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European Union emission inventory report 1990–2014 under the UNECE Convention on Long-range Transboundary Air Pollution (LRTAP)

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European Environment Agency

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Units, abbreviations and acronyms

Units, abbreviations and acronyms	
As	Arsenic
B(a)P	Benzo(a)pyrene
B(b)F	Benzo(b)fluoranthene
BC	Black carbon
B(k)F	Benzo(k)fluoranthene
C	Confidential (notation key)
Cd	Cadmium
CDR	Central Data Repository
CEIP	Centre on Emission Inventories and Projections
CH_4	Methane
CLRTAP	(UNECE) Convention on Long-range Transboundary Air Pollution
CO	Carbon monoxide
CO_2	Carbon dioxide
COPERT	COmputer Program to calculate Emissions from Road Transportation
Cr	Chromium
CRF	(UNFCCC) common reporting format (for greenhouse gases)
Cu	Copper
DG	Directorate-General
EC	European Commission
EEA	European Environment Agency
Eionet	European Environment Information and Observation Network
EMEP	European Monitoring and Evaluation Programme (cooperative programme for monitoring and evaluation of the long-range transmissions of air pollutants in Europe)
EPA	Environmental Protection Agency
EPER	European Pollutant Emission Register
E-PRTR	European Pollutant Release and Transfer Register
ERT	Expert Review Team
ETC/ACM	European Topic Centre on Air Pollution and Climate Change Mitigation (of the EEA)
ETS	Emissions Trading Scheme
EU	European Union
FGD	Flue-gas desulphurisation
Gg	1 gigagram = 10^9 g = 1 kilotonne (kt)
GHG	Greenhouse gas
GNFR	Gridding nomenclature for reporting/UNECE nomenclature for reporting of air pollutants
HCB	Hexachlorobenzene
HCE	Hexachloroethane
HFC(s)	Hydrofluorocarbon(s)
Hg	Mercury
HM(s)	Heavy metal(s)
IE	Included elsewhere (notation key)
IIR	Informative inventory report
IP	Indeno(1,2,3-cd)pyrene
IPCC	Intergovernmental Panel on Climate Change

Units, abbreviations and acronyms	
I-Teq	International toxic equivalent
KCA	Key category analysis
kg	1 kilogram = 10^3 g (gram)
LCP	Large combustion plant
LPS	Large point source
LRTAP	Long-range Transboundary Air Pollution
LTO	Landing/take-off
Mg	1 megagram = 10^6 g = 1 tonne (t)
Mt	Megatonne
N_2O	Nitrous oxide
NA	Not applicable (notation key)
n/a	Not available.
NE	Not estimated (notation key)
NEC Directive	EU National Emission Ceilings Directive (2001/81/EC)
NFR	Nomenclature for reporting/UNECE nomenclature for reporting of air pollutants
NFR14	Current format for reporting of air pollutants (Nomenclature for reporting)
NH_3	Ammonia
Ni	Nickel
NMVOC(s)	Non-methane volatile organic compound(s)
NO	Not occurring (notation key)
NO_2	Nitrogen dioxide
NO_X	Nitrogen oxides
NR	Not relevant (notation key)
O_3	Ozone
PAH(s)	Polyaromatic hydrocarbon(s)
Pb	Lead
PCB(s)	Polychlorinated biphenyl(s)
PCDD/F(s)	Polychlorinated dibenzodioxin(s)/dibenzofuran(s)
PFC(s)	Perfluorocarbon(s)
PM	Particulate matter
$PM_{2.5}$	Fine particulate matter with a diameter of 2.5 µm or less
PM_{10}	Particulate matter with a diameter of 10 µm or less
POP(s)	Persistent organic pollutant(s)
E-PRTR	Pollutant release and transfer
QA	Quality assurance
QC	Quality control
REP	Renewable Energy Plant
SCR	Selective catalytic reduction
Se	Selenium
SNAP	Selected Nomenclature for reporting of Air Pollutants
SNCR	Selective non-catalytic reduction
SO_2	Sulphur dioxide
SO_X	Sulphur oxides
t	1 tonne (metric) = 1 megagram (Mg) = 10^6 g
T	Tier (method)
TFEIP	Task Force on Emission Inventories and Projections
TSP	Total suspended particulate(s)
UNECE	United Nations Economic Commission for Europe
UNFCCC	United Nations Framework Convention on Climate Change
VOCS(s)	Volatile organic compound(s)
Zn	Zinc

Key category source sector abbreviations	
1A1a	Public electricity and heat production
1A1b	Petroleum refining
1A2a	Stationary combustion in manufacturing industries and construction: iron and steel
1A2b	Stationary combustion in manufacturing industries and construction: non-ferrous metals
1A2c	Stationary combustion in manufacturing industries and construction: chemicals
1A2f	Stationary combustion in manufacturing industries and construction: non-metallic minerals
1A2gvii	Mobile combustion in manufacturing industries and construction
1A2gviii	Stationary combustion in manufacturing industries and construction: other
1A3bi	Road transport: passenger cars
1A3bii	Road transport: light duty vehicles
1A3biii	Road transport: heavy duty vehicles and buses
1A3biv	Road transport: mopeds & motorcycles
1A3bv	Road transport: gasoline evaporation
1A3bvi	Road transport: automobile tyre and brake wear
1A3bvii	Road transport: automobile road abrasion
1A3dii	National navigation (shipping)
1A4ai	Commercial/institutional: stationary
1A4bi	Residential: stationary
1A4bii	Residential: household and gardening (mobile)
1A4ci	Agriculture/forestry/fishing: stationary
1A4cii	Agriculture/forestry/fishing: off-road vehicles and other machinery
1B2ai	Fugitive emissions oil: exploration, production, transport
1B2aiv	Fugitive emissions oil: refining/storage
1B2av	Distribution of oil products
2A5a	Quarrying and mining of minerals other than coal
2A5b	Construction and demolition
2B10a	Chemical industry: other
2C1	Iron and steel production
2C5	Lead production
2D3a	Domestic solvent use including fungicides
2D3b	Road paving with asphalt
2D3d	Coating applications
2D3e	Degreasing
2D3g	Chemical products
2D3h	Printing
2D3i	Other solvent use
2G	Other product use
2H2	Food and beverages industry
2I	Wood processing
2K	Consumption of POPs and heavy metals (e.g. electrical and scientific equipment)
2L	Other production, consumption, storage, transportation or handling of bulk products
3B1a	Manure management — dairy cattle
3B1b	Manure management — non-dairy cattle
3B3	Manure management — swine
3B4gi	Manure management — laying hens
3B4gii	Manure management — broilers
3B4giv	Manure management — other poultry
3Da1	Inorganic N-fertilisers (includes also urea application)
3Da2a	Animal manure applied to soils
3Da3	Urine and dung deposited by grazing animals
3Dc	Farm-level agricultural operations including storage, handling and transport of agricultural products

Key category source sector abbreviations	
3Df	Use of pesticides
3F	Field burning of agricultural residues
5C1bi	Industrial waste incineration
5C1biii	Clinical waste incineration
5C1biv	Sewage sludge incineration
5C2	Open burning of waste

Country codes	
AT	Austria
BE	Belgium
BG	Bulgaria
CY	Cyprus
CZ	Czech Republic
DE	Germany
DK	Denmark
EE	Estonia
EL	Greece
ES	Spain
FI	Finland
FR	France
HR	Croatia
HU	Hungary
IE	Ireland
IT	Italy
LT	Lithuania
LU	Luxembourg
LV	Latvia
MT	Malta
NL	Netherlands
PL	Poland
PT	Portugal
RO	Romania
SE	Sweden
SI	Slovenia
SK	Slovakia
UK	United Kingdom

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Executive summary

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

The LRTAP Convention obliges and invites Parties to report emissions data for numerous air pollutants:

- main pollutants: NO_X, NMVOCs, SO_X, NH_3 and carbon monoxide (CO);
- PM emitted directly into the air (primary PM):
  - PM with a diameter greater than 2.5 microns ($PM_{2.5}$, also called fine particulate matter);
  - PM with a diameter greater than 10 microns (PM_{10});
  - BC, the most strongly light-absorbing component of PM;
  - total suspended particulates (TSPs).
- priority heavy metals (HMs): lead (Pb), cadmium (Cd) and mercury (Hg);
- additional HMs: arsenic (As), chromium (Cr), copper (Cu), nickel (Ni), selenium (Se) and zinc (Zn);
- persistent organic pollutants (POPs): polychlorinated dibenzodioxins/dibenzofurans (PCDD/Fs), polycyclic aromatic hydrocarbons (PAHs), hexachlorobenzene (HCB) and polychlorinated biphenyls (PCBs);
- additional reporting of the individual PAHs benzo(a) pyrene (B(a)P), benzo(b)fluoranthene (B(b)F), benzo(k)fluoranthene (B(k)F) and indeno(1,2,3-cd) pyrene (IP), and of their sum as the total of all four.

These pollutants harm human health and the environment. Some of the pollutants also contribute to the formation of ground-level ozone (O_3) and secondary PM in the atmosphere while others have an indirect and direct effect on the sunlight absorbed by the Earth and reflected back to space (radiative forcing) and hence on the climate (EEA, 2014, 2015f and 2015g).

This report describes:

- the institutional arrangements and preparation processes behind the EU's emission inventory, methods and data sources, the key category

Box ES.1 The Gothenburg Protocol

The Gothenburg Protocol to the Long-range Transboundary Air Pollution (LRTAP) Convention sets emission ceilings. Parties to the convention must reduce their emissions to no more than these levels. These ceilings, for 2010 and after, are for the pollutants nitrogen oxides (NO_X), non-methane volatile organic compounds (NMVOCs), sulphur oxides (SO_X) and ammonia (NH3). In addition to the ceilings for individual countries, the protocol also specifies ceilings for the EU, which is a Party to the protocol in its own right (UNECE, 1999). The protocol was amended in 2012 with new emission reduction commitments for 2020 and beyond. The EU has not yet ratified it. However, Parties are already encouraged to also report primary particulate matter (PM) and black carbon (BC) emissions, in line with the revised emission-reporting guidelines (UNECE, 2014a) ([1]).

([1]) The EEA published its annual update of the NEC Directive reporting (EEA, 2016) on 10 June 2016. This briefing analyses the 2014 emission data for EU Member States reported under directive 2001/81/EC on national emission ceilings for certain atmospheric pollutants, known as the EU National Emission Ceilings (NEC) Directive (EC, 2001). For the EU Member States, the NEC Directive contains national emission ceilings that are either equal to or more ambitious than those set out in the Gothenburg Protocol.

Box ES.2 Status of reporting by EU-28 Member States

In 2016, Member States were requested to report emission inventory data and an informative inventory report (IIR). All Member States, except Greece, provided air emission inventories. For Greek data sets, and for other countries where data were missing for certain years or pollutants, a gap-filling procedure was applied to obtain as complete as possible an EU inventory. By 6 May 2016, 27 Member States had reported activity data, but only 22 Member States had reported activity data for the complete time series (1990–2014). 21 Member States provided IIRs. Reporting of gridded data, large point sources and projections was not requested in 2016; although three Member States reported gridded data, one Member State provided data on large point sources and 6 Member States reported projections. Detailed information on Member States' submissions is in Appendix 3.

analyses, and information on uncertainty, completeness and underestimations (Chapter 1);

- information on approved adjustments and adjustment applications (Chapter 2);
- emission trends for the EU-28 as a whole and for individual Member States, and the contribution that important individual source sectors make to emissions (Chapter 3);
- sectoral analyses and emission trends for key pollutants (Chapter 4);
- information on recalculations, as well as planned and implemented improvements (Chapter 5).

Emission data presented in this report are in the accompanying annexes and are also available for direct download through the EEA's LRTAP data viewer. The following sections summarise the main findings.

EU-28 emission trends

Figures ES.1–ES.3 present the aggregated EU-28 emission trends of air pollutants between 1990 and 2014 ([2]).

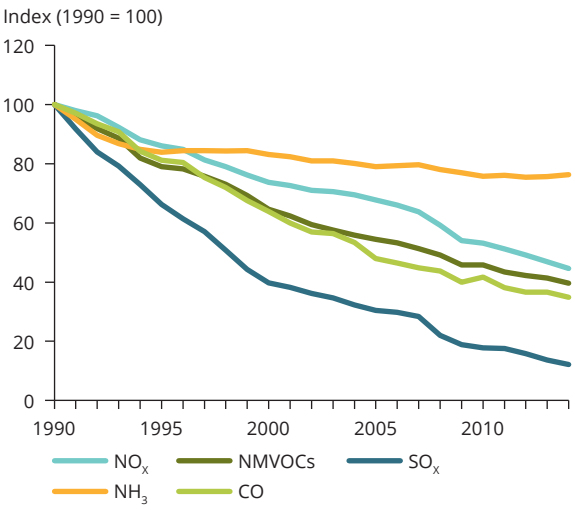
Emission trends of the main air pollutants between 1990 and 2014

With reference to the main air pollutants, SO_x was the pollutant with the greatest reduction in emissions across the EU-28. Emissions of SO_x in 2014 were 88 % less than in 1990 (Figure ES.1). This reduction is the result of a combination of measures:

- fuel switching in energy-related sectors, away from solid and liquid fuels with high sulphur content to low-sulphur fuels such as natural gas;
- applying flue-gas desulphurisation (FGD) techniques in industrial facilities;
- EU directives relating to the sulphur content of certain liquid fuels.

Emissions of the other main air pollutants have dropped considerably since 1990, including the three

Figure ES.1 EU-28 emission trends for the main air pollutants



([2]) By 15 February each year, Member States must report emission data for up to and including the last calendar year but one. Thus, by 15 February 2016, Member States were obliged to report for the years before 2015. Typically, it takes countries about 12 to 15 months to compile and report emission inventory data (for both air pollutants and greenhouse gases (GHGs)). This delay is mainly because of the time needed for official national and/or trade statistics to become available (typically up to 12 months after the end of the calendar year), together with the time needed for subsequent data processing, calculations, and quality assurance and quality control (QA/QC) checks.

air pollutants primarily responsible for the formation of ground-level O_3: CO (65 % reduction), NMVOCs (60 % reduction) and NO_X (55 % reduction). For the main pollutants, emissions have been decreasing more slowly over the last decade. However, emissions of NH_3 fell less than emissions of the other main pollutants (24 %) since 1990.

NH_3 is the only main air pollutant where emissions increased in the EU-28 (by 0.9 %) between 2013 and 2014. Emissions of NO_X and SO_X dropped by 4.7 % and 11.1 %, respectively. Emissions of NMVOCs decreased by 4.1 %, and of CO by 4.8 %.

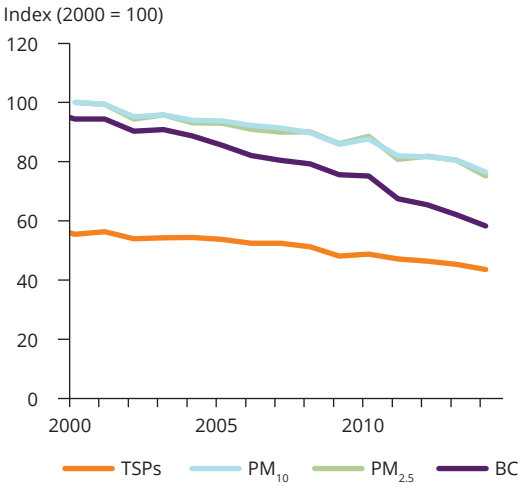
In absolute terms, emissions changed most for the following countries and sectors between 2013 and 2014:

- NH_3 emissions increased most in France, Germany and Spain, by 2.5 % (+ 17 Gg), 1.3 % (+ 10 Gg) and 2.7 % (+ 10 Gg), respectively. In all three countries the increases were caused solely by emissions in the 'agriculture' sector, mainly associated with fertiliser use and manure management.

- The drop in EU-28 NO_X emissions is mainly due to significant reductions reported by the United Kingdom, France and Poland. The decreases were 8.4 % (– 87 Gg), 8.3 % (– 80 Gg) and 6.6 % (– 51 Gg), respectively. In the United Kingdom, NO_X emissions fell most in the energy production and distribution sector (– 51 Gg), in the 'commercial, institutional and households' sector (– 16 Gg) and in the 'road transport' sector (– 13 Gg). In France, highest emission reductions were observed in the 'commercial, institutional and household' sector (– 27 Gg), the 'energy production and distribution' sector (– 23 Gg), and the 'road transport' sector (– 18 Gg). Also in Poland the 'energy production and distribution' sector showed the highest decreases (– 28 Gg), followed by the 'commercial, institutional and household' sector (– 13 Gg).

- Germany, Italy and France reported the highest reductions in NMVOC emissions, by 6.2 % (– 69 Gg), 6.5 % (– 59 Gg) and 8.4 % (– 58 Gg), respectively. In Germany emissions reduced most in the 'industrial processes and product use' sector (– 61 Gg), followed by the 'commercial, institutional and household' sector (– 9 Gg). The same is true for Italy, where emissions decreased by 24 Gg and 23 Gg in these two sectors. In France, emissions fell most in the 'commercial, institutional and household' sector, they dropped by 30 Gg and by 13 Gg in the 'industrial processes and product use' sector.

Figure ES.2 EU-28 emission trends for PM



- The largest reductions in SO_X emissions were in the United Kingdom and Poland: – 20.3 % (– 78 Gg) and – 6.2 % (– 53 Gg), respectively. In both countries, emissions reduced most in the ''energy production and distribution' sector (– 65 Gg and – 33 Gg, respectively), with a significant decrease also reported in the 'energy use in industry' sector (– 10 Gg and – 3 Gg, respectively).

- CO emissions decreased mainly due to a large drop of 8.8 % (– 226 Gg) reported by Italy. The main cause was a decrease in emissions in the 'commercial, institutional and households' sector (– 191 Gg).

Emission trends of particulate matter between 2000 and 2014

The LRTAP Convention formally requests Parties to report emissions of PM from 2000 onwards. Hence emission trends are shown for these years only. Aggregated emissions of TSPs have fallen by 56 % across the EU-28 since 1990 (Figure ES.2). Emissions of primary PM_{10} and $PM_{2.5}$ have fallen by 23 % and 25 %, respectively (since 2000), and of BC by 42 %.

Total PM emissions have decreased over the past decade mainly due to the introduction or improvement of abatement measures across the 'energy', 'road transport', and 'industry' sectors, coupled with other developments in industrial sectors, such as switching from more polluting fuels such as coal to natural gas.

Emission trends of heavy metals and POPs between 1990 and 2014

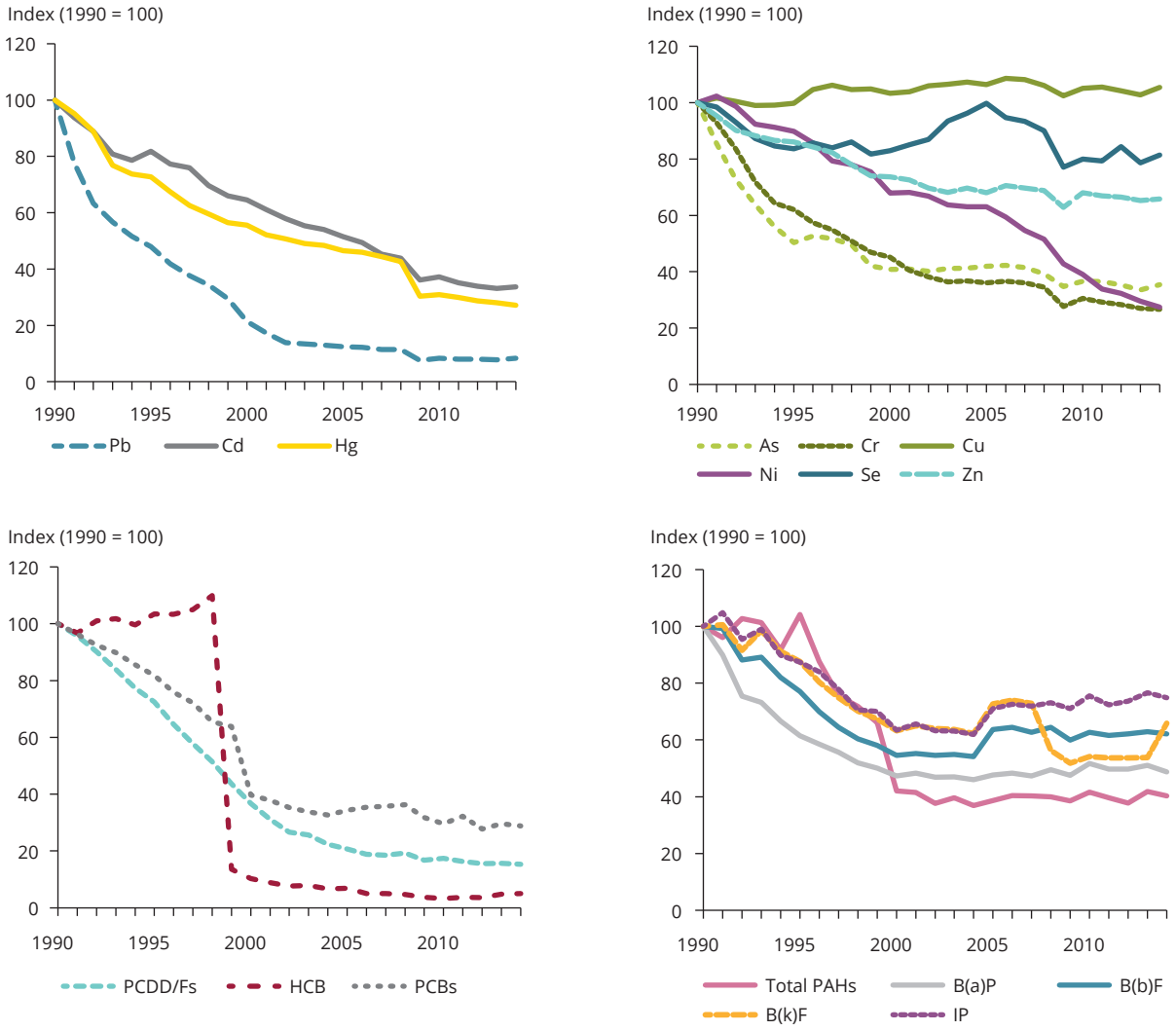
Emissions of the main HMs (Pb, Cd, Hg), dioxins and furans, HCB and PCBs have also dropped substantially since 1990, by about 66 % or more (Figure ES.3).

Much progress has been made since the early 1990s in reducing point-source emissions of these substances, particularly from industrial facilities. This has been achieved partially through improved abatement techniques for wastewater treatment, and for incinerators in the metal refining and smelting industries. In some countries, the emissions reduction follows the closure of older industrial facilities due to economic restructuring.

Copper emissions have increased a little over the years; they were 5 % higher in 2014 than in 1990. Emissions of other HMs reduced between 1990 to 2014: As by 65 %, Cr by 73 %, Ni by 73 %, Se by 19 % and Zn by 34 %. The decrease was 60 % for total PAHs ([3]).

For individual PAHs, the reductions were 51 % for B(a)P, 38 % for B(b)F, 34 % for B(k)F and 25 % for IP from 1990 to 2014. There have been clear decreases over the last 25 years, but emissions of PAHs have remained broadly stable since 2000 (Figure ES.3).

Figure ES.3 EU-28 emission trends for HMs and POPs



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

For certain pollutants, not all Member States reported data.

([3]) It is difficult to compare reductions of total PAHs and reductions of the other PAHs. The reporting completeness for the EU (sum of reporting/gap-filling of the Member States) differs strongly between total PAHs and the other PAHs.

Box ES.4 Effects of recalculated data for previously reported 2013 emissions

In 2016, several Member States submitted recalculations for one or more previously reported years. They resulted in changed emission inventories for all pollutants for 2013.

The recalculations for the previously reported EU-28 emission totals for the selected pollutants were: NO_X (+ 0.4 %), NMVOCs (+ 0.03 %), SO_X (+ 1.1 %), and NH_3 (+ 1.0 %). Recalculations reported by individual Member States for 2013 varied for NO_X between – 3 % to + 14 %, for NMVOCs from – 37 % to + 67 %, for SO_X from – 10 % to + 156 % and for NH_3 – 20 % to + 49 %.

Concerning the transparency of the recalculations made, in their informative inventory reports (IIRs) (see Appendix 5) the following Member States gave an account of their reasons for recalculating parts of time series or whole time series: Austria, Belgium, Bulgaria, Croatia, Cyprus, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, the Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden and the United Kingdom. Explanations included methodological improvements, revision of emission factors, reallocations, revision of activity data and correction of errors. Not all Member States however provided information on the rationale behind recalculations.

EU-28 key categories and main emission sources

Key categories are those individual sources that contribute the most, overall, to emissions of pollutants. They were determined by a level assessment ([4]) for NO_X, NMVOCs, SO_X, NH_3, CO, $PM_{2.5}$, PM_{10}, Cd, Pb, Hg, PCDD/Fs, total PAHs, B(a)P, HCB and PCBs.

A total of 57 different emission inventory source categories were identified as being key categories for at least one pollutant in 2014. A number of emission categories were identified as being key categories for more than one of the 14 pollutants assessed. Table ES.1 lists the most important key categories.

Figure ES.4 shows the share of EU-28 emissions by sector group. As observed in past years, each main air pollutant has one major source category: for NO_X, this is 'road transport'; for SO_X, 'energy production and distribution'; for NH_3, 'agriculture'; for NMVOCs, 'industrial processes and product use'; and for CO, as well as PM, 'commercial, institutional and households'.

Emissions of NO_X from the 'road transport' sector decreased by 59 % between 1990 and 2014. The road transport sector remains, nevertheless, a major source of the ground-level O_3 precursors NO_X, CO and NMVOCs in the EU; in 2014 it contributed 39 %, 21 % and 11 %, respectively, of total emissions of these pollutants in EU-28. It is also a major source of primary $PM_{2.5}$, PM_{10} and Pb emissions. Passenger cars and heavy-duty vehicles and buses are the principal contributors to NO_X emissions from this sector; in 2014, passenger cars alone contributed around 73 % of 'road transport' CO emissions.

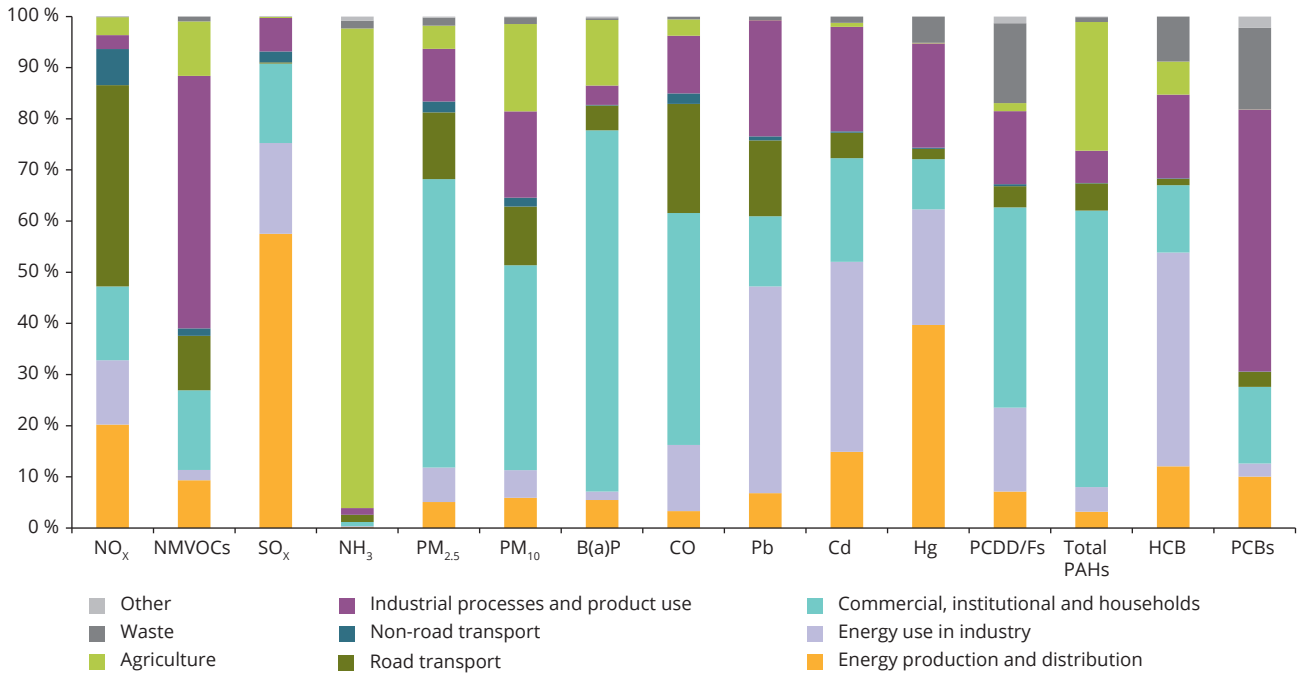
Table ES.1 Most relevant key categories for air pollutant emissions

Name of key category	Number of occurrences as key category
Residential: stationary (combustion) (NFR 1A4bi)	14 (NO_X, SO_X, NMVOCs, CO, Pb, Cd, Hg, $PM_{2.5}$, PM_{10}, PCDD/Fs, total PAHs,B(a)P, HCB, PCBs)
Public electricity and heat production (NFR 1A1a)	11 (NO_X, SO_X, CO, Pb, Cd, Hg, $PM_{2.5}$, PM_{10}, PCDD/Fs, HCB, PCBs)
Stationary combustion in manufacturing industries and construction: Non-metallic minerals (NFR 1A2f)	10 (NO_X, SO_X, CO, Pb, Cd, Hg, $PM_{2.5}$, PM_{10}, PCDD/Fs, HCB)
Iron and steel production (NFR 2C1)	9 (CO, Pb, Cd, Hg, $PM_{2.5}$, PM_{10}, PCDD/Fs, HCB, PCBs)
Road transport: passenger cars (NFR 1A3bi)	7 (NO_X, NMVOCs, CO, $PM_{2.5}$, PM_{10}, total PAHs, PCDD/Fs)

Notes: For NFR codes, see list of source sector abbreviations (Units, abbreviations and acronyms) or Appendix 4 (Conversion chart for aggregated sector groups).

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

Figure ES.4 Share of EU-28 emissions of the reported pollutants, by sector group



The 'commercial, institutional and households' sector is the most important source of B(a)P, CO, $PM_{2.5}$, PM_{10}, dioxins and furans, and total PAH. Energy- and process-related emissions from industry contribute considerably to the overall emissions of a number of the HMs and POPs.

Adjustments to emission inventories under the Gothenburg Protocol

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

Circumstances that allow adjustments to emission inventories are defined as follows:

- There are additional categories of emission sources that were not accounted for when the emission reduction commitments were set.
- Emission factors used to determine emission levels for particular source categories for the year in which emission reduction commitments are to be attained are significantly different than the emission factors applied to these categories at the time the emission reduction commitments were set.
- The methods for determining emissions from specific source categories have changed significantly between when emission reduction commitments were set and the year they are to be attained.

Under the Gothenburg Protocol, the EMEP Steering Board accepted inventory adjustment applications for emissions from seven countries in 2014 and 2015 (Table ES.2).

All but one adjustment application (by Finland for 'manure management' in 2015) submitted by Parties have been accepted. Reporting of information on adjusted emissions in no way removes the mandatory requirement for Parties to report unadjusted emissions.

Table ES.2 Accepted inventory adjustment applications

Year of acceptance	Member State	Pollutant	NFR	Years
2014	Denmark	NH_3	3Da1, 3De	2010–2012
2014	Germany	NO_X	1A3b	2010–2012
2014	Germany	NO_X	3B, 3D	2005–2012
2015	Belgium	NO_X	1A3bi–iv, 3B, 3Da1, 3Da2a	2010–2013
2015	Belgium	NMVOCs	3B, 3De	2010–2013
2015	Denmark	NMVOCs	3B	2010–2013
2015	Finland	NH_3	1A2gviii, 1A4ai, 1A4bi, 1A4ci, 1A3bi–iv	2010–2013
2015	France	NO_X	1A3bi–iv	2010–2013
2015	Germany	NMVOCs	3B, 3De	2010–2013
2015	Luxembourg	NO_X	1A3bi–iv	2010–2013
2015	Spain	NO_X	1A3bi, 1A3biii	2010–2012

Notes: For NFR codes, see list of source sector abbreviations (Units, abbreviations and acronyms) or Appendix 4 (Conversion chart for aggregated sector groups).

Source: UNECE, 2014b, 2015.

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

The Gothenburg Protocol originally listed 15 EU Member States. Table ES.3 shows their aggregated emissions for 2014 compared with the emission ceilings the protocol specified for the EU in 2010. For NO_X, NMVOCs and SO_X, emissions in 2014 were below the ceilings. For NH_3, the EU-15 emissions were slightly above the ceiling. The Gothenburg Protocol was amended in 2012 to set emission reduction commitments for 2020. So far, the EU has not ratified it (see Box ES.1).

Figure ES.5 shows whether or not each EU Member State met its Gothenburg ceiling in 2014 (except those countries which have not yet signed and/or ratified the Gothenburg Protocol). One Member State (Luxembourg) reported NO_X emissions higher than its 2010 ceiling in 2014. Four countries exceeded their NH_3 ceilings (Finland, Germany, the Netherlands and Spain). One Member State (Luxembourg) exceeded its limit for NMVOCs. All Member States complied with their SO_X ceilings. All of the newer Member States have met their 2010 emission ceilings for all pollutants.

Table ES.3 Emissions reported for 2014 by EU-15 Member States compared with Gothenburg Protocol EU emission ceilings for 2010

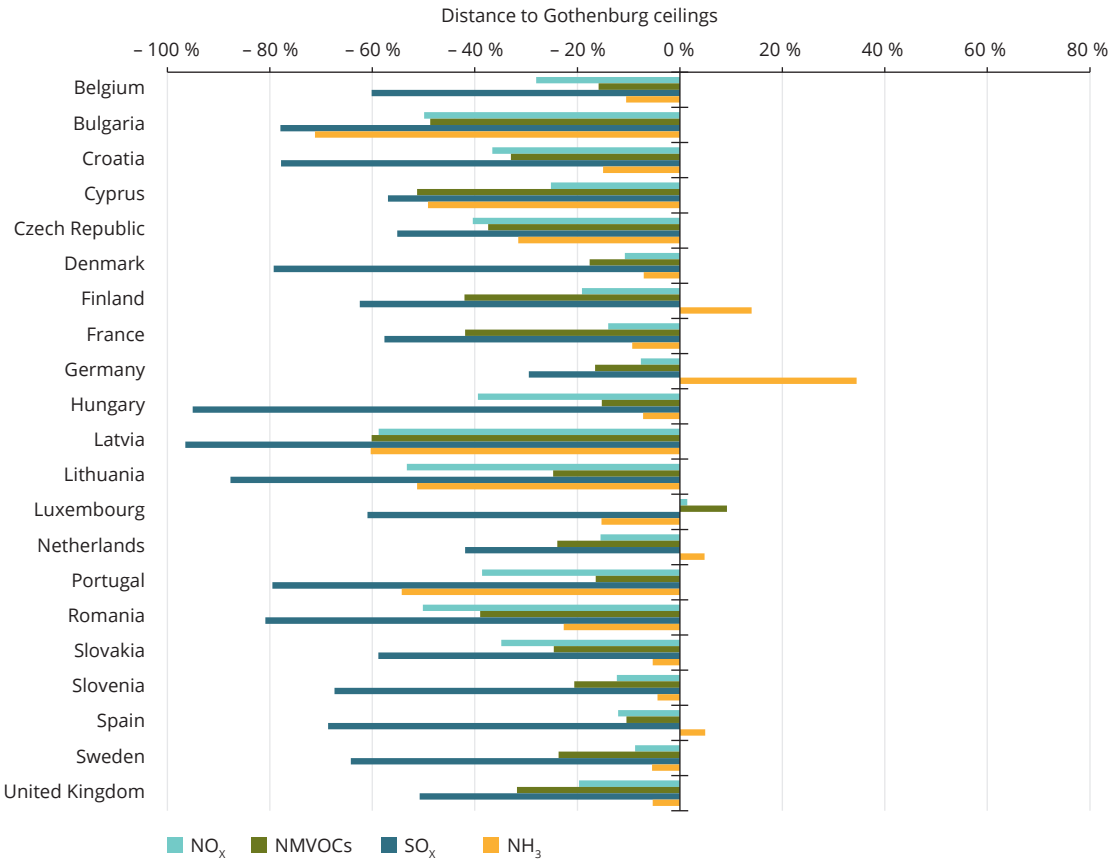
Pollutant	EU-15 emissions, 2014 (Gg)	EU-15 Gothenburg Protocol, 2010 ceilings (Gg)	Difference (%)
NO_X	5 587	6 671	– 16 %
NMVOCs	4 833	6 600	– 27 %
SO_X	1 598	4 059	– 61 %
NH_3	3 135	3 129	0.2 %

Notes: ([a]) For Spain, data for emission comparisons exclude emissions from the Canary Islands.

The comparison with emission ceilings is based on reporting on the basis of fuel sold, except for Austria, Belgium, Ireland, Lithuania, Luxembourg, the Netherlands and the United Kingdom. These countries may choose to use the national emissions total calculated on the basis of fuel used in the geographic area of the Party as a basis for ceilings comparisons instead (UNECE, 2014a).

This table takes the adjusted data based on applications that were accepted Under the Gothenburg Protocol by the EMEP Steering Body in 2014 and 2015 into account (see Table ES.2).

Figure ES.5 Distance to Gothenburg ceilings for EU Member States (based on provisional 2014 data)



Note: Estonia and Malta have not signed the Gothenburg Protocol and therefore do not have ceilings. Austria, Greece, Ireland, Italy and Poland have a ceiling, but they have not yet ratified the protocol. For Spain, data for emission comparisons exclude emissions from the Canary Islands. In this figure, the 'adjusted' emission inventory data for Belgium, Denmark, Finland, France, Germany Luxembourg and Spain are taken into account.

Progress by non-EU EEA member countries in meeting 2010 emission ceilings under the Gothenburg Protocol

Two non-EU EEA member countries (Norway and Switzerland) have ratified the Gothenburg Protocol and have specified emission ceilings for 2010 and onwards (UNECE, 1979, 1999). Emission data for Norway and Switzerland are the latest reported data under the LRTAP Convention (2016 submission round).

Data from the above-mentioned countries show that although Norway exceeded its NO_x ceiling from 2010 to 2012, it complied in 2013 and 2014, while it exceeded its NH_3 emissions ceilings in all years. Switzerland complied with all ceilings for all pollutants, except for NH_3 in 2010 (see Table ES.4). The EEA member countries Iceland and Turkey have not yet signed the Gothenburg Protocol. Liechtenstein has signed but not yet ratified the protocol.

Table ES.4 Progress by other EEA member countries in meeting Gothenburg Protocol emission ceilings

Country	NO_x					NMVOCs					SO_2					NH_3				
	2010	2011	2012	2013	2014	2010	2011	2012	2013	2014	2010	2011	2012	2013	2014	2010	2011	2012	2013	2014
Norway	×	×	×	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	×	×	×	×	×
Switzerland	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	×	✓	✓	✓	✓

Notes: '✓' indicates that the final (2010, 2011, 2012, 2013) or provisional (2014) emission data that a country reported meet or lie below its respective emission ceiling.

'×' indicates that a ceiling is exceeded.

Recommendations for improved data quality

Reporting has become more complete in recent years. However, a number of data gaps remain in the official data sets received from Member States. The completeness of submissions can therefore be further improved, particularly for historical data for 1990–2000 and for certain pollutants such as HMs and POPs. To compile as complete an EU inventory as possible, missing emission data are gap-filled as far as is feasible (for details, see Section 1.8).

Countries are encouraged to check if, and if yes why PM_{10} values are larger than the corresponding TSP values, $PM_{2.5}$ values are larger than PM_{10} values or BC values are larger than $PM_{2.5}$ values. Further, Member States which did not report data for BC in 2016 are encouraged to do so in 2017.

This report also contains several recommendations that may further improve the quality of the EU inventory in future. Member States should submit complete inventories and use proper notation keys for instances where estimated values are not available. They should recalculate emissions data for past years when new methods or new scientific knowledge become available. In this context, Member States are recommended to review and apply the information contained in the *EMEP/EEA air pollutant emission inventory guidebook — 2013* ('EMEP/EEA Guidebook' for short; EMEP/EEA, 2013) when compiling their emission inventory data sets.

Furthermore, all Member States have to report their emission inventories on the basis of fuel sold for the 'road transport' sector, in line with the reporting guidelines (UNECE, 2014a). All countries except the United Kingdom reported fuel sold data. A number of countries *may* choose to also report road transport emissions on the basis of fuel used, to check compliance.

Member States are encouraged to comply with requests from the EEA or ETC/ACM during the compilation of the EU-28 inventory. They can either resubmit inventory data (in the new NFR14 format) or update the next year's inventory to reflect new insights gained or errors identified.

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

1 Introduction

The European Commission (EC) provides this report and its accompanying data (on behalf of the EU) as an official submission to the secretariat for the Executive Body of the Long-range Transboundary Air Pollution (LRTAP) Convention.

The report covers the following subjects: the formal institutional arrangements that underpin the EU's emission inventory, the inventory preparation process, methods and data sources, key category analyses, information on quality assurance and control, general uncertainty evaluation, general assessment of completeness and information on underestimations (Chapter 1); adjustments under the Gothenburg Protocol (Chapter 2); emission trends and the contribution of key categories to total emissions (Chapter 3); sectoral analysis and emission trends for key pollutants (Chapter 4); and information on recalculations and planned improvements (Chapter 5).

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

main pollutants:

- nitrogen oxides (NO_X)
- non-methane volatile organic compounds (NMVOCs)
- sulphur oxides (SO_X)
- ammonia (NH_3)
- carbon monoxide (CO);

particulate matter (PM):

- PM_{10}
- fine PM ($PM_{2.5}$)
- total suspended particulates (TSPs)
- black carbon (BC);

priority heavy metals (HMs):

- lead (Pb)
- cadmium (Cd)
- mercury (Hg);

additional HMs:

- arsenic (As)
- chromium (Cr)
- copper (Cu)
- nickel (Ni)
- selenium (Se)
- zinc (Zn);

persistent organic pollutants (POPs):

- polychlorinated dibenzodioxin/polychlorinated dibenzofurans (PCDD/Fs)
- polycyclic aromatic hydrocarbons (PAHs)
- hexachlorobenzene (HCB)
- polychlorinated biphenyls (PCBs);

additional reporting of PAHs:

- benzo(a)pyrene (B(a)P)
- benzo(b)fluoranthene (B(b)F)
- benzo(k)fluoranthene (B(k)F)
- indeno(1,2,3-cd)pyrene (IP).

Emission estimates are not always available for all pollutants in each year, because there are gaps in the data from Member States. A gap-filling process was

trialled in 2010 for compiling the EU inventory, and was refined in 2011 (see Section 1.4.5). Nevertheless, for certain pollutants (PM, TSPs, HMs and POPs), some Member States did not report data for any year, which made it impossible to apply such gap-filling techniques. For these pollutants, the EU-28 total thus remains incomplete.

Several annexes accompany this inventory report.

- Annex A provides a copy of the formal LRTAP Convention data submission of the EU for 1990–2014 for the EU-28, in the required United Nations Economic Commission for Europe (UNECE) reporting format (NFR14).
- Annex B provides the updated EU NO_X emissions data for 1987–1989, as the 1988 NO_X protocol of the LRTAP Convention requires.
- Annex C provides results of the key category analysis (KCA) for the EU-28, showing the main emitting sectors for each pollutant.
- Annex D provides the gap-filled inventory of the EU-28, colour-coded for the different data sources used and the different additional gap-filling methods applied.
- Annex E provides Member States' projections for NO_X, NMVOCs, SO_X, NH_3, $PM_{2.5}$ and PM_{10} emissions for 2020, 2025, 2030, 2040 and 2050.
- Annexes F to I provide the LRTAP Convention data submission of the EU for 1990–2014, for the EU-9, EU-12, EU-15 and EU-27. Table A2.2 of Appendix 2 (LRTAP Convention emission-reporting programme for 2016) gives information on the country groupings.
- Annex J provides an overview of the sources of data on emissions of the individual pollutants that the 2016 EU-28 inventory compilation used.

1.1 Background

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

The EU ratified the UNECE's Convention on LRTAP (UNECE, 1979) in 1982. Since 1984, eight protocols have come into force. Table 1.1 presents the status of ratification of each protocol by the EU as a whole. The status differs across Member States.

On 4 May 2012, the Executive Body for the UNECE LRTAP Convention adopted amendments to the Gothenburg Protocol. The new text of the protocol includes national emission reduction commitments for the major air pollutants NO_X, NMVOCs, SO_X and NH_3, and for $PM_{2.5}$ (and BC as a component of PM). Countries are to achieve them in 2020 and beyond. For the EU, the emission reduction commitments from 2005 emission levels for 2020 and beyond are (UNECE, 2012a):

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

Year	LRTAP Convention and its protocols	Status of ratification
1979	'Geneva Convention': Convention on Long-range Transboundary Air Pollution (UNECE, 1979)	Signed and ratified (approval)
1984	'Geneva Protocol': Protocol on Long-term Financing of the Cooperative Programme for Monitoring and Evaluation of the Long-range Transmission of Air Pollutants in Europe (UNECE, 1984)	Signed and ratified (approval)
1985	'Helsinki Protocol': Protocol on the Reduction of Sulphur Emissions or their Transboundary Fluxes by at least 30 per cent (UNECE, 1985)	Not signed
1988	'Sofia Protocol': Protocol concerning the Control of Emissions of Nitrogen Oxides or their Transboundary Fluxes (UNECE, 1988)	Ratified (accession)
1991	'Geneva Protocol': Protocol concerning the Control of Emissions of Volatile Organic Compounds or their Transboundary Fluxes (1991) (UNECE, 1991)	Signed
1994	'Oslo Protocol': Protocol on Further Reduction of Sulphur Emissions (1994) (UNECE, 1994)	Signed and ratified (approval)
1998	'Aarhus Protocol': Protocol on Persistent Organic Pollutants (1998) (UNECE, 1998a)	Signed and ratified (approval)
1998	'Aarhus Protocol': Protocol on Heavy Metals (1998) (UNECE, 1998b)	Signed and ratified (approval)
1999	'Gothenburg Protocol': Protocol to Abate Acidification, Eutrophication and Ground-level Ozone (1999) (UNECE, 1999)	Ratified (accession)
2012	Amendments to the Gothenburg Protocol (UNECE, 2012a)	Not yet ratified

- 59 % for SO_2
- 42 % for NO_X
- 6 % for NH_3
- 28 % for NMVOCs
- 22 % for $PM_{2.5}$.

The EU has not yet ratified the amended Gothenburg Protocol.

The Executive Body of the LRTAP Convention adopted revised *Guidelines for Reporting Emissions and Projections Data under the Convention on Long-range Transboundary Air Pollution* (reporting guidelines) at its 32nd session, in March 2014 (UNECE, 2014a). Parties are to apply them in 2015 and subsequent years. A summary of the reporting requirements is in Appendix 2 (LRTAP Convention emission-reporting programme for 2016).

The deadline for individual Parties to submit data to the LRTAP Convention is 15 February of each year. There is a separate deadline of 15 March for submitting the accompanying inventory reports. The reporting guidelines specifies separate reporting dates for the EU. They allow time to compile an aggregated inventory based on the individual submissions from Member States. It should submit EU-28 inventory data to the Executive Secretary of the UNECE by 30 April each year, and the accompanying inventory report by 30 May. The reporting guidelines also request Parties to report emission inventory data using the new European Monitoring and Evaluation Programme (EMEP) NFR14 format.

In 2012, the Executive Body of the LRTAP Convention decided that adjustments to emission reduction commitments, or to inventories for the purposes of comparing total national emissions with them, may be applied in some circumstances, if such a circumstance keeps a Party from meeting one of its reduction commitments (UNECE, 2012b; see also Chapter 2).

The EMEP Steering Body reviews any supporting documentation and assesses if the adjustment is consistent with the circumstances and the guidance for adjustments (UNECE, 2012c). It makes the review available to the Parties, who have the option of making a submission to the Implementation Committee under Decision 2006/2 (UNECE, 2006).

In 2014, the EMEP Steering Body accepted inventory adjustment applications for emissions from Germany and Denmark, and in 2015 from Belgium, Denmark, Finland, France, Germany, Luxembourg and Spain (UNECE, 2014b, 2015). More information and adjusted emission data are in Chapter 2.

1.2 Institutional arrangements

1.2.1 Member States

Member States are responsible for selecting the activity data, emission factors and other parameters used for their national inventories. Member States should also follow the reporting guidelines (UNECE, 2014a) and apply the methodologies contained in the latest version of the *EMEP/EEA Guidebook* (EMEP/EEA, 2013).

Member States are also responsible for establishing quality assurance (QA) and quality control (QC) programmes for their inventories. The Member States' inventory report should include a description of the QA and QC activities and recalculations.

Member States submit their national LRTAP inventories and inventory reports, through participation in the Eionet network (see Section 1.2.2 below). In addition, they take part in the annual review and commenting phase of the draft EU inventory report. Member States check their national data and information used in the inventory report, and if necessary, send updates. They also provide general comments on the inventory report.

1.2.2 The EEA, EC, Eionet and ETC/ACM

European Environment Agency (EEA)

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

EEA activities include:

- overall coordination and management of the inventory compilation process;
- coordination of activities of the EEA's European Topic Centre on Air Pollution and Climate Change Mitigation (ETC/ACM), which checks the data, compiles the inventory and writes the draft report;
- communication with the EC;
- communication with Member States;
- circulation of the draft EU emission inventory and inventory report;

- hosting the official inventory database, and disseminating the data and the inventory report on the web.

Since 2004, the EEA and EMEP have supported a separate annual quality review of emission data the countries submit. It provides findings to countries each year, to improve the quality of emission data reported. Each year, EMEP publishes a joint report summarising the review findings. Section 1.6 below provides further details of the annual data review process.

European Commission (EC)

The EC formally submits the EU emission inventory data and inventory report to EMEP through the Executive Secretary of UNECE.

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

The ETC/ACM's ([5]) main activities regarding the EU's LRTAP Convention emissions inventory include:

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

European Environment Information and Observation Network (Eionet)

Eionet facilitates the work of the EEA and the ETC/ACM (EC, 1999). It comprises the EEA (supported by its European topic centres), a supporting network of experts from national environment agencies, and other bodies that deal with environmental information (Eionet, 2015b). Member States are requested to use the tools of the Central Data Repository (CDR) of the Eionet Reportnet to make their LRTAP Convention submissions available to the EEA.

1.3 Inventory preparation process

The basis of reporting for individual Member States and for the EU is the LRTAP Convention (UNECE, 1979), its protocols (Table 1.1) and subsequent decisions taken by the Executive Body. The reporting guidelines describe the data that Parties should report under the LRTAP Convention and its protocols. Under the agreement between Eionet countries and the EEA concerning priority data flows, EU Member States are requested to post a copy of their official submission to the LRTAP Convention in the CDR by 15 February each year. The ETC/ACM subsequently collects the data from the CDR, performs a QA and QC analysis, compiles the gap-filled EU LRTAP Convention emission inventory database, and produces an EU LRTAP Convention emission inventory and inventory report. The EC formally submits the EU's emission inventory data and informative inventory report (IIR) to EMEP through the Executive Secretary of UNECE. The inventory and accompanying documentation are then publicly available through the EEA website (see summary in Figure 1.1).

1.4 Methods and data sources

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

EU Member States report their emissions of NO_X, NMVOCs, SO_2 and NH_3 under Directive 2001/81/EC on national emission ceilings for certain atmospheric pollutants, known as the EU National Emission Ceilings (NEC) Directive (EC, 2001). They also report emissions of NO_X, SO_2, NMVOCs and CO under EU regulation No 525/2013, known as the EU Greenhouse Gas Monitoring Mechanism (EU, 2013). Member States should also copy this information to the CDR (Eionet, 2015a). Table 1.2 provides an overview of these different reporting obligations for EU Member States.

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

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

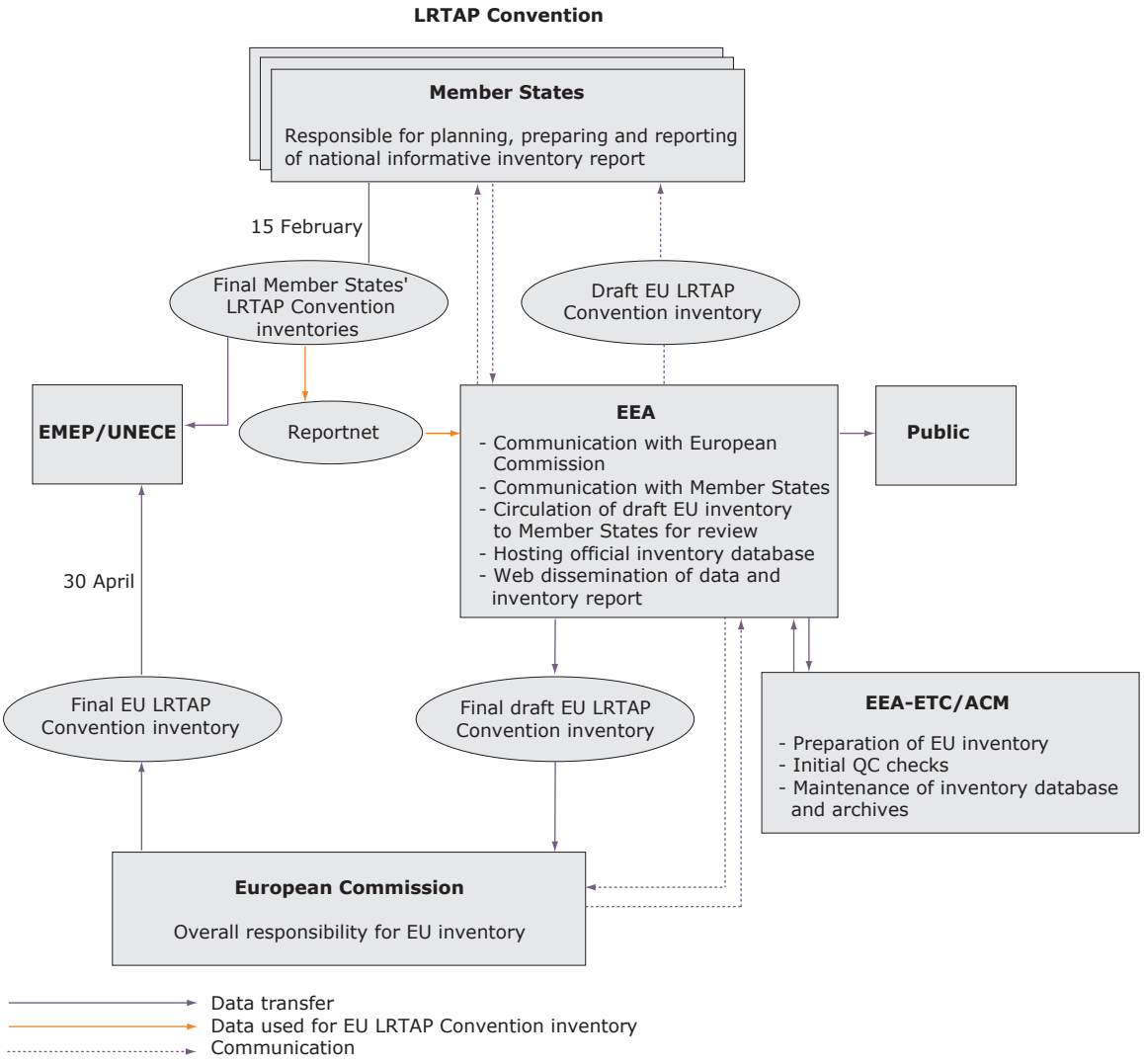


Table 1.2 Overview of air emission reporting obligations in the EU, 2015–2016

Legal obligation	Emissions to report	Annual reporting deadline for EU Member States	Annual reporting deadline for the EU [a]
LRTAP Convention [b]	NO_X (as nitrogen dioxide (NO_2)), NMVOCs, SO_X (as SO_2), NH_3, CO, HMs, POPs and PMs	15 February 2016	30 April 2016
NEC Directive	NO_X, NMVOCs, SO_2 and NH_3	31 December 2015	Not applicable
EU Monitoring Mechanism/United Nations Framework Convention on Climate Change (UNFCCC)	Carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), sulphur hexafluoride, NO_X, CO, NMVOCs and SO_2	15 January 2016 to the European Commission and 15 April 2016 to the UNFCCC	15 April 2016

Notes: [a] The European Community and European Union have signed a number of protocols over the years. The commitments include varying numbers of Member States. Therefore, it must report emissions separately for the EU-9, EU-12, EU-15, EU-27 and EU-28 (see Table A2.2 in Appendix 2 for more information on EU country groupings).

