention and EU National Emissions Ceilings Directive for the EU*'; this can be accessed online (EMEP CEIP, 2013b). A summary of the most important recommendations for improvements is presented below.

- 'The IIR could be improved by providing more detailed information on the sources which are included/not included in particular sectors'.

  The section on the general assessment of completeness (1.8) was extended. Figures on completeness of reporting of NFR templates submitted by Member States (Figure 1.3 to Figure 1.5) were extended, and now cover the years 1990, 2000, 2010 and 2011. Further, a new section on underestimations (Section 4.2) was included in the report, analysing the use of the notation key 'NE' by Member States and its contribution to potential underestimations. Information on gap-filling and non-availability of data was included for the trend tables (Table 2.3 to Table 2.28). Further, Table 1.8 on the effect of gap-filling on EU emission data was adjusted to the figures on completeness of reporting of NFR templates submitted by Member States (Figure 1.3 to Figure 1.5) to ensure comparability of this information. Also, reference was made to the Stage 1 review that assesses completeness of reporting at Member State level.

- 'The ERT recommended that more detailed information was provided in the IIR on the QA/QC procedures that are used to process the data from MS'.

  The section on QA, QC and verification methods was extended (Section 1.6). The procedure of checking data submitted by Member States was described in detail. This year, more focus was placed on analysing the plausibility of sectoral trends. Member State data were checked at sectoral level, and where outliers were found, the responsible categories were identified. When no explanation for a notable trend could be found in the IIRs, Member States were contacted ([14]). The focus of the checks was on data that have a major influence on EU-27 trends.

- 'The ERT strongly encouraged the EU to compile a clear improvement programme that targets improvements to the completeness of the inventory'.

  Despite clear progress having been made in recent years in terms of the completeness of reporting, a complete set of emission inventory data for the 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 as emission values for some Member States were not reported in any years. The gap-filling procedure has been continuously refined since its introduction for the 2010 EU CLRTAP inventory. Though there have been no major changes this year, a more extensive gap-filling procedure is being considered. Further, it is planned to work on the completeness of the inventory together with Member States. The issue of completeness will be discussed at the Task Force of Emission Inventories and Projections Meetings and at the Meetings of the Ambient Air Quality Expert Group. The first scheduled topic for discussion is the issue of potential underestimation. Further, the EEA will continue to encourage Member States to submit complete time-series.

- 'The ERT acknowledged that it is not straightforward to aggregate data that is a mixture of data and notation keys, however it is recommended that the current QA/QC systems for handling and processing notation keys are reviewed and improved. TThe EU may consider it necessary to amend data/notation keys from MS that are considered to be erroneous to deliver substantial improvements'.

  Analysis was carried out to locate where Member States report emission values or another notation key for pollutant/source combinations that are filled with the default value 'NA' in the reporting template. It was noted that this occurs frequently. So far, however, no data reported by Member States have been changed; scientific progress and technological advances may have been made since the last update of the reporting template and the EMEP/EEA Guidebook (EEA, 2009) that render the reported values/notation keys more appropriate than the default value 'NA'. This issue will be discussed at the Task Force of Emission Inventories and Projections Meeting in May 2013.

- 'The ERT strongly encouraged the EU to produce an uncertainty analysis for the inventory. The ERT srecognises that this will probably require a not insignificant amount of expert judgement and a number of assumptions to be made. However, the ERT consider that a complete uncertainty analysis for each pollutant would provide important information for planning improvements to the inventory'.

  This year, for the first time, the quantitative uncertainty estimates provided by Member States are presented in this report (Table 1.13). Ten Member States provided quantitative uncertainty estimates, providing a first indication of the range of uncertainty for the different pollutants. Due to small number of Member States providing an uncertainty estimate, the uncertainty of the EU-27 LRTAP inventory cannot be estimated.

([14]) Some Member States sent inventory data (single values for certain categories or also time series) in response. However, most of these data are not officially reported via CDR within this submission round and therefore not included in this year's EU inventory.

- 'The emissions from international/domestic aviation and shipping are reported as a simple sum of the emissions from each of the MSMS. This does not then represent emissions divided into those occurring within the EU and those from activities which cross the geographical boundary of the EU […] As a minimum, the ERT recommend that explanations and contextual information are included in the IIR. The ERT also ask the EU to consider options that would ensure that the reported data for domestic and international shipping and aviation are provided with supporting information to ensure that they are not used inappropriately by users.'

