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European Union emission inventory report 1990–2008 under the UNECE Convention on Long-range Transboundary Air Pollution (LRTAP)

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European Environment Agency
Kongens Nytorv 6
1050 Copenhagen K
Denmark
Tel.: +45 33 36 71 00
Fax: +45 33 36 71 99
Web: www.eea.europa.eu
Enquiries: www.eea.europa.eu/enquiries

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Title of report	**Annual European Union LRTAP Convention emission inventory report 1990–2008**
Contact names	Martin Adams (EEA) André Zuber (DG Environment) Sabine Göttlicher (ETC/ACC) Katarína Marečková (ETC/ACC)
Organisation	European Environment Agency European Commission, DG Environment
Address of the European Environment Agency	EEA Kongens Nytorv 6 1050 Copenhagen K Denmark
Email	martin.adams@eea.europa.eu
Address of the European Commission	European Commission DG Environment BU5 06/123 1049 Brussels Belgium
Email	andre.zuber@ec.europa.eu

Executive summary

This document is the European Union emission inventory report under the United Nations Economic Commission for Europe (UNECE) Convention on Long-range Transboundary Air Pollution (LRTAP). The report and its accompanying data are provided as an official submission to the secretariat for the Executive Body of the LRTAP Convention by the European Commission on behalf of the European Union. The report is updated and produced each year by the European Environment Agency (EEA) and its European Topic Centre on Air and Climate Change (ETC/ACC).

Under the LRTAP Convention, Parties (including the European Union) are obliged to report emissions data for a large number of air pollutants, including nitrogen oxides (NO_x), non-methane volatile organic compounds (NMVOCs), sulphur oxides (SO_x), ammonia (NH_3), carbon monoxide (CO), primary particulate matter ($PM_{2.5}$ and PM_{10}), and certain heavy metals lead (Pb), cadmium (Cd), mercury (Hg) and persistent organic pollutants (POPs), polychlorinated dibenzodioxin/ polychlorinated dibenzofurans (PCDD/F), total polycyclic aromatic hydrocarbons (total PAHs), hexachlorobenzene (HCB), hexachlorocyclohexane (HCH) and polychlorinated biphenyls (PCBs).

This report includes information on:

- the formal institutional arrangements that underpin the European Union's emission inventory (Chapter 1);
- emission trends for the EU-27 ([1]) and Member States, and the contribution of important individual emission sources to total emissions (Chapter 2);
- sector group emission trends for key pollutants (Chapter 3);
- information on recalculations and future planned improvements (Chapter 4).

There are several new elements incorporated into the present European Union emission inventory report compared to last year's publication (EEA, 2009a). The report now includes, for the first time:

- EU-27 emission trends for heavy metals (Pb, Cd, Hg) and POPs (PCDD/F, total PAHs, HCB, HCH, PCBs);
- an associated analysis of the most important emitting sources for these pollutants;
- analysis showing for each main sector group, the trends of important selected pollutants;
- an improved procedure to fill occasional gaps in the official data reported by countries, which allows for a more complete and robust analysis of EU-27 air pollutant trends.

Emissions data described in this report are included as accompanying annexes and are also available for direct download through the EEA's Dataservice ([2]).

EU-27 emission trends

This report describes the EU-27 emission trends for a number of air pollutants for the period 1990–2008. An improved gap-filling methodology used in compiling this year's EU-27 emission inventory means that for the first time a complete EU-27 time series trend for the main air pollutants (NO_x, SO_x, NMVOC, NH_3 and CO) can be reported to the LRTAP Convention. For the remaining pollutants, one or more Member States did not report emissions for any year meaning that gap-filling could not be applied. For these pollutants, therefore, the aggregated EU data are not yet complete and are likely to underestimate true emissions.

The EU-27 emission trends of the main pollutants, particulates, heavy metals and POPs are illustrated in Figure ES.1. Across the European Union, the

([1]) The EU-27 comprises Austria, Belgium, Bulgaria, Cyprus, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden and the United Kingdom.

([2]) The online dataviewer for the EU LRTAP Convention dataset is available at http://dataservice.eea.europa.eu/PivotApp/pivot.aspx?pivotid=478 [Accessed 5 March 2010].

acidifying pollutant SO_x achieved the largest percentage reduction of emissions since 1990 of a main pollutant. Emissions in 2008 were 78 % less than in 1990. It is noteworthy that SO_x emissions decreased rather sharply, falling 20 % in 2008 compared to 2007, mainly due to reductions reported in Bulgaria, Poland and Spain. In each of these Member States, the lower emissions were mainly due reductions reported from public power plants. For example in Spain the emission reduction was largely due to using lower amounts of more-polluting coal for electricity generation and use of more natural gas and renewables such as wind, photovoltaics and biomass.

Emissions of other key air pollutants also fell significantly in the period since 1990, including emissions of the three air pollutants primarily responsible for the formation of harmful ground-level ozone in the atmosphere: CO (58 % reduction), NMVOCs (51 % reduction) and NO_x (39 % reduction). Of these three pollutants, emissions of NO_x realised the largest reduction in 2008, falling by 6.8 %. As with SO_x, certain Member States, including France, Spain and the United Kingdom reported rather large decreases in 2008 compared to the previous year, particularly for the public power plant sectors. Emissions from the road transport sector also fell significant in these Member States, reflecting at least in part the lower amount of freight transport by road in the second half of 2008 as a result of the economic recession.

Trends of particulate matter ($PM_{2.5}$ and PM_{10}) emissions have been compiled for the years 2000–2008 only. While EU-27 emissions of both pollutants have fallen compared to 2000 (by 13 % and 8 % respectively) emission trends over the last five years or so have not shown much improvement, and indeed have actually increased slightly (by 0.2 %) in 2008 compared to the previous year.

The new EU-27 data now available on heavy metals and POPs reveal that since 1990 significant emission reductions have also occurred for the three toxic heavy metals and five POPs, in each case by around 60 % or more. As was noted for particulate matter, the decrease in total emissions of these substances has slowed over the last five years, particularly for the three heavy metals.

Progress of the European Union in meeting its 2010 emission reduction targets under the UNECE LRTAP Convention Gothenburg Protocol

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. In addition to the ceilings for individual countries, the protocol also specifies ceilings for the European Union, which itself is a Party to the protocol. The ceiling applies to the EU-15 grouping of Member States that constituted the European Community at the time the Gothenburg Protocol was agreed.

Table ES.1 shows the aggregated emissions for the year 2008 reported by the EU-15 Member States in comparison to the respective 2010 emission ceilings specified for the European Union. For NO_x, the 2008 emissions are significantly above the level of the ceiling, for the remaining pollutants the emissions in 2008 were below the respective pollutant ceilings. Later in 2010 EEA will publish its annual NEC Directive Status Report, which analyses, for the EU Member States, the more complete 2010 projections data recently reported under the EU NEC Directive. The NEC Directive contains national emission ceilings that, for the EU Member States, are either equal to or more ambitious than those in the Gothenburg Protocol.

Table ES.1 Comparison of emissions reported for 2008 by the EU-15 Member States with the emission ceilings for the European Union specified in the UNECE Gothenburg Protocol

Pollutant	EU-15 emissions year 2008 (Gg)	European Union (EU-15) Gothenburg Protocol 2010 ceilings (Gg)	Difference (%)	Sum of individual EU-15 ceilings (Gg) (a)
NO_x	8 264	6 671	24 %	6 648
NMVOC	6 555	6 600	– 1 %	6 600
SO_x	3 084	4 059	– 24 %	4 044
NH_3	3 036	3 129	– 3 %	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.

Main sources of EU-27 air pollutant emissions

Figure ES.2 shows the share of EU-27 emissions per pollutant by sector group. The road transport and energy production sector groups clearly remain significant sources of air pollutants in the EU-27. Sector groups associated with energy production remain by far the most important source of SO_x emissions and are also an important source of Cd, Hg and PCBs emissions, despite some significant reductions of these pollutants in the past. Within the energy production sector group, the individual source category '1 A 1 a – Public Electricity and Heat Production' ([3]), i.e. emissions arising from fuel combustion in public power and heat generating plants, was identified as a key category ([4]) for ten of the 15 pollutants assessed in this report. Further, emissions of SO_x from this single source category contributed more than half of the EU-27 total SO_x emissions in 2008.

NO_x emissions from the road transport sector group have decreased by 40 % since 1990, mainly as a result from the introduction of three-way catalytic converters on passenger cars and stricter regulation of emissions from heavy goods vehicles across Europe. The road transport sector group nevertheless remains the most important source of the ozone precursors NO_x and CO in the European Union, in 2008 contributing 41 % and 34 % of total EU-27 emissions respectively. It is also a major source of NMVOC, $PM_{2.5}$ and PM_{10} emissions. Passenger cars and heavy duty vehicles contribute the majority of NO_x emissions, whereas for CO passenger cars alone contribute around 80 % of the emissions from the road transport sector group. In contrast to the road transport sector, emissions of NO_x from aviation have increased significantly since 1990. Emissions from both domestic and international flight activities have almost doubled since 1990, increasing by 88 % between 1990 and 2008.

Household fuel combustion for the source category '1 A 4 b i – Residential: Stationary Plants' is an important source of air pollution for a number of the other pollutants. It is the most important key category for CO, $PM_{2.5}$, PM_{10}, PCDD/F and total PAHs, and the second most important key category for Cd and PCBs. Together with energy and process-related emissions from industry, these two sector groups contribute significantly to the overall emissions of a number of the heavy metals and POPs.

Recommendations for improved data quality

The present report was prepared using a more complete gap-filling procedure for the first time. This has led to significant improvement in the completeness of the European Union emission inventory, especially for the main pollutants where complete emission trends for the EU-27 can now be reported for the first time. Nevertheless, despite clear progress in recent years concerning the completeness of reporting, in the official datasets received from Member States a number of data gaps still remain. The completeness of Member State submissions can therefore be further improved. That is particularly so for historic 1990–2001 data and for certain pollutants such as heavy metals and POPs.

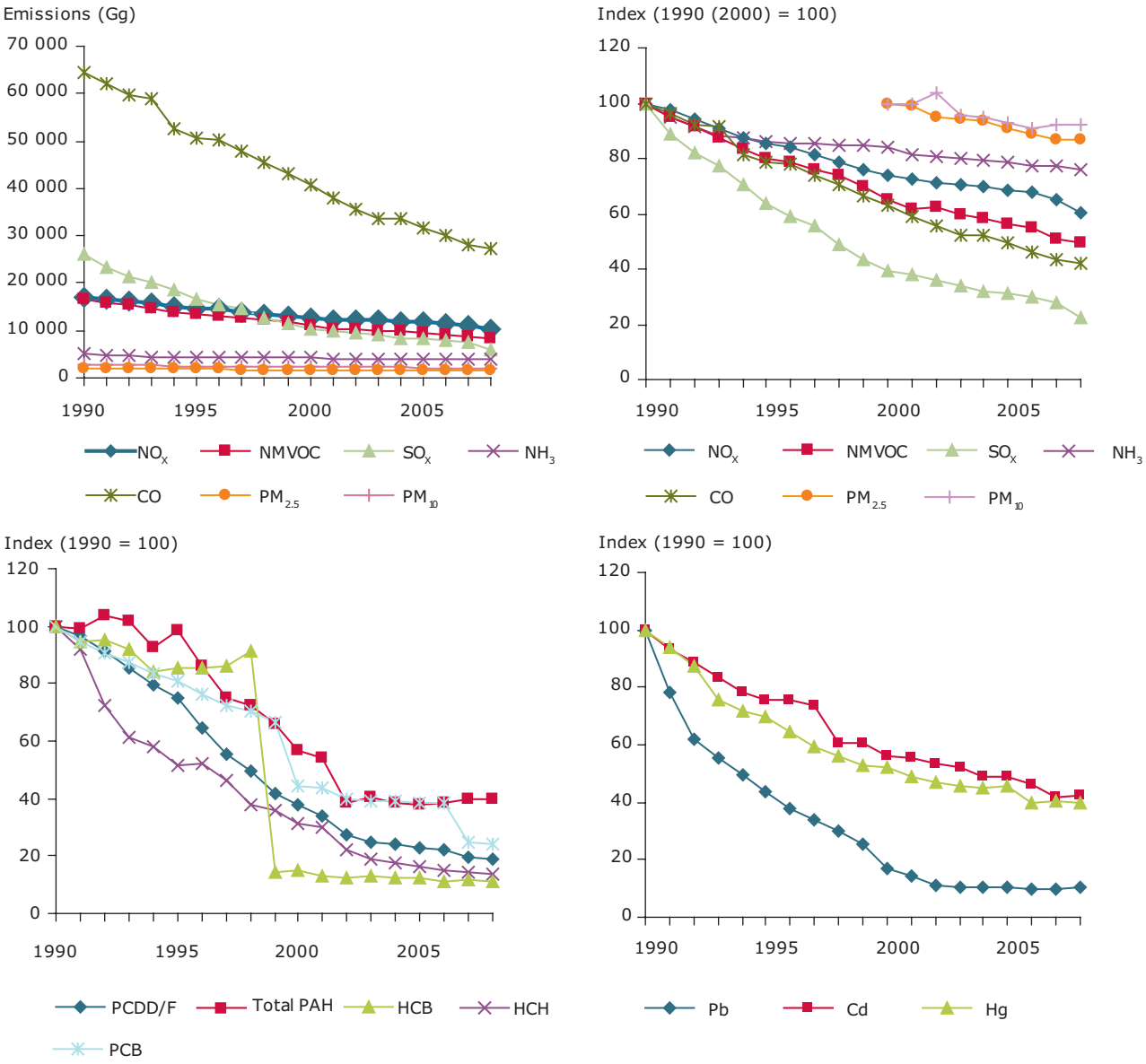
At a technical level, this report also makes several recommendations to assist in further improving the quality of the European Union inventory. First, Member States should use, for all years, the new data reporting format specified in the recently updated 2009 United Nations Economic Commission for Europe (UNECE) LRTAP Convention emission reporting guidelines. This allows a comparable aggregation and analysis of the underlying data received from countries, which is necessary for the European Union's own inventory. Second, Member States should submit complete inventories and use proper notation keys for instances were estimated values are not available. Third, Member States should recalculate emissions data for past years when new methods or new scientific knowledge become available. In this context, Member States are encouraged to review and apply the new information contained in the updated EMEP/EEA air pollutant emission inventory guidebook (EMEP/EEA, 2009) when compiling their emission inventory datasets.

([3]) As defined in EMEP/EEA (2009).

([4]) For each of the main air pollutants and particulate matter (PM_{10} and $PM_{2.5}$), the priority heavy metals and the POPs a key category analysis (KCA) was performed to identify the most important sectors that contribute to emissions of a given pollutant in 2008. A key category is defined as an emission source that has significant influence on the total inventory in terms of the absolute level of emissions, the trend in emissions, or both. In this report, the categories that are together responsible for 80 % of the total emissions for a given pollutant are classified as key categories (EMEP/EEA, 2009).

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 to ensuring that high quality data are available for the European Union's own inventory.

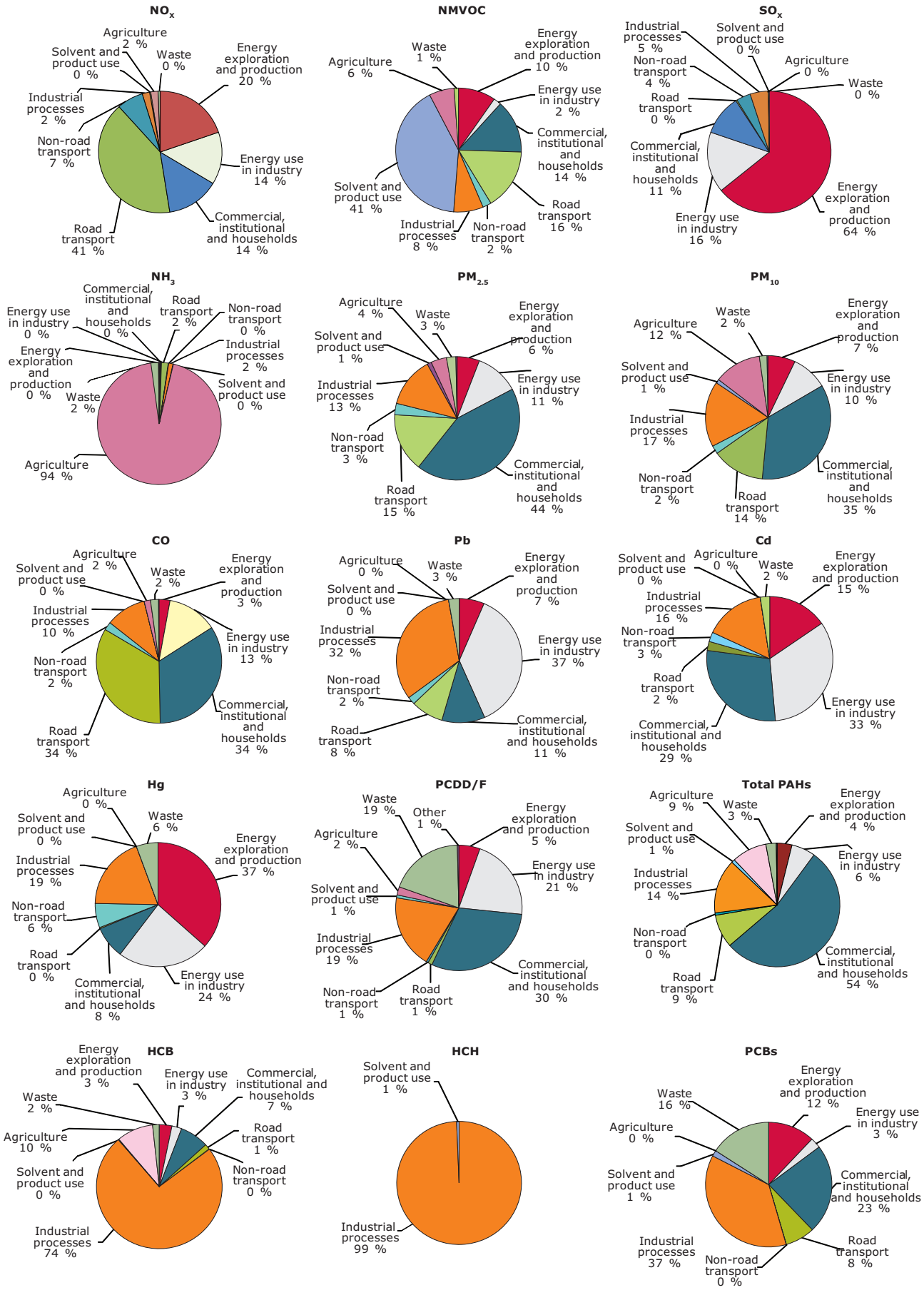
Figure ES.1 EU-27 emission trends for the main air pollutants, particulate matter, heavy metals and POPs



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

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

Figure ES.2 Share of EU-27 emissions per pollutant by sector group



1 Introduction

The present report and its accompanying data are provided by the European Commission (on behalf of the European Union) as an official submission to the Secretariat for the Executive Body of the LRTAP Convention.

The report provides information on the formal institutional arrangements that underpin the European Union's emission inventory (Chapter 1); emission trends reported by Member States, and the contribution of key categories to total emissions (Chapter 2); sector group emission trends for key pollutants (Chapter 3); and information on recalculations and planned improvements (chapter 4).

EU-27 emission totals are estimated for the pollutants for which data should be reported under the LRTAP Convention, i.e. emissions of nitrogen oxides (NO_x), non-methane volatile organic compounds (NMVOCs), sulphur oxides (SO_x), ammonia (NH_3) and carbon monoxide (CO), of particulate matter emissions ($PM_{2.5}$ and PM_{10}), of the so-called 'priority' heavy metals lead (Pb), cadmium (Cd) and mercury (Hg), and certain persistent organic pollutants (POPs), specifically polychlorinated dibenzodioxins/ polychlorinated dibenzofurans (PCDD/F), total polycyclic aromatic hydrocarbons (total PAHs), hexachlorobenzene (HCB), hexachlorocyclohexane (HCH), polychlorinated biphenyls (PCBs).

Emission estimates are not always available for all pollutants in each year due to gaps in the data reported by Member States. Following previous discussions with Member State representatives, a more complete gap-filling process than in previous years was trialled in 2010 for the compilation of the EU inventory. Nevertheless, for certain pollutants (i.e. particulate matter, the heavy metals 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 of this chapter.

A number of annexes accompany this inventory report:

- Annex A provides a copy of the formal LRTAP Convention data submission of the European Union for the years 1990–2008 for the EU-27 in the required UNECE reporting format (NFR09);
- Annex B provides the updated European Union NO_x emissions data for 1987–1989, 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 for the EU-27, showing the main emitting sectors for each pollutant;
- Annex D provides the gap-filled inventory of the EU-27 with colour codes 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 and $PM_{2.5}$ and PM_{10} emissions for the years 2010, 2015, 2020, 2030 and 2050.
- Compared to last year's report, 'European Union LRTAP Convention emission inventory report 1990–2007' (EEA, 2009a), the present report now includes a number of new elements:
- emission trends of heavy metals (Pb, Cd, Hg) and POPs (PCDD/F, total PAHs, HCB, HCH, PCBs);
- key category analyses and trend graphs of the top five key categories for the heavy metals (Pb, Cd, Hg) and POPs (PCDD/F, total PAHs, HCB, HCH, PCBs);
- sectoral emission trends for selected pollutants;
- a comparison of national totals estimated based on fuel sold or fuel consumed in each Member State for the year 2008.

1.1 Background

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

The European Union ratified the United Nations Economic Commission for Europe's Convention on Long-range Transboundary Air Pollution 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, came into force on 17 May 2005. Table 1.1 presents the status of ratification of each protocol by the European Union. The status differs in the individual Member States.

The UNECE LRTAP Convention Executive Body approved revised 'Guidelines for Reporting Emission Data under the Convention on Long-range Transboundary Air Pollution' at its twenty-sixth session in December 2008. These revised Reporting Guidelines (UNECE, 2009) 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 the present report.

In 2010, Parties were requested to report emissions data for NO_x, NMVOCs, SO_x, NH_3, CO, HMs, POPs and PM, and also associated activity data. 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 European Union 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 EMEP nomenclature for reporting (NFR09) format .

1.1.2 Reporting obligations under the NEC Directive and the EU Monitoring Mechanism

EU Member States also report their emissions of NO_x, NMVOCs, SO_2 and NH_3 under the National Emission Ceilings Directive (NECD) ([5]) and emissions of NO_x, SO_2, NMVOCs and CO under the EU Greenhouse Gas Monitoring Mechanism (EU-MM) ([6]) for the United Nations Framework Convention on Climate Change (UNFCCC). This information should also be copied by Member States to the EEA Eionet Reportnet Central Data Repository

Table 1.1 The European Union's 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)	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)	Signed and ratified (approval)
Protocol on the Reduction of Sulphur Emissions or their Transboundary Fluxes by at least 30 per cent (1985)	Not signed
Protocol concerning the Control of Emissions of Nitrogen Oxides or their Transboundary Fluxes (1988)	Ratified (accession)
Protocol concerning the Control of Emissions of Volatile Organic Compounds or their Transboundary Fluxes (1991)	Signed
Protocol on Further Reduction of Sulphur Emissions (1994)	Signed and ratified (approval)
Protocol on Persistent Organic Pollutants (1998)	Signed and ratified (approval)
Protocol on Heavy Metals (1998)	Signed and ratified (approval)
Protocol to Abate Acidification, Eutrophication and Ground-level Ozone (1999)	Ratified (accession)

([5]) Directive 2001/81/EC of the European Parliament and of the Council of 23 October 2001 on national emission ceilings for certain atmospheric pollutants, Official journal of the European Communities 309, 27.11.2001, p. 22.

([6]) Decision 280/2004/EC of the European Parliament and of the Council of 11 February 2004 concerning a mechanism for monitoring Community greenhouse gas emissions and for implementing the Kyoto Protocol, Official journal of the European Communities 49, 19.02.2004, p. 1.

(CDR) ([7]). The reporting obligations under the LRTAP Convention and NECD have now largely been harmonised since the adoption of the updated Reporting Guidelines. They now differ mainly only with respect to the geographical coverage for France, Portugal and Spain. As compared with the UNFCCC obligation, they differ in terms of inclusion of domestic and international aviation and navigation in the reported 'national total'. The main differences between the different reporting instruments are summarised in Table 1.3. The overall impact of these differences is small for most Member States.

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

The reporting obligations under the LRTAP Convention and NECD have now largely been harmonised since the adoption of the updated Reporting Guidelines. They now differ mainly only with respect to the geographical coverage for France, Portugal and Spain. As compared with the UNFCCC obligation, they differ in terms of inclusion of domestic and international aviation and navigation in the reported 'national total'. The main differences between the different reporting instruments are summarised in Table 1.3. The overall impact of these differences is small for most Member States.

1.2 Institutional arrangements

1.2.1 Member States

Member States are responsible for choosing 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 emission inventory guidebook (EMEP/EEA, 2009). While the latest version of the emission inventory guidebook was formally approved in 2009, not all Member States may yet have fully implemented its recommended methods in their own national emission inventories.

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

In addition to submitting their national LRTAP inventories and inventory reports, Member States through their participation in the Eionet network (see Section 1.2.2 below) also take part in the annual review and commenting phase of the draft European Union inventory report. The Member States check their national data and information used in the inventory report and if necessary send updates. In addition, general comments on the inventory report are provided.

1.2.2 The European Environment Agency, Eionet and the European Topic Centre on Air and Climate Change

European Environment Agency

The European Environment Agency assists the European Commission (DG Environment) in

Table 1.2 Overview of air emission reporting obligations in the European Union, 2009–2010

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), NMVOCs, SO_x (as SO_2), NH_3, CO, HMs, POPs([b]) and PM	15 February	30 April
NEC Directive	Emissions of NO_x, NMVOCs, SO_2 and NH_3	31 December	–
EU Monitoring Mechanism/UNFCCC	Emissions([c]) of CO2, CH4, N2O, HFCs, PFCs, SF6, NO_x, CO, NMVOCs and SO_2	15 January (to the European Commission) 15 April (to the UNFCCC)	15 April

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/F, total PAHs, HCB, HCH and PCBs.

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

([7]) Available at http://cdr.eionet.europa.eu.

Table 1.3 Major differences between the reporting obligations of air pollutants under the LRTAP Convention, NEC Directive and EU Monitoring Mechanism/UNFCCC

	EU NECD	LRTAP Convention–NFR ([a])	EU-MM/UNFCCC–CRF ([b])
Air pollutants	NO_x, NMVOCs, SO_2, NH_3	NO_x, NMVOCs, SO_x, NH_3, CO, HMs, POPs, PM	NO_x NMVOCs, SO_x, CO
Domestic aviation (landing and take-off)	Included in national total	Included in national total	Included in national total
Domestic aviation (cruise)	*Not included in national total* ([c])	*Not included in national total* ([c])	Included in national total
International aviation (landing and take-off)	Included in national total	Included in national total	*Not included in national total* ([c])
International aviation (cruise)	*Not included in national total* ([c])	*Not included in national total* ([c])	*Not included in national total* ([c])
National navigation (domestic shipping)	Included in national total	Included in national total	Included in national total
International inland shipping	Included in national total	Included in national total	*Not included in national total* ([c])
International maritime navigation	*Not included in national total* ([c])	*Not included in national total* ([c])	*Not included in national total* ([c])
Road transport	Emissions calculated based on fuel sold ([d])	Emissions calculated based on fuel sold ([d])	Emissions calculated based on fuel sold

Note: ([a]) 'NFR' denotes 'nomenclature for reporting', a sectoral classification system developed by UNECE/EMEP for reporting air emissions.
([b]) 'CRF' is the sectoral classification system developed by UNFCCC for reporting of greenhouse gases.
([c]) Categories not included in national totals should still be reported by Parties as so-called 'memo items'
([d]) In addition, Parties may also report emission estimates based on fuel used as an additional 'memo item'.

compiling the annual European Union LRTAP inventory. The activities of the EEA include:

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

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

European Topic Centre on Air and Climate Change

With regard to the European Union's LRTAP Convention emission inventory, the main ETC/ACC ([8]) 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 assesment reports, country review reports);
- consulting with Member States (via the EEA) in order to clarify data and other information provided;
- preparing the gap-filled European Union emission inventory and inventory report by 30 April, based on Member State submissions (subsequently submitted by the Commission to the UNECE);

([8]) The current ETC/ACC was established by a contract between the lead organisation Milieu-en Natuurplanbureau (MNP) and the EEA in 2006. Now based at the Netherlands Environmental Assessment Agency (PBL), it involves 11 organisations and institutions in eight European countries.

- preparing the updated European Union emission inventory and inventory report by 30 May.

Other partners – the European Commission and Eionet

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

The work of the EEA and the ETC/ACC is facilitated by the European environmental information and observation network (Eionet) ([9]), which consists of 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 (see http://eionet.europa.eu). Member States are requested to use the CDR of the Eionet Reportnet tools to make their LRTAP Convention submissions available to EEA.

1.3 Inventory preparation process

No specific European Union directive implements the LRTAP Convention's requirements to estimate air emissions and prepare air emission inventories. The basis of reporting for the individual Member States and for the European Union remains the LRTAP Convention, 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. Within the European Union, Member States are requested each year (under the agreement between Eionet countries and EEA concerning priority data flows) to post a copy of their official submission to the LRTAP Convention in the CDR by 15 February each year. The ETC/ACC subsequently collects the data from the CDR and compiles the gap-filled European Union LRTAP Convention emission inventory database, producing a European Union LRTAP Convention emission inventory and inventory report.

Within this legal and procedural framework, preparation of the annual LRTAP Convention emission inventory involves the Member States providing their data, the European Commission and EEA receiving the data, and finally the EEA and its ETC/ACC compiling the data, gap-filling missing data and preparing the actual inventory. The inventory and accompanying documentation are subsequently made publicly available through the EEA website. Figure 1.1 presents a flowchart diagram illustrating the dataflow that is used to compile the European Union's LRTAP Convention emission inventory.

1.4 Methods and data sources

The European Union 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 this data to EEA no later than 15 February 2010.

For the inventory prepared in 2010, all but two EU Member States (Italy and Luxembourg) provided data before 7 May 2010. This is a somewhat improved level of reporting and timeliness compared to 2009. Greece, Lithuania and Portugal, did not submit on time (Figure 1.2). Table 1.4 provides an overview of the data received from Member States' LRTAP Convention submissions in 2010. Twenty-five Member States submitted inventories and eleven Member States posted more than one submission on the CDR, providing additional information and/or revised inventories following their original data submission. Nineteen Member States submitted Informative Inventory Reports (IIR) until 7 May – the formal deadline of which was 15 March.

The updated Reporting Guidelines request that emissions data be provided by Parties to the Convention using the NFR09 format. While most Member States used the new NFR09 reporting templates, a small number used older formats for part or all of their submission (Czech Republic, Denmark, Finland, Portugal and Sweden). Table 1.4 shows the formats used by Member States to report data. In order to compile the EU-27 inventory it was necessary to transfer all submissions into a uniform format (see Appendix 3 for details).

1.4.1 General assessment of completeness

Four Member States (of the 25 that submitted inventories) provided only 2008 data. All other countries also submitted inventories for one or more

([9]) Council Regulation (EC) No 933/1999 of 29 April 1999 amending Regulation (EEC) No 1210/90 on the establishment of the European Environment Agency and Eionet. A brochure describing the structure, working methods, outputs and activities of Eionet is available at http://reports.eea.europa.eu/brochure_2004_3/en

Figure 1.1 Data flow for compiling the European Union LRTAP Convention emission inventory

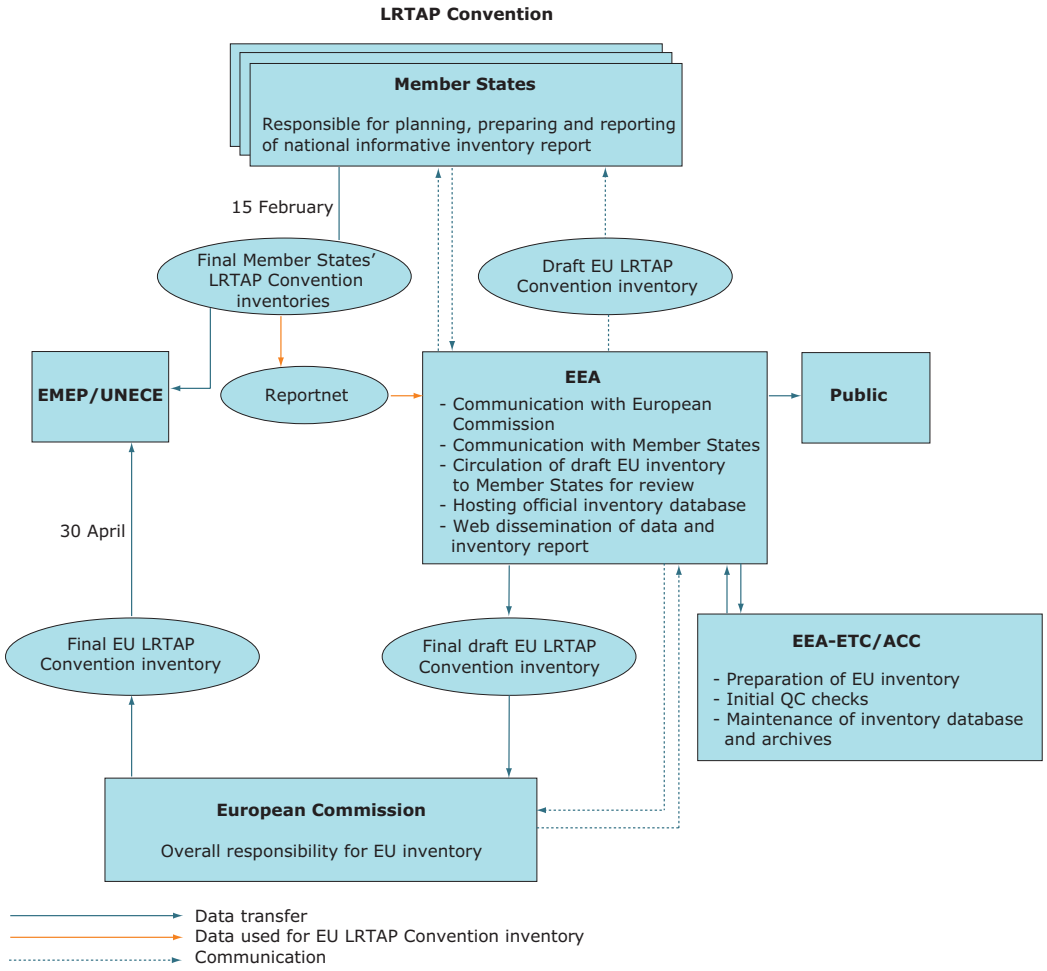
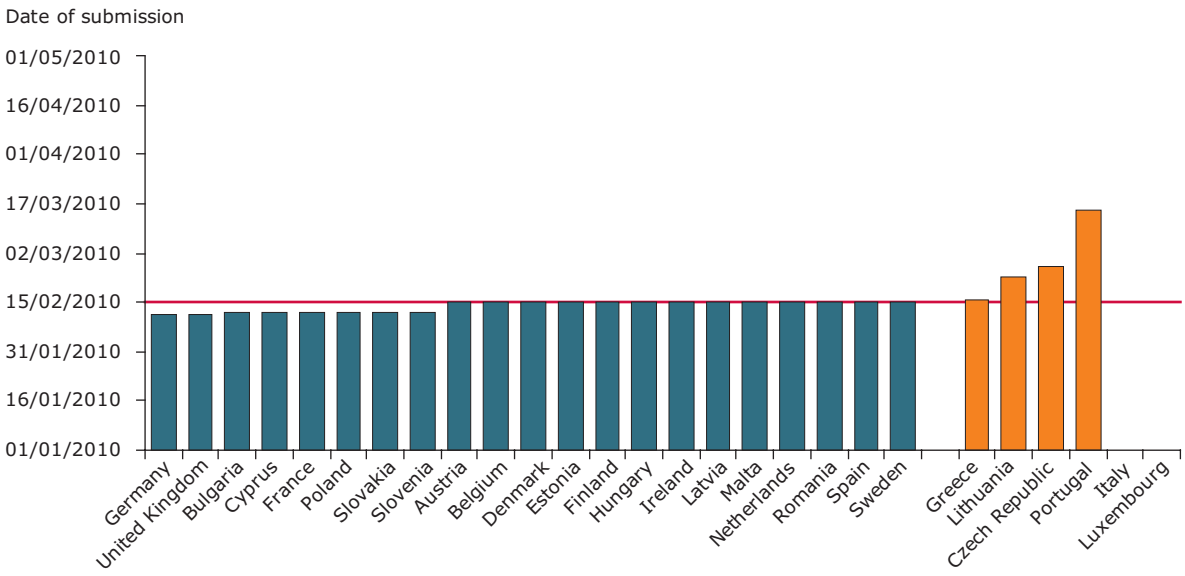


Figure 1.2 Dates of the first data submissions received from Member States (as of 7 May 2010)



Note: The Czech Republic sent data for the year 2008 by 15 February 2010 to CEIP with notification to the UNECE Secretariat. Later, the data were also uploaded on the Eionet CDR. This latter date, when the data first became available to EEA and Eionet, is listed in this report as the 'submission' date.