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

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

Reporting item	NEC	LRTAP	UNFCCC/MMR
Domestic aviation (LTO)	Incl.	Incl.	Incl.
Domestic aviation (cruise)	Not incl.	Not incl.	Incl.
International aviation (LTO)	Incl.	Incl.	Not incl.
International aviation (cruise)	Not incl.	Not incl.	Not incl.
National navigation (domestic shipping)	Incl.	Incl.	Incl.
International inland shipping	Incl.	Incl.	Not incl.
International maritime navigation	Not incl.	Not incl.	Not incl.
Road transport (fuel sold) (*)	Incl.	Incl.	Incl.

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

Incl., included in national totals.

Not incl., not included in national totals: memo item.

LTO, landing/take-off.

(*) In addition, Parties may also report emission estimates based on fuel used as an additional 'memo item': Austria, Belgium, Ireland, Lithuania, Luxembourg, the Netherlands, Switzerland and the United Kingdom may additionally choose to use the national emission total calculated on the basis of fuel used in the geographic area of the party as a basis for compliance (UNECE, 2014).

Reporting obligations under the LRTAP Convention and NEC Directive have now been harmonised since the adoption of the updated reporting guidelines (UNECE, 2014a). They differ from the UNFCCC obligations by including domestic and international aviation and navigation in the reported national totals. Table 1.3 summarises the main differences between the reporting instruments. The overall impact of these differences is small for most Member States.

1.4.2 General methods

The EU LRTAP Convention emission inventory is based on an aggregation of data reported by Member States. Methods used by Member States should follow those described in the *EMEP/EEA Guidebook* (EMEP/EEA, 2013). Overall, Member States do follow this recommendation, which ensures that they use the best available methods to estimate national emissions and that inventories are improved continuously. Moreover, the technical review procedures set up by EMEP CEIP check and assess Parties' data submissions as per the review guidelines, with a view to improving the quality of emission data and associated information reported to the LRTAP Convention.

The recommended structure for an IIR involves a general description of the methodologies and data sources used. This includes an overview of the emission factors used in the national inventory: country specific or default given in the *EMEP/EEA Guidebook* (EMEP/EEA, 2013), and specification of the sources of default emission factors and methods. It also includes a detailed description of activity data sources where data differ from national statistics. The following two sections summarise the information that Member States provide in their IIRs. This should help readers understand the foundation of the EU inventory. For detailed descriptions of methodologies and data sources, see the IIRs of Member States (see Appendix 5 Member State informative inventory reports (IIRs) for IIR references).

1.4.3 Data submissions and data sources

The deadline for Member States to report was 15 February 2016. In the 2016 reporting cycle, 24 Member States submitted their inventories and time series in time. Greece made no submission, and three Member States submitted their data after the formal deadline for submission (see Appendix 3 — Status of reporting and timeliness, Figure A3.1). Four Member States did not provide complete time series in 2016. All 27 Member States that submitted data used the new NFR14 reporting templates. Appendix 3 presents detailed information on Member States' submissions.

Table 1.4 Data sources commonly used for inventory sectors

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

The data source for the EU inventory is Member States' emission inventories. The IIRs should document detailed information on the data sources used by Member States. The level of detail varies widely across Member States, although the main data sources are official national statistics. Table 1.4 summarises commonly used data sources for the various sectors.

Sources for emission factors vary according to the tier method used. One main source for emission factors is the *EMEP/EEA Guidebook* (EMEP/EEA, 2013), but they can also be country or even plant specific. It is impossible to survey the emission factors used by the Member States for all emission sources, as this information is not uniformly available: some countries report details of their methodologies, while others do not. Detailed information is available in Member States' IIRs; Appendix 5 (Member State informative inventory reports (IIRs)) provides references to these reports.

1.4.4 Comparison of Member State emissions calculated on the basis of fuel sold versus fuel consumed in road transport

In Article V/A., paragraph 22, the reporting guidelines (UNECE, 2014a) specify how to report emissions from transport: 'For emissions from transport, all Parties should calculate emissions consistent with national energy balances reported to Eurostat or the International Energy Agency. Emissions from road vehicle transport should therefore be calculated on the basis of the fuel sold in the party concerned. In addition, Parties may voluntarily calculate emissions from road vehicles based on fuel used or kilometres driven in the geographic area of the Party. The method for the estimate(s) should be clearly specified in the IIR.'

Paragraph 23 of the guidelines details the basis for compliance checking: 'For Parties for which emission ceilings are derived from national energy projections based on the amount of fuel sold, compliance checking will be based on fuels sold in the geographic area of the party. Other Parties within the EMEP region (i.e. Austria, Belgium, Ireland, Lithuania, Luxembourg, the Netherlands, Switzerland and the United Kingdom of Great Britain and Northern Ireland) may choose to use the national emission total calculated on the basis of fuels used in the geographic area of the Party as a basis for compliance with their respective emission ceilings.'

Parties can estimate transport emissions using the amount of fuel sold within the country or using fuel consumed. When fuel purchased within a country is used outside the country (and vice versa), these estimates can differ significantly. The EU inventory compiled in 2016 estimates emissions from road transport based on fuel sold, except for the United Kingdom. This country reported its inventory (national total and data for the single source-sector categories) on the basis of fuel used only. As data about fuel sold are not available for the categories, the EU inventory used UK emission data based on fuel used.

Only Belgium, Ireland and Luxembourg reported additional national totals for compliance based on fuel used in the nomenclature for reporting (NFR) templates. Spain reported additional national totals excluding emissions from the Canary Islands. Austria and the Netherlands specify their fuel used emissions as 'Memo item' in the NFR template.

The other decisive factor for achieving consistent numbers for the whole EU is the method Member States use to calculate their emissions from road transport. Not all countries use the COmputer Programme to calculate Emissions from Road Transportation (COPERT) (EMEP/EEA, 2013); moreover, even where they use COPERT, they may apply different versions of the programme. This report has not quantified the impact of using these different approaches for EU transport emissions.

1.4.5 Data gaps and gap filling

Ideally, there should be no need to fill gaps in the reported inventory data, as it is the responsibility of Member States to submit full and accurate inventory data sets. However, Member States' submissions contain various data gaps for particular pollutants or years in the time series. Frequently, whole national inventories, emissions of some pollutants or sectoral emission data are missing.

The EMEP reporting guidelines (UNECE, 2014a) require that submitted emission inventories be complete. In 2009, a gap-filling procedure has been performed following a methodology paper by the EEA and the ETC/ACM (EEA, 2009). This procedure is also consistent with the techniques to fill emission data gaps that the *EMEP/EEA Guidebook* suggested (EMEP/EEA, 2013). It used a stepwise approach using emission data from other reporting obligations was to fill gaps in the national data sets, followed by further gap-filling procedures such as inter- or extrapolation and manual changes. For further information on the gap-filling procedure, please see Box 1.1.

However, gap filling was applied only where national total and sectoral data were unavailable, or where a national total was available but there were no sectoral data. In the former instance, sectors were first gap-filled and then summed to determine the

Box 1.1 Gap-filling procedure from 2010 onwards

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

1. Emission trends of all pollutants were compiled from 1990 onwards using the LRTAP Convention emission inventories that the Member States provided to the EEA in 2015.
2. For Member States that did not report complete data sets, emissions data officially reported in 2015 by Member States under the NEC Directive (NO_x, NMVOCS, SO_2 and NH_3) were used in the first instance to fill gaps. This step did not use notation keys.
3. A further step used notation keys that Member States reported in 2015 under the NEC Directive (NO_x, NMVOCS, SO_2 and NH_3) to fill any remaining gaps.
4. LRTAP Convention data submitted to EMEP CEIP in 2015 was the next source used to fill remaining gaps. There should be no difference between the Member States' LRTAP Convention emission inventories provided to the EEA and the data submitted to EMEP CEIP.
5. In the next step, Member State LRTAP Convention emission inventories provided to the EEA in previous years were used to fill still remaining gaps, followed by emission data reported in previous years under the EU Greenhouse Gas Monitoring Mechanism.
6. Older LRTAP Convention data submitted to EMEP CEIP were the final source of official information used to fill gaps.
7. Finally, for all remaining missing data, further gap-filling procedures were applied in line with procedures set out by the EEA (2009).

The further gap-filling procedures described in step 7 are summarised below:

(a) Linear interpolation was performed if 1 or several years in the middle of a time series were missing.

(b) Linear extrapolation was performed if 1 or several years at the beginning or end of a time series were missing, and if at least 5 consecutive years showing a clear trend ($r^2 \geq 0.6$) were available. Extrapolation 'backwards' was never allowed to result in negative values.

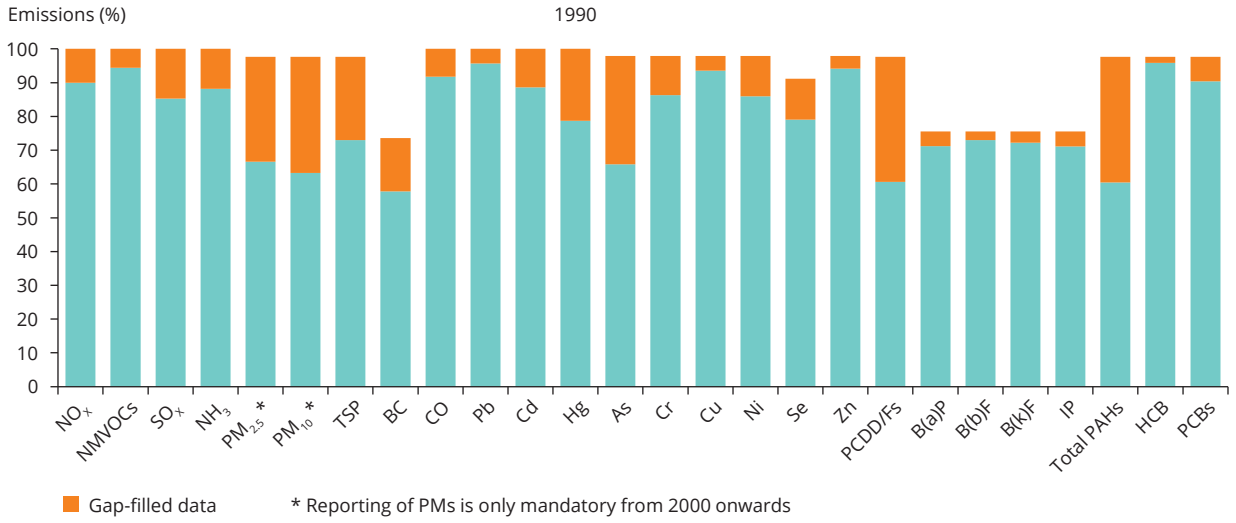
(c) If fewer than 5 consecutive years were available as a basis for extrapolation, or if years did not show a clear trend (this is the case when $r^2 < 0.6$), the value of the previous or next year was used to fill the gaps.

(d) If the notation key 'not applicable' (NA) or 'not occurring' (NO) was used as a basis for gap filling, it was treated as '0' and was not gap-filled.

(e) Manual changes of gap-filled PM_{10}, $PM_{2.5}$ and BC data were carried out if PM_{10} values were larger than the corresponding TSP values, $PM_{2.5}$ values were larger than PM_{10} values or BC values were larger than $PM_{2.5}$ values. Figure 1.2 and Figure 1.3 show how gap filling affects the total emissions at EU-28 level. Generally, there is much less need to gap-fill 2014 data than 1990 data. By contrast, gap-filling of 1990 data can constitute a high percentage of the national total (e.g. above 30 % for $PM_{2.5}$, PM_{10}, As, PCDD/F and total PAHs).

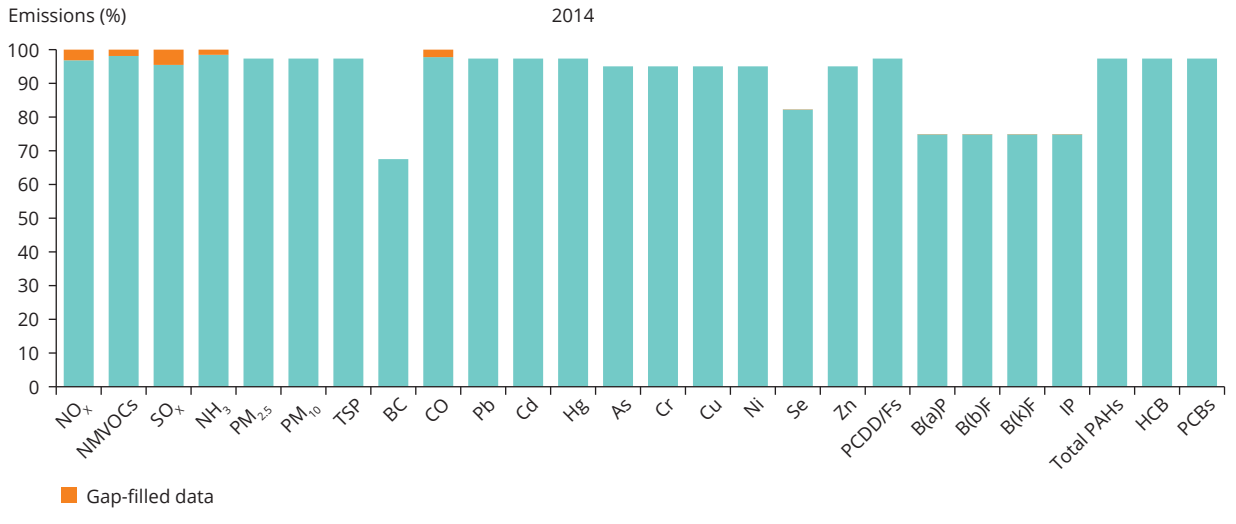
total. In the latter instance, the sectoral split of the previous or following year was used to fill the gaps. If a national total was available, but the sectoral data were incomplete, no gap filling was carried out. Further, inventories cannot be considered complete if the notation keys 'NE' (not estimated) and in some cases 'NR' (not relevant), or the value 0, are used for gap filling. The inventory is still considered incomplete at EU level. For PM, some HMs and POPs, some Member States lacked data for all years, and thus gap-filling was impossible too. In such instances, the EU-28 emission totals for these pollutants are not considered complete (i.e. they are underestimated). Figure 1.2 and Figure 1.3 also visualise the data missing from the EU inventory (missing Member State data). They show a simple estimation using a factor for the calculations. This factor was derived by taking the mean of the individual Member State's share of completely reported pollutant emissions. That is the Member State's average shares of NO_x, NMVOCs, SO_x, NH_3, CO, Pb, Cd and Hg for 1990, and its average shares of NO_x, NMVOCs, SO_x, NH_3 and CO for 2014.

Figure 1.2 Effect of gap filling on EU emissions for 1990



Notes: Incomplete inventory means that gap filling was not possible for all Member States, and emissions are therefore underestimated.

Figure 1.3 Completeness and effect of gap filling on EU emission data for 2014



Notes: Incomplete inventory means that gap filling was not possible for all Member States, and emissions are therefore underestimated.

Annex J shows how the various officially reported data sets were used to supplement the LRTAP Convention data submissions for those Member States where gap filling was required. Annex D offers a more detailed overview, showing for each Member State which data were gap-filled and how this was performed. The trend tables in Chapter 3 (Table 3.4 to Table 3.29) also provide an initial overview, indicating which data have been derived by gap filling. Four Member States (the Czech Republic, Malta, Romania and Slovakia) did not provide complete time series in 2016, and Greece did not send any inventory data.

1.4.6 Gridded data

According to the revised reporting guidelines, Parties within the geographical scope of EMEP should report gridded data every 4 years, commencing in 2017. From then on, they are to report gridded emissions in a new resolution (0.1 ° × 0.1 ° long-lat). Gridded data for the EU were last submitted in 2012 (EEA, 2012), so they are not reported again this year. However, in 2016, three Member States (Croatia, Finland and Poland) provided gridded data for one or several years (see Appendix 3 Status of reporting and timeliness, Table A3.1).

1.4.7 Large point sources (LPSs)

Parties within the geographical scope of EMEP were also required to provide data on LPSs every 5 years, commencing in 2000. With the revised reporting guidelines, this changed to every 4 years, starting in 2017. LPS data for the EU were last submitted in 2012 (EEA, 2012) and hence are not reported again this year. In 2016, one Member State (Poland) provided LPS data (see Table A3.1). Annex G of the *European Union emission inventory report 1990–2010 under the UNECE Convention on Long-range Transboundary Air Pollution (LRTAP)* provides further information on the last submission of EU LPS data (EEA, 2012).

1.4.8 Key category analyses

A key category is an emission-source category that has significant influence on an inventory. It may affect the absolute level of emissions, the trend in emissions, or both. This report classifies categories jointly responsible for 80 % of the national total emissions of a given pollutant as key categories (see EMEP/EEA, 2013).

A level analysis of 2014 emissions for each pollutant (following any necessary gap filling) determined EU-28 key categories. When a Member State used the notation 'included elsewhere' (IE) for a particular source/pollutant combination, the key category analysis (KCA) is likely to have underestimated the category concerned, and overestimated the one in which emissions were reported instead. In addition, as described earlier, PM, HM and POP data from some Member States could not be gap-filled, as they reported no data for any year. In these instances, emissions were aggregated without including data for all the EU-28 Member States, so that we could present a provisional KCA for these pollutants. The trend tables in Chapter 3 presenting Member State emissions show the instances where data were not reported.

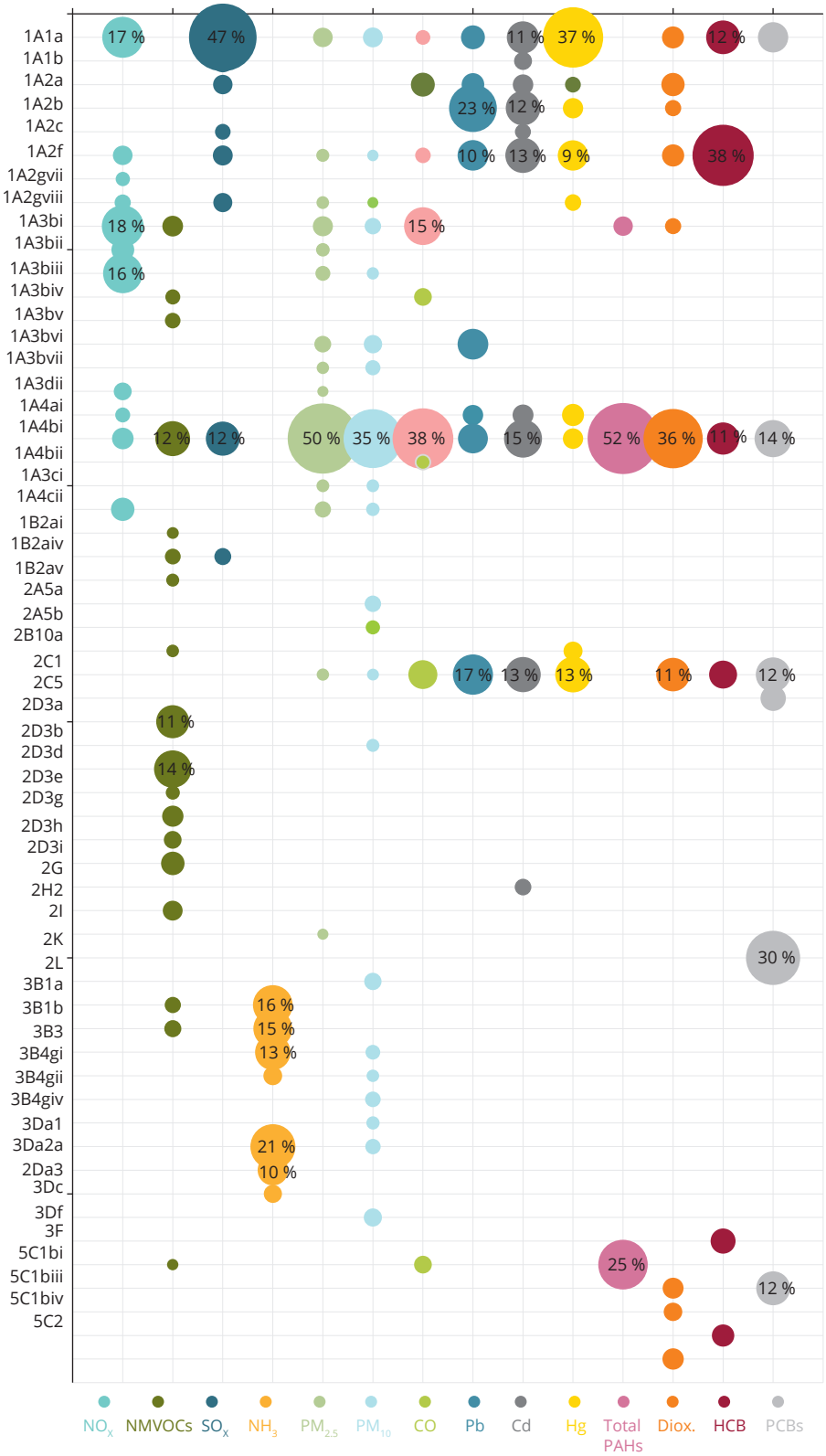
Chapter 3 provides a summary of the top five EU-28 key categories in 2014, for each pollutant. A complete list of all EU-28 key categories for NO_X, NMVOCs, SO_X, NH_3, $PM_{2.5}$, PM_{10}, CO, HMs (Pb, Cd and Hg) and POPs (PCDD/Fs, total PAHs, B(a)P, HCB and PCBs) emissions is also given in Figure 1.4. We do not consider the additional HMs and POPs and TSPs here.

A total of 57 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 1 of the 15 pollutants assessed. '1A4bi — Residential: Stationary' and '1A1a — Public electricity and heat production' were identified as being important emission sources for 14 and 11 pollutants, respectively. Similarly, '1A2f — Stationary combustion in manufacturing industries and construction: Non-metallic minerals' was a key category for 10 pollutants, and the categories '2C1 — Iron and steel production' and '1A3bi — Road transport: Passenger cars' were key categories for nine and seven pollutants, respectively.

For NO_X and CO, 11 and nine key categories were identified, respectively; as expected for both these pollutants, all key categories are sectors involving fuel combustion or thermal processes. Eight key categories were identified for SO_X (energy related, again), and seven for NH_3 (all from the 'Agriculture' sector). PM_{10}, $PM_{2.5}$ and NMVOC emission sources are more diverse, so larger numbers of source categories make up the key category threshold of 80 % of total emissions. For the PM pollutants, more than half of the key categories were energy related, while a key aspect for NMVOCs was high activity levels associated with solvents and product use.

For the HM Cd, 10 key categories were identified, as were nine for Hg and eight for Pb. Emissions from these key categories were all related to energy or industry, resulting particularly from processes associated with metal production.

Figure 1.4 EU-28 KCA results for 2014



Notes: Bubble size indicates amount of emissions.

For NFR14 codes, see list of source sector abbreviations (Units, abbreviations and acronyms) and (Appendix 4 Conversion chart for aggregated sector groups).

For the POPs, source categories from almost all sectors have been identified as key categories. On the whole, metal production was a key source of POP emissions. However, emissions from 'Residential: Stationary' also contributed considerably to emissions of many of the POPs.

Several factors may influence the determination of key categories at EU-28 level. The notation key 'IE' (see Appendix 1) means that a Member State can include emission estimates for one NFR sector in those of a different sector. Also, Member States have different ways of allocating emissions to the (sub)sector 'Other', which might lead to inconsistencies. Given such issues, the EU-28 KCA may not always accurately reflect the share of all main emission sources. It is also crucial to note that the results of a similar analysis of individual Member States will differ from the key sources determined for the EU-28.

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

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

The main activities improving the quality of the EU inventory are the checks that the EEA's ETC/ACM performs on the status of each Member State's submission. In addition, it checks the internal consistency of Member States' data tables before compiling the EU-28 tables. This year, like last year, it placed more emphasis on analysing the plausibility of sectoral trends. It checked Member State data at sectoral level: when it found outliers, it identified the categories responsible. When the ETC/ACM found no explanation for a trend in the IIRs, it contacted Member States. The checks focused on data that appreciably affect EU-28 trends. Member States also provide external checks through an Eionet review before the EU submits the EU-28 inventory to the secretariat of the LRTAP Convention.

Further, an important element in improving the quality of national and EU Convention on Long-range Transboundary Air Pollution (CLRTAP) inventories is the annual meeting of the Task Force on Emission Inventories and Projections (TFEIP). This expert meeting discusses quality issues concerning the emission reporting of Member States.

The agreed gap-filling procedures are one of the instruments used to assure and improve the quality of the EU inventory. They analyse and, where possible, fill gaps in reporting of sectoral emissions and total emissions for any year. This improves the key features of completeness, comparability and consistency over the years, and motivates Member States to report their data in the following reporting cycle (further details on gap filling are available in Section 1.4.5).

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

The EEA ETC/ACM and the EMEP CEIP perform more detailed QA activities in an annual review process (EMEP CEIP, 2016a). They review Member State LRTAP Convention emission inventories at the same time as reviewing those reported under the NEC Directive (EC, 2001). The technical review of inventories has three stages. Stages 1 and 2 include checks on timeliness, formats, consistency, accuracy, completeness and comparability of existing Member State inventory submissions. Test results, provided to Member States, are used to improve the quality of the national emission inventories. A joint EMEP/EEA review report publishes summary results of the review (stages 1 and 2) each year ([6]).

Stage 3 is a technical in-depth review of selected countries. It checks if submitted emission inventories are complete, consistent over time, properly documented and accurate. The annual in-depth review aims to be consistent across the Parties. The process should ensure that the Parties follow the same approach each year. CEIP selected the countries in cooperation with the EEA and EMEP. In 2015, it reviewed Azerbaijan, Belarus, the Czech Republic, Ireland, Moldova, the Netherlands, Slovakia, Slovenia and the Ukraine. The results are summarised in individual country-specific reports (EMEP CEIP, 2016b).

1.7 General uncertainty evaluation

To quantify uncertainty in the EU LRTAP emission inventory, Member States first need to provide detailed information on emission uncertainties. Only 15 Member States (Austria, Belgium, Croatia, Cyprus, Estonia, Denmark, Finland, France, Germany, Latvia, the Netherlands, Poland, Spain, Sweden and the United Kingdom) quantified uncertainty in their emissions

([6]) EMEP and EEA will jointly publish a summary of the results of the stage 1 and 2 review performed in 2016 (EMEP/EEA, 2016).

inventories of 2014. The pollutants that they consider and the assumptions behind the uncertainty analysis vary across Member States. Because so few Member States provide an uncertainty estimate, we cannot estimate the overall uncertainty of the EU-28 LRTAP inventory.

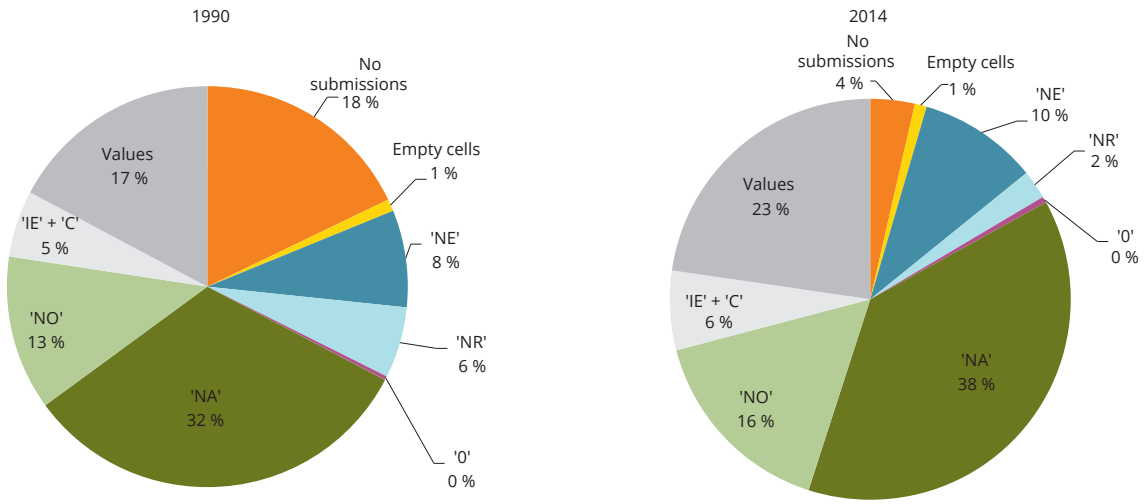
1.8 General assessment of completeness

Completeness in this context means that reports include estimates for all pollutants, all relevant source categories, all years and all territorial areas. As shown in Appendix 3, only one Member State (Greece) did not submit any data. Four Member States did not provide complete time series in 2016. Luxembourg did not provide any data for heavy metals; Slovenia and Austria submitted no data for additional HMs. Several Member States did not report data for BC or for B(a)P, B(b)F, B(k)F and/or IP. A total of 22 Member States reported activity data ([7]) for the complete time series (1990–2014). The stage 1 review provides detailed results for the completeness of Member State submissions (EMEP CEIP, 2016b).

Figure 1.5 shows a simple compilation indicating completeness of reporting by Member States for the inventory years 1990 and 2014. It uses the originally submitted NFR templates, i.e. before gap filling. It gives the percentages of each notation key or values that the reports present for source categories. The data are for all Member States and all pollutants (national totals only). The figures show that more data are available for 2014 than for 1990. The notation key 'NA' appears often. That is because an air pollutant is relevant only to specific emission sources (e.g. NH_3 for agriculture). This makes it necessary to use 'NA' for other sources. The use of the notation key 'NE', the reporting of empty cells, '0', and in some circumstances the reporting of the notation key 'NR' ([8]) count as incomplete reporting. For 2014, Member States reported 33 % of the data incompletely, and for 1990 they reported 17 % of the data incompletely.

The EMEP emission-reporting guidelines (UNECE, 2014a) require Parties to report data at least for the base year of the relevant protocol, and from the year it entered into force, and up to the latest year (2 years before the present) (see Appendix 2 — LRTAP Convention emission-reporting programme for 2016, Table A2.1). So, ideally, there should be no difference between the availability of data submissions for 1990 and for 2014. Several Member States use the notation key 'NR' for PM in 1990, as the LRTAP Convention formally requests Parties to report PM emissions only for 2000 and after.

Figure 1.5 Completeness of reporting of NFR templates submitted by Member States (all data entries for all pollutants, excluding national totals)



Notes: C, confidential; IE, included elsewhere; NA, not applicable; NE, not estimated; NO, not occurring; NR, not relevant.

Appendix 1 explains notation keys further.

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

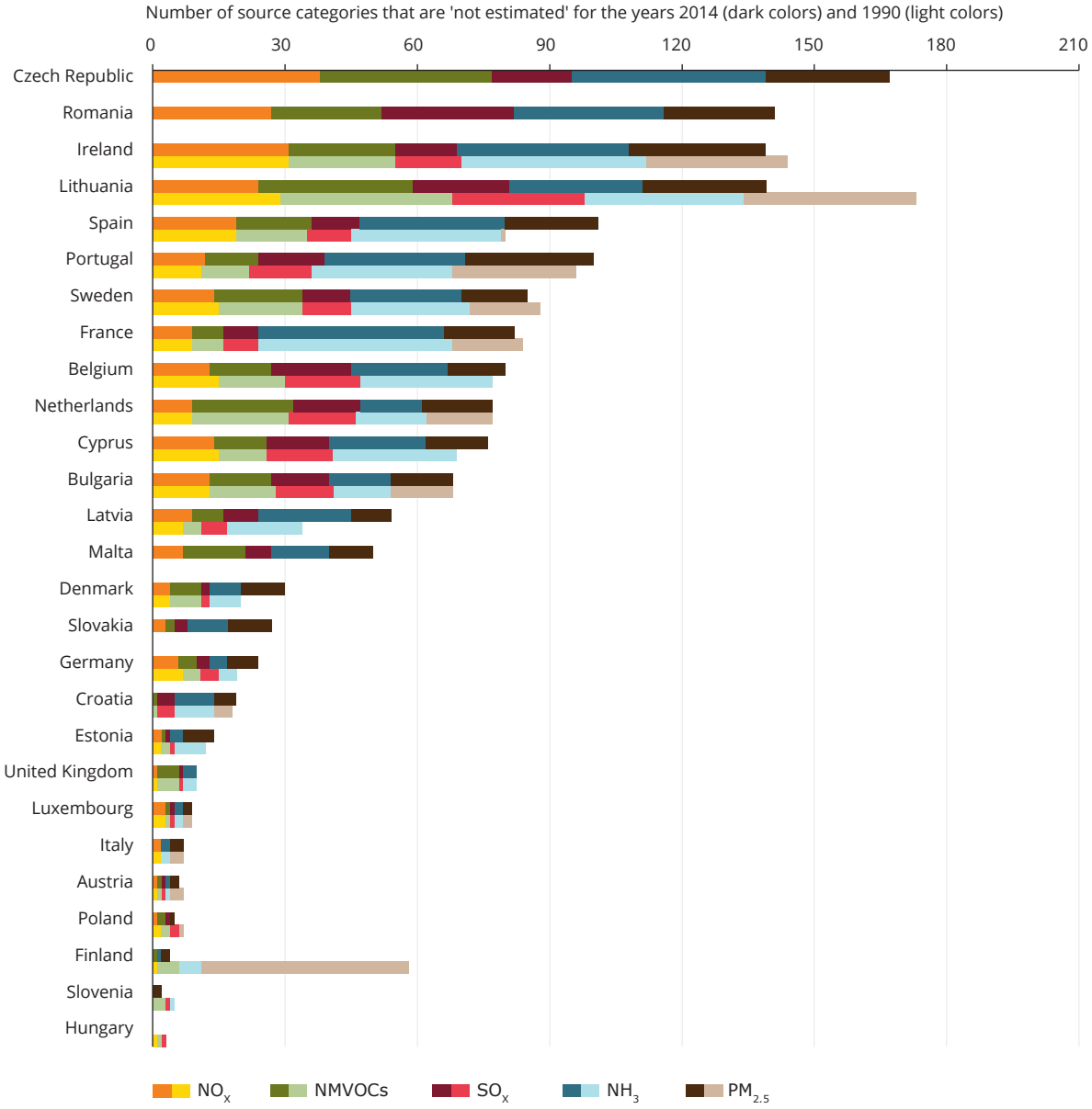
([8]) According to paragraph 9 of the emission-reporting guidelines (UNECE, 2014a), emission inventory reporting should cover all years from 1980 onwards if data are available. However, 'not relevant' (NR) has been added, to ease reporting where the different protocols do not strictly require details of emissions. Only in these circumstances is 'NR' correct and appropriate.

1.9 Underestimations

The official reporting guidelines of the LRTAP Convention (UNECE, 2014a) allow countries to report emissions as not estimated ('NE') for some sectors. Those are where they know emissions occur, but have not estimated or reported them. Countries should separately report why they have not estimated emissions.

Certain Member States used the notation key 'NE' for many source categories (see Figure 1.6). The Czech Republic, for example, reported 44 source categories of NH_3 in 2014 as 'NE'. In most cases, the use of 'NE' in reporting in 2014 is similar to its use in 1990. Most uses of 'NE' (across all pollutants and Member States) are in the categories '1B2c — Venting and flaring (oil, gas, combined oil and gas)', '1A3bvii — Road transport: Automobile road abrasion', '1A3ai(i) — International aviation LTO (civil)' and '1A3aii(i) — Domestic aviation LTO (civil)'. Within these categories, more than 25 % of the entries say 'NE'.

Figure 1.6 Number of 'not estimated' source categories for 2014 (dark shades) and 1990 (light shades)



Notes: The LRTAP Convention formally requests Parties to report emissions of PM for 2000 and after. Therefore, the number of 'NE' reporting for $PM_{2.5}$ in the year 1990 might be high for several countries.

2 Adjustments under the Gothenburg Protocol

In 2012, the Executive Body of the LRTAP Convention decided that adjustments to emission reduction commitments or to inventories may be applied in some circumstances (UNECE, 2012b). The EMEP Centre on Emission Inventories and Projections (CEIP) leads the adjustment procedure, coordinates the review of any supporting documentation and assesses if the adjustment is consistent with the particular circumstances and the guidance for adjustments (UNECE, 2012c). It makes the review available to the Parties, who have the option of making a submission to the Implementation Committee under Decision 2006/2 (UNECE, 2006).

These circumstances are as follows:

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

(b) emission factors used to determine emission levels for particular source categories have changed since the emission reduction commitments were set;

(c) the ways of determining emissions from specific source categories have changed significantly between the time when emission reduction commitments were set and the year they are to be attained.

Table 2.1 lists inventory adjustment applications that the EMEP Steering Body accepted in 2014 and 2015.

If a Party is planning to adjust its inventory for the purpose of comparing total national emissions with emission reduction commitments, in its notification it indicates to the UNECE secretariat and CEIP what categories and pollutants this will affect. It uses Annex II to the reporting guidelines as a basis (UNECE, 2014a). Table 2.2 shows Member States that submitted their adjustment applications together with their LRTAP submissions via CDR in 2016.

Table 2.3 gives an overview of reported adjustments within the LRTAP submission 2016. All approved and reported adjustments also appear in the emission trend tables in Section 3.3 (NO_X, Table 3.4), Section 3.4

Table 2.1 Accepted inventory adjustment applications

Year of acceptance	Member State	Pollutant	NFR	Years
2014	Denmark	NH_3	3Da1, 3De	2010–2012
2014	Germany	NO_X	1A3b	2010–2012
2014	Germany	NO_X	3B, 3D	2005–2012
2015	Belgium	NO_X	1A3bi–iv, 3B, 3Da1, 3Da2a	2010–2013
2015	Belgium	NMVOCs	3B, 3De	2010–2013
2015	Denmark	NMVOCs	3B	2010–2013
2015	Finland	NH_3	1A2gviii, 1A4ai, 1A4bi, 1A4ci, 1A3bi–iv	2010–2013
2015	France	NO_X	1A3bi–iv	2010–2013
2015	Germany	NMVOCs	3B, 3De	2010–2013
2015	Luxembourg	NO_X	1A3bi–iv	2010–2013
2015	Spain	NO_X	1A3bi, 1A3biii	2010–2012

Notes: For NFR14 codes, see list of source sector abbreviations (Units, abbreviations and acronyms).

Source: UNECE, 2014b, 2015.

Table 2.2 Adjustment application within the LRTAP submission 2016 (Annex II to the reporting guidelines) (as of 6 May 2016)

Member State	Pollutant	NFR	Years
Germany	NO_X	3Da2c, 3I	2010–2014
Germany	NH_3	3Da2c, 3I	2010–2014
Luxembourg	NO_X	1A3b, 3B, 3D	2010–2014
Luxembourg	NMVOCs	3B, 3D	2010–2014

Notes: For NFR14 codes, see list of source sector abbreviations (Units, abbreviations and acronyms).

Source: UNECE, 2014a.

Table 2.3 Reporting of approved adjustments within the LRTAP submission 2016 (Annex I and Annex VII to the reporting guidelines) (as of 6 May 2016)

Member State	Pollutant	Years	Annex I ('adjustment row')	Annex VII
Belgium	NO_X	2010–2014	Yes	Yes
Belgium	NMVOCs	2010	Yes	Yes
Denmark	NH_3	2010–2014	Yes	Yes
Denmark	NMVOCs	2010–2014	Yes	Yes
Finland	NH_3	2010–2014	Yes	Yes
France	NO_X	2010–2014	Yes	Yes
Germany	NO_X	2010–2014	Yes	Yes
Germany	NMVOCs	2010–2014	Yes	Yes
Germany *	NH_3	2010–2014	Yes	
Luxembourg	NOX	2010–2014	Yes	Yes
Luxembourg *	NMVOCs	2010–2014	Yes	
Spain	NOX	2010–2012	Yes	Yes

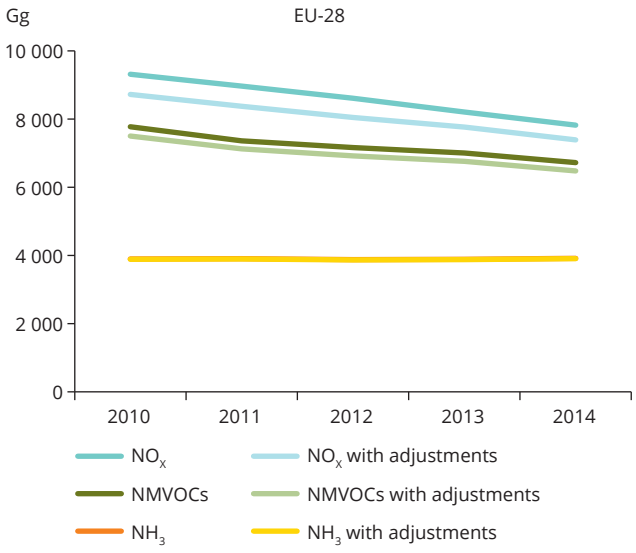
Notes: * The EMEP Steering Body has not approved these adjustments to date.

Source: UNECE, 2014a.

(NMVOCs, Table 3.5) and Section 3.6 (NH_3, Table 3.7). Parties shall report details of their approved adjusted aggregated emissions using the appropriate row in the main emissions reporting template (Annex I to the reporting guidelines (UNECE, 2014a)). They shall also provide detailed information by pollutant and sector for each adjustment using the template provided in Annex VII to the reporting guidelines. Reporting of information on adjusted emissions in no way removes the mandatory requirement for Parties to report unadjusted emissions as laid down in section V, Sections A–D, of the guidelines.

Figure 2.1 shows for the EU-28 the effect of the adjustments on the emissions (sum from Member States' adjustments). For NO_X and NMVOCs, the EU-28 emissions change considerably, but there is only a slight effect on the NH_3 emissions.

Figure 2.1 Adjusted and unadjusted emissions of NO_X, NMVOCs and NH_3 for the EU-28, 2010–2014



3 Trends and key categories of EU-28 pollutant emissions

The present EU-28 inventory lists emissions for all the main air pollutants: PMs, HMs and POPs. It also reports the individual PAHs for which the LRTAP Convention requires or recommends inventory reporting (UNECE, 1979).

The following sections of Chapter 3 summarise the contributions each Member State has made to the EU-28 total emissions of NO_X, NMVOCs, SO_X, NH_3, CO, $PM_{2.5}$, PM_{10}, TSPs, BC; the HMs Pb, Cd, Hg, As, Cr, Cu, Ni, Se and Zn; and the POPs PCDD/Fs, total PAHs, B(a)P, B(b)F, B(k)F, IP, HCB and PCBs. For the five most important key categories, we give the past emission trend of the EU-28. Greece had not submitted an inventory at the time of writing. Data for Greece could not be gap-filled, so the EU-28 total is an underestimate.

3.1 Total EU-28 emission trends and progress towards the Gothenburg Protocol 2010 emission ceilings

Emissions of all pollutants except Cu were lower in 2014 than in 1990 (or in 2000 for PM). Among the main air pollutants, the largest reductions across the EU-28 (in percentage terms) since 1990 are for SO_X emissions (which decreased by 88 %), followed by CO (− 65 %), NMVOCS (− 60 %), NO_X (− 55 %) and NH_3 (− 24 %) (Figure 3.1).

Emissions of PMs, BC and TSP have also dropped substantially since 1990 (Figure 3.2). Emission data for 2000–2014 indicate that $PM_{2.5}$ and PM_{10} emissions have fallen by 25 % and 23 %, respectively (Figure 3.2).

Figure 3.1 (a) EU-28 emission trends and (b) indexed emissions for the main air pollutants

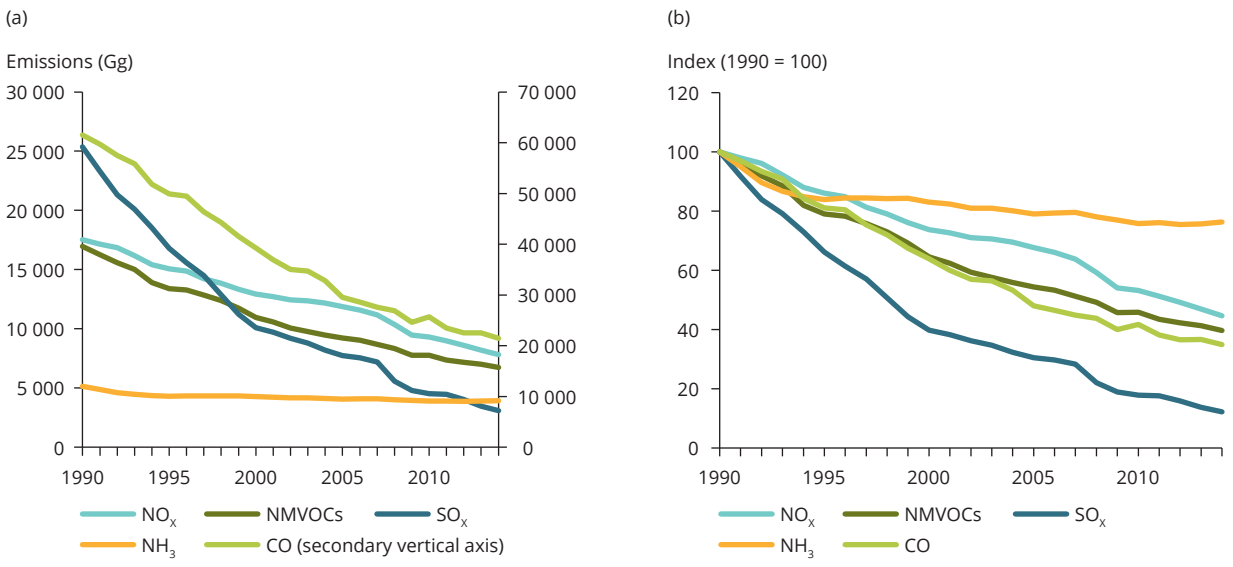
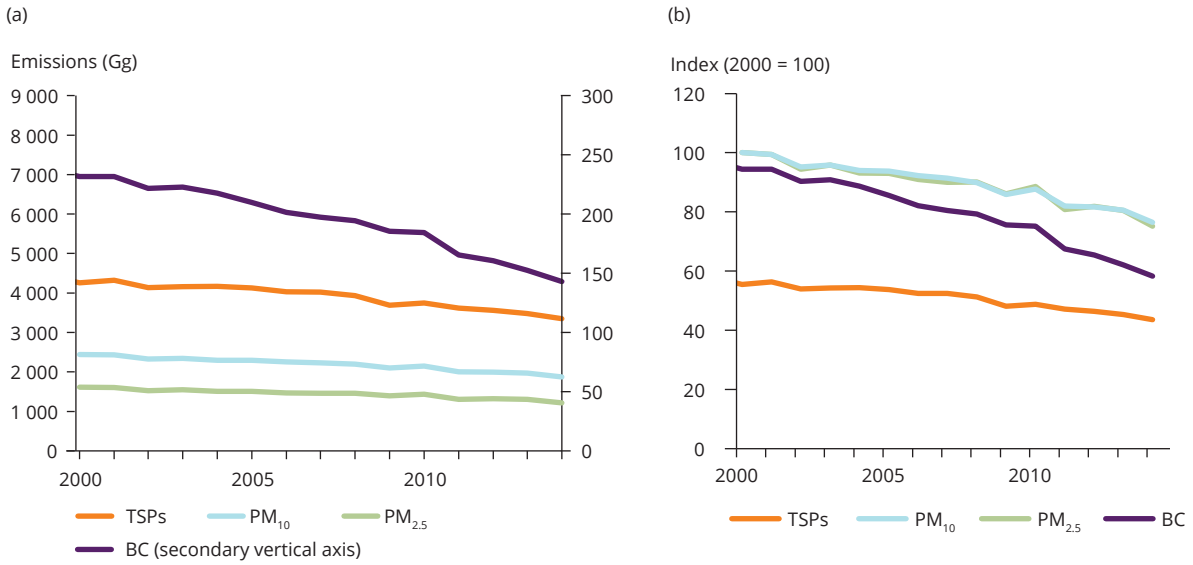


Figure 3.2 (a) EU-28 emission trends and (b) indexed emissions for PM and BC



Notes: The LRTAP Convention formally requests Parties to report emissions of PM for 2000 and after. Thus, emission trends can be shown for these years only.

The indexed emissions are based on emissions in 2000 (= 100).

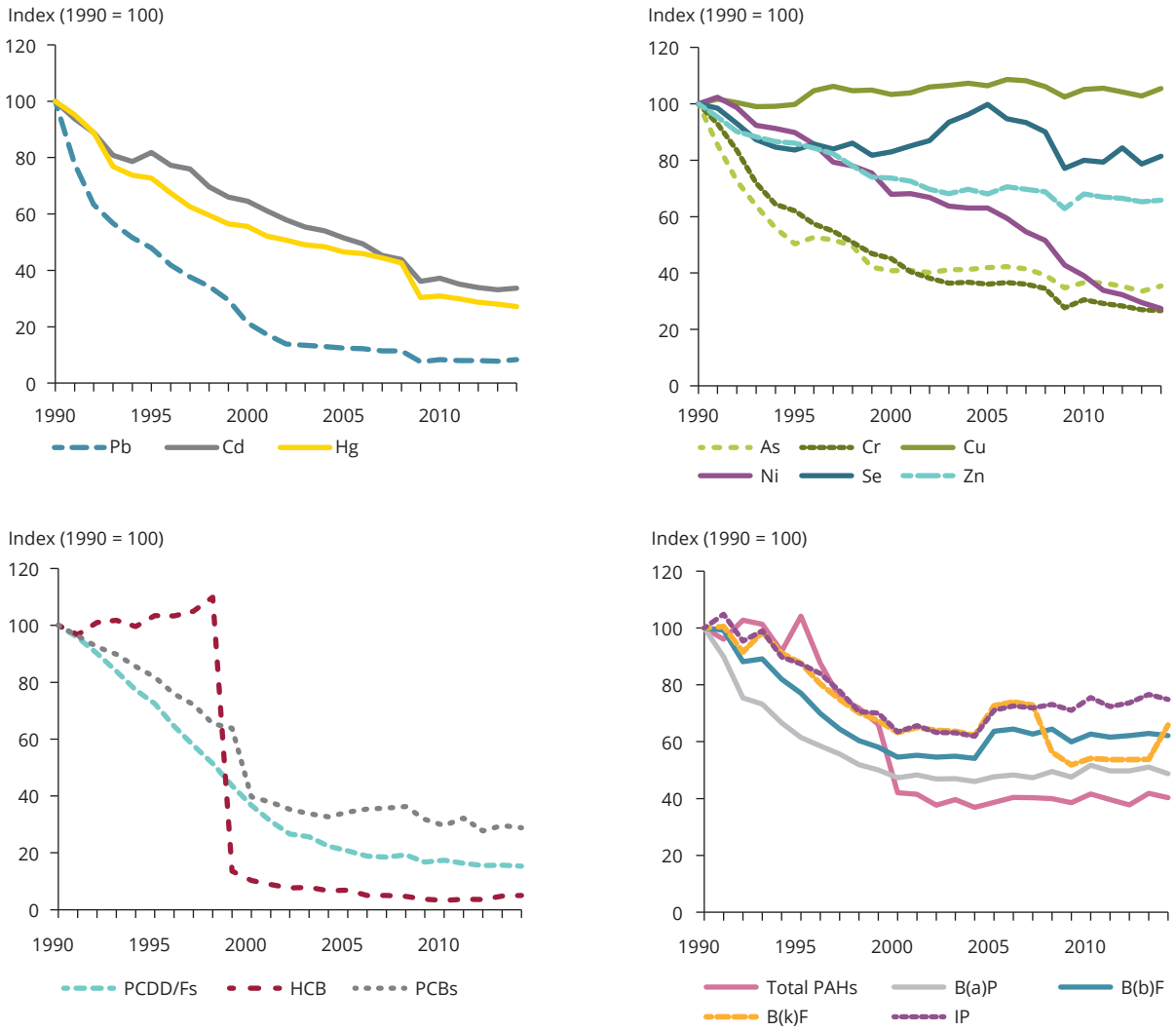
Also for heavy metals and POPs, emissions have reduced significantly since 1990 (Figure 3.3). Reductions are especially high for HCB (– 95 %), Pb (– 92 %) and PCDD/Fs (– 85 %).

For various pollutants (e.g. PM, HMs and POPs), some Member States did not report data, or reported the notation key 'NE' or 'NR' for certain years or the whole time series. In some cases, the data could not be gap-filled, so they were not included in the EU-28 total. In such instances, the EU-28 emission totals for these pollutants are not considered complete. Data tables in Chapter 3 (Table 3.4 to Table 3.29) show each Member State's reported emissions. Thus they indicate instances where emissions of a certain pollutant are unrecorded for all years.

The Gothenburg Protocol to the UNECE LRTAP Convention (UNECE, 1999) contains emission ceilings for the pollutants NO_X, NMVOCS, SO_X and NH_3. Parties to the protocol must meet them by 2010 and after. In their reports to the LRTAP Convention, some Member States have submitted emission projections for 2020, 2025 and 2030; others have submitted them for up to 2050. Submitted data are available in Annex E of this report. This report does not provide further detailed analysis of projections that countries reported in relation to the emission ceilings for 2010 in the Gothenburg Protocol. In June 2016, the EEA published its annual NEC Directive status report, which analyses, for EU Member States, the emission data reported under the EU NEC Directive (EEA, 2016). The national emission ceilings for EU Member States in the NEC Directive are either equal to or more ambitious than those set out in the Gothenburg Protocol.

This report compares emissions of four air pollutants that the EU-15 Member States reported for 2014 with the respective EU-15 emission ceilings set in the protocol. The reports are on the basis of fuel sold, except for Austria, Belgium, Ireland, Lithuania, Luxembourg, the Netherlands and the United Kingdom. These countries may choose to calculate emissions on the basis of fuel used in their territories (see Section 1.4.4).

Figure 3.3 Indexed EU-28 emission trends for the HMs and POPs



Notes: The drop in HCB emissions between 1998 and 1999 is due to the fact that the United Kingdom reported a considerable reduction over this period.

In addition to ceilings for individual countries, the protocol also specifies ceilings for the EU, which is itself a party to the protocol. Table 3.2 sets out the emissions that the EU-15 Member States reported for 2014, compared with the respective emission ceilings specified for the EU. For NO_X, NMVOCs and SO_X, emissions in 2014 were below the ceilings. For NH_3, the emissions were slightly above the ceiling.

Figure 3.4 shows whether or not EU Member States met the Gothenburg ceilings in 2014. Three Member States (Austria, Ireland and Luxembourg) reported NO_X emissions higher than their ceilings in 2010. Austria and Ireland have not yet ratified the Gothenburg Protocol so they could not apply for adjustments. Five countries exceeded their NH_3 ceilings (Austria, Finland, Germany, the Netherlands and Spain). Two Member State (Ireland and Luxembourg) did not comply with its ceiling for NMVOCs. All Member States complied with their SO_X ceilings. Note that all new Member States (i.e. the EU-13) have met their emission ceilings for all pollutants.