- An explanation and contextual information was included in the Inventory Report (Section 3.6).

- 'Several of the review findings asked for explanations for inconsistencies in the time series.'

  In recent years, explanatory information on trends and recalculations has increasingly been provided. This issue was spotlighted this year: further research was conducted on outliers in Member States' emission data, in order to ensure true emissions are reflected. A comparison of Member States' shares in the EU-27 total reveals extraordinarily high shares in some instances: for TSPs in France (26 %), Cd in Poland (46 %), Cu in Germany (56 %), Se in Spain (31 %), Zn in Germany (28 %), HCH in the United Kingdom (97 %) and Spain (36 %), PCBs in Portugal (26 %), BbF in Poland (28 %) and Romania (26 %), BkF in Romania (35 %) and IP in Poland (41 %). Future investigation could determine whether these high shares reflect true emissions, or whether they are attributable to incomplete reporting (or underestimates) by other Member States.

Improvement in reporting at Member State Level

- Timely submission: this year, only four Member States did not report on time (or did not report until 9 March 2013), compared with five countries in 2012.

- Completeness: last year, Luxembourg and Malta did not submit any data. This year, all Member States submitted data, although Greece and Luxembourg did so only for the main pollutants and CO. Several Member States submitted data not for the whole time series 1990-2011. The Czech Republic and Hungary submitted only data of the year 2011.

- 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 United Kingdom may choose to use the national emission total calculated on the basis of fuel used. This year, 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) request that all parties to the LRTAP Convention report emissions using the new NFR09 reporting format for their 2011 submissions. Like in 2012, 26 EU Member States had used the preferred template.

4.3.1 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 inTable 4.4. However,, but it should be noted that a systematic overview is difficult to achieve, as the information provided differs widely across Member States.

Table 4.4 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. 37).
Belgium	In the Flemish region, the emission, of the other chemical industry will be optimised by using more and more the emission figures from the companies reported in the yearly environmental reports. Further fine-tuning of the emissions of coating and inks manufacturing is planned. In Wallonia, the following improvements are planned: • revision of the emissions for wood paint application and other industrial paint applications; • 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 and 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; • recalculation of the years 2007 and 2008 for the printing industry; • estimation of the emissions for the years 1990 to 2000 for the preservation of wood.
Bulgaria	As noted earlier, the Bulgarian National Inventory System (BGNIS) plans that the same team responsible for dealing with the GHG inventory be responsible for preparation of UNECE/CLRTAP inventory. Thus any differences with the UNFCCC report will be eliminated. Planned improvements: application of higher tier methods for estimation of emissions; incorporation of ETS and E-PRTR databases 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. 90).
Cyprus	In the 2013 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 improvements and 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	Various studies have already been carried and/or are planned on this issue: to keep researching in order to have more precise emission data, especially for key sources; to handle the quantification of uncertainty; and to reduce the sources not taken into account or not treated sufficiently. Further, it is foreseen to improve the estimate of residential heating, which influences NO_x emissions. Moreover, it is planned to work on the allocation of industrial consumption, to follow the development of the EMEP/EEA (usage of new COPERT division for special vehicles) and to enforce all actions towards better QA and QC, which includes adaption of tools and procedures, communication with experts from different fields, retaining certified quality ISO9001, etc. (France's IIR, p. 89).
Germany	Improvements listed for individual source categories are as follows: updating the database for emission factors of LCP (NFR 1.A); development of a new calculation model for biogas-fired plants (NFR 1.A); revision of emission factors for gasoline-driven off-road mobile sources (NFRs 1.A.2.f ii, 1.A.4.b ii, 1.A.4.c ii, etc.); inclusion of particle exhaust emissions from gasoline-driven vehicles and mobile machinery (NFRs 1.A.2.f ii, 1.A.4.b ii, 1.A.4.c ii, etc.); inclusion of emissions from LPG-driven forklifters (NFR 1.A.4.b ii); revision of emission estimates for solid fuels in railways (NFR 1.A.3.c); separate reporting of AD and EM for commercial/institutional mobile sources (NFR 1.A.4.a ii); particle emissions from flaring in oil production plants and refineries (NFR 1.B.2.a); VOC emissions from cleaning of tank cars (NFR 1.B.2); revision of mineral fertilizer production (NFR 2.B.5 Other); inclusion of mercury emissions from chlorine-alkali industry (NFR 2.B); and relevance of NMVOC (NH3) from wastewater (latrines) (NFR 6.B).
Greece (Information from IIR 2012)	The main implemented/adopted measures for the improvement of the conventional power generation system are as follows: gradual decommissioning of old inefficient and more pollutant thermal power units; commissioning of new carbon capture ready power units that follow BAT and the new IED; increase of natural gas share in electricity production; interconnection of certain islands with the mainland grid; use of natural gas on the island of Crete for electricity production (Greece's IIR, p. 27).
Hungary	• 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