Table 1.4 Date on which EEA received inventory submissions, years covered and information provided by Member States, as of 7 May 2010

	Annual reporting						Minimum 5 year reporting		
Member State	**Submission date (a)**	**Re-submission date**	**NFR template**	**Other format**	**IIR 2009**	**Activity data (b)**	**Projections**	**Gridded data**	**LPS emissions**
Austria	15.02.2010	15.03.2010	NFR 2009–1		15.03.2010	1980–2008	np	np	np
Belgium	15.02.2010		NFR 2009–1		15.03.2010	1990–2008	np	np	np
Bulgaria	12.02.2010		NFR 2009–1		15.03.2010	2008	np	np	np
Cyprus	12.02.2010	01.03.2010	NFR 2009–1		01.03.2010	2008	2010	2008	2008
Czech Republic	26.02.2010	08.03.2010	NFR 2009–1 (2008), NFR 2008–1 (2007)		np	2008	np	np	np
Denmark	15.02.2010		NFR 2002–1		15.03.2010	1990, 1995, 2000, 2005, 2010, 2015, 2020	2010, 2015, 2020	np	np
Estonia	15.02.2010	15.03.2010	NFR 2009–1		15.03.2010	2007–2008	2010, 2015	np	np
Finland	15.02.2010	26.02.2010	NFR 2004–1 (1980–2006), NFR 2009–1 (2007–2008)		12.03.2010	2008	2020, 2050	2008	2008
France	12.02.2010		NFR 2009–1		15.03.2010 (French)	1980–2008	2010, 2020	np	np
Germany	11.02.2010		NFR 2009–1		15.03.2010	1990–2008	np	np	np
Greece	16.02.2010		NFR 2009–1		np	np	2010	np	np
Hungary	15.02.2010	22.02.2010	NFR 2009–1		08.03.2010	2008	2010, 2015, 2020, 2030	np	np
Ireland	15.02.2010		NFR 2009–1		np	2008	2010	np	np
Italy									
Latvia	15.02.2010	15.03.2010	NFR 2009–1		15.03.2010	1990–2008	np	np	np
Lithuania	23.02.2010		NFR 2009–1		np	2008	2010, 2015, 2020	np	np
Luxembourg									
Malta	15.02.2010	16.03.2010	NFR 2009–1		np	2000–2008	2010	np	np
Netherlands	15.02.2010	19.02.2010, 04.05.2010	NFR 2009–1		12.03.2010	1990–2008	2010, 2015, 2020	np	np
Poland	12.02.2010		NFR 2009–1		12.03.2010	2007–2008	np	np	np
Portugal	15.03.2010		NFR 2008–1		15.03.2010	1990–2008	np	np	np
Romania	15.02.2010	15.03.2010	NFR 2009–1		15.03.2010	2007–2008	2010, 2015, 2020, 2030	np	np
Slovakia	12.02.2010		NFR 2009–1 (2000–2008)	Nat. tot. (1990–1999)	12.02.2010	2000–2008	2010, 2015, 2020, 2030, 2050	1990, 1995, 2000, 2005	np
Slovenia	12.02.2010		NFR 2009–1		29.03.2010	1990–2008	2010, 2015, 2020	np	np
Spain	15.02.2010	01.03.2010	NFR 2009–1	Level 1 (1980–1989)	np	1990–2008	2010, 2015, 2020	1990–2008	1990–2008
Sweden	15.02.2010		NFR 2004–1 (1980–1989), mod. NFR 2008–1 (1990–2008)		15.02.2010	1990–2008	2010, 2015, 2002	np	np
United Kingdom	11.02.2010		NFR 2009–1		15.03.2010	1990–2008	2010	np	np

Note: (a) Refers to the first submission of inventory data to the CDR; submission of other data is possible at later dates.

(b) Activity data reported in 2010 including activity data related to the projections
'IIR' denotes 'informative inventory report'
'np' denotes 'not provided'
'x' denotes 'provided'.

Table 1.5 Overview of air pollutants and years reported by Member States in their LRTAP Convention submissions of 2010 (as of 7 May 2010)

Member State	NO_x, NMVOC, SO_x, NH_3, CO	$PM_{2.5}$, PM_{10}	TSP	Pb, Cd, Hg	Additional HMs (a)	POPs (PCDD/F, PAHs, HCB, HCH, PCBs)
Austria	1980–2008	1990, 1995, 2000–2008	1990, 1995, 2000–2008	1985–2008	np	1985–2008
Belgium	1990–2008	2000–2008	2000–2008	1990–2008	1990–2008	1990–2008
Bulgaria	2008	2008	2008	2008	2008	2008
Cyprus	1990–2008	2000–2008	2000–2008	1990–2008	1990–2008	1990–2008
Czech Republic	2007–2008	2007–2008	2007–2008	2007–2008	2007–2008	2007–2008
Denmark	1980–2008	2000–2008	2000–2008	1990–2008	1990–2008	1990–2008
Estonia	1990–2008	2000–2008	1990–2008	1990–2008	1990–2008	1990–2008
Finland	1980–2008	2000–2008	2000–2008	1990–2008	1990–2008	1990–2008
France	1980–2008	1990–2008	1990–2008	1990–2008	1990–2008	1990–2008
Germany	1990–2008	1995–2008	1990–2008	1990–2008	1990–2008	1990–2008
Greece	2008	np	np	np	np	np
Hungary	2008	2008	2008	2008	2008	2008
Ireland	1987, 1990–2008	1990–2008	1990–2008	1990–2008	1990–2008	1990–2008
Italy	np	np	np	np	np	np
Latvia	1990–2008	1990–2008	1990–2008	1990–2008	1990–2008	1990–2008
Lithuania	2008	2008	2008	2008	2008	2008
Luxembourg	np	np	np	np	np	np
Malta	2000–2008	2000–2008	2000–2008	2000–2008	2000–2008	np
Netherlands	1990–2008	1990–2008	1990–2008	1990–2008	1990–2008	1990–2008
Poland	2007–2008	2007–2008	2007–2008	2007–2008	2007–2008	2007–2008
Portugal	1990–2008	1990–2008	1990–2008	1990–2008	1990–2008	1990–2008
Romania	2007–2008	2007–2008	2007–2008	2007–2008	2007–2008	2007–2008
Slovakia	2000–2008	2000–2008	2000–2008	2000–2008	2000–2008	2000–2008
Slovenia	1980–2008	2000–2008	2000–2008	1990–2008	1990–2008	1990–2008
Spain	1980–2008	2000–2008	2000–2008	1990–2008	1990–2008	1990–2008
Sweden	1980–2008	1980–2008	1980–2008	1990–2008	1990–2008	1980–2008
United Kingdom	1980–2008	1980–2008	np	1980–2008	1980–2008	1990–2008

Note: 'HMs' denotes 'heavy metals'. Reporting of additional HMs is not mandatory.

'TSP' denotes 'total suspended particles'. Reporting of TSP is not required if a Member State reports PM emissions.

historical years. As Table 1.5 illustrates, however, only 23 countries submitted POPs inventories. Twenty-four Member States reported activity ([10]) data for at least one year and eleven Member States reported activity data for the entire time series (Table 1.4).

In previous years, total European Union emissions estimates of NO_x, NMVOCs, SO_x, NH_3, $PM_{2.5}$, PM_{10} and CO were presented in the report. This year for the first time also emissions estimates of the heavy metals (Pb, Cd and Hg) and the POPs (PCDD/F, total PAHs, HCB, HCH, PCBs) are presented. Due to significant gaps in heavy metal and POPs data available from Member States, such time-series trends can only be compiled after gap-filling of submitted inventories.

1.4.2 Data gaps and gap-filling

It is recognised that, ideally, there should be no need to gap-fill the reported inventory data, as

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

it is the role of Member States to submit full and accurate inventory data sets. However, as Table 1.6 and Table 1.7 indicate, Member State submissions contain various data gaps for particular pollutants or years in the time series. The most frequent problems observed are as follows:

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

The EMEP Reporting Guidelines (UNECE, 2009) require that submitted emission inventories be complete. In previous years, the inventory for the European Community was already partially gap-filled, whereby official data reported by Member States under other reporting obligations (e.g. the NEC Directive and EU-MM) was used to fill gaps. This process nevertheless still resulted in the Community's inventory being incomplete for certain pollutants and years.

Reflecting the need to submit a more complete dataset, several discussions were held with Member State representatives in both 2008 and 2009 concerning possible approaches to achieve more complete gap-filling of the European Union emission inventory. At a meeting in September 2009 ([1]), 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 European Union's 2010 emissions inventory was performed in accordance with a methodology paper developed by EEA and ETC/ACC (EEA, 2009b). The gap-filling methods described in the methodology paper are 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 datasets:

1. Emission trends of all pollutants were compiled from 1990 onward using the Member State LRTAP Convention emission inventories provided to EEA in 2010 or in previous years.
2. For Member States that did not report complete data, emissions data reported officially by Member States under EU-MM (NO_x, NMVOCs, SO_2, CO) and then NECD (NO_x, NMVOCs, SO_2, NH_3) were used in the first instance to fill gaps. Older LRTAP Convention data submitted to EMEP/CEIP was the final source of official data used to fill gaps.
3. Finally, for all remaining cases of missing data, further gap-filling procedures were applied in accordance with the procedures described in EEA (2009b).

The further gap-filling procedures described in Step 3 are summarised as follows:

i. interpolation was performed if one or several years in the middle of a time series were missing;
ii. 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 that showed a clear trend ($r^2 < 0.6$) were available. Extrapolation 'backwards' was never allowed to result in negative values;
iii. if fewer than five consecutive years were available as a basis for extrapolation, or if years did not show a clear trend, the value of the previous or next year was used to fill the gaps.
iv. 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 not available, or where a national total was available but 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 1.6 and Table 1.7 show how the various officially reported datasets were used to supplement the LRTAP Convention data submissions for those Member States where gap-filling was required. Appendix D provides a detailed overview showing, for each Member State, which data were gap-filled (and how).

The gap-filling procedure used in 2010 has allowed a more accurate determination of EU emission trends and the most significant emission sources of the various pollutants than in previous years. For certain pollutants (particulate matter, the heavy metals and

[1] Meeting of the Air and Fuels Committee under Directive 96/62/EC: Information on the Member States reporting under the National Emission Ceilings Directive 2001/81/EC, 28 September 2009, Brussels.

Table 1.6 Data sources of the main pollutants NO_x, NMVOCs, SO_x, NH_3, CO, $PM_{2.5}$ and PM_{10} emissions used for the 2010 EU–27 inventory compilation (as of 7 May 2010)

Member State	NFR as provided as LRTAP Convention submission under Eionet		NFR as provided under NEC Directive (NO_x, NMVOC, SO_x, NH_3)	CRF as provided under Council Decision 280/2004/EC under Eionet (NO_x, NMVOC, SO_x, CO)	Data submitted under LRTAP Convention to EMEP (CEIP database)
	NO_x, NMVOC, SO_x, NH_3, CO	$PM_{2.5}$ and PM_{10}			
Austria	1990–2008	1990, 1995, 2000–2008			
Belgium	1990–2008	2000–2008			
Bulgaria	2002–2008	2007–2008		1990–2001	1990–2001 (NH_3)
Cyprus	1990–2008	2000–2008			
Czech Republic	2002–2008	PM_{10}: 2002–2008; $PM_{2.5}$: 2003–2008		1990–2001	1990–1999 (NH_3), 2001 (PM_{10})
Denmark	1990–2008	2000–2008			
Estonia	1990–2008	2000–2008			
Finland	1990–2008	2000–2008			
France	1990–2008	1990–2008			
Germany	1990–2008	1995–2008			
Greece	1990–2008				
Hungary	1990, 1995, 2003–2008	1995, 2003–2008		1991–1994, 1996–1999, 2001–2002; CO: 1991–2002	NH_3: 1991–1994, 1996–1999, 2001–2002; PM_{10}, $PM_{2.5}$: 1996–2002
Ireland	1990–2008	1990–2008			
Italy	1990–2007	1990–2007		2008	
Latvia	1990–2008	1990–2008			
Lithuania	2002, 2005–2008	2005–2008		1990–2001	1990–2000 (NH_3), 2004 (PM_{10}, $PM_{2.5}$)
Luxembourg	1990–2007; CO: 1990–2005		2008 (NO_x, SO_x, NH_3)	2008 (NMVOC)	
Malta	2000–2008	2000–2008		1991–1994, 1996–1999; CO: 1990–1999	
Netherlands	1990–2008	1990–2008			
Poland	2002–2008	2003–2008		1990–2001	NH_3: 1990–2001; PM_{10}: 2000–2001
Portugal	1990–2008	1990–2008			
Romania	2005–2008	PM_{10}: 2005–2008; $PM_{2.5}$: 2007–2008		1990–1999, 2001–2004; CO: 1990–2004	1990–1999, 2001–2004 (NH_3)
Slovakia	2000–2008	2000–2008		1990–1999	1990–1999 (NH_3)
Slovenia	1990–2008	2000–2008			
Spain	1990–2008	2000–2008			
Sweden	1990–2008	1990–2008			
United Kingdom	1990–2008	1990–2008			

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.

1.4.3 Comparison of Member State emissions calculated on the basis of fuel sold versus fuel consumed

The Reporting Guidelines (UNECE, 2009) specify (para 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 kilometers driven in the geographic area of the Party. The method for the estimate(s) should be clearly specified in the IIR [informative inventory report]'*.

The difference between transport emissions estimated using the amount of fuel sold within a country and emissions estimated using the amount of fuel consumed in a country, can be significant for countries where 'tank tourism' occurs, i.e. where fuel purchased within a country is actually used outside the country and vice-versa.

Only Austria, Ireland and the Netherlands reported emissions based on fuel used that differed from the emissions based on fuel sold. Table 1.8 shows, for these countries, the difference between total

Table 1.7 Data sources of heavy metals (Pb, Cd, Hg), and the persistent organic pollutants (PCDD/F, total PAHs, HCB, HCH and PCBs) emissions used for the 2010 EU–27 inventory compilation (as of 7 May 2010)

Member State	NFR as provided as LRTAP Convention submission under Eionet		Data submitted under LRTAP Convention to EMEP (CEIP database)
	Pb, Cd, Hg	PCDD/F, total PAHs, HCB, HCH, PCBs	
Austria	1990–2008	1990–2008	
Belgium	1990–2008	1990–2008	
Bulgaria	2008	2008	1990, 1995–1999, 2001–2007
Cyprus	1990–2008	1990–2008	
Czech Republic	2007–2008	2007–2008	1990–2006; HCB: 2002–2006
Denmark	1990–2008	1990–2008	
Estonia	1990–2008	2008; PCBs: 1990–2008	1990–2007 (PCDD/F, PAHs)
Finland	1990–2008	1990–2008	
France	1990–2008	1990–2008	
Germany	1990–2008	1990–2008; HCH: 1990–1997	
Greece			
Hungary	2008	2008	1990–2007; HCH: 1990–1998; PCBs: 1990–2000, 2002–2003
Ireland	1990–2008	1990–2008	
Italy			1990–2007
Latvia	1990–2008	1990–2008	
Lithuania	2008	2008	Pb, Cd, Hg: 1990–2000, 2002–2007; PCDD/F, PAHs, PCBs: 1990, 1997–2000, 2002–2008
Luxembourg			
Malta	2000–2008		
Netherlands	1990–2008	1990–2008; HCH: 2001	
Poland	2007–2008	2007–2008	1990–2006
Portugal	1990–2008	1990–2008	
Romania	2007–2008	2007–2008	2005–2006; PAHs, HCB, PCBs: 1990, 1994–1996
Slovakia	2000–2008	2000–2008	Pb, Cd, Hg: 1990, 1992, 1994–1999; PCDD/F, PAHs, HCB, PCBs: 1990, 1995, 1997–1999
Slovenia	1990–2008	1990–2008	
Spain	1990–2008	1990–2008	
Sweden	1990–2008	1990–2008	
United Kingdom	1990–2008	1990–2008	

emissions for the year 2008 calculated using the two approaches.

1.4.4 Gridded data and large point sources

According to the revised Reporting Guidelines, Parties within the geographical scope of EMEP should report gridded data every five years, commencing 1990. Gridded data for the EU-27 were last submitted in 2007 and hence are not reported again this year. It is however noted that in 2010 Cyprus, Finland, Slovakia and Spain provided gridded data for one or several years (Table 1.4).

Parties within the geographical scope of EMEP are also required to provide data on large point sources (LPS) every five years, commencing 2000. In 2010 Cyprus and Finland reported LPS for 2008 and Spain reported updated LPS data for the entire time series. EU-27 LPS data were last submitted in 2007 and hence are not reported in 2010.

Further information concerning the last submission of EU-27 gridded and LPS data is provided in Annexes G and H of the Annual European Community emission inventory report 1990–2005 (EEA, 2007).

1.5 Key category analyses

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 change in

Table 1.8 Comparison of Member States' total emissions calculated on the basis of fuel sold and fuel consumed, 2008

Member States		NO_x	NMVOC	SO_x	NH_3	PM_{10}	$PM_{2.5}$	CO	Cd	Hg	Pb	dioxine	Total PAH	HCB	HCH	PCB
		Gg	Gg	Gg	Gg	Gg	Gg	Gg	Mg	Mg	Mg	g	Mg	kg	kg	kg
Austria	National total	207	163	22	63	36	21	696	1	1	15	40	8	44	NR	NR
	National total (FU)	162	161	22	63	35	20	671	1	1	15	40	8	43	NR	NR
	Difference	– 22 %	– 2 %	0 %	0 %	– 2 %	– 4 %	– 4 %	0 %	0 %	0 %	– 1 %	– 5 %	0 %		
Ireland	National total	108	57	45	104	15	10	162	1	1	17	16	3	1	NA	20
	National total (FU)	102	56	45	104	15	10	152	1	1	15	16	3	NA	NA	20
	Difference	– 6 %	– 1 %	0 %	0 %	– 3 %	– 3 %	– 6 %	– 1 %	0 %	– 7 %	– 1 %	– 1 %			0 %
Netherlands	National total	309	164	52	NE	38	20	571	NE	NE	45	NE	NE	NE	NE	NE
	National total (FU)	293	160	52	135	37	19	559	2	1	45	25	4	0	16 661	0
	Difference	– 5 %	– 2 %	0 %		– 2 %	– 5 %	– 2 %			0 %					

Note: In the Netherlands, road transport emissions are calculated on the basis of fuel used (km driven). The national total given in the line National total (FU) is thus the official national total reported by the Netherlands.

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

EU-27 key categories were determined using a level analysis of 2008 emissions for each pollutant (after any necessary gap-filling had occurred). It should be noted that when the notation 'IE' (included elsewhere) was used by a Member State for a particular source/pollutant combination the key category analysis is likely to have underestimated the category concerned and overestimated the category in which emission were instead reported. In addition, as described earlier, particulate matter, heavy metals 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 key category analysis 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 2008 for each pollutant. A complete list of all EU-27 key categories for NO_x, NMVOCs, SO_x, NH_3, $PM_{2.5}$, PM_{10} and CO, heavy metals (Pb, Cd and Hg) and POPs (PCDD/F, total PAHs, HCB, HCH and PCBs) emissions is also given in Chapter 2. Detailed Key Category Analysis (KCA) calculations are provided in Annex C to the present report.

1.6 Quality assurance, quality control and verification methods

Member States are encouraged to use appropriate quality assurance and quality control 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).

There is no formal quality assurance and quality control plan available for the European Union inventory. The main activities to enhance the quality of the inventory are the checks performed by the EEA-ETC/ACC on the status of each Member State's submission. In addition, the internal consistencies of the data tables submitted by Member States are checked before EU-27 tables are compiled. 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.

All inventory documents (submissions, inventory master file, inventory report, status reports and related correspondence) are archived electronically at the EEA-ETC/ACC. Revisions of data sets are recorded.

More detailed quality assurance activities are performed by the EEA-ETC/ACC and the EMEP

Centre on Emission Inventories and Projections (CEIP) in an annual review process ([11]). The review of Member State LRTAP Convention emission inventories is performed jointly with the review of those reported under the national emissions ceilings Directive (2001/81/EC). The technical review of inventories is carried out in three stages. Review stages one and two 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 one and two) are published each year in a joint EMEP/EEA review report ([12]).

In 2008 CEIP in cooperation with EEA and Member States started centralised reviews ([13]) of national inventories (stage 3). In 2009, Belgium, Bulgaria, Denmark, Finland, Hungary, Ireland, Latvia, Lithuania, Poland and Spain were reviewed. The results are published in individual country-specific reports (www.ceip.at/review-process/review-2009). The long-term goal of EMEP is to perform a centralised review every year of ten LRTAP Convention Parties, so that each Party undergoes a detailed review approximately once every five years ([14]).

1.7 General uncertainty evaluation

A quantification of uncertainty in the European Union LRTAP emission inventory first requires Member States to provide detailed information on emission uncertainties. To date, Member States have reported insufficient information to evaluate uncertainty at the overall European Union level.

([11]) More information is available at www.ceip.at/review-process.
([12]) A summary of the results of the stage one and two review performed in 2010 will be published jointly by EMEP/EEA.
([13]) In cooperation with 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.
([14]) The long-term schedule of country reviews is available at www.ceip.at/review-process/centralised-review-long-term-plan/.

2 Trends and key categories of EU-27 pollutant emissions

The present EU-27 inventory provides, for the first time, gap-filled emissions for all the main air pollutants, particulate matter, 'priority' heavy metals and POPs for which inventory reporting is required under the LRTAP Convention.

The following sections of this chapter provide a summary of the contributions made by each Member State to the EU-27 total emissions of NO_x, NMVOCs, SO_x, NH_3, CO, $PM_{2.5}$ and $PM_{10;}$ the heavy metals Pb, Cd and Hg; and the persistent organic pollutants PCDD/F, total PAHs, HCB, HCH and PCBs. Additionally, for each pollutant the key categories and their past trends in the EU-27 inventory are identified, that is, the individual sources which overall contribute most to the 2008 emissions of pollutants.

2.1 Total EU-27 emission trends

Past trends of the main air pollutants are presented in For certain pollutants, including particulate matter, heavy metals and POPs, some Member States lacked data for all years. That meant that 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 later in this chapter show the reported emissions by each Member State, therefore indicating instances where emissions of a certain pollutant are missing across all years.

Figure 2.1 and Table 2.1. Emissions of all pollutants were lower in 2008 than in 1990 (or 2000 for

Table 2.1 Total EU-27 emissions of the main air pollutants, heavy metals, POPs and particulate matter

Pollutant	Unit	1990	1995	2000	2001	2002	2003	2004	2005	2006	2007	2008	Change 1990–2008	Change 2007–2008
NO_x	Gg	17 152	14 669	12 692	12 422	12 186	12 149	12 008	11 738	11 604	11 151	10 397	– 39 %	– 6.8 %
NMVOC	Gg	16 807	13 404	10 899	10 405	10 466	9 981	9 793	9 451	9 281	8 566	8 296	– 51 %	– 3.2 %
SO_x	Gg	26 208	16 703	10 248	9 995	9 447	8 902	8 331	8 126	7 869	7 339	5 867	– 78 %	– 20.1 %
NH_3	Gg	4 997	4 299	4 198	4 071	4 029	3 993	3 964	3 945	3 879	3 876	3 799	– 24 %	– 2.0 %
CO	Gg	64 526	50 779	40 771	37 842	35 703	33 807	33 489	31 794	29 951	28 038	27 228	– 58 %	– 2.9 %
Pb	Mg	22 398	9 856	3 805	3 179	2 434	2 409	2 320	2 269	2 244	2 157	2 293	– 90 %	6.3 %
Cd	Mg	281	212	157	155	150	147	138	138	130	118	118	– 58 %	0.2 %
Hg	Mg	218	152	113	107	102	100	98	99	87	89	87	– 60 %	– 1.4 %
PCDD/F	g I– Teq	11 245	8 418	4 274	3 815	3 063	2 759	2 707	2 568	2 465	2 212	2 124	– 81 %	– 4.0 %
total PAH	Mg	3 416	3 374	1 931	1 848	1 321	1 390	1 326	1 302	1 306	1 369	1 359	– 60 %	– 0.8 %
HCB	kg	5 737	4 894	844	764	714	746	710	724	641	657	633	– 89 %	– 3.6 %
HCH	kg	196 732	101 360	62 187	58 621	43 850	37 160	34 570	32 328	30 139	28 597	27 240	– 86 %	– 4.7 %
PCB	kg	11 732	9 483	5 233	5 132	4 678	4 611	4 609	4 512	4 483	2 928	2 816	– 76 %	– 3.8 %
													Change 2000–2008	**Change 2007–2008**
$PM_{2.5}$	Gg			1 612	1 593	1 526	1 514	1 510	1 466	1 428	1 400	1 403	– 13 %	0.2 %
PM_{10}	Gg			2 299	2 297	2 387	2 202	2 186	2 137	2 088	2 122	2 126	– 8 %	0.2 %

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

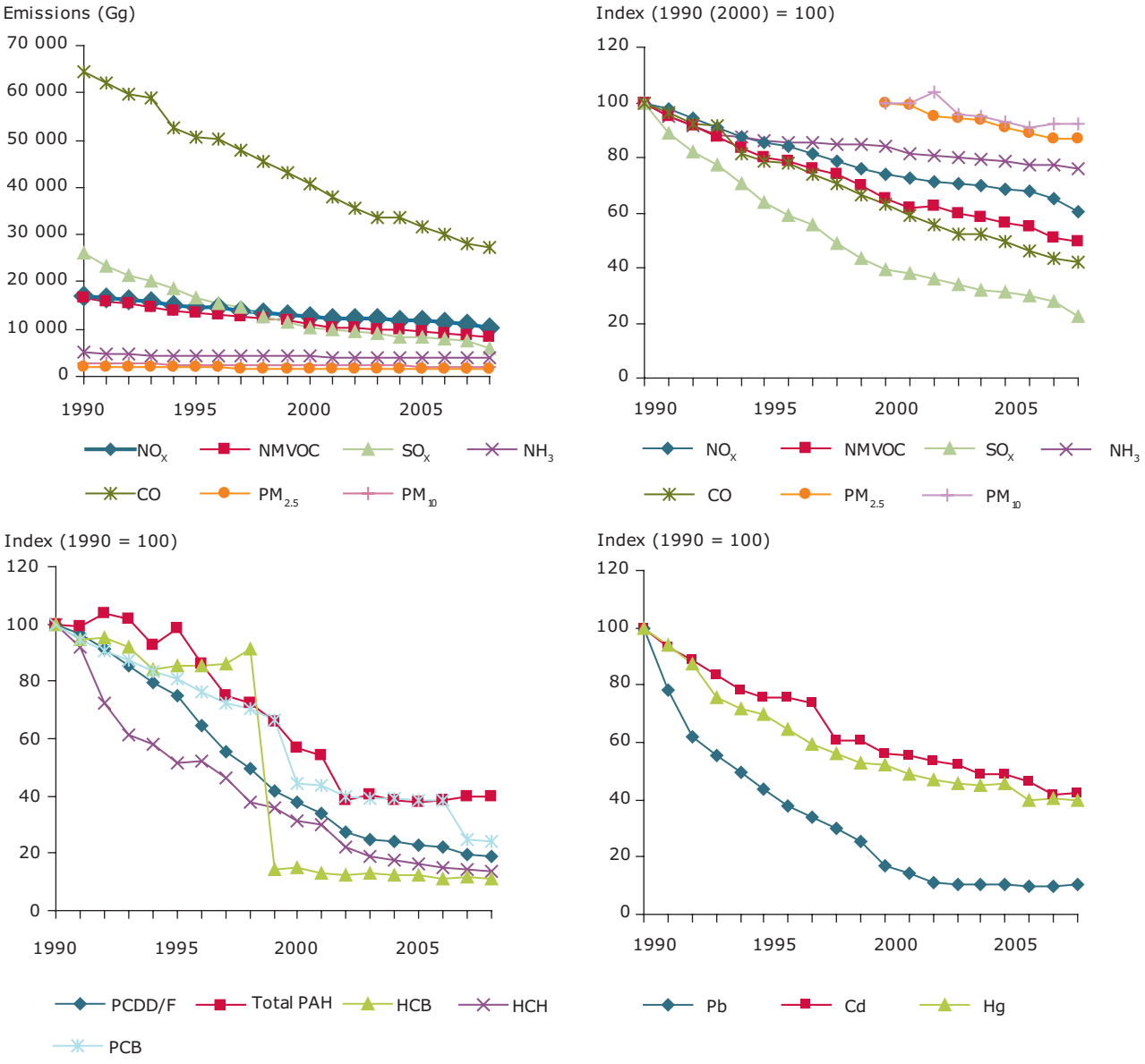
Negative percentage values indicate that emissions have fallen.

The 1990–2008 changes of emissions in Table 2.1 and subsequent tables are expressed as $100*(E_{2008} - E_{1990})/E_{1990}$ (%), where E_{2008} and E_{1990} are 2008 and 1990 total emissions, respectively. The 2007–2008 changes of emissions are expressed as $100*(E_{2008} - E_{2007})/E_{2007}$ (%), where E_{2008} and E_{2007} are the 2008 and 2007 total emissions, respectively.

particulate matter). 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 78 %), followed by CO (– 58 %), NMVOC (– 51 %), NO_x (– 39 %) and NH_3 (– 24 %). Substantial decreases in emissions of heavy metals and POPs have also been recorded since 1990. Emission trends compiled for the period 2000–2008 indicate that $PM_{2.5}$ emissions have fallen by 13 % and PM_{10} emissions by 8 %.

For certain pollutants, including particulate matter, heavy metals and POPs, some Member States lacked data for all years. That meant that 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 later in this chapter show the reported emissions by each Member State, therefore indicating instances where emissions of a certain pollutant are missing across all years.

Figure 2.1 EU-27 emission trends for the main air pollutants, particulate matter, heavy metals and POPs



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

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

2.2 EU-27 projections and progress toward UNECE Gothenburg protocol 2010 emission ceilings

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. Under the reporting process to the LRTAP Convention, some Member States have submitted emission projections for the year 2010 and up to 2050 in some cases. Submitted data is available in Annex E to the present report. As not all Member States have reported projections for all pollutants, 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.

However, later in 2010 EEA will publish its annual NEC Directive Status Report, which analyses, for the EU Member States, the more complete projections data reported under the EU NEC Directive. The NEC Directive contains national emission ceilings that, for the EU Member States, are either equal to or more ambitious than those in the Gothenburg Protocol.

In addition to the ceilings for individual countries, the protocol also specifies ceilings for the European Union which itself is a Party to the protocol. The ceiling applies only to the EU-15 grouping of Member States that constituted the European Community at the time the Gothenburg Protocol was agreed. Table 2.2 shows the emissions for the year 2008 reported by the EU-15 Member States in comparison to the respective emission ceilings specified for the European Union. Only for NO_x are the 2008 emissions above the level of the ceiling, for the remaining pollutants the emissions in 2008 were below the respective pollutant ceilings.

2.3 EU-27 key category analysis – main emission sources

Table 2.3 presents the EU-27 key categories, i.e. the individual sources that overall contributed most to 2008 emissions of pollutants, determined by a level assessment ([15]) for each of the main air pollutants, particulate matter, heavy metals and POPs.

Fifty-three different emission inventory source categories were identified as being key categories for at least one pollutant. A number of emission categories were identified as being key categories for more than one of the fifteen 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 ten pollutants respectively. Similarly, '1 A 2 f i − Stationary Combustion in Manufacturing Industries and Construction: Other' and '2 C 1 − Iron and Steel Production' were both key categories for nine pollutants, while the transport sectors '1 A 3 b i – Road transport: Passenger cars' and '1 A 3 d ii − National navigation (Shipping)' contributed significantly to emissions of six pollutants.

For NO_x and CO, nine and eight key categories respectively were identified and as would be expected for both these pollutants, all key categories are sectors in which fuel combustion or thermal process are involved. Fewer key categories were identified for SO_x (six, again all energy related) and NH_3 (five, all from the sector 'agriculture') PM_{10}, $PM_{2.5}$ and NMVOC emission sources are more diverse and thus larger numbers of source categories make up

Table 2.2 Comparison of emissions reported for 2008 by the EU-15 Member States with the emission ceilings for the European Union specified in the UNECE Gothenburg Protocol

Pollutant	EU-15 emissions year 2008 (Gg)	European Union (EU-15) Gothenburg Protocol 2010 ceilings (Gg)	Difference (%)	Sum of individual EU-15 ceilings (Gg) ([a])
NO_x	8 264	6 671	24 %	6 648
NMVOC	6 555	6 600	– 1 %	6 600
SO_x	3 084	4 059	– 24 %	4 044
NH_3	3 036	3 129	– 3 %	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.

([15]) 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).