Table 3.1 Total EU-28 emissions of the main air pollutants: HMs, POPs and PM

Pollutant	Unit	1990	1995	2000	2005	2010	2011	2012	2013	2014	Change 1990–2014	Change 2013–2014
NO_X	Gg	17 518	15 073	12 917	11 861	9 315	8 972	8 612	8 209	7 820	– 55 %	– 4.7 %
*NO_X (adjusted data *)*	*Gg*	*17 518*	*15 073*	*12 917*	*11 861*	*8 720*	*8 380*	*8 050*	*7 767*	*7 388*		
NMVOCs	Gg	16 953	13 399	10 951	9 223	7 770	7 365	7 162	7 007	6 723	– 60 %	– 4.1 %
*NMVOCs (adjusted data *)*	*Gg*	*16 953*	*13 399*	*10 951*	*9 223*	*7 504*	*7 129*	*6 923*	*6 762*	*6 476*		
SO_X	Gg	25 373	16 800	10 092	7 726	4 510	4 456	4 021	3 468	3 083	– 88 %	– 11.1 %
NH_3	Gg	5 137	4 310	4 268	4 058	3 893	3 908	3 875	3 885	3 918	– 24 %	0.9 %
*NH_3 (adjusted data *)*	*Gg*	*5 137*	*4 310*	*4 268*	*4 058*	*3 882*	*3 897*	*3 865*	*3 874*	*3 907*		
TSPs	Gg	7 669	4 992	4 254	4 123	3 743	3 614	3 559	3 478	3 346	– 56 %	– 3.8 %
BC	Gg	245	246	232	210	184	166	161	152	143	– 42 %	– 6.1 %
Benzo(a)pyrene	Mg	382	235	181	182	198	190	190	195	186	– 51 %	– 4.6 %
CO	Gg	61 513	49 897	39 273	29 525	25 667	23 474	22 504	22 527	21 441	– 65 %	– 4.8 %
Pb	Mg	22 942	11 001	4 919	2 846	1 912	1 851	1 848	1 782	1 925	– 92 %	8.1 %
Cd	Mg	186	152	120	96	69	65	63	61	62	– 66 %	1.6 %
Hg	Mg	211	154	117	98	65	63	61	59	57	– 73 %	– 3.0 %
As	Mg	532	268	217	223	195	194	188	178	188	– 65 %	5.5 %
Cr	Mg	1 240	770	560	447	378	362	351	335	330	– 73 %	– 1.4 %
Cu	Mg	3 398	3 390	3 513	3 617	3 570	3 588	3 541	3 493	3 582	5 %	2.6 %
Ni	Mg	2 258	2 028	1 534	1 423	882	764	729	667	621	– 73 %	– 7.0 %
Se	Mg	264	221	219	264	212	210	223	208	215	– 19 %	3.4 %
Zn	Mg	10 355	8 915	7 634	7 043	7 042	6 936	6 882	6 758	6 822	– 34 %	0.9 %
PCDD/Fs	g I-Teq	11 836	8 584	4 347	2 444	2 065	1 937	1 844	1 854	1 811	– 85 %	– 2.3 %
Benzo(b)fluoranthene	Mg	298	229	162	189	187	183	185	187	185	– 38 %	– 1.2 %
Benzo(k)fluoranthene	Mg	159	139	101	116	86	85	85	86	105	– 34 %	22.6 %
Indeno(1,2,3-cd)pyrene	Mg	155	135	98	110	117	112	114	119	116	– 25 %	– 2.3 %
Total PAHs	Mg	2 767	2 883	1 165	1 069	1 150	1 096	1 046	1 156	1 116	– 60 %	– 3.5 %
HCB	kg	5 853	6 058	605	405	192	215	211	282	292	– 95 %	3.4 %
PCBs	kg	13 082	10 699	5 190	4 492	3 869	4 221	3 624	3 876	3 774	– 71 %	– 2.6 %
											Change 2000–2014	**Change 2013–2014**
$PM_{2.5}$	Gg			1 616	1 504	1 431	1 306	1 323	1 301	1 214	– 25 %	– 6.7 %
PM_{10}	Gg			2 444	2 291	2 145	2 005	1 997	1 968	1 870	– 23 %	– 5.0 %

Notes: Grey-shaded cells indicate that data for these pollutants are complete (reported and gap-filled data): Member States have not used 'NE', 'NR', '0' or empty cells, or gap-filling without notation keys was possible. Negative percentage values indicate that emissions have decreased.

Table 3.1 and subsequent tables (Table 3.4 to Table 3.29) express changes in emissions between 1990 and 2014 as $100 \times (E_{2014} - E_{1990}) / E_{1990}$ (%), where E_{2014} and E_{1990} are 2014 and 1990 total emissions, respectively. They express changes in emissions from 2013 to 2014 as $100 \times (E_{2014} - E_{2013}) / E_{2013}$ (%), where E_{2014} and E_{2013} are the 2014 and 2013 total emissions, respectively.

The bases for the EU inventory shown inTable 3.1 and subsequent tables (Table 3.4 to Table 3.29 inclusive) are national total data of the entire territory, based on fuel sold. Data for the United Kingdom are based on fuel used. See Section 1.4.4 for further details.

* Adjusted data: under the Gothenburg Protocol, the EMEP Steering Board accepted inventory adjustment applications ([9]) for emissions from several Member States. This table takes these adjustments into account. See Chapter 2 for further details.

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

Table 3.2 Comparison of emissions reported for 2014 by EU-15 Member States with emission ceilings for the EU specified in the UNECE Gothenburg Protocol

Pollutant	EU-15 emissions, 2014 (Gg)	EU-15 Gothenburg Protocol, 2010 ceilings (Gg)	Difference (%)
NO_X	5 587	6 671	– 16 %
NMVOCs	4 833	6 600	– 27 %
SO_X	1 598	4 059	– 61 %
NH_3	3 135	3 129	0.2 %

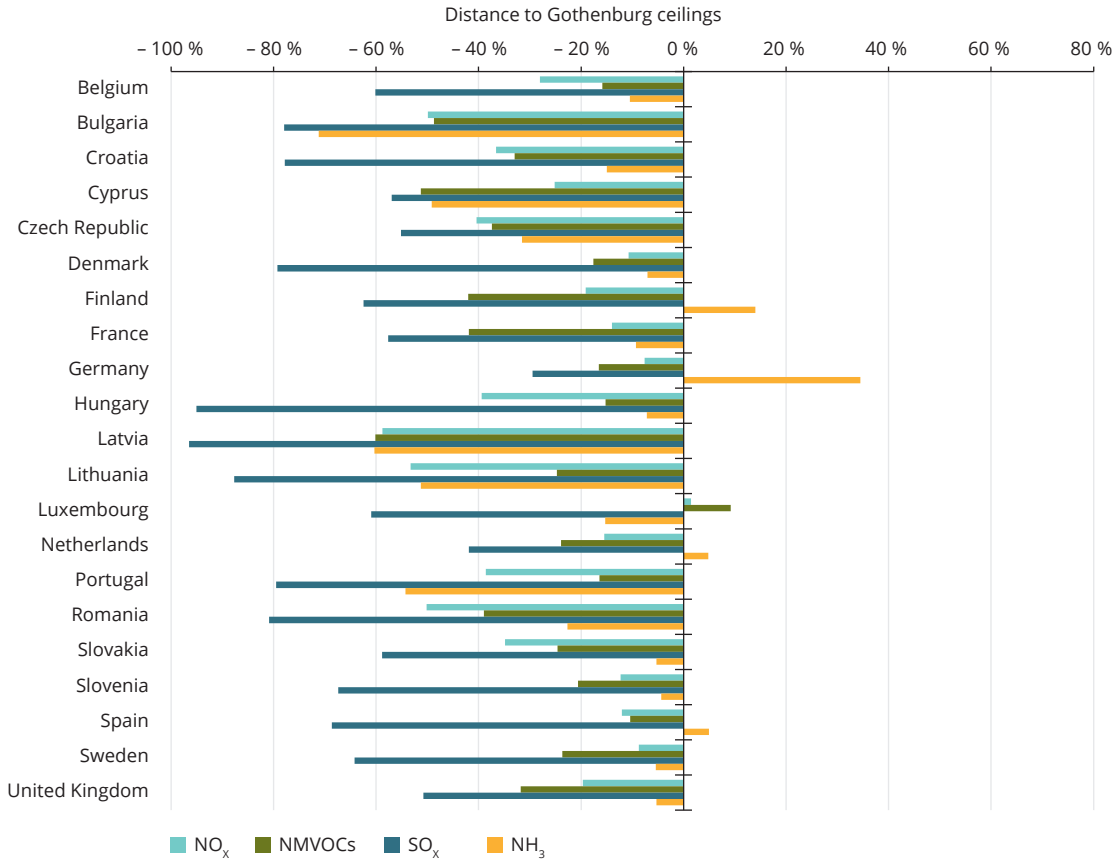
Notes: (a) Emission ceilings are also specified for individual EU-15 Member States. The sum of these ceilings is different from the ceilings specified for the EU-15 as a whole.

For Spain, data for emission comparisons exclude emissions from the Canary Islands.

The comparison with emission ceilings is based on reporting on the basis of fuel sold, except for Austria, Belgium, Ireland, Lithuania, Luxembourg, the Netherlands and the United Kingdom. These countries may choose to calculate emissions on the basis of fuel used in their territories instead (UNECE, 2014a).

Under the Gothenburg Protocol, the EMEP Steering Board accepted inventory adjustment applications for emissions from Belgium, Denmark, Finland, France, Germany and Luxembourg in 2014. This table takes these adjusted data into account.

Figure 3.4 Distance of Member State emissions in 2014 to the ceilings set in the Gothenburg Protocol for 2010



Note: Estonia and Malta have not signed the Gothenburg Protocol and therefore do not have ceilings. Austria, Greece, Ireland, Italy and Poland have a ceiling, but they have not yet ratified the protocol. For Spain, data for emission comparisons exclude emissions from the Canary Islands. In this figure, the 'adjusted' emission inventory data for Belgium, Denmark, Finland, France, Germany Luxembourg and Spain are taken into account.

3.2 Progress of non-EU countries in meeting 2010 emission ceilings under the Gothenburg Protocol to the UNECE LRTAP Convention

The Gothenburg Protocol of the LRTAP Convention specifies emissions ceilings for 2010 and onwards for three EEA member countries that are not in the EU (Liechtenstein, Norway and Switzerland) (UNECE, 1979, 1999, 2012a and 2012b). Only Norway and Switzerland have ratified the Protocol. Norway exceeded its NO_X ceilings for 2010–2012, and its NH_3 emissions ceilings in all years. Switzerland complied with all ceilings for all pollutants, except for NH_3 in 2010 (see Table 3.3).

3.3 Nitrogen oxide emission trends and key categories

Between 1990 and 2014, NO_X emissions dropped in the EU-28 by 55 %. Between 2013 and 2014, the decrease was 4.7 %, mainly because the United Kingdom, France and Poland noted reductions (Table 3.4). The Member States that contributed most (i.e. more than 10 %) to NO_X emissions in 2014 were Germany, the United Kingdom, France, Spain and Italy.

Table 3.4 to Table 3.29 include two EU-28 totals. The first is the sum of national totals that Member States officially reported. The second is the sum of the sectors of all Member States. A difference between these two EU totals arises when only national totals and no sectoral data are available. There is a third EU-28 total for NO_X (Table 3.4), NMVOCs (Table 3.5) and NH_3 (Table 3.7). This total makes allowance for approved adjustments (see also Chapter 2).

Spain stated that the dramatic drop in NO_X emissions in 2008 (the value for the national total is 14 % lower compared to the previous year) was due to the closure of the main brown coal mine in Spain in 2007 and the necessary retrofitting in 2008 of the adjacent thermal plant (see Spain's IIR, listed in Appendix 5).

The chief key categories for NO_X emissions were '1A3bi — Road transport: Passenger cars', '1A1a — Public electricity and heat production' and '1A3biii — Road

Table 3.3 Progress by other EEA member countries in meeting Gothenburg Protocol UNECE LRTAP Convention emission ceilings

Member State	NO_X Emission data (Gg)					Ceilings (Annex I)	Emission–ceiling comparison					NMVOCs Emission data (Gg)					Ceilings (Annex I)	Emission–ceiling comparison				
	2010	2011	2012	2013	2014		2010	2011	2012	2013	2014	2010	2011	2012	2013	2014		2010	2011	2012	2013	2014
Liechtenstein	0.37	0.36	0.36	0.36	0.34	0.37	×	✓	✓	✓	✓	0.24	0.23	0.22	0.22	0.21	0.86	✓	✓	✓	✓	✓
Norway	177	170	163	151	140	156	×	×	×	✓	✓	139	132	132	134	138	195	✓	✓	✓	✓	✓
Switzerland	74	69	68	66	62	79	✓	✓	✓	✓	✓	86	84	82	81	79	144	✓	✓	✓	✓	✓

Member State	SO_X Emission data (Gg)					Ceilings (Annex I)	Emission–ceiling comparison					NH_3 Emission data (Gg)					Ceilings (Annex I)	Emission–ceiling comparison				
	2010	2011	2012	2013	2014		2010	2011	2012	2013	2014	2010	2011	2012	2013	2014		2010	2011	2012	2013	2014
Liechtenstein	0.03	0.02	0.03	0.03	0.02	0.11	✓	✓	✓	✓	✓	0.17	0.17	0.17	0.16	0.17	0.15	×	×	×	×	×
Norway	20	19	17	17	17	22	✓	✓	✓	✓	✓	27	26	26	26	26	23	×	×	×	×	×
Switzerland	11	9	9	9	8	26	✓	✓	✓	✓	✓	63	63	62	62	63	63	×	✓	✓	✓	✓

Notes: Emission data for Liechtenstein, Norway and Switzerland are the latest reported data under the LRTAP Convention (2016 submission round), and are compared with the respective emission ceilings of the Gothenburg Protocol. Switzerland's assessment is based on fuel used data.

Liechtenstein has signed but not yet ratified the protocol. Neither Iceland nor Turkey has yet signed the Gothenburg Protocol.

'✓' indicates that the final (2010, 2011, 2012, 2013) or provisional (2014) emission data that a country reported meet or lie below its respective emission ceiling.

'×' indicates that a ceiling is exceeded.

Table 3.4 Member State contributions to EU emissions of NO_x

	NO_x (Gg)									Change		Share in EU-28	
Member State	**1990**	**1995**	**2000**	**2005**	**2010**	**2011**	**2012**	**2013**	**2014**	**1990–2014**	**2013–2014**	**1990**	**2014**
Austria	216	194	210	235	179	169	163	162	151	– 30 %	– 6.8 %	1.2 %	1.9 %
Belgium	412	383	345	318	251	233	214	206	197	– 52 %	– 4.5 %	2.4 %	2.5 %
Adjusted data *					*189*	*172*	*154*	*147*	*140*				
Bulgaria	270	188	149	185	140	157	142	127	133	– 51 %	4.7 %	1.5 %	1.7 %
Croatia	104	79	85	82	65	61	56	55	55	– 47 %	0.8 %	0.6 %	0.7 %
Cyprus	17	19	22	21	18	21	21	16	17	1 %	6.5 %	0.1 %	0.2 %
Czech Republic	737	418	298	279	220	207	193	181	170	– 77 %	– 6.0 %	4.2 %	2.2 %
Denmark	300	291	225	203	147	139	128	123	113	– 62 %	– 7.8 %	1.7 %	1.4 %
Estonia	76	47	44	41	42	40	37	34	33	– 56 %	– 1.5 %	0.4 %	0.4 %
Finland	285	258	213	187	174	160	152	145	137	– 52 %	– 5.0 %	1.6 %	1.8 %
France	1 958	1 780	1 622	1 429	1 087	1 024	987	966	886	– 55 %	– 8.3 %	11.2 %	11.3 %
Adjusted data *					*940*	*871*	*837*	*815*	*740*				
Germany	2 882	2 164	1 924	1 572	1 337	1 316	1 275	1 272	1 224	– 58 %	– 3.8 %	16.5 %	15.7 %
Adjusted data *					*1 080*	*1 062*	*1 036*	*1 045*	*999*				
Greece	326	329	359	417	319	296	259	250	248	– 24 %	– 0.9 %	1.9 %	3.2 %
Hungary	238	184	177	167	139	130	121	121	120	– 50 %	– 0.6 %	1.4 %	1.5 %
Ireland	136	134	140	137	86	77	79	78	77	– 43 %	– 1.1 %	0.8 %	1.0 %
Italy	2 051	1 924	1 459	1 249	978	950	867	816	790	– 61 %	– 3.1 %	11.7 %	10.1 %
Latvia	93	51	43	44	41	35	35	35	35	– 63 %	– 0.1 %	0.5 %	0.4 %
Lithuania	127	61	53	59	55	51	53	52	51	– 60 %	– 0.7 %	0.7 %	0.7 %
Luxembourg	42	37	43	59	39	39	35	32	28	– 34 %	– 11.8 %	0.2 %	0.4 %
Adjusted data *					*36*	*36*	*32*	*29*	*25*				
Malta	6.6	8.7	8.7	9.3	8.1	7.9	8.6	4.9	6.5	– 1 %	32.6 %	0.0 %	0.1 %
Netherlands	603	505	419	367	300	286	272	260	235	– 61 %	– 9.5 %	3.4 %	3.0 %
Poland	1 074	1 074	842	851	874	855	832	774	723	– 33 %	– 6.6 %	6.1 %	9.2 %
Portugal	237	267	265	257	179	171	160	160	160	– 33 %	– 0.5 %	1.4 %	2.0 %
Romania	466	400	382	317	235	244	242	220	218	– 53 %	– 1.0 %	2.7 %	2.8 %
Slovakia	226	179	91	104	92	88	84	83	85	– 63 %	2.0 %	1.3 %	1.1 %
Slovenia	68	65	54	52	48	48	47	44	39	– 42 %	– 10.3 %	0.4 %	0.5 %
Spain	1 338	1 412	1 394	1 422	960	955	923	819	802	– 40 %	– 2.1 %	7.6 %	10.3 %
Adjusted data *					*833*	*833*	*812*						
Sweden	278	250	214	182	157	149	141	138	135	– 51 %	– 2.3 %	1.6 %	1.7 %
United Kingdom	2 949	2 372	1 834	1 617	1 145	1 063	1 085	1 036	949	– 68 %	– 8.4 %	16.8 %	12.1 %
EU-28 ([a])	**17 518**	**15 073**	**12 917**	**11 861**	**9 315**	**8 972**	**8 612**	**8 209**	**7 820**	**– 55 %**	**– 4.7 %**	**100 %**	**100 %**
EU-28 ([b])	17 517	15 074	12 918	11 861	9 314	8 971	8 612	8 208	8 208				
EU-28 ([c])	17 518	15 073	12 917	11 861	8 720	8 380	8 050	7 767	7 388				

Notes: Grey shaded cells denote gap-filled data. For more detailed information, see Annex D.

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

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

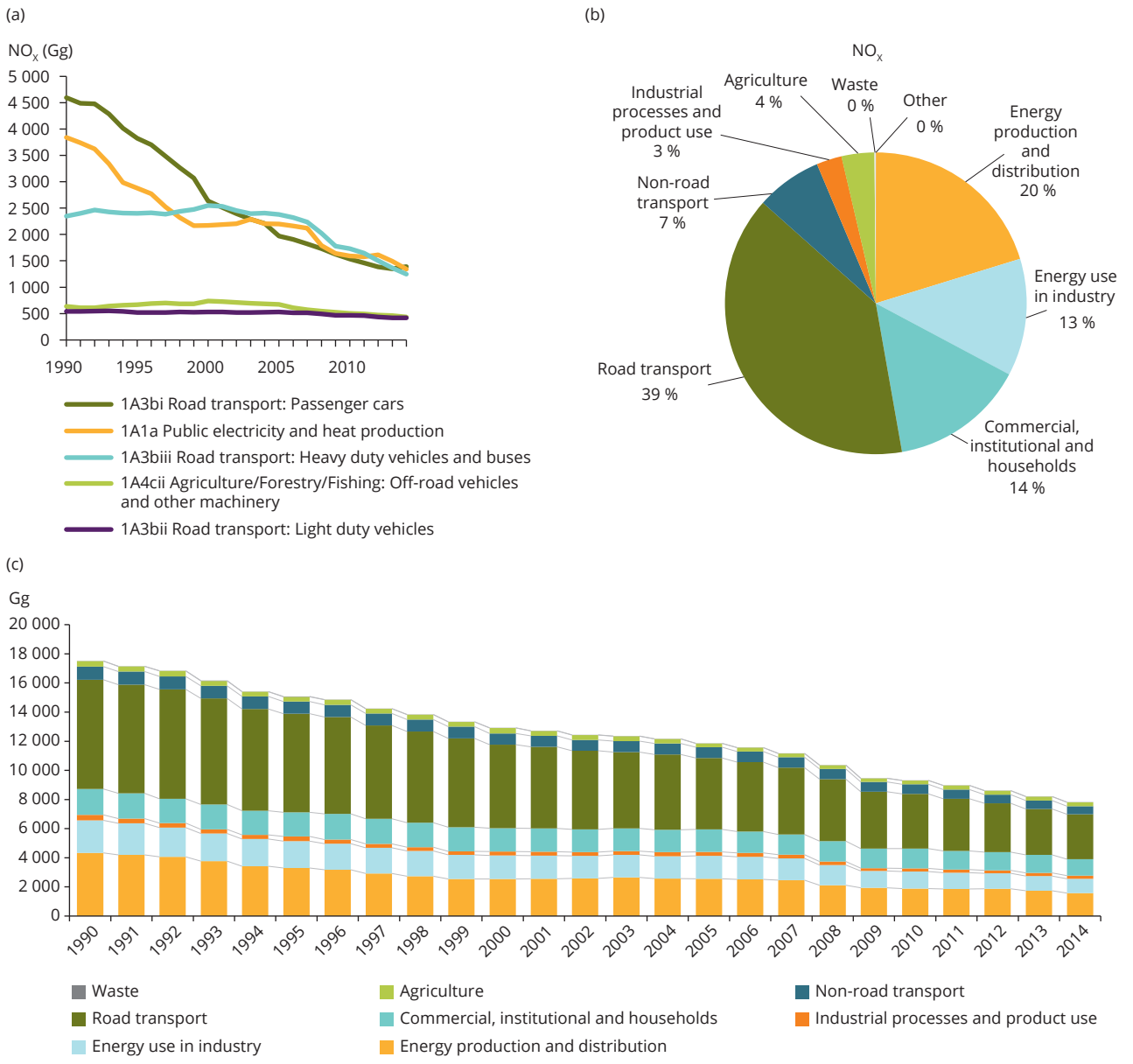
([c]) Sum of national totals as reported by Member States allowing for approved adjustments.

* Adjusted data: under the Gothenburg Protocol, the EMEP Steering Board accepted inventory adjustment applications for emissions from Belgium, France, Germany, Luxembourg and Spain.

transport: Heavy duty vehicles and buses'. Together, they made up 51 % of total emissions (see Figure 3.5). Of the top five key categories, the highest relative reductions in emissions between 1990 and 2014 were in the most important, '1A3bi — Road transport: Passenger cars' (– 69.7 %) (see Figure 3.5(a)).

Figure 3.5(b) shows the contribution that each aggregated sector group made to total EU-28 emissions. For NO_x, common key emission sources are the energy and transport sectors. Emission reductions from the road transport sector are primarily a result of fitting catalysts to vehicles (EEA, 2015a). The legislative standards known as 'Euro' standards have driven this move. Nevertheless, the road transport sector represents the largest source of NO_x emissions, accounting for 39 % of total EU-28 emissions in 2014. The electricity/energy production sectors have also reduced their emissions, thanks to measures such as introducing combustion modification technologies (e.g. low-NO_x burners), implementing flue-gas abatement techniques (e.g. NO_x scrubbers and selective catalytic reduction (SCR) and non-selective catalytic reduction (SNCR) techniques), and switching fuel from coal to gas (EEA, 2015a).

Figure 3.5 NO_x emissions in the EU-28: (a) trend in emissions from the five most important key categories, 1990–2014; (b) share by sector group, 2014; (c) sectoral trends in emissions



3.4 Non-methane volatile organic compound emission trends and key categories

Between 1990 and 2014, NMVOC emissions dropped in the EU-28 by 85 %. Between 2013 and 2014, Member States reported a decrease of 4.1%, mainly due to decreased emissions in Germany, France and Italy (Table 3.5). In 2014, the Member States that contributed most (i.e. more than 10 %) to NMVOCS emissions were Germany, Italy and the United Kingdom.

The most important key categories for NMVOC emissions were '2D3d — Coating applications', '1A4bi — Residential: Stationary' and '2D3a — Domestic solvent use including fungicides'. Together, they made up 38 % of total emissions (Figure 3.6(a)). Among the top five key categories, the highest relative reductions in emissions between 1990 and 2014 were in the most important key category, '2D3d — Coating applications' (− 52.7 %).

Table 3.5 Member State contributions to EU emissions of NMVOCs

	NMVOCs (Gg)									Change		Share in EU-28	
Member State	**1990**	**1995**	**2000**	**2005**	**2010**	**2011**	**2012**	**2013**	**2014**	**1990–2014**	**2013–2014**	**1990**	**2014**
Austria	281	204	153	137	119	115	114	116	110	– 61 %	– 4.4 %	1.7 %	1.6 %
Belgium	330	278	218	178	147	135	132	130	122	– 63 %	– 5.9 %	1.9 %	1.8 %
*Adjusted data **					*118*								
Bulgaria	606	153	105	104	107	106	97	93	95	– 84 %	1.5 %	3.6 %	1.4 %
Croatia	141	82	84	85	64	61	56	54	60	– 57 %	12.4 %	0.8 %	0.9 %
Cyprus	16	16	14	13	11	8.4	8.1	7.1	6.8	– 58 %	– 3.6 %	0.1 %	0.1 %
Czech Republic	301	207	242	209	170	154	149	144	138	– 54 %	– 4.6 %	1.8 %	2.0 %
Denmark	203	203	173	148	125	118	115	114	106	– 48 %	– 7.5 %	1.2 %	1.6 %
*Adjusted data **					*90*	*82*	*79*	*78*	*70*				
Estonia	67	43	39	33	24	24	23	23	23	– 66 %	– 1.5 %	0.4 %	0.3 %
Finland	252	218	166	134	111	100	99	95	75	– 70 %	– 20.5 %	1.5 %	1.1 %
France	2 398	2 011	1 619	1 189	813	750	713	697	639	– 73 %	– 8.4 %	14.1 %	9.5 %
Germany	3 389	2 026	1 599	1 338	1 236	1 166	1 134	1 110	1 041	– 69 %	– 6.2 %	20.0 %	15.5 %
*Adjusted data **					*1 034*	*965*	*930*	*902*	*830*				
Greece	268	258	264	220	185	159	152	147	125	– 53 %	– 14.9 %	1.6 %	1.9 %
Hungary	293	203	168	145	124	122	120	120	116	– 60 %	– 3.1 %	1.7 %	1.7 %
Ireland	136	128	112	105	91	88	88	90	87	– 36 %	– 2.7 %	0.8 %	1.3 %
Italy	1 990	2 020	1 563	1 281	1 046	954	942	909	849	– 57 %	– 6.5 %	11.7 %	12.6 %
Latvia	100	76	65	62	50	51	56	55	54	– 46 %	– 0.9 %	0.6 %	0.8 %
Lithuania	145	108	80	81	75	72	73	68	69	– 52 %	1.8 %	0.9 %	1.0 %
Luxembourg	23	20	16	15	11	11	12	12	11	– 53 %	– 7.4 %	0.1 %	0.2 %
Malta	1.8	2.0	3.1	3.3	2.6	3.0	3.2	3.0	3.0	65 %	0.4 %	0.0 %	0.0 %
Netherlands	489	349	243	180	165	161	156	148	143	– 71 %	– 3.3 %	2.9 %	2.1 %
Poland	546	682	575	584	665	647	640	615	606	11 %	– 1.4 %	3.2 %	9.0 %
Portugal	270	267	252	213	183	177	171	173	169	– 37 %	– 2.6 %	1.6 %	2.5 %
Romania	356	204	266	388	344	340	343	324	319	– 10 %	– 1.4 %	2.1 %	4.8 %
Slovakia	125	91	64	130	120	121	114	106	106	– 15 %	– 0.1 %	0.7 %	1.6 %
Slovenia	72	64	54	46	39	37	35	34	32	– 56 %	– 5.3 %	0.4 %	0.5 %
Spain	1 065	990	1 007	844	667	634	588	612	614	– 42 %	0.3 %	6.3 %	9.1 %
Sweden	369	288	237	219	210	204	193	187	184	– 50 %	– 1.8 %	2.2 %	2.7 %
United Kingdom	2 720	2 208	1 568	1 137	865	845	837	822	819	– 70 %	– 0.4 %	16.0 %	12.2 %
EU-28 (a)	**16 953**	**13 399**	**10 951**	**9 223**	**7 770**	**7 365**	**7 162**	**7 007**	**6 723**	**– 60 %**	**– 4.1 %**	**100 %**	**100 %**
EU-28 (b)	16 953	13 399	10 950	9 222	7 770	7 365	7 162	7 007	6 723				
EU-28 (c)	16 953	13 399	10 951	9 223	7 504	7 129	6 923	6 762	6 476				

Notes: Grey shaded cells denote gap-filled data. For more detailed information, see Annex D.

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

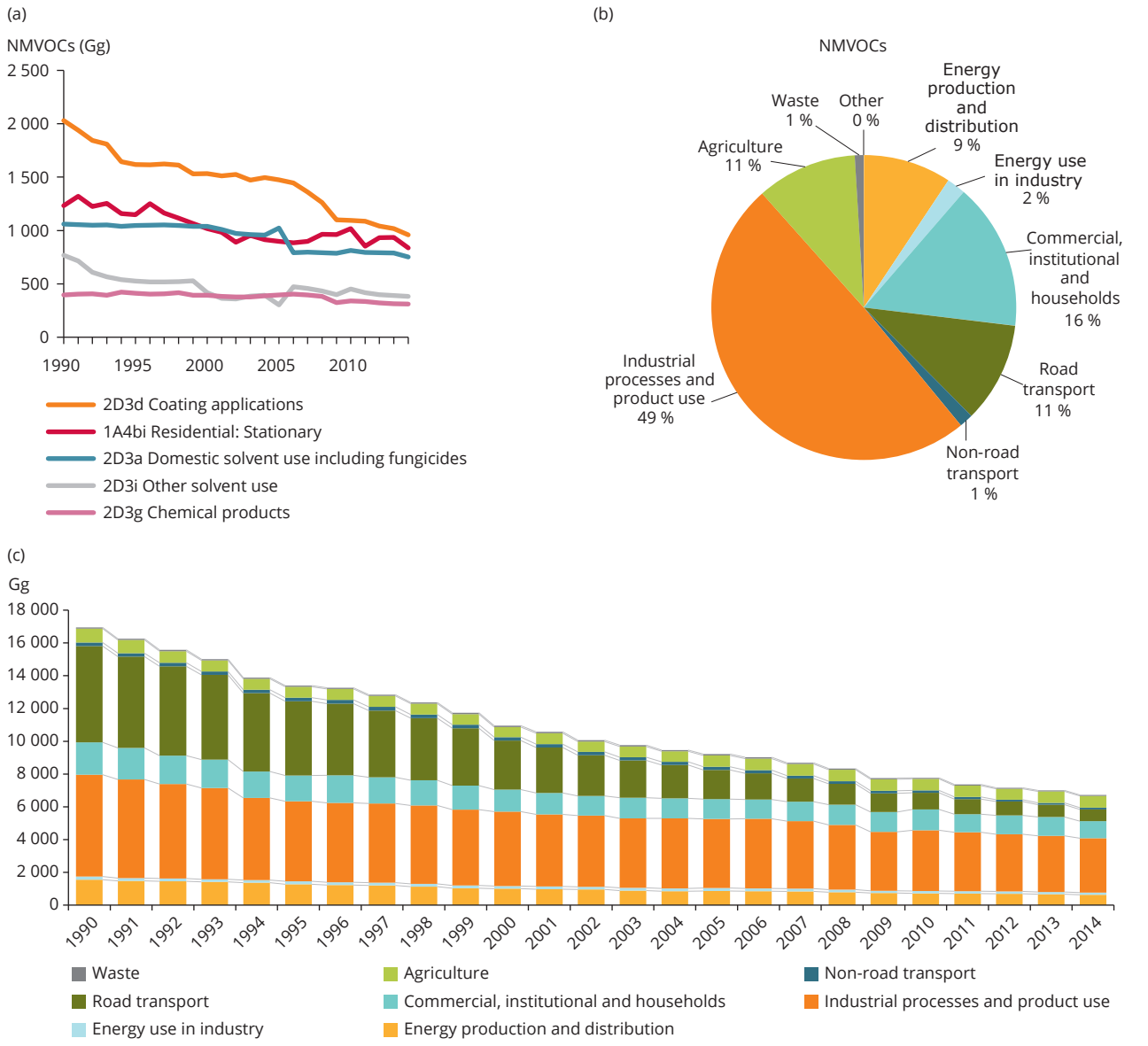
(b) Sum of sectors: differences arise when only national totals and no sectoral data are available.

(c) Sum of national totals as reported by Member States allowing for approved adjustments.

* Adjusted data: under the Gothenburg Protocol, the EMEP Steering Board accepted inventory adjustment applications for emissions from Belgium, Denmark and Germany.

Figure 3.6(b) shows the contribution that each aggregated sector group made to total EU-28 emissions. For NMVOCs, the chief emission source is 'industrial processes and product use' (49 %), followed by 'commercial, institutional and households', 'agriculture' and 'road transport'.

Figure 3.6 NMVOC emissions in the EU-28: (a) trend in emissions from the five most important key categories, 1990–2014; (b) share by sector group, 2014; (c) sectoral trends in emissions



3.5 Sulphur oxide emission trends and key categories

Between 1990 and 2014, SO_X emissions dropped in the EU-28 by 88 %. Between 2013 and 2014, emissions decreased by 11.1 %, mainly thanks to reduced emissions in Greece, the United Kingdom, Poland and France (see Table 3.6). The Member States that contributed most (i.e. more than 10 %) to SO_X emissions in 2014 were Poland, Germany and the United Kingdom.

Spain stated that the dramatic drop in SO_X emissions in 2008 (the value for the national total is 55 % lower compared to the previous year) was due to the closure of the main brown coal mine in Spain in 2007 and the necessary retrofitting in 2008 of the adjacent thermal plant (Appendix 5, Spain's IIR).

Category '1A1a — Public electricity and heat production' is the most significant key category for SO_X emissions, making up 47 % of total SO_X emissions (Figure 3.7(a)). Among the top five key categories, the highest relative reductions in emissions between 1990 and 2014 were achieved in the most important, '1A1a — Public electricity and heat production' (− 90.1 %), the third most important, '1A1b — Petroleum refining' (− 83.7 %), and the fourth most important '1A2f — Stationary combustion in manufacturing industries and construction: Non-metallic minerals' (− 81.7 %).

Table 3.6 Member State contributions to EU emissions of SO_X

	SO_X (Gg)									Change		Share in EU-28	
Member State	**1990**	**1995**	**2000**	**2005**	**2010**	**2011**	**2012**	**2013**	**2014**	**1990–2014**	**2013–2014**	**1990**	**2014**
Austria	74	47	32	26	18	17	16	16	16	– 78 %	0.9 %	0.3 %	0.5 %
Belgium	365	258	174	143	61	53	47	45	42	– 88 %	– 5.5 %	1.4 %	1.4 %
Bulgaria	1 101	1 301	863	779	389	516	330	196	189	– 83 %	– 3.5 %	4.3 %	6.1 %
Croatia	170	77	59	58	35	29	25	17	16	– 91 %	– 5.7 %	0.7 %	0.5 %
Cyprus	31	39	48	38	22	21	16	14	17	– 46 %	22.1 %	0.1 %	0.5 %
Czech Republic	1 871	1 090	224	208	160	160	155	138	127	– 93 %	– 7.9 %	7.4 %	4.1 %
Denmark	179	147	32	26	16	14	13	13	11	– 94 %	– 12.2 %	0.7 %	0.4 %
Estonia	272	116	97	76	83	73	41	37	41	– 85 %	11.8 %	1.1 %	1.3 %
Finland	263	100	80	70	67	61	51	47	44	– 83 %	– 8.1 %	1.0 %	1.4 %
France	1 307	980	637	467	286	250	235	217	169	– 87 %	– 22.0 %	5.2 %	5.5 %
Germany	5 312	1 707	646	474	432	428	413	410	388	– 93 %	– 5.5 %	20.9 %	12.6 %
Greece	476	540	496	541	265	262	245	227	138	– 71 %	– 39.0 %	1.9 %	4.5 %
Hungary	825	616	428	41	31	34	31	30	27	– 97 %	– 10.9 %	3.2 %	0.9 %
Ireland	184	163	142	74	28	27	25	25	19	– 89 %	– 23.8 %	0.7 %	0.6 %
Italy	1 801	1 327	754	407	217	195	176	145	131	– 93 %	– 10.1 %	7.1 %	4.2 %
Latvia	100	49	18	8.8	4.5	4.3	4.3	3.8	3.8	– 96 %	– 1.4 %	0.4 %	0.1 %
Lithuania	167	69	37	32	21	24	21	20	18	– 89 %	– 10.0 %	0.7 %	0.6 %
Luxembourg	15	8.8	3.3	2.4	1.8	1.3	1.5	1.6	1.6	– 90 %	0.6 %	0.1 %	0.1 %
Malta	0.0	0.0	24	11	8.1	7.9	7.7	5.0	4.7	> 100 %	– 7.1 %	0.0 %	0.2 %
Netherlands	193	131	73	64	34	33	34	30	29	– 85 %	– 1.8 %	0.8 %	0.9 %
Poland	2 812	2 300	1 498	1 246	970	917	892	853	800	– 72 %	– 6.2 %	11.1 %	26.0 %
Portugal	315	321	251	177	53	48	43	39	35	– 89 %	– 10.1 %	1.2 %	1.1 %
Romania	854	748	526	601	349	320	258	203	176	– 79 %	– 13.3 %	3.4 %	5.7 %
Slovakia	524	245	98	89	72	69	57	53	45	– 91 %	– 15.3 %	2.1 %	1.5 %
Slovenia	201	124	94	41	10	12	11	12	8.8	– 96 %	– 23.9 %	0.8 %	0.3 %
Spain	2 170	1 855	1 496	1 278	421	457	404	259	255	– 88 %	– 1.6 %	8.6 %	8.3 %
Sweden	105	69	42	36	32	29	28	27	24	– 77 %	– 10.6 %	0.4 %	0.8 %
United Kingdom	3 685	2 372	1 220	711	423	393	439	386	308	– 92 %	– 20.3 %	14.5 %	10.0 %
EU-28 (a)	**25 373**	**16 800**	**10 092**	**7 726**	**4 510**	**4 456**	**4 021**	**3 468**	**3 083**	**– 88 %**	**– 11.1 %**	**100 %**	**100 %**
EU-28 (b)	25 373	16 803	10 092	7 726	4 510	4 456	4 021	3 468	3 083				

Notes: Grey shaded cells denote gap-filled data. For more detailed information, see Annex D.

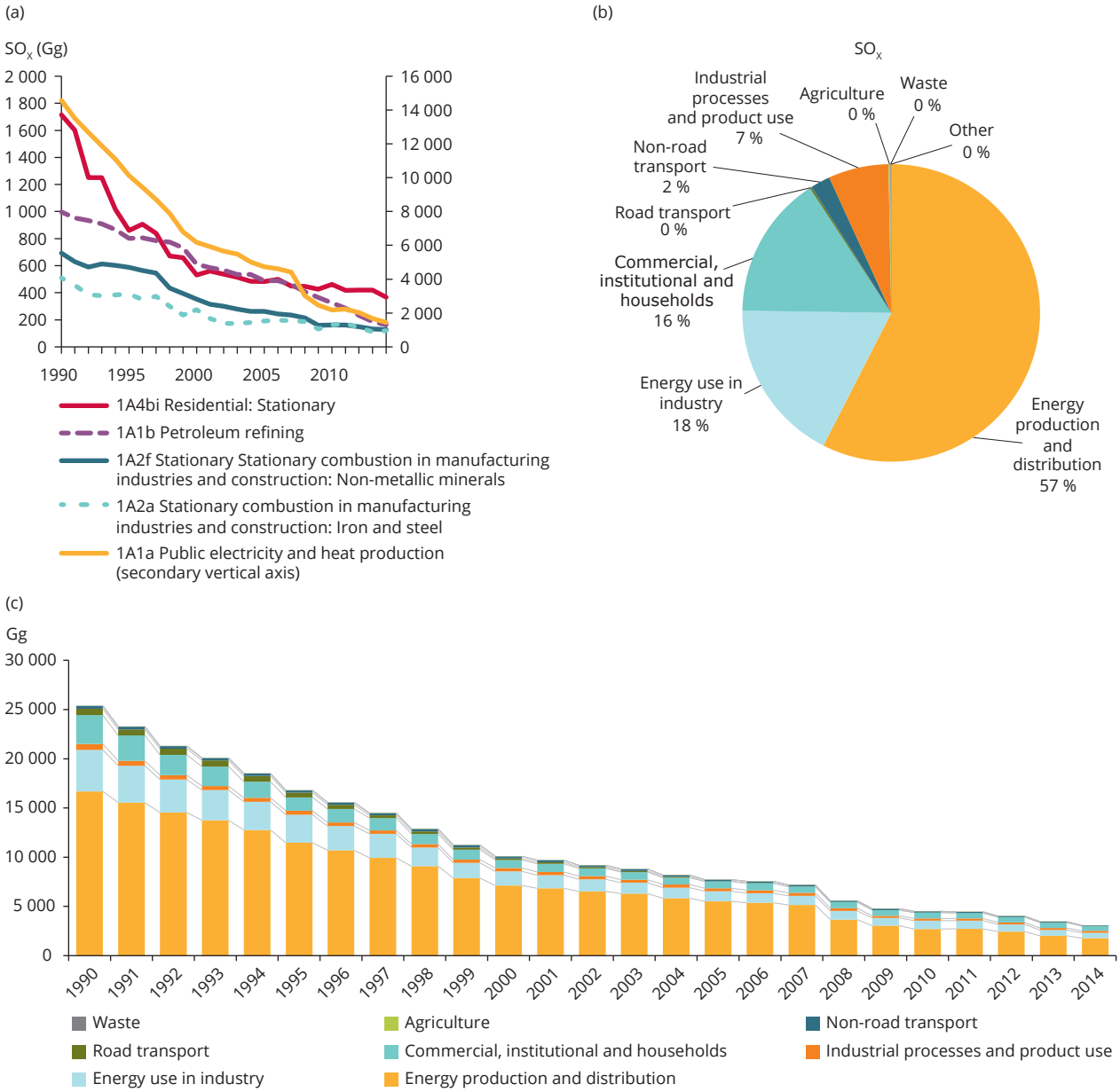
(a) Sum of national totals as reported by Member States.

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

For these main emitting sources, several measures have combined to reduce emissions since 1990: switching fuel in energy-related sectors away from high-sulphur solid and liquid fuels to low-sulphur fuels such as natural gas; fitting flue-gas desulphurisation (FGD) abatement technology in industrial facilities; and the impact of EU directives relating to the sulphur content of certain liquid fuels (EEA, 2015a).

Figure 3.7(b) shows the contribution that each aggregated sector group made to total EU-28 emissions. For SO_x, common chief emission sources are the energy sectors.

Figure 3.7 **SO_x emissions in the EU-28: (a) trend in emissions from the five most important key categories, 1990–2014; (b) share by sector group, 2014; (c) sectoral trends in emissions**



3.6 Ammonia emission trends and key categories

Between 1990 and 2014, NH_3 emissions in the EU-28 dropped by 24 %. Between 2013 and 2014, emissions increased by 0.9 %, mainly because of increases in France, Germany, Spain and the United Kingdom (see Table 3.7). The Member States that contributed most (i.e. more than 10 %) to NH_3 emissions in 2014 were Germany, France and Italy.

Belgium explained that the significant decrease in NH_3 emissions in the manure management sectors between 1999 and 2000 is mainly due to the implementation of the Manure Action Plan 2bis (e.g. measures on addressing low use of manure) in Flanders (personal communication by Belgium in 2016).

Germany stated that its rising emission trend in recent years result from the storage and use of energy crops and their residuals (personal communication by Germany in 2016).

Table 3.7 Member State contributions to EU emissions of NH_3

	NH_3 (Gg)									Change		Share in EU-28	
Member State	**1990**	**1995**	**2000**	**2005**	**2010**	**2011**	**2012**	**2013**	**2014**	**1990–2014**	**2013–2014**	**1990**	**2014**
Austria	66	70	67	66	67	67	67	67	67	1 %	0.7 %	1.3 %	1.7 %
Belgium	117	113	83	68	68	67	67	67	66	– 44 %	– 0.8 %	2.3 %	1.7 %
Bulgaria	113	58	41	48	42	40	38	31	31	– 72 %	1.2 %	2.2 %	0.8 %
Croatia	44	34	34	35	30	31	31	27	26	– 42 %	– 5.6 %	0.9 %	0.7 %
Cyprus	5.2	5.9	5.9	5.8	5.4	5.1	4.9	4.6	4.6	– 12 %	– 0.7 %	0.1 %	0.1 %
Czech Republic	156	86	84	74	68	67	67	69	69	– 56 %	1.0 %	3.0 %	1.8 %
Denmark	125	110	98	89	80	78	76	74	73	– 42 %	– 0.4 %	2.4 %	1.9 %
Adjusted data *					*71*	*70*	*68*	*64*	*64*				
Estonia	27	12	10	11	12	12	13	13	13	– 52 %	1.5 %	0.5 %	0.3 %
Finland	38	36	38	39	38	37	37	37	37	– 2 %	– 1.0 %	0.7 %	0.9 %
Adjusted data *					*36*	*36*	*36*	*36*	*35*				
France	704	683	715	686	700	694	694	690	708	1 %	2.5 %	13.7 %	18.1 %
Germany	793	678	698	678	682	724	705	730	740	– 7 %	1.3 %	15.4 %	18.9 %
Greece	85	74	71	68	64	62	61	59	61	– 28 %	2.4 %	1.6 %	1.6 %
Hungary	159	93	96	89	79	79	78	83	84	– 47 %	0.9 %	3.1 %	2.1 %
Ireland	105	109	112	110	106	102	103	105	105	0 %	0.3 %	2.0 %	2.7 %
Italy	472	452	454	422	389	402	415	402	393	– 17 %	– 2.1 %	9.2 %	10.0 %
Latvia	45	19	16	16	17	17	17	17	17	– 61 %	2.8 %	0.9 %	0.4 %
Lithuania	85	42	37	45	43	42	42	41	41	– 52 %	0.3 %	1.6 %	1.0 %
Luxembourg	6.3	6.6	6.9	6.2	6.1	6.1	5.9	6.	6.1	– 4 %	0.8 %	0.1 %	0.2 %
Malta	1.9	1.9	1.8	1.6	1.6	1.5	1.5	1.6	1.6	– 16 %	0.2 %	0.0 %	0.0 %
Netherlands	372	231	182	160	140	136	132	130	134	– 64 %	2.6 %	7.2 %	3.4 %
Poland	414	320	287	274	274	273	264	270	265	– 36 %	– 1.7 %	8.1 %	6.8 %
Portugal	72	67	67	50	47	49	51	51	49	– 31 %	– 2.9 %	1.4 %	1.3 %
Romania	300	217	206	204	168	166	166	165	162	– 46 %	– 1.6 %	5.8 %	4.1 %
Slovakia	65	40	32	43	36	36	37	37	37	– 43 %	– 1.5 %	1.3 %	0.9 %
Slovenia	24	22	22	21	20	20	19	19	19	– 20 %	– 0.4 %	0.5 %	0.5 %
Spain	361	338	420	386	373	361	351	363	373	3 %	2.7 %	7.0 %	9.5 %
Sweden	57	66	61	57	54	54	53	54	54	– 5 %	– 0.6 %	1.1 %	1.4 %
United Kingdom	324	324	324	306	281	281	276	272	281	– 13 %	3.3 %	6.3 %	7.2 %
EU-28 (a)	**5 137**	**4 310**	**4 268**	**4 058**	**3 893**	**3 908**	**3 875**	**3 885**	**3 918**	**– 24 %**	**0.9 %**	**100 %**	**100 %**
EU-28 (b)	5 137	4 310	4 268	4 058	3 893	3 908	3 875	3 885	3 918				
EU-28 (c)	5 137	4 310	4 268	4 058	3 882	3 897	3 865	3 874	3 907				

Notes: Grey shaded cells denote gap-filled data. For more detailed information, see Annex D.

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

(b) Sum of sectors.

(c) Sum of national totals as reported by Member States under consideration of approved adjustments.

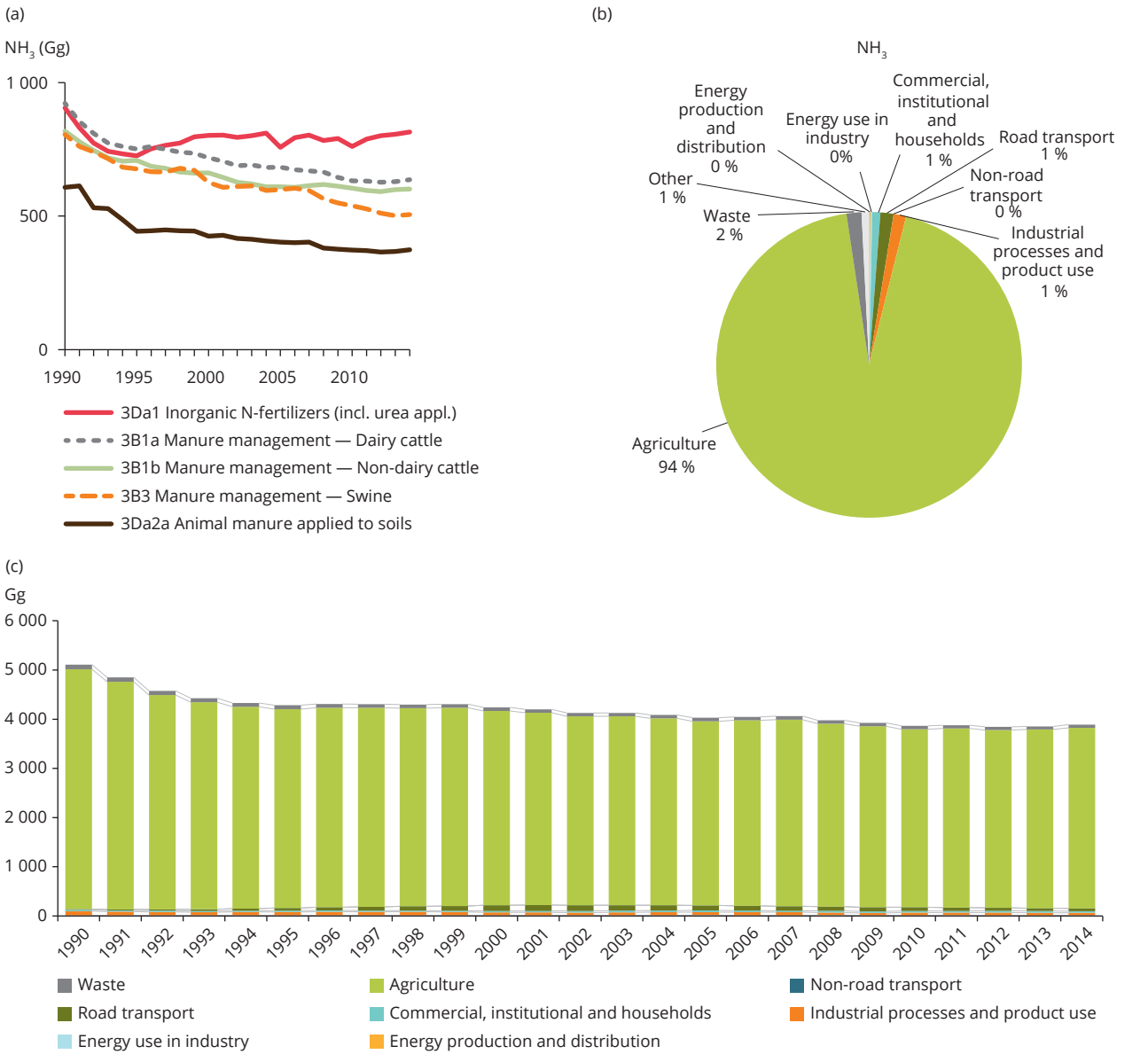
* Adjusted data: under the Gothenburg Protocol, the EMEP Steering Board accepted inventory adjustment applications for emissions from Denmark and Finland.

Spain's agricultural sector increased its use of N-synthetic fertilisers early in the period. As a result, NH_3 emissions increased notably, reaching a maximum in 2000. Afterwards there was a decrease of emissions due to reduced use of inorganic fertilisers. Potential causes were the economic downturn between 2008 and 2013 and the gradual introduction of abatement techniques in fertilisation. In 2013 and 2014, the consumption of inorganic fertilisers rose again. That generated the increase in NH_3 emissions observed at the end of the period (Appendix 5, Spain's IIR).

The principal key categories for NH_3 emissions are '3Da1— Inorganic N-fertilizers', '3B1a — Manure management — Dairy cattle' and '3B1b — Manure management — Non-dairy cattle'. They jointly make up 52 % of total NH_3 emissions (see Figure 3.8(a)). Among the top five key categories, the highest relative reduction in emissions between 1990 and 2014 was in the fifth most important, '3Da2a — Animal manure applied to soils' (− 38.4 %).

Figure 3.8(b) shows the contribution that each aggregated sector group made to total EU-28 emissions. A single sector group, agriculture, is responsible for most (94 %) of the NH_3 emissions in the EU-28. The fall in NH_3 emissions in the agricultural sector is due to the combined effect of reduced livestock numbers across Europe (especially cattle), changes in the handling and management of organic manures and the abated use of nitrogenous fertilisers (EEA, 2015a).

Figure 3.8 NH_3 emissions in the EU-28: (a) trend in emissions from the five most important key categories, 1990–2014; (b) share by sector group, 2014; (c) sectoral trends in emissions



3.7 Fine particulate matter emission trends and key categories

Between 2000 and 2014, $PM_{2.5}$ emissions dropped in the EU-28 by 25 %. Between 2013 and 2014, the decrease was 6.7 %, mainly because emissions decreased in France, Italy, Finland and Poland (see Table 3.8). The Member States that contributed most (i.e. more than 10 %) to $PM_{2.5}$ emissions in 2014 were France, Italy and Poland. Greece did not report $PM_{2.5}$ emissions for any year, so data were not gap-filled. The EU-28 total is therefore an underestimate.

In certain categories, several countries reported $PM_{2.5}$ values higher than the respective PM_{10} values.

Domestic fuel use in '1A4bi — Residential: Stationary' is the principal key category for $PM_{2.5}$ emissions, making up 50 % of the total (Figure 3.9(a)). Among the top five key categories, the highest relative reductions in emissions between 2000 and 2014 were in the fifth most important key category, '1A4cii — Agriculture/ Forestry/Fishing: Off-road vehicles and other machinery' (− 56 %). There were also high reductions in the third most important, '1A1a — Public electricity and heat production' (− 53.6 %), and the second most important, '1A3bi —Road transport: Passenger cars' (− 45 %). In contrast to the other two top key categories, the chief, '1A4bi — Residential: Stationary' (4.9 %), and the fourth most important, '1A3bvi — Road transport: Automobile tyre and brake wear' (13 %), increased since 2000.

Table 3.8 Member State contributions to EU emissions of $PM_{2.5}$

	$PM_{2.5}$ (Gg)							Change		Share in EU-28	
Member State	**2000**	**2005**	**2010**	**2011**	**2012**	**2013**	**2014**	**2000–2014**	**2013–2014**	**2000**	**2014**
Austria	24	22	19	18	18	18	17	– 30 %	– 8.1 %	1.5 %	1.4 %
Belgium	41	36	37	30	32	34	28	– 32 %	– 18.2 %	2.6 %	2.3 %
Bulgaria	23	28	29	31	31	30	28	22 %	– 3.6 %	1.4 %	2.3 %
Croatia	15	16	13	13	12	11	19	25 %	76.2 %	1.0 %	1.6 %
Cyprus	3.9	2.6	1.6	1.4	1.2	1.0	1.0	– 75 %	– 5.9 %	0.2 %	0.1 %
Czech Republic	37	35	29	26	26	26	23	– 39 %	– 10.4 %	2.3 %	1.9 %
Denmark	24	29	28	24	23	21	18	– 24 %	– 13.9 %	1.5 %	1.5 %
Estonia	15	14	14	18	8.1	11	7.8	– 49 %	– 27.4 %	0.9 %	0.6 %
Finland	39	35	37	34	35	34	24	– 38 %	– 28.3 %	2.4 %	2.0 %
France	320	255	216	188	189	190	169	– 47 %	– 11.2 %	19.8 %	13.9 %
Germany	158	131	120	116	110	111	104	– 34 %	– 5.9 %	9.8 %	8.6 %
Greece	n/a	n/a	n/a	n/a	n/a	n/a	n/a				
Hungary	36	27	29	30	29	28	26	– 28 %	– 6.7 %	2.2 %	2.1 %
Ireland	21	19	17	15	15	16	15	– 29 %	– 7.2 %	1.3 %	1.2 %
Italy	189	165	192	146	172	168	152	– 19 %	– 9.7 %	11.7 %	12.5 %
Latvia	22	22	18	18	19	18	18	– 19 %	– 0.7 %	1.4 %	1.5 %
Lithuania	18	19	20	19	19	18	17	– 2 %	– 5.4 %	1.1 %	1.4 %
Luxembourg	2.5	2.8	2.1	1.9	1.9	1.9	2.0	– 21 %	3.6 %	0.2 %	0.2 %
Malta	1.0	1.3	0.7	0.8	0.8	0.8	0.8	– 17 %	6.0 %	0.1 %	0.1 %
Netherlands	28	21	16	15	14	13	13	– 54 %	– 5.8 %	1.7 %	1.0 %
Poland	156	165	163	152	152	143	135	– 14 %	– 5.9 %	9.7 %	11.1 %
Portugal	62	57	47	48	47	45	44	– 28 %	– 1.9 %	3.8 %	3.7 %
Romania	88	115	129	117	122	116	116	32 %	0.2 %	5.4 %	9.5 %
Slovakia	23	39	29	31	31	32	30	34 %	– 3.8 %	1.4 %	2.5 %
Slovenia	13	13	14	14	14	14	12	– 5 %	– 12.3 %	0.8 %	1.0 %
Spain	101	98	79	77	74	70	68	– 33 %	– 2.2 %	6.3 %	5.6 %
Sweden	26	27	25	24	24	23	21	– 20 %	– 11.7 %	1.6 %	1.7 %
United Kingdom	130	108	106	97	103	108	105	– 19 %	– 3.1 %	8.0 %	8.7 %
EU-28 (a)	**1 616**	**1 504**	**1 431**	**1 306**	**1 323**	**1 301**	**1 214**	**– 25 %**	**– 6.7 %**	**100 %**	**100 %**
EU-28 (b)	1 616	1 504	1 431	1 306	1 323	1 301	1 214				

Notes: Dark-grey shaded cells indicate that no emission values are available (n/a, not available). See Appendix 1 for an explanation of the notation keys reported by Member States.