Table 4.4 Overview of improvements planned at Member State level (cont.)

Ireland	Energy sector: by updating emission factors using the information in the latest version of the Inventory Guidebook and by accounting more completely for technological improvements over time. Industry, solvents and waste sector: continue the practice of outsourcing contracts on a periodic basis to re-examine and extend the inventory time -series. Solvents sector: emission control strategies are being implemented in Ireland (for total emissions of NMVOC). General: review emission estimates in light of any new information that may become available for future submissions.
Italy (Information from IIR 2012)	For the energy and industrial processes sectors, a major development concerns the harmonisation of information collected in the framework of different obligations, large combustion plants, E-PRTR and emissions trading, thus highlighting the main discrepancies in data and detecting potential errors. For the agriculture and waste sectors, improvements relate to the availability of new information on emission factors and activity data, as well as on parameters necessary to carry out the estimates: specifically, a study on the best available technologies used in agriculture practices and availability of information on waste composition and other parameters following the entering into force of the European landfill directive (1999/31/EC). A general revision will concern PAHscover PAH, dioxin and HM estimates in order to improve accuracy and reduce uncertainty (Italy's IIR, p. 128).
Latvia	Planned improvements are listed in the IIR (p. 118) and mainly concern activity data for Energy, Solvent use and Industry.
Lithuania	Source-specific planned improvements are listed in the sectoral chapters. The reported improvements comprise uncertainty analyses for the sectors Transport (road transport, aviation, railway transport, water navigation, off-road transport, gas transport) and Industrial processes (organic chemicals and food production).
Luxembourg	No IIR available.
Malta	There is the possibility of updating the time series with respect to HM emissions (Malta's IIR, p. 20).
Netherlands	For the coming submission, the following improvements are envisaged. General: New policy measures take time to implement. In some cases, the introduction of measures is required by law or regulated by permits. The implementation is checked by the competent authorities or inspectorates. Information about this inspection is often selective or based on incidents, and therefore is not easily translated into a national percentage. In the coming year, a methodology will be developed to help translate this information on a national scale. Transport: Statistics Netherlands will derive new average annual mileages for so-called 'special vehicles' (e.g. garbage trucks, camper vans, tow trucks and fire trucks),motorcycles and mopeds. Further, a study on the average load factors for heavy-duty trucks will be commissioned, as the load factors affect the fuel consumption and resulting emissions of heavy-duty vehicles (Netherlands' IIR, p. 80).
Poland	The planned improvement programme is focused on the following tasks: verifying NMVOC emissions from solvent use; gathering additional activity data to include new emission sources (e.g. venting and flaring; use of fireworks), development of); developing broader uncertainty evaluations for air emission pollutants; further developing methodology by applying higher tiers of estimation methodology, especially for key categories (Poland's IIR, p. 5, 98). Emission data for LPSs, reported in 2012 in an aggregated form due to statistical confidentiality, will be prepared on an individual basis for 2014 submission, based on data reported to the national database (Poland's IIR, p. 98).
Portugal	The existence and importance of NMVOC emissions from non-tree crops is much subject to debate. It is expected that further improvements in methodology may lead to changes in emission estimates for this source sector. It is expected that efforts will be made in the future to revise and improve the methodology and emission factors for the estimate of NMVOC from agriculture and forestry. The emission factors could be estimated for each specific year using meteorological data. The possible inclusion of emissions of foliage under-canopy or dominated trees should be addressed, at least for some types of ecosystems. An improvement in information concerning resin extraction may ameliorate the estimates of VOC emissions from resin-tapping in Maritime pine. (Portugal's IIR, pp 8–16).
Romania	Main priorities for the next submission include the implementation of a QA/QC system, and the addition of new sources to the estimates as well as improvements of existing ones. (Romania's IIR, p. 2)
Slovakia	No information on planned improvements.
Slovenia	Planned improvements relate to the subcategories 'Stationary Combustion in manufacturing industries and construction' (1A2a–1A2fi), 'Residential: Stationary plants' (1A4bi), 'International aviation' (1A3a i (i)), 'Fugitive emissions' (1B1a–1b2av), 'Agriculture' (4B1a–4D2c) and 'Municipal waste incineration' (6Cc) (Slovenia's IIR, p. 170).