Table 2.3 Results of key category analysis for the EU-27 for the year 2008 – cumulative contribution of emission sources to total emissions of NO_x, NMVOCs, SO_x, NH_3, CO, $PM_{2.5}$ and PM_{10}, the heavy metals Pb, Cd, Hg, and the persistent organic pollutants PCDD/F, total PAHs, HCB, HCH, PCBs (in descending order)

NO_x key categories	(%)	(%) cumul.
1 A 3 b i Road transport: Passenger cars	19 %	19 %
1 A 3 b iii Road transport: Heavy duty vehicles	18 %	37 %
1 A 1 a Public Electricity and Heat Production	17 %	54 %
1 A 2 f i Stationary combustion in manufacturing industries and construction: Other	8 %	62 %
1 A 4 c ii Agriculture/Forestry/Fishing: Off-road vehicles and other machinery	5 %	68 %
1 A 4 b i Residential: Stationary plants	5 %	72 %
1 A 3 d ii National navigation (Shipping)	4 %	76 %
1 A 3 b ii Road transport: Light duty vehicles	3 %	80 %
1 A 2 f ii Mobile Combustion in manufacturing industries and construction	2 %	82 %

SO_x key categories	(%)	(%) cumul.
1 A 1 a Public Electricity and Heat Production	53 %	53 %
1 A 2 f i Stationary combustion in manufacturing industries and construction: Other	9 %	62 %
1 A 4 b i Residential: Stationary plants	7 %	69 %
1 A 1 b Petroleum refining	7 %	76 %
1 A 3 d ii National navigation (Shipping)	3 %	80 %
1 A 2 a Stationary combustion in manufacturing industries and construction: Iron and steel	3 %	83 %

CO key categories	(%)	(%) cumul.
1 A 3 b i Road transport: Passenger cars	28 %	28 %
1 A 4 b i Residential: Stationary plants	27 %	55 %
2 C 1 Iron and steel production	8 %	63 %
1 A 2 a Stationary combustion in manufacturing industries and construction: Iron and steel	8 %	70 %
1 A 2 f i Stationary combustion in manufacturing industries and construction: Other	4 %	74 %
1 A 3 b iii Road transport: Heavy duty vehicles	2 %	76 %
1 A 3 b iv Road transport: Mopeds & motorcycles	2 %	78 %
1 A 1 a Public Electricity and Heat Production	2 %	80 %

$PM_{2.5}$ key categories	(%)	(%) cumul.
1 A 4 b i Residential: Stationary plants	35 %	35 %
1 A 4 c ii Agriculture/Forestry/Fishing: Off-road vehicles and other machinery	6 %	41 %
1 A 2 f i Stationary combustion in manufacturing industries and construction: Other	5 %	46 %
1 A 3 b i Road transport: Passenger cars	5 %	51 %
1 A 3 b iii Road transport: Heavy duty vehicles	4 %	55 %
1 A 1 a Public Electricity and Heat Production	4 %	59 %
2 C 1 Iron and steel production	4 %	63 %
2 A 7 a Quarrying and mining of minerals other than coal	3 %	66 %
1 A 3 b ii Road transport: Light duty vehicles	3 %	69 %
1 A 3 d ii National navigation (Shipping)	2 %	71 %
1 A 2 f ii Mobile Combustion in manufacturing industries and construction	2 %	73 %
1 A 3 b vi Road transport: Automobile tyre and brake wear	2 %	75 %
1 A 2 d Stationary combustion in manufacturing industries and construction: Pulp, Paper and Print	2 %	77 %
4 D 1 a Synthetic N-fertilizers	2 %	78 %
1 A 3 b vii Road transport: Automobile road abrasion	1 %	80 %
1 A 4 c i Agriculture/Forestry/Fishing: Stationary	1 %	81 %

NMVOC key categories	(%)	(%) cumul.
3 D 2 Domestic solvent use including fungicides	11 %	11 %
1 A 3 b i Road transport: Passenger cars	11 %	22 %
1 A 4 b i Residential: Stationary plants	10 %	32 %
3 A 3 Other coating application	7 %	39 %
3 D 3 Other product use	6 %	45 %
3 A 2 Industrial coating application	5 %	50 %
3 C Chemical products	5 %	54 %
3 A 1 Decorative coating application	4 %	58 %
2 D 2 Food and drink	3 %	61 %
3 B 1 Degreasing	2 %	64 %
1 B 2 a v Distribution of oil products	2 %	66 %
1 B 2 a i Exploration, production, transport	2 %	68 %
1 B 2 a iv Refining/storage	2 %	70 %
1 A 3 d ii National navigation (Shipping)	2 %	72 %
2 B 5 a Other chemical industry	2 %	73 %
1 A 3 b iii Road transport: Heavy duty vehicles	2 %	75 %
4 D 1 a Synthetic N-fertilizers	2 %	77 %
1 A 4 c ii Agriculture/Forestry/Fishing: Off-road vehicles and other machinery	2 %	79 %
3 D 1 Printing	2 %	80 %

NH_3 key categories	(%)	(%) cumul.
4 D 1 a Synthetic N-fertilizers	22 %	22 %
4 B 1 a Cattle dairy	20 %	42 %
4 B 1 b Cattle non-dairy	19 %	61 %
4 B 8 Swine	16 %	77 %
4 B 9 a Laying hens	4 %	81 %

PM_{10} key categories	(%)	(%) cumul.
1 A 4 b i Residential: Stationary plants	28 %	28 %
4 D 1 a Synthetic N-fertilizers	5 %	33 %
1 A 2 f i Stationary combustion in manufacturing industries and construction: Other	5 %	37 %
1 A 1 a Public Electricity and Heat Production	4 %	42 %
1 A 4 c ii Agriculture/Forestry/Fishing: Off-road vehicles and other machinery	4 %	46 %
2 C 1 Iron and steel production	4 %	50 %
1 A 3 b i Road transport: Passenger cars	4 %	54 %
2 A 7 a Quarrying and mining of minerals other than coal	4 %	57 %
1 A 3 b iii Road transport: Heavy duty vehicles	3 %	60 %
1 A 3 b vi Road transport: Automobile tyre and brake wear	3 %	63 %
4 B 8 Swine	2 %	66 %
2 G Other production, consumption, storage, transportation or handling of bulk products	2 %	68 %
1 A 3 b vii Road transport: Automobile road abrasion	2 %	69 %
1 A 3 b ii Road transport: Light duty vehicles	2 %	71 %
2 A 6 Road paving with asphalt	2 %	73 %
2 A 7 b Construction and demolition	2 %	75 %
1 A 4 c i Agriculture/Forestry/Fishing: Stationary	2 %	76 %
1 A 2 d Stationary combustion in manufacturing industries and construction: Pulp, Paper and Print	1 %	78 %
1 A 2 f ii Mobile Combustion in manufacturing industries and construction	1 %	79 %
1 A 3 d ii National navigation (Shipping)	1 %	80 %

Cd key categories	(%)	(%) cumul.
1 A 2 f i Stationary combustion in manufacturing industries and construction: Other	23 %	23 %
1 A 4 b i Residential: Stationary plants	20 %	43 %
1 A 1 a Public Electricity and Heat Production	10 %	53 %
2 C 1 Iron and steel production	9 %	62 %
1 A 2 b Stationary combustion in manufacturing industries and construction: Non-ferrous metals	6 %	68 %
1 A 4 c i Agriculture/Forestry/Fishing: Stationary	5 %	73 %
1 A 1 b Petroleum refining	4 %	77 %
1 A 4 a i Commercial/institutional: Stationary	4 %	80 %

Hg key categories	(%)	(%) cumul.
1 A 1 a Public Electricity and Heat Production	28 %	28 %
1 A 2 f i Stationary combustion in manufacturing industries and construction: Other	16 %	44 %
2 C 1 Iron and steel production	8 %	52 %
1 A 3 d ii National navigation (Shipping)	5 %	57 %
1 A 4 b i Residential: Stationary plants	5 %	62 %
1 A 1 c Manufacture of solid fuels and other energy industries	5 %	67 %
2 C 5 e Other metal production	4 %	71 %
1 A 2 a Stationary combustion in manufacturing industries and construction: Iron and steel	4 %	74 %
2 B 5 a Other chemical industry	3 %	78 %
1 A 1 b Petroleum refining	3 %	81 %

HCB key categories	(%)	(%) cumul.
2 C 1 Iron and steel production	63%	63%
4 G Agriculture other	10%	73%
1 A 4 b i Residential: Stationary plants	6%	79%
2 B 5 a Other chemical industry	5%	85%

PCDD/F key categories	(%)	(%) cumul.
1 A 4 b i Residential: Stationary plants	27 %	27 %
2 C 1 Iron and steel production	10 %	38 %
1 A 2 f i Stationary combustion in manufacturing industries and construction: Other	9 %	46 %
1 A 2 a Stationary combustion in manufacturing industries and construction: Iron and steel	9 %	55 %%
6 D Other waste	8 %	63 %
6 C b Industrial waste incineration	5 %	68 %
2 C 5 e Other metal production	4 %	73 %
1 A 1 a Public Electricity and Heat Production	4 %	76 %
1 A 2 b Stationary combustion in manufacturing industries and construction: Non-ferrous metals	3 %	80 %
6 C e Small scale waste burning	3 %	83 %

Pb key categories	(%)	(%) cumul.
1 A 2 f i Stationary combustion in manufacturing industries and construction: Other	15 %	15 %
2 C 1 Iron and steel production	15 %	31 %
1 A 2 b Stationary combustion in manufacturing industries and construction: Non-ferrous metals	14 %	45 %
2 C 5 b Lead production	9 %	54 %
1 A 4 b i Residential: Stationary plants	7 %	61 %
1 A 2 a Stationary combustion in manufacturing industries and construction: Iron and steel	7 %	68 %
2 C 5 e Other metal production	5 %	73 %
1 A 1 a Public Electricity and Heat Production	5 %	77 %
1 A 3 b vi Road transport: Automobile tyre and brake wear	4 %	82 %

PCB key categories	(%)	(%) cumul.
1 A 4 b i Residential: Stationary plants	22 %	22 %
2 F Consumption of POPs and heavy metals (e.g. electricial and scientific equipment)	19 %	41 %
2 C 1 Iron and steel production	12 %	54 %
1 A 1 a Public Electricity and Heat Production	11 %	64 %
6 C b Industrial waste incineration	6 %	70 %
6 C e Small scale waste burning	5 %	76 %
1 A 3 b iii Road transport: Heavy duty vehicles	5 %	81 %

Total PAH key categories	(%)	(%) cumul.
1 A 4 b i Residential: Stationary plants	50 %	50 %
4 F Field burning of agricultural wastes	9 %	59 %
1 A 3 b i Road transport: Passenger cars	8 %	66 %
2 C 3 Aluminum production	7 %	73 %
2 C 5 e Other metal production	3 %	77 %
1 A 2 b Stationary combustion in manufacturing industries and construction: Non-ferrous metals	3 %	80 %
1 B 1 b Fugitive emission from solid fuels: Solid fuel transformation	3 %	82 %

HCH key categories	(%)	(%) cumul.
2 A 7 d Other Mineral products	62 %	62 %
2 F Consumption of POPs and heavy metals (e.g. electricial and scientific equipment)	37 %	99 %

Note: The codes and descriptions shown correspond to the UNECE emissions reporting nomenclature – the Nomenclature For Reporting (NFR).

the key category threshold of 80 % of total emissions. For the particulate matter pollutants, the majority of the key categories were energy related, while for NMVOC almost half of the key categories are from activities associated with solvents and product use.

Eight key categories were identified for the heavy metal Cd, nine for Pb, and ten for Hg. Emissions from these key categories were all energy or industry related, particularly from processes associated with metal production.

For the persistent organic pollutants, key categories fell across a range of activities, including energy use, industrial processes, waste and agricultural activities. Generally, metal production was an

important source of POPs emissions, however emissions from residential households also contributed significantly 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 transfer of emission inventories submitted in NFR02 into the NFR09 format might lead to an over- or underestimation of a category affected by the mapping. Due to such issues, the EU-27 key category analysis 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.

2.4 Nitrogen oxides (NO_x) emission trends

Between 1990 and 2008, NO_x emissions decreased in the EU-27 by 39 %. Between 2007 and 2008 the decrease was 6.8 %, mainly caused by reductions

Table 2.4 Member States' contributions to European Union emissions of NO_x (Gg)

Member State	NO_x (Gg)											Change		Share in EU-27	
	1990	1995	2000	2001	2002	2003	2004	2005	2006	2007	2008	1990–2008	2007–2008	1990	2008
Austria	195	182	207	218	227	238	236	242	227	221	207	6 %	–6.2 %	1.1 %	2.0 %
Belgium	400	392	332	316	299	297	300	288	266	259	241	– 40 %	– 7.0 %	2.3 %	2.3 %
Bulgaria	242	151	128	138	197	209	216	233	246	187	192	– 21 %	3.1 %	1.4 %	1.8 %
Cyprus	15	18	21	20	21	21	21	21	20	21	20	27 %	– 6.2 %	0.1 %	0.2 %
Czech Republic	741	429	396	332	318	323	328	278	282	283	261	– 65 %	– 7.8 %	4.3 %	2.5 %
Denmark	274	266	201	198	195	204	188	181	182	169	152	– 45 %	– 10.2 %	1.6 %	1.5 %
Estonia	74	39	36	39	40	41	39	36	35	38	34	– 53 %	– 9.2 %	0.4 %	0.3 %
Finland	300	259	210	220	208	219	205	177	193	184	166	– 45 %	– 10.0 %	1.7 %	1.6 %
France	1 922	1 775	1 642	1 599	1 559	1 529	1 501	1 489	1 414	1 362	1 272	– 34 %	– 6.6 %	11.2 %	12.2 %
Germany	2 876	2 152	1 854	1 771	1 677	1 614	1 574	1 515	1 520	1 455	1 393	– 52 %	– 4.2 %	16.8 %	13.4 %
Greece	300	321	330	344	341	361	359	386	361	374	357	19 %	– 4.5 %	1.7 %	3.4 %
Hungary	238	190	185	183	183	180	180	203	208	190	183	– 23 %	– 3.4 %	1.4 %	1.8 %
Ireland	123	125	135	137	128	123	122	123	118	117	108	– 12 %	– 7.1 %	0.7 %	1.0 %
Italy	2 007	1 868	1 434	1 422	1 367	1 360	1 319	1 229	1 188	1 147	1 067	– 47 %	– 7.0 %	11.7 %	10.3 %
Latvia	73	44	40	43	42	43	42	41	41	41	38	– 48 %	– 7.2 %	0.4 %	0.4 %
Lithuania	136	51	46	44	51	51	53	58	61	69	68	– 50 %	– 2.2 %	0.8 %	0.7 %
Luxembourg	23	19	16	16	16	16	14	14	14	14	18	– 21 %	34.8 %	0.1 %	0.2 %
Malta	8	8	8	9	9	10	12	12	12	12	11	50 %	– 1.9 %	0.0 %	0.1 %
Netherlands	557	464	390	381	372	371	353	341	324	299	293	– 47 %	– 2.2 %	3.2 %	2.8 %
Poland	1 280	1 120	838	805	796	808	804	811	921	860	831	– 35 %	– 3.4 %	7.5 %	8.0 %
Portugal	236	272	299	301	311	291	294	298	275	263	252	7 %	– 4.2 %	1.4 %	2.4 %
Romania	459	386	304	328	342	353	367	323	326	309	295	– 36 %	– 4.6 %	2.7 %	2.8 %
Slovakia	222	178	107	108	100	96	99	104	97	97	95	– 57 %	– 1.5 %	1.3 %	0.9 %
Slovenia	58	61	50	50	49	49	48	46	47	45	47	– 19 %	5.7 %	0.3 %	0.5 %
Spain	1 341	1 379	1 394	1 365	1 408	1 401	1 447	1 434	1 402	1 416	1 236	– 8 %	– 12.7 %	7.8 %	11.9 %
Sweden	302	266	211	202	196	190	181	174	169	164	154	– 49 %	– 5.8 %	1.8 %	1.5 %
United Kingdom	2 749	2 254	1 877	1 834	1 734	1 753	1 708	1 682	1 654	1 557	1 403	– 49 %	– 9.9 %	16.0 %	13.5 %
EU-27 (a)	17 152	14 669	12 692	12 422	12 186	12 149	12 008	11 738	11 604	11 151	10 397	**– 39 %**	**– 6.8 %**	**100 %**	**100 %**
EU-27 (b)	17 164	14 683	12 705	12 435	12 207	12 149	12 008	11 736	11 604	11 149	10 401				

Note ([16]): (a) Sum of national totals as reported by Member States.

(b) Sum of national total emissions after re-allocation of Memo Items in line with the new UNECE Reporting Guidelines (UNECE, 2009) for countries that reported emissions in older NFR formats.

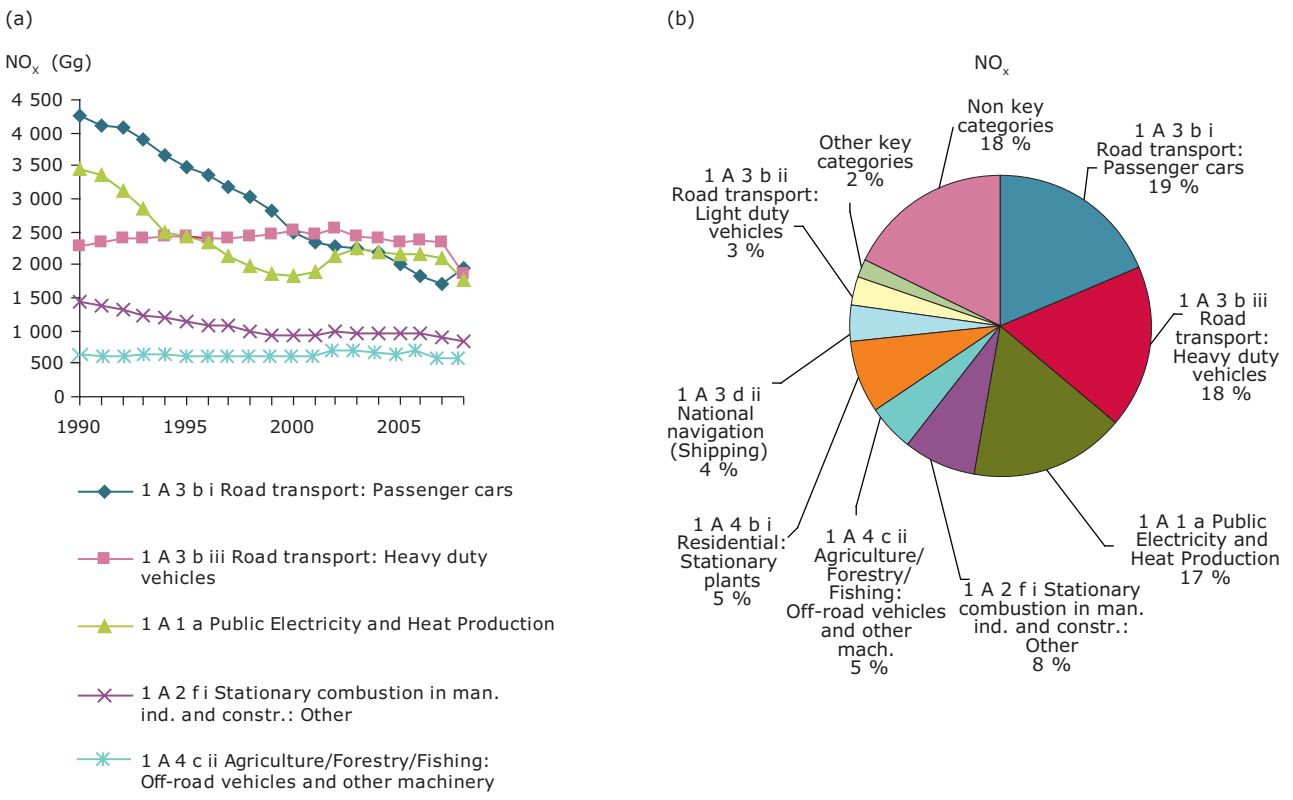
Negative percentage values indicate that emissions have fallen.

([16]) For this and the following tables, two EU-27 totals are given. The first corresponds to the sum of national totals officially reported by Member States. The second is a recalculated EU-27 total following the mapping of emissions reported in the older NFR formats to NFR09. As described earlier, the national totals in these respective reporting formats differ slightly due to the inclusion of different 'memo items' in the required total (see e.g. Appendix 3). Hence following a conversion of inventories in the NFR02 format to NFR09 and subsequent aggregation, the EU-27 total can also change.

reported in France, Spain and the United Kingdom (Table 2.4). The two Member States that contributed most to the emissions of NO_x in 2008 were Germany and the United Kingdom.

The sectors '1 A 3 b i – Road Transport: Passenger cars', '1 A 3 b iii – Road transport heavy duty vehicles' and '1 A 1 a – Public Electricity and Heat Production' were the most important key categories for NO_x emissions (Figure 2.2). Of the top five key categories, the highest relative reductions in emissions between 1990 and 2008 were achieved in the most important key category '1 A 3 b i – Road Transport passenger cars' (– 54 %) (Figure 2.2).

Figure 2.2 NO_x emissions from key categories in the EU-27: (a) trend in NO_x emissions from the five most important key categories, 1990–2008; (b) contribution of key categories to EU-27 emissions, 2008



Note: In some instances Member States did not report data but instead used the notation keys listed in Appendix 1.

Reduced emissions from the road transport sector have mainly resulted from the introduction of three-way catalytic converters on cars and stricter regulation of emissions from heavy goods vehicles across Europe. Nevertheless, the road transport sectors together represent the largest source of NO_x emissions, accounting for 40 % of total EU-27 emissions in 2008. In the electricity/energy production sectors reductions have also occurred, in these instances as a result of measures such as the introduction of combustion modification technologies (such as use of low NO_x burners), implementation of flue-gas abatement techniques (e.g. NO_x scrubbers and selective (SCR) and selective non-catalytic reduction (SNCR) techniques) and fuel-switching from coal to gas.

2.5 Non-methane volatile organic compounds (NMVOC) emission trends

Between 1990 and 2008, NMVOC emissions decreased in the EU-27 by 51 %. Between 2007 and

Table 2.5 Member State contributions to European Union NMVOC emissions (Gg)

Member State	NMVOC (Gg)											Change		Share in EU-27	
	1990	1995	2000	2001	2002	2003	2004	2005	2006	2007	2008	1990–2008	2007–2008	1990	2008
Austria	274	223	177	177	182	182	162	168	176	165	163	– 40 %	– 0.7 %	1.6 %	2.0 %
Belgium	314	267	203	195	181	171	158	150	143	124	119	– 62 %	– 4.5 %	1.9 %	1.4 %
Bulgaria	117	94	79	82	292	119	130	147	159	82	123	4 %	49.2 %	0.7 %	1.5 %
Cyprus	14	14	13	12	13	14	14	13	13	13	12	–18 %	– 10.4 %	0.1 %	0.1 %
Czech Republic	311	215	244	220	203	203	203	182	179	174	166	– 47 %	– 4.7 %	1.9 %	2.0 %
Denmark	192	168	143	135	131	126	123	121	116	111	106	– 45 %	– 3.9 %	1.1 %	1.3 %
Estonia	70	44	40	40	39	41	41	37	35	36	35	– 50 %	– 2.3 %	0.4 %	0.4 %
Finland	226	185	160	155	154	145	140	132	133	129	118	– 48 %	– 8.6 %	1.3 %	1.4 %
France	2 726	2 320	1 865	1 769	1 633	1 582	1 475	1 386	1 289	1 179	1 086	– 60 %	– 7.9 %	16.2 %	13.1 %
Germany	3 735	2 076	1 581	1 485	1 409	1 340	1 350	1 329	1 296	1 274	1 267	– 66 %	– 0.5 %	22.2 %	15.3 %
Greece	280	305	299	294	289	288	332	289	291	204	219	– 22 %	7.0 %	1.7 %	2.6 %
Hungary	205	150	166	162	160	155	157	177	177	148	141	– 31 %	– 4.7 %	1.2 %	1.7 %
Ireland	82	75	69	68	64	62	60	59	58	58	57	– 30 %	– 0.9 %	0.5 %	0.7 %
Italy	1 939	2 001	1 565	1 500	1 431	1 373	1 319	1 248	1 221	1 194	1 125	– 42 %	– 5.8 %	11.5 %	13.6 %
Latvia	102	62	56	57	58	59	59	59	58	57	54	– 47 %	– 4.8 %	0.6 %	0.7 %
Lithuania	110	72	70	66	72	80	75	84	78	74	71	– 35 %	– 2.9 %	0.7 %	0.9 %
Luxembourg	14	14	10	10	10	9	10	9	9	9	4	– 68 %	– 48.4 %	0.1 %	0.1 %
Malta	6	7	3	3	3	3	3	3	4	3	3	– 52 %	– 10.2 %	0.0 %	0.0 %
Netherlands	461	322	227	204	193	180	170	175	166	164	160	– 65 %	– 2.6 %	2.7 %	1.9 %
Poland	831	769	599	576	898	892	888	885	929	568	583	– 30 %	2.6 %	4.9 %	7.0 %
Portugal	299	268	244	232	230	221	214	209	205	201	198	– 34 %	– 1.5 %	1.8 %	2.4 %
Romania	335	281	265	266	282	301	359	332	353	436	449	34 %	3.1 %	2.0 %	5.4 %
Slovakia	141	101	67	71	69	70	72	74	71	68	68	– 52 %	0.2 %	0.8 %	0.8 %
Slovenia	63	62	49	48	46	45	44	43	41	41	38	– 40 %	– 6.5 %	0.4 %	0.5 %
Spain	1 036	975	1 018	998	922	933	921	885	873	863	816	– 21 %	– 5.6 %	6.2 %	9.8 %
Sweden	352	247	199	187	185	187	185	183	178	180	173	– 51 %	– 3.7 %	2.1 %	2.1 %
United Kingdom	2 569	2 087	1 488	1 392	1 317	1 201	1 128	1 070	1 029	1 012	942	– 63 %	– 6.9 %	15.3 %	11.4 %
EU-27 (a)	16 807	13 404	10 899	10 405	10 466	9 981	9 793	9 451	9 281	8 566	8 296	**– 51 %**	**– 3.2 %**	**100 %**	**100 %**
EU-27 (b)	16 861	13 441	10 918	10 424	10 484	10 033	9 840	9 495	9 297	8 568	8 296				

Note ([16]): (a) Sum of national totals as reported by Member States.

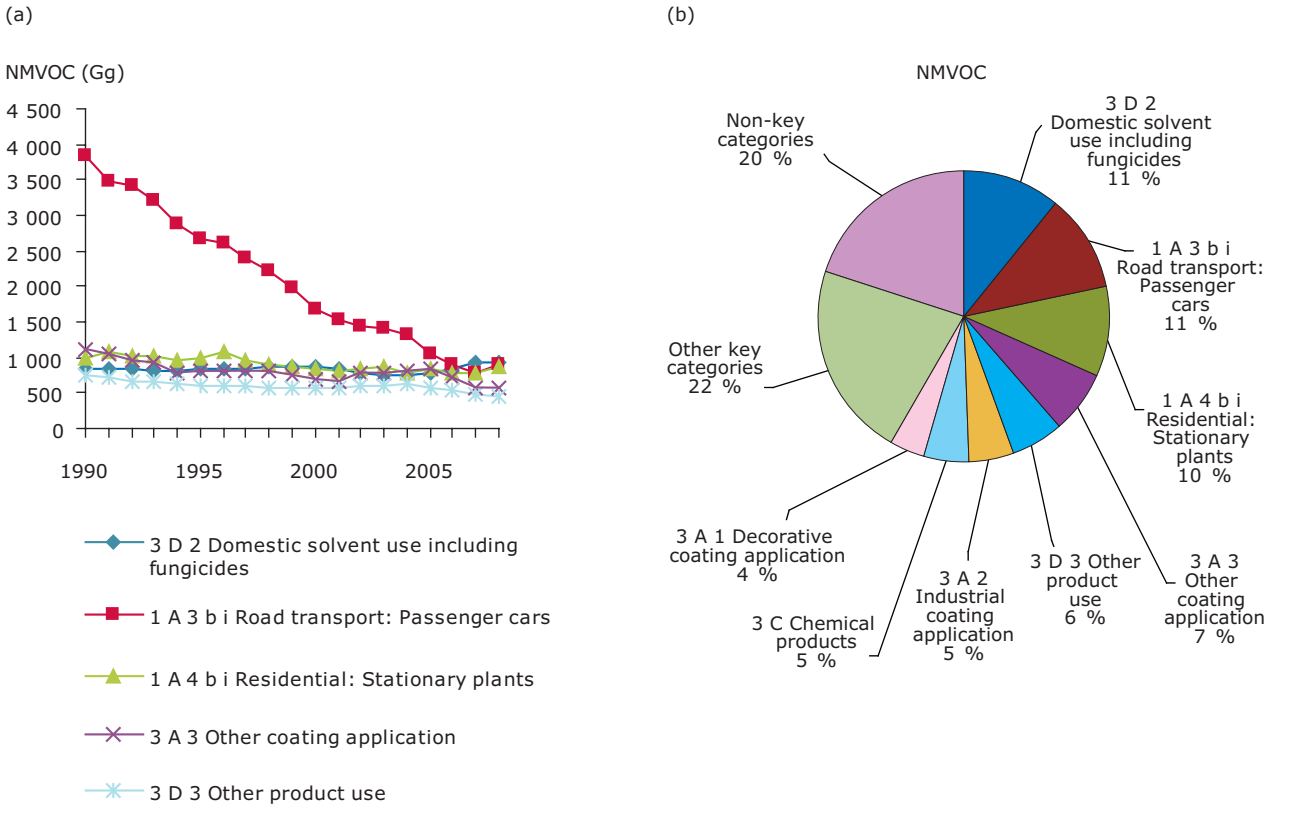
(b) Sum of national total emissions after re-allocation of Memo Items in line with the new UNECE Reporting Guidelines (UNECE, 2009) for countries that reported emissions in older NFR formats.

Negative percentage values indicate that emissions have fallen.

2008 the decrease was 3.2 %, mainly caused by reductions in France, Italy and the United Kingdom (Table 2.5). The two Member States that contributed most to emissions of NMVOC in 2008 were Germany and Italy.

The three sectors '3 D 2 – Domestic solvent use including fungicides', '1 A 3 b i – Road Transport: Passenger cars' and '1 A 4 b i – Residential: Stationary plants' were the most important key categories for NMVOC emissions, together comprising 32 % of the total (Figure 2.3). Among the top five key categories the highest relative reductions in emissions between 1990 and 2008 were achieved in the second most important key category '1 A 3 b i – Road Transport: Passenger cars' (–76 %) and, as was the case for NO_x, this largely reflects successful implementation of vehicle emission standards and use of vehicle exhaust catalytic converters.

Figure 2.3 NMVOC emissions from key categories in the EU-27: (a) trend in NMVOC emissions from the five most important key categories, 1990–2008; (b) contribution of key categories to EU-27 NMVOC emissions, 2008



Note: In some instances Member States did not report data but instead used the notation keys listed in Appendix 1.

2.6 Sulphur oxides (SO_x) emission trends

Between 1990 and 2008, SO_x emissions decreased in the EU-27 by 78 %. Between 2007 and 2008 the decrease was 20.1 %, mainly caused by reductions in Bulgaria, Poland and Spain (Inspection of the time series trends for some Member States shows some significant changes in emission reductions since 1990. For example, emissions of SO_x in Slovenia fell considerably in 2001 and again in 2006 due to the introduction of flue gas desulphurisation abatement equipment in thermal power plants.

Table 2.6). The two Member States that contributed most to the emissions of SO_x in 2008 were Bulgaria and Poland (Inspection of the time series trends for some Member States shows some significant changes in emission reductions since 1990. For example, emissions of SO_x in Slovenia fell considerably in 2001 and again in 2006 due to the introduction of flue gas desulphurisation abatement equipment in thermal power plants.

Inspection of the time series trends for some Member States shows some significant changes in emission reductions since 1990. For example,

Table 2.6 Member State contributions to European Union SO_x emissions (Gg)

Member State	SO_x (Gg)											Change		Share in EU-27	
	1990	1995	2000	2001	2002	2003	2004	2005	2006	2007	2008	1990–2008	2007–2008	1990	2008
Austria	74	47	32	33	32	32	28	28	28	25	22	– 70 %	– 9.2 %	0.3 %	0.4 %
Belgium	361	261	172	167	157	155	158	145	135	125	99	– 73 %	– 20.9 %	1.4 %	1.7 %
Bulgaria	1 517	1 300	1 045	1 096	965	968	929	900	877	859	735	– 52 %	– 14.4 %	5.8 %	12.5 %
Cyprus	30	37	46	43	44	45	38	36	29	27	22	– 27 %	– 19.3 %	0.1 %	0.4 %
Czech Republic	1 876	1 095	264	251	237	231	227	219	211	216	174	– 91 %	– 19.5 %	7.2 %	3.0 %
Denmark	178	138	29	27	26	32	26	23	26	24	20	– 89 %	– 19.4 %	0.7 %	0.3 %
Estonia	268	113	94	90	87	100	88	76	70	88	69	– 74 %	– 21.2 %	1.0 %	1.2 %
Finland	259	95	74	85	79	99	84	69	85	83	70	– 73 %	– 15.3 %	1.0 %	1.2 %
France	1 335	976	621	566	505	504	486	471	429	415	358	– 73 %	– 13.7 %	5.1 %	6.1 %
Germany	5 311	1 713	637	633	585	570	555	525	532	506	498	– 91 %	– 1.7 %	20.3 %	8.5 %
Greece	487	536	493	502	513	545	529	545	536	543	448	– 8 %	– 17.6 %	1.9 %	7.6 %
Hungary	1 010	705	489	404	365	347	247	129	118	84	88	– 91 %	3.8 %	3.9 %	1.5 %
Ireland	182	161	139	134	101	78	71	70	60	54	45	– 76 %	– 17.6 %	0.7 %	0.8 %
Italy	1 795	1 320	749	697	616	518	480	401	379	339	294	– 84 %	– 13.4 %	6.8 %	5.0 %
Latvia	102	49	15	11	10	8	5	5	4	4	3	– 97 %	– 22.6 %	0.4 %	0.0 %
Lithuania	214	85	42	38	43	38	41	44	43	39	32	– 85 %	– 18.4 %	0.8 %	0.5 %
Luxembourg	18	8	1	1	1	1	1	1	1	1	3	– 83 %	136.0 %	0.1 %	0.1 %
Malta	16	27	24	26	25	27	17	17	17	17	16	4 %	– 6.0 %	0.1 %	0.3 %
Netherlands	192	129	73	74	68	64	66	65	64	60	52	– 73 %	– 14.4 %	0.7 %	0.9 %
Poland	3 210	2 376	1 511	1 564	1 455	1 375	1 241	1 222	1 222	1 216	999	– 69 %	– 17.9 %	12.2 %	17.0 %
Portugal	292	305	281	264	261	176	177	180	159	154	107	– 63 %	– 30.6 %	1.1 %	1.8 %
Romania	757	639	460	506	540	532	514	831	863	575	562	– 26 %	– 2.3 %	2.9 %	9.6 %
Slovakia	526	246	127	131	103	105	96	89	88	71	69	– 87 %	– 1.6 %	2.0 %	1.2 %
Slovenia	203	130	99	66	69	63	54	41	18	15	14	– 93 %	– 7.9 %	0.8 %	0.2 %
Spain	2 176	1 791	1 463	1 439	1 541	1 277	1 321	1 272	1 170	1 170	527	– 76 %	– 55.0 %	8.3 %	9.0 %
Sweden	105	69	41	40	40	41	37	36	36	33	31	– 71 %	– 6.2 %	0.4 %	0.5 %
United Kingdom	3 715	2 352	1 226	1 105	978	968	813	687	669	595	512	– 86 %	– 13.9 %	14.2 %	8.7 %
EU-27 ([a])	26 208	16 703	10 248	9 995	9 447	8 902	8 331	8 126	7 869	7 339	5 867	**– 78 %**	**– 20.1 %**	**100 %**	**100 %**
EU-27 ([b])	26 208	16 704	10 251	9 996	9 448	8 911	8 338	8 138	7 869	7 339	5 867				

Note ([16]): ([a]) Sum of national totals as reported by Member States.

([b]) Sum of national total emissions after re-allocation of Memo Items in line with the new UNECE Reporting Guidelines (UNECE, 2009) for countries that reported emissions in older NFR formats.

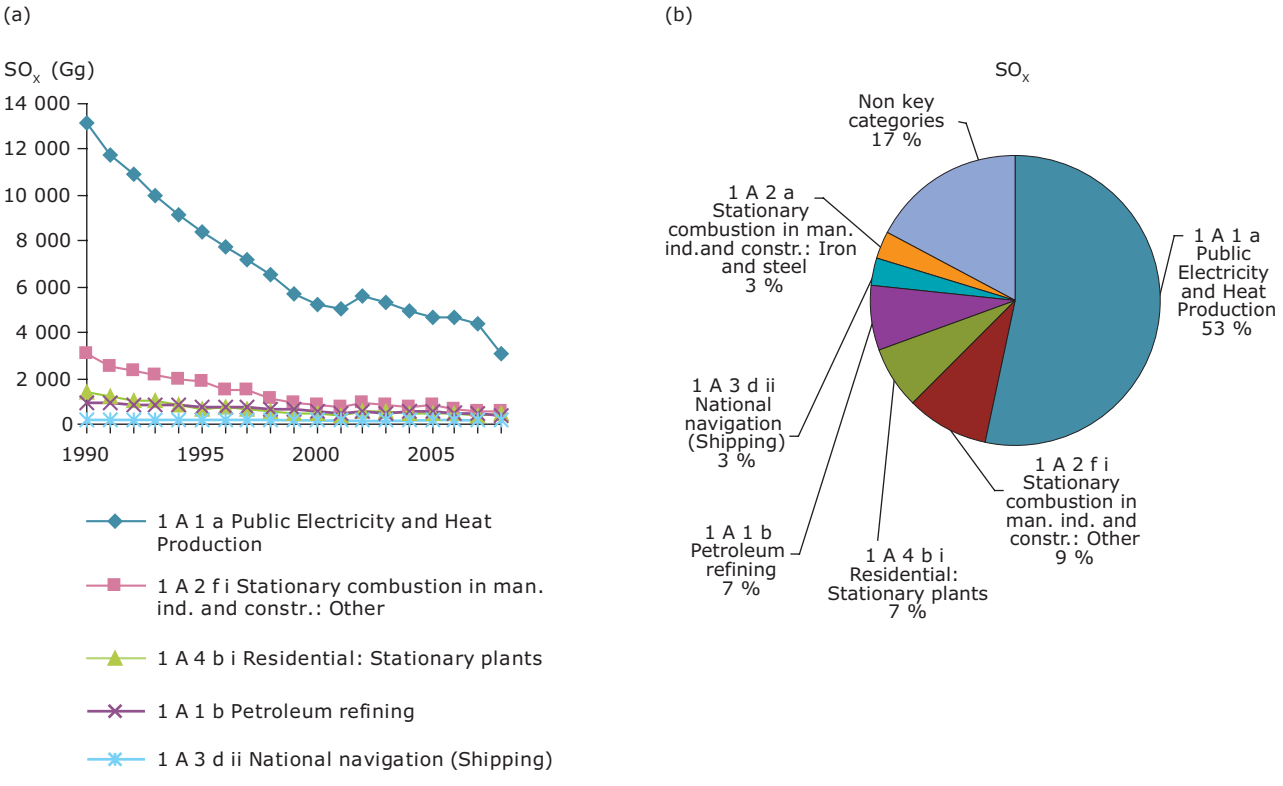
Negative percentage values indicate that emissions have fallen.

emissions of SO_x in Slovenia fell considerably in 2001 and again in 2006 due to the introduction of flue gas desulphurisation abatement equipment in thermal power plants.

The sector '1 A 1 a – Public Electricity and Heat Production' is the most important key category for SO_x emissions, comprising 53 % of total SO_x emissions (For these main emitting sources, the reduction in emissions since 1990 has been achieved as a result of a combination of measures, including switching fuel in energy-related sectors away from high sulphur solid and liquid fuels to low sulphur fuels such as natural gas, the fitting of flue gas desulphurisation abatement technology in industrial facilities and the impact of European Community directives relating to the sulphur content of certain liquid fuels.

Figure 2.4). Among the top five key categories the highest relative reduction in emissions between 1990 and 2008 were achieved in the second most important key category '1 A 2 f i – Stationary combustion in manufacturing industries and construction: Other' (– 82 %), the most important key category '1 A 1 a – Public Electricity and Heat Production' (– 76 %) and the third most important key category '1 A 4 b i – Residential: Stationary plants' (– 69 %) (For these main emitting sources, the reduction in emissions since 1990 has been achieved as a result of a combination of measures, including switching fuel in energy-related sectors away from high sulphur solid and liquid fuels to low sulphur fuels such as natural gas, the fitting of flue gas desulphurisation abatement technology in industrial facilities and the impact of European Community directives relating to the sulphur content of certain liquid fuels.

Figure 2.4 SO_x emissions from key categories in the EU-27: (a) trend in SO_x emissions from the five most important key categories, 1990–2008; (b) contribution of key categories to SO_x emissions, 2008



Note: In some instances Member States did not report data but instead used the notation keys listed in Appendix 1.

For these main emitting sources, the reduction in emissions since 1990 has been achieved as a result of a combination of measures, including switching fuel in energy-related sectors away from high sulphur solid and liquid fuels to low sulphur fuels such as natural gas, the fitting of flue gas desulphurisation abatement technology in industrial facilities and the impact of European Community directives relating to the sulphur content of certain liquid fuels.

2.7 Ammonia (NH_3) emission trends

Between 1990 and 2008, NH_3 emissions decreased in the EU-27 by 24 %. Between 2007 and 2008 the decrease was 2 %, mainly caused by reductions in Romania, Spain and the United Kingdom (Table 2.7). The two Member States that contributed most to the emissions of NH_3 in 2008 were France and Germany (Table 2.7).