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

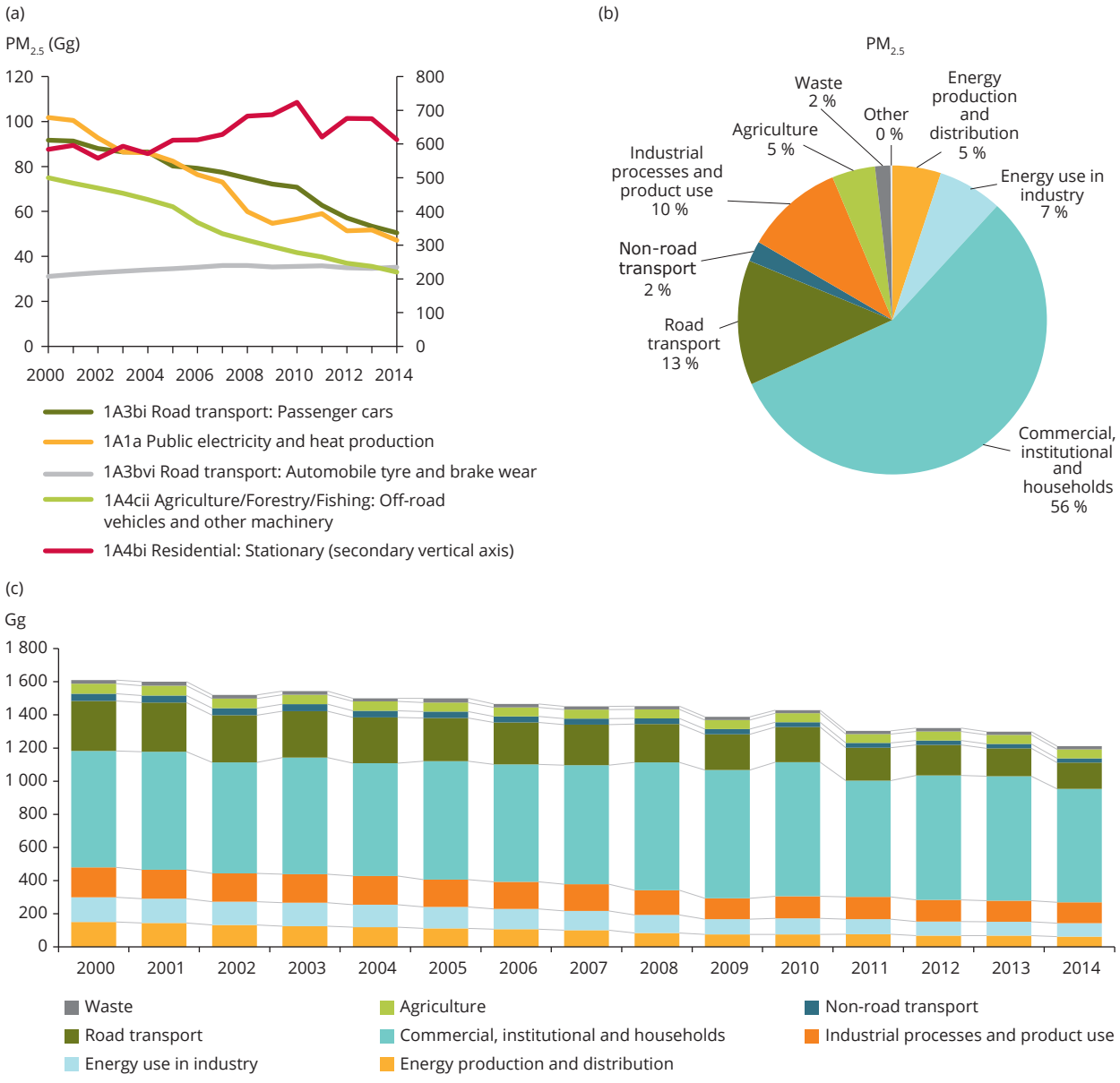
(a) Sum of national totals as reported by Member States.

(b) Sum of sectors.

The LRTAP formally requests Parties to report emissions of PM for 2000 and after.

Figure 3.9(b) shows the contribution to total EU-28 emissions that each aggregated sector group made. The 'commercial, institutional and households' sector group is a major source of $PM_{2.5}$, and also of PM_{10}, total PAHs, PCDD/Fs and PCBs.

Figure 3.9 $PM_{2.5}$ emissions in the EU-28: (a) trend in emissions from the five most important key categories, 1990–2014; (b) share by sector group, 2014; (c) sectoral trends in emissions



Notes: The LRTAP Convention formally requests Parties to report emissions of PM for 2000 and after.

3.8 PM_{10} emission trends and key categories

Between 2000 and 2014, PM_{10} emissions in the EU-28 dropped by 23 %. Between 2013 and 2014, the decrease was 4.9 %, mainly because emissions fell in France, Italy, Poland and Finland (see Table 3.9). The Member States that contributed most (i.e. more than 10 %) to PM_{10} emissions in 2014 were France, Poland and Germany. Greece did not report PM_{10} emissions for any year, so data were not gap-filled. The EU-28 total is therefore an underestimate.

Estonia stated that the decrease in its PM_{10} emissions from 2013 to 2014 was mainly because the facility Eesti Energia Narva Elektrijaamad AS produced less electricity (see Estonia's IIR, listed in Appendix 5).

Table 3.9 Member State contributions to EU emissions of PM_{10}

	PM_{10} (Gg)							Change		Share in EU-28	
Member State	**2000**	**2005**	**2010**	**2011**	**2012**	**2013**	**2014**	**2000–2014**	**2013–2014**	**2000**	**2014**
Austria	39	37	34	33	33	33	31	– 20 %	– 4.2 %	1.6 %	1.7 %
Belgium	56	49	47	40	41	44	38	– 33 %	– 14.7 %	2.3 %	2.0 %
Bulgaria	36	46	56	51	47	48	46	28 %	– 4.1 %	1.5 %	2.5 %
Croatia	22	25	20	20	19	17	26	18 %	51.0 %	0.9 %	1.4 %
Cyprus	6.3	4.7	3.3	2.9	2.4	2.0	1.9	– 70 %	– 4.2 %	0.3 %	0.1 %
Czech Republic	55	51	43	38	38	38	35	– 36 %	– 7.5 %	2.2 %	1.9 %
Denmark	39	44	43	37	36	34	31	– 20 %	– 9.3 %	1.6 %	1.7 %
Estonia	32	22	23	34	13	17	12	– 61 %	– 25.1 %	1.3 %	0.7 %
Finland	55	49	50	47	47	45	34	– 38 %	– 23.9 %	2.3 %	1.8 %
France	458	378	327	300	299	300	276	– 40 %	– 8.1 %	18.7 %	14.8 %
Germany	275	234	229	230	224	226	221	– 20 %	– 2.4 %	11.3 %	11.8 %
Greece	n/a	n/a	n/a	n/a	n/a	n/a	n/a				
Hungary	62	49	48	49	47	45	45	– 28 %	– 0.8 %	2.5 %	2.4 %
Ireland	31	30	27	25	25	26	24	– 21 %	– 4.5 %	1.3 %	1.3 %
Italy	223	196	220	173	199	194	177	– 21 %	– 8.6 %	9.1 %	9.5 %
Latvia	26	28	23	25	26	24	24	– 9 %	0.1 %	1.1 %	1.3 %
Lithuania	20	21	22	21	21	20	19	– 3 %	– 5.0 %	0.8 %	1.0 %
Luxembourg	3.1	3.6	2.8	2.7	2.6	2.6	2.6	– 16 %	0.3 %	0.1 %	0.1 %
Malta	1.4	2.2	1.3	1.4	1.4	1.3	1.3	– 6 %	3.1 %	0.1 %	0.1 %
Netherlands	42	35	30	29	28	27	26	– 38 %	– 2.6 %	1.7 %	1.4 %
Poland	276	293	285	259	259	246	232	– 16 %	– 5.6 %	11.3 %	12.4 %
Portugal	87	88	66	66	63	59	55	– 37 %	– 7.0 %	3.5 %	2.9 %
Romania	125	151	165	154	160	153	154	23 %	0.7 %	5.1 %	8.2 %
Slovakia	45	47	35	37	38	38	37	– 17 %	– 2.8 %	1.8 %	2.0 %
Slovenia	17	16	16	16	16	16	14	– 15 %	– 11.4 %	0.7 %	0.8 %
Spain	179	188	140	137	129	123	122	– 32 %	– 0.9 %	7.3 %	6.5 %
Sweden	40	41	40	38	37	37	34	– 14 %	– 8.4 %	1.6 %	1.8 %
United Kingdom	194	162	149	138	145	151	148	– 23 %	– 1.9 %	7.9 %	7.9 %
EU-28 ([a])	**2 444**	**2 291**	**2 145**	**2 005**	**1 997**	**1 968**	**1 870**	**– 23 %**	**– 5.0 %**	**100 %**	**100 %**
EU-28 ([b])	2 443	2 290	2 144	2 005	1 997	1 968	1 870				

Notes: Dark-grey shaded cells indicate that no emission values are available (n/a, not available). See Appendix 1 for an explanation of the notation keys reported by Member States.

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

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

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

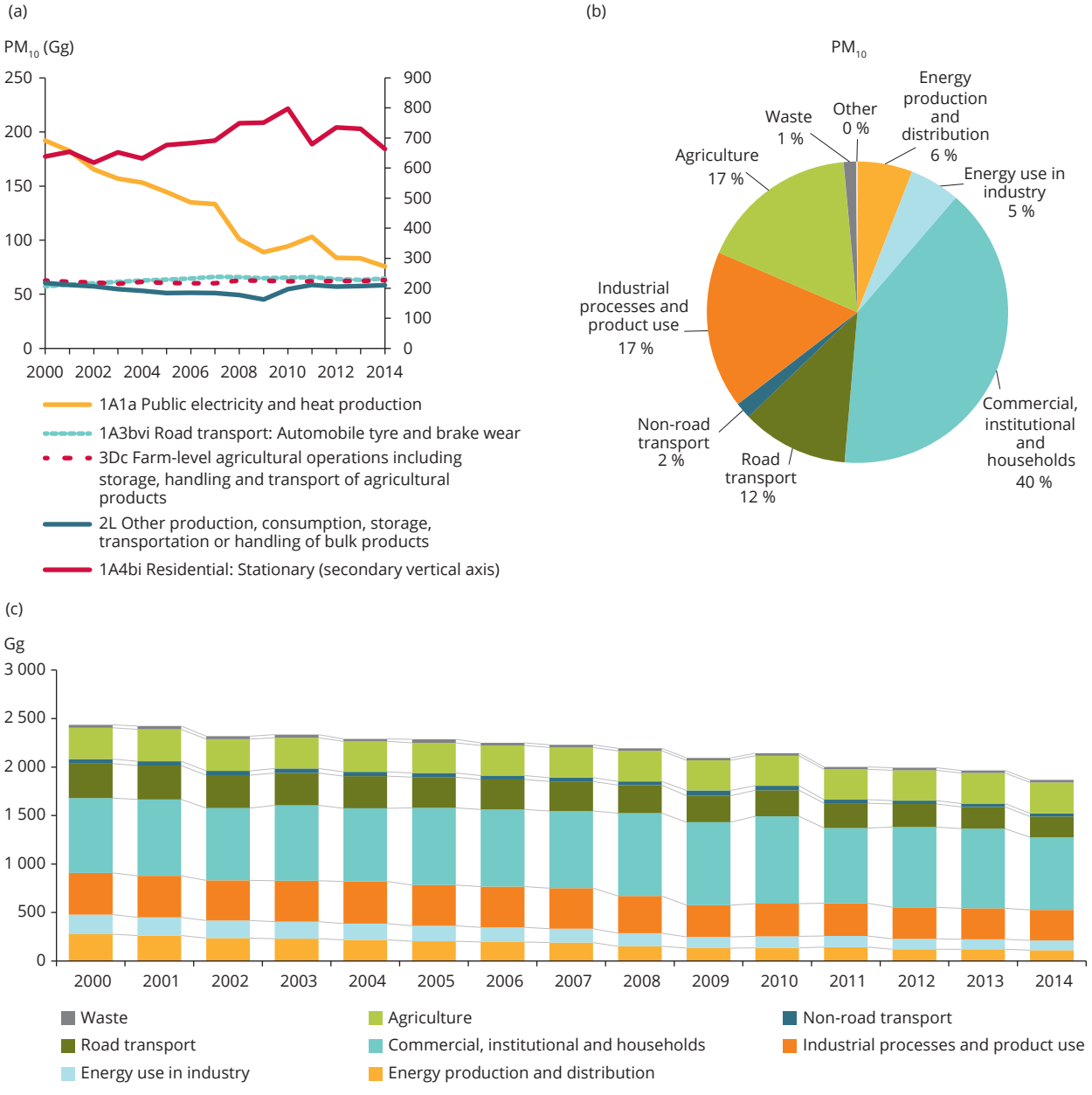
The LRTAP Convention formally requests Parties to report emissions of PM for 2000 and after.

In certain categories, several countries reported PM_{10} values higher than the respective TSP values.

As it is for $PM_{2.5}$, '1A4bi — Residential: Stationary' is the most significant key category for PM_{10} emissions, accounting for 35 % of total PM_{10} emissions (see Figure 3.10(a)). Among the top five key categories, the highest relative reductions in emissions between 1990 and 2014 were in the second most important, '1A1a — Public electricity and heat production' (− 60.6 %) (Figure 3.10(a)), and the fifth most important, '2L — Other production, consumption, storage, transport or handling of bulk products' (− 3.6 %). Emissions from the other top five key categories increased.

Figure 3.10(b) shows the contribution to total EU-28 emissions that each aggregated sector group made. The 'commercial, institutional and households' sector group is a very significant source of PM_{10}, and likewise of $PM_{2.5}$, total PAHs, PCDD/Fs and PCBs.

Figure 3.10 PM_{10} emissions in the EU-28: (a) trend in emissions from the five most important key categories, 1990–2014; (b) share by sector group, 2014; (c) sectoral trends in emissions



Notes: The LRTAP Convention formally requests Parties to report emissions of PM for 2000 and after.

3.9 Total suspended particulate emission trends

Between 1990 and 2014, TSP emissions in the EU-28 dropped by 56 %. Between 2013 and 2014, emissions decreased by 3.8 %, mainly because France, Portugal, Italy and Poland reduced emissions (Table 3.10). The Member States that contributed most (i.e. more than 10 %) to TSP emissions in 2014 were France, Poland and Germany. Greece did not report TSP emissions for any year, so data were not gap-filled. The EU-28 total is therefore an underestimate.

Germany explained that between 1990 and 2014 the total TSP emissions dropped by over 82 %. This was for three reasons: after reunification, the stricter regulations of the former Federal Republic of Germany extended to the former Democratic Republic of Germany; it changed over from solid to gaseous and liquid fuel; and filter technologies for combustion plants and industrial processes improved (Appendix 5, Germany's IIR).

Table 3.10 Member State contributions to EU emissions of TSPs

	TSPs (Gg)									Change		Share in EU-28	
Member State	**1990**	**1995**	**2000**	**2005**	**2010**	**2011**	**2012**	**2013**	**2014**	**1990–2014**	**2013–2014**	**1990**	**2014**
Austria	62	62	63	61	57	57	56	56	55	– 11 %	– 2.0 %	0.8 %	1.7 %
Belgium	92	85	79	69	60	52	55	58	50	– 46 %	– 13.2 %	1.2 %	1.5 %
Bulgaria	83	113	83	129	99	112	98	93	96	15 %	2.7 %	1.1 %	2.9 %
Croatia	39	26	31	42	34	34	32	27	38	– 3 %	38.1 %	0.5 %	1.1 %
Cyprus	18	14	11	7.0	5.0	4.5	3.6	2.8	2.7	– 85 %	– 4.4 %	0.2 %	0.1 %
Czech Republic	640	202	70	64	53	48	47	47	44	– 93 %	– 6.5 %	8.3 %	1.3 %
Denmark	133	120	106	104	104	99	96	93	91	– 31 %	– 2.3 %	1.7 %	2.7 %
Estonia	274	127	69	32	28	40	17	20	17	– 94 %	– 16.5 %	3.6 %	0.5 %
Finland	38	35	77	74	74	71	71	68	52	37 %	– 23.4 %	0.5 %	1.6 %
France	1 254	1 169	1 104	1 000	906	884	882	883	845	– 33 %	– 4.3 %	16.4 %	25.3 %
Germany	1 926	454	410	351	344	351	342	346	342	– 82 %	– 1.3 %	25.1 %	10.2 %
Greece	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a				
Hungary	194	185	176	176	170	168	168	165	167	– 14 %	1.0 %	2.5 %	5.0 %
Ireland	50	41	37	35	32	30	30	31	29	– 41 %	– 4.0 %	0.6 %	0.9 %
Italy	321	314	269	242	271	216	246	240	221	– 31 %	– 8.1 %	4.2 %	6.6 %
Latvia	27	30	33	41	33	40	42	37	37	38 %	1.3 %	0.3 %	1.1 %
Lithuania	28	21	22	23	23	23	23	22	21	– 28 %	– 5.3 %	0.4 %	0.6 %
Luxembourg	17	8.9	3.5	4.1	3.4	3.2	3.2	3.2	3.2	– 81 %	– 1.2 %	0.2 %	0.1 %
Malta	2.8	3.8	4.6	6.0	1.4	1.6	1.5	1.4	0.9	– 66 %	– 32.9 %	0.0 %	0.0 %
Netherlands	97	73	51	43	37	36	36	35	34	– 64 %	– 2.3 %	1.3 %	1.0 %
Poland	993	739	444	469	462	432	426	403	383	– 61 %	– 4.8 %	12.9 %	11.4 %
Portugal	126	180	206	245	162	154	140	121	101	– 20 %	– 16.9 %	1.6 %	3.0 %
Romania	271	269	278	293	291	286	279	260	262	– 3 %	0.7 %	3.5 %	7.8 %
Slovakia	290	106	57	66	49	47	46	47	46	– 84 %	– 1.8 %	3.8 %	1.4 %
Slovenia	22	20	19	18	17	17	16	16	14	– 35 %	– 11.9 %	0.3 %	0.4 %
Spain	208	223	247	262	188	182	170	161	159	– 23 %	– 1.1 %	2.7 %	4.8 %
Sweden	64	59	49	52	49	48	46	47	43	– 33 %	– 7.5 %	0.8 %	1.3 %
United Kingdom	400	312	255	214	191	178	187	194	191	– 52 %	– 1.3 %	5.2 %	5.7 %
EU-28 ([a])	**7 669**	**4 992**	**4 254**	**4 123**	**3 743**	**3 614**	**3 559**	**3 478**	**3 346**	**– 56 %**	**– 3.8 %**	**100 %**	**100 %**
EU-28 ([b])	7 669	4 992	4 253	4 122	3 743	3 614	3 559	3 479	3 346				

Notes: Dark-grey shaded cells indicate that no emission values are available (n/a, not available). See Appendix 1 for an explanation of the notation keys reported by Member States.

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

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

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

3.10 Black carbon emission trends

Between 1990 and 2014, BC emissions in the EU-28 dropped by 42 %. Between 2013 and 2014, emissions decreased by 6.1 %, mainly because emissions reduced in France, Italy, the United Kingdom and Finland (Table 3.11). The Member States that contributed most (i.e. more than 10 %) to BC emissions in 2014 were France, Italy and the United Kingdom. Several Member States did not provide data for BC, and some of these gaps could not be filled with data. The EU-28 total is therefore an underestimate.

In certain categories, several countries reported BC values higher than the respective $PM_{2.5}$ values.

Table 3.11 Member State contributions to EU emissions of BC

	Black Carbon (Gg)									Change		Share in EU-28	
Member State	**1990**	**1995**	**2000**	**2005**	**2010**	**2011**	**2012**	**2013**	**2014**	**1990–2014**	**2013–2014**	**1990**	**2014**
Austria	NR	NR	NR	NR	NR	NR	NR	NR	NR				
Belgium	11	9.9	8.8	7.8	7.0	5.8	5.6	5.5	4.6	– 58 %	– 16.3 %	4.5 %	3.2 %
Bulgaria	0.7	0.3	0.9	1.6	1.3	1.3	1.4	1.1	1.2	85 %	7.8 %	0.3 %	0.9 %
Croatia	3.7	2.5	2.9	3.1	2.6	2.5	2.4	2.1	3.2	– 15 %	50.1 %	1.5 %	2.2 %
Cyprus	0.2	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.1	– 37 %	7.1 %	0.1 %	0.1 %
Czech Republic	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.3	> 100 %	> 100 %	0.0 %	2.3 %
Denmark	5.3	5.3	5.9	6.1	5.6	5.3	4.7	4.5	4.0	– 25 %	– 12.0 %	2.2 %	2.8 %
Estonia	4.6	3.8	3.4	3.4	3.1	3.5	2.1	2.5	1.9	– 58 %	– 22.5 %	1.9 %	1.4 %
Finland	6.4	5.4	7.2	6.6	6.3	5.3	6.3	5.8	4.7	– 26 %	– 18.4 %	2.6 %	3.3 %
France	73	78	67	57	49	44	41	40	34	– 53 %	– 13.4 %	29.6 %	24.0 %
Germany	NR	NR	NR	NR	NR	NR	NR	NR	NR				
Greece	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a				
Hungary	5.1	5.0	5.1	4.8	4.9	5.0	4.8	4.5	4.2	– 17 %	– 7.0 %	2.1 %	2.9 %
Ireland	3.9	3.6	3.9	3.6	2.8	2.6	2.4	2.4	2.2	– 44 %	– 7.2 %	1.6 %	1.5 %
Italy	48	48	44	38	34	29	28	27	25	– 49 %	– 7.7 %	19.7 %	17.2 %
Latvia	2.0	2.4	2.9	3.5	3.0	3.0	3.2	2.9	2.9	47 %	– 1.3 %	0.8 %	2.0 %
Lithuania	1.9	1.7	1.9	2.1	2.1	2.0	2.1	2.0	1.9	– 1 %	– 5.1 %	0.8 %	1.3 %
Luxembourg	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a				
Malta	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.1	> 100 %	> 100 %	0.0 %	0.1 %
Netherlands	17	13	10	8.0	5.4	5.1	4.5	4.0	3.5	– 79 %	– 13.0 %	6.8 %	2.5 %
Poland	NE	NE	NE	NE	NE	NE	NE	NE	NE				
Portugal	6.7	7.1	8.5	7.2	5.9	5.8	5.3	5.1	5.0	– 25 %	– 0.6 %	2.7 %	3.5 %
Romania	3.3	4.9	7.0	9.9	12	11	12	10	10	> 100 %	0.0 %	1.3 %	7.3 %
Slovakia	0.5	0.6	0.8	1.2	1.0	0.9	0.9	0.9	0.9	74 %	3.0 %	0.2 %	0.6 %
Slovenia	1.9	1.9	2.1	2.5	2.7	2.6	2.6	2.6	2.3	22 %	– 13.0 %	0.8 %	1.6 %
Spain	7.0	7.2	7.6	7.6	6.5	6.3	6.0	5.5	5.2	– 25 %	– 5.3 %	2.8 %	3.6 %
Sweden	5.4	4.9	4.7	4.6	4.3	4.2	3.9	3.9	3.6	– 33 %	– 6.7 %	2.2 %	2.5 %
United Kingdom	38	40	36	31	25	22	21	20	19	– 51 %	– 6.5 %	15.6 %	13.2 %
EU-28 ([a])	**245**	**246**	**232**	**210**	**184**	**166**	**161**	**152**	**143**	**– 42 %**	**– 6.1 %**	**100 %**	**100 %**
EU-28 ([b])	245	246	232	210	184	166	161	152	143				

Notes: Dark-grey shaded cells indicate that no emission values are available (n/a, not available). See Appendix 1 for an explanation of the notation keys reported by Member States.

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

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

([b]) Sum of sectors.

3.11 Carbon monoxide emission trends and key categories

Between 1990 and 2014, CO emissions dropped in the EU-28 by 65 %. Between 2013 and 2014, the decrease was -4.8 %, and was mainly because emissions decreased in Italy, France, Belgium and Poland (Table 3.12). The Member States that contributed most (i.e. more than 10 %) to CO emissions in 2014 were France, Germany, Poland and Italy.

Belgium explained that the peak of CO emissions in 2013 was because its plants produced lime without oxygen supply (reducing atmosphere) (see Belgium's IIR, listed in Appendix 5).

Table 3.12 Member State contributions to EU emissions of CO

	CO (Gg)									Change		Share in EU-28	
Member State	**1990**	**1995**	**2000**	**2005**	**2010**	**2011**	**2012**	**2013**	**2014**	**1990–2014**	**2013–2014**	**1990**	**2014**
Austria	1 286	987	785	685	580	563	563	582	537	– 58 %	– 7.7 %	2.1 %	2.5 %
Belgium	1 414	1 128	941	765	526	422	373	555	353	– 75 %	– 36.3 %	2.3 %	1.6 %
Bulgaria	781	637	456	408	325	327	321	298	291	– 63 %	– 2.2 %	1.3 %	1.4 %
Croatia	464	313	346	267	178	167	157	136	203	– 56 %	49.1 %	0.8 %	0.9 %
Cyprus	53	46	35	26	18	17	16	15	14	– 73 %	– 2.9 %	0.1 %	0.1 %
Czech Republic	1 028	892	700	656	569	517	516	524	462	– 55 %	– 11.8 %	1.7 %	2.2 %
Denmark	747	667	492	465	408	371	355	339	312	– 58 %	– 8.1 %	1.2 %	1.5 %
Estonia	215	212	195	153	155	130	140	134	127	– 41 %	– 5.3 %	0.3 %	0.6 %
Finland	723	607	570	477	412	384	382	368	339	– 53 %	– 8.1 %	1.2 %	1.6 %
France	10 399	8 905	6 532	5 319	4 326	3 636	3 234	3 292	3 090	– 70 %	– 6.1 %	16.9 %	14.4 %
Germany	12 581	6 441	4 795	3 722	3 533	3 452	3 095	3 121	2 964	– 76 %	– 5.0 %	20.5 %	13.8 %
Greece	1 132	953	921	720	525	492	450	414	463	– 59 %	11.8 %	1.8 %	2.2 %
Hungary	1 399	897	475	414	322	352	344	319	289	– 79 %	– 9.1 %	2.3 %	1.4 %
Ireland	350	291	247	217	147	135	129	123	115	– 67 %	– 7.0 %	0.6 %	0.5 %
Italy	7 430	7 398	5 002	3 574	3 162	2 524	2 729	2 566	2 340	– 69 %	– 8.8 %	12.1 %	10.9 %
Latvia	388	294	236	203	147	151	156	141	135	– 65 %	– 4.1 %	0.6 %	0.6 %
Lithuania	450	282	196	199	183	165	167	147	144	– 68 %	– 1.6 %	0.7 %	0.7 %
Luxembourg	468	226	56	46	33	30	31	31	31	– 93 %	– 0.3 %	0.8 %	0.1 %
Malta	0.8	1.0	0.7	0.7	11	12	12	12	5.1	> 100%	– 58.3 %	0.0 %	0.0 %
Netherlands	1 144	920	752	724	681	659	627	597	571	– 50 %	– 4.4 %	1.9 %	2.7 %
Poland	2 497	3 478	2 646	2 738	3 119	2 945	2 972	2 868	2 704	8 %	– 5.7 %	4.1 %	12.6 %
Portugal	803	807	673	472	355	332	303	293	263	– 67 %	– 10.1 %	1.3 %	1.2 %
Romania	2 397	2 345	3 655	957	875	801	824	771	774	– 68 %	0.4 %	3.9 %	3.6 %
Slovakia	515	423	277	272	221	227	222	218	225	– 56 %	3.2 %	0.8 %	1.0 %
Slovenia	324	285	190	154	135	132	129	127	108	– 67 %	– 14.9 %	0.5 %	0.5 %
Spain	3 663	3 166	2 706	2 144	2 004	1 992	1 757	2 001	2 011	– 45 %	0.5 %	6.0 %	9.4 %
Sweden	1 107	982	723	612	560	543	520	516	497	– 55 %	– 3.5 %	1.8 %	2.3 %
United Kingdom	7 754	6 315	4 673	3 136	2 159	1 994	1 981	2 019	2 072	– 73 %	2.6 %	12.6 %	9.7 %
EU-28 (a)	**61 513**	**49 897**	**39 273**	**29 525**	**25 667**	**23 474**	**22 504**	**22 527**	**21 441**	**– 65 %**	**– 4.8 %**	**100 %**	**100 %**
EU-28 (b)	61 460	49 851	39 238	29 499	25 649	23 457	22 488	22 513	21 441				

Notes: Grey shaded cells denote gap-filled data. For more detailed information, see Annex D.

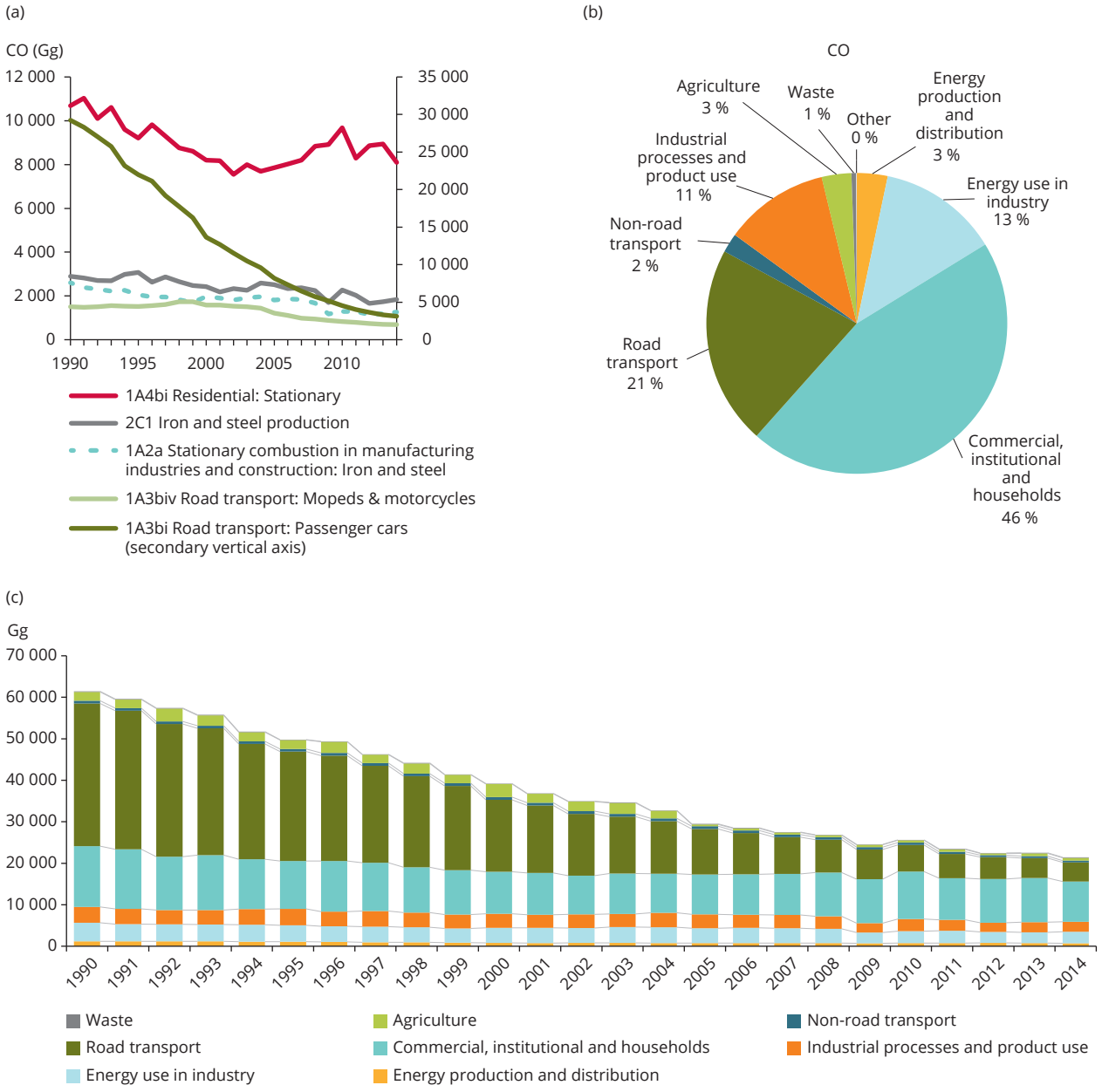
(a) Sum of national totals as reported by Member States.

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

'1A4bi — Residential: Stationary' and '1A3bi — Road transport: Passenger cars' were the most important key categories for CO emissions, jointly accounting for 52 % of the total. Among the top five key categories, the highest relative reduction in emissions between 1990 and 2014 was in the second most important key category, '1A3bi — Road transport: Passenger cars' (− 89.2 %) (see Figure 3.11(a)).

Figure 3.11(b) shows the contribution to total EU-28 emissions that each aggregated sector group made. For CO, common major emission sources are 'commercial, institutional and households' and 'road transport'.

Figure 3.11 CO emissions in the EU-28: (a) trend in emissions from the five most important key categories, 1990–2014; (b) share by sector group, 2014; (c) sectoral trends in emissions



3.12 Lead emission trends and key categories

Between 1990 and 2014, Pb emissions dropped in the EU-28 by 92 %. Between 2013 and 2014, emissions increased by 8 %, mainly because emissions increased in Bulgaria (see Table 3.13). The Member States that contributed most (i.e. more than 10 %) to Pb emissions in 2014 were Poland, Italy Germany, Spain and Bulgaria. Data for Greece could not be gap-filled for 2010 to 2014, so the EU-28 total is underestimated for those years.

Latvia's Pb emissions have decreased by 96 %. The most significant decrease in emissions occurred in 1999, when changes in international legislation prohibited use of liquid fuels with high Pb content (see Latvia's IIR, listed in Appendix 5).

Portugal stated that the Pb emissions registered from 1990 to 2014 show a downward trend, falling by 94 %. This is mainly a result of the reduction in emissions from road transport, due to the phasing out of leaded petrol within the EU (see Portugal's IIR, listed in Appendix 5).

'1A2b — Stationary combustion in manufacturing industries and construction: Non-ferrous metals', '2C1 — Iron and steel production', '1A3bvi — Road transport: Automobile tyre and brake wear' and '1A2f — Stationary combustion in manufacturing industries and construction: Non-metallic minerals' were the leading

Table 3.13 Member State contributions to EU emissions of Pb

	Pb (Mg)									Change		Share in EU-28	
Member State	**1990**	**1995**	**2000**	**2005**	**2010**	**2011**	**2012**	**2013**	**2014**	**1990–2014**	**2013–2014**	**1990**	**2014**
Austria	215	16	12	13	15	15	15	16	15	– 93 %	– 4.3 %	0.9 %	0.8 %
Belgium	253	186	107	74	40	29	29	26	23	– 91 %	– 8.8 %	1.1 %	1.2 %
Bulgaria	321	323	256	126	70	75	75	76	198	– 38 %	> 100 %	1.4 %	10.3 %
Croatia	538	328	276	52	7.0	6.9	6.4	6.5	7.0	– 99 %	7.3 %	2.3 %	0.4 %
Cyprus	35	41	43	29	31	30	27	24	24	– 31 %	0.1 %	0.2 %	1.3 %
Czech Republic	269	180	328	57	20	17	20	18	23	– 91 %	29.0 %	1.2 %	1.2 %
Denmark	128	26	19	17	12	12	11	11	11	– 91 %	0.2 %	0.6 %	0.6 %
Estonia	206	86	37	36	39	38	34	39	37	– 82 %	– 7.4 %	0.9 %	1.9 %
Finland	338	67	45	22	23	22	19	18	14	– 96 %	– 20.3 %	1.5 %	0.8 %
France	4 296	1 477	282	173	135	130	124	122	117	– 97 %	– 4.1 %	18.7 %	6.1 %
Germany	2 070	702	393	277	220	220	212	208	213	– 90 %	2.6 %	9.0 %	11.1 %
Greece	470	470	470	470	n/a	n/a	n/a	n/a	n/a			2.0 %	
Hungary	644	195	22	9.2	7.3	7.9	7.6	6.9	6.8	– 99 %	– 1.2 %	2.8 %	0.4 %
Ireland	124	78	19	18	16	15	14	14	13	– 89 %	– 4.9 %	0.5 %	0.7 %
Italy	4 418	2 032	948	284	266	263	265	256	260	– 94 %	1.6 %	19.3 %	13.5 %
Latvia	97	61	6.4	4.3	3.8	3.5	3.3	3.2	3.3	– 97 %	1.5 %	0.4 %	0.2 %
Lithuania	150	91	6.9	4.2	4.5	4.6	4.1	3.9	3.8	– 97 %	– 4.0 %	0.7 %	0.2 %
Luxembourg	19	9.1	1.4	1.5	1.3	1.8	1.8	1.3	1.5	– 92 %	13.5 %	0.1 %	0.1 %
Malta	0.4	0.5	0.7	0.8	3.4	5.8	13	8.6	4.3	> 100 %	– 49.8 %	0.0 %	0.2 %
Netherlands	334	156	29	31	39	24	17	15	10	– 97 %	– 32.1 %	1.5 %	0.5 %
Poland	605	605	485	498	545	517	531	514	517	– 15 %	0.6 %	2.6 %	26.9 %
Portugal	548	753	37	36	33	33	34	33	34	– 94 %	0.8 %	2.4 %	1.8 %
Romania	151	125	102	72	42	42	39	36	37	– 76 %	2.3 %	0.7 %	1.9 %
Slovakia	99	79	89	61	50	51	51	46	57	– 43 %	22.3 %	0.4 %	2.9 %
Slovenia	600	388	130	129	9.7	9.5	8.6	8.4	7.8	– 99 %	– 6.2 %	2.6 %	0.4 %
Spain	2 764	955	596	228	205	203	210	197	209	– 92 %	6.4 %	12.0 %	10.9 %
Sweden	359	38	27	15	13	12	11	11	11	– 97 %	4.0 %	1.6 %	0.6 %
United Kingdom	2 891	1 533	152	108	62	61	65	62	66	– 98 %	6.5 %	12.6 %	3.4 %
EU-28 (a)	**22 942**	**11 001**	**4 919**	**2 846**	**1 912**	**1 851**	**1 848**	**1 782**	**1 925**	**– 92 %**	**8.1 %**	**100 %**	**100 %**
EU-28 (b)	22 472	10 532	4 450	2 376	1 913	1 851	1 849	1 782	1 925				

Notes: Dark-grey shaded cells indicate that no emission values are available (n/a, not available). See Appendix 1 for an explanation of the notation keys reported by Member States.

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

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

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

key categories for Pb emissions, together making up 60 % of total Pb emissions (see Figure 3.12(a)).

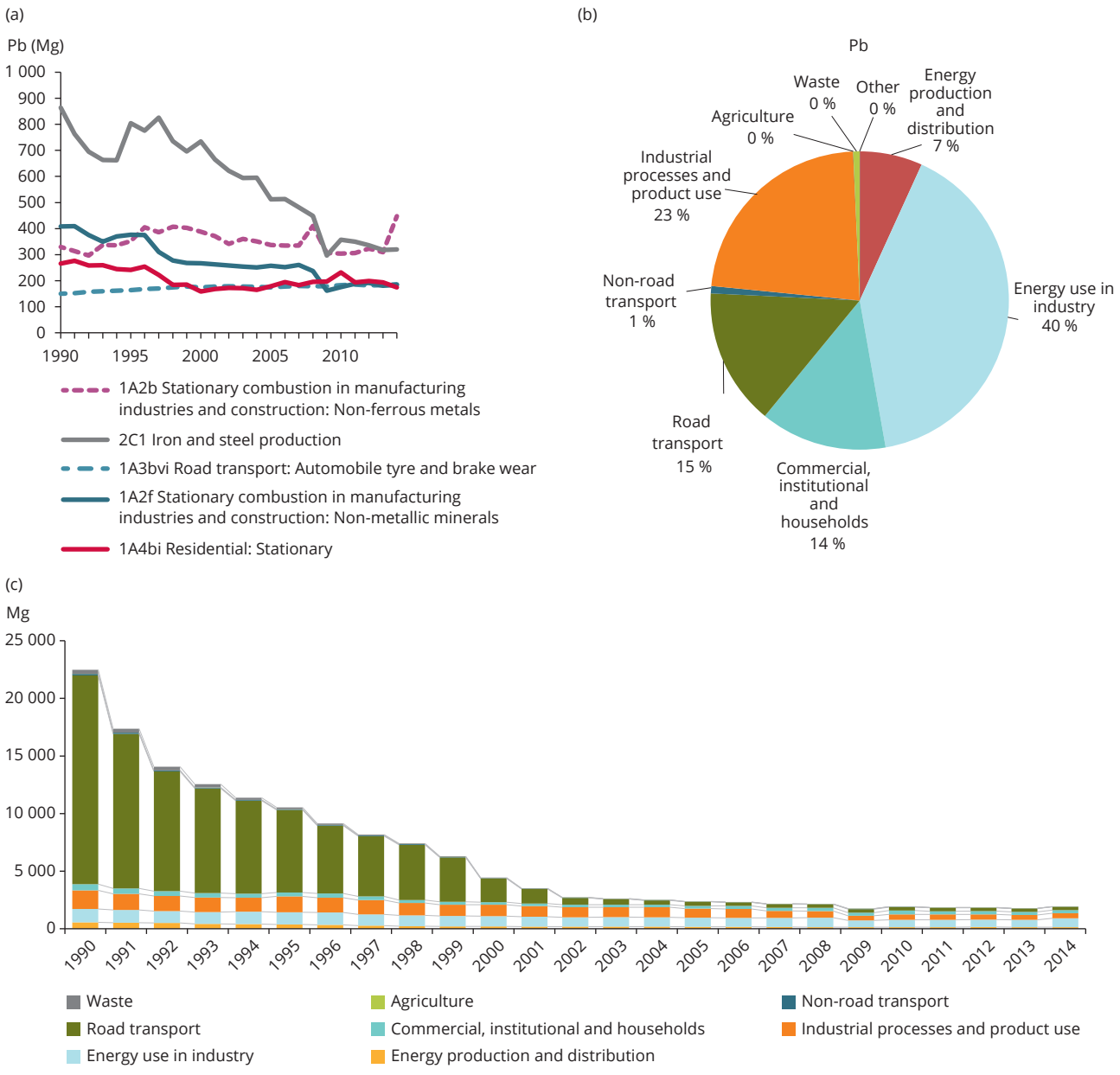
The largest relative reductions in emissions between 1990 and 2014 were from the second most important key category, '2C1 — Iron and steel production' (− 63 %), and the fourth most important key category, '1A2f — Stationary combustion in manufacturing industry' (− 54.8 %). The fourth most important key category, '1A3bvi — Road transport: Automobile tyre and brake wear', has increased by 24.5 % since 1990.

The high increase in Pb emissions from the category '2C1 — Iron and steel production' between 1994 and 1995 is mainly because of data from Germany.

Emissions of Pb from the category '1A2b — Stationary combustion in manufacturing industries and construction: Non-ferrous metals' peaked in 2008. That was mainly because Bulgaria reported high emissions for that year.

Emissions of Pb have declined to a tenth of the total in 1990. This is primarily because countries reduced

Figure 3.12 Pb emissions in the EU-28: (a) trend in emissions from the five most important key categories, 1990–2014; (b) share by sector group, 2014; (c) sectoral trends in emissions



emissions from the 'road transport' sector. The promotion of unleaded petrol within the EU through a combination of fiscal and regulatory measures has been a notable success story. EU Member States and other EEA member countries have now phased out the use of leaded petrol. In the EU, the Directive on the Quality of Petrol and Diesel Fuels (98/70/EC) regulated that goal (EEA, 2015c).

Figure 3.12(b) shows the contribution that each aggregated sector group made to total EU-28 emissions. For Pb, common major emission sources are the sectors 'energy use in industry', 'industrial processes and product use', 'road transport' and 'commercial, institutional and households'.

3.13 Cadmium emission trends and key categories

Between 1990 and 2014, Cd emissions decreased by 66 % in the EU-28. Between 2013 and 2014, they increased by 1.6 % (Table 3.14), mainly because emissions increased in Bulgaria, the United Kingdom, Croatia and Poland. The Member States that contributed most (i.e. more than 10 %) to Cd emissions in 2014 were Poland, Spain, Italy and Germany. Greece did not submit an inventory in 2016. Greece reported an emission value only once (for 1996), which has been used to gap-fill the years up to 2005. Data for 2010 to 2014 could not be gap-filled, so the EU-28 total is underestimated for those years.

Table 3.14 Member State contributions to EU emissions of Cd

	Cd (Mg)									Change		Share in EU-28	
Member State	**1990**	**1995**	**2000**	**2005**	**2010**	**2011**	**2012**	**2013**	**2014**	**1990–2014**	**2013–2014**	**1990**	**2014**
Austria	1.6	1.0	0.9	1.1	1.2	1.2	1.2	1.2	1.1	– 28 %	– 5.3 %	0.9 %	1.8 %
Belgium	6.1	5.0	2.8	2.2	2.4	2.2	2.0	2.1	2.0	– 68 %	– 7.8 %	3.3 %	3.1 %
Bulgaria	5.2	3.7	3.5	2.9	1.1	1.2	1.1	1.2	2.1	– 60 %	77.7 %	2.8 %	3.3 %
Croatia	0.9	0.4	0.5	0.6	0.5	0.5	0.5	0.5	0.8	– 8 %	69.0 %	0.5 %	1.3 %
Cyprus	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	– 40 %	2.9 %	0.0 %	0.1 %
Czech Republic	4.3	3.6	2.7	2.9	0.8	0.8	0.8	0.7	0.7	– 83 %	1.5 %	2.3 %	1.2 %
Denmark	1.1	0.6	0.6	0.6	0.7	0.6	0.6	0.6	0.6	– 48 %	– 4.7 %	0.6 %	0.9 %
Estonia	4.5	2.2	0.8	0.8	0.9	0.9	0.8	1.0	0.9	– 80 %	– 7.0 %	2.4 %	1.4 %
Finland	6.3	1.7	1.3	1.3	1.4	1.3	1.3	1.2	0.8	– 87 %	– 32.3 %	3.4 %	1.3 %
France	21	18	14	5.7	3.1	2.9	2.7	2.8	2.9	– 86 %	4.6 %	11.1 %	4.6 %
Germany	20	14	12	9.1	7.1	7.1	6.8	6.9	6.5	– 67 %	– 5.3 %	10.7 %	10.4 %
Greece	3.0	3.0	3.0	3.0	n/a	n/a	n/a	n/a	n/a			1.6 %	
Hungary	3.7	2.9	1.4	0.9	1.1	1.1	1.0	1.0	0.9	– 75 %	– 6.0 %	2.0 %	1.5 %
Ireland	0.5	0.5	0.6	0.4	0.3	0.3	0.3	0.3	0.3	– 39 %	8.6 %	0.3 %	0.5 %
Italy	10	9.5	8.9	8.2	7.0	6.8	6.9	6.5	6.5	– 36 %	0.2 %	5.5 %	10.4 %
Latvia	0.5	0.6	0.5	0.6	0.6	0.6	0.6	0.6	0.6	26 %	2.4 %	0.3 %	1.0 %
Lithuania	0.8	0.5	0.5	0.6	0.5	0.5	0.5	0.5	0.5	– 41 %	– 6.6 %	0.4 %	0.8 %
Luxembourg	0.1	0.1	0.0	0.1	0.1	0.1	0.1	0.0	0.1	– 36 %	8.9 %	0.0 %	0.1 %
Malta	0.2	0.4	0.5	0.6	0.1	0.0	0.0	0.0	0.0	– 96 %	– 50.5 %	0.1 %	0.0 %
Netherlands	2.1	1.1	1.0	1.8	2.6	1.2	0.9	0.7	0.6	– 70 %	– 9.4 %	1.2 %	1.0 %
Poland	22	27	19	15	15	15	15	14	14	– 38 %	1.8 %	12.0 %	22.2 %
Portugal	6.3	6.5	6.2	6.8	4.3	3.0	2.7	4.3	4.3	– 31 %	1.4 %	3.4 %	6.9 %
Romania	3.8	3.8	3.8	3.8	3.3	3.2	3.2	2.9	2.9	– 24 %	1.1 %	2.1 %	4.7 %
Slovakia	9.7	10	9.1	5.8	1.0	0.8	0.9	0.9	1.1	– 89 %	18.0 %	5.2 %	1.8 %
Slovenia	1.4	0.9	0.7	0.8	0.5	0.5	0.5	0.5	0.5	– 65 %	– 14.6 %	0.7 %	0.8 %
Spain	25	23	19	15	9.9	9.3	9.0	8.0	8.1	– 68 %	1.8 %	13.6 %	13.0 %
Sweden	2.3	0.8	0.6	0.6	0.6	0.6	0.6	0.6	0.6	– 75 %	1.8 %	1.3 %	0.9 %
United Kingdom	23	11	6.1	3.9	2.9	3.1	2.7	2.8	3.1	– 86 %	8.9 %	12.3 %	5.0 %
EU-28 (a)	**186**	**152**	**120**	**96**	**69**	**65**	**63**	**61**	**62**	**– 66 %**	**1.6 %**	**100 %**	**100 %**
EU-28 (b)	183	149	117	93	69	65	63	61	62				

Notes: Dark-grey shaded cells indicate that no emission values are available (n/a, not available). See Appendix 1 for an explanation of the notation keys reported by Member States.

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

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

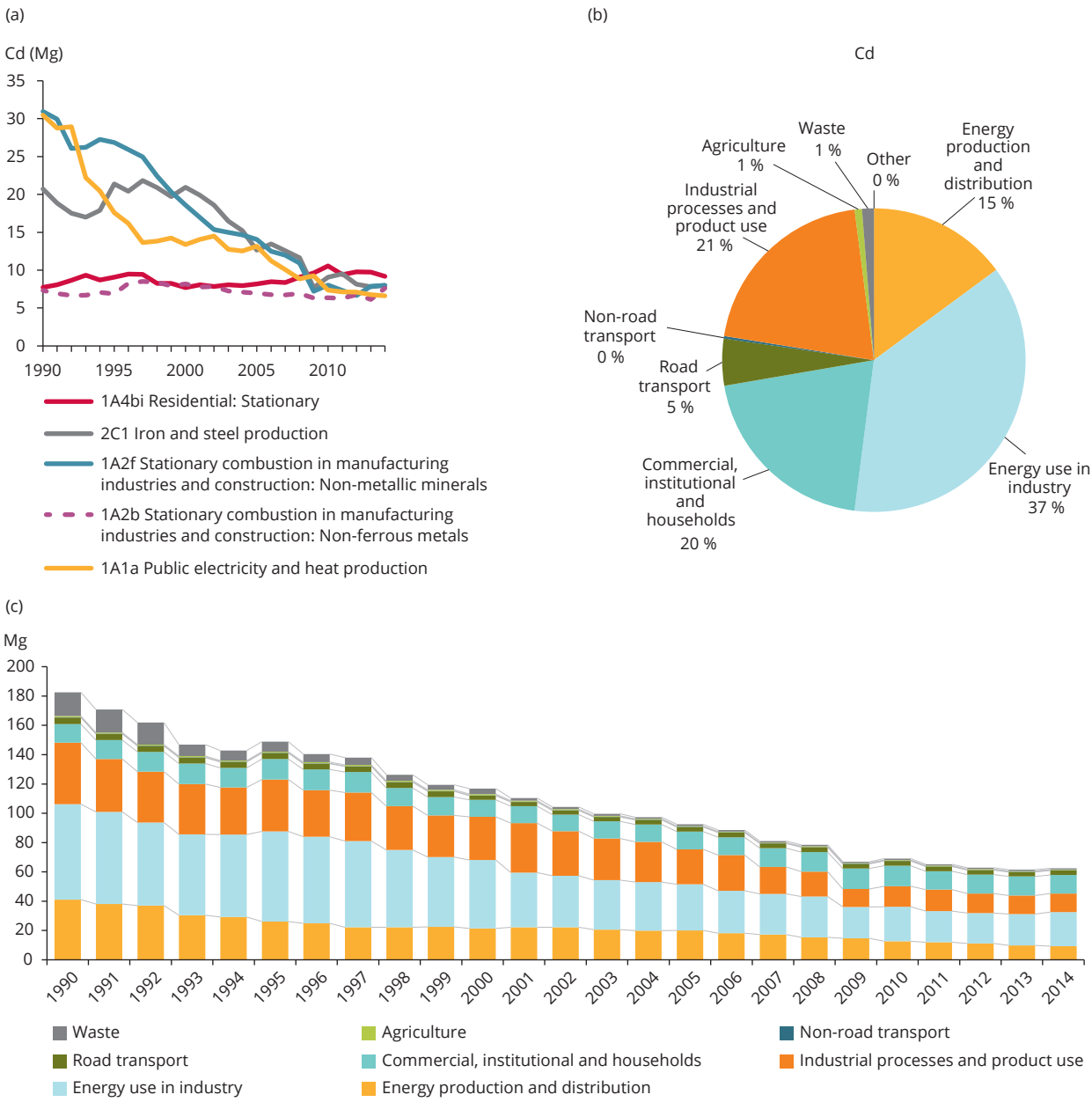
(b) Sum of sectors: differences arise when only national totals and no sectoral data are available.

'1A4bi — Residential: Stationary', '2C1 — Iron and steel production' and '1A2f — Stationary combustion in manufacturing industries and construction: Non-metallic minerals' were the principal key categories for Cd emissions, making up 40 % of total Cd emissions (see Figure 3.13(a)). Among the top five key categories, the highest relative reductions in emissions between 1990 and 2014 were in the fifth most important, '1A1a — Public electricity and heat production' (− 78.3 %), and the second most important, '1A2f — Stationary combustion in manufacturing industries and construction: Non-metallic minerals' (− 74.2 %).

As they have for Pb, industrial sources of Cd emissions have decreased since the early 1990s overall. This is largely because abatement technologies for wastewater treatment and incinerators have improved, and so have metal refining and smelting facilities (EEA, 2015c).

Figure 3.13(b) shows the contribution that each aggregated sector group made to total EU-28 emissions. For Cd, common leading emission sources are the energy sectors and the 'commercial, institutional and households' sector.

Figure 3.13 Cd emissions in the EU-28: (a) trend in emissions from the five most important key categories, 1990–2014; (b) share by sector group, 2014; (c) sectoral trends in emissions



3.14 Mercury emission trends and key categories

Between 1990 and 2014, Hg emissions dropped by 73 % in the EU-28. Between 2013 and 2014, the decrease was 3 % (see Table 3.15), mainly because emissions reduced in the United Kingdom, Poland, Germany and the Czech Republic. The Member States that contributed most (i.e. more than 10 %) to Hg emissions in 2014 were Poland, Germany and Italy. Data for Greece could not be gap-filled for 2010 to 2014, so the EU-28 total is underestimated for those years.