Table 4.4 Overview of improvements planned at Member State level (cont.)

Spain	The most important areas of improvement are: • harmonising the inventory with other registries (e.g. PRTR); • improving basic information relating to the energy balance; • continuing to present the temporal development of emission factors and activity data adequately to represent the implementation of environmental measures (e.g. in the area of the solvent use); • continuing to introduce more advanced methodologies for emission estimates; • revising emission factors, in accordance with the EMEP/EEA guidebook; • making quantitative uncertainty estimates and advances in the method used to determine key categories; • undertaking preparatory work for the change to the new EMEP grid.
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. 75). 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. The relevant sectors are NFR 1, 2, 4, 6 and 7 (United Kingdom's IIR, pp. 197–199).

Note: Grey-shaded rows (Greece and Italy) denote IIRs submitted in 2012 (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 — 2009* (EMEP/EEA, 2009), 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 2013

Emission data should be submitted to the EMEP CEIP by **15 February 2013**. IIRs should reach the centre no later than **15 March 2013**. Table A2.1 below summarises information contained in the revised emission reporting guidelines (UNECE, 2009).

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 A2.1 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	1980–2011
2.	Particulate matter	$PM_{2.5}$, PM_{10}, TSPs	2000–2011
3.	Heavy metals	Pb, Cd, Hg **(As, Cr, Cu, Ni, Se, Zn)**	1990–2011
4.	POPs	([b])	1990–2011
B.	**Sector emissions**		
1.	Main pollutants	NO_x, NMVOC, SO_x, NH_3, CO	1980–2011
2.	Particulate matter	$PM_{2.5}$, PM_{10}, TSPs	2000–2011
3.	Heavy metals	Pb, Cd, Hg **(As, Cr, Cu, Ni, Se, Zn)**	1990–2011
4.	POPs	([b])	1990–2011
C.	**Activity data**	Liquid fuels, solid fuels, gaseous fuels, biomass, other fuels, other activity	1990–2011
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 21 March 2013)
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 LPS.

Appendix 3 Status of reporting

Table A3.1 Member State inventory submissions 2013: date received by the EEA, years covered and information provided (cut-off date: 6 May 2013)