Table 2.7 Member State contributions to European Union NH_3 emissions (Gg)

Member State	NH_3 (Gg)											Change		Share in EU-27	
	1990	1995	2000	2001	2002	2003	2004	2005	2006	2007	2008	1990–2008	2007–2008	1990	2008
Austria	65	71	65	64	64	64	63	63	63	64	63	– 4 %	– 1.1 %	1.3 %	1.7 %
Belgium	120	115	84	82	80	77	72	70	70	69	69	– 42 %	– 0.2 %	2.4 %	1.8 %
Bulgaria	144	99	109	56	56	52	54	57	55	58	58	– 60 %	0.0 %	2.9 %	1.5 %
Cyprus	5	6	6	6	6	6	6	6	5	5	5	4 %	0.8 %	0.1 %	0.1 %
Czech Republic	156	86	74	67	72	82	70	68	63	60	58	– 63 %	– 3.4 %	3.1 %	1.5 %
Denmark	111	96	88	85	83	80	80	76	74	74	74	– 33 %	– 0.6 %	2.2 %	1.9 %
Estonia	26	12	10	10	9	10	10	9	9	10	10	– 61 %	3.7 %	0.5 %	0.3 %
Finland	42	35	33	33	33	33	33	36	36	35	37	– 12 %	6.0 %	0.8 %	1.0 %
France	791	773	797	784	786	759	752	746	740	740	754	– 5 %	1.9 %	15.8 %	19.9 %
Germany	671	591	594	606	594	589	588	581	578	581	587	– 13 %	1.0 %	13.4 %	15.5 %
Greece	79	85	74	74	73	73	73	73	73	65	63	– 20 %	– 3.3 %	1.6 %	1.7 %
Hungary	124	77	84	66	65	67	74	80	81	71	69	– 45 %	– 2.5 %	2.5 %	1.8 %
Ireland	110	115	121	115	113	112	111	110	110	106	104	– 5 %	– 1.6 %	2.2 %	2.7 %
Italy	466	448	451	452	439	434	426	414	410	418	406	– 13 %	– 2.9 %	9.3 %	10.7 %
Latvia	48	16	13	15	15	15	15	16	16	16	16	– 66 %	0.6 %	1.0 %	0.4 %
Lithuania	84	38	25	38	51	34	33	39	35	36	29	– 65 %	– 19.8 %	1.7 %	0.8 %
Luxembourg	5	6	6	6	5	5	5	5	5	5	4	– 19 %	– 15.8 %	0.1 %	0.1 %
Malta	2	2	2	2	2	2	2	2	2	2	2	– 19 %	– 9.2 %	0.0 %	0.0 %
Netherlands	253	196	155	147	142	138	137	137	137	137	135	– 47 %	– 1.7 %	5.1 %	3.5 %
Poland	508	380	322	328	325	323	317	326	287	289	285	– 44 %	– 1.4 %	10.2 %	7.5 %
Portugal	63	60	63	61	60	55	55	54	51	52	51	– 20 %	– 2.0 %	1.3 %	1.3 %
Romania	300	217	206	164	156	182	191	204	199	203	187	– 38 %	– 7.9 %	6.0 %	4.9 %
Slovakia	65	40	32	32	33	32	29	29	27	27	25	– 61 %	– 6.4 %	1.3 %	0.7 %
Slovenia	20	18	19	19	20	19	17	18	18	19	18	– 12 %	– 5.3 %	0.4 %	0.5 %
Spain	318	311	380	381	378	392	386	367	378	388	358	13 %	– 7.7 %	6.4 %	9.4 %
Sweden	54	62	56	53	52	53	53	53	52	50	50	– 8 %	– 1.3 %	1.1 %	1.3 %
United Kingdom	366	343	330	324	317	307	311	305	305	295	282	– 23 %	– 4.6 %	7.3 %	7.4 %
EU-27 (a)	4 997	4 299	4 198	4 071	4 029	3 993	3 964	3 945	3 879	3 876	3 799	**– 24 %**	**– 2.0 %**	**100 %**	**100 %**
EU-27 (b)	4 996	4 299	4 198	4 071	4 029	3 993	3 963	3 944	3 878	3 876	3 799				

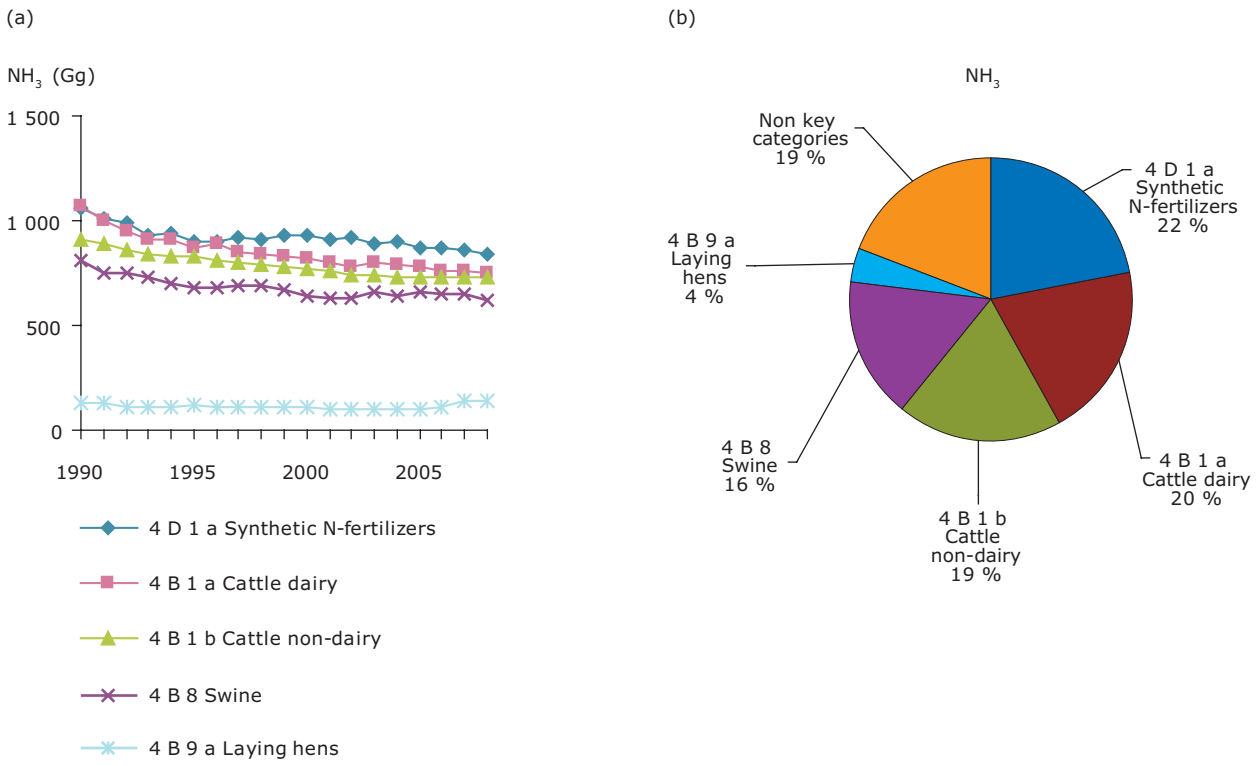
Note ([16]): (a) Sum of national totals as reported by Member States.

(b) Sum of national total emissions after re-allocation of Memo Items in line with the new UNECE Reporting Guidelines (UNECE, 2009) for countries that reported emissions in older NFR formats.

Negative percentage values indicate that emissions have fallen.

Sectors '4 D 1 a – Synthetic N-fertilizers', '4 B 1 a – Cattle Dairy and 4 B 1 b – Cattle Non-Dairy' are the most important key categories for NH_3 emissions, together comprising 61 % of total NH_3 emissions (Figure 2.5). Among the top five key categories the highest relative reduction in emissions between 1990 and 2008 was achieved in the second most important key category '4 B 1 a – Cattle Dairy' (– 30 %). The fall in NH_3 emissions in the agricultural sector was primarily due to reduced livestock numbers (especially cattle) since 1990, changes in the handling and management of organic manures and decreased use of nitrogenous fertilisers.

Figure 2.5 NH_3 emissions from key categories in the EU-27: (a) trend in NH_3 emissions from the five most important key categories, 1990–2008; (b) contribution of key categories to NH_3 emissions, 2008



Note: In some instances Member States did not report data but instead used the notation keys listed in Appendix 1.

2.8 Particulate matter $PM_{2.5}$ emission trends

Greece and Luxembourg did not report $PM_{2.5}$ emissions for any year and thus data for these countries could not be gap-filled. The EU-27 total is therefore underestimated. Between 2000 and 2008, $PM_{2.5}$ emissions decreased in the EU-27 by 13 %. Between 2007 and 2008, $PM_{2.5}$ emissions rose by 0.2 %, mainly due to increases in Bulgaria and Romania (Table 2.7). The two Member States that contributed most to the emissions of $PM_{2.5}$ in 2008 were France and Poland (Table 2.8).

Table 2.8 Member State contributions to European Union $PM_{2.5}$ emissions (Gg)

Member State	$PM_{2.5}$ (Gg)									Change		Share in EU-27	
	2000	2001	2002	2003	2004	2005	2006	2007	2008	2000–2008	2007–2008	2000	2008
Austria	22	23	22	22	22	23	21	21	21	– 6 %	0.5 %	1.4 %	1.5 %
Belgium	33	30	30	29	28	25	25	22	20	– 41 %	– 9.1 %	2.1 %	1.4 %
Bulgaria	1	1	1	1	1	1	1	1	24	1864 %	1863.7 %	0.1 %	1.7 %
Cyprus	3	3	3	3	3	3	3	3	3	– 4 %	– 1.9 %	0.2 %	0.2 %
Czech Republic	56	49	44	38	35	21	22	21	21	– 62 %	– 1.1 %	3.5 %	1.5 %
Denmark	22	23	22	24	24	25	26	30	28	26 %	– 6.2 %	1.4 %	2.0 %
Estonia	21	22	23	21	22	20	15	20	20	– 5 %	– 1.5 %	1.3 %	1.4 %
Finland	37	38	39	38	38	34	35	34	36	– 1 %	5.1 %	2.3 %	2.6 %
France	378	367	344	344	337	319	301	288	282	– 25 %	– 2.1 %	23.5 %	20.1 %
Germany	137	134	128	125	123	119	119	113	110	– 19 %	– 2.7 %	8.5 %	7.9 %
Greece	NE	NE	NE	NE	NE	NE	NE	NE	NE				
Hungary	26	24	25	27	27	31	29	21	23	– 12 %	6.1 %	1.6 %	1.6 %
Ireland	12	12	11	11	11	11	11	10	10	– 16 %	– 3.4 %	0.7 %	0.7 %
Italy	161	158	147	143	144	133	130	131	124	– 23 %	– 5.1 %	10.0 %	8.8 %
Latvia	23	25	25	26	27	27	26	26	25	11 %	– 1.5 %	1.4 %	1.8 %
Lithuania	9	9	9	9	9	9	9	10	10	17 %	8.4 %	0.5 %	0.7 %
Luxembourg	NE	NE	NE	NE	NE	NE	NE	NE	NE				
Malta	1	1	1	1	1	1	1	1	1	40 %	– 0.2 %	0.1 %	0.1 %
Netherlands	25	24	23	23	21	21	20	20	19	– 23 %	– 2.8 %	1.6 %	1.4 %
Poland	135	142	142	142	134	138	136	134	131	– 3 %	– 2.1 %	8.4 %	9.3 %
Portugal	98	98	91	91	103	97	95	96	97	– 1 %	0.3 %	6.1 %	6.9 %
Romania	108	108	108	108	108	108	108	108	125	16 %	15.6 %	6.7 %	8.9 %
Slovakia	32	32	29	27	31	40	35	28	27	– 16 %	– 6.1 %	2.0 %	1.9 %
Slovenia	15	15	14	14	14	14	14	14	14	– 8 %	– 3.2 %	0.9 %	1.0 %
Spain	127	127	129	130	130	131	130	134	125	– 1 %	– 6.8 %	7.8 %	8.9 %
Sweden	28	28	28	29	29	29	29	29	27	– 4 %	– 6.0 %	1.8 %	1.9 %
United Kingdom	103	99	88	87	87	86	86	84	81	– 21 %	– 3.7 %	6.4 %	5.8 %
EU-27 (a)	1 612	1 593	1 526	1 514	1 510	1 466	1 428	1 400	1 403	**– 13 %**	**0.2 %**	**100 %**	**100 %**
EU-27 (b)	1 612	1 593	1 526	1 514	1 510	1 466	1 428	1 400	1 403				

Note ([16]): (a) Sum of national totals as reported by Member States.

(b) Sum of national total emissions after re-allocation of Memo Items in line with the new UNECE Reporting Guidelines (UNECE, 2009) for countries that reported emissions in older NFR formats.

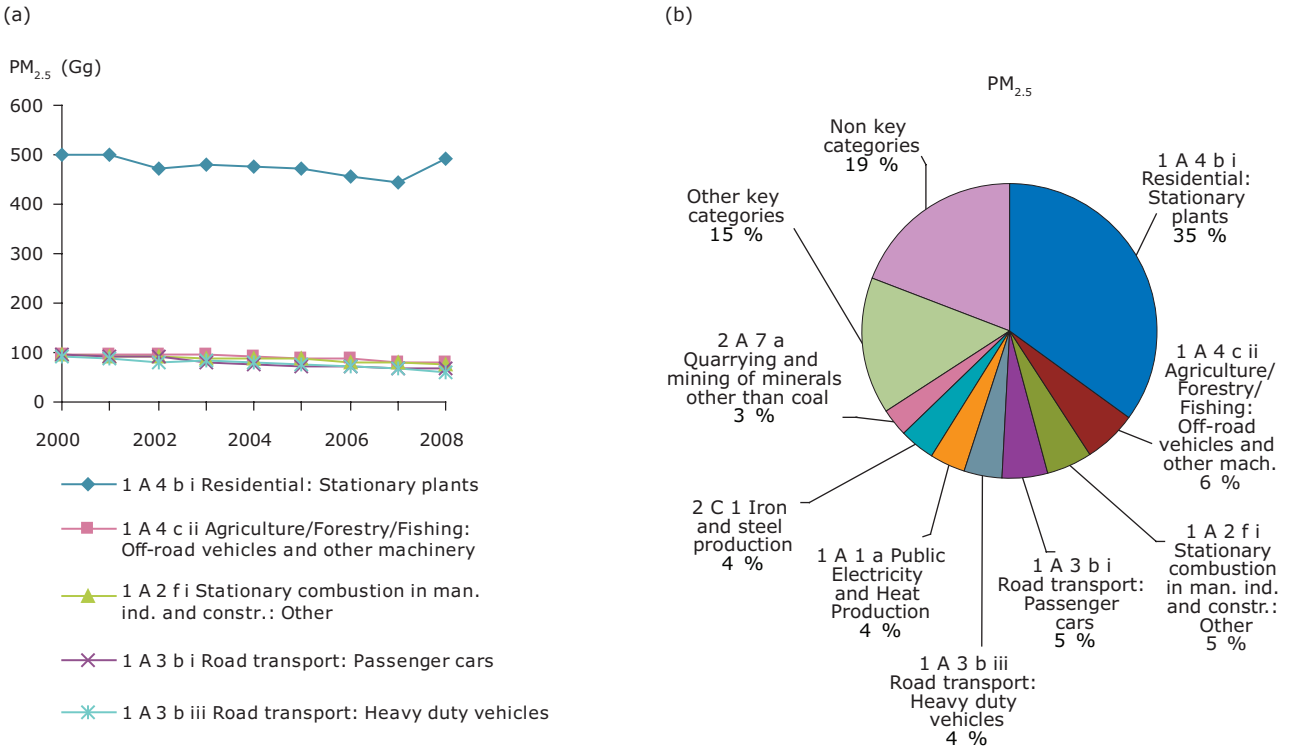
Parties to the LRTAP Convention are formally requested to report emissions of particulate matter (PM) only for the years 2000 and onwards.

Negative percentage values indicate that emissions have fallen.

See Appendix 1 for an explanation of the notation keys reported by Member States.

Domestic fuel use in the residential sector '1 A 4 b i – Residential: Stationary Plants' is the most important key category for $PM_{2.5}$ emissions, comprising 35 % of total $PM_{2.5}$ emissions (Figure 2.6). Among the top five key categories the highest relative reductions in emissions between 2000 and 2008 were achieved in the fifth most important key category '1 A 3 b iii – Road Transport: Heavy duty vehicles' (– 33 %) and the fourth most important key category '1 A 3 b i – Road Transport: Passenger cars' (– 29 %).

Figure 2.6 $PM_{2.5}$ emissions from key categories in the EU-27: (a) trend in $PM_{2.5}$ emissions from the five most important key categories, 1990–2008; (b) contribution of key categories to $PM_{2.5}$ emissions, 2008



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

In some instances Member States did not report data but instead used the notation keys listed in Appendix 1.

2.9 Particulate matter PM_{10} emission trends

Greece and Luxembourg did not report PM_{10} emissions for any year and thus data for these countries could not be gap-filled. The EU-27 total is underestimated. Between 2000 and 2008 PM_{10} decreased in the EU-27 by 8 %. Between 2007 and 2008 emissions increased by 0.2 %. High increases were reported by Bulgaria and Romania (Table 2.9). The two Member States that contributed most to the emissions of PM_{10} in 2008 were France and Poland

Table 2.9 Member State contributions to European Union PM_{10} emissions (Gg)

Member State	PM_{10} (Gg)									Change		Share in EU-27	
	2000	2001	2002	2003	2004	2005	2006	2007	2008	2000–2008	2007–2008	2000	2008
Austria	37	37	36	36	36	37	35	35	36	– 3 %	1.8 %	1.6 %	1.7 %
Belgium	48	45	44	44	42	38	37	33	30	– 37 %	– 7.8 %	2.1 %	1.4 %
Bulgaria	16	16	16	16	16	16	16	16	59	260 %	259.8 %	0.7 %	2.8 %
Cyprus	5	4	4	4	4	4	4	4	4	– 13 %	– 2.7 %	0.2 %	0.2 %
Czech Republic	46	43	51	51	47	34	35	35	35	– 24 %	0.9 %	2.0 %	1.6 %
Denmark	30	30	29	31	31	33	34	37	35	18 %	– 6.1 %	1.3 %	1.6 %
Estonia	37	37	33	30	30	26	20	28	25	– 32 %	– 12.0 %	1.6 %	1.2 %
Finland	47	54	55	55	57	51	55	48	49	5 %	2.4 %	2.0 %	2.3 %
France	566	551	524	525	517	493	474	459	452	– 20 %	– 1.6 %	24.6 %	21.3 %
Germany	237	231	223	217	217	211	211	207	203	– 14 %	– 1.9 %	10.3 %	9.6 %
Greece	NE	NE	NE	NE	NE	NE	NE	NE	NE				
Hungary	47	43	44	48	47	52	48	36	38	– 20 %	6.0 %	2.0 %	1.8 %
Ireland	18	18	17	16	16	17	16	15	15	– 16 %	– 2.7 %	0.8 %	0.7 %
Italy	192	191	179	175	177	165	162	163	156	– 19 %	– 4.1 %	8.4 %	7.3 %
Latvia	24	27	26	28	28	28	27	27	27	10 %	– 1.6 %	1.0 %	1.3 %
Lithuania	9	10	10	10	11	11	11	12	12	31 %	5.9 %	0.4 %	0.6 %
Luxembourg	NE	NE	NE	NE	NE	NE	NE	NE	NE				
Malta	1	2	2	2	2	2	2	2	2	54 %	1.2 %	0.1 %	0.1 %
Netherlands	44	42	41	39	38	38	37	37	37	– 16 %	– 1.3 %	1.9 %	1.7 %
Poland	282	300	474	303	280	289	285	269	263	– 7 %	– 2.0 %	12.3 %	12.4 %
Portugal	127	135	122	117	133	130	123	125	125	– 2 %	– 0.1 %	5.5 %	5.9 %
Romania	47	47	47	47	47	47	46	130	144	208 %	11.3 %	2.0 %	6.8 %
Slovakia	39	40	35	34	36	45	39	34	32	– 18 %	– 7.3 %	1.7 %	1.5 %
Slovenia	18	18	17	17	17	17	18	17	15	– 16 %	– 9.9 %	0.8 %	0.7 %
Spain	170	171	174	174	174	173	171	175	160	– 6 %	– 8.7 %	7.4 %	7.5 %
Sweden	40	40	40	41	41	42	41	41	39	– 3 %	– 4.9 %	1.8 %	1.8 %
United Kingdom	172	164	142	141	141	138	139	137	133	– 23 %	– 2.9 %	7.5 %	6.3 %
EU-27 [a]	2 299	2 297	2 387	2 202	2 186	2 137	2 088	2 122	2 126	**– 8 %**	**0.2 %**	**100 %**	**100 %**
EU-27 [b]	2 299	2 302	2 391	2 202	2 186	2 137	2 088	2 122	2 126				

Note [16]**:** [a] Sum of national totals as reported by Member States.

[b] Sum of national total emissions after re-allocation of Memo Items in line with the new UNECE Reporting Guidelines (UNECE, 2009) for countries that reported emissions in older NFR formats.

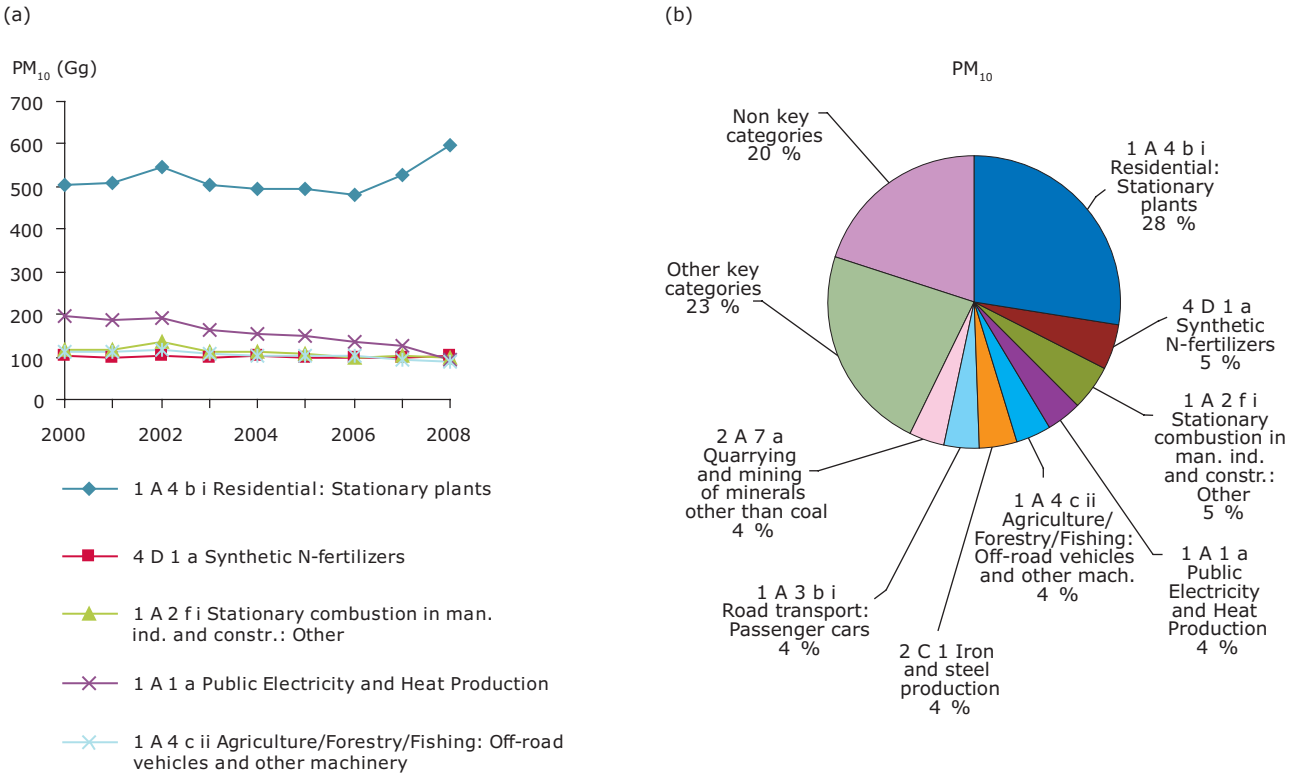
Parties to the LRTAP Convention are formally requested to report emissions of particulate matter (PM) only for the years 2000 and onwards.

Negative percentage values indicate that emissions have fallen.

See Appendix 1 for an explanation of the notation keys reported by Member States.

As for $PM_{2.5}$, the residential sector '1 A 4 b i – Residential: Stationary Plants' is the most important key category for PM_{10} emissions, accounting for 28 % of total PM_{10} emissions (Figure 2.7). Among the top five key categories the highest relative reductions in emissions between 1990 and 2008 were achieved in the fourth most important key category '1 A 1 a – Public Electricity and Heat Production' (– 52 %) (Figure 2.7).

Figure 2.7 PM_{10} emissions from key categories in the EU-27: (a) trend in PM_{10} emissions from the five most important key categories, 1990– 2008; (b) contribution of key categories to PM_{10} emissions, 2008



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

In some instances Member States did not report data but instead used the notation keys listed in Appendix 1.

2.10 Carbon monoxide (CO) emission trends

Between 1990 and 2008, CO emissions decreased in the EU-27 by 58 %. Between 2007 and 2008 the decrease was 2.9 %, mainly caused by reductions in France, Italy and the United Kingdom (Table 2.10). Bulgaria reported an increase of more than 60 % between 2007 and 2008. The two Member States that contributed most to the emissions of CO in 2008 were France and Germany.

Table 2.10 Member State contributions to European Union CO emissions (Gg)

Member State	CO (Gg)											Change		Share in EU-27	
	1990	1995	2000	2001	2002	2003	2004	2005	2006	2007	2008	1990–2008	2007–2008	1990	2008
Austria	1 435	1 276	966	930	891	885	842	832	786	742	696	– 52 %	– 6.2 %	2.2 %	2.6 %
Belgium	1 379	1 116	1 071	1 013	983	951	898	839	818	588	592	– 57 %	0.8 %	2.1 %	2.2 %
Bulgaria	790	644	635	583	700	716	755	740	785	250	409	– 48 %	63.4 %	1.2 %	1.5 %
Cyprus	43	38	30	30	29	29	29	27	25	24	23	– 47 %	– 7.9 %	0.1 %	0.1 %
Czech Republic	1 030	897	643	649	546	578	572	511	484	509	439	– 57 %	– 13.8 %	1.6 %	1.6 %
Denmark	722	649	476	471	448	455	442	451	442	455	436	– 40 %	– 4.2 %	1.1 %	1.6 %
Estonia	286	205	179	187	182	180	175	159	146	165	168	– 41 %	1.5 %	0.4 %	0.6 %
Finland	561	436	610	604	600	564	551	522	510	501	485	– 13 %	– 3.1 %	0.9 %	1.8 %
France	10 846	9 281	6 696	6 274	6 070	5 757	5 924	5 408	4 890	4 608	4 435	– 59 %	– 3.8 %	16.8 %	16.3 %
Germany	12 181	6 590	5 050	4 783	4 484	4 275	4 075	3 843	3 820	3 777	3 755	– 69 %	– 0.6 %	18.9 %	13.8 %
Greece	1 302	1 334	1 364	1 275	1 244	1 200	637	1 075	956	726	685	– 47 %	– 5.6 %	2.0 %	2.5 %
Hungary	997	636	581	568	563	600	559	587	569	507	512	– 49 %	0.9 %	1.5 %	1.9 %
Ireland	418	317	255	244	225	214	201	190	181	171	162	– 61 %	– 5.0 %	0.6 %	0.6 %
Italy	6 927	6 876	4 857	4 646	4 218	4 064	3 881	3 506	3 342	3 334	3 030	– 56 %	– 9.1 %	10.7 %	11.1 %
Latvia	509	385	309	318	304	308	306	304	296	285	271	– 47 %	– 5.0 %	0.8 %	1.0 %
Lithuania	499	279	1 528	217	224	221	183	190	200	208	222	– 56 %	6.6 %	0.8 %	0.8 %
Luxembourg	17	10	7	7	7	7	4	4	4	3	2	– 91 %	– 37.7 %	0.0 %	0.0 %
Malta	24	30	1	1	1	1	1	1	1	1	1	– 96 %	0.8 %	0.0 %	0.0 %
Netherlands	1 093	845	687	667	642	623	628	600	590	567	559	– 49 %	– 1.3 %	1.7 %	2.1 %
Poland	7 406	4 547	3 463	3 528	3 410	2 626	3 426	3 333	2 804	2 553	2 674	– 64 %	4.7 %	11.5 %	9.8 %
Portugal	817	775	671	603	590	569	562	544	520	505	486	– 40 %	– 3.8 %	1.3 %	1.8 %
Romania	824	1 370	1 192	1 237	1 230	1 268	1 610	1 496	1 417	1 447	1 452	76 %	0.3 %	1.3 %	5.3 %
Slovakia	505	416	308	315	296	301	303	289	285	261	251	– 50 %	– 4.0 %	0.8 %	0.9 %
Slovenia	310	296	208	199	191	181	167	161	154	155	147	– 52 %	– 4.7 %	0.5 %	0.5 %
Spain	3 654	3 165	2 675	2 609	2 380	2 453	2 312	2 126	2 113	2 101	1 995	– 45 %	– 5.0 %	5.7 %	7.3 %
Sweden	937	866	664	626	610	613	583	581	549	551	520	– 44 %	– 5.6 %	1.5 %	1.9 %
United Kingdom	9 014	7 498	5 645	5 260	4 635	4 169	3 868	3 474	3 264	3 045	2 822	– 69 %	– 7.3 %	14.0 %	10.4 %
EU-27 (a)	64 526	50 779	40 771	37 842	35 703	33 807	33 489	31 794	29 951	28 038	27 228	**– 58 %**	**– 2.9 %**	**100 %**	**100 %**
EU-27 (b)	64 532	50 789	40 782	37 852	35 712	34 500	33 482	31 799	29 959	28 046	27 232				

Note ([16]): (a) Sum of national totals as reported by Member States.

(b) Sum of national total emissions after re-allocation of Memo Items in line with the new UNECE Reporting Guidelines (UNECE, 2009) for countries that reported emissions in older NFR formats.

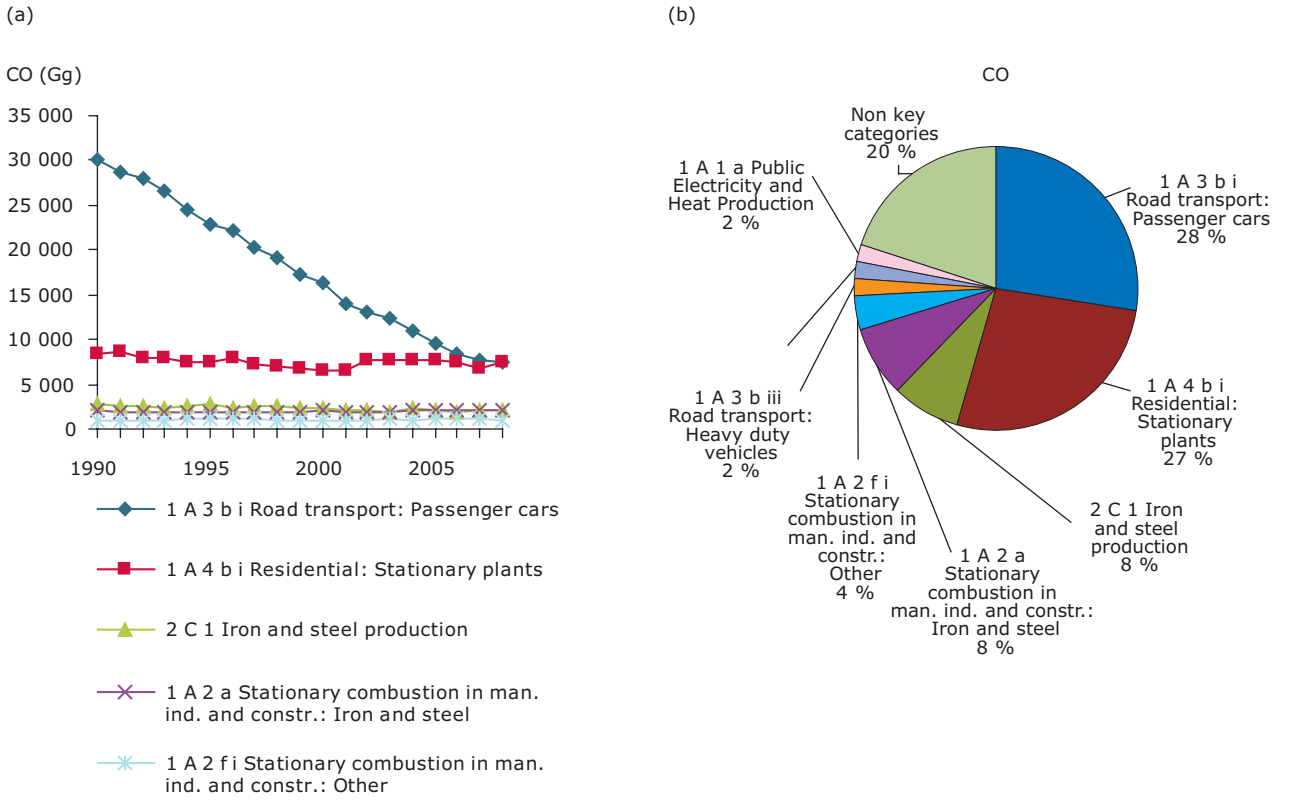
Negative percentage values indicate that emissions have fallen.

For Malta emission trends used in this report are a combination of data submitted to the UNFCCC and to the LRTAP Convention, however these two data sets appear not to be totally consistent. Data for CO submitted by Malta to UNFCCC are:

Malta	1990	1995	2000	2001	2002	2003	2004	2005	2006	2007	2008
CO (Gg)	23.88	30.23	30.09	29.32	28.83	28.73	28.18	27.85	28.58	29.47	30.27

'1 A 3 b i – Road Transport: Passenger Cars' and '1 A 4 b i – Residential: Stationary Plants' were the most important key categories for CO emissions, together accounting for 55 % of total CO emissions (Figure 2.8). Among the top five key categories the highest relative reductions in emissions between 1990 and 2008 were achieved in the most important key category 1 A 3 b i – Road Transport: Passenger Cars (– 75 %) (Figure 2.8).

Figure 2.8 CO emissions from key categories in the EU-27: (a) trend in CO emissions from the five most important key categories, 1990–2008; (b) contribution of key categories to EU-27 CO emissions, 2008



Note: In some instances Member States did not report data but instead used the notation keys listed in Appendix 1.

2.11 Lead (Pb) emission trends

Luxembourg did not report Pb emissions for any year and thus data were not gap-filled. Therefore, the EU-27 total is underestimated. Between 1990 and 2008, Pb emissions decreased in the EU-27 by 90 %. Between 2007 and 2008, however, emissions increased by 6.3 % (Table 2.11). Belgium, Bulgaria and Slovakia reported increases of more than 10 % between 2007 and 2008. The two Member States that contributed most to the emissions of Pb in 2008 were Bulgaria and Poland.