'1A1a — Public electricity and heat production 'and '2C1 — Iron and steel were the chief key categories for Hg emissions, making up 51 % of the total (see Figure 3.14(a)). Among the top five key categories, the highest relative reduction in emissions between 1990 and 2014 was in the most important, '1A1a — Public electricity and heat production' (− 65 %). The third most important, '1A2f — Stationary combustion in manufacturing industries and construction: Non-metallic minerals' (− 57 %), and the fifth most important, '1A4bi — Residential: Stationary' (− 56.4 %), also show high reductions.

Table 3.15 Member State contributions to EU emissions of Hg

	Hg (Mg)									Change		Share in EU-28	
Member State	**1990**	**1995**	**2000**	**2005**	**2010**	**2011**	**2012**	**2013**	**2014**	**1990–2014**	**2013–2014**	**1990**	**2014**
Austria	2.1	1.2	0.9	1.0	1.0	1.0	1.0	1.0	1.0	– 55 %	– 5.6 %	1.0 %	1.7 %
Belgium	5.7	3.0	3.0	2.0	1.7	1.7	1.3	1.4	1.5	– 73 %	10.0 %	2.7 %	2.7 %
Bulgaria	2.4	2.0	1.5	1.6	0.9	1.0	0.8	0.8	0.8	– 68 %	– 0.5 %	1.2 %	1.4 %
Croatia	1.2	0.3	0.5	0.6	0.5	0.5	0.5	0.5	0.5	– 57 %	3.2 %	0.5 %	0.9 %
Cyprus	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	7 %	23.4 %	0.0 %	0.2 %
Czech Republic	7.5	7.4	3.1	3.7	3.6	3.2	3.0	2.8	2.6	– 66 %	– 7.5 %	3.6 %	4.5 %
Denmark	3.2	2.3	1.0	0.7	0.4	0.4	0.3	0.3	0.3	– 90 %	– 3.2 %	1.5 %	0.6 %
Estonia	1.2	0.6	0.6	0.5	0.7	0.7	0.6	0.7	0.7	– 41 %	– 1.4 %	0.5 %	1.2 %
Finland	1.0	0.7	0.6	0.9	0.9	0.6	0.7	0.7	0.6	– 39 %	– 6.7 %	0.5 %	1.1 %
France	25	21	12	6.4	4.5	4.6	4.1	3.8	3.9	– 84 %	1.4 %	11.7 %	6.8 %
Germany	32	20	18	14	11	10	9.9	9.5	9.1	– 72 %	– 4.2 %	15.3 %	15.9 %
Greece	13	13	13	13	n/a	n/a	n/a	n/a	n/a			6.2 %	
Hungary	3.0	2.3	2.1	1.5	1.3	1.2	1.1	0.9	0.9	– 70 %	1.3 %	1.4 %	1.6 %
Ireland	0.9	0.8	0.6	0.7	0.6	0.6	0.6	0.6	0.5	– 40 %	– 4.1 %	0.4 %	0.9 %
Italy	12	10	9.2	9.9	8.7	8.6	8.4	8.1	8.2	– 30 %	0.4 %	5.5 %	14.2 %
Latvia	0.3	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	– 75 %	3.1 %	0.1 %	0.1 %
Lithuania	1.3	0.5	0.2	0.4	0.2	0.4	0.2	0.2	0.2	– 85 %	– 6.3 %	0.6 %	0.3 %
Luxembourg	0.4	0.2	0.3	0.2	0.0	0.0	0.1	0.1	0.1	– 87 %	– 65.6 %	0.2 %	0.1 %
Malta	0.4	0.5	0.6	0.6	0.0	0.0	0.0	0.0	0.0	– 98 %	– 48.6 %	0.2 %	0.0 %
Netherlands	3.6	1.5	1.1	1.0	0.6	0.7	0.6	0.6	0.5	– 85 %	– 9.4 %	1.7 %	1.0 %
Poland	14	13	10	9.8	9.6	9.6	9.9	10	9.6	– 32 %	– 4.3 %	6.7 %	16.7 %
Portugal	3.2	3.4	3.1	2.6	1.7	1.6	1.6	1.6	1.5	– 54 %	– 3.6 %	1.5 %	2.6 %
Romania	11	9.4	7.7	5.4	2.2	2.4	2.2	1.9	2.0	– 82 %	3.8 %	5.4 %	3.5 %
Slovakia	13	4.3	6.1	2.6	1.0	0.9	1.0	1.1	1.2	– 91 %	8.3 %	6.0 %	2.1 %
Slovenia	0.3	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	– 50 %	– 13.0 %	0.1 %	0.3 %
Spain	14	16	13	11	6.9	6.6	6.4	5.6	5.5	– 62 %	– 1.9 %	6.8 %	9.5 %
Sweden	1.5	1.0	0.8	0.7	0.5	0.5	0.5	0.5	0.5	– 71 %	– 9.7 %	0.7 %	0.8 %
United Kingdom	38	20	8.3	7.5	6.6	6.0	5.7	6.1	5.4	– 86 %	– 10.5 %	17.8 %	9.5 %
EU-28 ([a])	**211**	**154**	**117**	**98**	**65**	**63**	**61**	**59**	**57**	**– 73 %**	**– 3.0 %**	**100 %**	**100 %**
EU-28 ([b])	198	141	104	85	65	63	61	59	57				

Notes: Dark-grey shaded cells indicate that no emission values are available (n/a, not available). See Appendix 1 for an explanation of the notation keys reported by Member States.

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

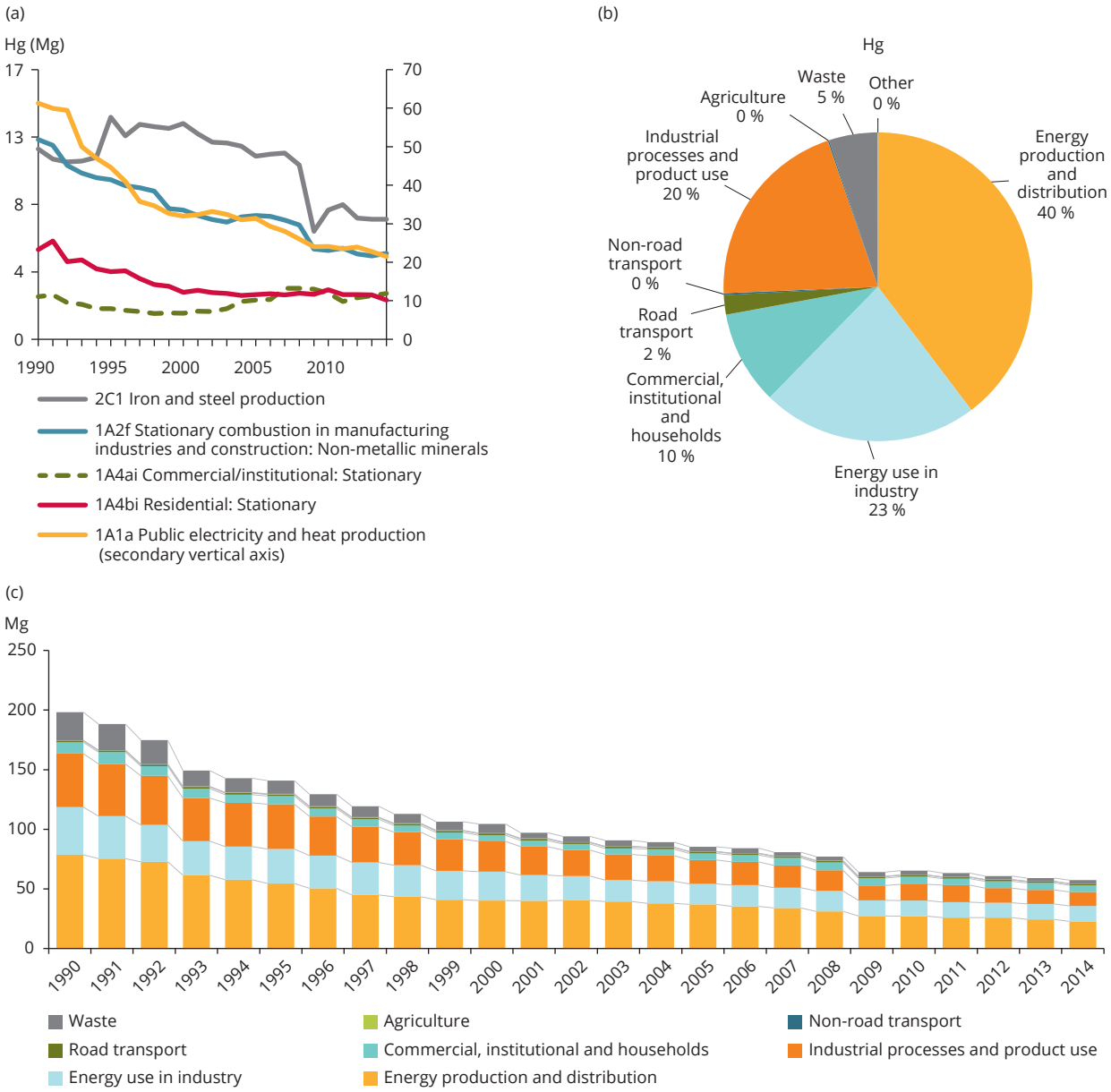
([a]) Sum of national totals as reported by Member States.

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

Emissions from categories '1A1a — Public electricity and heat production' and '1A2gviii — Stationary combustion in manufacturing industries and construction: Other' have decreased considerably since 1990. This decrease is mainly due to changes in the industrial sector: improving emission controls on mercury cells and replacing them by diaphragm or membrane cells, and switching from coal to gas and other energy sources in the power- and heat-generating sectors in many countries (EEA, 2015c).

Figure 3.14(b) shows the contribution that each aggregated sector group made to total EU-28 emissions. For Hg, principal emission sources are the energy sectors and the sector 'industrial processes'.

Figure 3.14 Hg emissions in the EU-28: (a) trend in emissions from the five most important key categories, 1990–2014; (b) share by sector group, 2014; (c) sectoral trends in emissions



3.15 Arsenic emission trends

Between 1990 and 2014, As emissions in the EU-28 dropped by 65 %. Between 2013 and 2014, emissions increased by 5.5 %, mainly because emissions increased in Slovakia, Spain and Bulgaria (see Table 3.16). The Member States that contributed most (i.e. more than 10 %) to As emissions in 2014 were Italy, Poland and Slovakia. Greece reported an emission value only once (for 1996), which has been used to gap-fill the years up to 2005. Likewise, Luxembourg once reported a notation key 'NR' for As emissions, which was used to gap-fill all missing years. Austria and Slovenia did not provide emission data for As. Therefore, the EU-28 total is an underestimate.

Table 3.16 Member State contributions to EU emissions of As

	As (Mg)									Change		Share in EU-28	
Member State	**1990**	**1995**	**2000**	**2005**	**2010**	**2011**	**2012**	**2013**	**2014**	**1990–2014**	**2013–2014**	**1990**	**2014**
Austria	NR	NR	NR	NR	NR	NR	NR	NR	NR				
Belgium	7.1	6.0	4.5	3.1	2.1	1.9	1.7	1.6	1.3	– 81 %	– 16.2 %	1.3 %	0.7 %
Bulgaria	19	15	7.3	15	3.5	4.2	3.0	2.9	4.4	– 77 %	52.1 %	3.6 %	2.4 %
Croatia	8.6	1.2	1.0	1.1	0.8	0.6	0.6	0.4	0.3	– 96 %	– 25.5 %	1.6 %	0.2 %
Cyprus	0.1	0.2	0.2	0.2	0.1	0.2	0.2	0.1	0.1	3 %	9.0 %	0.0 %	0.1 %
Czech Republic	9.5	7.8	6.5	4.7	2.8	3.2	3.2	3.3	2.3	– 75 %	– 28.8 %	1.8 %	1.2 %
Denmark	1.3	0.8	0.9	0.5	0.3	0.3	0.3	0.4	0.3	– 76 %	– 11.5 %	0.3 %	0.2 %
Estonia	19	10	8.6	9.2	11	11	9.6	11	10	– 46 %	– 8.8 %	3.5 %	5.4 %
Finland	33.2	3.5	4.3	2.7	3.7	3.4	2.9	2.9	2.4	– 93 %	– 16.0 %	6.2 %	1.3 %
France	17	17	15	12	7.6	6.8	6.0	6.4	5.4	– 69 %	– 16.1 %	3.3 %	2.9 %
Germany	80	6.7	5.8	5.9	5.5	5.2	5.2	5.3	5.0	– 94 %	– 5.8 %	15.1 %	2.7 %
Greece	4.0	4.0	4.0	4.0	n/a	n/a	n/a	n/a	n/a			0.8 %	
Hungary	3.9	3.2	3.0	2.5	2.2	2.2	2.1	1.8	1.9	– 52 %	5.0 %	0.7 %	1.0 %
Ireland	1.6	1.7	1.7	1.5	1.2	1.2	1.3	1.2	1.2	– 24 %	– 0.4 %	0.3 %	0.7 %
Italy	37	27	45	40	45	46	45	44	44	21 %	0.4 %	6.9 %	23.6 %
Latvia	0.4	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	– 62 %	13.7 %	0.1 %	0.1 %
Lithuania	0.7	0.3	0.2	0.2	0.2	0.2	0.2	0.2	0.2	– 69 %	– 9.4 %	0.1 %	0.1 %
Luxembourg	NR	NR	NR	NR	NR	NR	NR	NR	NR				
Malta	0.1	0.2	0.2	0.3	0.1	0.0	0.0	0.0	0.0	– 99 %	– 98.3 %	0.0 %	0.0 %
Netherlands	1.3	0.9	0.9	1.3	0.6	1.0	0.8	0.7	0.7	– 48 %	– 6.1 %	0.2 %	0.3 %
Poland	52	53	40	45	49	45	45	44	44	– 15 %	– 0.1 %	9.7 %	23.3 %
Portugal	2.8	3.0	3.0	2.9	1.5	1.4	1.6	1.5	1.5	– 48 %	– 1.5 %	0.5 %	0.8 %
Romania	14	12	10	8.2	5.1	5.7	4.8	4.1	4.2	– 69 %	3.4 %	2.6 %	2.2 %
Slovakia	147	39	9.0	23	21	23	20	14	24	– 83 %	75.9 %	27.6 %	12.9 %
Slovenia	NR	NR	NR	NR	NR	NR	NR	NR	NR				
Spain	17	17	21	20	15	15	17	13	15	– 10 %	13.1 %	3.1 %	8.0 %
Sweden	5.6	1.5	0.8	0.9	0.9	0.9	0.9	0.9	0.9	– 84 %	2.7 %	1.0 %	0.5 %
United Kingdom	51	37	24	18	16	16	17	18	18	– 65 %	– 0.8 %	9.6 %	9.5 %
EU-28 ([a])	**532**	**268**	**217**	**223**	**195**	**194**	**188**	**178**	**188**	**– 65 %**	**5.5 %**	**100 %**	**100 %**
EU-28 ([b])	528	264	213	219	195	194	188	178	188				

Notes: Dark-grey shaded cells indicate that no emission values are available (n/a, not available). See Appendix 1 for an explanation of the notation keys reported by Member States.

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

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

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

3.16 Chromium emission trends

Between 1990 and 2014, Cr emissions in the EU-28 dropped by 73 %. Between 2013 and 2014, emissions stayed relatively stable, falling by 1.4 % (see Table 3.17). The Member States that contributed most (i.e. more than 10 %) to Cr emissions in 2014 were France, Poland, Italy and Malta. Greece did not submit an inventory in 2016. However, Greece reported an emission value only once (for 1996), which has been used to gap-fill the years up to 2005. Likewise, Luxembourg once reported a notation key 'NR' for Cr emissions, which was used to gap-fill all missing years. Austria and Slovenia did not provide emission data for Cr. Therefore, the EU-28 total is an underestimate.

Table 3.17 Member State contributions to EU emissions of Cr

	Cr (Mg)									Change		Share in EU-28	
Member State	**1990**	**1995**	**2000**	**2005**	**2010**	**2011**	**2012**	**2013**	**2014**	**1990–2014**	**2013–2014**	**1990**	**2014**
Austria	NR	NR	NR	NR	NR	NR	NR	NR	NR				
Belgium	31	26	18	17	13	11	11	5.9	5.7	– 82 %	– 3.8 %	2.5 %	1.7 %
Bulgaria	21	11	7.6	9.9	5.3	5.9	5.3	5.1	5.6	– 73 %	9.2 %	1.7 %	1.7 %
Croatia	4.8	2.9	2.5	2.8	1.8	1.8	1.7	1.4	1.9	– 59 %	37.2 %	0.4 %	0.6 %
Cyprus	0.2	0.2	0.3	0.3	0.2	0.2	0.2	0.2	0.2	23 %	7.0 %	0.0 %	0.1 %
Czech Republic	22	22	22	22	23	20	18	18	18	– 19 %	– 1.8 %	1.8 %	5.4 %
Denmark	5.8	3.0	1.5	1.6	1.6	1.5	1.4	1.5	1.4	– 75 %	– 5.9 %	0.5 %	0.4 %
Estonia	18	10	8.4	9.1	11	10	9.2	11	9.8	– 46 %	– 6.9 %	1.5 %	3.0 %
Finland	29	22	28	18	22	18	18	18	20	– 30 %	13.2 %	2.3 %	6.2 %
France	392	189	104	45	27	24	22	23	19	– 95 %	– 13.8 %	31.6 %	5.9 %
Germany	132	74	63	57	57	58	57	57	57	– 57 %	– 1.3 %	10.7 %	17.1 %
Greece	10. 00	10. 00	10. 00	10. 00	n/a	n/a	n/a	n/a	n/a			0.8 %	
Hungary	18	12	11	12	10	11	9.8	6.7	7.9	– 56 %	17.8 %	1.5 %	2.4 %
Ireland	3.8	3.8	4.0	2.7	2.1	2.0	2.0	2.0	2.0	– 47 %	1.2 %	0.3 %	0.6 %
Italy	92	74	52	59	52	52	50	46	44	– 52 %	– 3.4 %	7.4 %	13.3 %
Latvia	1.3	1.3	1.1	1.3	1.2	1.2	1.3	1.3	1.3	3 %	3.5 %	0.1 %	0.4 %
Lithuania	1.8	1.0	0.9	1.2	1.1	1.1	1.2	1.2	1.1	– 40 %	– 5.6 %	0.1 %	0.3 %
Luxembourg	NR	NR	NR	NR	NR	NR	NR	NR	NR				
Malta	0.6	0.9	1.2	1.5	1.3	1.3	1.3	1.3	0.1	– 91 %	– 95.6 %	0.0 %	0.0 %
Netherlands	12	8.5	5.0	4.3	3.8	3.7	3.7	3.6	3.5	– 70 %	– 3.4 %	1.0 %	1.1 %
Poland	99	76	47	43	52	48	48	46	45	– 55 %	– 3.3 %	8.0 %	13.6 %
Portugal	13	14	15	14	11	10	10	10	10	– 20 %	1.0 %	1.0 %	3.1 %
Romania	37	31	26	19	12	12	12	11	11	– 69 %	0.7 %	3.0 %	3.4 %
Slovakia	77	12	7.8	5.5	3.6	3.4	3.6	3.7	3.7	– 95 %	– 1.1 %	6.2 %	1.1 %
Slovenia	NR	NR	NR	NR	NR	NR	NR	NR	NR				
Spain	34	38	41	42	31	30	31	28	29	– 17 %	1.8 %	2.8 %	8.7 %
Sweden	24	13	7.3	11	5.5	6.8	5.4	5.3	5.0	– 79 %	– 7.3 %	1.9 %	1.5 %
United Kingdom	160	115	75	39	28	27	27	28	28	– 83 %	0.0 %	12.9 %	8.4 %
EU-28 ([a])	**1 240**	**770**	**560**	**447**	**378**	**362**	**351**	**335**	**330**	**– 73 %**	**– 1.4 %**	**100 %**	**100 %**
EU-28 ([b])	1 230	760	550	437	378	362	351	335	330				

Notes: Dark-grey shaded cells indicate that no emission values are available (n/a, not available). See Appendix 1 for an explanation of the notation keys reported by Member States.

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

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

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

3.17 Copper emission trends

Between 1990 and 2014, Cu emissions in the EU-28 increased by 5 %. Between 2013 and 2014, emissions increased by 5 %, mainly because emissions increased from Germany, the Czech Republic, Spain, Slovakia (see Table 3.18). The Member State that contributed most (i.e. more than 10 %) to Cu emissions in 2014 was Germany. Greece reported an emission value only once (for 1996), which has been used to gap-fill the years up to 2005. Likewise, Luxembourg once reported a notation key 'NR' for Cu emissions, which was used to gap-fill all missing years. Austria and Slovenia did not provide emission data for Cu. Therefore, the EU-28 total is an underestimate.

Table 3.18 Member State contributions to EU emissions of Cu

	Cu (Mg)									Change		Share in EU-28	
Member State	**1990**	**1995**	**2000**	**2005**	**2010**	**2011**	**2012**	**2013**	**2014**	**1990–2014**	**2013–2014**	**1990**	**2014**
Austria	NR	NR	NR	NR	NR	NR	NR	NR	NR				
Belgium	39	39	39	36	35	34	33	30	31	– 22 %	2.3 %	1.2 %	0.9 %
Bulgaria	103	74	56	97	19	20	20	19	20	– 81 %	3.8 %	3.0 %	0.6 %
Croatia	8.5	5.2	6.7	7.4	7.5	7.3	7.2	7.4	7.4	– 13 %	0.6 %	0.3 %	0.2 %
Cyprus	1.3	1.7	2.2	2.3	2.4	2.4	2.2	1.9	2.0	48 %	0.6 %	0.0 %	0.1 %
Czech Republic	17	14	11	14	13	8.9	7.7	6.8	37	> 100 %	> 100 %	0.5 %	1.0 %
Denmark	32	37	39	41	42	42	41	41	42	29 %	2.2 %	0.9 %	1.2 %
Estonia	10	5.0	3.7	4.6	5.0	4.9	4.7	5.0	5.0	– 50 %	0.6 %	0.3 %	0.1 %
Finland	157	89	78	60	63	58	57	57	54	– 66 %	– 6.1 %	4.6 %	1.5 %
France	222	216	218	220	211	216	207	212	208	– 6 %	– 1.8 %	6.5 %	5.8 %
Germany	1 712	1 856	2 035	2 056	2 113	2 156	2 142	2 155	2 197	28 %	2.0 %	50.4 %	61.3 %
Greece	14	14	14	14	n/a	n/a	n/a	n/a	n/a			0.4 %	
Hungary	24	15	17	21	22	21	19	18	20	– 16 %	10.2 %	0.7 %	0.6 %
Ireland	9.6	11	18	21	18	18	17	17	18	85 %	2.5 %	0.3 %	0.5 %
Italy	137	148	144	150	136	138	129	121	122	– 11 %	0.4 %	4.0 %	3.4 %
Latvia	5.0	3.5	3.7	5.1	5.5	4.8	4.7	4.8	5.1	1 %	6.0 %	0.1 %	0.1 %
Lithuania	8.6	4.4	4.2	5.1	5.9	6.1	5.7	5.7	5.6	– 34 %	– 1.1 %	0.3 %	0.2 %
Luxembourg	NR	NR	NR	NR	NR	NR	NR	NR	NR				
Malta	0.6	0.7	0.8	0.9	27	27	27	27	0.9	59 %	– 96.6 %	0.0 %	0.0 %
Netherlands	46	49	51	53	58	56	55	55	55	19 %	0.0 %	1.4 %	1.5 %
Poland	334	361	306	342	348	331	331	319	326	– 2 %	2.3 %	9.8 %	9.1 %
Portugal	22	28	37	37	34	31	29	29	29	35 %	2.5 %	0.6 %	0.8 %
Romania	14	17	19	22	19	20	21	20	21	42 %	1.3 %	0.4 %	0.6 %
Slovakia	102	49	23	44	53	55	51	38	49	– 52 %	30.3 %	3.0 %	1.4 %
Slovenia	NR	NR	NR	NR	NR	NR	NR	NR	NR				
Spain	134	157	229	247	226	219	224	197	220	65 %	11.8 %	3.9 %	6.2 %
Sweden	100	86	76	53	54	55	54	54	54	– 46 %	1.2 %	2.9 %	1.5 %
United Kingdom	144	110	81	64	54	57	53	53	53	– 63 %	1.1 %	4.2 %	1.5 %
EU-28 (a)	**3 398**	**3 390**	**3 513**	**3 617**	**3 570**	**3 588**	**3 541**	**3 493**	**3 582**	**5 %**	**2.6 %**	**100 %**	**100 %**
EU-28 (b)	3 384	3 376	3 499	3 603	3 570	3 588	3 541	3 493	3 582				

Notes: Dark-grey shaded cells indicate that no emission values are available (n/a, not available). See Appendix 1 for an explanation of the notation keys reported by Member States.

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

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

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

3.18 Nickel emission trends

Between 1990 and 2014, Ni emissions in the EU-28 dropped by 73 %. Between 2013 and 2014, emissions decreased by 7 %, mainly because France, the United Kingdom, Germany and Poland reported reductions (see Table 3.19). The Member States that contributed most (i.e. more than 10 %) to Ni emissions in 2014 were Poland, Spain, the United Kingdom and Germany. Greece reported an emission value once only (for 1996), which has been used to gap-fill the years up to 2005. Likewise, Luxembourg once reported a notation key 'NR' for Ni emissions, which was used to gap-fill all missing years. Austria and Slovenia did not provide emission data for Ni. Therefore, the EU-28 total is an underestimate.

In Bulgaria, Ni emissions in 2000 were much lower than in the years before and after, because Ni emissions from primary Cu production decreased (personal communication by Bulgaria in 2012).

Table 3.19 Member State contributions to EU emissions of Ni

	Ni (Mg)									Change		Share in EU-28	
Member State	**1990**	**1995**	**2000**	**2005**	**2010**	**2011**	**2012**	**2013**	**2014**	**1990–2014**	**2013–2014**	**1990**	**2014**
Austria	NR	NR	NR	NR	NR	NR	NR	NR	NR				
Belgium	31	28	33	25	8.9	8.7	6.1	4.6	4.1	– 87 %	– 10.7 %	1.4 %	0.7 %
Bulgaria	30	30	7.6	23	6.6	6.9	5.3	5.6	5.7	– 81 %	3.1 %	1.4 %	0.9 %
Croatia	26	20	17	20	15	12	10	7.4	6.9	– 74 %	– 7.6 %	1.2 %	1.1 %
Cyprus	5.9	7.2	9.9	12	7.1	8.9	9.4	5.2	5.2	– 11 %	0.2 %	0.3 %	0.8 %
Czech Republic	26	25	23	20	13	12	8.2	7.9	8.6	– 67 %	9.3 %	1.2 %	1.4 %
Denmark	21	16	8.7	7.8	5.3	4.7	4.5	4.2	3.7	– 83 %	– 12.8 %	0.9 %	0.6 %
Estonia	27	10	6.4	6.4	6.6	6.4	5.6	6.5	6.0	– 78 %	– 7.3 %	1.2 %	1.0 %
Finland	63	34	34	27	22	20	19	16	17	– 74 %	2.2 %	2.8 %	2.7 %
France	286	220	183	149	87	75	61	49	40	– 86 %	– 17.7 %	12.7 %	6.5 %
Germany	279	163	120	133	111	99	96	94	86	– 69 %	– 8.0 %	12.4 %	13.9 %
Greece	101	101	101	101	n/a	n/a	n/a	n/a	n/a			4.5 %	
Hungary	24	35	16	4.6	4.3	3.7	3.6	3.2	3.3	– 86 %	5.0 %	1.1 %	0.5 %
Ireland	8.7	11	16	9.9	2.3	1.5	1.5	1.4	1.6	– 82 %	10.3 %	0.4 %	0.3 %
Italy	122	112	103	109	38	37	34	30	29	– 76 %	– 3.7 %	5.4 %	4.6 %
Latvia	9.3	5.7	1.8	1.0	0.5	0.5	0.4	0.4	0.4	– 96 %	1.0 %	0.4 %	0.1 %
Lithuania	30	14	6.4	5.9	3.5	2.5	3.4	2.2	2.0	– 93 %	– 8.8 %	1.3 %	0.3 %
Luxembourg	NR	NR	NR	NR	NR	NR	NR	NR	NR				
Malta	8.3	13	17	21	5.9	0.7	0.7	0.7	0.1	– 98 %	– 81.3 %	0.4 %	0.0 %
Netherlands	73	85	19	10	2.1	2.4	2.1	2.0	1.8	– 98 %	– 7.6 %	3.2 %	0.3 %
Poland	243	242	165	165	183	161	159	146	139	– 43 %	– 5.0 %	10.8 %	22.4 %
Portugal	106	108	95	87	36	29	24	19	16	– 85 %	– 17.9 %	4.7 %	2.5 %
Romania	67	51	36	20	7.9	8.8	7.5	5.0	5.0	– 93 %	– 0.1 %	3.0 %	0.8 %
Slovakia	72	33	23	22	18	17	17	17	16	– 78 %	– 4.5 %	3.2 %	2.6 %
Slovenia	NR	NR	NR	NR	NR	NR	NR	NR	NR				
Spain	264	324	305	289	170	149	137	118	111	– 58 %	– 5.3 %	11.7 %	17.9 %
Sweden	33	33	20	20	18	14	12	11	8.9	– 73 %	– 16.8 %	1.5 %	1.4 %
United Kingdom	300	306	170	133	109	85	102	112	104	– 65 %	– 7.4 %	13.3 %	16.7 %
EU-28 ([a])	**2 258**	**2 028**	**1 534**	**1 423**	**882**	**764**	**729**	**667**	**621**	**– 73 %**	**– 7.0 %**	**100 %**	**100 %**
EU-28 ([b])	2 158	1 927	1 434	1 323	882	765	729	667	621				

Notes: Dark-grey shaded cells indicate that no emission values are available (n/a, not available). See Appendix 1 for an explanation of the notation keys reported by Member States.

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

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

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

3.19 Selenium emission trends

Between 1990 and 2014, Se emissions in the EU-28 dropped by 19 %. Between 2013 and 2014, emissions increased by 3.4 %, mainly because emissions increased in Bulgaria, Spain, Slovakia and Portugal (see Table 3.20). The Member States that contributed most (i.e. more than 10 %) to Se emissions in 2014 were Spain and Portugal. Greece reported an emission value only once (for 1996), which has been used to gap-fill the years up to 2005. Likewise, Luxembourg once reported a notation key 'NR' for Se emissions, which was used to gap-fill all missing years. Austria, Slovenia and Poland did not provide emission data for Se. Therefore, the EU-28 total is an underestimate.

In 2005, Belgium had high Se emissions in the category '1A2f — Stationary combustion in manufacturing industries and construction: Non-metallic minerals'. They were because of one glass plant in Wallonia. The plant gives these annual emissions based on measurements, and the concentration of Se was very high in 2005 (personal communication by Belgium in 2014). Likewise, Belgium's high emissions in 2010 are mainly attributable to the operations of a particular company in the glass industry in Wallonia (comment received from Belgium in 2012).

Table 3.20 Member State contributions to EU emissions of Se

	Se (Mg)									Change		Share in EU-28	
Member State	**1990**	**1995**	**2000**	**2005**	**2010**	**2011**	**2012**	**2013**	**2014**	**1990–2014**	**2013–2014**	**1990**	**2014**
Austria	NR	NR	NR	NR	NR	NR	NR	NR	NR				
Belgium	5.1	6.2	6.4	27	11	3.9	3.4	3.5	4.0	– 22 %	12.4 %	1.9 %	1.9 %
Bulgaria	41	12	5.2	13	14	16	15	16	19	– 53 %	17.9 %	15.5 %	8.9 %
Croatia	0.4	0.3	0.3	0.4	0.3	0.3	0.3	0.3	0.3	– 26 %	3.8 %	0.2 %	0.2 %
Cyprus	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	11 %	12.8 %	0.0 %	0.0 %
Czech Republic	12	12	12	14	8.1	8.3	8.0	7.4	7.5	– 37 %	2.4 %	4.5 %	3.5 %
Denmark	4.9	4.5	2.9	2.1	1.9	1.5	1.3	1.6	1.6	– 68 %	0.2 %	1.8 %	0.7 %
Estonia	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	– 18 %	4.3 %	0.0 %	0.0 %
Finland	0.0	0.0	0.0	0.0	0.5	0.2	0.0	0.1	0.4	> 100 %	> 100 %	0.0 %	0.2 %
France	15	15	15	15	12	12	11	11	11	– 28 %	– 1.3 %	5.7 %	5.1 %
Germany	3.5	3.8	3.9	4.1	3.7	3.6	3.6	3.5	3.5	0 %	– 0.9 %	1.3 %	1.6 %
Greece	0.2	0.2	0.2	0.2	n/a	n/a	n/a	n/a	n/a			0.1 %	
Hungary	6.4	5.8	5.7	4.0	3.5	3.6	3.5	3.4	3.3	– 49 %	– 4.3 %	2.4 %	1.5 %
Ireland	2.0	2.2	2.2	2.1	1.5	1.5	1.8	1.6	1.6	– 23 %	0.9 %	0.8 %	0.7 %
Italy	9.4	9.7	11	12	11	11	11	10	9.8	5 %	– 1.4 %	3.6 %	4.6 %
Latvia	0.4	0.3	0.2	0.1	0.1	0.1	0.1	0.1	0.1	– 81 %	– 6.5 %	0.1 %	0.0 %
Lithuania	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	– 56 %	– 8.4 %	0.1 %	0.0 %
Luxembourg	NR	NR	NR	NR	NR	NR	NR	NR	NR				
Malta	0.0	0.0	0.0	0.0	0.2	0.1	2.1	0.1	0.0	> 100 %	– 85.9 %	0.0 %	0.0 %
Netherlands	0.4	0.3	0.5	2.6	1.5	0.8	0.8	0.5	0.8	96 %	52.8 %	0.1 %	0.4 %
Poland	NE	NE	NE	NE	NE	NE	NE	NE	NE				
Portugal	12	17	23	27	30	30	32	32	32	> 100 %	1.5 %	4.6 %	14.9 %
Romania	14	14	13	13	12	14	12	9.2	9.6	– 32 %	4.6 %	5.3 %	4.5 %
Slovakia	8.7	9.0	6.8	8.4	10	11	11	9.1	9.6	11 %	6.0 %	3.3 %	4.5 %
Slovenia	NR	NR	NR	NR	NR	NR	NR	NR	NR				
Spain	50	57	76	85	71	73	85	81	83	67 %	3.4 %	18.9 %	38.7 %
Sweden	1.0	1.2	1.1	1.3	1.5	1.5	1.5	1.5	1.4	36 %	– 6.5 %	0.4 %	0.6 %
United Kingdom	77	50	33	34	17	17	20	17	16	– 79 %	– 3.2 %	29.3 %	7.6 %
EU-28 (a)	**264**	**221**	**219**	**264**	**212**	**210**	**223**	**208**	**215**	**– 19 %**	**3.4 %**	**100 %**	**100 %**
EU-28 (b)	264	221	219	264	212	210	223	208	215				

Notes: Dark-grey shaded cells indicate that no emission values are available (n/a, not available). See Appendix 1 for an explanation of the notation keys reported by Member States.

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

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

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

3.20 Zinc emission trends

Between 1990 and 2014, Zn emissions in the EU-28 dropped by 34 %. Between 2013 and 2014, emissions increased slightly by 0.9 %, mainly because Germany, the Netherlands, the Czech Republic and Spain reported increased emissions (see Table 3.21). The Member States that contributed most (i.e. more than 10 %) to Zn emissions in 2014 were Germany, Poland and Italy. Greece reported an emission value only once (for 1996), which has been used to gap-fill the years up to 2005. Likewise, Luxembourg once reported a notation key 'NR' for Zn emissions, which was used to gap-fill all missing years. Austria and Slovenia did not provide emission data for Zn. Therefore, the EU-28 total is an underestimate.

Ireland explained the emission decline after 2000 by the closure of Ireland's only steel plant in 2001. From 1990 to 2001, the main determinant of the trend in Zn emissions was metal production (2C). It accounted on average for 52.6 % of national total emissions throughout that period (Ireland's IIR, 2015).

Table 3.21 Member State contributions to EU emissions of Zn

	Zn (Mg)									Change		Share in EU-28	
Member State	**1990**	**1995**	**2000**	**2005**	**2010**	**2011**	**2012**	**2013**	**2014**	**1990–2014**	**2013–2014**	**1990**	**2014**
Austria	NR	NR	NR	NR	NR	NR	NR	NR	NR				
Belgium	234	187	184	132	111	104	89	82	82	– 65 %	0.4 %	2.3 %	1.2 %
Bulgaria	222	153	292	175	120	134	125	125	136	– 39 %	8.5 %	2.1 %	2.0 %
Croatia	27	15	17	18	18	19	19	18	31	17 %	70.3 %	0.3 %	0.5 %
Cyprus	3.8	4.6	6.0	6.9	5.3	5.8	5.8	4.3	4.5	18 %	3.4 %	0.0 %	0.1 %
Czech Republic	90	84	79	76	76	74	68	63	81	– 10 %	29.7 %	0.9 %	1.2 %
Denmark	69	63	54	57	61	58	55	56	56	– 19 %	– 0.2 %	0.7 %	0.8 %
Estonia	107	64	50	53	63	61	55	63	57	– 46 %	– 8.1 %	1.0 %	0.8 %
Finland	591	342	91	135	161	133	140	134	130	– 78 %	– 3.2 %	5.7 %	1.9 %
France	2 218	1 413	1 004	572	504	501	496	483	467	– 79 %	– 3.4 %	21.4 %	6.8 %
Germany	1 705	1 728	1 893	1 899	1 969	1 997	1 981	2 001	2 029	19 %	1.4 %	16.5 %	29.7 %
Greece	52	52	52	52	n/a	n/a	n/a	n/a	n/a			0.5 %	
Hungary	85	62	45	38	39	42	45	38	37	– 56 %	– 2.8 %	0.8 %	0.5 %
Ireland	54	49	55	26	21	19	19	19	19	– 64 %	1.2 %	0.5 %	0.3 %
Italy	967	953	915	988	920	978	941	882	867	– 10 %	– 1.7 %	9.3 %	12.7 %
Latvia	26	26	22	27	25	25	27	26	27	6 %	3.3 %	0.2 %	0.4 %
Lithuania	25	18	18	20	20	19	20	19	18	– 29 %	– 5.2 %	0.2 %	0.3 %
Luxembourg	NR	NR	NR	NR	NR	NR	NR	NR	NR				
Malta	0.4	0.5	0.6	0.7	10	11	8.5	10	2.4	> 100 %	– 76.0 %	0.0 %	0.0 %
Netherlands	224	146	95	88	110	102	103	99	127	– 43 %	28.5 %	2.2 %	1.9 %
Poland	1 796	1 779	1 248	1 297	1 510	1 382	1 432	1 374	1 366	– 24 %	– 0.6 %	17.3 %	20.0 %
Portugal	71	78	94	96	92	96	94	93	94	31 %	1.1 %	0.7 %	1.4 %
Romania	144	136	136	137	126	119	122	115	116	– 20 %	0.2 %	1.4 %	1.7 %
Slovakia	105	68	68	68	57	57	60	63	72	– 31 %	14.8 %	1.0 %	1.1 %
Slovenia	NR	NR	NR	NR	NR	NR	NR	NR	NR				
Spain	262	294	380	415	390	397	397	378	392	50 %	3.8 %	2.5 %	5.8 %
Sweden	213	172	134	157	188	173	176	173	171	– 20 %	– 1.3 %	2.1 %	2.5 %
United Kingdom	1 065	1 028	701	507	448	430	403	440	439	– 59 %	– 0.3 %	10.3 %	6.4 %
EU-28 ([a])	**10 355**	**8 915**	**7 634**	**7 043**	**7 042**	**6 936**	**6 882**	**6 758**	**6 822**	**– 34 %**	**0.9 %**	**100 %**	**100 %**
EU-28 ([b])	10 303	8 863	7 582	6 991	7 042	6 936	6 882	6 758	6 822				

Notes: Dark-grey shaded cells indicate that no emission values are available (n/a, not available). See Appendix 1 for an explanation of the notation keys reported by Member States.

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

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

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

3.21 Dioxin and furan emission trends and key categories

Between 1990 and 2014, PCDD/F emissions dropped in the EU-28 by 85 %. Between 2013 and 2014, the decrease was 2.3 % (see Table 3.22), mainly because Italy, Bulgaria, Belgium and Malta reported decreased emissions. The Member States that contributed most (i.e. more than 10 %) to PCDD/F emissions in 2014 were Italy, Poland, the United Kingdom and Romania. Greece did not report PCDD/F emissions for any year, so data were not gap-filled. The EU-28 total is therefore an underestimate.

The decrease of dioxin emissions in France (1990–2012) is due to regulations limiting emissions, especially in the field of waste incineration, industrial energy processes (steel and metallurgy) and combustion in manufacturing (see France's IIR, listed in Appendix 5). The drop in dioxin emissions between 1995 and 2000 is due to improvements in sinter plants (personal communication by France in 2013).

Cyprus explained that the strong decrease in dioxin emissions in 2003 is because its only clinical waste incineration plant shut down in 2003 (comment received from Cyprus in 2016).

The strong decrease of emissions in Finland between 2004 and 2005 is because the emission factors changed. It was not possible to change the whole time series accordingly (comment received from Finland in 2016).

Table 3.22 Member State contributions to EU emissions of PCDD/Fs

	PCDD/Fs (g I-TEQ)									Change		Share in EU-28	
Member State	**1990**	**1995**	**2000**	**2005**	**2010**	**2011**	**2012**	**2013**	**2014**	**1990–2014**	**2013–2014**	**1990**	**2014**
Austria	161	58	52	38	37	34	34	38	32	– 80 %	– 16.2 %	1.4 %	1.7 %
Belgium	576	398	117	60	53	44	50	43	36	– 94 %	– 16.7 %	4.9 %	2.0 %
Bulgaria	74	97	112	110	43	51	57	60	50	– 33 %	– 16.6 %	0.6 %	2.8 %
Croatia	29	16	19	18	12	12	13	11	20	– 32 %	84.7 %	0.2 %	1.1 %
Cyprus	2.0	2.2	2.3	0.4	0.3	0.3	0.4	0.5	0.3	– 83 %	– 34.4 %	0.0 %	0.0 %
Czech Republic	1 252	1 135	481	305	80	63	28	26	29	– 98 %	12.1 %	10.6 %	1.6 %
Denmark	67	49	32	26	26	24	23	22	22	– 67 %	1.5 %	0.6 %	1.2 %
Estonia	8.1	5.6	6.7	5.7	6.4	6.3	4.7	3.7	3.9	– 51 %	7.3 %	0.1 %	0.2 %
Finland	34	37	34	12	15	13	14	12	13	– 61 %	7.6 %	0.3 %	0.7 %
France	1 782	1 722	557	236	141	132	119	123	117	– 93 %	– 4.5 %	15.1 %	6.5 %
Germany	750	231	151	70	71	68	65	66	62	– 92 %	– 6.0 %	6.3 %	3.4 %
Greece	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a				
Hungary	113	70	56	45	52	55	53	45	44	– 61 %	– 1.9 %	1.0 %	2.4 %
Ireland	67	49	40	39	31	30	29	30	28	– 59 %	– 8.0 %	0.6 %	1.5 %
Italy	504	484	404	329	311	270	287	283	269	– 47 %	– 4.9 %	4.3 %	14.8 %
Latvia	25	24	23	27	17	17	18	16	16	– 38 %	– 0.9 %	0.2 %	0.9 %
Lithuania	23	15	17	19	21	20	21	26	27	18 %	2.8 %	0.2 %	1.5 %
Luxembourg	13	21	5.3	1.5	1.7	1.7	1.0	0.9	1.0	– 92 %	5.6 %	0.1 %	0.1 %
Malta	1.0	1.0	1.0	1.0	8.6	1.0	1.0	12	4.5	> 100 %	– 61.2 %	0.0 %	0.2 %
Netherlands	742	66	31	29	31	31	25	25	22	– 97 %	– 12.1 %	6.3 %	1.2 %
Poland	278	303	209	209	228	228	241	243	241	– 13 %	– 1.0 %	2.3 %	13.3 %
Portugal	525	524	329	126	203	183	102	132	128	– 76 %	– 2.9 %	4.4 %	7.1 %
Romania	3 073	2 063	1 053	210	203	212	220	191	195	– 94 %	2.2 %	26.0 %	10.8 %
Slovakia	169	150	107	86	61	46	50	47	53	– 69 %	13.4 %	1.4 %	2.9 %
Slovenia	19	13	12	14	16	16	15	16	14	– 26 %	– 13.1 %	0.2 %	0.8 %
Spain	181	157	126	117	119	122	116	122	127	– 30 %	3.7 %	1.5 %	7.0 %
Sweden	67	47	39	46	49	45	44	45	42	– 37 %	– 6.5 %	0.6 %	2.3 %
United Kingdom	1 303	843	328	265	229	209	211	216	215	– 83 %	– 0.6 %	11.0 %	11.9 %
EU-28 (a)	**11 836**	**8 584**	**4 347**	**2 444**	**2 065**	**1 937**	**1 844**	**1 854**	**1 811**	**– 85 %**	**– 2.3 %**	**100 %**	**100 %**
EU-28 (b)	11 836	8 584	4 347	2 445	2 066	1 937	1 844	1 854	1 811				

Notes: Dark-grey shaded cells indicate that no emission values are available (n/a, not available). See Appendix 1 for an explanation of the notation keys reported by Member States.

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

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

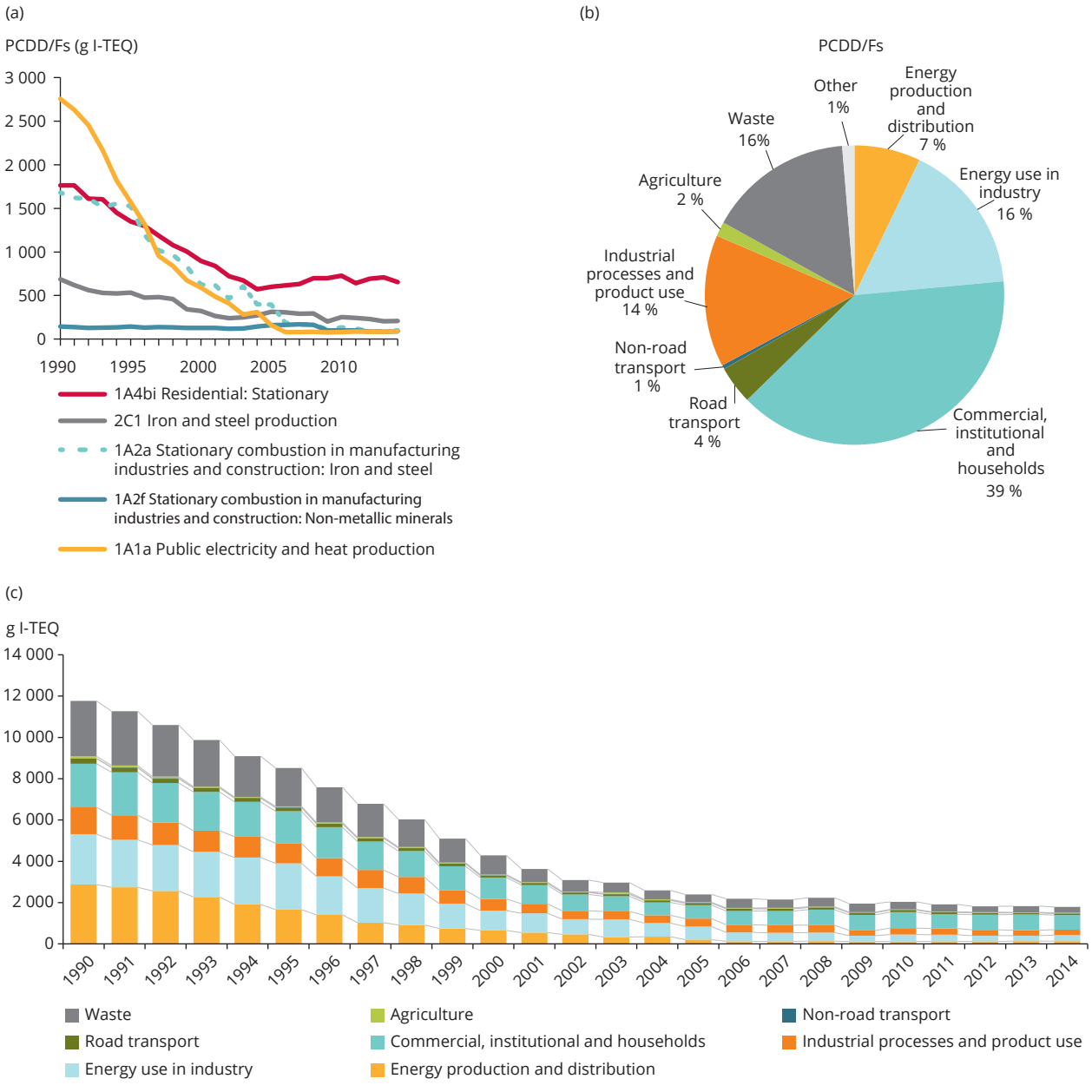
(b) Sum of sectors: differences arise when only national totals and no sectoral data are available.

I-Teq, international toxic equivalent.

'1A4bi — Residential: Stationary' and '2C1 — Iron and steel production' were the primary key categories for PCDD/F emissions, together making up 48 % of total PCDD/F emissions (see Figure 3.15(a)). Among the top five key categories, the highest relative reductions in emissions between 1990 and 2014 were in the fifth most important, '1A1a — Public electricity and heat production' (− 96.7 %). The third most important, '1A2a — Stationary combustion in manufacturing industry and construction: Iron and steel'(− 94 %), also saw high reductions.

Figure 3.15(b) shows the contribution that each aggregated sector group made to total EU-28 emissions. The 'commercial, institutional and households' sector group is an important source of PCDD/Fs and also of $PM_{2.5}$, PM_{10}, total PAHs and PCBs.

Figure 3.15 PCDD/F emissions in the EU-28: (a) trend in emissions from the five most important key categories, 1990–2014; (b) share by sector group, 2014; (c) sectoral trends in emissions



3.22 Total polycyclic aromatic hydrocarbon emission trends and key categories

Between 1990 and 2014, total PAH emissions dropped in the EU-28 by 60 %. Between 2013 and 2014, they decreased by 3.5 %, mainly because Germany, Poland, Italy and Finland reported decreased emissions (see Table 3.23). The Member States that contributed most (i.e. more than 10 %) to total PAH emissions in 2014 were Spain, Germany, Poland and Portugal. Greece did not report PAH emissions for any year, so data were not gap-filled. The EU-28 total is therefore an underestimate.

'1A4bi — Residential: Stationary' was the principal key category for these emissions, making up 52 % of total PAH emissions (see Figure 3.16(a)). Among the key categories, the highest relative reductions in emissions between 1990 and 2014 were in the most important category, '1A4bi — Residential: Stationary' (− 63.5 %). On the other hand, the third most important key category, '1A3bi — Road transport: Passenger cars', shows an increase from 2013 to 2014, although the values are relatively small compared with the most important key category. The relative increase in emissions between 1990 and 2014 for this key category was 73.1 %.

Table 3.23 Member State contributions to EU total emissions of PAHs

	Total PAHs (Mg)									Change		Share in EU-28	
Member State	**1990**	**1995**	**2000**	**2005**	**2010**	**2011**	**2012**	**2013**	**2014**	**1990–2014**	**2013–2014**	**1990**	**2014**
Austria	16	8.8	7.4	6.7	6.0	5.4	5.6	6.2	4.9	– 70 %	– 21.3 %	0.6 %	0.4 %
Belgium	79	66	43	37	33	31	29	28	23	– 71 %	– 19.5 %	2.9 %	2.0 %
Bulgaria	50	66	57	55	29	32	32	30	28	– 44 %	– 7.2 %	1.8 %	2.5 %
Croatia	16	5.3	5.9	5.6	4.7	4.8	4.6	4.2	8.0	– 49 %	87.3 %	0.6 %	0.7 %
Cyprus	1.7	1.4	1.1	0.9	0.6	0.6	0.5	0.4	0.5	– 73 %	9.9 %	0.1 %	0.0 %
Czech Republic	752	1 357	28	27	26	22	23	23	20	– 97 %	– 15.3 %	27.2 %	1.8 %
Denmark	5.2	5.8	6.2	8.3	8.9	7.9	7.3	7.2	6.4	22 %	– 12.3 %	0.2 %	0.6 %
Estonia	9.0	10.0	8.7	7.8	8.4	7.1	7.2	7.2	7.0	– 22 %	– 2.6 %	0.3 %	0.6 %
Finland	15	17	14	12	17	15	16	16	9.7	– 37 %	– 37.4 %	0.6 %	0.9 %
France	45	43	34	26	23	19	20	21	19	– 57 %	– 9.5 %	1.6 %	1.7 %
Germany	378	165	158	146	208	182	173	184	158	– 58 %	– 14.1 %	13.6 %	14.2 %
Greece	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a				
Hungary	85	33	17	17	17	19	18	17	15	– 83 %	– 12.4 %	3.1 %	1.3 %
Ireland	49	31	23	21	20	18	18	19	16	– 66 %	– 12.4 %	1.8 %	1.5 %
Italy	99	101	68	73	96	74	91	86	77	– 22 %	– 10.8 %	3.6 %	6.9 %
Latvia	17	17	17	14	11	11	11	9. 8	9. 6	– 45 %	– 2.1 %	0.6 %	0.9 %
Lithuania	18	8.5	9.0	10	11	11	11	11	10	– 42 %	– 6.8 %	0.6 %	0.9 %
Luxembourg	4.8	2.7	1.0	1.1	1.0	0.9	0.5	0.5	0.5	– 89 %	0.0 %	0.2 %	0.0 %
Malta	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	32	> 100 %	> 100 %	0.0 %	2.9 %
Netherlands	20	10	5.1	5.1	4.8	5.0	4.6	4.6	4.7	– 77 %	0.3 %	0.7 %	0.4 %
Poland	147	211	148	156	148	143	145	155	143	– 3 %	– 7.7 %	5.3 %	12.9 %
Portugal	154	146	145	116	109	114	115	117	116	– 25 %	– 1.1 %	5.6 %	10.4 %
Romania	274	182	91	88	87	84	83	79	80	– 71 %	1.3 %	9.9 %	7.2 %
Slovakia	29	15	13	19	18	19	19	20	19	– 34 %	– 2.0 %	1.0 %	1.7 %
Slovenia	8.7	6.0	5.1	5.7	6.3	6.4	6.3	6.4	5.6	– 36 %	– 12.8 %	0.3 %	0.5 %
Spain	273	262	226	175	223	233	171	265	266	– 3 %	0.1 %	9.8 %	23.8 %
Sweden	18	18	15	19	13	14	13	13	12	– 33 %	– 5.3 %	0.7 %	1.1 %
United Kingdom	205	94	19	16	21	19	22	25	24	– 88 %	– 4.4 %	7.4 %	2.1 %
EU-28 (a)	**2 767**	**2 883**	**1 165**	**1 069**	**1 150**	**1 096**	**1 046**	**1 156**	**1 116**	**– 60 %**	**– 3.5 %**	**100 %**	**100 %**
EU-28 (b)	2 768	2 884	1 166	1 069	1 150	1 096	1 046	1 157	1 116				

Notes: Dark-grey shaded cells indicate that no emission values are available (n/a, not available). See Appendix 1 for an explanation of the notation keys reported by Member States.