	Annual reporting						Minimum 5 year reporting		
Member State	**Submission date ([a])**	**Date of resubmission and/or additional information**	**NFR template**	**Other format**	**IIR 2010**	**Activity data ([b])**	**Projections**	**Gridded data**	**LPS emissions**
Austria	15.02.2013		NFR 2009-1		15.03.2013, 18.04.2013	1980—2011	2010, 2015, 2020, 2030		
Belgium	15.02.2013	12.04.2013	NFR 2009-1		15.03.2013	1988, 1990, 2000, 2005—2011	2015, 2020		
Bulgaria	15.02.2013		NFR 2009-1		15.03.2013	1990—2011	2020		
Cyprus	12.02.2013		NFR 2009-1		12.02.2013	1990—2011	2015, 2020	2011	2011
Czech Republic	07.02.2013		NFR 2009-1			2011			
Denmark	13.02.2013		NFR 2009-1		12.03.2013	1980—2011	2010, 2015, 2020, 2030		
Estonia	14.02.2013		NFR 2009-1		15.03.2013	1990—2011	2015, 2020		
Finland	15.02.2013	01.03.2013	NFR 2009-1		15.03.2013	1990—2011	2020, 2030, 2050	2011	2011
France	14.02.2013		NFR 2009-1		14.03.2013	1980—2011	2010, 2015, 2020		
Germany	12.02.2013		NFR 2009-1		12.02.2013	1990—2011			
Greece	18.02.2013		NFR 2009-1			1990—2011	2020		
Hungary	07.03.2013		NFR 2009-1		25.04.2013	2011			
Ireland	14.02.2013	28.03.2013	NFR 2009-1		28.03.2013	1990—2011	2010, 2015, 2020, 2030		
Italy	29.04.2013		NFR 2008-1			1980—2011			
Latvia	14.02.2013	15.03.2013	NFR 2009-1		15.03.2013	1990—2011			
Lithuania	13.02.2013		NFR 2009-1		14.03.2013	1995, 2000, 2005, 2007—2011	2010, 2015, 2020	2010	2010
Luxembourg	19.03.2013		NFR 2009-1			1990—2011			
Malta	14.02.2013		NFR 2009-1		12.03.2013	2000—2011			
Netherlands	15.02.2013		NFR 2009-1		15.03.2013	1990—2011	2020, 2030		
Poland	15.02.2013	15.03.2013	NFR 2009-1		15.02.2013	2000—2011	2010		
Portugal	14.02.2013		NFR 2009-1		22.03.2013	1990—2011			
Romania	15.02.2013		NFR 2009-1		12.03.2013	2006—2011			
Slovakia	15.02.2013	15.03.2013	NFR 2009-1		15.03.2013	2000—2011	2010, 2015, 2020, 2030, 2050	2010	
Slovenia	11.02.2013		NFR 2009-1		14.03.2013	1990—2011	2015, 2020, 2030		
Spain	14.02.2013		NFR 2009-1	Level 1 (1980—1989)	15.03.2013	1990—2011	2015, 2020, 2030	1990—2011	1990—2011
Sweden	14.02.2013		NFR 2009-1		14.02.2013	1990—2011	2010, 2015, 2020, 2030		
United Kingdom	15.02.2013		NFR 2009-1		13.03.2013	1990—2011		2010	2010

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 2013.

IIR: informative inventory report; np: not provided.

Red colored dates means that data were submitted after the formal deadline for submissions (15. February).

Table A3.2 Member States' LRTAP Convention submissions of 2012 (as of 6 May 2013)

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	1980–2011	1990, 1995, 2000–2011	1990, 1995, 2000–2011	1985–2011	np	1985–2011
Belgium	1988, 1990, 2000, 2005–2011	2000, 2005–2011	2000, 2005–2011	1990, 2000, 2005–2011	1990, 2000, 2005–2011	1990, 2000, 2005–2011
Bulgaria	1990–2011	1990–2011	1990–2011	1990–2011	1990–2011	1990–2011
Cyprus	1990–2011	2000–2011	2000–2011	1990–2011	1990–2011	1990–2011
Czech Republic	2011	2011	2011	2011	2011	2011
Denmark	1980–2011	2000–2011	2000–2011	1990–2011	1990–2011	1990–2011
Estonia	1990–2011	2000–2011	1990–2011	1990–2011	1990–2011	1990–2011
Finland	1980–2011	1990–2011	1990–2011	1990–2011	1990–2011	1990–2011
France	1980–2011	1990–2011	1990–2011	1990–2011	1990–2011	1990–2011
Germany	1990–2011	1995–2011	1990–2011	1990–2011	1990–2011	1990–2011
Greece	1990–2011	np	np	np	np	np
Hungary	2011	2011	2011	2011	2011	2011
Ireland	1987, 1990–2011	1990–2011	1990–2011	1990–2011	1990–2011	1990–2011
Italy	1980–2011	1990–2011	1990–2011	1990–2011	1990–2011	1990–2011
Latvia	1990–2011	2000–2011	2000–2011	1990–2011	1990–2011	1990–2011
Lithuania	1990, 1995, 2000, 2005, 2007–2011	1990, 1995, 2000, 2005, 2007–2011	1990, 1995, 2000, 2005, 2007–2011	1990, 1995, 2000, 2005, 2007–2011	1990, 1995, 2000, 2005, 2007–2011	1990, 1995, 2000, 2005, 2007–2011
Luxembourg	1990–2011	np	np	np	np	np
Malta	2000–2011	2000–2011	2000–2011	2000–2011	2000–2011	2010, 2011
Netherlands	1990–2011	1990–2011	1990–2011	1990–2011	1990–2011	1990–2011
Poland	2000–2011	2000–2011	2000–2011	2000–2011	2000–2011	2000–2011
Portugal	1990–2011	1990–2011	1990–2011	1990–2011	1990–2011	1990–2011
Romania	2006–2011	2006–2011	2006–2011	2006–2011	2006–2011	2006–2011
Slovakia	2000–2011	2000–2011	2000–2011	2000–2011	2000–2011	2000–2011
Slovenia	1980–2011	2000–2011	2000–2011	1990–2011	np	1990–2011
Spain	1990–2011	2000–2011	2000–2011	1990–2011	1990–2011	1990–2011
Sweden	1990–2011	1990–2011	1990–2011	1990–2011	1990–2011	1990–2011
United Kingdom	1980–2011	1980–2011	1980–2011	1980–2011	1980–2011	1990–2011