The sectors '1 A 2 f i – Stationary Combustion in Manufacturing Industries and Construction: Other' and '2 C 1 – Iron and Steel Production' and '1 A 2 b – Stationary Combustion in Manufacturing Industries and Construction: Non-Ferrous Metals' were the

Table 2.11 Member State contributions to European Union Pb emissions (Mg)

Member State	Pb (Mg)											Change		Share in EU-27	
	1990	1995	2000	2001	2002	2003	2004	2005	2006	2007	2008	1990–2008	2007–2008	1990	2008
Austria	219	16	12	12	12	13	13	14	14	14	15	– 93 %	1.5 %	1.0 %	0.6 %
Belgium	436	237	104	87	81	77	86	76	71	56	66	– 85 %	18.1 %	1.9 %	2.9 %
Bulgaria	436	297	200	177	105	148	143	115	124	124	297	– 32 %	139.3 %	1.9 %	13.0 %
Cyprus	25	26	20	20	18	17	7	2	2	2	3	– 90 %	5.0 %	0.1 %	0.1 %
Czech Republic	269	180	108	47	47	39	37	47	43	44	39	– 86 %	– 11.9 %	1.2 %	1.7 %
Denmark	122	15	10	10	9	9	9	9	8	8	8	– 93 %	6.1 %	0.5 %	0.4 %
Estonia	134	63	32	31	31	36	35	34	31	40	34	– 74 %	– 13.2 %	0.6 %	1.5 %
Finland	327	56	36	38	40	34	28	24	25	22	20	– 94 %	– 7.7 %	1.5 %	0.9 %
France	4 257	1 436	237	202	196	143	126	122	113	108	95	– 98 %	– 12.2 %	19.0 %	4.2 %
Germany	1 870	348	114	116	115	113	112	112	116	117	116	– 94 %	– 0.3 %	8.3 %	5.1 %
Greece	70	70	70	70	70	70	70	70	70	70	70	0 %	0.0 %	0.3 %	3.1 %
Hungary	663	130	42	51	34	34	34	38	37	35	36	– 95 %	3.9 %	3.0 %	1.6 %
Ireland	125	80	18	17	16	16	16	17	17	17	17	– 87 %	0.2 %	0.6 %	0.7 %
Italy	4 372	1 988	936	703	237	242	256	266	274	274	279	– 94 %	2.0 %	19.5 %	12.2 %
Latvia	63	47	10	10	10	11	11	8	8	9	8	– 87 %	– 5.1 %	0.3 %	0.4 %
Lithuania	47	30	16	15	15	15	5	6	6	7	7	– 85 %	8.3 %	0.2 %	0.3 %
Luxembourg	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR				
Malta	0	1	1	1	1	1	1	1	1	1	1	105 %	– 10.1 %	0.0 %	0.0 %
Netherlands	338	162	36	41	45	41	43	39	39	45	45	– 87 %	0.5 %	1.5 %	2.0 %
Poland	1 372	937	648	610	588	596	544	536	589	553	551	– 60 %	– 0.5 %	6.1 %	24.0 %
Portugal	554	772	74	89	86	88	89	79	71	66	58	– 90 %	– 12.7 %	2.5 %	2.5 %
Romania	162	162	162	162	162	162	162	162	118	106	90	– 45 %	– 15.2 %	0.7 %	3.9 %
Slovakia	150	71	75	72	76	84	78	83	83	68	78	– 48 %	14.9 %	0.7 %	3.4 %
Slovenia	347	198	42	24	14	13	14	13	14	14	15	– 96 %	3.8 %	1.5 %	0.7 %
Spain	2 788	967	626	409	275	271	267	274	276	275	269	– 90 %	– 2.1 %	12.4 %	11.7 %
Sweden	361	36	26	23	20	19	18	15	14	11	9	– 97 %	– 14.6 %	1.6 %	0.4 %
United Kingdom	2 890	1 530	150	142	131	116	118	109	82	72	67	– 98 %	– 6.6 %	12.9 %	2.9 %
EU-27 (a)	22 398	9 856	3 805	3 179	2 434	2 409	2 320	2 269	2 244	2 157	2 293	**– 90 %**	**6.3 %**	**100 %**	**100 %**
EU-27 (b)	22 337	9 791	3 738	3 110	2 364	2 337	2 250	2 198	2 173	2 086	2 224				

Note (16)**:** (a) Sum of national totals as reported by Member States.

(b) Sum of national total emissions after re-allocation of Memo Items in line with the new UNECE Reporting Guidelines (UNECE, 2009) for countries that reported emissions in older NFR formats.

Negative percentage values indicate that emissions have fallen.

See Appendix 1 for an explanation of the notation keys reported by Member States.

Empty cells indicate instances where gap-filling has not yet been applied.

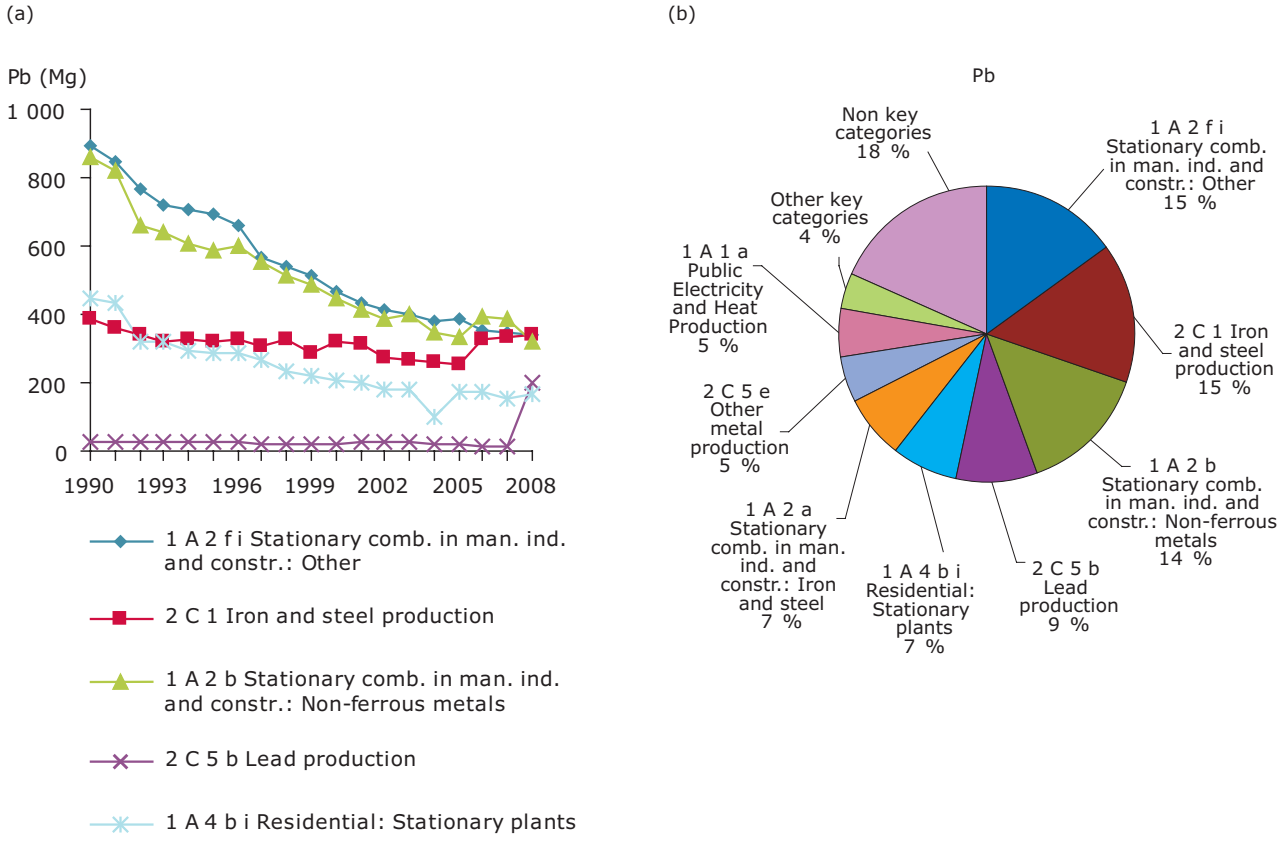
most important key categories for Pb emissions, together comprising 45 % of total Pb emissions (Figure 2.9).

The largest relative reductions in emissions between 1990 and 2008 were from the fifth most important key category '1 A 4 b i – Residential: Stationary Plants', the third most important key category '1 A 2 b – Stationary Combustion in Manufacturing Industries and Construction: Non-Ferrous Metals' (– 63 %) and the most important key category '1 A 2 f i – Stationary Combustion in Manufacturing Industries and Construction: Other' (– 62 %).

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

Between 2007 and 2008, emissions from sector '2 C 5 b – Lead Production' increased sharply (Figure 2.9). The increase is caused by data from Bulgaria, which only reported data for 2008 under the LRTAP Convention.

Figure 2.9 Pb emissions from key categories in the EU-27: (a) trend in Pb emissions from the five most important key categories, 1990–2008; (b) contribution of key categories to EU-27 Pb emissions, 2008



Note: In some instances Member States did not report data but instead used the notation keys listed in Appendix 1.

2.12 Cadmium (Cd) emission trends

Luxembourg did not report Cd emissions for any year and thus data were not gap-filled. The EU-27 total is therefore underestimated. Between 1990 and 2008, Cd emissions decreased in the EU-27 by 58 %. Between 2007 and 2008 they increased by 0.2 % (Table 2.12). The two Member States that contributed most to the emissions of Cd in 2008 were Poland and Spain.

Sectors '1 A 2 f i – Stationary Combustion in Manufacturing Industries and Construction: Other' and '1 A 4 b i – Residential: Stationary Plants' were the most important key categories for Cd emissions, comprising 43 % of total Cd emissions (Figure 2.10). Among the top five key categories the highest relative reductions in emissions between 1990 and 2008 were achieved from 1 A 2 b i – Stationary combustion in manufacturing industry and construction: Non-ferrous metals' (– 77 %), '1 A 1 a –

Table 2.12 Member State contributions to European Union Cd emissions (Mg)

Member State	Cd (Mg)											Change		Share in EU-27	
	1990	1995	2000	2001	2002	2003	2004	2005	2006	2007	2008	1990– 2008	2007–2008	1990	2008
Austria	2	1	1	1	1	1	1	1	1	1	1	– 27 %	3.7 %	0.6 %	1.0 %
Belgium	7	5	2	2	2	2	2	2	2	2	2	– 71 %	17.8 %	2.5 %	1.7 %
Bulgaria	28	13	12	10	12	15	15	12	12	8	4	– 87 %	– 53.3 %	10.1 %	3.1 %
Cyprus	0	0	0	0	0	0	0	0	0	0	0	67 %	3.5 %	0.0 %	0.1 %
Czech Republic	4	4	3	3	3	2	2	3	3	3	4	– 13 %	29.3 %	1.5 %	3.2 %
Denmark	1	1	1	1	1	1	0	0	0	0	0	– 62 %	– 1.1 %	0.4 %	0.4 %
Estonia	4	2	1	1	1	1	1	1	1	1	1	– 86 %	– 9.9 %	1.6 %	0.5 %
Finland	6	2	1	2	1	1	1	1	1	1	1	– 81 %	10.8 %	2.3 %	1.0 %
France	20	17	14	12	12	9	6	6	4	4	4	– 81 %	– 1.6 %	7.1 %	3.2 %
Germany	12	2	2	3	3	3	2	3	3	3	3	– 77 %	– 0.4 %	4.3 %	2.3 %
Greece	3	3	3	3	3	3	3	3	3	3	3	0 %	0.0 %	1.1 %	2.5 %
Hungary	6	4	3	3	3	3	3	2	2	1	2	– 70 %	10.8 %	2.0 %	1.4 %
Ireland	1	1	1	1	1	1	1	1	1	1	1	– 32 %	– 8.2 %	0.3 %	0.5 %
Italy	10	10	9	9	7	8	8	8	9	9	9	– 14 %	2.8 %	3.7 %	7.5 %
Latvia	0	0	0	0	0	0	0	0	0	0	0	– 28 %	– 3.6 %	0.1 %	0.2 %
Lithuania	4	2	1	1	1	1	1	0	0	0	0	– 88 %	11.2 %	1.4 %	0.4 %
Luxembourg	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR				
Malta	0	0	0	1	1	1	1	1	1	1	1	130 %	– 9.1 %	0.1 %	0.5 %
Netherlands	2	1	1	2	2	2	2	2	2	2	2	– 20 %	– 0.2 %	0.8 %	1.4 %
Poland	92	83	50	53	49	48	45	46	43	40	42	– 54 %	3.5 %	32.6 %	35.3 %
Portugal	5	6	6	6	6	5	5	6	5	5	5	0 %	– 1.3 %	1.9 %	4.6 %
Romania	10	10	10	10	10	10	10	10	6	4	5	– 51 %	22.9 %	3.6 %	4.1 %
Slovakia	9	10	8	8	6	8	4	7	7	10	11	17 %	13.4 %	3.4 %	9.3 %
Slovenia	1	1	1	1	0	0	0	0	0	0	0	– 43 %	6.4 %	0.3 %	0.4 %
Spain	27	23	20	20	21	19	19	18	18	15	15	– 44 %	– 2.9 %	9.5 %	12.6 %
Sweden	2	1	1	1	1	1	1	1	1	1	1	– 78 %	– 11.4 %	0.8 %	0.4 %
United Kingdom	23	11	6	5	5	3	3	4	4	3	3	– 88 %	– 5.3 %	8.2 %	2.3 %
EU-27 (a)	281	212	157	155	150	147	138	138	130	118	118	**– 58 %**	**0.2 %**	**100 %**	**100 %**
EU-27 (b)	278	209	154	152	147	144	135	135	127	115	115				

Note ([16]): (a) Sum of national totals as reported by Member States.

(b) Sum of national total emissions after re-allocation of Memo Items in line with the new UNECE Reporting Guidelines (UNECE, 2009) for countries that reported emissions in older NFR formats.

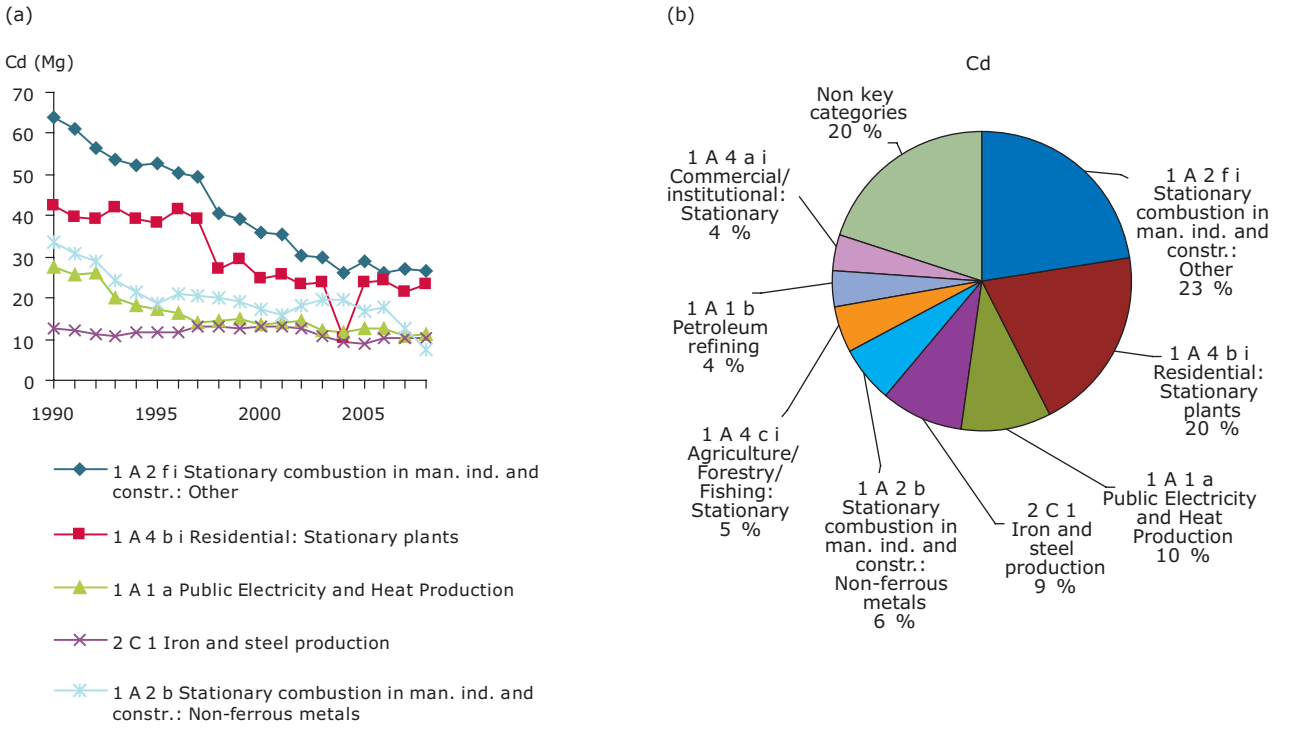
Negative percentage values indicate that emissions have fallen.

See Appendix 1 for an explanation of the notation keys reported by Member States.

Public Electricity and Heat Production' (– 60 %) and '1 A 2 f i – Stationary Combustion in Manufacturing Industries and Construction: Other' (-58 %) (Figure 2.10). The dip in emissions from '1 A 4 b i – Residential: Stationary Plants' in the year 2004 is due to data submitted by Poland to EMEP.

As was the case for lead, since the early 1990s industrial sources of cadmium emissions have in general decreased, reflecting improved abatement technologies for combustion facilities and in the metal refining and smelting industries.

Figure 2.10 Cd emissions from key categories in the EU-27: (a) trend in Cd emissions from the five most important key categories, 1990–2008; (b) contribution of key categories to EU-27 Cd emissions, 2008



Note: In some instances Member States did not report data but instead used the notation keys listed in Appendix 1.

2.13 Mercury (Hg) emission trends

Greece and Luxembourg did not report Hg emissions for any year and the data thus was not gap-filled. The EU-27 total is therefore underestimated. Between 1990 and 2008, Hg emissions decreased in the EU-27 by 60 %. Between 2007 and 2008 the decrease was only 1.4 % (Table 2.13). The two Member States that contributed most to the emissions of Hg in 2008 were Poland and Romania.

The sectors '1 A 1 a – Public Electricity and Heat Production' and '1 A 2 f i – Stationary Combustion in

Table 2.13 Member State contributions to European Union Hg emissions (Mg)

Member State	Hg (Mg)											Change		Share in EU-27	
	1990	1995	2000	2001	2002	2003	2004	2005	2006	2007	2008	1990–2008	2007–2008	1990	2008
Austria	2	1	1	1	1	1	1	1	1	1	1	– 52 %	0.3 %	1.0 %	1.2 %
Belgium	7	3	3	2	3	3	3	2	2	3	3	– 51 %	17.8 %	3.1 %	3.8 %
Bulgaria	13	7	4	4	4	5	5	3	4	3	2	– 88 %	– 41.3 %	6.0 %	1.8 %
Cyprus	0	0	0	0	0	0	0	0	0	0	0	23 %	1.0 %	0.1 %	0.2 %
Czech Republic	8	7	4	3	3	2	2	4	4	4	4	– 45 %	4.9 %	3.4 %	4.7 %
Denmark	3	3	1	1	1	1	1	1	1	1	1	– 75 %	1.1 %	1.5 %	0.9 %
Estonia	1	1	1	1	1	1	1	1	1	1	1	– 49 %	– 11.8 %	0.5 %	0.7 %
Finland	1	1	1	1	1	1	1	1	1	0	1	– 31 %	74.5 %	0.5 %	0.9 %
France	24	19	11	9	9	6	6	6	6	4	4	– 83 %	– 3.9 %	11.0 %	4.6 %
Germany	20	3	4	4	4	4	4	4	4	4	4	– 81 %	– 5.3 %	9.2 %	4.3 %
Greece	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR				
Hungary	6	5	4	4	4	4	4	4	3	3	3	– 52 %	6.3 %	2.9 %	3.4 %
Ireland	1	1	1	1	1	1	1	1	1	1	1	– 16 %	– 11.3 %	0.4 %	0.8 %
Italy	12	11	10	10	10	10	10	10	11	11	11	– 8 %	1.1 %	5.4 %	12.4 %
Latvia	0	0	0	0	0	0	0	0	0	0	0	– 70 %	– 5.3 %	0.1 %	0.1 %
Lithuania	0	0	0	0	0	0	0	0	0	0	0	1406 %	– 21.3 %	0.0 %	0.3 %
Luxembourg	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR				
Malta	0	0	0	1	1	1	1	1	1	1	1	120 %	– 10.4 %	0.1 %	0.6 %
Netherlands	4	1	1	1	1	1	1	1	1	1	1	– 75 %	– 0.7 %	1.6 %	1.0 %
Poland	33	32	26	23	20	20	20	20	16	16	16	– 53 %	– 2.7 %	15.3 %	17.9 %
Portugal	4	4	4	4	4	3	3	3	3	3	3	– 32 %	– 5.5 %	1.7 %	3.0 %
Romania	11	11	11	11	11	11	11	11	5	11	12	0 %	3.7 %	5.3 %	13.2 %
Slovakia	12	4	6	4	4	5	4	4	4	3	4	– 67 %	31.8 %	5.7 %	4.7 %
Slovenia	1	1	1	1	1	1	1	1	1	1	1	– 26 %	6.4 %	0.6 %	1.0 %
Spain	15	15	13	13	13	12	12	12	11	10	9	– 36 %	– 8.7 %	6.7 %	10.7 %
Sweden	2	1	1	1	1	1	1	1	1	1	1	– 66 %	– 8.8 %	0.7 %	0.6 %
United Kingdom	38	20	8	8	7	7	6	7	7	7	6	– 84 %	– 10.1 %	17.3 %	7.1 %
EU-27 [a]	218	152	113	107	102	100	98	99	87	89	87	**– 60 %**	**– 1.4 %**	**100 %**	**100 %**
EU-27 [b]	218	152	113	107	103	100	98	99	87	89	87				

Note [16]**:** [a] Sum of national totals as reported by Member States.

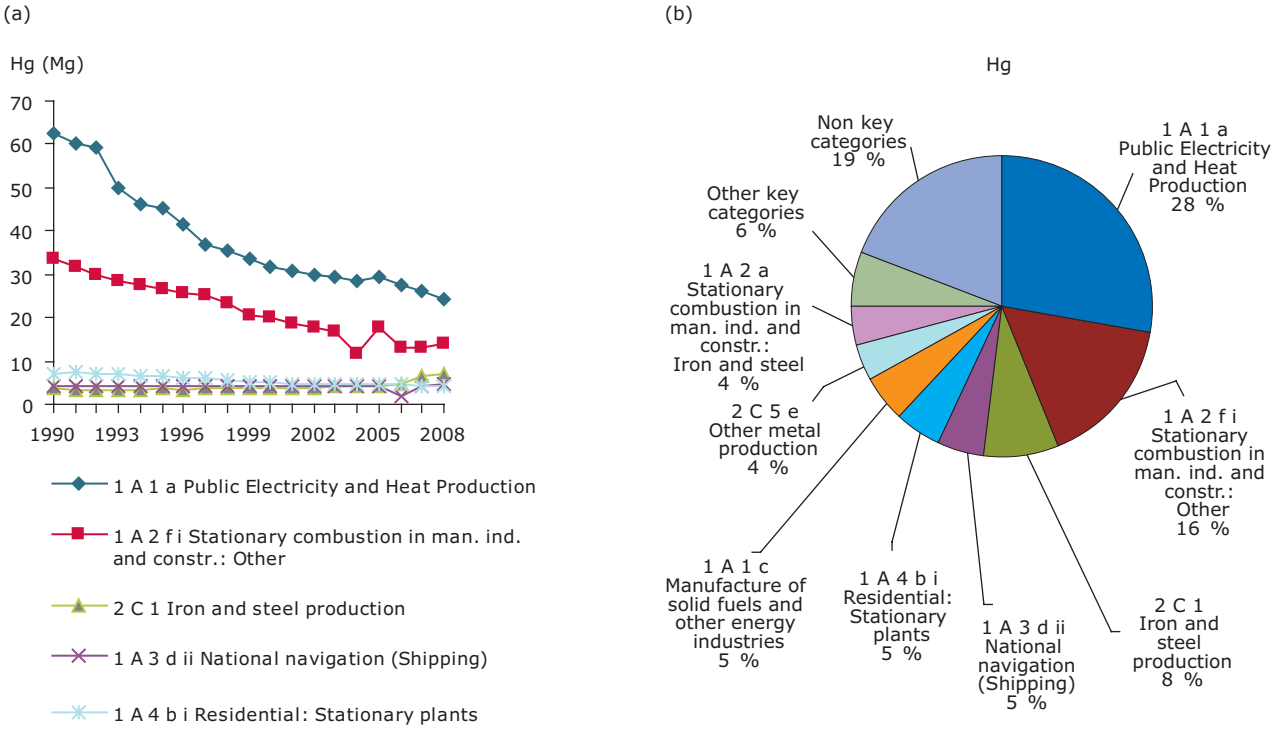
[b] Sum of national total emissions after re-allocation of Memo Items in line with the new UNECE Reporting Guidelines (UNECE, 2009) for countries that reported emissions in older NFR formats.

Negative percentage values indicate that emissions have fallen.

See Appendix 1 for an explanation of the notation keys reported by Member States.

Manufacturing Industries and Construction: Other' were the most important key categories for Hg emissions, comprising 44 % of total Hg emissions (Figure 2.11). Emissions from these sectors have decreased significantly though since 1990, partly reflecting a general decline of coal use across Europe as a result of fuel switching (Figure 2.11).

Figure 2.11 Hg emissions from key categories in the EU-27: (a) trend in Hg emissions from the five most important key categories, 1990–2008; (b) contribution of key categories to EU-27 Hg emissions, 2008



Note: In some instances Member States did not report data but instead used the notation keys listed in Appendix 1.

2.14 Dioxins and furans (PCDD/F) emission trends

Greece, Luxembourg and Malta did not report PCDD/F emissions for any year and thus data were not gap-filled. The EU-27 total is therefore underestimated. Between 1990 and 2008, PCDD/F emissions decreased in the EU-27 by 81 %. Between 2007 and 2008 the decrease was only 4.0 % (Table 2.14). The two Member States that contributed most to the emissions of PCDD/F in 2008 were Italy and Poland.

Table 2.14 Member State contributions to European Union PCDD/F emissions (g I-Teq)

Member State	PCDD/F (g I–Teq)											Change		Share in EU-27	
	1990	1995	2000	2001	2002	2003	2004	2005	2006	2007	2008	1990–2008	2007–2008	1990	2008
Austria	161	58	52	54	41	42	41	45	41	40	40	– 75 %	0.8 %	1.4 %	1.9 %
Belgium	626	486	116	80	58	60	62	61	57	58	66	– 89 %	13.6 %	5.6 %	3.1 %
Bulgaria	554	456	223	201	219	255	239	230	247	150	52	– 91 %	– 65.0 %	4.9 %	2.5 %
Cyprus	2	2	2	2	2	1	0	0	0	1	0	– 72 %	– 5.3 %	0.0 %	0.0 %
Czech Republic	1 252	1 135	744	620	177	114	187	179	175	169	150	– 88 %	– 10.9 %	11.1 %	7.1 %
Denmark	69	53	34	32	28	33	27	28	28	32	32	– 54 %	– 2.7 %	0.6 %	1.5 %
Estonia	6	5	3	3	4	4	4	3	3	5	5	– 11 %	5.5 %	0.1 %	0.2 %
Finland	36	41	32	31	32	32	32	26	14	12	15	– 58 %	25.6 %	0.3 %	0.7 %
France	1 759	1 691	515	382	354	232	312	191	118	116	101	– 94 %	– 12.4 %	15.6 %	4.8 %
Germany	114	89	76	75	74	73	74	74	76	76	76	– 33 %	0.6 %	1.0 %	3.6 %
Greece	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR				
Hungary	172	95	74	104	73	76	74	92	92	85	88	– 49 %	3.6 %	1.5 %	4.2 %
Ireland	26	25	23	23	30	35	27	23	23	16	16	– 39 %	0.9 %	0.2 %	0.8 %
Italy	472	460	369	293	283	282	289	294	302	318	324	– 32 %	1.7 %	4.2 %	15.2 %
Latvia	27	29	26	29	27	28	29	30	30	30	28	5 %	– 5.0 %	0.2 %	1.3 %
Lithuania	20	17	4	13	12	12	11	11	11	11	11	– 45 %	– 0.3 %	0.2 %	0.5 %
Luxembourg	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR				
Malta	NR	NR	0	0	0	0	0	0	0	0	NR				
Netherlands	740	67	30	29	28	27	27	36	26	26	25	– 97 %	– 4.1 %	6.6 %	1.2 %
Poland	529	515	333	447	433	482	483	416	449	396	399	– 25 %	1.0 %	4.7 %	18.8 %
Portugal	14	14	12	11	11	10	10	10	9	9	9	– 35 %	– 2.8 %	0.1 %	0.4 %
Romania	3 073	2 063	1 053	851	649	447	245	297	268	164	173	– 94 %	5.3 %	27.3 %	8.1 %
Slovakia	136	116	90	87	91	70	65	86	67	66	68	– 50 %	3.0 %	1.2 %	3.2 %
Slovenia	16	12	11	11	10	10	10	10	10	10	11	– 35 %	3.5 %	0.1 %	0.5 %
Spain	185	165	150	144	145	150	153	152	159	164	160	– 13 %	– 2.0 %	1.6 %	7.5 %
Sweden	60	40	33	34	34	33	36	39	38	36	38	– 37 %	4.4 %	0.5 %	1.8 %
United Kingdom	1 195	787	267	260	246	249	268	237	222	224	236	– 80 %	5.6 %	10.6 %	11.1 %
EU-27 (a)	11 245	8 418	4 274	3 815	3 063	2 759	2 707	2 568	2 465	2 212	2 124	**– 81 %**	**– 4.0 %**	**100 %**	**100 %**
EU-27 (b)	11 245	8 419	4 274	3 815	3 063	2 759	2 707	2 567	2 465	2 212	2 124				

Note ([16]): (a) Sum of national totals as reported by Member States.

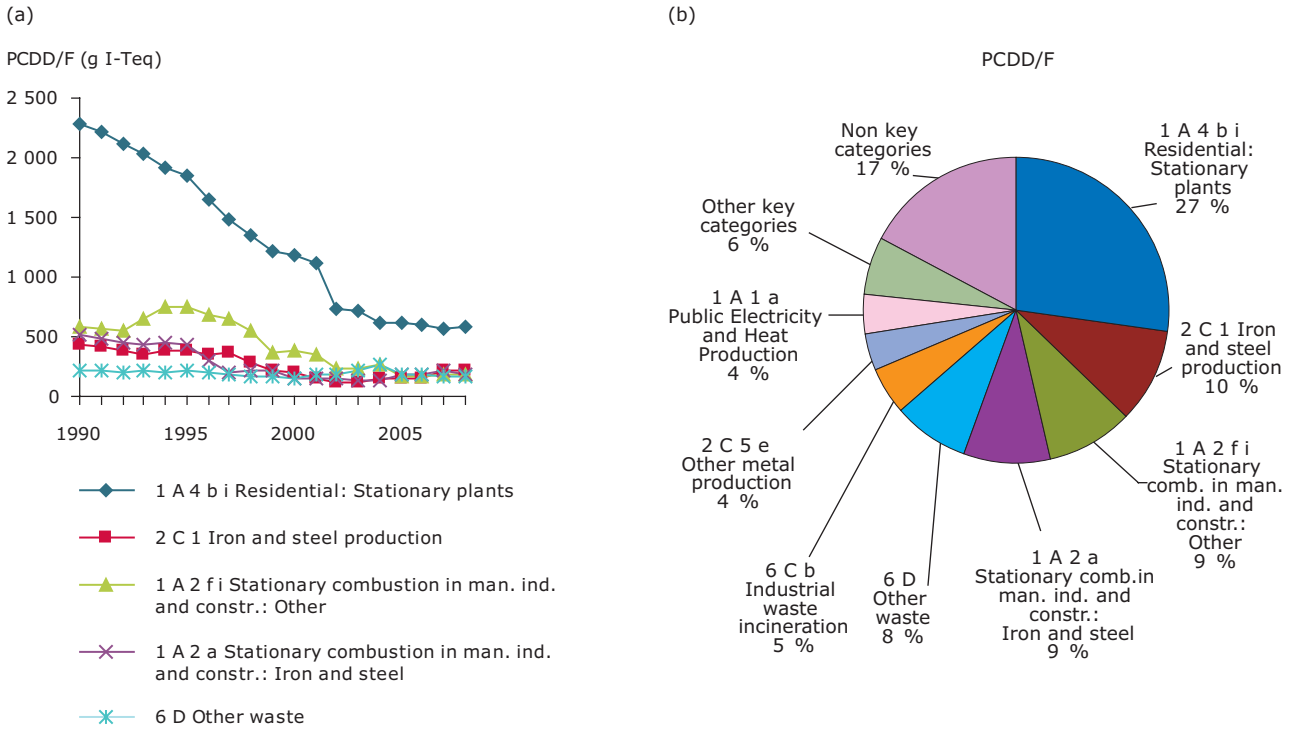
(b) Sum of national total emissions after re-allocation of Memo Items in line with the new UNECE Reporting Guidelines (UNECE, 2009) for countries that reported emissions in older NFR formats.

Negative percentage values indicate that emissions have fallen.

See Appendix 1 for an explanation of the notation keys reported by Member States.

Sectors '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 comprising 38 % of total PCDD/F emissions (Figure 2.12). Among the top five key categories the highest relative reductions in emissions between 1990 and 2008 were achieved in the most important key category '1 A 4 b i – Residential: Stationary Plants' (– 75 %) and the third most important key category '1 A 2 f i – Stationary Combustion in Manufacturing Industry and Construction: Other' (– 68 %) (Figure 2.12).

Figure 2.12 PCDD/F emissions from key categories in the EU-27: (a) trend in PCDD/F emissions from the five most important key categories, 1990–2008; (b) contribution of key categories to EU-27 PCDD/F emissions, 2008



Note: In some instances Member States did not report data but instead used the notation keys listed in Appendix 1.

2.15 Polycyclic aromatic hydrocarbons (total PAHs) emission trends

Greece, Luxembourg and Malta did not report total PAHs emissions for any year and thus data were not gap-filled. The EU-27 total is therefore underestimated. Between 1990 and 2008, total PAHs emissions decreased in the EU-27 by 60 %. Between 2007 and 2008 they decreased by 0.8 (Table 2.15). The two Member States that contributed most to the emissions of total PAHs in 2008 were Spain and Belgium.

Table 2.15 Member State contributions to European Union total PAHs emissions (Mg)

Member State	total PAH (Mg)											Change		Share in EU-27	
	1990	1995	2000	2001	2002	2003	2004	2005	2006	2007	2008	1990–2008	2007–2008	1990	2008
Austria	17	10	8	9	8	9	9	9	8	8	8	– 53 %	0.2 %	0.5 %	0.6 %
Belgium	415	269	235	243	235	247	244	249	233	230	227	– 45 %	– 1.2 %	12.2 %	16.7 %
Bulgaria	677	443	192	97	129	140	130	124	130	75	19	– 97 %	– 74.0 %	19.8 %	1.4 %
Cyprus	5	4	3	3	3	2	3	2	2	2	1	– 73 %	– 20.9 %	0.1 %	0.1 %
Czech Republic	752	1 357	488	460	24	21	24	24	17	16	19	– 97 %	17.9 %	22.0 %	1.4 %
Denmark	7	8	10	11	10	12	12	14	15	18	17	138 %	– 6.2 %	0.2 %	1.2 %
Estonia	12	14	13	13	13	13	14	13	12	13	13	7 %	– 1.4 %	0.4 %	1.0 %
Finland	16	17	16	16	17	17	17	13	13	13	15	– 8 %	11.7 %	0.5 %	1.1 %
France	39	38	28	27	24	25	24	22	20	19	19	– 52 %	1.0 %	1.1 %	1.4 %
Germany	219	118	128	141	138	142	141	142	145	140	158	– 28 %	12.4 %	6.4 %	11.6 %
Greece	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR				
Hungary	48	26	19	55	20	22	21	23	23	13	15	– 69 %	10.6 %	1.4 %	1.1 %
Ireland	6	4	3	3	3	3	3	3	3	3	3	– 57 %	5.0 %	0.2 %	0.2 %
Italy	103	121	128	129	118	123	141	138	143	155	159	54 %	2.5 %	3.0 %	11.7 %
Latvia	26	29	28	28	28	29	29	29	29	28	27	4 %	– 2.2 %	0.8 %	2.0 %
Lithuania	18	33	34	50	45	47	15	16	16	15	15	– 19 %	– 4.4 %	0.5 %	1.1 %
Luxembourg	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR				
Malta	NR	NR	0	0	0	0	0	0	0	0	NR				
Netherlands	15	8	5	5	5	5	6	5	3	4	4	– 73 %	6.9 %	0.4 %	0.3 %
Poland	159	237	167	164	160	157	158	165	162	154	160	0 %	4.0 %	4.7 %	11.8 %
Portugal	8	8	8	9	9	10	10	10	10	10	10	36 %	4.2 %	0.2 %	0.8 %
Romania	274	182	91	72	54	36	17	17	17	139	157	– 43 %	12.6 %	8.0 %	11.5 %
Slovakia	29	15	13	14	13	13	16	19	18	18	18	– 37 %	0.2 %	0.9 %	1.3 %
Slovenia	13	12	12	10	10	10	10	10	10	10	10	– 23 %	– 0.2 %	0.4 %	0.8 %
Spain	321	307	274	259	227	280	254	224	250	257	256	– 20 %	– 0.5 %	9.4 %	18.9 %
Sweden	17	16	14	15	14	16	16	18	19	18	18	6 %	– 3.6 %	0.5 %	1.3 %
United Kingdom	218	97	16	16	14	12	12	11	10	9	10	– 95 %	4.7 %	6.4 %	0.7 %
EU-27 (a)	3 416	3 374	1 931	1 848	1 321	1 390	1 326	1 302	1 306	1 369	1 359	**– 60 %**	**– 0.8 %**	**100 %**	**100 %**
EU-27 (b)	3 416	3 374	1 931	1 848	1 321	1 401	1 326	1 302	1 306	1 369	1 359				

Note ([15]): (a) Sum of national totals as reported by Member States.

(b) Sum of national total emissions after re-allocation of Memo Items in line with the new UNECE Reporting Guidelines (UNECE, 2009) for countries that reported emissions in older NFR formats.