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

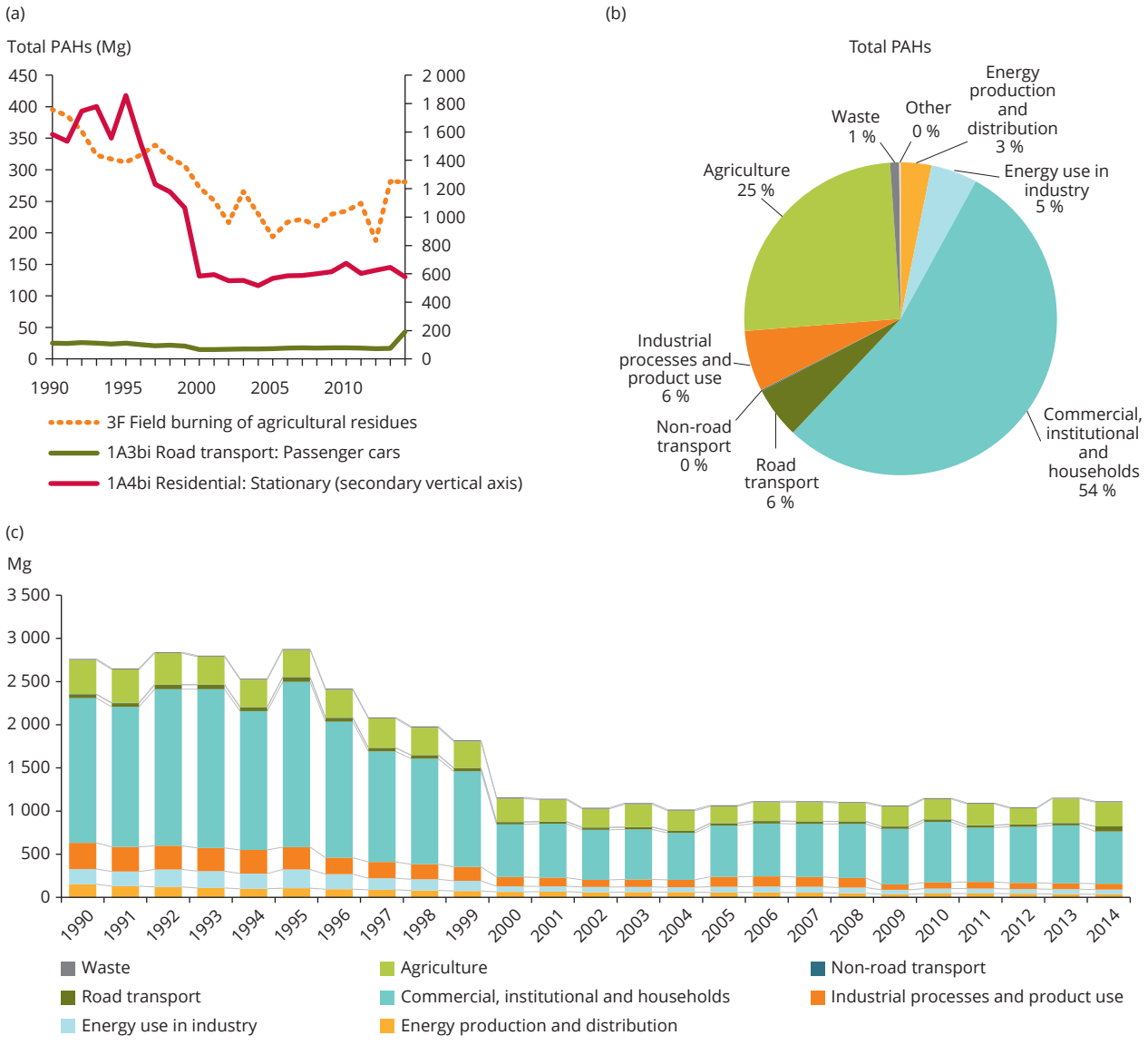
(a) Sum of national totals as reported by Member States.

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

Emissions from these sources have declined overall since 1990, thanks to less residential use of coal, improvements in abatement technologies for metal refining and smelting, and stricter regulations on emissions from the 'road transport' sector (EEA, 2015b).

Figure 3.16(b) shows the contribution that each aggregated sector group made to total EU-28 emissions. The 'commercial, institutional and households' sector group is a very important source of total PAHs, as well as of $PM_{2.5}$, PM_{10}, PCDD/Fs and PCBs.

Figure 3.16 Total PAH emissions in the EU-28: (a) trend in emissions from the three most important key categories, 1990–2014; (b) share by sector group, 2014; (c) sectoral trends in emissions



3.23 Benzo(a)pyrene emission trends and key categories

Between 1990 and 2014, B(a)P emissions in the EU-28 dropped by 51 %. Between 2013 and 2014, they decreased by 4.6 %, mainly because emissions decreased in Germany, Poland, the Czech Republic and Hungary (see Table 3.24). The Member States that contributed most (i.e. more than 10 %) to B(a)P emissions in 2014 were Poland, Germany, Romania and Portugal. Several Member States did not provide data for B(a)P, and several of these gaps could not be filled with data. The EU-28 total is therefore an underestimate.

'1A4bi — Residential: Stationary' was the principal key category for B(a)P emissions, accounting for 68 % of the total. The highest relative reductions in

Table 3.24 Member State contributions to EU emissions of B(a)P

	Benzo(a)pyrene (Mg)									Change		Share in EU-28	
Member State	**1990**	**1995**	**2000**	**2005**	**2010**	**2011**	**2012**	**2013**	**2014**	**1990–2014**	**2013–2014**	**1990**	**2014**
Austria	NR	NR	NR	NR	NR	NR	NR	NR	NR				
Belgium	NE	NE	NE	NE	NE	NE	NE	NE	NE				
Bulgaria	8.0	6.2	6.6	7.6	8.1	8.9	9.0	8.5	7.8	– 2 %	– 7.9 %	2.1 %	4.2 %
Croatia	4.8	1.7	1.9	1.9	1.6	1.6	1.6	1.5	2.7	– 45 %	71.8 %	1.3 %	1.4 %
Cyprus	0.3	0.2	0.1	0.1	0.0	0.0	0.0	0.0	0.0	– 89 %	– 8.3 %	0.1 %	0.0 %
Czech Republic	11	11	11	11	11	9.4	9.9	10	8.7	– 20 %	– 14.3 %	2.8 %	4.7 %
Denmark	1.6	1.8	2.0	2.7	2.9	2.5	2.4	2.3	2.0	24 %	– 13.4 %	0.4 %	1.1 %
Estonia	2.5	2.8	2.4	2.2	2.4	2.0	2.1	2.1	2.0	– 21 %	– 3.9 %	0.7 %	1.1 %
Finland	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	> 100 %	> 100 %	0.0 %	0.1 %
France	13	12	9.6	7.2	6.2	5.3	5.7	5.9	5.3	– 58 %	– 9.7 %	3.3 %	2.9 %
Germany	139	48	31	23	34	30	28	30	25	– 82 %	– 15.4 %	36.3 %	13.6 %
Greece	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a				
Hungary	27	10.5	5.4	5.2	5.4	6.0	5.7	5.3	4.6	– 83 %	– 13.0 %	7.1 %	2.5 %
Ireland	14	8.7	6.2	5.9	5.5	5.1	4.9	5.3	4.6	– 67 %	– 12.4 %	3.6 %	2.5 %
Italy	NE	NE	NE	NE	NE	NE	NE	NE	NE				
Latvia	6.4	6.1	6.4	4.9	3.7	3.8	3.9	3.5	3.4	– 47 %	– 1.7 %	1.7 %	1.8 %
Lithuania	5.4	2.8	3.1	3.4	3.8	3.7	3.7	3.7	3.4	– 36 %	– 6.1 %	1.4 %	1.9 %
Luxembourg	1.3	0.8	0.3	0.3	0.3	0.3	0.1	0.1	0.1	– 89 %	0.0 %	0.3 %	0.1 %
Malta	0	0	0	0	0.0	0.0	0.0	0.0	3.4	> 100 %	> 100 %	0.0 %	1.8 %
Netherlands	5.2	3.1	1.8	1.8	1.6	1.6	1.6	1.6	1.6	– 69 %	1.9 %	1.4 %	0.9 %
Poland	36	49	36	38	45	43	44	46	43	20 %	– 6.7 %	9.4 %	23.2 %
Portugal	26	25	26	22	20	22	23	24	23	– 11 %	– 1.6 %	6.8 %	12.5 %
Romania	7.8	11	14	26	27	26	26	24	25	> 100 %	1.1 %	2.1 %	13.3 %
Slovakia	3.2	3.3	3.7	5.2	5.0	5.3	5.3	5.6	5.5	72 %	– 1.8 %	0.8 %	2.9 %
Slovenia	2.9	2.2	2.0	2.2	2.6	2.6	2.5	2.6	2.2	– 24 %	– 15.5 %	0.8 %	1.2 %
Spain	IE	IE	IE	IE	IE	IE	IE	IE	IE				
Sweden	5.3	5.2	4.4	5.5	4.1	4.1	4.0	4.0	3.7	– 29 %	– 6.0 %	1.4 %	2.0 %
United Kingdom	62	22	6.5	5.4	7.3	6.6	7.8	8.8	8.3	– 86 %	– 5.1 %	16.1 %	4.5 %
EU-28 (a)	**382**	**235**	**181**	**182**	**198**	**190**	**190**	**195**	**186**	**– 51 %**	**– 4.6 %**	**100 %**	**100 %**
EU-28 (b)	382	235	181	182	198	190	190	195	186				

Notes: Dark-grey shaded cells indicate that no emission values are available (n/a, not available). See Appendix 1 for an explanation of the notation keys reported by Member States.

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

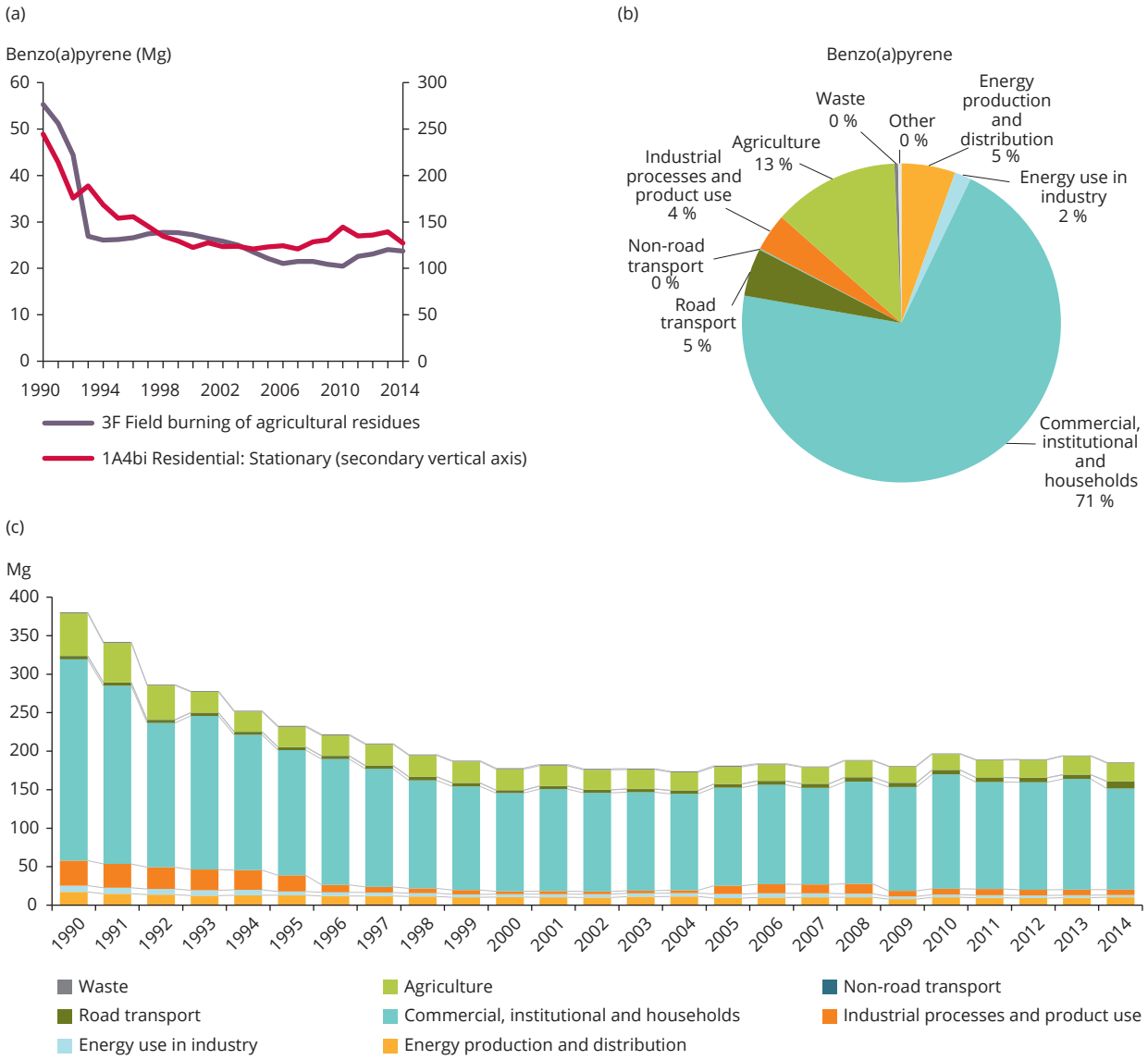
(a) Sum of national totals as reported by Member States.

(b) Sum of sectors.

emissions between 1990 and 2014 were in the second most important key category, '3F — Field burning of agricultural residues' (− 57.1 %), and the most important, '1A4bi — Residential: Stationary' (− 47.9 %) (see Figure 3.17(a)).

Figure 3.17(b) shows the contribution that each aggregated sector group made to total EU-28 emissions. For B(a)P, the chief emission source is 'commercial, institutional and households'.

Figure 3.17 B(a)P emissions in the EU-28: (a) (a) trend in emissions from the two most important key categories, 1990–2014; (b) share by sector group, 2014; (c) sectoral trends in emissions



3.24 Benzo(b)fluoranthene emission trends

Between 1990 and 2014, B(b)F emissions in the EU-28 decreased by 38 %. Between 2013 and 2014, they decreased by 1.2 %, mainly because emissions reduced in Poland, Ireland, Bulgaria and Hungary (see Table 3.25). The Member States that contributed most (i.e. more than 10 %) to B(b)F emissions in 2014 were Poland, Portugal and Romania. Several Member States did not provide data for B(b)F, and some of these gaps could not be filled with data. The EU-28 total is therefore an underestimate.

Sweden explained that the marked decline in its B(b)F emissions between 2008 and 2009 was because aluminium production changed (2C3). Aluminium production was a key source of PAH emissions in Sweden before 2009. Currently, primary aluminium production takes place in one facility, which historically used both the prebaked and the Söderberg processes. All pot-lines operating the Söderberg technology shut down by December 2008. Closing down the Söderberg ovens also ended the need for anode production in late 2008. For this reason, there was a pronounced decrease in PAH (B(b)F) emissions (personal communication by Sweden in 2015).

Table 3.25 Member State contributions to EU emissions of B(b)F

	Benzo(b)fluoranthene (Mg)									Change		Share in EU-28	
Member State	**1990**	**1995**	**2000**	**2005**	**2010**	**2011**	**2012**	**2013**	**2014**	**1990–2014**	**2013–2014**	**1990**	**2014**
Austria	NR	NR	NR	NR	NR	NR	NR	NR	NR				
Belgium	NE	NE	NE	NE	NE	NE	NE	NE	NE				
Bulgaria	11	8.3	7.9	8.8	9.3	10	10	9.6	8.7	– 20 %	– 9.5 %	3.6 %	4.7 %
Croatia	5.6	1.9	2.0	1.9	1.6	1.6	1.6	1.4	2.7	– 51 %	96.0 %	1.9 %	1.5 %
Cyprus	0.8	0.7	0.5	0.4	0.3	0.3	0.3	0.2	0.2	– 73 %	10.5 %	0.3 %	0.1 %
Czech Republic	5.8	5.8	5.7	5.4	5.3	4.5	4.6	4.8	4.1	– 30 %	– 14.3 %	2.0 %	2.2 %
Denmark	1.7	1.9	2.1	2.8	3.0	2.7	2.5	2.5	2.2	33 %	– 10.8 %	0.6 %	1.2 %
Estonia	2.8	2.8	2.5	2.4	2.6	2.2	2.3	2.2	2.3	– 19 %	3.6 %	1.0 %	1.2 %
Finland	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	> 100 %	> 100 %	0.0 %	0.1 %
France	15	14	11	8.5	7.5	6.5	6.8	7.1	6.4	– 57 %	– 9.5 %	5.1 %	3.5 %
Germany	3.2	1.3	1.3	1.2	1.2	1.2	1.2	1.3	1.3	– 59 %	1.6 %	1.1 %	0.7 %
Greece	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a				
Hungary	32	12	6.3	6.1	5.9	6.6	6.3	5.9	5.2	– 84 %	– 12.7 %	10.8 %	2.8 %
Ireland	20	13	9.8	9.2	8.4	7.7	7.5	7.9	6.9	– 66 %	– 12.6 %	6.9 %	3.7 %
Italy	NE	NE	NE	NE	NE	NE	NE	NE	NE				
Latvia	5.9	5.3	5.1	4.5	3.5	3.6	3.6	3.2	3.1	– 46 %	– 2.1 %	2.0 %	1.7 %
Lithuania	7.1	3.0	3.0	3.5	4.0	3.9	3.9	3.9	3.6	– 49 %	– 6.9 %	2.4 %	2.0 %
Luxembourg	1.5	0.9	0.4	0.4	0.4	0.3	0.2	0.2	0.2	– 87 %	0.0 %	0.5 %	0.1 %
Malta	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	5.3	> 100 %	> 100 %	0.0 %	2.9 %
Netherlands	7.9	3.3	1.7	1.6	1.6	1.7	1.5	1.5	1.5	– 81 %	– 0.8 %	2.6 %	0.8 %
Poland	33	52	38	40	44	43	44	47	43	30 %	– 8.4 %	11.0 %	23.1 %
Portugal	54	50	48	43	40	41	41	42	42	– 23 %	– 0.6 %	18.1 %	22.5 %
Romania	0.1	0.1	0.1	29	29	28	28	26	27	> 100 %	1.6 %	0.0 %	14.5 %
Slovakia	4.2	4.3	4.4	6.9	6.5	6.9	6.9	7.1	6.9	64 %	– 2.0 %	1.4 %	3.7 %
Slovenia	2.7	1.8	1.4	1.5	1.5	1.5	1.5	1.5	1.4	– 50 %	– 9.6 %	0.9 %	0.7 %
Spain	IE	IE	IE	IE	IE	IE	IE	IE	IE				
Sweden	6.8	6.6	5.6	7.6	4.4	4.4	4.3	4.3	4.0	– 41 %	– 6.7 %	2.3 %	2.2 %
United Kingdom	76	40	5.2	5.0	6.4	5.6	6.9	7.8	7.5	– 90 %	– 3.8 %	25.6 %	4.1 %
EU-28 (a)	**298**	**229**	**162**	**189**	**187**	**183**	**185**	**187**	**185**	**– 38 %**	**– 1.2 %**	**100 %**	**100 %**
EU-28 (b)	298	229	162	189	186	183	185	187	185				

Notes: Dark-grey shaded cells indicate that no emission values are available (n/a, not available). See Appendix 1 for an explanation of the notation keys reported by Member States.

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

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

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

3.25 Benzo(k)fluoranthene emission trends

Between 1990 and 2014, B(k)F emissions in the EU-28 decreased by 34 %. Between 2013 and 2014, they rose by 22.6 %, mainly because emissions increased in Malta (see Table 3.26). The Member States that contributed most (i.e. more than 10 %) to B(k)F emissions in 2014 were Malta, Portugal, Romania and Poland. Several Member States did not provide data for B(k)F, and several of these gaps could not be filled with data. The EU-28 total is therefore an underestimate.

Table 3.26 Member State contributions to EU emissions of B(k)F

	Benzo(k)fluoranthene (Mg)									Change		Share in EU-28	
Member State	**1990**	**1995**	**2000**	**2005**	**2010**	**2011**	**2012**	**2013**	**2014**	**1990–2014**	**2013–2014**	**1990**	**2014**
Austria	NR	NR	NR	NR	NR	NR	NR	NR	NR				
Belgium	NE	NE	NE	NE	NE	NE	NE	NE	NE				
Bulgaria	4.6	3.6	4.0	4.6	5.0	5.4	5.4	5.2	4.8	4 %	– 7.5 %	2.9 %	4.5 %
Croatia	2.4	0.7	0.7	0.7	0.6	0.6	0.6	0.5	1.0	– 58 %	91.2 %	1.5 %	1.0 %
Cyprus	0.4	0.4	0.3	0.3	0.2	0.2	0.2	0.2	0.2	– 55 %	15.7 %	0.2 %	0.2 %
Czech Republic	5.1	5.1	5.1	4.7	4.4	3.7	3.9	4.0	3.3	– 35 %	– 16.7 %	3.2 %	3.2 %
Denmark	0.6	0.7	0.8	1.1	1.2	1.0	1.0	1.0	0.9	36 %	– 9.8 %	0.4 %	0.8 %
Estonia	1.7	1.8	1.6	1.4	1.4	1.2	1.2	1.3	1.2	– 29 %	– 8.0 %	1.0 %	1.1 %
Finland	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	> 100 %	> 100 %	0.0 %	0.1 %
France	9.2	9.0	7.1	5.4	4.7	4.0	4.2	4.4	4.0	– 57 %	– 9.4 %	5.8 %	3.8 %
Germany	1.8	1.0	1.0	0.9	0.9	0.9	0.9	0.9	0.9	– 48 %	0.5 %	1.1 %	0.9 %
Greece	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a				
Hungary	13	5.0	2.6	2.5	2.5	2.7	2.6	2.5	2.2	– 83 %	– 11.7 %	8.0 %	2.1 %
Ireland	7.8	5.0	3.6	3.4	3.2	2.9	2.8	3.0	2.6	– 66 %	– 12.2 %	4.9 %	2.5 %
Italy	NE	NE	NE	NE	NE	NE	NE	NE	NE				
Latvia	2.4	2.1	2.1	1.7	1.3	1.4	1.4	1.2	1.2	– 49 %	– 1.7 %	1.5 %	1.2 %
Lithuania	2.8	1.2	1.2	1.4	1.6	1.5	1.5	1.5	1.4	– 50 %	– 7.2 %	1.8 %	1.3 %
Luxembourg	1.0	0.5	0.2	0.2	0.2	0.2	0.1	0.1	0.1	– 93 %	0.0 %	0.6 %	0.1 %
Malta	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	23	> 100 %	> 100 %	0.0 %	21.6 %
Netherlands	4.0	2.3	0.9	0.8	0.8	0.8	0.8	0.8	0.8	– 80 %	0.3 %	2.5 %	0.7 %
Poland	33	52	38	40	13	12	12	13	12	– 64 %	– 6.8 %	20.7 %	11.4 %
Portugal	26	24	24	20	20	21	21	21	21	– 21 %	– 1.4 %	16.6 %	19.9 %
Romania	0.1	0.1	0.1	18	17	17	16	16	16	> 100 %	0.8 %	0.1 %	15.2 %
Slovakia	1.8	1.9	2.0	2.9	2.8	2.8	2.9	2.9	2.9	58 %	– 1.3 %	1.1 %	2.7 %
Slovenia	1.7	1.3	1.1	1.3	1.5	1.5	1.5	1.5	1.3	– 24 %	– 15.7 %	1.0 %	1.2 %
Spain	IE	IE	IE	IE	IE	IE	IE	IE	IE				
Sweden	1.8	1.8	1.5	1.6	1.7	1.7	1.6	1.6	1.5	– 14 %	– 6.6 %	1.1 %	1.4 %
United Kingdom	38	20	3.5	3.0	2.7	2.4	2.9	3.3	3.2	– 92 %	– 3.4 %	23.7 %	3.0 %
EU-28 (a)	**159**	**139**	**101**	**116**	**86**	**85**	**85**	**86**	**105**	**– 34 %**	**22.6 %**	**100 %**	**100 %**
EU-28 (b)	159	139	101	116	86	85	85	86	105				

Notes: Dark-grey shaded cells indicate that no emission values are available (n/a, not available). See Appendix 1 for an explanation of the notation keys reported by Member States.

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

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

(b) Sum of sectors.

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

Between 1990 and 2014, IP emissions in the EU-28 fell by 25 %. Between 2013 and 2014, emissions decreased by 2.4 %, mainly because Poland, the Czech Republic, France and Bulgaria reported decreased emissions (see Table 3.27). The Member States that contributed most (i.e. more than 10 %) to IP emissions in 2014 were Poland, Portugal and Romania. Several Member States did not provide data for IP, and some of these gaps could not be filled with data. The EU-28 total is therefore an underestimate.

Table 3.27 Member State contributions to EU emissions of IP

	Indeno(1,2,3-cd)pyrene (Mg)									Change		Share in EU-28	
Member State	**1990**	**1995**	**2000**	**2005**	**2010**	**2011**	**2012**	**2013**	**2014**	**1990–2014**	**2013–2014**	**1990**	**2014**
Austria	NR	NR	NR	NR	NR	NR	NR	NR	NR				
Belgium	NE	NE	NE	NE	NE	NE	NE	NE	NE				
Bulgaria	4.1	3.3	4.0	4.6	5.1	5.5	5.6	5.3	5.0	21 %	– 6.5 %	2.7 %	4.3 %
Croatia	2.3	1.0	1.1	1.1	0.8	0.9	0.8	0.7	1.5	– 35 %	> 100 %	1.5 %	1.3 %
Cyprus	0.2	0.2	0.1	0.1	0.0	0.0	0.0	0.0	0.0	– 90 %	– 8.6 %	0.1 %	0.0 %
Czech Republic	6.2	6.2	6.2	5.7	5.2	4.3	4.4	4.6	3.7	– 40 %	– 18.2 %	4.0 %	3.2 %
Denmark	1.3	1.3	1.3	1.8	1.8	1.6	1.5	1.5	1.3	– 1 %	– 14.7 %	0.8 %	1.1 %
Estonia	1.9	2.6	2.2	1.8	2.0	1.6	1.7	1.6	1.5	– 21 %	– 5.1 %	1.2 %	1.3 %
Finland	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	> 100 %	> 100 %	0.0 %	0.1 %
France	7.9	7.7	6.1	4.7	4.1	3.6	3.8	3.9	3.6	– 55 %	– 9.1 %	5.1 %	3.1 %
Germany	1.3	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	– 45 %	2.8 %	0.8 %	0.6 %
Greece	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a				
Hungary	13	5.5	2.9	2.7	3.0	3.3	3.2	3.0	2.7	– 79 %	– 11.5 %	8.2 %	2.3 %
Ireland	6.7	4.2	3.1	2.9	2.7	2.5	2.4	2.6	2.3	– 66 %	– 12.3 %	4.3 %	2.0 %
Italy	NE	NE	NE	NE	NE	NE	NE	NE	NE				
Latvia	2.9	3.1	3.2	2.7	2.0	2.1	2.1	1.9	1.8	– 37 %	– 2.9 %	1.9 %	1.6 %
Lithuania	2.6	1.6	1.8	2.0	2.1	2.1	2.1	2.1	1.9	– 27 %	– 6.3 %	1.7 %	1.7 %
Luxembourg	1.0	0.5	0.2	0.2	0.2	0.2	0.1	0.1	0.1	– 90 %	0.0 %	0.6 %	0.1 %
Malta	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	3.6	> 100 %	> 100 %	0.0 %	3.1 %
Netherlands	2.8	1.4	0.8	0.8	0.8	0.9	0.8	0.8	0.8	– 72 %	– 0.6 %	1.8 %	0.7 %
Poland	45	59	37	39	47	44	45	50	46	1 %	– 8.1 %	29.3 %	39.4 %
Portugal	19	18	18	15	14	15	15	16	16	– 19 %	– 1.4 %	12.3 %	13.4 %
Romania	0.1	0.1	0.1	14	14	13	13	12	13	> 100 %	1.5 %	0.0 %	10.9 %
Slovakia	2.9	3.0	3.1	4.0	3.8	3.9	4.0	4.0	3.9	36 %	– 2.6 %	1.9 %	3.4 %
Slovenia	0.8	0.5	0.4	0.4	0.5	0.5	0.4	0.4	0.4	– 48 %	– 5.2 %	0.5 %	0.4 %
Spain	IE	IE	IE	IE	IE	IE	IE	IE	IE				
Sweden	3.0	3.1	2.6	3.1	2.4	2.4	2.3	2.3	2.1	– 29 %	– 6.3 %	2.0 %	1.9 %
United Kingdom	30	13	3.7	3.2	4.4	3.9	4.7	5.2	4.9	– 83 %	– 5.0 %	19.2 %	4.2 %
EU-28 (a)	**155**	**135**	**98**	**110**	**117**	**112**	**114**	**119**	**116**	**– 25 %**	**– 2.3 %**	**100 %**	**100 %**
EU-28 (b)	155	135	98	110	117	112	114	119	116				

Notes: Dark-grey shaded cells indicate that no emission values are available (n/a, not available). See Appendix 1 for an explanation of the notation keys reported by Member States.

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

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

(b) Sum of sectors.

3.27 Hexachlorobenzene emission trends and key categories

Between 1990 and 2014, HCB emissions in the EU-28 fell by 95 %. Between 2013 and 2014, the increase was 3.4 %, mainly because emissions increased in Finland, Germany, the United Kingdom and Bulgaria (see Table 3.28). The Member State that contributed most (i.e. more than 10 %) to HCB emissions in 2014 was Austria. Greece did not report HCB emissions for any year, so data were not gap-filled. The EU-28 total is therefore an underestimate.

Austria explained that in 2014 the sector '1A — Fuel combustion activities' increased its share to 97%. The reason is that an Austrian cement plant unintentionally released HCB, significantly increasing emissions between 2012 and 2014. The accidental releases happened because HCB-contaminated material (lime) was co-incinerated at too low temperatures, which did not destroy the HCB (personal communication by Austria in 2016, and Appendix 5, Austria's IIR).

Belgium explained the jump in HCB emissions from 1990 to 1995 by (much) higher amounts of burned

Table 3.28 Member State contributions to EU emissions of HCBs

	HCB (kg)									Change		Share in EU-28	
Member State	**1990**	**1995**	**2000**	**2005**	**2010**	**2011**	**2012**	**2013**	**2014**	**1990–2014**	**2013–2014**	**1990**	**2014**
Austria	92	53	44	43	40	37	62	144	141	53 %	– 2.3 %	1.6 %	48.3 %
Belgium	70	199	51	20	14	30	20	8.6	9.0	– 87 %	3.8 %	1.2 %	3.1 %
Bulgaria	23	25	20	21	19	22	16	14	16	– 31 %	15.9 %	0.4 %	5.5 %
Croatia	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.3	63 %	98.6 %	0.0 %	0.1 %
Cyprus	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	– 81 %	25.4 %	0.0 %	0.0 %
Czech Republic	4.5	9.4	14	8.7	6.2	4.5	4.1	4.4	3.7	– 19 %	– 16.4 %	0.1 %	1.3 %
Denmark	27	8.4	5.7	3.8	2.9	2.7	2.5	2.7	2.5	– 91 %	– 7.2 %	0.5 %	0.9 %
Estonia	0.2	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	44 %	– 17.1 %	0.0 %	0.1 %
Finland	39	38	42	36	13	30	13	21	26	– 33 %	23.2 %	0.7 %	9.0 %
France	1 197	70	44	12	6.8	6.7	6.8	6.5	6.3	– 99 %	– 3.9 %	20.4 %	2.1 %
Germany	27	8.0	9.5	8.7	7.9	7.9	7.0	7.5	10	– 63 %	35.7 %	0.5 %	3.5 %
Greece	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a				
Hungary	2.6	2.8	2.8	1.9	1.8	1.7	1.4	1.2	1.2	– 53 %	– 0.2 %	0.0 %	0.4 %
Ireland	41	41	1.1	1.9	1.6	1.6	1.7	1.6	1.6	– 96 %	– 0.3 %	0.7 %	0.6 %
Italy	43	38	25	21	14	17	22	21	21	– 50 %	2.8 %	0.7 %	7.3 %
Latvia	0.2	0.3	0.2	0.3	0.2	0.2	0.3	0.3	0.3	42 %	5.0 %	0.0 %	0.1 %
Lithuania	0.1	0.0	0.1	0.1	0.1	0.1	0.1	0.2	0.2	> 100 %	20.9 %	0.0 %	0.1 %
Luxembourg	0.4	1.3	0.6	0.6	0.9	0.8	0.4	0.4	0.4	1 %	9.2 %	0.0 %	0.1 %
Malta	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	– 29 %	– 31.7 %	0.0 %	0.0 %
Netherlands	45	1.2	1.5	1.6	2.4	2.5	2.7	2.8	2.8	– 94 %	0.6 %	0.8 %	1.0 %
Poland	7.5	9.6	11	9.5	13	13	13	13	14	81 %	4.3 %	0.1 %	4.6 %
Portugal	3.9	4.6	4.1	2.9	2.5	3.3	3.1	3.3	3.4	– 11 %	2.6 %	0.1 %	1.2 %
Romania	99	64	29	4.1	3.3	3.6	3.3	2.9	3.0	– 97 %	4.6 %	1.7 %	1.0 %
Slovakia	2.8	2.5	1.5	1.5	1.0	1.2	1.0	0.9	1.1	– 61 %	17.0 %	0.0 %	0.4 %
Slovenia	47	38	38	0.5	0.6	0.6	0.6	0.6	0.5	– 99 %	– 17.2 %	0.8 %	0.2 %
Spain	326	150	180	135	4.0	4.4	4.0	3.8	3.9	– 99 %	1.2 %	5.6 %	1.3 %
Sweden	1.4	1.7	1.6	2.2	2.7	2.6	2.7	2.7	2.5	81 %	– 6.1 %	0.0 %	0.9 %
United Kingdom	3 753	5 291	77	69	32	23	22	18	21	– 99 %	14.0 %	64.1 %	7.2 %
EU-28 (a)	**5 853**	**6 058**	**605**	**405**	**192**	**215**	**211**	**282**	**292**	**– 95 %**	**3.4 %**	**100 %**	**100 %**
EU-28 (b)	5 853	6 058	605	405	192	215	211	282	292				

Notes: Dark-grey shaded cells indicate that no emission values are available (n/a, not available). See Appendix 1 for an explanation of the notation keys reported by Member States.

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

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

(b) Sum of sectors.

sludge (comment received from Belgium in 2014). The strong decrease in HCB emissions from 1999 to 2000 is because the sewage sludge incineration sector used a lower emission factor from 2000 onwards (personal communication by Belgium in 2016).

France reported a pronounced decrease in HCB emissions between 1990 and 1995. This decrease is mainly due to the aluminium industry, which used chlorine to refine aluminium by eliminating magnesium traces. Until the early 1990s, it used hexachloroethane (HCE) as a core source, which resulted in HCB emissions. This was the main HCB source within the national inventory. In 1993, France banned HCE for secondary aluminium refining. Following this ban, the secondary aluminium industry no longer emits HCB (personal communication by France in 2015).

Ireland reported a marked decrease in HCB emissions between 1995 and 2000. The only source of HCB is the secondary manufacturing of aluminium. The *EMEP/EEA Guidebook* indicates 5 g of HCB per tonne of aluminium (EMEP/EEA, 2013). This factor has been used to estimate HCB emissions across the time series until Ireland banned use of the HCE-based cover gas in 1996; For the NFR-sector '2C2 — Ferroalloys production', for which Ireland indicated the highest country specific HCB values up to 1996, Ireland reports that emissions did not occur in the years following 1996 (Ireland's IIR, 2015).

Poland reported 4.3 % more HCB emissions in 2014 than 2013. The main reason was the higher volume of secondary copper production in 'combustion in manufacturing industries' (see Poland's IIR, listed in Appendix 5).

'1A2f — Stationary combustion in manufacturing industries and construction: Non-metallic minerals', '1A1a — Public electricity and heat production' and '1A4bi — Residential: Stationary' were the chief key categories for HCB emissions, accounting for 61 % of the total (see Figure 3.18(a)). Among the top five key categories, the highest relative reductions in emissions between 1990 and 2014 were in the fifth most important, '3Df — Use of pesticides' (− 89.6 %), and the second most important, '1A1a — Public electricity and heat production' (− 61.6 %).

The big increase in the most important key category resulted from unintentional emissions in Austria (see Austria's IIR, listed in Appendix 5).

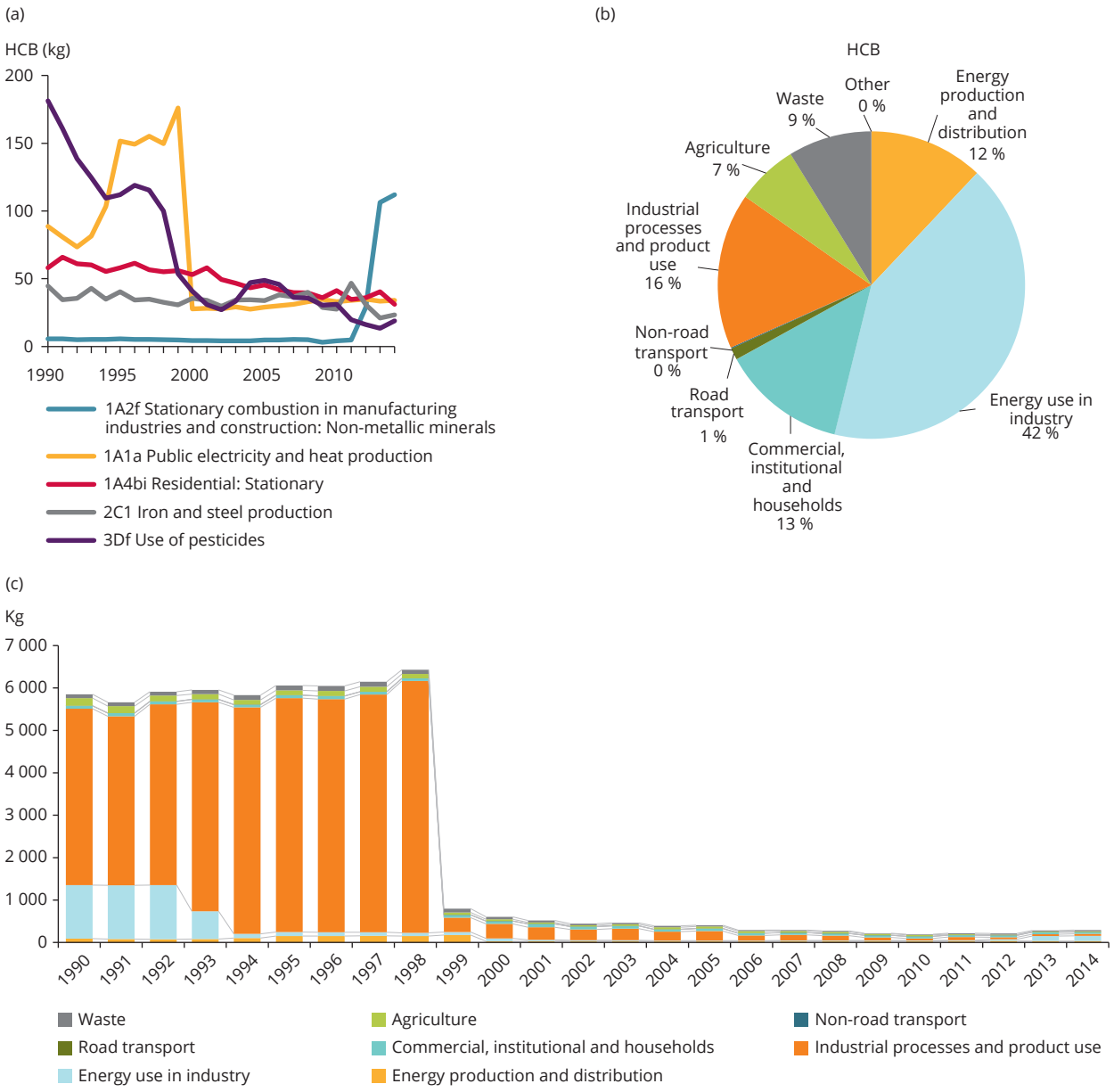
The emission peak from 1995 to 1999 in the category '1A1a — Public electricity and heat production' was due to high levels of emissions from Belgium.

Data from the United Kingdom account for the decreases in emissions from 1998 to 2000 in the category '3Df — Use of pesticides'.

Figure 3.18(b) shows the contribution that each aggregated sector group made to total EU-28 emissions. For HCB, primary emission sources are the sector groups 'energy use in industry', 'industrial processes and product use', 'commercial, institutional and households' and 'energy production and distribution'.

The drop in HCB emissions between 1998 and 1999 visible in Figure 3.18(c) is due to a considerable reduction reported by the United Kingdom.

Figure 3.18 HCB emissions in the EU-28: (a) trend in emissions from the five most important key categories, 1990–2014; (b) share by sector group, 2014; (c) sectoral trends in emissions



3.28 Polychlorinated biphenyl emission trends and key categories

Between 1990 and 2014, PCB emissions dropped in the EU-28 by 71 %. Between 2013 and 2014, they decreased by 2.6 %, mainly because of large reductions by Poland and the United Kingdom (see Table 3.29). The Member States that contributed most (i.e. more than 10 %) to the emissions of PCBs in 2014 were the United Kingdom, Poland, Croatia and Portugal. Greece did not report emissions for any year. The EU-28 total is therefore an underestimate.

The increase in PCB emissions between 2012 and 2013 can be explained by high emissions in Austria. In general, the trend in PCB emissions is directly linked with activities in NFR sector '2C — Metal production', among which '2C5 — Lead production' is the largest source. Therefore, the reason for this increase is the rising production activity in reported secondary lead production. Activity data on secondary lead production are from official Austrian statistics (personal communication by Austria in 2016 and Appendix 5, Austria's IIR).

In Portugal, PCB trends are related to category '5C1bi — Industrial waste incineration', which represents the main source of the national total emissions for this pollutant (99.9 % in 2014). There were pronounced increases in 2003 to 2008, inclusive, and emissions values in 2010 and 2012 were low, linked to the amount of industrial waste combusted (Appendix 5, Portugal's IIR).

Table 3.29 Member State contributions to EU emissions of PCBs

	PCBs (kg)									Change		Share in EU-28	
Member State	**1990**	**1995**	**2000**	**2005**	**2010**	**2011**	**2012**	**2013**	**2014**	**1990–2014**	**2013–2014**	**1990**	**2014**
Austria	194	162	163	176	179	182	176	224	218	12 %	– 2.6 %	1.5 %	5.8 %
Belgium	105	88	92	71	95	57	9.1	4.7	11	– 90 %	> 100 %	0.8 %	0.3 %
Bulgaria	6.2	5.3	3.8	4.0	4.2	4.7	5.0	4.7	3.4	– 46 %	– 27.2 %	0.0 %	0.1 %
Croatia	483	468	441	436	434	433	431	430	429	– 11 %	– 0.4 %	3.7 %	11.4 %
Cyprus	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	15 %	8.9 %	0.0 %	0.0 %
Czech Republic	773	623	3.0	1.4	2.1	2.2	2.4	2.6	3.5	– 99.6 %	33.9 %	5.9 %	0.1 %
Denmark	112	41	40	45	44	45	44	43	44	– 60 %	2.8 %	0.9 %	1.2 %
Estonia	8.4	4.1	2.6	3.7	4.2	3.6	3.5	3.9	4.2	– 50 %	7.2 %	0.1 %	0.1 %
Finland	321	293	228	181	156	157	154	152	154	– 52 %	1.6 %	2.5 %	4.1 %
France	184	160	107	75	61	55	57	57	48	– 74 %	– 15.1 %	1.4 %	1.3 %
Germany	1 680	1 484	948	195	233	243	232	241	236	– 86 %	– 2.1 %	12.8 %	6.3 %
Greece	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a				
Hungary	36	19	16	15	12	13	12	7.5	8.8	– 76 %	17.9 %	0.3 %	0.2 %
Ireland	42	36	36	39	14	14	14	14	16	– 62 %	10.8 %	0.3 %	0.4 %
Italy	290	302	266	278	211	218	225	204	198	– 32 %	– 2.8 %	2.2 %	5.2 %
Latvia	4.3	1.1	0.4	0.5	0.4	0.4	0.3	0.3	0.3	– 94 %	– 1.0 %	0.0 %	0.0 %
Lithuania	375	365	351	333	311	304	300	297	297	– 21 %	0.0 %	2.9 %	7.9 %
Luxembourg	36	32	4.0	1.8	1.4	1.6	1.3	2.4	2.4	– 93 %	– 2.1 %	0.3 %	0.1 %
Malta	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	– 99.9 %	– 96.9 %	0.0 %	0.0 %
Netherlands	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	– 99.98 %	0.0 %	0.0 %	0.0 %
Poland	801	927	581	616	747	726	733	753	685	– 14 %	– 9.0 %	6.1 %	18.2 %
Portugal	63	69	83	374	172	644	178	411	411	> 100 %	0.0 %	0.5 %	10.9 %
Romania	135	87	39	182	52	42	31	29	29	– 79 %	1.3 %	1.0 %	0.8 %
Slovakia	67	40	31	56	52	51	54	54	58	– 12 %	8.7 %	0.5 %	1.5 %
Slovenia	599	411	301	231	198	162	139	142	148	– 75 %	3.6 %	4.6 %	3.9 %
Spain	24	36	33	37	33	31	27	27	27	10 %	– 1.2 %	0.2 %	0.7 %
Sweden	8.9	9.4	9.8	9.5	9.2	9.8	8.8	8.6	9.0	1 %	5.3 %	0.1 %	0.2 %
United Kingdom	6 733	5 036	1 409	1 130	843	822	787	763	733	– 89 %	– 4.0 %	51.5 %	19.4 %
EU-28 (a)	**13 082**	**10 699**	**5 190**	**4 492**	**3 869**	**4 221**	**3 624**	**3 876**	**3 774**	**– 71 %**	**– 2.6 %**	**100 %**	**100 %**
EU-28 (b)	13 082	10 699	5 190	4 492	3 869	4 221	3 624	3 876	3 774				

Notes: Dark-grey shaded cells indicate that no emission values are available (n/a, not available). See Appendix 1 for an explanation of the notation keys reported by Member States.

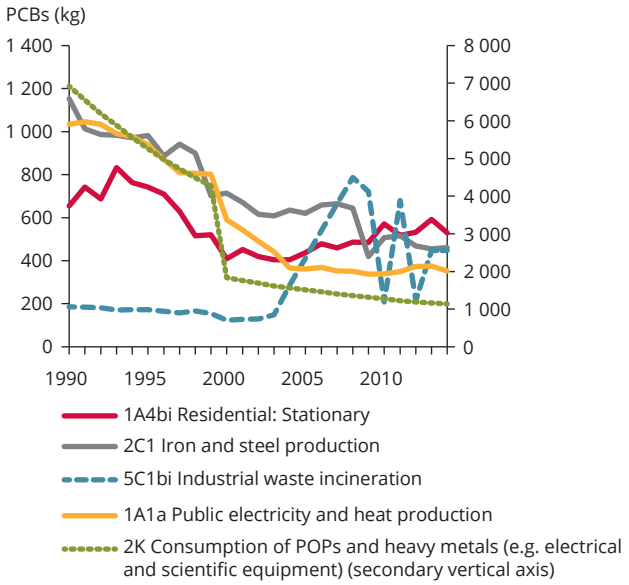
Light-grey shaded cells denote gap-filled data. For more detailed information, see Annex D.

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

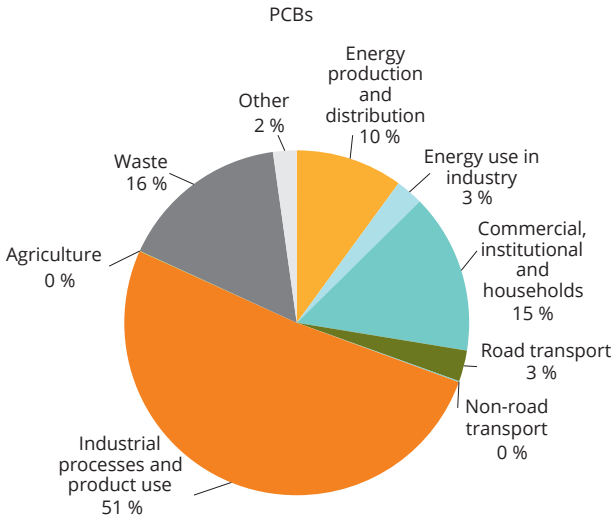
(b) Sum of sectors.

Figure 3.19 **PCB emissions from key categories in the EU-28: (a) trend in emissions from the five most important key categories, 1990–2014; (b) share by sector group, 2014; (c) sectoral trends in emissions**

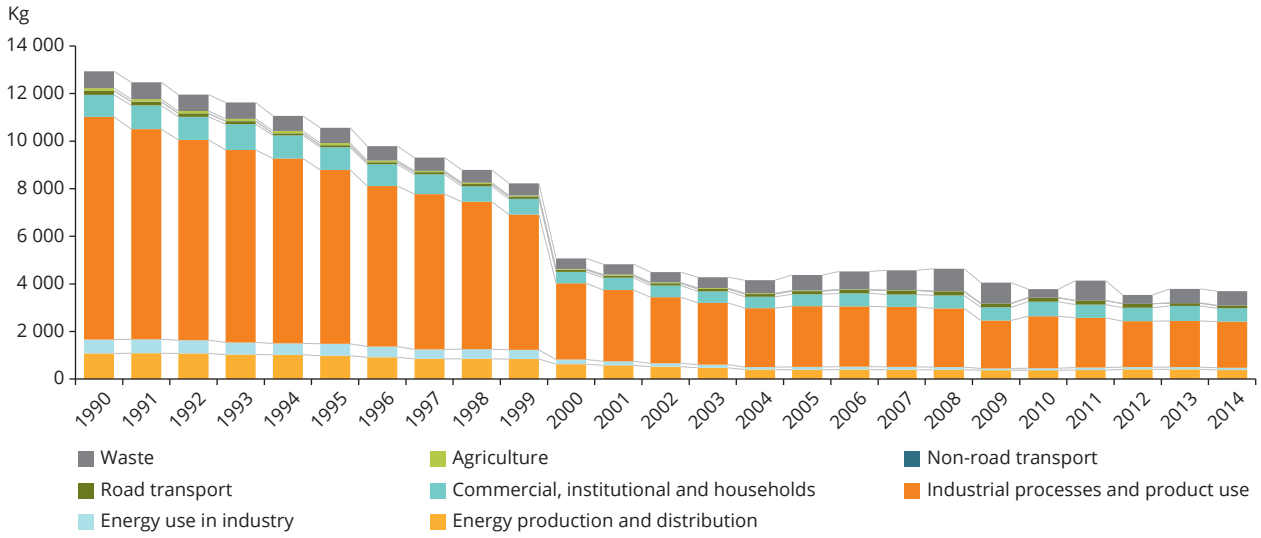
(a)



(b)



(c)



'2K — Consumption of POPs and heavy metals (e.g. electrical and scientific equipment)' and '1A4bi — Residential: Stationary' were the chief key categories for PCB emissions, together making up 44 % of the total (see Figure 3.19(a)). Among the top five key categories, the highest relative reductions in emissions between 1990 and 2014 were in the principal key category, '2K — Consumption of POPs and heavy metals (e.g. electrical and scientific equipment)' (− 83.5 %) (see Figure 3.19(a)).

The large decrease in emissions from '2K — Consumption of POPs and heavy metals (e.g. electrical and scientific equipment)' between 1999 and 2000 is due to reductions that the United Kingdom reported. For this country, the key emission source for PCBs has historically been the use of PCBs as a heat-transfer fluid in dielectric equipment. Older equipment used to leak, and the United Kingdom bases its estimates on these leaks. It banned the use of PCBs in new equipment around 1986. The original estimates assumed how much equipment was in use around 1990. After that, it reached the end of its life and was replaced by non-PCB alternatives. The year 2000 was a milestone. The EU set a target in 1996 (EC, 1996) to remove all dielectric equipment containing PCBs with a fill size > 5 kg to hazardous waste facilities. This accounts for a 90 % decline in the stockpile and emissions. These estimates are highly uncertain (personal communication by the United Kingdom in 2013).

Figure 3.19(b) shows the contribution that each aggregated sector group made to total EU-28 emissions. For PCBs, common important emission sources are 'industrial processes and product use', 'waste' and the 'commercial, institutional and households' sector group. For the sector group 'commercial, institutional and households' the same is true of $PM_{2.5}$, PM_{10}, total PAHs and PCDD/Fs.

4 Sectoral analysis and emission trends for key pollutants

Chapter 4 sets out emission trends and detailed methodologies of the key pollutants, aggregated into the following main sector groups:

- energy production and distribution
- energy use in industry
- industrial processes and product use
- commercial, institutional and households
- road transport
- non-road transport
- agriculture
- waste.

Appendix 4 of this report provides a conversion chart showing how the aggregated sector groups include the individual NFR source categories (see Table A4.1). Box 4.1 gives some general explanations relevant to the figures and tables in this chapter.

Box 4.1 Explanations of the figures in this chapter

- The LRTAP Convention formally requests Parties to report emissions of PM for 2000 and after. The figures in this chapter show only data from 2000 onwards.
- The figures showing indexed values (in percentages) use 1990 as the index year (1990 = 100 %), with the exception of PM_{10} and $PM_{2.5}$, for which the index year is 2000 (2000 = 100 %).

4.1 Sectoral analysis and emission trends for 'energy production and distribution'

The 'energy production and distribution' sector grouping comprises emissions from a number of activities that employ fuel combustion to produce energy products and electricity, for instance. It is a primary source of many pollutants, especially SO_X. Despite considerable past reductions, this sector group contributes 57 % of the total EU-28 emissions of this pollutant.

The sector is an important source of SO_X, Hg and NO_X. Poland, Germany and the United Kingdom contributed most (in absolute terms) to the emissions of SO_X in this sector in 2014. Germany, Poland and Spain reported the highest emissions of Hg. Germany, the United Kingdom and Poland contributed most to NO_X emissions.

For emissions of the main pollutants (see Figure 4.1), the highest absolute and relative reduction within this sector group was for SO_X (− 89 %) between 1990 and 2014. $PM_{2.5}$ and PM_{10} emissions have decreased notably since 2000, $PM_{2.5}$ by 59 % and PM_{10} by 60 %.

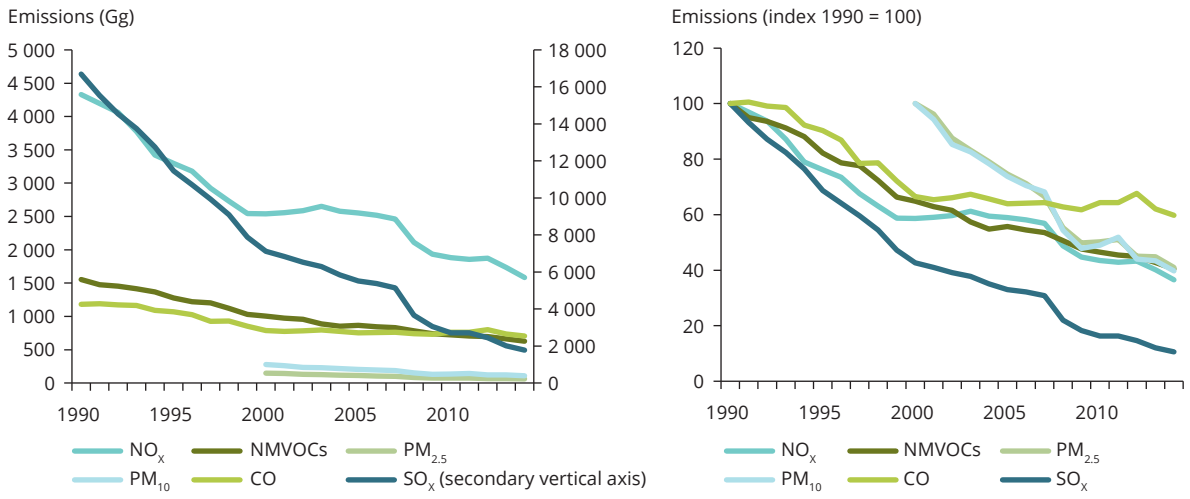
The strong decrease in NO_X emissions between 2007 and 2008 is mainly because of emission reductions reported by Spain and the United Kingdom in the sector '1A1a — Public electricity and heat production'. Spain explained that its dramatic drop in 2008 was due to the closure of the main brown coal mine in Spain in 2007 and the necessary retrofitting in 2008 of the adjacent thermal plant (Appendix 5, Spain's IIR).

Furthermore, emission reductions reported for the same category in Spain, Bulgaria and Poland are mainly responsible for the strong decrease in SO_X emissions in the same year.

The peak in CO emissions in 2012 is because between 2011 and 2012 Italy and Estonia reported increases in the category '1A1c — Manufacture of solid fuels and other energy industries' and the United Kingdom reported increases in the category '1A1a — Public electricity and heat production'. Between 2012 and 2013, France and Croatia reported decreases in the category '1B2aiv — Fugitive emissions oil: Refining/storage' and Italy, Spain and Poland reported decreases in the category '1A1c— Manufacture of solid fuels and other energy industries'.

The peak in $PM_{2.5}$ and PM_{10} emissions in 2011 comes from high emission values that Estonia reported in the category '1A1a — Public electricity and heat production'.