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-27 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 & 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
1 A 4 b i	1 A 4 b i Residential: Stationary plants	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 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
1A 4 c iii	1A 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 Aluminum 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
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. electricial 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

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

NFR Code	Full name	EEA aggregated sector name
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 Waste-water handling	Waste
6 C a	6 C a Clinical wasteincineration (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 6 May 2013)

Country code	Title of IIR	Source	Date of submission
AT	Austria's Informative Inventory Report (IIR) 2013. Submission under the UNECE Convention on Long-range Transboundary Air Pollution	http://cdr.eionet.europa.eu/at/un/CLRTAP_AT/envuw_ga	15.3.2013, Re-submission: 18.4.2013
BE	Informative Inventory Report about Belgium's annual submission of air emission data reported in February 2013 under the Convention on Long-range Transboundary Air Pollution (CLRTAP)	http://cdr.eionet.europa.eu/be/un/UNECE_CLRTAP_BE/envuunmdg/IIR_BE_2013.pdf/manage_document	15.3.2013
BG	Bulgarian Informative Inventory Report National Emissions Inventory for year 2011. 2013 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/envuuocwq/IIR_BG_2013_15_March_2013.pdf/manage_document	15.3.2013
CY	Cyprus Informative Inventory Report 2011	http://cdr.eionet.europa.eu/cy/un/UNECE_CLRTAP_CY/envurokca/CyprusInformativeInventoryReport2011.pdf/manage_document	12.2.2013
CZ	No IIR available		
DK	Annual Danish Informative Inventory Report to UNECE. Emission inventories from the base year of the protocols to year 2011	http://cdr.eionet.europa.eu/dk/Air_Emission_Inventories/Submission_EMEP_UNECE/envut7j9g/Danish_Informative_Inventory_Report_2013.pdf/manage_document	12.3.2013
EE	Estonian Informative Inventory Report 1990-2011. Submitted under the Convention on Long-range Transboundary Air Pollution	http://cdr.eionet.europa.eu/ee/un/UNECE_CLRTAP_EE/envuumqaa/Estonian_IIR_2013.pdf/manage_document	15.3.2013
FI	Air Pollutant Emissions in Finland 1980–2011. Informative Inventory Report to the UNECE CLRTAP, 15 February 2013	http://cdr.eionet.europa.eu/fi/un/UNECE_CLRTAP_FI/envuumwxg/FI_IIR2013_2011_Part1_15032013.pdf/manage_document http://cdr.eionet.europa.eu/fi/un/UNECE_CLRTAP_FI/envuumwxg/FI_IIR2013_2011_Part2_150313.pdf/manage_document	15.3.2013
FR	Inventaire des emissions de pollutants atmospheriques en France au titre de la Convention sur la pollution atmospherique transfrontaliere a longue distance et de la Directive Europeenne relative aux plafonds d'emissions nationaux (NEC)	http://cdr.eionet.europa.eu/fr/eu/colqhxdtq/envuuh3aa/UNECE_france_mars2013.pdf/manage_document	14.3.2013
DE	IIR DE 2013. German Informative Inventory Report	http://cdr.eionet.europa.eu/de/un/UNECE_CLRTAP_DE/envurjtqw/iir	12.2.2013
GR	No IIR available		
HU	Informative Inventory Report 1980–2011	http://cdr.eionet.europa.eu/hu/un/UNECE_CLRTAP_HU/envuxkoyg	25.4.2013
IE	Ireland Informative Inventory Report 2013. Air Pollutant Emissions in Ireland 1990-2011 reported to the Secretariat of the UN/ECE Convention on Long-range Transboundary Air Pollution	http://cdr.eionet.europa.eu/ie/un/colurvayg/envuvqtta/Ireland_IIR_2013_FINAL.pdf/manage_document	28.3.2013
IT	No IIR available		
LV	Latvia's Informative Inventory Report 1990–2011. Submitted under the Convention on Long-range Transboundary Air Pollution	http://cdr.eionet.europa.eu/lv/un/copy_of_colqhgwdg/envuuojgq/LV_IIR_15032013.pdf/manage_document	15.3.2013