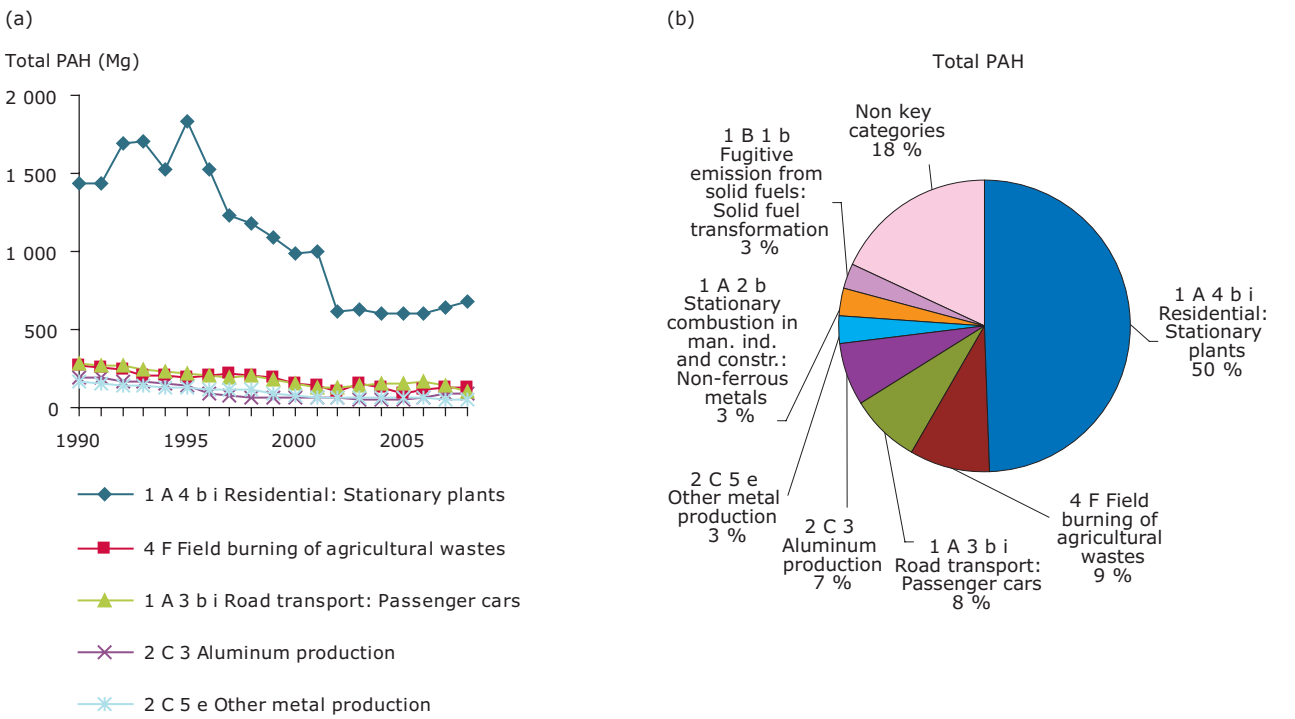
Negative percentage values indicate that emissions have fallen.

See Appendix 1 for an explanation of the notation keys reported by Member States.

Sector '1 A 4 b i Residential: Stationary plants' was the most important key category for total PAHs emissions, comprising 50 % of total PAHs emissions (Figure 2.13). Among the top five key categories, the highest relative reductions in emissions between 1990 and 2008 were achieved in the fifth most important key category '2 C 5 e – Other metal production' (– 72 %) and the third most important key category '1 A 3 b i – Road transport: Passenger cars' (– 63 %) (Figure 2.13).

Emissions from these sources have in general declined since 1990 as a result of decreased residential use of coal, improvements in abatement technologies for metal refining and smelting, and stricter regulations on emissions from the road transport sector.

Figure 2.13 Total PAHs emissions from key categories in the EU-27: (a) trend in total PAHs emissions from the five most important key categories, 1990–2008; (b) contribution of key categories to EU-27 total PAHs emissions, 2008



Note: In some instances Member States did not report data but instead used the notation keys listed in Appendix 1.

2.16 Hexachlorobenzene (HCB) emission trends

Greece, Lithuania, Luxembourg, Malta and the Netherlands did not report HCB emissions for any year and thus data were not gap-filled. The EU-27 total is therefore underestimated. Between 1990 and 2008, HCB emissions decreased in the EU-27 by 89 %. Between 2007 and 2008 the decrease was 3.6 %, mainly caused by reductions in Finland (Table 2.16). The two Member States that contributed most to the emissions of HCB in 2008 were Spain and the United Kingdom.

Table 2.16 Member State contributions to European Union HCB emissions (kg)

	HCB (kg)											Change		Share in EU-27	
Member State	**1990**	**1995**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**1990–2008**	**2007–2008**	**1990**	**2008**
Austria	92	53	44	47	44	44	42	48	44	43	44	– 53 %	1.8 %	1.6 %	6.9 %
Belgium	10	8	8	9	10	10	9	7	8	7	8	– 21 %	7.3 %	0.2 %	1.2 %
Bulgaria	544	79	44	43	38	45	21	19	25	26	26	– 95 %	3.3 %	9.5 %	4.2 %
Cyprus	0	0	0	0	0	0	0	0	0	0	0	– 70 %	– 0.6 %	0.0 %	0.0 %
Czech Republic	4	4	4	4	4	0	4	5	4	4	4	– 8 %	– 3.4 %	0.1 %	0.6 %
Denmark	3	2	1	1	1	1	1	0	1	1	1	– 83 %	0.7 %	0.1 %	0.1 %
Estonia	0	0	0	0	0	0	0	0	0	0	0	144 %	12.8 %	0.0 %	0.0 %
Finland	41	41	43	24	17	15	31	36	43	44	26	– 38 %	– 42.4 %	0.7 %	4.0 %
France	1 200	75	50	41	34	29	23	19	14	14	14	– 99 %	1.2 %	20.9 %	2.2 %
Germany	2	2	2	2	2	2	2	2	2	2	2	20 %	– 0.3 %	0.0 %	0.3 %
Greece	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR				
Hungary	7	4	4	1	5	5	4	6	7	7	9	25 %	30.0 %	0.1 %	1.4 %
Ireland	40	40	0	0	0	1	2	1	1	1	1	– 97 %	– 0.3 %	0.7 %	0.2 %
Italy	0	0	0	0	0	0	0	0	0	0	0	52 %	1.9 %	0.0 %	0.0 %
Latvia	0	0	0	0	0	0	0	0	0	0	0	57 %	– 11.2 %	0.0 %	0.0 %
Lithuania	NA	NR	NR	NR	NE	NE	NA	NA	NA	NA	0				0.0 %
Luxembourg	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR				
Malta	NR	NR	0	0	0	0	0	0	0	0	0				0.0 %
Netherlands	0	0	0	0	0	0	0	0	0	0	0			0.0 %	0.0 %
Poland	62	51	46	8	9	7	8	9	9	10	10	– 84 %	– 1.8 %	1.1 %	1.5 %
Portugal	1	1	1	0	0	0	0	0	0	0	0	– 95 %	0.0 %	0.0 %	0.0 %
Romania	1	1	1	1	1	1	1	2	2	2	2	41 %	– 6.9 %	0.0 %	0.3 %
Slovakia	3	2	2	2	2	2	2	2	2	2	2	– 18 %	– 11.3 %	0.0 %	0.3 %
Slovenia	47	37	38	38	0	0	0	0	0	0	0	– 99 %	2.9 %	0.8 %	0.0 %
Spain	510	366	472	470	478	517	464	474	389	402	393	– 23 %	– 2.2 %	8.9 %	62.2 %
Sweden	0	0	0	0	0	0	0	0	0	0	0	– 21 %	– 6.0 %	0.0 %	0.0 %
United Kingdom	3 170	4 128	82	73	70	69	94	93	92	91	91	– 97 %	0.3 %	55.3 %	14.4 %
EU-27 (a)	5 737	4 894	844	764	714	746	710	724	641	657	633	**– 89 %**	**– 3.6 %**	**100 %**	**100 %**
EU-27 (b)	5 737	4 894	844	764	714	746	710	724	641	657	633				

Note ([16]): (a) Sum of national totals as reported by Member States.

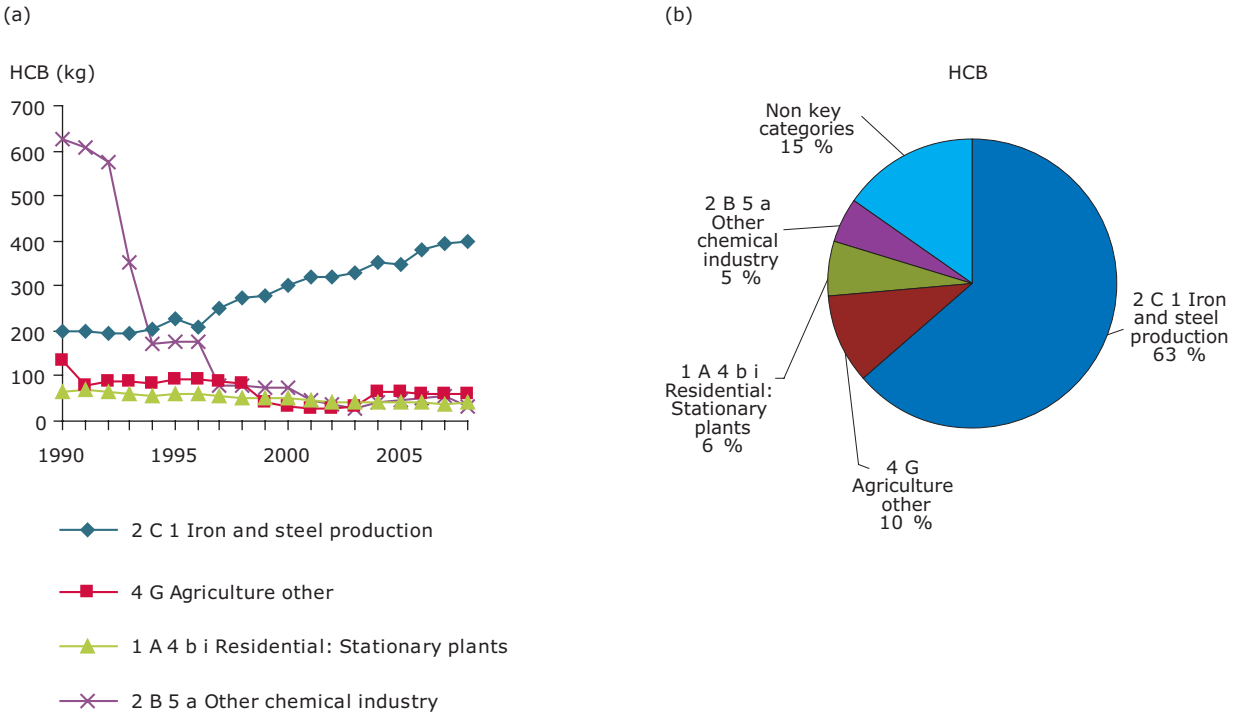
(b) Sum of national total emissions after re-allocation of Memo Items in line with the new UNECE Reporting Guidelines (UNECE, 2009) for countries that reported emissions in older NFR formats.

Negative percentage values indicate that emissions have fallen.

See Appendix 1 for an explanation of the notation keys reported by Member States.

'2 C 1 – Iron and Steel Production' was the most important key category for HCB emissions, accounting for 63 % of total HCB emissions (Figure 2.14). Among the top four key categories the highest relative reductions in emissions between 1990 and 2008 was achieved in the fourth most important key category '2 B 5 a – Other Chemical Industry' (– 95 %). In contrast, emission from the most important key category '2 C 1 – Iron and Steel Production' have almost doubled since 1990 (Figure 2.14).

Figure 2.14 HCB emissions from key categories in the EU-27: (a) trend in HCB emissions from the five most important key categories, 1990–2008; (b) contribution of key categories to EU-27 HCB emissions, 2008



Note: In some instances Member States did not report data but instead used the notation keys listed in Appendix 1.

2.17 Hexachlorocyclohexane (HCH) emission trends

Several Member States did not report HCH emissions for any year and the data thus could not be gap-filled. The EU-27 total is therefore far from complete. The Netherlands only reported emissions for a single year (2001), the same value has been assumed for other years consistent with the data gap-filling protocol used. Based on the limited data available, between1990 and 2008, HCH emissions decreased in the EU-27 by 86 %. Between 2007 and 2008 the decrease was 4.7 %, mainly caused by reductions in the United Kingdom (Table 2.17). Apart from the Netherlands, the United Kingdom contributed most to the emissions of HCH in 2008.

There were only two key categories for HCH emissions '2 A 7 d – Other Mineral Products' and '2 F – Consumption of POPs and Heavy Metals (e.g. electrical and scientific equipment)' which together contributed 99 % to total HCH emissions.

Table 2.17 Member State contributions to European Union HCH emissions (kg)

Member State	HCH (kg)											Change		Share in EU-27	
	1990	1995	2000	2001	2002	2003	2004	2005	2006	2007	2008	1990–2008	2007–2008	1990	2008
Austria	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR				
Belgium	163	165	167	167	168	168	169	170	171	172	173	6 %	0.6 %	0.1 %	0.6 %
Bulgaria	NR	NR	NR	NA	NA	NA	NA	NA	NA	NA	NA				
Cyprus	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE				
Czech Republic	NR	NR	NR	0	0	0	0	0	NA	0	0				0.0 %
Denmark	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA				
Estonia	NR	NR	NR	NO	NO	NO	NO	NO	NO	NA	NA				
Finland	NE	NE	NE	NE	NE	NA	NE	NE	NA	0	NA				
France	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA				
Germany	60 200	13 100	0	0	0	0	0	0	0	0	0	– 100 %		30.6 %	0.0 %
Greece	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR				
Hungary	9 281	1 650	22	22	22	22	22	22	22	22	22	– 100 %	0.0 %	4.7 %	0.1 %
Ireland	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA				
Italy	0	0	0	0	0	0	0	0	0	0	0			0.0 %	0.0 %
Latvia	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA				
Lithuania	NA	NR	NR	NR	NE	NE	NA	NA	NA	NA	0				0.0 %
Luxembourg	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR				
Malta	NR	NR	0	0	0	0	0	0	0	0	0				0.0 %
Netherlands	16 661	16 661	16 661	16 661	16 661	16 661	16 661	16 661	16 661	16 661	16 661	0 %	0.0 %	8.5 %	61.2 %
Poland	NR	NR	NR	NO	NO	NR	NR	NR	NR	NR	NR				
Portugal	0	0	0	0	0	0	0	0	0	0	0			0.0 %	0.0 %
Romania	855	855	855	855	855	855	855	855	429	429	429	– 50 %	0.0 %	0.4 %	1.6 %
Slovakia	NO	NO	NE	NE	NE	NE	NE	NE	NE	NE	NE				
Slovenia	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA				
Spain	9 194	9 538	11 250	11 631	3 877	NE	NE	NE	NE	NE	NE			4.7 %	
Sweden	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA				
United Kingdom	100 378	59 392	33 232	29 285	22 267	19 453	16 863	14 620	12 856	11 313	9 955	– 90 %	– 12.0 %	51.0 %	36.5 %
EU– 27 (a)	196 732	101 360	62 187	58 621	43 850	37 160	34 570	32 328	30 139	28 597	27 240	**– 86 %**	**– 4.7 %**	**100 %**	**100 %**
EU-27 (b)	186 596	98 855	61 310	57 744	42 973	36 283	33 693	31 451	29 687	28 146	26 789				

Note ([16]): (a) Sum of national totals as reported by Member States.

(b) Sum of national total emissions after re-allocation of Memo Items in line with the new UNECE Reporting Guidelines (UNECE, 2009) for countries that reported emissions in older NFR formats.

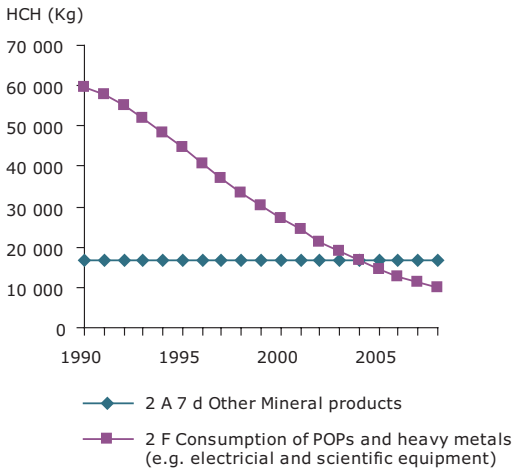
Negative percentage values indicate that emissions have fallen.

See Appendix 1 for an explanation of the notation keys reported by Member States.

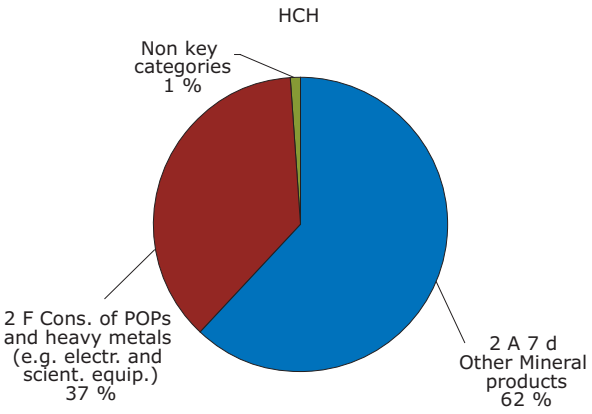
High relative reductions in emissions between 1990 and 2008 were achieved in the key category '2 F – Consumption of POPs and heavy metals (e.g. electrical and scientific equipment)' (– 83 %) (Figure 2.15). The data for sector '2 A 7 d – Other Mineral products' were only based on data reported by a single Member State (the Netherlands) and for a single year (2001). The reliability of this data is therefore not considered to be high.

Figure 2.15 HCH emissions from key categories in the EU-27: (a) trend in HCH emissions from the five most important key categories, 1990–2008; (b) contribution of key categories to EU-27 HCH emissions, 2008

(a)



(b)



Note: In some instances Member States did not report data but instead used the notation keys listed in Appendix 1.

2.18 Polychlorinated biphenyls (PCBs) emission trends

As was the case for HCH, several Member States did not report PCBs emissions for any year and the data thus were not gap-filled. The EU-27 total is therefore underestimated. Based on the limited data available, between 1990 and 2008, PCB emissions decreased in the EU-27 by 76 %. Between 2007 and 2008 the decrease was 3.8 %, mainly caused by reductions in Bulgaria, Slovenia and the United Kingdom (Table 2.18). The two Member States that contributed

Table 2.18 Member State contributions to European Union PCB emissions (kg)

Member State	PCB (kg)											Change		Share in EU-27	
	1990	1995	2000	2001	2002	2003	2004	2005	2006	2007	2008	1990–2008	2007–2008	1990	2008
Austria	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR				
Belgium	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE				
Bulgaria	258	382	230	212	250	261	270	259	282	251	221	– 14 %	– 12.0 %	2.2 %	7.9 %
Cyprus	0	0	0	0	0	0	0	0	0	0	0	16 %	0.0 %	0.0 %	0.0 %
Czech Republic	773	623	474	407	82	3	88	82	89	48	43	– 94 %	– 10.1 %	6.6 %	1.5 %
Denmark	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA				
Estonia	90	52	45	47	47	54	52	50	46	57	51	– 44 %	– 11.2 %	0.8 %	1.8 %
Finland	314	284	221	209	192	192	180	174	177	164	156	– 50 %	– 5.1 %	2.7 %	5.5 %
France	180	158	106	97	75	75	77	76	72	67	65	– 64 %	– 2.8 %	1.5 %	2.3 %
Germany	18	17	17	17	16	17	17	18	18	19	19	2 %	– 1.4 %	0.2 %	0.7 %
Greece	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR				
Hungary	151	113	102	101	99	103	103	103	103	103	103	– 32 %	0.0 %	1.3 %	3.6 %
Ireland	68	63	58	49	66	79	55	43	41	20	20	– 71 %	– 2.4 %	0.6 %	0.7 %
Italy	0	0	0	0	0	0	0	0	0	0	0	– 1 %	1.0 %	0.0 %	0.0 %
Latvia	4	1	1	1	1	1	1	1	1	1	1	– 77 %	– 3.3 %	0.0 %	0.0 %
Lithuania	43	32	11	19	13	13	24	25	26	32	36	– 15 %	13.0 %	0.4 %	1.3 %
Luxembourg	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR				
Malta	NR	NR	0	0	0	0	0	0	0	0	0				0.0 %
Netherlands	0	0	0	0	0	0	0	0	0	0	0			0.0 %	0.0 %
Poland	2 425	2 323	2 265	2 327	2 282	2 281	2 256	2 281	2 292	641	668	– 72 %	4.2 %	20.7 %	23.7 %
Portugal	59	66	37	67	93	117	117	117	119	122	124	109 %	2.0 %	0.5 %	4.4 %
Romania	135	0	1	1	1	1	1	2	2	224	202	50 %	– 9.7 %	1.1 %	7.2 %
Slovakia	66	41	33	33	30	30	32	35	34	35	34	– 48 %	– 2.0 %	0.6 %	1.2 %
Slovenia	448	321	231	213	184	170	150	124	107	107	73	– 84 %	– 31.1 %	3.8 %	2.6 %
Spain	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE				
Sweden	0	0	0	0	0	0	0	0	0	0	0	– 20 %	– 5.6 %	0.0 %	0.0 %
United Kingdom	6 698	5 007	1 403	1 333	1 248	1 215	1 185	1 124	1 073	1 036	998	– 85 %	– 3.6 %	57.1 %	35.5 %
EU-27 (a)	11 732	9 483	5 233	5 132	4 678	4 611	4 609	4 512	4 483	2 928	2 816	**– 76 %**	**– 3.8 %**	**100 %**	**100 %**
EU-27 (b)	11 732	9 483	5 234	5 132	4 678	4 611	4 609	4 512	4 483	2 928	2 816				

Note ([16]): (a) Sum of national totals as reported by Member States.

(b) Sum of national total emissions after re-allocation of Memo Items in line with the new UNECE Reporting Guidelines (UNECE, 2009) for countries that reported emissions in older NFR formats.

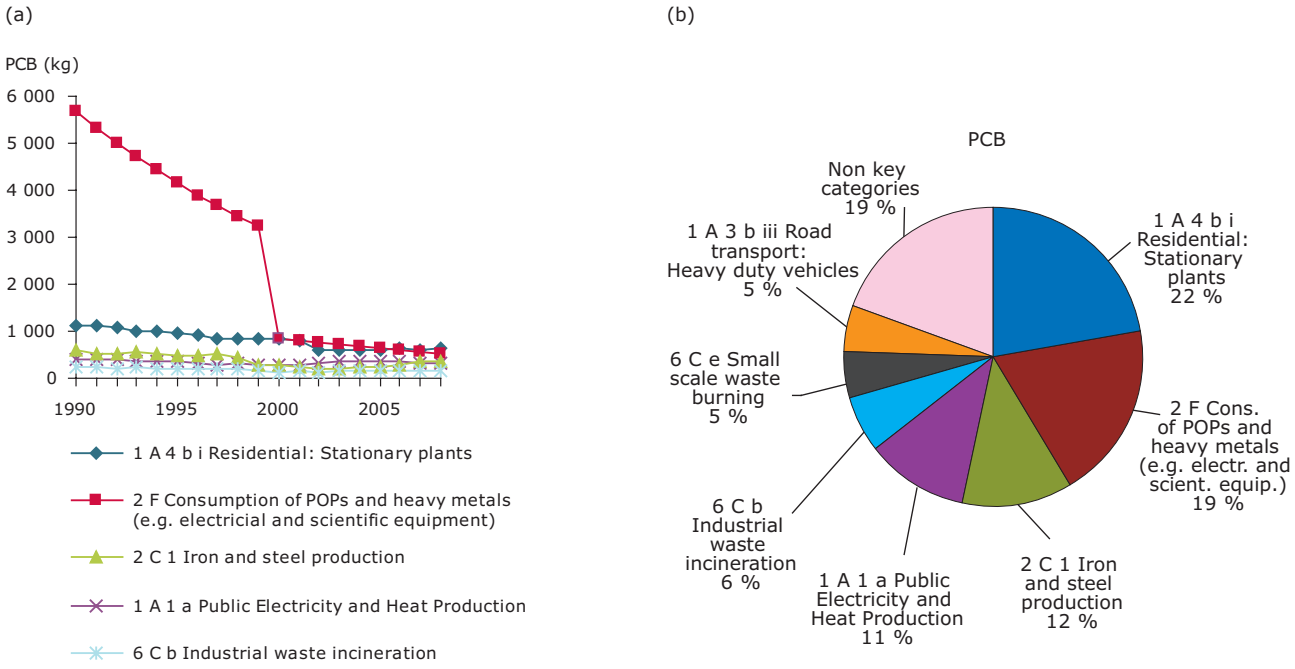
Negative percentage values indicate that emissions have fallen.

See Appendix 1 for an explanation of the notation keys reported by Member States.

most to the emissions of PCB in 2008 were Poland and the United Kingdom.

The sectors '1 A 4 b i – Residential: Stationary Plants' and '2 F – Consumption of POPs and Heavy Metals (e.g. electrical and scientific equipment)' were the most important key categories for PCB emissions, together comprising 41 % of total PCB emissions (Figure 2.16). Among the top five key categories the highest relative reductions in emissions between 1990 and 2008 were achieved in the second most important key category '2 F – Consumption of POPs and Heavy Metals (e.g. electrical and scientific equipment)' (– 91 %) (Figure 2.16). The strong decrease in emissions from '2 F – Consumption of POPs and heavy metals (e.g. electrical and scientific equipment)' between 2000 and 2001 is due to reductions reported by the United Kingdom.

Figure 2.16 PCB emissions from key categories in the EU-27: (a) trend in PCB emissions from the five most important key categories, 1990–2008; (b) contribution of key categories to EU-27 PCB emissions, 2008



Note: In some instances Member States did not report data but instead used the notation keys listed in Appendix 1.

3 Emission trends by sector

The present chapter sets out emission trends of the key pollutants aggregated into the following main sector groups:

- energy exploration and production
- 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.

Figure 3.1 shows, for each pollutant, the contribution to total EU-27 emissions made by the aggregated sector groups. For NO_x, SO_x and the heavy metals, the energy sectors, the transport sectors and 'commercial, institutional and households' energy use are among the most important emission sources. The latter sector group is also a very significant source of $PM_{2.5}$, PM_{10} and total PAHs, PCDD/F and PCBs. A single sector group, agriculture, is responsible for the vast majority (94 %) of NH_3 emissions in the EU-27. Similarly, for certain other pollutants such as HCB and HCH, just two sector groups – agriculture and industrial processes – contribute the majority of emissions. The contributions of the waste and non-road transport sector groups to total emissions was comparatively small for all pollutants. The following sections of this chapter show the trends of important pollutants in each of the grouped sectors.

3.1 Emission trends for 'energy exploration and production'

The sector grouping 'energy exploration and production' comprises emissions from a number of activities involving fuel combustion in order, for example, to produce energy products and electricity. It is an important source of many pollutants, especially SO_x. Despite significant past reductions, this sector group still contributes almost 65 % of the total EU-27 emissions of this pollutant.

For emissions of the main pollutants and particulate matter (Figure 3.2), the highest absolute and relative reduction (– 75 %) was for SO_x between 1990 and 2008. For particulate matter a notable relative reduction of more than 40 % has occurred within this sector group since 2000.

Of the three heavy metals, lead shows the highest emission reduction in absolute and relative terms (– 78 %) (Figure 3.3). For emissions of POPs, the highest relative reduction occurred for PCDD/F (– 95 %) (Figure 3.4).

3.2 Emission trends for 'energy use in industry'

Energy use (fuel combustion) in industry is an important source of many pollutants. For the main pollutants and particulate matter, the highest absolute and relative reduction (– 76 %) between 1990 and 2008 occurred for SO_x (Figure 3.5). In contrast, CO emissions were almost constant during this period.

For the three heavy metals, lead shows the highest emission reduction, both in absolute and relative terms (– 65 %) (Figure 3.6). Cadmium and mercury had similar emission reductions in relative terms (– 64 % and 61 %, respectively).

For POPs, only PCDD/F and total PAHs are important pollutants in the sector group 'energy use in industry'. Trends of these pollutants are given in Figure 3.7.

Figure 3.1 Share of emissions per pollutant by sector group

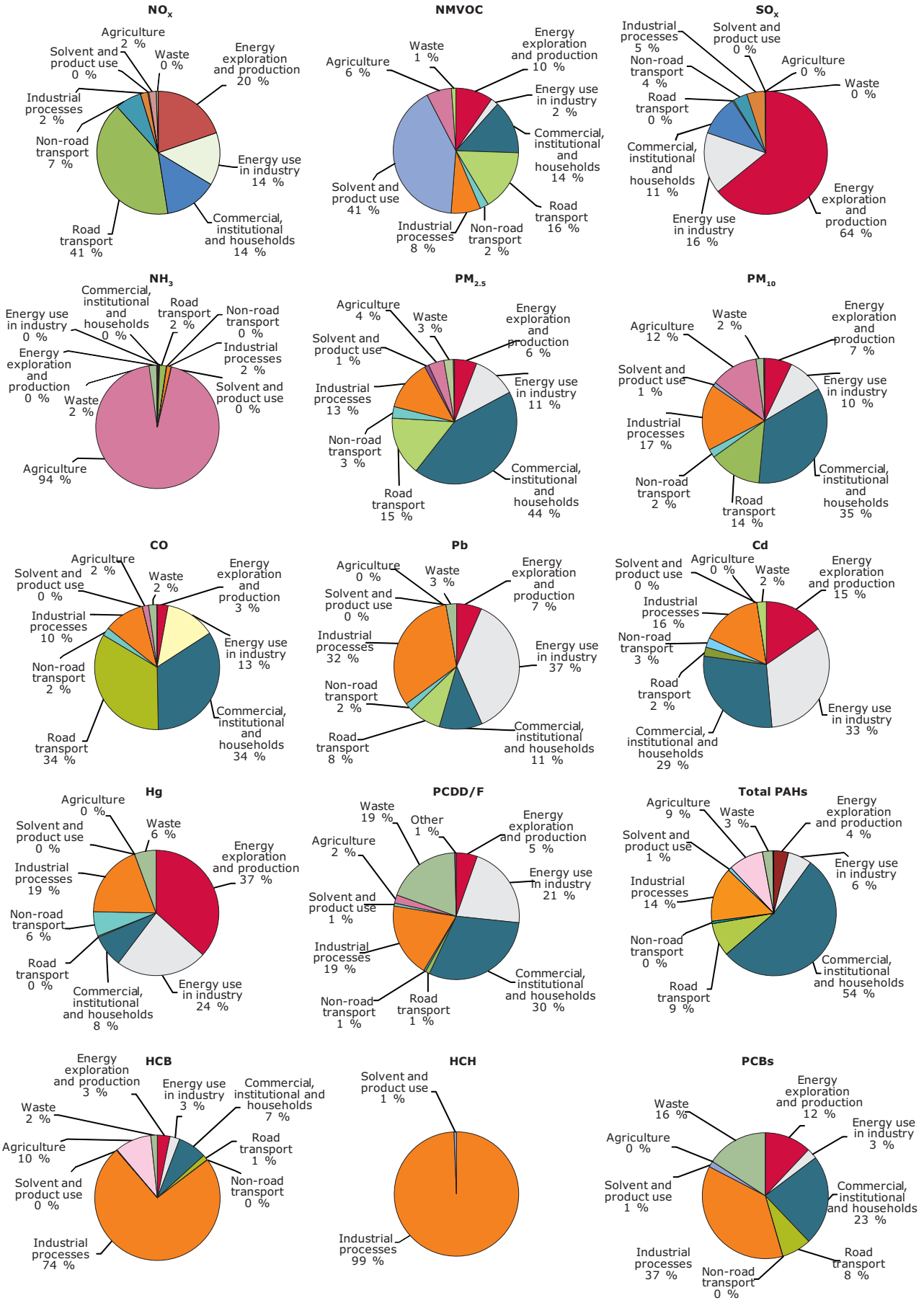
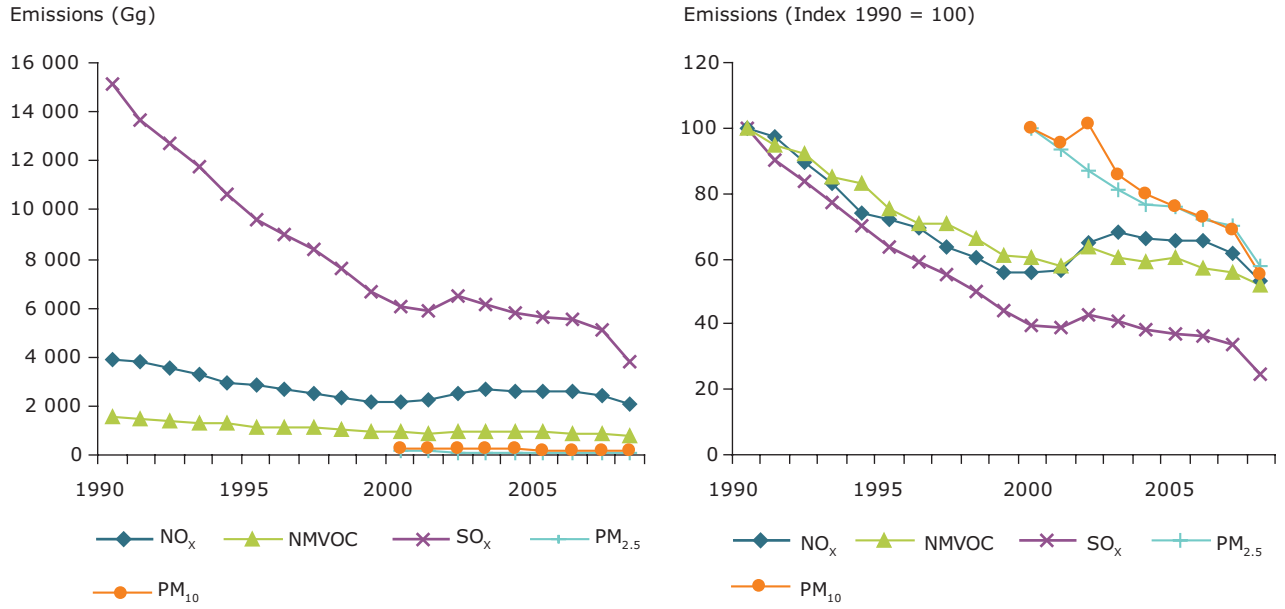


Figure 3.2 EU-27 emission trends in the sector 'energy exploration and production' for NO_x, NMVOC and SO_x, in Gg between 1990 and 2008 (index year 1990 = 100), and for PM_{10} and $PM_{2.5}$ between 2000 and 2008 (index year 2000 = 100)

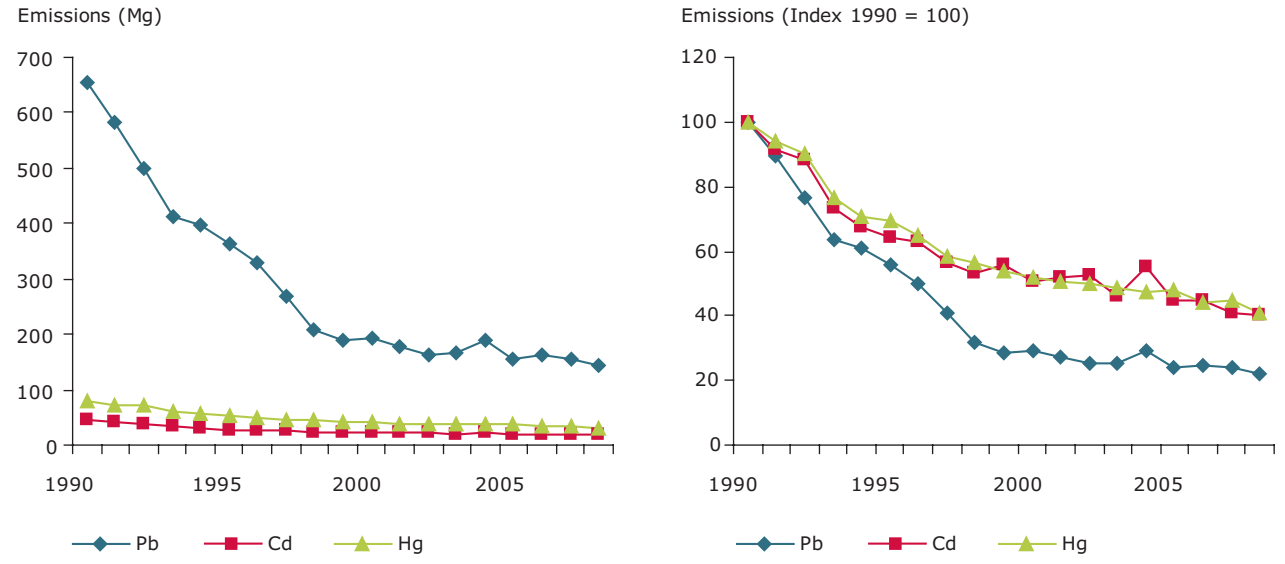


Note: For particulate matter, data from some Member States could not be gap-filled as values were not reported for any year. To enable presentation of provisional emission trends, in these instances emissions have been aggregated without including data for all the EU-27 Member States.

Parties to the LRTAP Convention are formally requested to report emissions of particulate matter (PM) only for the year 2000 and onwards.

Several Member States reported notation keys (see Appendix 1) for some of the individual NFR source categories included in this grouped sector.