Figure 4.1 EU-28 emission trends in the sector 'energy production and distribution' for NO_X, NMVOCs, SO_X, PMs and CO between 1990 (2000) and 2014



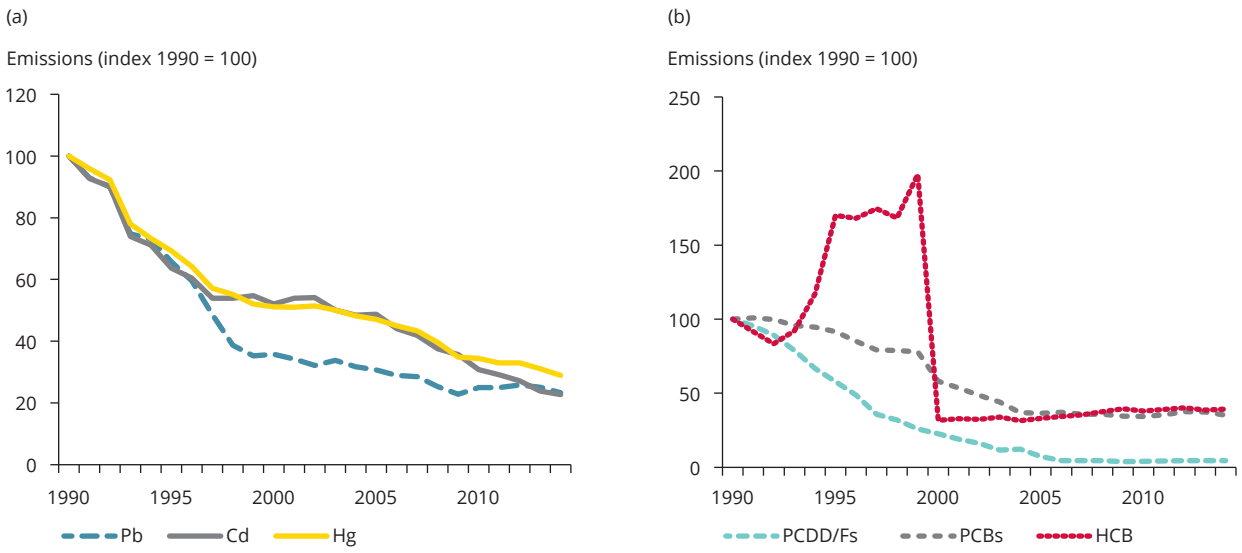
Notes: For PM, data from Greece could not be gap-filled, as it did not report values for any year. To show provisional EU-28 emission trends, the emissions have been aggregated without including data from this country.

Of the three main HMs, Cd shows the highest reduction in relative terms (− 77 %) (see Figure 4.2(a)).

There was an apparent strong decrease in PCB emissions between 1999 and 2000. That is due to the difference between reported data for the Czech Republic, starting in 2000, and gap-filled data up to 1999 in the category '1A1a — Public electricity and heat production'.

For emissions of POPs, the highest relative reduction was in PCDD/Fs (− 96 %) (see Figure 4.2(b)). The high HCB emissions in 1993 to 1999 are because Belgium reported high emission values in the category '1A1a — Public electricity and heat production'. Belgium explained that the strong decrease in HCB emissions from 1999 to 2000 is due to the use of a lower emission factor from 2000 onwards in the sewage sludge incineration sector (personal communication by Belgium in 2016).

Figure 4.2 EU-28 emission trends in the sector group 'energy production and distribution' (a) for the HMs (Pb, Cd and Hg), and (b) for POPs (PCDD/Fs, PCBs and HCB) between 1990 and 2014



Notes: For the HMs, no data for Greece from 2009–2014 were available. To enable presentation of provisional EU-28 emission trends, the emissions have been aggregated without including emission data for this Member State.

For PCDD/Fs and PCBs, data from Greece could not be gap-filled, as it did not report values for any year. To enable presentation of provisional EU-28 emission trends, the emissions have been aggregated without including data from this country.

4.2 Sectoral analysis and emission trends for 'energy use in industry'

The 'energy use in industry' sector is a primary source for heavy metals and HCB. Poland, Bulgaria and Spain contributed most (in absolute terms) to the emissions of Pb in this sector in 2014. For Cd, Poland, Spain and Portugal reported the highest emissions. Austria contributed most to the emissions of HCB.

Energy use (fuel combustion) in industry is an important source of many pollutants. For the main pollutants, the highest absolute and relative reduction (− 87 %) between 1990 and 2014 was in SO_X (see Figure 4.3).

The strong decrease in CO emissions between 2008 and 2009 results from emission reductions that several countries reported, especially France, Italy, Belgium and Germany.

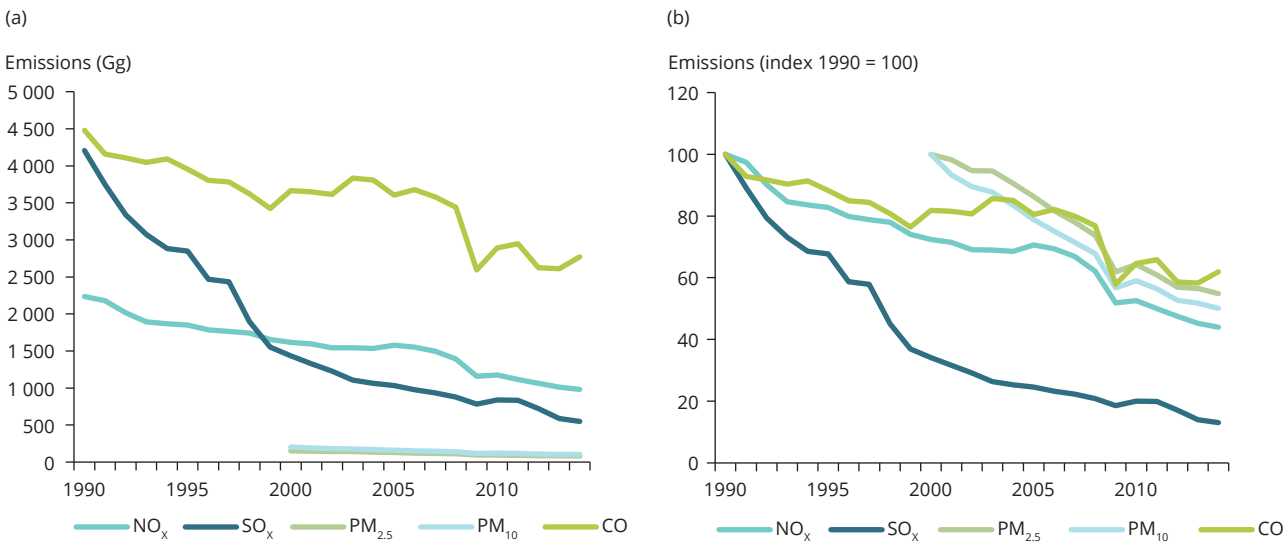
Of the three HMs, Hg shows the highest reduction in relative terms (− 68 %) (see Figure 4.4(a)).

Lead emissions decreased between 1996 and 1997, peaked in 2008, decreased between 2008 and 2009 and increased considerably between 2013 and 2014. This pattern is mainly because of Bulgaria's data for '1A2b — Stationary combustion in manufacturing industries and construction: Non-ferrous metals'.

The strong decrease in Hg emissions between 2008 and 2009 is due to reductions that several countries reported, especially Slovakia and Italy.

The high Cd emissions from 1995 to 1997 reflect high levels reported from Poland and gap-filled data from Slovakia. The decrease between 2000 and 2001 results from Slovakia's data. Slovakian data for 2000 are gap-filled using data reported under CLRTAP in 2015, and it reported data for 2001 in 2016. The decrease in Cd emissions between 2008 and 2009 is caused by reductions that several countries reported.

Figure 4.3 EU-28 emission trends in the sector group 'energy use in industry' for NO_X, SO_X, PMs and CO between 1990 (2000) and 2014

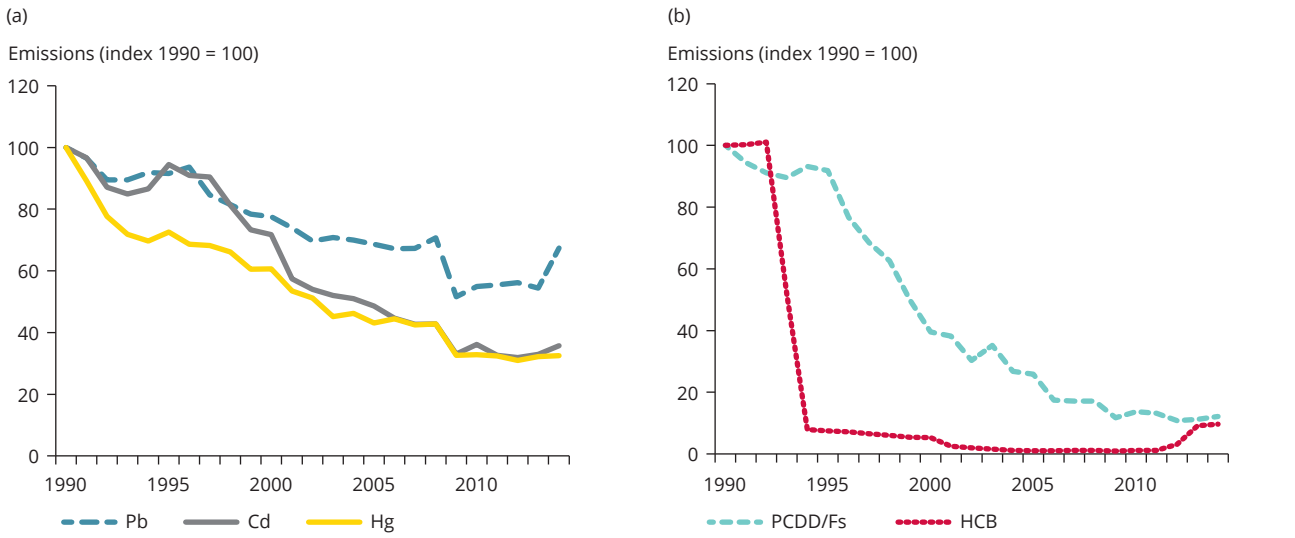


Notes: For PM, data from Greece could not be gap-filled, as it did not report values for any year. To enable presentation of provisional EU-28 emission trends, emissions have been aggregated without including data from this Member State.

Among POPs, HCB and PCDD/Fs are key pollutants in the sector group 'energy use in industry'. Figure 4.4(b) presents trends for these pollutants.

The trend in PCDD/F emissions has much to do with gap-filled and reported data from the Czech Republic for the category '1A2a — Stationary combustion in manufacturing industries and construction: Iron and steel'. In addition, the PCDD/F emissions peak from 1994 to 1995 is attributable to data from France. Data from France also influence the huge reduction in HCB emissions from 1993 to 1994. For both pollutants, emissions in the category '1A2b — Stationary Combustion in manufacturing industries and construction: Non-ferrous metals' decreased. A new Zn production plant (second fusion), set up during 1993, affected them. Since 1998, however, this plant has used emission reduction equipment (personal communication by France in 2013). The increase in HCB emissions from 2012 to 2014 is due to high emissions from the category '1A2f — Stationary combustion in manufacturing industries and construction: Non-metallic minerals' according to data from Austria. The reason is that an Austrian cement plant unintentionally released HCB, resulting in a significant increase in emissions between 2012 and 2014 (comment received from Austria in 2016).

Figure 4.4 **EU-28 emission trends in the sector group 'energy use in industry' (a) for the HMs (Pb, Cd and Hg), and (b) for POPs (PCDD/Fs and HCB) between 1990 and 2014**



Notes: For the HMs, no data for Greece from 2009–2014 were available. To enable presentation of provisional EU-28 emission trends, the emissions have been aggregated without including emission data for this Member State.

For PCDD/Fs and HCB, data from Greece could not be gap-filled, as it did not report values for any year. To enable presentation of provisional EU-28 emission trends, the emissions have been aggregated without including data from this country.

4.3 Sectoral analysis and emission trends for 'industrial processes and product use'

The 'industrial processes and product use' sector grouping refers to emissions from industrial sources other than those arising from fuel combustion within the industrial sector. This is the primary sector group for NMVOCs and PCB emissions, and makes significant contributions to emissions of HCB, CO, PM, HMs and POPs. Of all the countries that reported data, Germany, the United Kingdom and Italy contributed most to NMVOC emissions, and the United Kingdom, Lithuania and Austria contributed most to PCB emissions in the 'industrial processes and product use' sector in 2014. Figure 4.5 shows past trends in emissions of the relevant main pollutants.

Data from France for the category '2C1 — Iron and steel production' have a great influence on the trend in emissions of CO. These emissions of CO from category 2C1 fluctuate over the years, depending on the amount of blast furnace gas that is produced, reused or flared. These amounts depend on the operating conditions and how feasible it is for iron and steel or collieries plants to reuse the gas that blast furnaces continuously produce. This may fluctuate a great deal from one year to another, resulting in peaks (1995, 2004 and 2010) or decreases (1992, 2001 and 2009) (personal communication by France in 2013).

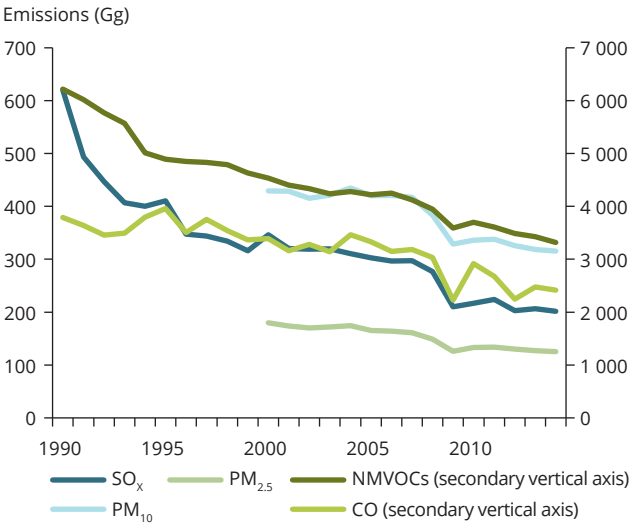
The decrease in SO_X emissions from 1990 to 1991, the increase from 1999 to 2000 and the decrease from 2008 to 2009 mainly reflect emission data from Germany. The decrease from 1995 to 1996 is due to reductions in the category '2B10a — Chemical industry: Other' that Italy reported.

'Industrial processes and product use' make a considerable contribution to the total EU-28 emissions of HMs, despite seeing considerable reductions since 1990. Figure 4.6(a) shows past emission trends for these pollutants. Hg shows the highest relative reduction in emissions between 1990 and 2014 (− 74 %).

The increases in emissions of Pb, Cd and Hg from 1994 to 1995 are from the category '2C1 — Iron and steel production' in Germany.

Among POPs, the highest relative reduction between 1990 and 2014 occurred for HCB (− 99 %) (Figure 4.6(b)).

Figure 4.5 EU-28 emission trends in the sector group 'industrial processes' for NMVOCs, SO_X, CO and PM between 1990 (2000) and 2014



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

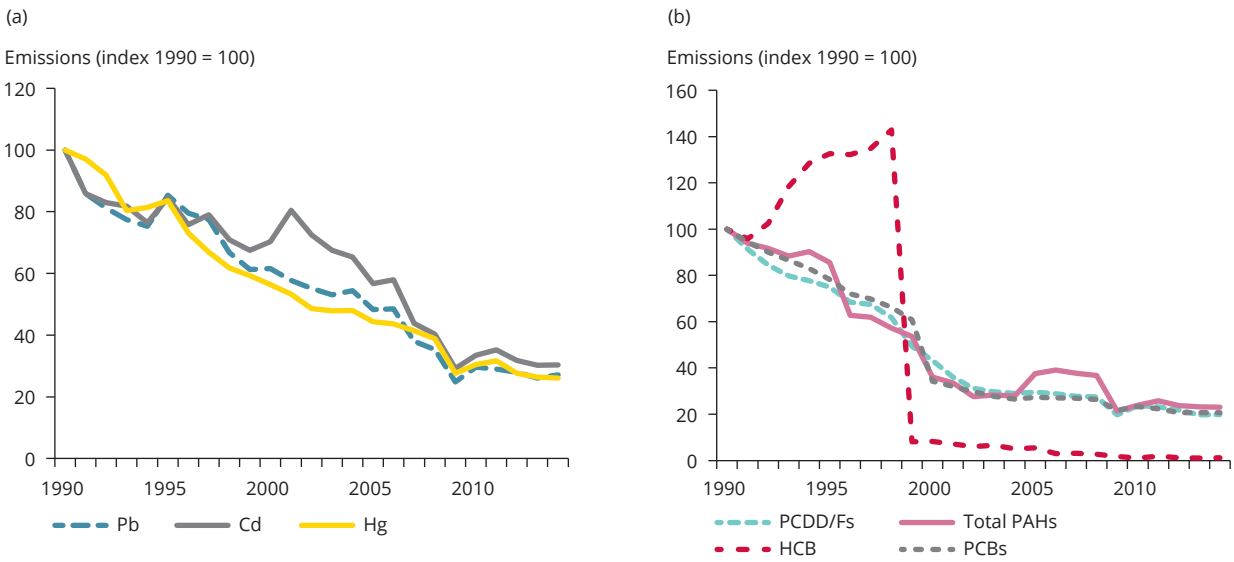
The considerable change in HCB emissions is mainly the result of an increase in '2C3 — Aluminium production' in the United Kingdom until 1998. Historically, the United Kingdom's secondary aluminium industry has used HCE as a cover gas. When HCE was manufactured, it was contaminated with HCB and pentachlorobenzene. Van der Most and Veldt (1992) quote the emission factor as 5 g of HCB per tonne of HCE used. In 1999, the United Kingdom banned the use of HCE for this application, and the emissions ceased (personal communication by the United Kingdom in 2011).

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

The decrease in total PAHs from 1994 to 1996 also reflects data from the United Kingdom in the category '2C3 — Aluminium production'. The decrease in total

PAHs from 1999 to 2000 reflects data from Italy in the category '2C1 — Iron and steel production'. The high total PAH emissions from 2005 to 2008 reflect gap-filled data for Romania in the category '2C3 — Aluminium production'. The drop in HCB emissions between 1998 and 1999 is due to a considerable reduction reported by the United Kingdom.

Figure 4.6 EU-28 emission trends in the sector group 'industrial processes and product use' (a) for the HMs (Pb, Cd, Hg), and (b) for the POPs (PCDD/Fs, total PAHs, HCB and PCBs) between 1990 and 2014



Notes: For the HMs, no data for Greece from 2009–2014 were available. To enable presentation of provisional EU-28 emission trends, the emissions have been aggregated without including emission data for this Member State.

For PCDD/Fs and HCB, data from Greece could not be gap-filled, as it did not report values for any year. To enable presentation of provisional EU-28 emission trends, the emissions have been aggregated without including data from this country.

4.4 Sectoral analysis and emission trends for 'commercial, institutional and households'

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

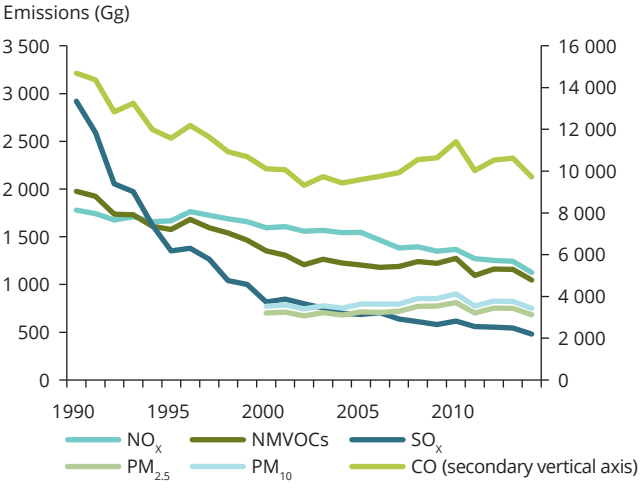
The 'commercial, institutional and households' sector is an important source of B(a)P, CO, $PM_{2.5}$, PM_{10}, Cd, dioxins and furans, total PAHs and PCB. Poland, Germany and Romania contributed most (in absolute terms) to the emissions of B(a)P, and Germany, Poland and Italy contributed most to the emissions of total PAHs in this sector in 2014. For $PM_{2.5}$ Italy, Romania and France reported the highest emissions. Poland, Italy and Romania emitted the biggest proportion of PM_{10} in 2014. Poland, Italy and France contributed most to CO emissions.

Of the main pollutants, the highest relative reduction between 1990 and 2014 for the sector grouping was again in SO_X (− 84 %). By contrast, PM emissions have changed little since 2000 (see Figure 4.7).

The decrease of CO emissions between 1990 and 1992 reflects data from Germany in the categories '1A4a — Commercial/institutional: Stationary' and '1A4bi — Residential: Stationary'. The increase from 1992 to 1993 reflects data from France in the category '1A4bi — Residential: Stationary'. The peak in 1996 reflects data from France and Poland, and gap-filled data for Romania. The low emissions in 2002, the peak in 2010 and the decrease from 2010 to 2011 reflect data from Italy for the category '1A4bi — Residential: Stationary'. The decrease between 2013 and 2014 reflects data from several countries, especially France, Italy, Poland and Germany.

The decreases in SO_X and NMVOC emissions between 1990 and 1992 are caused by emission reductions in Germany. Data from several countries, especially Italy and France, are responsible for the peak in reported NMVOC emissions in 2010, and for the decrease between 2010 and 2011.

Figure 4.7 **EU-28 emission trends in the sector group 'commercial, institutional and households' for NO_X, NMVOCs, SO_X, PMs and CO between 1990 (2000) and 2014**



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

Of the three HMs in the sector 'commercial, institutional and households', Pb shows the highest reduction, both absolutely and relatively (− 50 %) (see Figure 4.8(a)).

The trends in emissions of Cd and Pb largely reflect data from Poland for the category '1A4bi — Residential: Stationary'. The trend for Hg largely reflects data from Italy for the category '1A4ai — Commercial/institutional: Stationary'. The Hg peak in 1991 reflects data from France for the category '1A4bi — Residential: Stationary'.

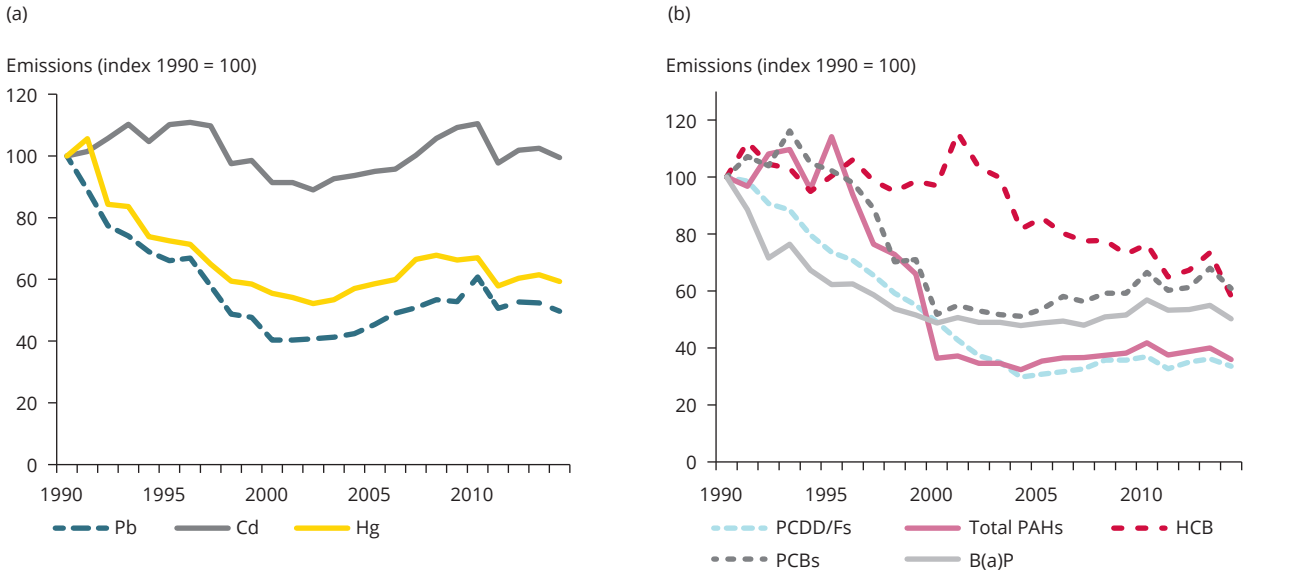
Among POPs relevant to the 'commercial, institutional and households' sector, the highest absolut and relative reduction occurred for dioxins and furans (− 66 %) (see Figure 4.8(b)).

The trend in emissions of PCB largely reflects data from Poland for the category '1A4bi — Residential: Stationary'. Further, the trend for HCB largely reflects data from Austria for the category '1A4bi — Residential: Stationary'. The reason is the unintentional releases of HCB by an Austrian cement plant, which significantly increased emissions between 2012 and 2014 (personal communication by Austria in 2016). The peak in 2001 and the high HCB emission data from 2001 to 2003 result from reports of high emissions from the Czech Republic in the category '1A4bi — Residential: Stationary' and Italy in the category '1A4ai — Commercial/institutional: Stationary'.

The trend in total emissions of PAHs largely reflects gap-filled data from the Czech Republic.

The peak in benzo(a)pyrene emissions in 1993 reflects data from Poland in the category '1A4bi — Residential: Stationary'. The strong decrease from 1990 to 1992 and the peak in 2010 reflect data that Germany reported in the category '1A4bi — Residential: Stationary'.

Figure 4.8 **EU-28 emission trends in the sector group 'commercial, institutional and households' (a) for the HMs (Pb, Cd and Hg), and (b) for POPs (PCDD/Fs, total PAHs, B(a)P, HCB and PCBs) between 1990 and 2014**



Notes: For the HMs, no data for Greece from 2009–2014 were available. To enable presentation of provisional EU-28 emission trends, the emissions have been aggregated without including emission data for this Member State.

For PCDD/Fs, total PAHs, HCB and PCB, data from Greece could not be gap-filled, as it did not report values for any year. For B(a)P, several Member States (Austria, Belgium, Greece, Italy, Spain) did not provide emission data. To enable presentation of provisional EU-28 emission trends, the emissions have been aggregated without including data from these countries.

4.5 Sectoral analysis and emission trends for 'road transport'

As noted earlier, the individual NFR sources that make up the 'road transport' sector group together contribute considerably to emissions of a number of pollutants, including NO_X, NMVOCs, CO, $PM_{2.5}$, PM_{10}, Pb and certain POPs. Figure 4.9 shows the past emission trends for these pollutants in this sector.

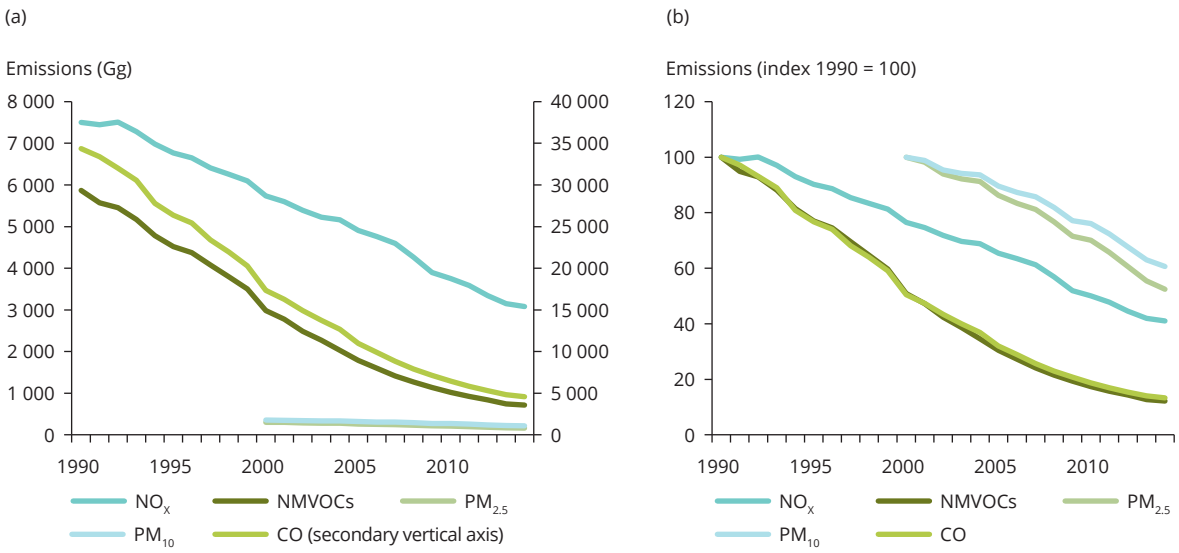
France, Germany and Italy contributed most (in absolute terms) to NO_X emissions in the 'road transport' sector in 2014. For CO, Germany, Poland and Italy reported the highest emissions.

For the 'road transport' sector, the main HM is Pb, showing a high relative reduction in emissions (− 98 %) between 1990 and 2014 (see Figure 4.10(a)). However, in recent years, little progress has been made in reducing emissions from road transport further; total emissions of Pb have remained largely constant. The promotion of unleaded petrol within the EU and in other EEA member countries through a combination of fiscal and regulatory measures has been a success story. For example, EU Member States have completely phased out the use of leaded petrol. Directive 98/70/EC relating to the quality of petrol and diesel fuels (EC, 1998) regulated that goal. Nevertheless, the 'road transport' sector remains a key source of Pb, contributing around 15 % of total Pb emissions in the EU-28.

Of the POPs, PCDD/Fs, total PAHs and benzo(a)pyrene are the most important in the 'road transport' sector group. Figure 4.10(b) shows past emissions trends for these pollutants.

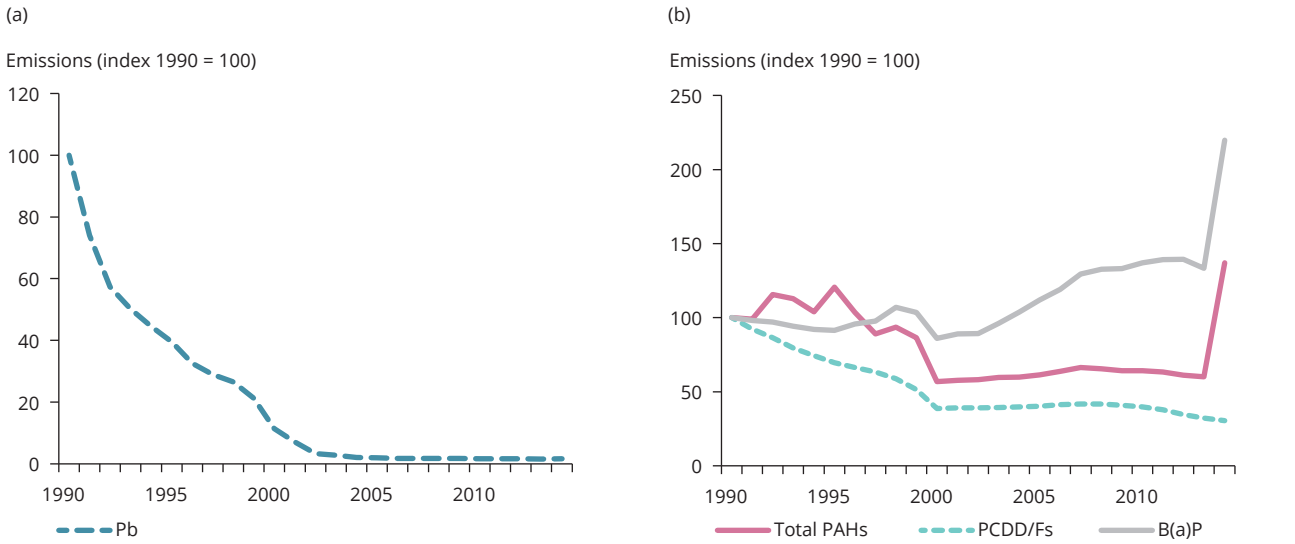
Total PAH and benzo(a)pyrene emissions increased steeply between 2013 and 2014. That reflects the high emissions Malta reported for 2014 in the category '1A3bi — Road transport: Passenger cars'. The trend in emissions of total PAHs from 1990 to 1999 largely reflects the fact that data for the Czech Republic were gap-filled over this period.

Figure 4.9 EU-28 emission trends in the sector group 'road transport' for NO_X, NMVOCs, PMs and CO between 1990 (2000) and 2014



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

Figure 4.10 EU-28 emission trends in the sector group 'road transport' (a) for the priority HM Pb, and (b) for the POPs (PCDD/Fs, total PAHs and B(a)P between 1990 and 2014



Notes: For Pb, no data for Luxembourg and no sectoral data for Greece were available. To enable presentation of provisional EU-28 emission trends, the emissions have been aggregated without including emission data for these Member States.

For HCB and PCBs, data from Greece could not be gap-filled, as it did not report values for any year. To enable presentation of provisional EU-28 emission trends, the emissions have been aggregated without including data from these countries.

4.6 Sectoral analysis and emission trends for 'non-road transport'

An important pollutant in the 'non-road transport' sector group is NO_X. The United Kingdom, Italy and Germany contributed most (in absolute terms) to NO_X emissions in 2014.

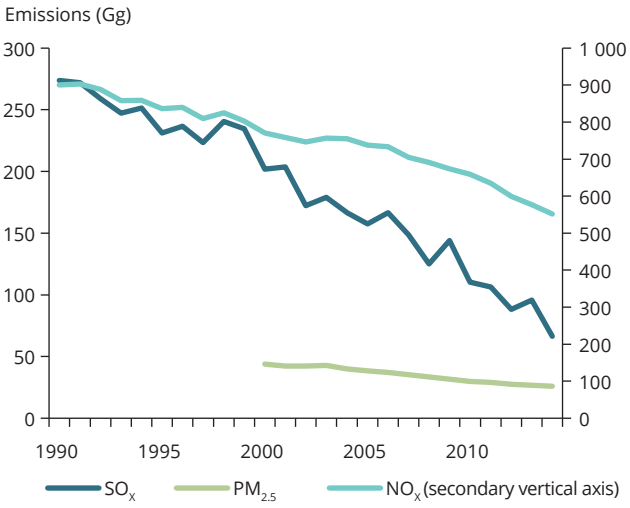
Little progress has been made since 1990 in reducing emissions from NO_X (see Figure 4.11). Among the main pollutants, the highest relative reduction between 1990 and 2014 occurred for NH_3 (− 82 %).

The trend in SO_X emissions largely reflects data for the category '1A3dii — National navigation (shipping)' from Greece (gap-filled data from previous CLRTAP submissions) and Spain.

The 'non-road transport' sector group does not contribute a great deal to HM and POP emissions. Therefore, we do not show trends for pollutants from these two groups of substances.

Emissions from international/domestic aviation and shipping are reported as a simple sum of the emissions from each of the Member States. Accordingly, emissions from international/domestic aviation and shipping are not divided into those occurring within the EU and those that cross the geographical boundaries of the EU. However, the guidelines (UNECE, 2014a) define international emissions as those that start in one country and finish in another. Thus, the reporting matches the guidelines.

Figure 4.11 **EU-28 emission trends in the sector group 'non-road transport' for NO_X, $PM_{2.5}$ and SO_X between 1990 (2000) and 2014**



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

4.7 Sectoral analysis and emission trends for 'agriculture'

As noted earlier, the 'agriculture' sector group is responsible for the vast majority of NH_3 emissions in the EU-28. Germany, France and Italy contributed most (in absolute terms) to emissions of NH_3 in 2014.

Agricultural emissions of NH_3 have decreased by 26 % since 1990 (see Figure 4.12).

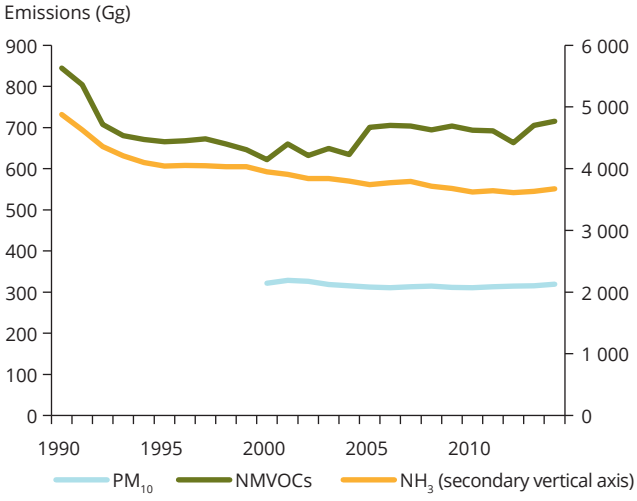
The increase in emissions of NMVOCs from 2012 to 2014 reflects high emission levels that Spain reported in the category '3F — Field burning of agricultural residues', and that Romania's reported emissions started with emissions for 2005.

For the POPs, this sector contributes considerably to emissions of total PAHs, B(a)P and HCB. Figure 4.13 shows past emission trends for these pollutants.

The trend in emissions of HCB largely reflects data that the United Kingdom reported for the category '3Df — Use of pesticides'. HCB occurs as an impurity or a by-product in the manufacture of several pesticides currently in use in the United Kingdom (chlorothalonil and chlorthal-dimethyl) or used in the past (quintozene). After being applied to agricultural land, pesticides would volatilise into the atmosphere from deposits on plants or soil. Estimates assume that more than 70 % of the newly applied HCB is emitted into the atmosphere. Over 95 % of the HCB emitted into the atmosphere comes from chlorthalonil (see the United Kingdom's IIR, listed in Appendix 5).

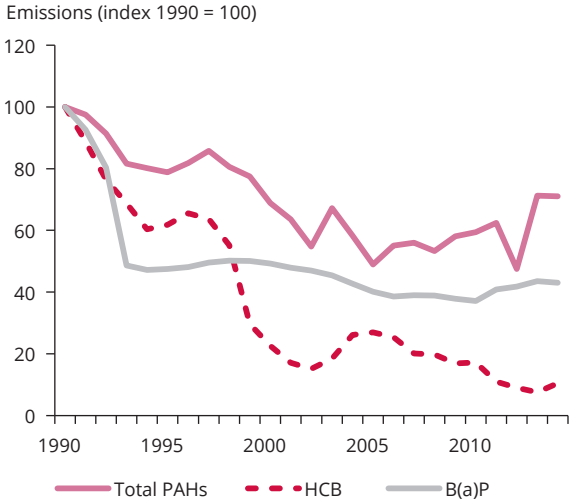
The trend in emissions of total PAHs largely reflects data that Spain reported for the category '3F — Field burning of agricultural residues'. The strong decrease in B(a)P emissions from 1990 to 1993 reflects data that the United Kingdom reported for the category '3F — Field burning of agricultural residues'.

Figure 4.12 **EU-28 emission trends in the sector group 'agriculture' for NMVOCs, NH_3 and PM_{10} between 1990 (2000) and 2014**



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

Figure 4.13 **EU-28 emission trends in the sector group 'agriculture' for POPs (total PAHs, B(a)P and HCB) between 1990 and 2014**



Notes: For total PAHs and HCB, data from Greece could not be gap-filled, as it did not report values for any year. For B(a)P, several Member States (Austria, Belgium, Greece, Italy, Spain) did not provide emission data. To enable presentation of provisional EU-28 emission trends, the emissions have been aggregated without including data from these countries.

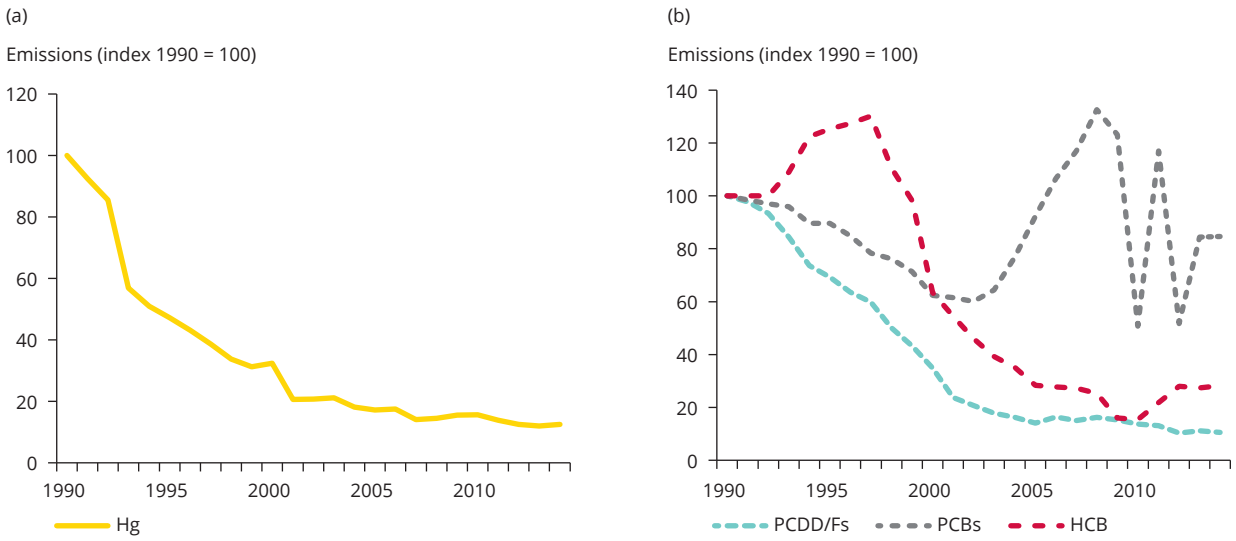
4.8 Sectoral analysis and emission trends for 'waste'

The 'waste' sector group is an important source of certain pollutants, including PCBs, PCDD/Fs, HCB and Hg. Figure 4.14 shows the past emission trends for these pollutants.

Emissions of PCBs increased markedly starting in 2003, and dipped and jumped from 2003 to 2014. This reflects data that Portugal reported for the category '5C1bi — Industrial waste incineration'. Portugal explained that the emission trends for industrial incineration follow the trends in the activity data. The final disposal of industrial waste includes landfill, incineration, export (e.g. dangerous waste) and recycling. The differences across years in the amounts of industrial waste incinerated are striking. They can be explained, at least partly, by the variation in annual market demand for residues (personal communication by Portugal in 2013).

The trend in emissions of HCB in 1990 to 1999 largely reflects data for the category '5C1biv — Sewage sludge incineration' from Belgium. Belgium explained that the strong decrease in HCB emissions from 1999 to 2000 is because the sewage sludge incineration sector used a lower emission factor from 2000 onwards (comment received from Belgium in 2016).

Figure 4.14 EU-28 emission trends in the sector group 'waste' for the HM Hg, and for the POPs (PCDD/Fs, HCB and PCBs) between 1990 and 2014



Notes: For the HMs, no data for Greece from 2009–2014 were available. To enable presentation of provisional EU-28 emission trends, the emissions have been aggregated without including emission data for this Member State.

For PCDD/Fs and PCB, data from Greece could not be gap-filled, as it did not report values for any year. To enable presentation of provisional EU-28 emission trends, the emissions have been aggregated without including data from these countries.

5 Recalculations, and implemented or planned improvements

5.1 Recalculations

5.1.1 Recalculations

Recalculations are changes made to past emission estimates (for one or more years) to eliminate errors or to incorporate additional factors or data. The *EMEP/EEA Guidebook* (EMEP/EEA, 2013) stipulates that it is 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 does not reflect mitigation activities transparently;
- 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

Table 5.1 Comparison of data submitted in 2015 and 2016 by Member States (relative data, percentage of EU-28 national total)

Pollutant	Unit	1990	1995	2000	2005	2010	2011	2012	2013
NO_x	Gg	0 %	1 %	1 %	1 %	1 %	1 %	1 %	0 %
NMVOCs	Gg	– 2 %	0 %	0 %	1 %	2 %	1 %	1 %	0 %
SO_x	Gg	– 2 %	0 %	0 %	0 %	1 %	1 %	1 %	1 %
NH_3	Gg	– 3 %	0 %	0 %	0 %	0 %	0 %	1 %	1 %
TSPs	Gg	4 %	4 %	1 %	1 %	2 %	– 1 %	0 %	– 2 %
BC	Gg								
Benzo(a)pyrene	Mg	– 9 %	– 2 %	– 1 %	– 1 %	2 %	1 %	2 %	0 %
CO	Gg	– 7 %	1 %	4 %	0 %	4 %	2 %	4 %	1 %
Pb	Mg	– 1 %	0 %	4 %	– 1 %	– 2 %	– 2 %	– 3 %	– 3 %
Cd	Mg	– 27 %	1 %	– 1 %	– 2 %	– 1 %	– 2 %	– 1 %	– 2 %
Hg	Mg	– 8 %	1 %	0 %	0 %	– 1 %	– 2 %	– 2 %	– 2 %
As	Mg	– 4 %	2 %	2 %	0 %	0 %	0 %	1 %	– 1 %
Cr	Mg	– 5 %	0 %	2 %	1 %	1 %	1 %	1 %	0 %
Cu	Mg	– 9 %	– 1 %	– 1 %	– 1 %	– 2 %	– 2 %	– 2 %	– 2 %
Ni	Mg	– 7 %	– 3 %	– 1 %	– 1 %	3 %	2 %	3 %	– 4 %
Se	Mg	2 %	2 %	2 %	1 %	– 5 %	– 5 %	1 %	2 %
Zn	Mg	– 13 %	– 4 %	– 3 %	– 4 %	– 2 %	– 3 %	– 1 %	– 2 %
PCDD/Fs	g I-Teq	– 2 %	1 %	– 4 %	9 %	3 %	– 1 %	3 %	– 1 %
Benzo(b)fluoranthene	Mg	– 13 %	– 3 %	– 3 %	– 2 %	0 %	– 2 %	– 1 %	0 %
Benzo(k)fluoranthene	Mg	– 20 %	– 2 %	0 %	– 1 %	1 %	– 1 %	0 %	– 1 %
Indeno(1,2,3-cd)pyrene	Mg	– 24 %	– 6 %	– 6 %	– 5 %	– 4 %	– 4 %	– 3 %	– 3 %
Total PAHs	Mg	0 %	0 %	– 29 %	– 1 %	2 %	0 %	2 %	9 %
HCB	kg	10 %	24 %	– 2 %	– 2 %	– 8 %	– 7 %	2 %	43 %
PCBs	kg	– 8 %	4 %	– 3 %	7 %	11 %	10 %	11 %	12 %
				2000	**2005**	**2010**	**2011**	**2012**	**2013**
$PM_{2.5}$	Gg			3 %	4 %	7 %	3 %	6 %	2 %
PM_{10}	Gg			5 %	6 %	9 %	5 %	7 %	4 %

to evaluate officially reported emissions data properly. Member States often do not document why they report different numbers in one year from an earlier year.

Table 5.1compares total emissions from the EU-28 according to their submissions in 2015 with those in 2016. For some Member States, recalculations might reflect changes in compilation methods (gap-filling) rather than 'true' recalculations by the countries themselves.

The highest recalculations are for HCB, total PAHs, Cd and IP. These are ascribable to differences between data submitted in the 2016 inventory and data submitted in the 2015 inventory from Poland for Cd and IP, the Czech Republic for PAHs, and the United Kingdom (1995) and Austria (2013) for HCB.

The United Kingdom has used new statistics to revise activity data for HCB. The main changes include the following: values for chlorothalonil use in Northern Ireland have been updated with 2014 data; values for chlorothalonil and chlorthal-dimethyl use in the United Kingdom have been retrospectively updated; and quintozene use has been updated with new data that the Food and Environment Research Agency published. Those revisions are responsible for the decrease in the estimate of HCB emissions for 2013 (– 21 %) (Appendix 5, the United Kingdom's IIR).

Austria explained that, in 2014, HCB emissions from the sector '1A — Fuel Combustion Activities' increased to 97 % of the country's total. The reason is the significant increase in emissions between 2012 and 2014 due to unintentional releases of HCB by an Austrian cement plant (personal communication by Austria in 2016, and Appendix 5, Austria's IIR).

Under the revised reporting guidelines (UNECE, 2014a), all countries should submit explanatory IIRs, which should include details of any recalculations made. Some Member States provide very detailed explanations for their recalculations of parts or the whole time series (e.g. methodological improvements,

Table 5.2 Overview of Member States' recalculations contributing most to EU recalculations

Pollutant	Countries contributing most to recalculations at EU level
NO_X	CZ, 2000; FR, 1990–1995; HU, 1990–2000; NL, 1990–1995, 2005–2011; PL, 1990; RO, 1995–2000; UK, 1990–2005
NMVOCs	CZ, 2005; FR, 1990–2013; DE, 2013; IT, 1990–2012; LV, 1990–2013; PL, 1990; SK, 2005–2013; ES, 2013
SO_X	CZ, 2000; GR, 2013; MT, 1995; PL, 1990–2012; SK, 2000;ES, 2013
NH_3	FR, 1990–2013; DE, 2010–2013; PL, 1990; ES, 1990
$PM_{2.5}$	IT, 2000–2012; UK, 2013
PM_{10}	FR, 2000–2013; IT, 2000–2012; ES, 2000–2013; UK, 2013
TSPs	FR, 1995–2000; IT, 1990–2012; PL, 1990–1995; ES, 2000–2010; UK, 1990–2013
CO	CZ, 1990–2012; FI, 2000–2012; FR, 1990, 2000–2013; DE, 1990–1995, 2012–2013; HU, 1990–2010; IT, 1990–2012; MT, 1995; NL, 1995; PL, 1990, 2010, 2012; RO, 1990–2013; SI, 2005, 2011–2013; ES, 2013; SE, 1990–2013; UK, 1990–2005, 2012–2013
Pb	CZ, 2000; FR, 1990–1995; DE, 1990–2005; HU, 1990–1995; PL, 1990–2011, 2013; RO, 2012 SI, 1990–2005
Cd	PL, 1990
Hg	PL, 1990
As	CZ, 1990–2000; PL, 1990
Cr	CZ, 1990, 2000–2005, 2011; PL, 1990
Cu	FR, 1990–2013; DE, 1990; PL, 1990, 2000–2005, 2011, 2013
Ni	BE, 1990–1995; PL, 1990; UK, 2010
Se	CZ, 1990–2005; ES, 2012–2013; UK, 2005–2013
Zn	CZ, 1990–2010, 2012; PL, 1990–2013; ES, 2012–2013; UK, 2012–2013
PCDD/Fs	CZ, 2000–2011; IT, 1990–2012; LV, 2011–2013; PL, 1990
Total PAHs	CZ, 2000; IT, 2010, 2012; ES, 2013
B(a)P	PL, 1990
B(b)F	PL, 1990
B(k)F	PL, 1990
IP	IE, 2005–2011; NL, 1990; PL, 1990
HCB	AT, 2013; BE, 1990; PL, 1990; UK, 1990–1995
PCBs	CZ, 2000–2005, 2012; PL, 1990; SI, 1990–2013; UK, 1990–2013

revisions of emission factors, reallocations, revisions of activity data and corrections of errors). Others, however, do not explain the rationale behind recalculations, despite having submitted IIRs.

Austria provided detailed information on its recalculations. They were because of revisions, updates of activity data, and improvements of methodologies and emission factors (Appendix 5, Austria's IIR).

Belgium provided detailed information on its recalculations. The main reasons are that the *EMEP/EEA Guidebook* updated emissions factors in all the regions (Flanders, Wallonia and Brussels) and, on the sectoral level, new data were available and corrections were made (Appendix 5, Belgium's IIR).

Bulgaria reported that it had recalculated for sectors 1A3b (the entire time series for road transport) and 5C1biii (Appendix 5, Bulgaria's IIR).

Croatia provided detailed information on its recalculations for almost all pollutants since 1990. The main reason for recalculations is methodology improvement. Table ES4-1 in Croatia's IIR offers an overview of the recalculations (Appendix 5, Croatia's IIR).

Cyprus stated that it had made some methodological improvements to the national emissions inventory. This resulted in recalculations of the time series from 1990 to 2013, inclusive, to improve the accuracy of emission data. The main reason was the implementation of the new *EMEP/EEA Guidebook* (Appendix 5, Cyprus's IIR).

The **Czech Republic** stated recalculation of all ammonia emission balance since 2000 was executed. Data for the Waste sector were recalculated because of changes to the categorization within certain partial sectors. (Appendix 5, the Czech Republic's IIR).

Denmark provided detailed information on its recalculations. It had put considerable work into improving the inventory. The submission includes recalculated inventories for the whole time series. The reasons for the recalculation are changed methodology, updated activity data, new data, correction of errors and updated emission factors (Appendix 5, Denmark's IIR).

Estonia provided detailed information on its recalculations from 1990 to 2013. The reasons for recalculating are new emission factors (the *EMEP/EEA Guidebook*), correction of emissions, additional emissions, update of activity data, correction of errors, correction of emission factors and correction of calculations (Appendix 5, Estonia's IIR).

Finland provided detailed information on recalculations. It had recalculated the time series for several subcategories, not including the 'energy' sector. Once it has recalculated this sector, it will report the entire time series (1990–2013). At present, it is checking basic data, methods and underlying assumptions ad hoc. It will check them systematically once recalculations are complete. It will reallocate emissions as well (Appendix 5, Finland's IIR).

France stated that recalculations were due to the review of methods and emission factors in the road transport sector, incorporation of specific emission data from declarations, and updates of the energy balance and activity data in the agricultural sector.

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

Hungary provided detailed information on recalculations. Recalculations were due to updated activity data, incorporation of measured data and updated methodology (Appendix 5, Hungary's IIR).

Italy provided detailed information on its recalculations. It had put considerable work into improving the inventory. Reasons for recalculations were updates of methodology, updated activity data, correction of errors and the availability of new data. (Appendix 5, Italy's IIR).

Latvia provided detailed information on recalculations. Recalculations were due to improved activity data, updated methodology and revised/new emission factors (Appendix 5, Latvia's IIR).

Lithuania corrected the activity data for the transport sectors according to renewed data from the vehicle licensing authority, REGITRA (Appendix 5, Lithuania's IIR).

Luxembourg reported recalculations due to updates of activity data, methodology and emission factors for several source categories (Appendix 5, Luxembourg's IIR).

The **Netherlands** provided detailed information on its recalculations. The Dutch energy statics were recalculated for the whole time series to streamline with international requirements and definitions. Also the availability of new activity data lead to recalculations of ammonia emissions (Appendix 5, the Netherlands' IIR).

Poland reported that in 2015 it had updated energy data from 1990. This changed the inventory data for

combustion processes, affecting the whole trend. It has changed methodology and recalculated activity data and emissions for the whole time series to ensure consistent trends. Given the lack of direct statistical data for historical years, it approximated some activity data on the basis of interpolated data or data available for other years (Appendix 5, Poland's IIR).

Portugal provided detailed information on its recalculations. Since the last submission, recalculations were mainly due to updates of background information and methodological revisions according to the *EMEP/EEA Guidebook* and the *2006 IPCC [Intergovernmental Panel on Climate Change] Guidelines for National Greenhouse Gas Inventories* (IPCC, 2006). They were in line with recommendations issued during the CLRTAP inventory reviews and other inventory review processes under the UNFCCC and the EC (Appendix 5, Portugal's IIR).

Romania noted that it had recalculated emissions from road transportation for 2005–2014 using COPERT 4 software. It had also recalculated the emissions for sectors 2D3a, 2D3f and 5D3 because new population data were available (Appendix 5, Romania's IIR).

Slovakia provided detailed information on its recalculations. The reasons were corrections, emission factors in compliance with the *EMEP/EEA Guidebook*, reallocations and updated activity data (Appendix 5, Slovakia's IIR).

Slovenia provided detailed information on its recalculations. They were due to corrections, availability of better data, new estimations, revised guidelines and emission factors from the *EMEP/EEA Guidebook* (Appendix 5, Slovenia's IIR).

Spain provided detailed information on its recalculations. The main reasons were changes in estimation methods, new methodologies and error correction (Appendix 5, Spain's IIR).

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

The **United Kingdom** provided detailed information on recalculations made since its last CLRTAP submission. Reasons were improved emission estimates, new or additional data sources, the use of updated emission factors and methodological changes (Appendix 5, the United Kingdom's IIR).

The annual joint EMEP/EEA inventory review report (EMEP/EEA, 2016) presents a summary of the individual recalculations that Member States reported. This report is available from the CEIP website in July of each year (EMEP CEIP, 2016b).

5.1.2 Member States' emission changes due to review improvements

In addition, EMEP CEIP has the task of reviewing the submitted emissions, to help Parties improve national inventories (EMEP CEIP, 2016a; EMEP/EEA, 2016). These yearly reviews should help Member States to prepare and improve their inventories. Member States compile their individual emission estimates and submit their inventories together with their IIRs.