Table A5.1 List of submitted IIRs including source and date of submission (cut-off date 6 May 2013) (cont.)

Country code	Title of IIR	Source	Date of submission
LT	Lithuania's National Inventory Report 2013. Emission Inventories 1990-2011- Submitted under the UNECE Convention on Long-range Transboundary Air Pollution	http://cdr.eionet.europa.eu/lt/un/UNECE_CLRTAP_LT/envuugceg/IIR_2011.pdf/manage_document	14.3.2013
LU	No IIR available		
MT	Informative Inventory Report for Malta	http://cdr.eionet.europa.eu/mt/un/UNECE_CLRTAP_MT/envut8nna/Final_IIR2013.pdf/manage_document	12.3.2013
NL	Emissions of transboundary air pollutants in the Netherlands 1990–2011. Informative Inventory Report 2013	http://cdr.eionet.europa.eu/nl/eu/colqt3lza/envuunbuq/NL_IIR_2013.pdf/manage_document	15.3.2013
PL	Poland's Informative Inventory Report 2013. Submission under UN ECE Convention on Long-range Transboundary Air Pollution	http://cdr.eionet.europa.eu/pl/un/EMEP%20emissions%20data/envuumgmw/IIR__Poland_2013.pdf/manage_document	15.2.2013
PT	Portuguese Informative Inventory Report 1990-2011 submitted under the UNECE Convention on Long-range Transboundary Air Pollution	http://cdr.eionet.europa.eu/pt/un/UNECE_CLRTAP_PT/envuuytrw/PT_IIR_20130315.pdf/manage_document	22.3.2013
RO	Romania's Informative Inventory Report 2013. Submission under UNECE Convention on Long-range Transboundary Air Pollution	http://cdr.eionet.europa.eu/ro/un/UNECE_CLRTAP_RO/envut9avg/RO_IIR_2013.doc.pdf/manage_document	12.3.2013
SK	Slovak Republic: Informative Inventory Report 2013 Under the Convention on Long-range Transboundary Air Pollution	http://cdr.eionet.europa.eu/sk/un/UNECE_CLRTAP_SK/envuumbzq	15.3.2013
SI	Informative Inventory Report 2013 for Slovenia. Submission under the UNECE Convention on Long-Range Transboundary Air Pollution	http://cdr.eionet.europa.eu/si/un/UNECE_CLRTAP_SI/envuuglkw/IIR_2013_Slovenia.pdf/manage_document	14.3.2013
ES	Inventario de Emisiones de España Años 1990–2011. Comunicación a la Secretaría del Convenio de Ginebra y al Programa EMEP	http://cdr.eionet.europa.eu/es/un/UNECE_CLRTAP_ES/envuumdcw/Informe_IIR_1990_2011_CLRTAP_EMEP.pdf/manage_document	15.3.2013
SE	Informative Inventory Report Sweden 2013. Submitted under the Convention on Long-range Transboundary Air Pollution	http://cdr.eionet.europa.eu/se/un/colqgyzla/envuryz7q/IIR_submission_2013_Report_14jan_SE_.pdf/manage_document	14.2.2013
GB	UK Informative Inventory Report (1980 to 2011)	http://cdr.eionet.europa.eu/gb/un/cols3f2jg/envuucg3a/UK_IIR_2013_Final.pdf/manage_document	13.3.2013

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