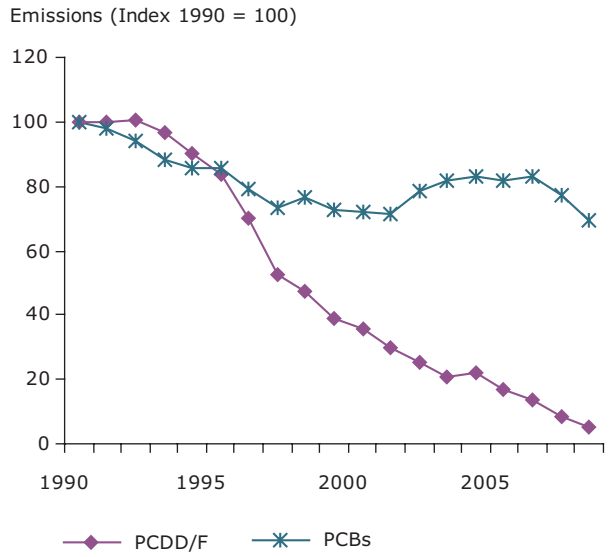
Figure 3.3 EU-27 emission trends in the sector group 'energy exploration and production' for the heavy metals Pb, Cd, Hg between 1990 and 2008 (index year 1990 = 100)



Note: For the heavy metals, data for one or more Member States could not be gap-filled as values were not reported for any year. To enable presentation of provisional emission trends, in these instances emissions have been aggregated without including data for all the EU-27 Member States.

Several Member States reported notation keys (see Appendix 1) for some of the individual NFR source categories included in this grouped sector.

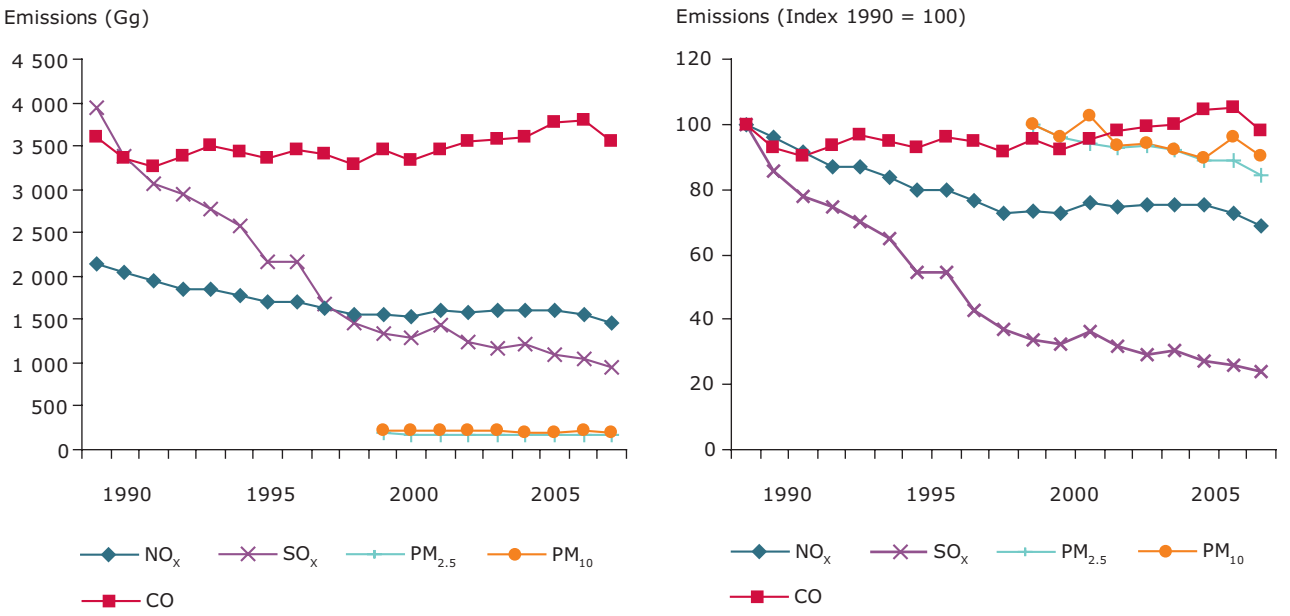
Figure 3.4 EU-27 emission trends in the sector group 'energy exploration and production' for the POPs (PCDD/F and PCBs) between 1990 and 2008 (index year 1990 = 100)



Note: For POPs, data from some Member States could not be gap-filled as values were not reported for any year. To enable presentation of provisional emission trends, in these instances emissions have been aggregated without including data for all the EU-27 Member States.

Several Member States reported notation keys (see Appendix 1) for some of the individual NFR source categories included in this grouped sector.

Figure 3.5 EU-27 emission trends in the sector group 'energy use in industry' for NO_x, SO_x and CO in Gg between 1990 and 2008 (index year 1990 = 100), and for PM_{10} and $PM_{2.5}$ between 2000 and 2008 (index year 2000 = 100)

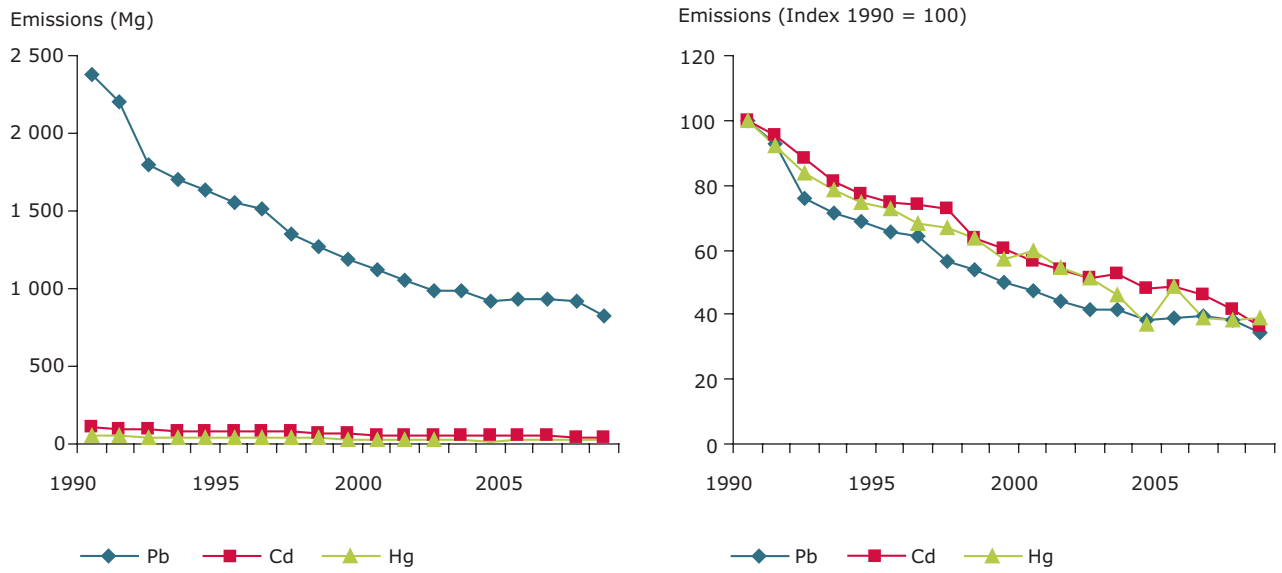


Note: For particulate matter, data from some Member States could not be gap-filled as values were not reported for any year. To enable presentation of provisional emission trends, in these instances emissions have been aggregated without including data for all the EU-27 Member States.

Parties to the LRTAP Convention are formally requested to report emissions of particulate matter (PM) only for the year 2000 and onwards.

Several Member States reported notation keys (see Appendix 1) for some of the individual NFR source categories included in this grouped sector.

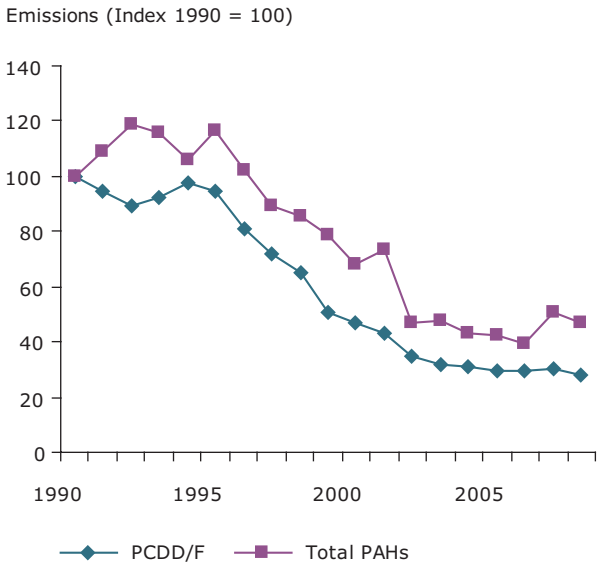
Figure 3.6 EU-27 emission trends in the sector group 'energy use in industry' for the heavy metals Pb, Cd, Hg between 1990 and 2008 (index year 1990 = 100)



Note: For the heavy metals, data for one or more Member States could not be gap-filled as values were not reported for any year. To enable presentation of provisional emission trends, in these instances emissions have been aggregated without including data for all the EU-27 Member States.

Several Member States reported notation keys (see Appendix 1) for some of the individual NFR source categories included in this grouped sector.

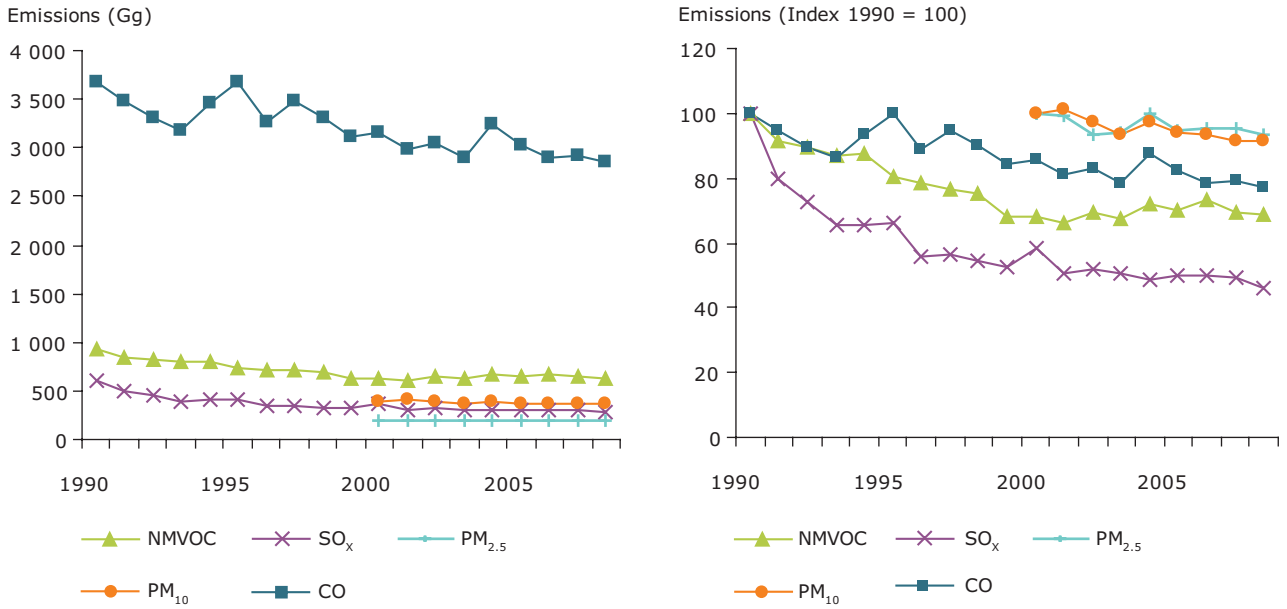
Figure 3.7 EU-27 emission trends in the sector group 'energy use in industry' for the POPs (PCDD/F and total PAHs) between 1990 and 2008 (index year 1990 = 100)



Note: For the POPs, data from some Member States could not be gap-filled as values were not reported for any year. To enable presentation of provisional emission trends, in these instances emissions have been aggregated without including data for all the EU-27 Member States.

Several Member States reported notation keys (see Appendix 1) for some of the individual NFR source categories included in this grouped sector.

Figure 3.8 EU-27 emission trends in the sector group 'industrial processes' for NMVOC, SO_x and CO in Gg between 1990 and 2008 (index year 1990 = 100), for PM_{10} and $PM_{2.5}$ between 2000 and 2008 (index year 2000 = 100)

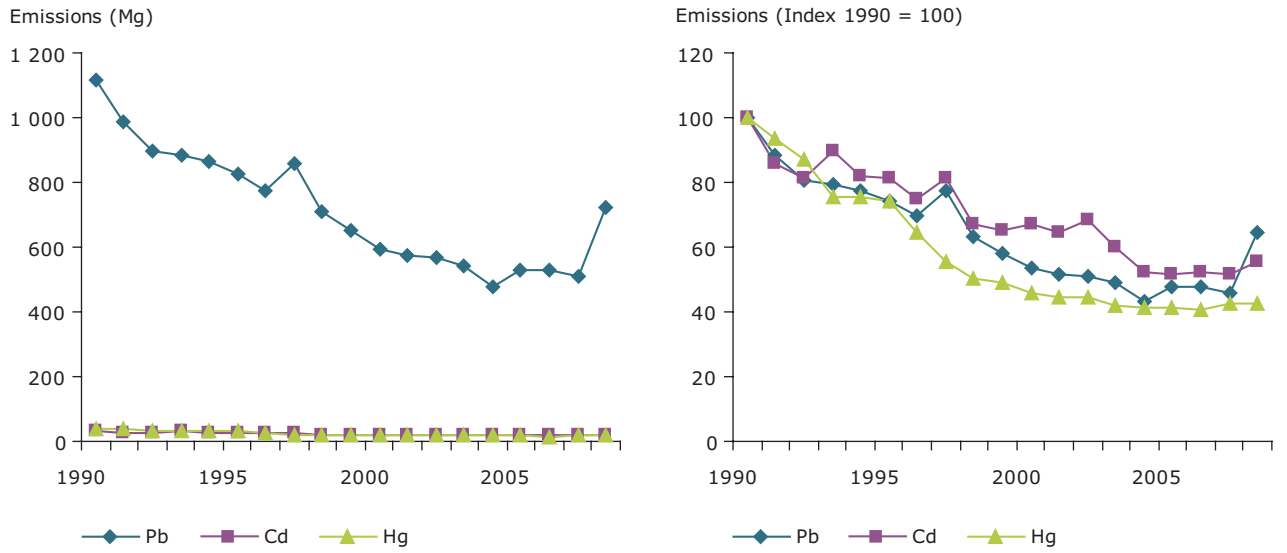


Note: For particulate matter data from some Member States could not be gap-filled as values were not reported for any year. To enable presentation of provisional emission trends, in these instances emissions have been aggregated without including data for all the EU-27 Member States.

Parties to the LRTAP Convention are formally requested to report emissions of particulate matter (PM) only for the year 2000 and onwards.

Several Member States reported notation keys (see Appendix 1) for some of the individual NFR source categories included in this grouped sector.

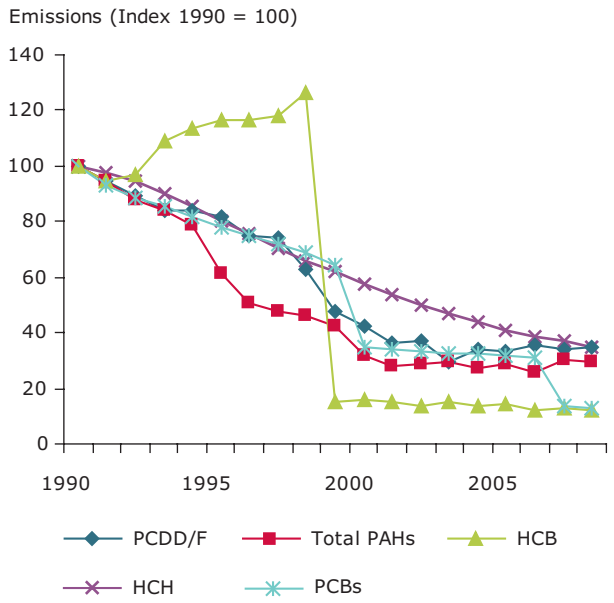
Figure 3.9 EU-27 emission trends in the sector group 'industrial processes' for the heavy metals Pb, Cd, Hg between 1990 and 2008 (index year 1990 = 100)



Note: For the heavy metals, data for one or more Member States could not be gap-filled as values were not reported for any year. To enable presentation of provisional emission trends, in these instances emissions have been aggregated without including data for all the EU-27 Member States.

Several Member States reported notation keys (see Appendix 1) for some of the individual NFR source categories included in this grouped sector.

Figure 3.10 **EU-27 emission trends in the sector group 'industrial processes' for the POPs (PCDD/F, total PAHs, HCB, HCH and PCBs) between 1990 and 2008 (index year 1990 = 100)**



Note: For POPs, data from some Member States could not be gap-filled as values were not reported for any year. To enable presentation of provisional emission trends, in these instances emissions have been aggregated without including data for all the EU-27 Member States.

Several Member States reported notation keys (see Appendix 1) for some of the individual NFR source categories included in this grouped sector.

3.3 Emission trends for 'industrial processes'

The industrial process 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 HCH and HCB emissions and makes important contributions to emissions of most of the main pollutants and particulate matter; past emission trends for these pollutants are shown in Figure 3.8.

Industrial processes make a significant contribution to the total EU-27 emissions of heavy metals, despite significant reductions since 1990. Past emission trends for these pollutants are show in Figure 3.9. Lead shows the highest absolute emission reduction between 1990 and 2008; in relative terms Hg shows the highest percentage reduction (– 58 %).

For POPs, the highest relative reduction between 1990 and 2008 occurred for total HCB (– 88 %), although the emission trend was far from consistent, increasing until 1998 then falling abruptly in 1999 and remaining fairly constant since (Figure 3.10). This significant change is mainly caused by a reported increase and a subsequent drop in HCB emissions from '2 C 3 – Aluminium Production' in the United Kingdom. A similar high reduction was observed for PCBs emissions (– 87 %).

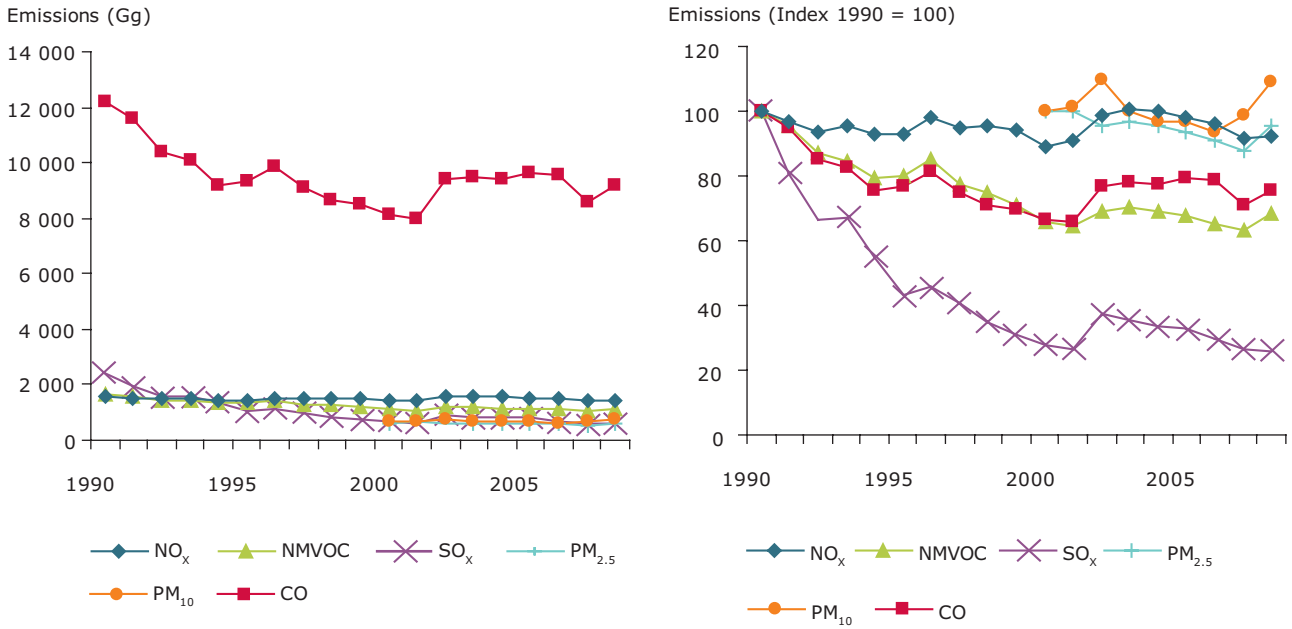
3.4 Emission trends for 'commercial, institutional and households'

As shown earlier in Figure 3.1, emissions arising from fuel combustion by commercial and institutional facilities and households make a significant contribution to total emissions of many pollutants. For the main pollutants and particulate matter, the highest relative reduction between 1990 and 2008 for the sector grouping again occurred for SO_x (– 74 %). Contrastingly, NO_x emissions and particulate matter emissions have changed very little since 1990 and 2000 respectively (Figure 3.11).

Of the three heavy metals in the sector 'commercial, institutional and households', lead shows the highest emission reduction in absolute and relative terms (– 72 %) (Figure 3.12).

For the POPs relevant to the sector 'commercial, institutional and households' the highest relative reduction occurred for PCDD/F (– 77 %) (Figure 3.13).

Figure 3.11 **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 2008 (index year 1990 = 100), for PM_{10} and $PM_{2.5}$ between 2000 and 2008 (index year 2000 = 100)**

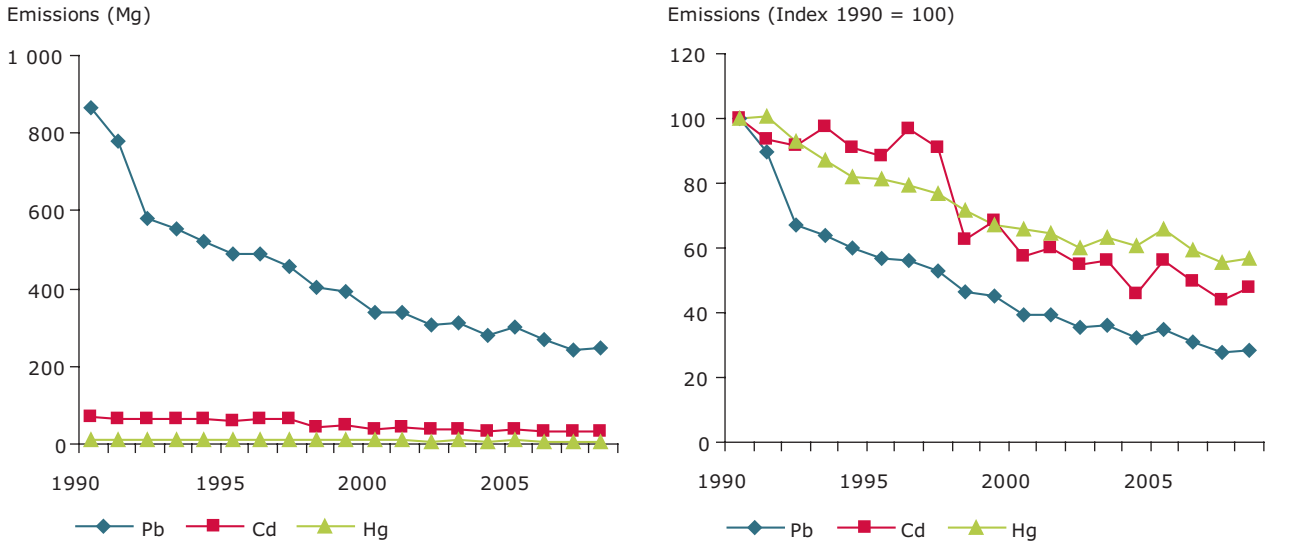


Note: For particulate matter, data from some Member States could not be gap-filled as values were not reported for any year. To enable presentation of provisional emission trends, in these instances emissions have been aggregated without including data for all the EU-27 Member States.

Parties to the LRTAP Convention are formally requested to report emissions of particulate matter (PM) only for the year 2000 and onwards.

Several Member States reported notation keys (see Appendix 1) for some of the individual NFR source categories included in this grouped sector.

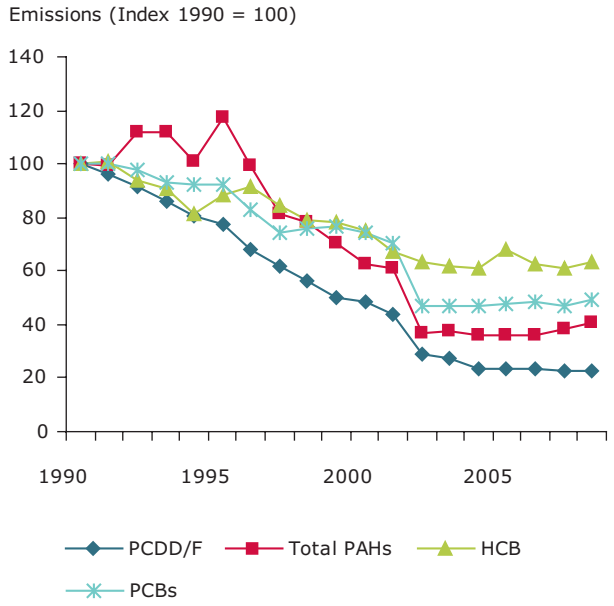
Figure 3.12 **EU-27 emission trends in the sector group 'commercial, institutional and households' for the heavy metals Pb, Cd, Hg between 1990 and 2008 (index year --1990 = 100)**



Note: For the heavy metals, data for one or more Member States could not be gap-filled as values were not reported for any year. To enable presentation of provisional emission trends, in these instances emissions have been aggregated without including data for all the EU-27 Member States.

Several Member States reported notation keys (see Appendix 1) for some of the individual NFR source categories included in this grouped sector.

Figure 3.13 EU-27 emission trends in the sector group 'commercial, institutional and households' for the POPs (PCDD/F, total PAHs, HCB and PCBs) between 1990 and 2008 (index year 1990 = 100)



Note: For POPs, data from some Member States could not be gap-filled as values were not reported for any year. To enable presentation of provisional emission trends, in these instances emissions have been aggregated without including data for all the EU-27 Member States.

Several Member States reported notation keys (see Appendix 1) for some of the individual NFR source categories included in this grouped sector.

3.5 Emission trends for 'road transport'

As earlier noted, together, the individual NFR sources that make up the grouped road transport sector group contribute significantly to emissions of a number of pollutants, including NO_x, NMVOC, CO, $PM_{2.5}$, PM_{10} and certain POPs. Figure 3.14 shows the past emission trends of pollutants in this sector.

For the sector 'road transport' the main heavy metal is Pb, showing high relative emission reduction (– 99 %) between 1990 and 2008 (Figure 3.15). However over the last five years, little progress has been made in reducing emissions further; total emissions of lead 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 particular success story. EU Member States have for example completely phased out the use of leaded petrol, a goal that was regulated by Directive 98/70/EC. Nevertheless, the road transport sector still remains an important source of lead, still contributing around 8 % of total lead emissions in the EU-27.

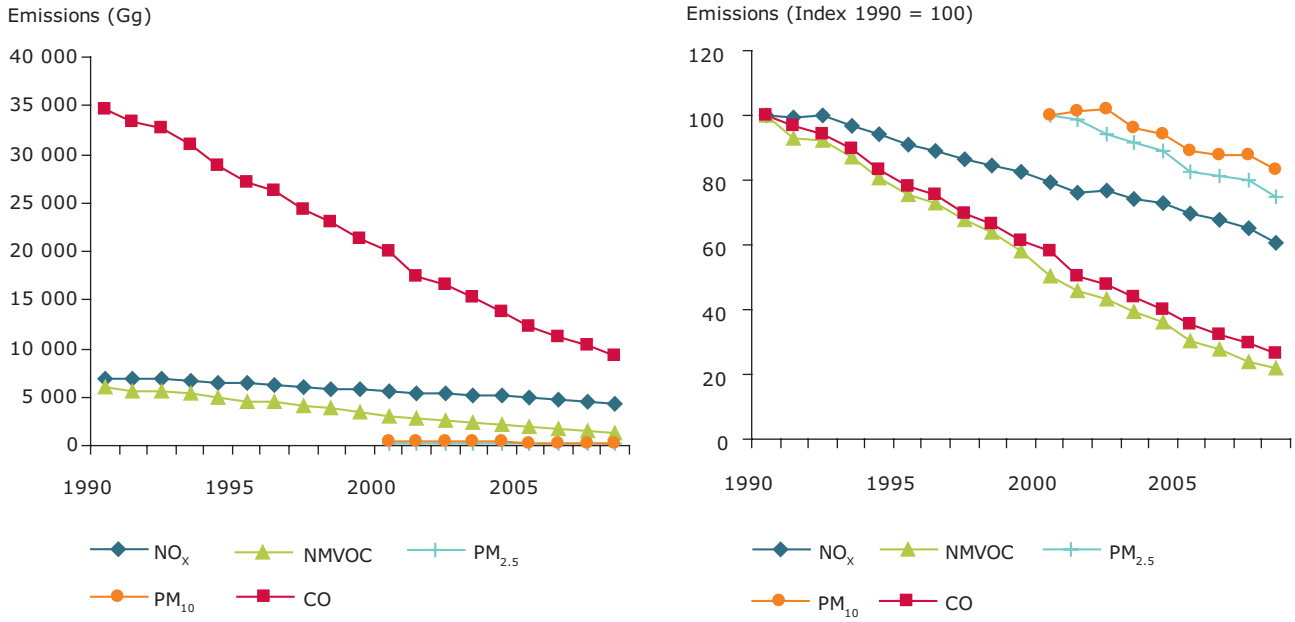
Of the POPs, PAHs and PCBs are the most important in the sector group 'road transport'. Trends of past emissions for these pollutants are shown in Figure 3.16.

3.6 Emission trends for 'non-road transport'

Nitrogen oxides, SO_x and $PM_{2.5}$ are important pollutants in the sector group 'non-road transport'. Little progress has been made since 1990 in reducing emissions from this source, and $PM_{2.5}$ emissions have even increased by 21 % between 2000 and 2008 (Figure 3.17).

The sector group 'non-road transport' makes only a small contribution to emissions of heavy metals and POPs. Trends of pollutants from these two groups of substances are therefore not shown.

Figure 3.14 **EU-27 emission trends in the sector group 'road transport' for NO_x, NMVOC and CO in Gg between 1990 and 2008 (index year 1990 = 100), for PM_{10} and $PM_{2.5}$ between 2000 and 2008 (index year 2000 = 100)**

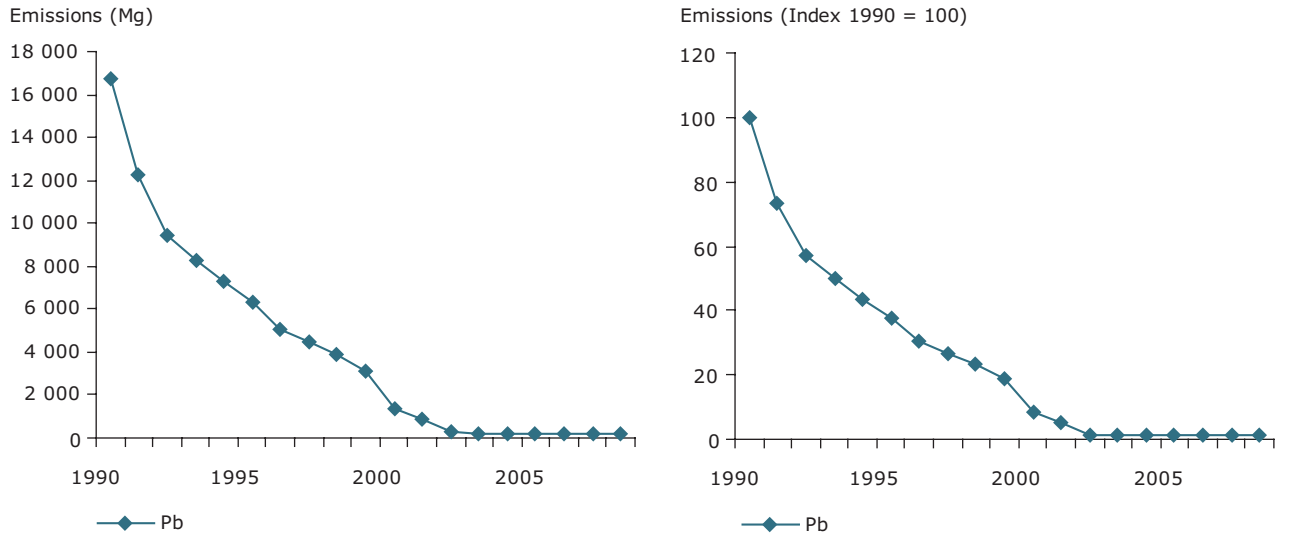


Note: For particulate matter, data from some Member States could not be gap-filled as values were not reported for any year. To enable presentation of provisional emission trends, in these instances emissions have been aggregated without including data for all the EU-27 Member States.

Parties to the LRTAP Convention are formally requested to report emissions of particulate matter (PM) only for the year 2000 and onwards.

Several Member States reported notation keys (see Appendix 1) for some of the individual NFR source categories included in this grouped sector.

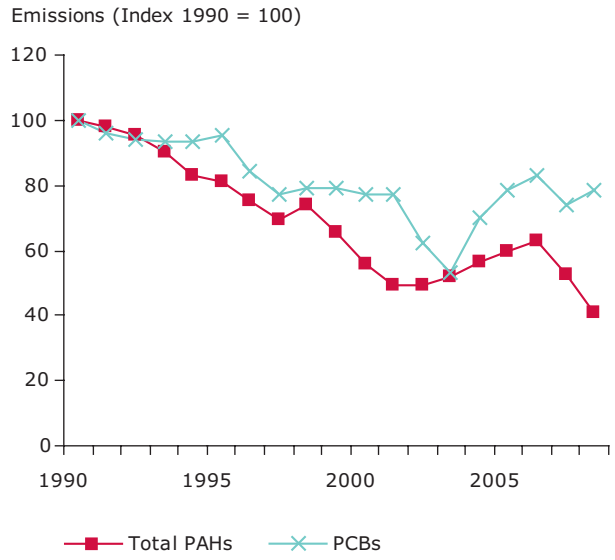
Figure 3.15 **EU-27 emission trends in the sector group 'road transport' for the priority heavy metal Pb between 1990 and 2008 (index year 1990 = 100)**



Note: For the heavy metals, data for one or more Member States could not be gap-filled as values were not reported for any year. To enable presentation of provisional emission trends, in these instances emissions have been aggregated without including data for all the EU-27 Member States.

Several Member States reported notation keys (see Appendix 1) for some of the individual NFR source categories included in this grouped sector.

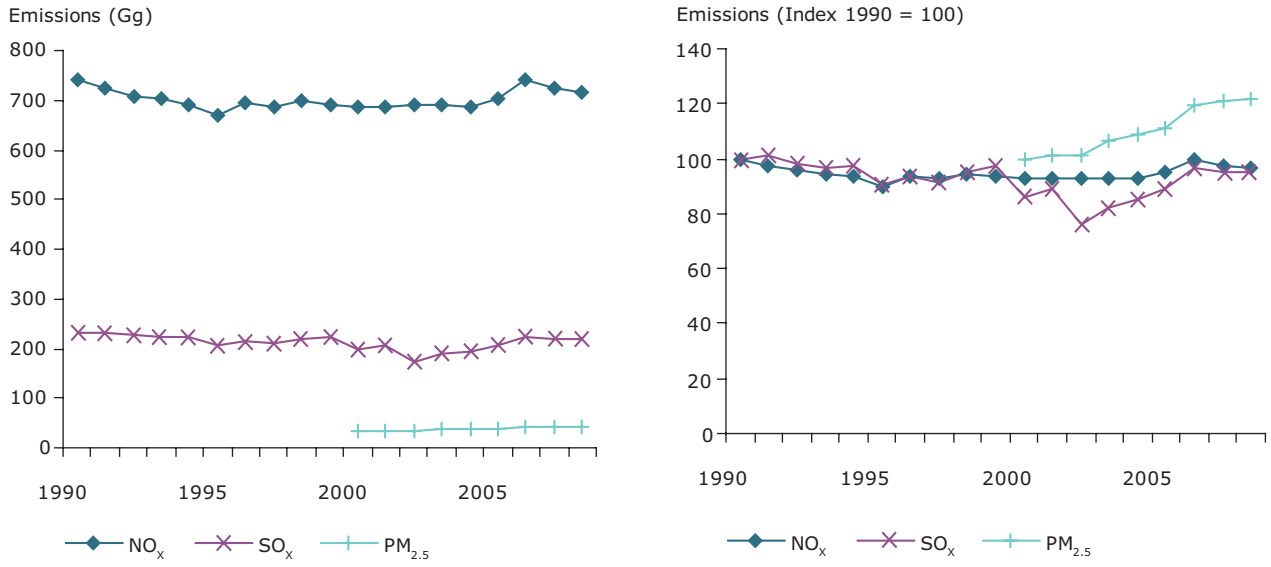
Figure 3.16 EU-27 emission trends in the sector group 'road transport' for the POPs (total PAHs and PCBs) between 1990 and 2008 (index year 1990 = 100)



Note: For POPs, data from some Member States could not be gap-filled as values were not reported for any year. To enable presentation of provisional emission trends, in these instances emissions have been aggregated without including data for all the EU-27 Member States.

Several Member States reported notation keys (see Appendix 1) for some of the individual NFR source categories included in this grouped sector.