The Stage 1 review — an automated test — happens every year to assess timeliness, completeness and format. The Stage 2 review assesses recalculations, KCA, inventory comparison, trends and time series. Stage 3 is an in-depth review by experts whom the Parties nominate. Each year, the plan is to review 10 Parties' inventories.

In 2015, EMEP CEIP reviewed Azerbaijan, Belarus, the Czech Republic, Ireland, the Republic of Moldova, the Netherlands, Slovakia, Slovenia and the Ukraine. In their IIRs, some of these Member States refer explicitly to improvements made as a consequence of these reviews.

5.2 Planned and implemented improvements

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

The joint EMEP/EEA annual review of inventory data helps improve Member States' inventories. The review of data reported under the LRTAP Convention happens jointly with the review of data reported by Member States under the NEC Directive. Since 2009, there has been a centralised Stage 3 review process. Two teams of emission experts perform the reviews. Member States are encouraged to nominate reviewers for the EMEP roster of emission review experts; nomination process details are available on the CEIP website. In 2012, the EU emission inventory report (1990–2010) under the UNECE LRTAP Convention was reviewed (EEA, 2012). Its next review will be in 2017.

Countries are encouraged to check if, and if yes why PM_{10} values are larger than the corresponding TSP values, $PM_{2.5}$ values are larger than PM_{10} values or BC values are larger than $PM_{2.5}$ values. Further, Member States which did not report data for BC in 2016 are encouraged to do so in 2017.

5.2.1 Improvements at EU level

Planned improvements

- Further progress concerning **completeness of reporting**: although clear progress has been made in recent years on making reporting complete, a full set of emission inventory data for air pollutants is still not available for all Member States, as noted earlier in this report. Further, for certain pollutants (including PM, HMs and POPs), data could not be fully gap-filled, because some Member States had not reported emission values in any years (see Figures 1.2 and 1.3).

- **Updating of emission data** by Member States, for past years too: the ETC/ACM has also identified a problem with filling gaps by using data submitted several years ago. In a number of cases, because countries have not since submitted corrected or updated data sets, the EU-28 inventory unavoidably contains inconsistencies. The quality of the EU's inventory will thus be enhanced if the consistency and completeness of Member States' submissions improves. Such improvements would help reliable trend analysis to inform policy.

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

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

- **More explanatory information** on trends and recalculations: this would be possible if the IIRs contained such information.

- Further research on **outliers in Member States' emission data** to help ensure that they reflect real emissions: a comparison of Member States' contributions to the EU-28 total reveals extraordinarily high proportions in some instances, e.g. for SO_X in Poland (26 %), TSP in France (25 %), Pb in Poland (27 %), Cu in Germany (61 %), Se in Spain (39 %), Zn in Germany (30 %), IP in Poland (39 %) and HCB in Austria (48 %). Future investigation could determine whether these high proportions reflect actual emissions or they are ascribable to incomplete reporting (or underestimates) by other Member States.

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

Improvements undertaken in 2016

- The figures on the effect of gap-filling on EU emissions have been modified and revised to show the completeness of reporting as well (Figure 1.2 and Figure 1.3).

- Instead of the tables on the key category analysis, there is a more descriptive Figure (Figure 1.4).

- The figures on the completeness of reporting of NFR templates that Member States submitted have been simplified (Figure 1.5).

- There is a chapter about adjustments under the Gothenburg Protocol (Chapter 2).

- The trend chapter (Chapter 3) includes figures on sectoral trends in emissions for certain pollutants (NO_X, NMVOCs, SO_X, NH_3, PMs, CO, main HMs, PCDD/F, total PAHs, B(a)P, HCB and PCBs).

- Again, manual corrections for BC, $PM_{2.5}$ and PM_{10} improved the gap-filled inventory.

- Early data checks on submitted Member State inventories were performed.

Improvements in reporting at Member State level

- Basis of emissions from transport: according to the reporting guidelines (UNECE, 2014a), all Member

States should calculate and report emissions from road vehicle transport on the basis of fuel sold. Only for the purpose of comparison with the ceilings, Austria, Belgium, Ireland, Lithuania, Luxembourg, the Netherlands and the United Kingdom may choose to use the national emission total calculated on the basis of fuel used. This year again, the United Kingdom submitted data based only on fuel used, but for the first time the Netherlands submitted its data partly (NO_X, NMVOCs, SO_X, PMs and CO) based on fuel sold. It still based the emissions of the other pollutants on fuel used.

- The updated reporting guidelines (UNECE, 2014a) request that Parties to the LRTAP Convention provide emissions data using the new NFR14 format. All EU Member States that submitted data used the new template.

5.2.2 Improvements at Member State level

Improvements at Member State level also automatically improve the EU inventory. For this reason, it is of interest to note which countries have planned to improve their inventories. Table 5.3 provides an overview of these. However, it is not easy to gain a systematic overview of the overall situation, as Member States provide varying amounts of information.

Table 5.3 Overview of improvements planned at Member State level

Member State	Improvements planned
Austria	The corresponding sector analysis chapters describe required methodological changes and planned improvements (Appendix 5, Austria's IIR).
Belgium	Belgium's IIR lists planned improvements in sections 9.1–9.4. The relevant sectoral chapters also describe them (Appendix 5, Belgium's IIR).
Bulgaria	Planned improvements: - application of higher-tier method for estimation of emissions; - incorporation of ETS and E-PRTR databases into emission inventory in NFR sector 1 'energy' and NFR sector 2 'industrial processes and other solvents and product use'; - incorporation of data provided by branch business associations; - revision of activity data in NFR sector 3 'agriculture', in line with agro-statistical data from the Ministry of Agriculture and Food; - improving the accuracy of the estimates; - improving transparency, completeness, consistency, including recalculations of time series and comparability of national emission inventory (Appendix 5, Bulgaria's IIR).
Croatia	Table ES6-1 of Croatia's IIR lists planned improvements in detail, including recalculations and collection of new data (Appendix 5, Croatia's IIR).
Cyprus	The 2016 IIR reports no planned improvements.
Czech Republic	For the sectors energy (mobile sources) and agriculture (manure management) a few improvements are planned (Appendix 5, Czech Repubic's IIR).
Denmark	The emission inventory will detail implementation of other NH_3-reducing technologies when data are available. The QA/QC plan for the agricultural sector is continually under development. Until now, the main focus has been on checking internal procedures. The relevant sectoral chapters describe sector-specific planned improvements (Appendix 5, Denmark's IIR).
Estonia	Estonia's IIR lists source-specific planned improvements: they include recalculations, improvement of data quality and improvement of QA/QC procedures (Appendix 5, Estonia's IIR).
Finland	Table 14.3 of Finland's IIR sets out sector-specific improvement needs. Further, the sectoral chapters describe the source-specific planned improvements (Appendix 5, Finland's IIR).
France	Diverse investigations have been launched and are planned within this context. - Conducting research to improve accuracy, especially for key categories. - Establishing measures to determine uncertainties. - Reducing the number of non-considered or poorly determined pollutants. There are still plans to improve the estimation from heating boilers in the residential sector, which could strongly influence NOX emissions. - Introducing further splits for energy consumption in the industry sector. - Adopting the recent developments of EMEP/EEA. - Strengthening all activities for better QA and QC of the system, especially towards the implementation of procedures and tools, cooperation with experts from different fields and maintaining the ISO 9001 certification system (Appendix 5, France's IIR).
Germany	Planned improvements for the overall inventory include updating projections (data and text), and working on completing the POP inventory. Those listed for individual source categories for stationary combustion are improvements/revision of emission factors, new calculations and correction of activity data. For mobile combustion, these include new estimates and revision of models (Appendix 5, Germany's IIR).
Greece	*No IIR available.*

Table 5.3 Overview of improvements planned at Member State level (cont.)

Member State	Improvements planned
Hungary	- Further improvement of the coordination with E-PRTR reporting and within LAIR (Air Quality Protection System) reporting process. - Quantitative uncertainty analysis. - Improvement of QA/QC actions. Application of the same processes as applied within the UNFCCC annual emission inventory reporting (Appendix 5, Hungary's IIR).
Ireland (information from IIR 2015)	The sectoral chapters of Ireland's IIR describe the source-specific planned improvements.
Italy	For the 'energy' and 'industrial processes' sectors, significant progress is planned in management of the information system. This collates data collected under different obligations (Large Combustion Plants Directive, E-PRTR and Emissions Trading Scheme), to highlight major discrepancies and to detect potential errors. For the sectors 'agriculture' and 'waste', improvements related to the availability of new information on emission factors, activity data, etc. are planned. Further work is planned to update/change emission factors for the $PM_{2.5}$, BC, PAH, dioxin and HMs (Appendix 5, Italy's IIR).
Latvia	The IIR lists planned improvements. They mainly concern the implementation of new methodologies (Appendix 5, Latvia's IIR).
Lithuania	The sectoral chapters list source-specific planned improvements. The reported improvements comprise uncertainty analyses for the transport sector (railway transport, gas transport) (Appendix 5, Lithuania's IIR).
Luxembourg	The IIR lists planned improvements (Luxembourg's IIR, p. 324). They mainly concern updating the method of calculating emissions, correction of errors and notation keys, reallocation of emissions and completeness (Appendix 5, Luxembourg's IIR).
Malta (information from IIR 2013)	The time series may be updated with respect to HM emissions (Malta's IIR, p. 20).
Netherlands	In 2015 the IIR and NFR-tables were examined in a stage 3 review. The findings were considered in this year's inventory, the remaining issues will be implemented in the 2017 and 2018 inventories. Some source specific improvements are planned. The sectoral chapters of the Netherlands' IIR describe them. (Appendix 5, Netherlands' IIR).
Poland	The planned programme of improvement focuses on the following tasks: verifying NMVOC emissions from solvent use; gathering additional activity data to include new emission sources (e.g. venting and flaring); and further methodology development by applying higher tiers of estimation methodology (especially for key categories) (Appendix 5, Poland's IIR).
Portugal	Each source-specific section presents a detailed explanation of the planned sectoral improvements (Appendix 5, Portugal's IIR).
Romania	Planned improvements relate to NFR categories 1B2ai and 1B2b. The aim is to use new data from 'gasoline distribution' and 'natural gas extraction' to be suitable for a better estimation of emissions (Appendix 5, Romania's IIR).
Slovakia	Short-term plans for improvement include recalculations for some pollutants. In the long run, the calculation of NMVOC and NOX emissions will use the Tier 2 method (Appendix 5, Slovakia's IIR).
Slovenia	Planned improvements relate to sectors 1 and 2. The main aim is to estimate emissions that were not estimated before. A detailed list of the planned improvements is in Slovenia's IIR (Appendix 5, Slovenia's IIR).
Spain	The principal areas of improvement are: - harmonising the inventory with other registries (e.g. E-PRTR); - continuing to update emission factors and methodologies based on guidance in the *EMEP/EEA Guidebook*; - carrying out quantitative estimations of uncertainty and improvements in the methodology for identifying key categories; - implementing a QA programme based on external audits; - continuing to revise the inventory of persistent organic compounds; - introduction of correspondences between SNAP-NFR and SNAP-CRF; - integrating the Expert Review Team (ERT) recommendations from the 2014 in-depth review. Sections 8.2.1–8.2.4 also list improvements at sectoral level (Appendix 5, Spain's IIR).
Sweden	Experts at the Swedish Environmental Protection Agency (EPA) review the inventory estimates, methodologies and emissions factors used. The experts also identify areas of improvement, which constitute part of the basis for improvements in coming submissions. Other than this, there is no information on planned improvements (Appendix 5, Sweden's IIR).
United Kingdom	A number of improvements to the inventory are planned, although not all improvements are expected to be incorporated into the next version of the inventory. Planned improvements are relevant to the sectors 'energy', 'industrial processes' and 'waste', and include methodological changes as well as revision of activity data and emission factors (Appendix 5, the United Kingdom's IIR).

Note: Countries marked in grey text did not submit an IIR in 2016.

References

EC, 1996, Council Directive 96/59/EC of 24 September 1996 concerning integrated pollution prevention and control (OJ L 243, 24.9.1996) (http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:31996L0061&rid=6) accessed 23 March 2016.

EC, 1998, Directive 98/70/EC of the European Parliament and of the Council of 13 October 1998 relating to the quality of petrol and diesel fuels and amending Council Directive 93/12/EEC (OJ L 350, 28.12.1998, p. 58) (http://eur-lex.europa.eu/resource.html?uri=cellar:e373d7a7-043c-4fd5-94ba-389d24e8fe26.0008.02/DOC_1&format=PDF) accessed 23 March 2016.

EC, 1999, 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 (OJ L 117, 5.5.1999, p. 1–4) (http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:1999:117:0001:0004:EN:PDF) accessed 23 March 2016 (a brochure describing the structure, working methods, outputs and activities of Eionet is available: EEA, *Eionet connects*, European Environment Agency (http://www.eea.europa.eu/publications/eionet-connects) accessed 23 March 2016).

EC, 2001, Directive 2001/81/EC of the European Parliament and of the Council of 23 October 2001 on national emission ceilings for certain atmospheric pollutants (OJ L 309, 27.11.2001, p. 22) (http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2001:309:0022:0030:EN:PDF) accessed 23 March 2016.

EEA, 2009, *Proposed gap-filling procedure for the European Community LRTAP Convention emission inventory*, Technical paper for the meeting of the Air and Fuels Committee under Directive 96/62/EC, concerning 'Information on the Member States' reporting under the National Emission Ceilings Directive 2001/81/EC', 28 September 2009, Brussels, European Environment Agency, Copenhagen. Available upon request.

EEA, 2012, *European Union emission inventory report 1990–2010 under the UNECE Convention on Long-range Transboundary Air Pollution (LRTAP)*, EEA Technical report No 8/2012, European Environment Agency (http://www.eea.europa.eu/publications/eu-emission-inventory-report-1990-2010) accessed 23 March 2016.

EEA, 2014, *Effect of air pollution on European ecosystems*, EEA Technical report No 11/2014, European Environment Agency (http://www.eea.europa.eu/publications/effects-of-air-pollution-on) accessed 23 March 2016.

EEA, 2015a, 'Emissions of the main air pollutants in Europe (CSI 040)',, European Environment Agency (http://www.eea.europa.eu/data-and-maps/indicators/main-anthropogenic-air-pollutant-emissions/assessment-1) accessed 23 March 2016.

EEA, 2015b, 'Persistent organic pollutants (POP) emissions (APE 006)', European Environment Agency (http://www.eea.europa.eu/data-and-maps/indicators/eea32-persistent-organic-pollutant-pop-emissions-1/assessment-5) accessed 23 March 2016.

EEA, 2015c, 'Heavy metal emissions (APE 005)', European Environment Agency (http://www.eea.europa.eu/data-and-maps/indicators/eea32-heavy-metal-hm-emissions-1/assessment-5) accessed 23 March 2016.

EEA, 2015d, *NEC Directive status report 2014*, EEA Technical report No 7/2015, European Environment Agency (http://www.eea.europa.eu/publications/nec-directive-status-report-2014) accessed 23 March 2016.

EEA, 2015e, 'European Environment Agency: Air pollutant emissions data viewer (LRTAP Convention)', European Environment Agency (http://www.eea.europa.eu/data-and-maps/data/data-viewers/air-emissions-viewer-lrtap) accessed 23 March 2016.

EEA, 2015f, *Air quality in Europe — 2015 report*, EEA Report No 5/2015, European Environment Agency (http://www.eea.europa.eu//publications/air-quality-in-europe-2015) accessed 23 March 2016.

EEA, 2015g, *SOER 2015 — The European environment — state and outlook 2015, European briefings, the air and climate system*, European Environment Agency (http://

www.eea.europa.eu/soer-2015/europe/the-air-and-climate-system) accessed 5 April 2016.

Eionet, 2015a, 'Eionet — Central Data Repository', European Environmental Information and Observation Network (http://cdr.eionet.europa.eu/) accessed 23 March 2016.

Eionet, 2015b, 'Eionet — European Environment Information and Observation Network', European Environmental Information and Observation Network (http://eionet.europa.eu/) accessed 23 March 2016.

EMEP CEIP, 2016a, 'Introduction to the review process' (http://www.ceip.at/ms/ceip_home1/ceip_home/review_process/) accessed 23 March 2016.

EMEP CEIP, 2016b, 'Review results' (http://www.ceip.at/ms/ceip_home1/ceip_home/review_results/) accessed 23 March 2016.

EMEP/EEA, 2013, *EMEP/EEA air pollutant emission inventory guidebook — 2013*, EEA Technical Report No 12/2013, European Environment Agency (http://www.eea.europa.eu/publications/emep-eea-guidebook-2013) accessed 23 March 2016.

EMEP/EEA, 2016, *Inventory review 2016: Review of emission data reported under the LRTAP Convention and NEC Directive Stage 1 and 2 review,* EEA Technical Report CEIP, European Environment Agency, *in preparation*.

EU, 2013, Regulation (EU) No 525/2013 of the European Parliament and of the Council of 21 May 2013 on a mechanism for monitoring and reporting greenhouse gas emissions and for reporting other information at national and Union level relevant to climate change and repealing Decision No 280/2004/EC (OJ L 165/13, 18.6.2013) (http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32013R0525&from=EN) accessed 23 May 2016.

IPCC, 2006, *2006 IPCC guidelines for national greenhouse gas inventories*, Intergovernmental Panel on Climate Change (http://www.ipcc-nggip.iges.or.jp/public/2006gl/index.html) accessed 23 March 2016.

UNECE, 1979, *The 1979 Geneva Convention on Long-range Transboundary Air Pollution*, United Nations Economic Commission for Europe (http://www.unece.org/env/lrtap/lrtap_h1.html) accessed 23 March 2016.

UNECE, 1984, *The 1984 Geneva Protocol on Long-term Financing of the Cooperative Programme for Monitoring and Evaluation of the Long-range Transmission of Air Pollutants in Europe (EMEP)*, United Nations Economic Commission for Europe (http://www.unece.org/env/lrtap/emep_h1.html) accessed 23 March 2016.

UNECE, 1985, *The 1985 Helsinki Protocol on the Reduction of Sulphur Emissions or their Transboundary Fluxes by at least 30 per cent*, United Nations Economic Commission for Europe (http://www.unece.org/env/lrtap/sulf_h1.html) accessed 23 March 2016.

UNECE, 1988, *The 1988 Sofia Protocol concerning the Control of Nitrogen Oxides or their Transboundary Fluxes*, United Nations Economic Commission for Europe (http://www.unece.org/env/lrtap/nitr_h1.html) accessed 23 March 2016.

UNECE, 1991, *The 1991 Geneva Protocol concerning the Control of Emissions of Volatile Organic Compounds or their Transboundary Fluxes*, United Nations Economic Commission for Europe (http://www.unece.org/env/lrtap/vola_h1.html) accessed 23 March 2016.

UNECE, 1994, *The 1994 Oslo Protocol on Further Reduction of Sulphur Emissions*, United Nations Economic Commission for Europe (http://www.unece.org/env/lrtap/fsulf_h1.html) accessed 23 March 2016.

UNECE, 1998a, *The 1998 Aarhus Protocol on Persistent Organic Pollutants (POPs)*, United Nations Economic Commission for Europe (http://www.unece.org/env/lrtap/pops_h1.html) accessed 23 March 2016.

UNECE, 1998b, *The 1998 Aarhus Protocol on Heavy Metals*, United Nations Economic Commission for Europe (http://www.unece.org/env/lrtap/hm_h1.html) accessed 23 March 2016.

UNECE, 1999, *The 1999 Gothenburg Protocol to Abate Acidification, Eutrophication and Ground-level Ozone,* United Nations Economic Commission for Europe (http://www.unece.org/env/lrtap/multi_h1.html) accessed 23 March 2016.

UNECE, 2006, *Implementation Committee, its structure and functions and procedure for review,* United Nations Economic Commission for Europe (ECE/EB.AIR/2006/2) (http://www.unece.org/fileadmin/DAM/env/documents/2006/eb/EB/EB%20Decisions/Decision%202006.2.pdf) accessed 23 March 2016.

UNECE, 2012a, *Decision 2012/2, Amendment of the text of and annexes II to IX to the 1999 Protocol to Abate Acidification, Eutrophication and Ground-level Ozone and the addition of new annexes X and XI* (http://www.unece.org/fileadmin/DAM/env/lrtap/full%20text/ECE_EB.AIR_111_Add1_2_E.pdf) accessed 23 March 2016.

UNECE, 2012b, *Decision 2012/3, Adjustments under the Gothenburg Protocol to emission reduction commitments or to inventories for the purposes of comparing total national emissions with them,* United Nations Economic Commission for Europe (ECE/EB.AIR/111) (http://www.unece.org/fileadmin/DAM/env/documents/2013/air/ECE_EB.AIR_111_Add.1__ENG_DECISION_3.pdf) accessed 23 March 2016.

UNECE, 2012c, *Decision 2012/12, Guidance for adjustments under the 1999 Protocol to Abate Acidification, Eutrophication and Ground-level Ozone to emission reduction commitments or to inventories for the purposes of comparing total national emissions with them,* United Nations Economic Commission for Europe (ECE/EB.AIR/113) (http://www.unece.org/fileadmin/DAM/env/documents/2012/EB/Decision_2012_12.pdf) accessed 23 March 2016.

UNECE, 2014a, *Guidelines for reporting emissions and projections data under the Convention on Long-range Transboundary Air Pollution*, United Nations Economic Commission for Europe (ECE/EB.AIR/125) (http://www.ceip.at/fileadmin/inhalte/emep/2014_Guidelines/ece.eb.air.125_ADVANCE_VERSION_reporting_guidelines_2013.pdf) accessed 23 March 2016.

UNECE, 2014b, *Review of adjustment applications — Report by the Centre on Emission Inventories and Projections*, United Nations Economic Commission for Europe (ECE/EB.AIR/GE.1/2014/10) (http://www.ceip.at/fileadmin/inhalte/emep/pdf/2015/ece.eb.air.ge.1.2014.10.edited.ae_formatting_accepted.ko.pdf) accessed 23 March 2016.

UNECE, 2015, *Review of adjustment applications — Report by the Centre on Emission Inventories and Projections*, United Nations Economic Commission for Europe (ECE/EB.AIR/GE.1/2015/10- ECE/EB.AIR/WG.1/2015/13) (http://www.ceip.at/fileadmin/inhalte/emep/Adjustments/ece.eb.air.ge.1.2015.10_ece.eb.air.wg.1.2015.13.AV.pdf) accessed 23 March 2016.

Van der Most, P. F. J. and Veldt, C., 1992, *Emission factors manual PARCOM-ATMOS — Emission factors for air pollutants*, Netherlands Organisation for Applied Scientific Research (TNO), The Hague, Netherlands.

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 they have not considered in their inventories, although the *EMEP/EEA Guidebook* (EMEP/EEA, 2013) includes them, and explain the reason for the exclusion. Similarly, each Party should indicate if it has excluded part of its territory, and explain why. In addition, each Party should use the notations presented below to fill the blanks in all the tables of the NFR inventory. This approach helps assess how complete emission data reports are. The notations are as follows ([10]).

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

NE **'**Not estimated' means emissions occur, but have not been estimated or reported. Where an inventory uses 'NE', the Party should indicate why it could not estimate emissions.

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

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

C 'Confidential' is for aggregated emissions that the inventory includes elsewhere, because reporting at a disaggregated level could lead to the disclosure of confidential information. Where an inventory uses 'C', it should make reference to the protocol provision that authorises it.

NR 'Not relevant' eases reporting where different protocols do not strictly require details of emissions. According to Article III, paragraph 9, in the emission-reporting guidelines, emission inventory reporting should cover all years from 1980 onwards if data are available. However, some Parties, for example, do not need to report 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 it has used to estimate them.

([10]) Further explanation and guidance concerning the use of these notation codes are in the EMEP emission reporting guidelines (UNECE, 2014a).

Appendix 2 LRTAP Convention emission-reporting programme for 2016

Emission data should be submitted to EMEP CEIP by **15 February 2016**. IIRs should reach the centre no later than **15 March 2016**. Table A2.1 summarises information contained in the revised emission-reporting guidelines (UNECE, 2014a).

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

Description of contents	Pollutant(s)	Reporting years [a]
Yearly: minimum (and additional)		
A. National total emissions		
1. Main pollutants	NO_x, NMVOCs, SO_x, NH_3, CO	1980–2014
2. Particulate matter [b]	$PM_{2.5}$, PM_{10}, (TSPs, BC)	2000–2014
3. Heavy metals [b]	Pb, Cd, Hg, (As, Cr, Cu, Ni, Se, Zn)	1990–2014
4. Persistent organic pollutants [b]	PCDD/Fs, total PAHs, PCBs, HCB (PAHs: B(a)P, B(b)F, B(k)F, IP)	1990–2014
B. Emissions by NFR source category		
1. Main pollutants	NO_x, NMVOCs, SO_x, NH_3, CO	1990–2014
2. Particulate matter [b]	$PM_{2.5}$, PM_{10}, (TSPs, BC)	2000–2014
3. Heavy metals [b]	Pb, Cd, Hg, (As, Cr, Cu, Ni, Se, Zn)	1990–2014
4. Persistent organic pollutants [b]	PCDD/Fs, total PAHs, PCBs, HCB (PAHs: B(a)P, B(b)F, B(k)F, IP)	1990–2014
C. Activity data	NO_x, NMVOCs, SO_x, NH_3, CO	1990–2014
4-yearly: minimum reporting (from 2017 onwards)		
D. Gridded data in the EMEP 0.1° x 0.1° long/lat grid — sector emissions (GNFR14) and national totals (optional)	NO_x, NMVOCs, SO_x, NH_3, CO, $PM_{2.5}$, PM_{10}, Pb, Cd, Hg, PCDD/F, PAHs, HCB, PCBs	2000 (optional), 2005, 2010, 2015 and every 4 years
E. Emissions from LPSs	NO_x, NMVOCs, SO_x, NH_3, CO, $PM_{2.5}$, PM_{10}, Pb, Cd, Hg, PCDD/F, PAHs, HCB, PCBs	2000 (optional), 2005, 2010, 2015 and every 4 years
F. Projected emissions and projected activity data		
1. National total emission projections	NO_x, NMVOCs, SO_x, NH_3, $PM_{2.5}$, BC	2020, 2025, 2030, where available 2040 and 2050
2. Emission projections by NFR14	NO_x, NMVOCs, SO_x, NH_3, $PM_{2.5}$, BC	2020, 2025, 2030, where available 2040 and 2050
3. Projected activity data by NFR14		2020, 2025, 2030, where available 2040 and 2050
5-yearly: additional reporting for review and assessment purposes		
Volatile organic compound (VOC) speciation/height distribution/temporal distribution		Parties are encouraged to review the information used for modelling at http://www.ceip.at/ms/ceip_home1/ceip_home/webdab_emepdatabase/emissions_emepmodels/ online (accessed 14 March 2016)
Land-use data/Hg breakdown		
Percentage of toxic congeners of PCDD/F emissions		
Pre-1990 emissions of PAHs, HCB, PCDD/Fs and PCBs		
Information on natural emissions		

Notes: [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 (i.e. the second-last before the current year) should be reported.

[b] Parties report the pollutants listed in brackets voluntarily.

Reporting format

Each Party should use the reporting format in Annex IV of the reporting guidelines (UNECE, 2014a) for its annual submissions. It should submit the information to the CEIP formally, preferably in electronic form, and notify the UNECE secretariat. The reporting format, including the NFR, is standardised for reporting estimates of emissions. It includes activity data, projected activity data, projected emissions and other relevant information. The reporting format aims to facilitate electronic submissions. This should make it simpler to process emission information and prepare useful documentation about technical analysis and synthesis.

The new NFR14 format covers:

- national annual emissions and national annual sector emissions (Annex I);
- total and aggregated sector emissions for reporting emissions of NO_X, NMVOCs, SO_X, NH_3, PM, BC, CO, Pb, Cd, Hg, PCDD/Fs, PAHs, HCB and PCBs, for the EMEP 0.1° × 0.1° grid cell and from LPSs (Annexes V and VI);
- for 2020, 2025, 2030, 2040 and 2050, projected activity data and projected national total emissions of NO_X, NMVOCs, sulphur and NH_3, which Parties are to report for the source categories listed in Annex IV (A-WM, B-WM, A-WaM, B-WaM).

Table A2.2 European Union — country grouping

EU-9	refers to the nine Member States up to 31 December 1980: Belgium (BE), Denmark (DK), France (FR), Germany (DE), Ireland (IE), Italy (IT), Luxembourg (LU), the Netherlands (NL) and the United Kingdom (UK)
EU-12	refers to the 12 Member States from 1 January 1981 to 31 December 1994: the EU-9 plus Greece (EL), Portugal (PT) and Spain (ES)
EU-15	refers to the 15 Member States from 1 January 1995 to 30 April 2003: the EU-12 plus Austria (AT), Finland (FI) and Sweden (SE)
EU-27	refers to the 27 Member States from 1 May 2003 to 30 June 2013: the EU-15 plus Bulgaria (BG), Cyprus (CY), the Czech Republic (CZ), Estonia (EE), Hungary (HU), Latvia (LV), Lithuania (LT), Malta (MT), Poland (PL), Romania (RO), Slovakia (SK) and Slovenia (SI)
EU-28	refers to the 28 Member States from 1 July 2013: the EU-27 plus Croatia (HR)

Appendix 3 Status of reporting and timeliness

Table A3.1 Member State inventory submissions 2016: date received by the EEA, years covered and information provided (as of 6 May 2016, IIRs: 9 May 2016)

Member State	Annual reporting					Minimum 5-year reporting		
	Submission date [a]	Date of resubmission and/or additional information	NFR template	IIR 2016	Activity data [b]	Projections	Gridded data	LPS emissions
Austria	15.02.2016		2014-2	15.03.2016 26.04.2016	1990–2014	np	np	np
Belgium	15.02.2016	15.03.2016 04.04.2016	2014-1	15.03.2016	1990–2014	np	np	np
Bulgaria	15.02.2016	07.04.2016	2014-1	15.03.2016	1990–2014	2020, 2025, 2030	np	np
Croatia	15.02.2016	22.02.2016 15.03.2016	2014-1	15.03.2016	1987–1988, 1990–2014	2020, 2025, 2030	2014	np
Cyprus	15.02.2016	17.03.2016 (only 2014 data)	2014-2	15.03.2016	1990–2014	np	np	np
Czech Republic	16.02.2016	15.03.2016 05.05.2016	2014-2	20.03.2016	2000–2014	np	np	np
Denmark	15.02.2016		2014-1	15.03.2016	1980–2014	np	np	np
Estonia	12.02.2016	15.03.2016	2014-2	15.03.2016	1990–2014	2020, 2025, 2030	np	np
Finland	15.02.2016	10.03.2016 15.03.2016 30.04.2016	2014-1	15.03.2016 30.04.2016	2008–2014	2020, 2025, 2030, 2050 (NH_3)	2014	np
France	12.02.2016		2014-2	14.03.2016 15.03.2016	1980–2014	np	np	np
Germany	10.02.2016		2014-2	10.02.2016	1990–2014	np	np	np
Greece								
Hungary	15.02.2016	29.02.2016	2014-1	17.03.2016	1990–2014	np	np	np
Ireland	15.02.2016		2014-2		1990–2014	np	np	np
Italy	15.02.2016		2014-1	15.03.2016	1990–2014	np	np	np
Latvia	12.02.2016	15.03.2016 06.05.2016	2014-2	15.03.2016	1990–2014	2020, 2025, 2030	np	np
Lithuania	15.02.2016		2014-1	14.03.2016	1990–2014	np	np	np
Luxembourg	16.02.2016	15.04.2016	2014-2	15.03.2016 15.04.2016	1990–2014	2020, 2025, 2030	np	np
Malta	01.02.2016		2014-1		2000–2014	np	np	np
Netherlands	15.02.2016		2014-1	21.04.2016	1990–2014	2020, 2025, 2030	np	np
Poland	05.02.2016	28.04.2016	2014-1	10.03.2016	1990–2014	np	2014	2014
Portugal	15.02.2016	15.03.2016	2014-1	15.03.2016	1990–2014	np	np	np
Romania	15.02.2016	15.03.2016	2014-1	15.03.2016	2005–2014	np	np	np
Slovakia	16.02.2016	15.03.2016	2014-2	15.03.2016 09.05.2016	2001–2014	np	np	np
Slovenia	11.02.2016		2014-2	14.03.2016	1990–2014	np	np	np
Spain	15.02.2016	14.03.2015	2014-2	14.03.2016	1990–2014	np	np	np
Sweden	12.02.2016	24.02.2016	2014-1	12.02.2016 24.02.2016	1990–2014	np	np	np
United Kingdom	15.02.2016	15.03.2016	2014-2	15.03.2016	1990–2014	2020, 2025, 2030	np	np

Notes: [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 2016.

np, not provided.

Red-coloured dates indicate that data were submitted after the formal deadline for submissions (15 February; IIR: 15 March).

Table A3.2 Member States' LRTAP Convention submissions of 2015 (as of 6 May 2016)

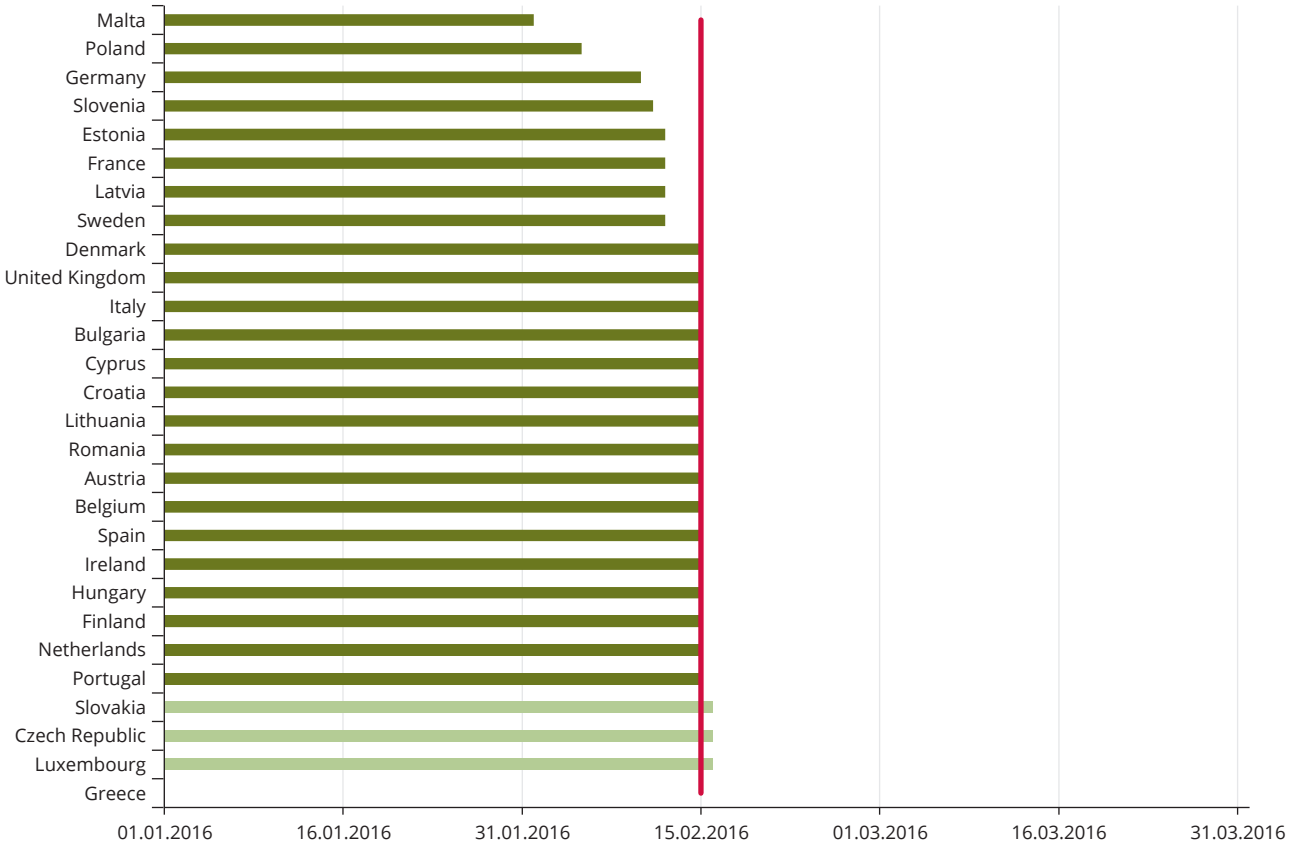
Member State	NO_X, NMVOC, SO_X, NH_3, CO	$PM_{2.5}$, PM_{10}, TSP [a], BC	Pb, Cd, Hg	Additional HMs [b]	POPs (PCDD/F, PAHs, HCB, PCBs)
Austria	1990–2014	1990, 1995, 2000–2014	1990–2014	np	1990–2014
Belgium	1990–2014	2000–2014	1990–2014	1990–2014	1990–2014
Bulgaria	1990–2014	1990–2014	1990–2014	1990–2014	1990–2014
Croatia	1987, 1988, 1990–2014	1987, 1988, 1990–2014	1987, 1988, 1990–2014	1987, 1988, 1990–2014	1987, 1988, 1990–2014
Cyprus	1990–2014	2000–2014	1990–2014	1990–2014	1990–2014
Czech Republic	2000–2014	2000–2014	2000–2014	2000–2014	2000–2014
Denmark	(1980,) 1985–2014	2000–2014	1990–2014	1990–2014	1990–2014
Estonia	1990–2014	(1990–) 2000–2014	1990–2014	1990–2014	1990–2014
Finland	(1980–) (1987–) 1990–2014	2000–2014	1990–2014	1990–2014	1990–2014
France	(1980–) 1988–2014	1990–2014	1990–2014	1990–2014	1990–2014
Germany	1990–2014	(1990,) 1995–2014	1990–2014	1990–2014	1990–2014
Greece	np	np	np	np	np
Hungary	1990–2014	2000–2014	1990–2014	1990–2014	1990–2014
Ireland	(1987,) 1990–2014	2000–2014	1990–2014	1990–2014	1990–2014
Italy	1990–2014	1990–2014	1990–2014	1990–2014	1990–2014
Latvia	1990–2014	2000–2014	1990–2014	1990–2014	1990–2014
Lithuania	1990–2014	1990–2014	1990–2014	1990–2014	1990–2014
Luxembourg	1990–2014	1990–2014	1990–2014	np	1990–2014
Malta	2000–2014	2000 (2012)–2014	2000–2014	2000–2014	(2005, 2008,) 2010–2014
Netherlands	1990–2014	1990–2014	1990–2014	1990–2014	1990–2014
Poland	1990–2014	1990–2014	1990–2014	1990–2014	1990–2014
Portugal	1990–2014	1990–2014	1990–2014	1990–2014	1990–2014
Romania	2005–2014	2005–2014	2005–2014	2005–2014	2005–2014
Slovakia	2001–2014	2001–2014	2001–2014	2001–2014	2001–2014.
Slovenia	(1980–, 1986–,) 1990–2014	2000–2014	1990–2014	np	1990–2014
Spain	1990–2014	2000–2014	1990–2014	1990–2014	1990–2014
Sweden	1990–2014	1990 (2000)–2014	1990–2014	1990–2014	1990–2014
United Kingdom	1990–2014	1990 (2000)–2014	1990–2014	1990–2014	1990–2014

Notes: [a] Member States do not have to report TSPs if they report PM emissions.

[b] Reporting of additional HMs is not mandatory.

np, not provided.

Figure A3.1 Dates of first data submissions received from Member States (as of 6 May 2016)



Appendix 4 Conversion chart for aggregated sector groups

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

- energy production and distribution
- energy use in industry
- industrial processes and product use
- commercial, institutional and households
- road transport
- non-road transport
- agriculture
- waste.

Table A4.1 provides a conversion chart showing which of the individual NFR source categories was in each of the aggregated sector groups.

Table A4.1 Conversion chart for aggregated sector groups

NFR code	Full name	EEA aggregated sector name
1A1a	Public electricity and heat production	Energy production and distribution
1A1b	Petroleum refining	Energy production and distribution
1A1c	Manufacture of solid fuels and other energy industries	Energy production and distribution
1A2a	Stationary combustion in manufacturing industries and construction: Iron and steel	Energy use in industry
1A2b	Stationary combustion in manufacturing industries and construction: Non-ferrous metals	Energy use in industry
1A2c	Stationary combustion in manufacturing industries and construction: Chemicals	Energy use in industry
1A2d	Stationary combustion in manufacturing industries and construction: Pulp, paper and print	Energy use in industry
1A2e	Stationary combustion in manufacturing industries and construction: Food processing, beverages and tobacco	Energy use in industry
1A2f	Stationary combustion in manufacturing industries and construction: Non-metallic minerals	Energy use in industry
1A2gvii	Mobile combustion in manufacturing industries and construction	Energy use in industry
1A2gviii	Stationary combustion in manufacturing industries and construction: Other	Energy use in industry
1A3ai(i)	International aviation LTO (civil)	Non-road transport
1A3aii(i)	Domestic aviation LTO (civil)	Non-road transport
1A3bi	Road transport: Passenger cars	Road transport
1A3bii	Road transport: Light duty vehicles	Road transport
1A3biii	Road transport: Heavy duty vehicles and buses	Road transport
1A3biv	Road transport: Mopeds & motorcycles	Road transport
1A3bv	Road transport: Gasoline evaporation	Road transport
1A3bvi	Road transport: Automobile tyre and brake wear	Road transport
1A3bvii	Road transport: Automobile road abrasion	Road transport
1A3c	Railways	Non-road transport
1A3di(ii)	International inland waterways	Non-road transport
1A3dii	National navigation (shipping)	Non-road transport
1A3ei	Pipeline transport	Non-road transport
1A3eii	Other	Non-road transport
1A4ai	Commercial/institutional: Stationary	Commercial, institutional and households

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

NFR code	Full name	EEA aggregated sector name
1A4aii	Commercial/institutional: Mobile	Commercial, institutional and households
1A4bi	Residential: Stationary	Commercial, institutional and households
1A4bii	Residential: Household and gardening (mobile)	Commercial, institutional and households
1A4ci	Agriculture/forestry/fishing: Stationary	Commercial, institutional and households
1A4cii	Agriculture/forestry/fishing: Off-road vehicles and other machinery	Commercial, institutional and households
1A4ciii	Agriculture/forestry/fishing: National fishing	Non-road transport
1A5a	Other stationary (including military)	Commercial, institutional and households
1A5b	Other, mobile (including military, land-based and recreational boats)	Commercial, institutional and households
1B1a	Fugitive emission from solid fuels: Coal mining and handling	Energy production and distribution
1B1b	Fugitive emission from solid fuels: Solid fuel transformation	Energy production and distribution
1B1c	Other fugitive emissions from solid fuels	Energy production and distribution
1B2ai	Fugitive emissions oil: Exploration, production, transport	Energy production and distribution
1B2aiv	Fugitive emissions oil: Refining/storage	Energy production and distribution
1B2av	Distribution of oil products	Energy production and distribution
1B2b	Fugitive emissions from natural gas (exploration, production, processing, transmission, storage, distribution and other)	Energy production and distribution
1B2c	Venting and flaring (oil, gas, combined oil and gas)	Energy production and distribution
1B2d	Other fugitive emissions from energy production	Energy production and distribution
2A1	Cement production	Industrial processes and product use
2A2	Lime production	Industrial processes and product use
2A3	Glass production	Industrial processes and product use
2A5a	Quarrying and mining of minerals other than coal	Industrial processes and product use
2A5b	Construction and demolition	Industrial processes and product use
2A5c	Storage, handling and transport of mineral products	Industrial processes and product use
2A6	Other mineral products	Industrial processes and product use
2B1	Ammonia production	Industrial processes and product use
2B2	Nitric acid production	Industrial processes and product use
2B3	Adipic acid production	Industrial processes and product use
2B5	Carbide production	Industrial processes and product use
2B6	Titanium dioxide production	Industrial processes and product use
2B7	Soda ash production	Industrial processes and product use
2B10a	Chemical industry: Other	Industrial processes and product use
2B10b	Storage, handling and transport of chemical products	Industrial processes and product use
2C1	Iron and steel production	Industrial processes and product use
2C2	Ferroalloys production	Industrial processes and product use
2C3	Aluminium production	Industrial processes and product use
2C4	Magnesium production	Industrial processes and product use
2C5	Lead production	Industrial processes and product use
2C6	Zinc production	Industrial processes and product use
2C7a	Copper production	Industrial processes and product use
2C7b	Nickel production	Industrial processes and product use
2C7c	Other metal production	Industrial processes and product use
2C7d	Storage, handling and transport of metal products	Industrial processes and product use
2D3a	Domestic solvent use including fungicides	Industrial processes and product use
2D3b	Road paving with asphalt	Industrial processes and product use
2D3c	Asphalt roofing	Industrial processes and product use
2D3d	Coating applications	Industrial processes and product use
2D3e	Degreasing	Industrial processes and product use
2D3f	Dry cleaning	Industrial processes and product use
2D3g	Chemical products	Industrial processes and product use

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

NFR code	Full name	EEA aggregated sector name
2D3h	Printing	Industrial processes and product use
2D3i	Other solvent use	Industrial processes and product use
2G	Other product use	Industrial processes and product use
2H1	Pulp and paper industry	Industrial processes and product use
2H2	Food and beverages industry	Industrial processes and product use
2H3	Other industrial processes	Industrial processes and product use
2I	Wood processing	Industrial processes and product use
2J	Production of POPs	Industrial processes and product use
2K	Consumption of POPs and heavy metals (e.g. electrical and scientific equipment)	Industrial processes and product use
2L	Other production, consumption, storage, transportation or handling of bulk products	Industrial processes and product use
3B1a	Manure management — Dairy cattle	Agriculture
3B1b	Manure management — Non-dairy cattle	Agriculture
3B2	Manure management — Sheep	Agriculture
3B3	Manure management — Swine	Agriculture
3B4a	Manure management — Buffalo	Agriculture
3B4d	Manure management — Goats	Agriculture
3B4e	Manure management — Horses	Agriculture
3B4f	Manure management — Mules and asses	Agriculture
3B4gi	Manure management — Laying hens	Agriculture
3B4gii	Manure management — Broilers	Agriculture
3B4giii	Manure management — Turkeys	Agriculture
3B4giv	Manure management — Other poultry	Agriculture
3B4h	Manure management — Other animals	Agriculture
3Da1	Inorganic N-fertilisers (includes also urea application)	Agriculture
3Da2a	Animal manure applied to soils	Agriculture
3Da2b	Sewage sludge applied to soils	Agriculture
3Da2c	Other organic fertilisers applied to soils (including compost)	Agriculture
3Da3	Urine and dung deposited by grazing animals	Agriculture
3Da4	Crop residues applied to soils	Agriculture
3Db	Indirect emissions from managed soils	Agriculture
3Dc	Farm-level agricultural operations including storage, handling and transport of agricultural products	Agriculture
3Dd	Off-farm storage, handling and transport of bulk agricultural products	Agriculture
3De	Cultivated crops	Agriculture
3Df	Use of pesticides	Agriculture
3F	Field burning of agricultural residues	Agriculture
3I	Agriculture other	Agriculture
5A	Biological treatment of waste — Solid waste disposal on land	Waste
5B1	Biological treatment of waste — Composting	Waste
5B2	Biological treatment of waste — Anaerobic digestion at biogas facilities	Waste
5C1a	Municipal waste incineration	Waste
5C1bi	Industrial waste incineration	Waste
5C1bii	Hazardous waste incineration	Waste
5C1biii	Clinical waste incineration	Waste
5C1biv	Sewage sludge incineration	Waste
5C1bv	Cremation	Waste
5C1bvi	Other waste incineration	Waste
5C2	Open burning of waste	Waste
5D1	Domestic wastewater handling	Waste
5D2	Industrial wastewater handling	Waste
5D3	Other wastewater handling	Waste
5E	Other waste	Waste
6A	Other (included in national total for entire territory)	Other

Notes: LTO: Landing/Take-off.

Appendix 5 Member State informative inventory reports (IIRs)

Table A5.1 List of submitted IIRs including source and date of submission (cut-off date 9 May 2016)

Country code	Title of IIR	Source	Date of submission
AT	Austria's Informative Inventory Report (IIR) 2016. Submission under the UNECE Convention on Long-range Transboundary Air Pollution	http://cdr.eionet.europa.eu/at/un/CLRTAP_AT/envvubonq/AT_IIR2016_Draft.pdf	15.3.2016
	Austria's Informative Inventory Report (IIR) 2016. Submission under the UNECE Convention on Long-range Transboundary Air Pollution (Resubmission)	http://cdr.eionet.europa.eu/at/un/CLRTAP_AT/envvximvg/AT_IIR_2016_REP0566.pdf	26.4.2016
BE	Informative Inventory Report. About Belgium's annual submission of air emission data reported in February 2016 under the Convention on Long-range Transboundary Air Pollution CLRTAP	http://cdr.eionet.europa.eu/be/un/UNECE_CLRTAP_BE/envvugtla/IIR_2016_BE.pdf	15.3.2016
BG	Bulgaria's Informative Inventory Report 2016 (IIR). Submission under the UNECE Convention on Long-Range Transboundary Air Pollution	http://cdr.eionet.europa.eu/bg/un/copy_of_UNECE_CLRTAP_BG/envvufgxw/IIR_2016_BGR.pdf	15.3.2016
CY	Cyprus Informative Inventory. Report 2014	http://cdr.eionet.europa.eu/cy/un/UNECE_CLRTAP_CY/envvufm9w/20160301-CyprusInformativeInventoryReport2014.pdf	15.3.2016
CZ	Czech Informative Inventory Report 2014. Submission under the UNECE Convention on Long-range Transboundary Air Pollution	http://cdr.eionet.europa.eu/cz/un/UNECE_CLRTAP_CZ/envvu7moa/CZ_IIR_2016.pdf	20.3.2016
DE	German Informative Inventory Report	http://iir-de.wikidot.com	10.2.2016
DK	Annual Danish Informative Inventory Report to UNECE. Emission inventories from the base year of the protocols to year 2014	http://cdr.eionet.europa.eu/dk/Air_Emission_Inventories/Submission_EMEP_UNECE/envvue6qq/Danish_Informative_Inventory_Report_2016.pdf	15.3.2016
EE	Estonian Informative Inventory Report 1990–2014. Submitted under the Convention on Long-range Transboundary Air Pollution	http://cdr.eionet.europa.eu/ee/un/UNECE_CLRTAP_EE/envvufwdg/Estonian_IIR_2016.pdf	15.3.2016
ES	Spain. Informative Inventory Report. 1990–2014	http://cdr.eionet.europa.eu/es/un/UNECE_CLRTAP_ES/envvubzaw/SPAIN_2016-CLRTAP_Informative_Inventory_Report-IIR.pdf	14.3.2016
FI	Air Pollutant Emissions in Finland 1990–2014. Informative Inventory Report to the UNECE CLRTAP	http://cdr.eionet.europa.eu/fi/un/UNECE_CLRTAP_FI/envvufmeq/FI_IIR2016_15March2016_Part1.pdf	15.3.2016
	Air Pollutant Emissions in Finland 1990–2014. Informative Inventory Report to the Secretariat of the UNECE. Convention on Long-range Transboundary Air Pollution	http://cdr.eionet.europa.eu/fi/un/UNECE_CLRTAP_FI/envvysfew/FI_IIR2016_30April2016_Part3_Uncertainties_2014.pdf	30.4.2016
FR	Inventaire des émissions de polluants atmosphériques en France au titre de la convention sur la pollution atmosphérique transfrontalière à longue distance et de la directive Européenne relative aux plafonds d'émissions nationaux (NEC)	http://cdr.eionet.europa.eu/fr/eu/colqhxdtq/envvuhicg/UNECE_France_mars2016.pdf/manage_document	15.3.2016
HR	Republic of Croatia 2016. Informative Inventory Report (1990–2014). under the Convention on Long-range Transboundary Air Pollution (CLRTAP)	http://cdr.eionet.europa.eu/hr/un/UNECE_CLRTAP_HR/envvuipeq/IIR_CROATIA_2016_v2.pdf	15.3.2016
HU	Informative Inventory Report. Hungary	http://cdr.eionet.europa.eu/hu/un/UNECE_CLRTAP_HU/envvurl9g/IIR_HU_1990-2014_2016MARCH.pdf	17.3.2016
IE	No IIR available		

Table A5.1 List of submitted IIRs including source and date of submission (cut-off date 9 May 2015) (cont.)

Country code	Title of IIR	Source	Date of submission
IT	Italian Emission Inventory 1990–2014 Informative Inventory Report 2016	http://groupware.sinanet.isprambiente.it/reportnet/library/ae1sclrtapsandsnecsdata/ae-1-clrtap-data-2016/informative-inventory-report-2016	15.3.2016
LT	Lithuania's Informative Inventory Report 2014	http://cdr.eionet.europa.eu/lt/un/UNECE_CLRTAP_LT/envvua_xq/Emisiju_ataskaita_EN_2015_.pdf	14.3.2016
LU	Luxembourg's Informative Inventory Report 1990–2014. Submission under the UNECE Convention on Long-range Transboundary Air Pollution	http://cdr.eionet.europa.eu/lu/un/UNECE_CLRTAP_LU/envvuhbxa/LU_IIR_2016_draft_160315_v4.pdf	15.3.2016
	Luxembourg's Informative Inventory Report 1990–2014. Submission under the UNECE Convention on Long-range Transboundary Air Pollution (Resubmission)	http://cdr.eionet.europa.eu/lu/un/UNECE_CLRTAP_LU/envvuhbxa/LU_IIR_2016_final_160415.pdf	15.4.2016
LV	Latvia's Informative Inventory Report 2016. Submitted under the Convention on Long-range Transboundary Air Pollution	http://cdr.eionet.europa.eu/lv/un/copy_of_colqhgwdg/envvugxfw/LV_IIR_15032016.pdf	15.3.2016
MT	No IIR available		
NL	Emissions of transboundary air pollutants in the Netherlands 1990-2014. Informative Inventory Report 2016	http://cdr.eionet.europa.eu/nl/eu/colqt3lza/envvxi0eg/NL_IIR_2016.pdf	21.4.2016
PL	Poland's Informative Inventory Report 2016. Submission under UN ECE Convention on Long-range Transboundary Air Pollution	http://cdr.eionet.europa.eu/pl/un/EMEP%20emissions%20data/envvufslg/IIR_2016_fin2.pdf	10.3.2016
PT	Portuguese Informative Inventory Report 1990–2014. Submitted under the UNECE Convention on Long-range Transboundary Air Pollution	http://cdr.eionet.europa.eu/pt/un/UNECE_CLRTAP_PT/envvugvfa/IIR_global_-_FINAL.pdf	15.3.2016
RO	Romania's Informative Inventory Report 2016. Submission under the UNECE Convention on Long-range Transboundary Air Pollution	http://cdr.eionet.europa.eu/ro/un/UNECE_CLRTAP_RO/envvuggpa/RO_IIR_2016.pdf	15.3.2016
SE	Informative Inventory Report Sweden 2016. Submitted under the Convention on Long-range Transboundary Air Pollution	http://cdr.eionet.europa.eu/se/un/colqgyzla/envvr30w/SE_IIR_submission_2016_v1.pdf	12.2.2016
	Informative Inventory Report Sweden 2016. Submitted under the Convention on Long-range Transboundary Air Pollution (Resubmission)	http://cdr.eionet.europa.eu/se/un/colqgyzla/envvs10ha/SE_Informative_Inventory_Report_submission_2016_v.2.pdf	24.2.2016
SI	2016. Informative Inventory Report for Slovenia. Submission under the UNECE Convention on Long-range Transboundary Air Pollution	http://cdr.eionet.europa.eu/si/un/UNECE_CLRTAP_SI/colvrynfq/envvuaviq/IIR_2016_Slovenia.pdf	14.3.2016
SK	Informative Inventory Report 2015. Slovak Republic. Under the Convention on Long-range Transboundary Air Pollution	http://cdr.eionet.europa.eu/sk/un/UNECE_CLRTAP_SK/envvuhqjw/SK_IIR__2016_Draft.pdf	15.3.2016
	Informative Inventory Report 2015. Slovak Republic. Under the Convention on Long-range Transboundary Air Pollution (Resubmission)	http://cdr.eionet.europa.eu/sk/un/UNECE_CLRTAP_SK/envvzcncq/SK_IIR__2016_V2.pdf	09.5.2016
UK	UK Informative Inventory Report (1990 to 2014)	http://cdr.eionet.europa.eu/gb/un/cols3f2jg/envvuaj0w/GB_IIR_2016_Final.pdf	15.3.2016

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