Figure 3.17 EU-27 emission trends in the sector group 'non-road transport' for NO_x and SO_x in Gg between 1990 and 2008 (index year 1990 = 100), for $PM_{2.5}$ between 2000 and 2008 (index year 2000 = 100)

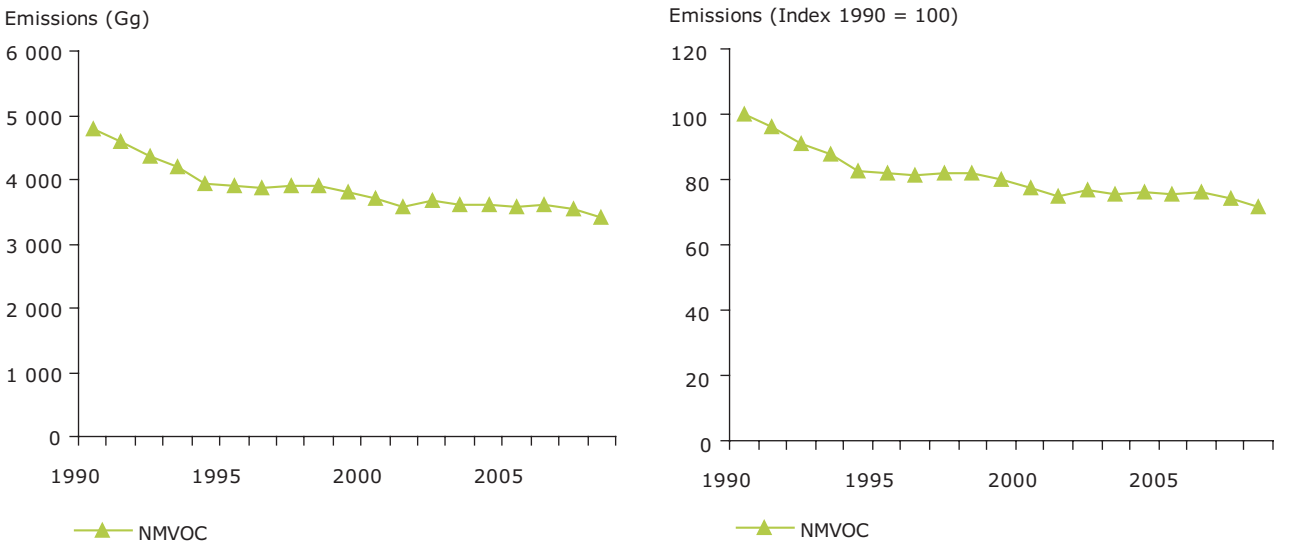


Note: For particulate matter data from some Member States could not be gap-filled as values were not reported for any year. To enable presentation of provisional emission trends, in these instances emissions have been aggregated without including data for all the EU-27 Member States.

Parties to the LRTAP Convention are formally requested to report emissions of particulate matter (PM) only for the year 2000 and onwards.

Several Member States reported notation keys (see Appendix 1) for some of the individual NFR source categories included in this grouped sector.

Figure 3.18 EU-27 emission trends in the sector group 'solvent and product use' NMVOC in Gg between 1990 and 2008 (index year 1990 = 100)



Note: Several Member States reported notation keys (see Appendix 1) for some of the individual NFR source categories included in this grouped sector.

3.7 Emission trends for 'solvent and product use'

The only significant emissions from this sector group are NMVOC. Between 1990 and 2008, NMVOC emissions decreased by 28 % in the EU-27 (Figure 3.18).

3.8 Emission trends for 'agriculture'

As noted earlier, the agriculture sector group is particularly important in terms of its being responsible for the vast majority of NH_3 emissions in the EU-27. Agricultural emissions of NH_3 have decreased by around – 24 % since 1990 (Figure 3.19). The sector also contributes around 12 % of PM_{10} emissions, and 6 % of total NMVOC emissions.

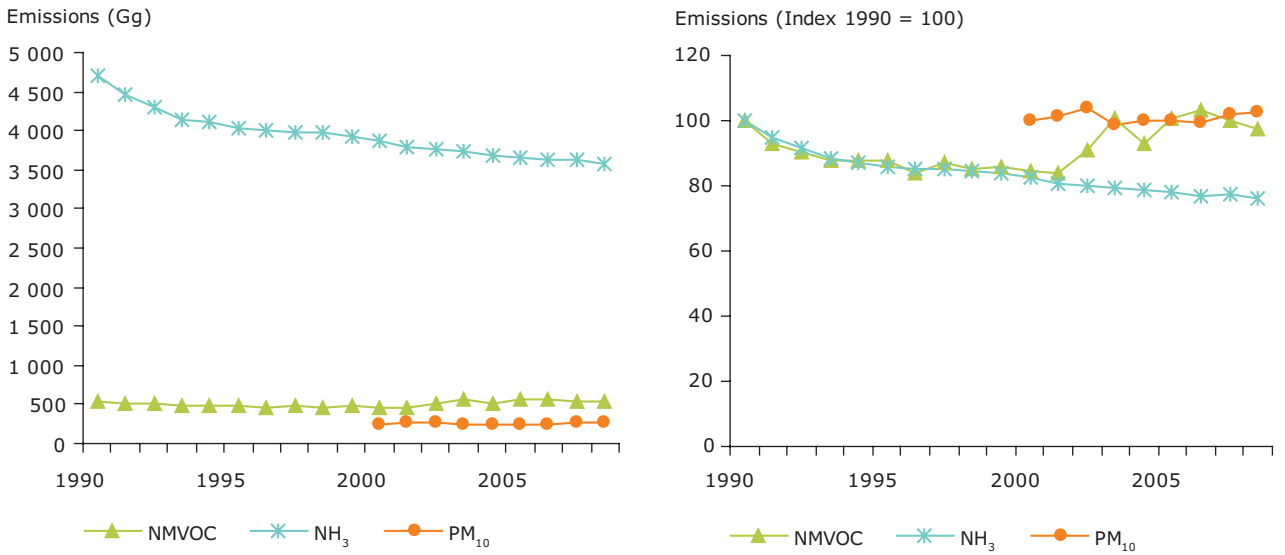
The agriculture sector group does not contribute significantly to emissions of heavy metals.

Of the POPs, the 'agriculture' sector contributes significantly to emissions of PAHs and HCB. Trends of past emissions for these pollutants are shown in Figure 3.20.

3.9 Emission trends for 'waste'

The waste sector group is an important source of certain pollutants, including PCBs, PCDD/F and Hg. Figure 3.21 shows the past emission trends for these pollutants.

Figure 3.19 EU-27 emission trends in the sector group 'agriculture' for NMVOC and NH_3 in Gg between 1990 and 2008 (index year 1990 = 100), for PM_{10} between 2000 and 2008 (index year 2000 = 100)

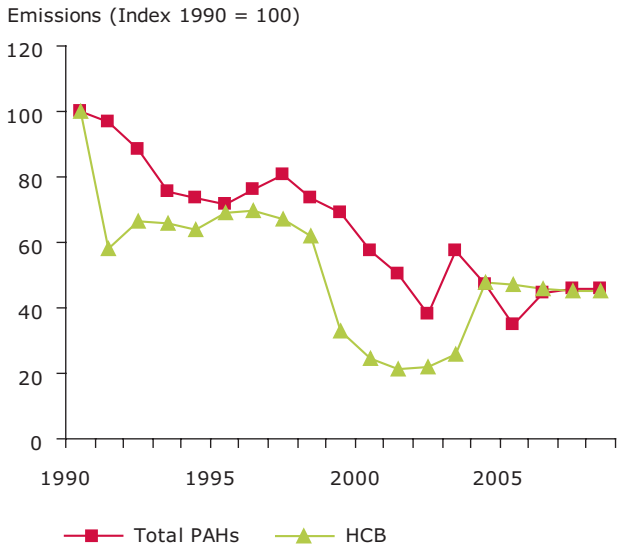


Note: For particulate matter, data from some Member States could not be gap-filled as values were not reported for any year. To enable presentation of provisional emission trends, in these instances emissions have been aggregated without including data for all the EU-27 Member States.

Parties to the LRTAP Convention are formally requested to report emissions of particulate matter (PM) only for the year 2000 and onwards.

Several Member States reported notation keys (see Appendix 1) for some of the individual NFR source categories included in this grouped sector.

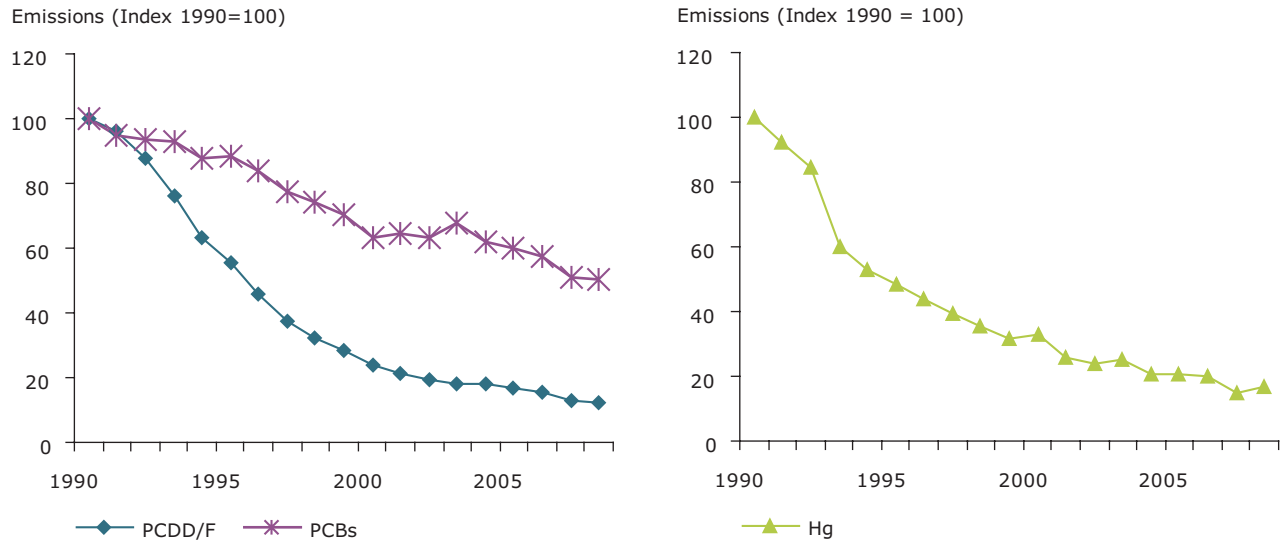
Figure 3.20 EU-27 emission trends in the sector group 'agriculture' for the POPs (total PAHs and HCB) between 1990 and 2008 (index year 1990 = 100)



Note: For the POPs, data from some Member States could not be gap-filled as values were not reported for any year. To enable presentation of provisional emission trends, in these instances emissions have been aggregated without including data for all the EU-27 Member States.

Several Member States reported notation keys (see Appendix 1) for some of the individual NFR source categories included in this grouped sector.

Figure 3.21 EU-27 emission trends in the sector group 'waste' for the POPs (PCDD/F and PCBs) between 1990 and 2008 (index year 1990 = 100)



Note: The Hg and POPs data from some Member States could not be gap-filled as values were not reported for any year. To enable presentation of provisional emission trends, in these instances emissions have been aggregated without including data for all the EU-27 Member States.

Several Member States reported notation keys (see Appendix 1) for some of the individual NFR source categories included in this grouped sector.

4 Recalculations and planned improvements

4.1 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 insufficient to reflect mitigation activities in a transparent manner;
- the capacity (resources) for inventory preparation has increased;
- new inventory methods become available;
- 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. It is often not documented why Member States have reported different numbers in one year compared to an earlier year.

Under the revised Reporting Guidelines (UNECE, 2009) all countries should now submit explanatory Informative Inventory Reports (IIRs) which should include details of recalculations made. Not all counties yet do so. In other instances, although Member States have submitted IIRs, information on the rationale behind recalculations is not always provided.

This year, as a result of the methodological changes involved with trialling a more complete gap-filling procedure for the compilation of EU-27 LRTAP Convention inventory, a detailed analysis of the recalculations reported by Member States has not been performed. This avoids the situation that for some Member States the recalculations might reflect changes in compilation methods rather than true recalculations performed by the countries themselves.

A summary of the individual recalculations reported by Member States is made available in the annual joint EMEP/EEA inventory review report. This report is made available through the CEIP website in July of each year ([17]).

4.2 Planned improvements

4.2.1 Consistency and completeness

EEA-ETC/ACC has noted that the main future challenge for European Union Member States continues to be to improve the quality of data submissions particularly in order to obtain more complete and timely UNECE LRTAP Convention emission inventories. The improvements cannot be implemented at the EU level alone but also need to involve the development and prioritisation of reliable and timely inventory reporting systems in the Member States themselves.

Despite clear progress in recent years concerning the completeness of reporting, as noted earlier in this report a complete set of emission inventory data for the air pollutants is still not available for all Member States. Further, despite the introduction of a more complete gap-filling procedure for this year's inventory, for certain pollutants including particulate matter, the heavy metals and POPs, data could not be fully gap-filled as emission values for some Member States were not reported in any year.

A further issue identified by ETC/ACC concerns the use of data submitted several years ago in the gap-filling procedure. In a number of cases, because countries have not since re-submitted corrected or updated datasets, inconsistencies are unavoidably introduced into the EU-27 inventory. The quality of the European Union's inventory would thus

([17]) www.ceip.at/review-process.

be further improved if the consistency and completeness of Member States' submissions further improves, particularly for reporting of 1990–2001 data and POPs data in general. Such improvements would facilitate reliable trend analysis and inform policy.

The improved inventory gap-filling procedure performed in 2010 has helped ensure a more complete European Union emission inventory. Based on experiences in this year's inventory compilation process, the methods used will be reviewed and feedback provided to Member State representatives concerning options for further improvements.

4.2.2 Format of reported data

The updated Reporting Guidelines (UNECE, 2009) request that all Parties to the LRTAP Convention report emissions using the new NFR09 reporting format for their 2009 submissions. Of the 24 Member States that submitted inventories in 2010, 22 used the new template for at least one inventory year; only two used older formats. However, less historic emissions data was made available in the NFR09 format because some Member States either did not resubmit historic emission data in 2010 or did submit historic data but used older reporting templates. Member States are therefore encouraged in the future also to report for historic years using the new reporting format.

4.2.3 Data review and improved explanatory information

Improvements to the Member States' inventory quality 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 National Emissions Ceilings Directive (2001/81/EC). Since 2009 a centralised Stage 3 review process is in place that aims to review inventories from ten countries annually. The reviews are performed by two teams of emission experts. Member States are encouraged to nominate reviews to the EMEP roster of emission review experts; details on the nomination process may be obtained from the CEIP website.

An uncertainty and sensitivity analysis of the European Union's LRTAP Convention emission inventory could be used in the future to identify specific sources within the inventories of member States that would benefit from further improvements, for example scientific research to improve the robustness of emission factors. However, this type of analysis also requires Member States to report sufficient information to underpin the analysis, which is not yet done.

Finally, for this 2010 European Union inventory report cycle, the present report was partially adapted to EMEP's recommended structure for IIRs, with further adaptations needed to comply in full. Further improvements are somewhat dependent on improved information being provided by Member States. For example, further explanatory information on trends and recalculations could be provided if such information is present in the IIRs received.

References

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Units and abbreviations

kg	1 kilogram = 10^3 g (gram)
t	1 tonne (metric) = 1 megagram (Mg) == 10^6 g
Mg	1 megagram = 10^6 g = 1 tonne (t)
Gg	1 gigagram = 10^9 g = 1 kilotonne (kt)
Tg	1 teragram = 10^{12} g = 1 megatonne (Mt)
TJ	1 terajoule
As	arsenic
Cd	cadmium
CDR	central data repository of EEA's Eionet Reportnet
CEIP	EMEP Centre on Emission Inventories and Projections
CH_4	methane
CO	carbon monoxide
CO_2	carbon dioxide
Cr	chromium
CRF	UNFCCC common reporting format for greenhouse gases
Cu	copper
EEA	European Environment Agency
Eionet	European environmental information and observation network
EMEP	Co-operative programme for monitoring and evaluation of the long-range transmissions of air pollutants in Europe
ERT	expert review team
EU	European Union
HCB	hexachlorobenzene
HCH	hexachlorocyclohexane
HFCs	hydrofluorocarbons
Hg	mercury
HMs	heavy metals
IIR	informative inventory report
KCA	key category analysis
LRTAP Convention	UNECE Convention on Long-range Transboundary Air Pollution
N_2O	nitrous oxide
NECD	EU National Emission Ceilings Directive (2001/81/EC)
NFR	UNECE nomenclature for reporting of air pollutants
NH_3	ammonia
Ni	nickel
NMVOCs	non-methane volatile organic compounds
NO_2	nitrogen dioxide
NO_x	nitrogen oxides
PAHs	polycyclic aromatic hydrocarbons
Pb	lead
PCDD/F	polychlorinated dibenzodioxin/ polychlorinated dibenzofuran
PCBs	polychlorinated biphenyls
PFCs	perfluorocarbons
PM	particulate matter
PM_{10}	particles measuring 10 µm or less
$PM_{2.5}$	particles measuring 2.5 µm or less
POPs	persistent organic pollutants
Se	selenium
SF_6	sulphur hexafluoride
SO_2	sulphur dioxide
SO_x	sulphur oxides
TSP	total suspended particles
UNECE	United Nations Economic Commission for Europe
UNFCCC	United Nations Framework Convention on Climate Change
Zn	zinc

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 but included in the *EMEP/EEA air pollutant emission inventory guidebook* (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 notation 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 notation is as follows ([18])

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 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 paragraph 9 in the Emission Reporting Guidelines, emission inventory reporting should cover all years from 1980 onwards if data are available. However, 'NR' (not relevant) is introduced to ease the reporting where emissions are not strictly required by the different protocols, e.g. for some Parties emissions of NMVOCs 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.

([18]) 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 2010

This Appendix contains a summary of the information provided in the EMEP emission reporting guidelines (UNECE, 2009).

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

Description of contents	Components	Reporting years ([a])
Yearly: minimum (and additional)		
A. National totals:		
1. Main pollutants	NO_x, NMVOCs, SO_x, NH_3, CO	1980–2008
2. Particulate matter	$PM_{2.5}$, PM_{10}, TSP	2000–2008
3. Heavy metals	Pb, Cd, Hg/(*As, Cr, Cu, Ni, Se, Zn*)	1990–2008
4. POPs	([b])	1990–2008
B. Sector emissions:		
1. Main pollutants	NO_x, NMVOCs, SO_x, NH_3, CO	1980–2008
2. Particulate matter	$PM_{2.5}$, PM_{10}, TSP	2000–2008
3. Heavy metals	Pb, Cd, Hg/(*As, Cr, Cu, Ni, Se, Zn*)	1990–2008
4. POPs	([b])	1990–2008
5-yearly: minimum reporting		
C. Gridded data in the EMEP 50 × 50 km² grid		
1. National totals	Main pollutants, PM, Pb, Cd, Hg, PAHs, HCH, HCB, PCBs, PCDD/F	1990, 1995, 2000 and 2005 (PM for 2000 and 2005)
2. Sector emissions	Main pollutants, PM, Pb, Cd, Hg, PCDD/F, PAHs, HCB, HCH, PCBs	1990, 1995, 2000 and 2005 (PM for 2000 and 2005)
D. Emissions from large-point sources	Main pollutants, PM, HMs, PCDD/F, PAHs, HCB, HCH, PCBs	1990, 1995, 2000 and 2005 (PM for 2000 and 2005)
E. Historical and projected activity data and projected national total emissions		
1. National total emissions	See table IV 2A in the emission reporting guidelines	2010, 2015,2020, 2030 and 2050
2. Energy consumption	See tables IV 2B and 2C in the emission reporting guidelines	1990, 1995, 2000, 2005, 2010, 2015 2020, 2030 and 2050
3. Energy consumption for transport sector	See table IV 2D in the emission reporting guidelines	1990, 1995, 2000, 2005, 2010, 2015 2020, 2030 and 2050
4. Agricultural activity	See table IV 2E in the emission reporting guidelines	1990, 1995, 2000, 2005, 2010, 2015 2020, 2030 and 2050
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 www.ceip.at/emission-data-webdab/emissions-used-in-emep-models/
Land-use data/mercury breakdown		
% of toxic congeners of PCDD/F emissions		
Pre-1990 emissions of PAHs, HCB, PCDD/F and PCB		
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]) Polychlorinated dibenzodioxin/ polychlorinated dibenzofuran (PCDD/F), polycyclic aromatic hydrocarbons (PAHs),hexachlorobenzene (HCB), hexachlorocyclohexane (HCH), polychlorinated biphenyls (PCBs). (See revised Emission Reporting Guidelines.): www.ceip.at/reporting-instructions/).

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 NFR, is a standardised format for reporting estimates of emissions – i.e. the Nomenclature for Reporting (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 analysis 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 nitrogen oxides, non-methane volatile organic compounds, sulphur, ammonia, particulate matter, carbon monoxide, lead, cadmium, mercury, PCDD/F, PAHs, HCB, HCH and PCBs, for the EMEP grid squares of 50 km x 50 km and emissions from large point sources (annex IV, tables IV 3A gridded and IV 3B LPS);
- for the years 2010, 2015, 2020, 2030 and 2050 projected activity data and projected national total emissions of sulphur, nitrogen oxides, ammonia and non-methane volatile organic compounds to be reported for the source categories listed in annex IV (2A-WM, 2B-WM, 2A-WaM, 2B-WaM).

Appendix 3 Mapping tables

To allow the European Union inventory to be reported in the requested NFR09 format, emissions inventories that were not available in NFR09 format (because either historic years were not resubmitted in 2010 or an 'older' NFR format (mostly NFR02) was used for the 2010 submission) needed to be transferred into NFR09 format. As the categories in NFR02 and NFR09 are not identical, a procedure for allocating the source categories from NFR02 to NFR09 was developed. The present appendix provides details of the mapping schema used. The most detailed information that a Member State provided was always used, even if such detailed information was only available for a few source categories. The same mapping schema was applied for all Member States that reported in NFR02 formats.

Table A3.1 Mapping from Annex IV Table I NFR02 to Annex IV Table I NFR09

NFR02		NFR09
1 A 1 a Public electricity and heat production	=	1 A 1 a Public electricity and heat production
1 A 1 b Petroleum refining	=	1 A 1 b Petroleum refining
1 A 1 c Manufacture of solid fuels and other energy industries	=	1 A 1 c Manufacture of solid fuels and other energy industries
1 A 2 Manufacturing industries and construction	Note: the allocation of aggregation lines is given in sheet 'aggregation lines'	
1 A 2 a Iron and steel	=	1 A 2 a Stationary combustion in manufacturing industries and construction: iron and steel
1 A 2 b Non-ferrous metals	=	1 A 2 b Stationary combustion in manufacturing industries and construction: non-ferrous metals
1 A 2 c Chemicals	=	1 A 2 c Stationary combustion in manufacturing industries and construction: chemicals
1 A 2 d Pulp, paper and print	=	1 A 2 d Stationary combustion in manufacturing industries and construction: pulp, paper and print
1 A 2 e Food processing, beverages and tobacco	=	1 A 2 e Stationary combustion in manufacturing industries and construction: food processing, beverages and tobacco
1 A 2 f Other	→	1 A 2 f i Stationary combustion in manufacturing industries and construction: other
	×	1 A 2 f ii Mobile combustion in manufacturing industries and construction
1 A 3 a ii (i) Civil aviation (domestic, LTO)	=	1 A 3 a ii (i) Civil aviation (domestic, LTO)
1 A 3 a ii (ii) Civil aviation (domestic, cruise)	National total/ memo Item	
	Memo item/national total	1 A 3 a i (i) International aviation (LTO)
1 A 3 b Road transportation	Aggregation line	
1 A 3 b i Road transport: passenger cars	=	1 A 3 b i Road transport: passenger cars
1 A 3 b ii Road transport: light duty vehicles	=	1 A 3 b ii Road transport: light duty vehicles
1 A 3 b iii Road transport: heavy duty vehicles	=	1 A 3 b iii Road transport: heavy duty vehicles
1 A 3 b iv Road transport: mopeds & motorcycles	=	1 A 3 b iv Road transport: mopeds & motorcycles
1 A 3 b v Road transport: gasoline evaporation	=	1 A 3 b v Road transport: gasoline evaporation
1 A 3 b vi Road transport: automobile tyre and brake wear	=	1 A 3 b vi Road transport: automobile tyre and brake wear

NFR02		NFR09
1 A 3 b vii Road transport: automobile road abrasion	=	1 A 3 b vii Road transport: automobile road abrasion
1 A 3 c Railways	=	1 A 3 c Railways
	Memo item/national total	1 A 3 d i (ii) International inland waterways
1 A 3 d ii National navigation	=	1 A 3 d ii National navigation (shipping)
1 A 3 e Other	Added to 1A3e	
1 A 3 e i Pipeline compressors	→	1 A 3 e Pipeline compressors
1 A 3 e ii Other mobile sources and machinery	Added to 1A3e	
1 A 4 a Commercial/institutional	→	1 A 4 a i Commercial/institutional: stationary
	×	1 A 4 a ii Commercial/institutional: mobile
1 A 4 b Residential	Aggregation line	
1 A 4 b i Residential plants	=	1 A 4 b i Residential: stationary plants
1 A 4 b ii Household and gardening (mobile)	=	1 A 4 b ii Residential: household and gardening (mobile)
1 A 4 c Agriculture/forestry/fishing	Aggregation line	
1 A 4 c i Stationary	=	1 A 4 c i Agriculture/forestry/fishing: stationary
1 A 4 c ii Off-road vehicles and other machinery	=	1 A 4 c ii Agriculture/forestry/fishing: off-road vehicles and other machinery
1A 4 c iii National fishing	=	1A 4 c iii Agriculture/forestry/fishing: national fishing
1 A 5 a Other, stationary (including military)	=	1 A 5 a Other, stationary (including military)
1 A 5 b Other, mobile (Including military)	=	1 A 5 b Other, mobile (including military, land based and recreational boats)
1B1 Fugitive emissions from solid fuels	Aggregation line	
1 B 1 a Coal mining and handling	=	1 B 1 a Fugitive emission from solid fuels: coal mining and handling
1 B 1 b Solid fuel transformation	=	1 B 1 b Fugitive emission from solid fuels: solid fuel transformation
1 B 1 c Other	=	1 B 1 c Other fugitive emissions from solid fuels
1 B 2 Oil and natural gas	Aggregation line	
1 B 2 a Oil	Aggregation line	
1 B 2 a i Exploration production, transport	=	1 B 2 a i Exploration production, transport
1 B 2 a iv Refining/storage	=	1 B 2 a iv Refining/storage
1 B 2 a v Distribution of oil products	=	1 B 2 a v Distribution of oil products
1 B 2 a vi Other	→	1 B 3 Other fugitive emissions from geothermal energy production, peat and other energy extraction not included in 1 B 2
1 B 2 b Natural gas	=	1 B 2 b Natural gas
1 B 2 c Venting and flaring	=	1 B 2 c Venting and flaring
2 A Mineral products	Aggregation line	
2 A 1 Cement production	=	2 A 1 Cement production
2 A 2 Lime production	=	2 A 2 Lime production
2 A 3 Limestone and dolomite use	=	2 A 3 Limestone and dolomite use
2 A 4 Soda ash production and use	=	2 A 4 Soda ash production and use
2 A 5 Asphalt roofing	=	2 A 5 Asphalt roofing
2 A 6 Road paving with asphalt	=	2 A 6 Road paving with asphalt
	×	2 A 7 a Quarrying and mining of minerals other than coal
	×	2 A 7 b Construction and demolition

NFR02		NFR09
	×	2A 7 c Storage, handling and transport of mineral products
2 A 7 Other including non fuel mining & construction	→	2 A 7 d Other mineral products
2 B Chemical industry	Aggregation line	
2 B 1 Ammonia production	=	2 B 1 Ammonia production
2 B 2 Nitric acid production	=	2 B 2 Nitric acid production
2 B 3 Adipic acid production	=	2 B 3 Adipic acid production
2 B 4 Carbide production	=	2 B 4 Carbide production
2 B 5 Other	→	2 B 5 a Other chemical industry
	×	2 B 5 b Storage, handling and transport of chemical products
	×	2 C 1 Iron and steel production
	×	2 C 2 Ferroalloys production
	×	2 C 3 Aluminum production
	×	2 C 5 a Copper production
	×	2 C 5 b Lead production
	×	2 C 5 c Nickel production
	×	2 C 5 d Zinc production
2 C Metal production	→	2 C 5 e Other metal production
	×	2 C 5 f Storage, handling and transport of metal products
2 D Other production	Aggregation line	
2 D 1 Pulp and paper	=	2 D 1 Pulp and paper
2 D 2 Food and drink	=	2 D 2 Food and drink
	×	2 D 3 Wood processing
	×	2 E Production of POPs
	×	2 F Consumption of POPs and heavy metals (e.g. electricial and scientific equipment)
2 G Other	=	2 G Other production, consumption, storage, transportation or handling of bulk products
	×	3 A 1 Decorative coating application
	×	3 A 2 Industrial coating application
3 A Paint application	→	3 A 3 Other coating application
3 B Degreasing and dry cleaning	→	3 B 1 Degreasing
	×	3 B 2 Dry cleaning
3 C Chemical products, manufacture and processing	=	3 C Chemical products
	×	3 D 1 Printing
	×	3 D 2 Domestic solvent use including fungicides
3 D Other, including products containing HMs and POPs	→	3 D 3 Other product use
4 B Manure management	Aggregation line	
4 B 1 Cattle	Aggregation line	
4 B 1 a Dairy	=	4 B 1 a Cattle dairy
4 B 1 b Non-dairy	=	4 B 1 b Cattle non-dairy
4 B 2 Buffalo	=	4 B 2 Buffalo
4 B 3 Sheep	=	4 B 3 Sheep
4 B 4 Goats	=	4 B 4 Goats
4 B 5 Camels and llamas	Added to 4B13	

NFR02		NFR09
4 B 6 Horses	=	4 B 6 Horses
4 B 7 Mules and asses	=	4 B 7 Mules and asses
4 B 8 Swine	=	4 B 8 Swine
	×	4 B 9 a Laying hens
	×	4 B 9 b Broilers
	×	4 B 9 c Turkeys
4 B 9 Poultry	→	4 B 9 d Other poultry
4 B 13 Other	=	4 B 13 Other
4 C Rice cultivation	Added to 4G	
4 D 1 Direct soil emission	→	4 D 1 a Synthetic N-fertilizers
	×	4 D 2 a Farm-level agricultural operations including storage, handling and transport of agricultural products
	×	4 D 2 b Off-farm storage, handling and transport of bulk agricultural products
	×	4 D 2 c N-excretion on pasture range and paddock unspecified
4 F Field burning of agricultural wastes	=	4 F Field burning of agricultural wastes
4 G Other	=	4 G Agriculture other
5 B Forest and grassland conversion	Added to 7A	
6 A Solid waste disposal on land	=	6 A Solid waste disposal on land
6 B Wastewater handling	=	6 B Wastewater handling
	×	6 C a Clinical waste incineration
6 C Waste incineration	→	6 C b Industrial waste incineration
	×	6 C c Municipal waste incineration
	×	6 C d Cremation
	×	6 C e Small scale waste burning
6 D Other waste	=	6 D Other waste
7 Other	→	7 A Other (included in National total for entire territory)
National total for the entire territory (2002 Guidelines)		National total for the entire territory
		National total accounting transport emissions based on fuel used
National total for the entire territory (1997 Guidelines)		
National total for the EMEP grid domain		National total for the EMEP grid domain
		National total as reported under UNFCCC
1 A 3 a i (i) International aviation (LTO)	Memo item/national total	
		1 A 3 a ii (ii) Civil aviation (domestic, cruise)
1 A 3 a i (ii) International aviation (cruise)	=	1 A 3 a i (ii) International aviation (cruise)
1 A 3 d i (i) International maritime navigation	=	1 A 3 d i (i) International maritime navigation
1 A 3 d i (ii) International inland waterways	Memo item/national total	
5 E Other	=	7 B Other not included in national total of the entire territory
X (11 08 Volcanoes)	=	11 A (11 08 Volcanoes)
		11 B Forest fires
		11 C Other natural emissions
		1 A 3 Transport (fuel used)

Table A3.2 Mapping Table I NFR02 to Table I NFR09 - accounting of aggregated emissions

NFR02		NFR09
1 A 2 Manufacturing industries and construction	→	1 A 2 f i Stationary combustion in manufacturing industries and construction: other
1 A 3 b Road Transportation	→	1 A 3 b i Road Transport: passenger cars
1 A 4 b Residential	→	1 A 4 b i Residential: stationary plants
1 A 4 c Agriculture/forestry/fishing	→	1 A 4 c ii Agriculture/forestry/fishing: Off-road vehicles and other machinery
1B1 Fugitive emissions from solid fuels	→	1 B 1 c Other fugitive emissions from solid fuels
1 B 2 Oil and natural gas	→	1 B 2 a i Exploration production, transport
1 B 2 a Oil	Also accounted under 1B2ai	1 B 2 a iv Refining/storage
2 A Mineral products	→	2 A 7 d Other mineral products
2 B Chemical Industry	→	2 B 5 a Other chemical industry
2 D Other Production	Added to 2G	2 D 1 Pulp and paper
4 B 1 Cattle	→	4 B 1 a Cattle dairy
4 B Manure Management	→	4 B 13 Other
National total for the entire territory (2002 Guidelines)		National total for the entire territory

Note: → The aggregated category from NFR02 is accounted for under the NFR09 category indicated, unless more detail was given by the respective Member State.

Appendix 4 Schema for mapping EMEP NFR09 sectors

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 exploration and production
- 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 A4.1.

Table A4.1 Schema for mapping EMEP NFR09 sectors

NFR Code	Long name	EEA aggregated sector name
1 A 1 a	1 A 1 a Public electricity and heat production	Energy exploration and production
1 A 1 b	1 A 1 b Petroleum refining	Energy exploration and production
1 A 1 c	1 A 1 c Manufacture of solid fuels and other energy industries	Energy exploration and production
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 exploration and production
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
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 exploration and production
1 B 1 b	1 B 1 b Fugitive emission from solid fuels: Solid fuel transformation	Energy exploration and production
1 B 1 c	1 B 1 c Other fugitive emissions from solid fuels	Energy exploration and production
1 B 2 a i	1 B 2 a i Exploration, production, transport	Energy exploration and production
1 B 2 a iv	1 B 2 a iv Refining / storage	Energy exploration and production
1 B 2 a v	1 B 2 a v Distribution of oil products	Energy exploration and production
1 B 2 b	1 B 2 b Natural gas	Energy exploration and production
1 B 2 c	1 B 2 c Venting and flaring	Energy exploration and production
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 exploration and production
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

NFR Code	Long name	EEA aggregated sector name
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. electrical and scientific equipment)	Industrial processes
2 G	2 G Other production, consumption, storage, transportation or handling of bulk products (Please specify the sources included/excluded in the notes column to the right)	Industrial processes
3 A 1	3 A 1 Decorative coating application	Solvent and product use
3 A 2	3 A 2 Industrial coating application	Solvent and product use
3 A 3	3 A 3 Other coating application (Please specify the sources included/ excluded in the notes column to the right)	Solvent and product use
3 B 1	3 B 1 Degreasing	Solvent and product use
3 B 2	3 B 2 Dry cleaning	Solvent and product use
3 C	3 C Chemical products	Solvent and product use
3 D 1	3 D 1 Printing	Solvent and product use
3 D 2	3 D 2 Domestic solvent use including fungicides	Solvent and product use
3 D 3	3 D 3 Other product use	Solvent and product use
4 B 1 a	4 B 1 a Cattle dairy	Agriculture
4 B 1 b	4 B 1 b Cattle non-dairy	Agriculture
4 B 2	4 B 2 Buffalo	Agriculture
4 B 3	4 B 3 Sheep	Agriculture
4 B 4	4 B 4 Goats	Agriculture
4 B 6	4 B 6 Horses	Agriculture
4 B 7	4 B 7 Mules and asses	Agriculture
4 B 8	4 B 8 Swine	Agriculture
4 B 9 a	4 B 9 a Laying hens	Agriculture
4 B 9 b	4 B 9 b Broilers	Agriculture
4 B 9 c	4 B 9 c Turkeys	Agriculture
4 B 9 d	4 B 9 d Other poultry	Agriculture
4 B 13	4 B 13 Other	Agriculture
4 D 1 a	4 D 1 a Synthetic N-fertilizers	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
6:00 AM	6 A Solid waste disposal on land	Waste
6 B	6 B Waste-water handling	Waste
6 C a	6 C a Clinical waste incineration (d)	Waste
6 C b	6 C b Industrial waste incineration (d)	Waste
6 C c	6 C c Municipal waste incineration (d)	Waste
6 C d	6 C d Cremation	Waste
6 C e	6 C e Small scale waste burning	Waste
6 D	6 D Other waste (e)	Waste
7:00 AM	7 A Other (included in national total for entire territory)	Other

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European Environment Agency
Kongens Nytorv 6
1050 Copenhagen K
Denmark

Tel.: +45 33 36 71 00
Fax: +45 33 36 71 99

Web: eea.europa.eu
Enquiries: eea.europa.eu/enquiries

Publications Office
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European Environment Agency