ANNUAL DANISH INFORMATIVE INVENTORY REPORT TO UNECE

Emission inventories from the base year of the protocols to year 2009

NERI Technical Report no. 821 2011

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Ole-Kenneth Nielsen
Morten Winther
Mette Hjorth Mikkelsen
Leif Hoffmann
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Steen Gyldenkærne
Patrik Fauser
Marlene S. Plejdrup
Rikke Albrektsen
Katja Hjelgaard
Henrik G. Bruun

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Authors: Ole-Kenneth Nielsen, Morten Winther, Mette Hjorth Mikkelsen, Leif Hoffmann, Malene Nielsen, Steen Gyldenkærne, Patrik Fauser, Marlene S. Plejdrup, Rikke Albrektsen, Katja Hjelgaard, Henrik G. Bruun.
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Abstract: This report is a documentation report on the emission inventories for Denmark as reported to the UNECE Secretariat under the Convention on Long Range Transboundary Air Pollution due by 15 February 2011. The report contains information on Denmark's emission inventories regarding emissions of (1) SO_X for the years 1980-2009, (2) NO_X, CO, NMVOC and NH_3 for the years 1985-2009, (3) Particulate matter: TSP, PM_{10}, $PM_{2.5}$ for the years 2000-2009, (4) Heavy Metals: Pb, Cd, Hg, As, Cr, Cu, Ni, Se and Zn for the years 1990-2009, (5) Polyaromatic hydrocarbons (PAH): Benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene and indeno(1,2,3-cd)pyrene for the years 1990-2009 and (6) Dioxin and HCB. Further, the report contains information on background data for emissions inventory.

Keywords: Emission Inventory; Emissions; Projections; UNECE; EMEP; NO_X; CO; NMVOC; SO_X; NH_3; TSP; PM_{10}; $PM_{2.5}$; Pb; Cd; Hg; As; Cr; Cu; Ni; Se; Zn; Polyaromatic hydrocarbons; Benzo(a)pyrene, Benzo(b)fluoranthene

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Summary

I Background information on emission inventories

Annual report

This report is Denmark's Annual Informative Inventory Report (IIR) due March 15, 2011 to the UNECE-Convention on Long-Range Transboundary Air Pollution (LRTAP). The report contains information on Denmark's inventories for all years from the base years of the protocols to 2009.

The gases reported under the LRTAP Convention are SO_2, NO_X, NMVOC, CO, NH_3, As, Cd, Cr, Cu, Hg, Ni, Pb, Se, Zn, dioxins/furans, HCB, PAHs, TSP, PM_{10} and $PM_{2.5}$.

The annual emission inventory for Denmark is reported in the Nomenclature for Reporting (NFR 2009) format. In December 2008 new reporting guidelines were decided by the EMEP Executive Body. Many of the new elements and demands in the reporting guidelines have not been implemented. The reason for this is that they require significantly more resources, which have not been made availbale.

The issues addressed in this report are: trends in emissions, description of each NFR category, uncertainty estimates, recalculations, planned improvements and procedures for quality assurance and control. The structure of the report follows to the extent possible the proposed outline.

This report and NFR tables are available to the public on NERI's homepage:
http://www.dmu.dk/Luft/Emissioner/Home+of+Inventory/

and on the Eionet central data repository:
http://cdr.eionet.europa.eu/dk/Air_Emission_Inventories/Submission_EMEP_UNECE

Responsible institute

The National Environmental Research Institute (NERI), Aarhus University, is on behalf of the Danish Ministry of the Environment responsible for the annual preparation and submission to the UNECE-LRTAP Convention of the Annual Danish Emissions Report and the inventories in the NFR format. NERI participates in meetings under the UNECE Task Force on Emission Inventories and Projections and the related expert panels, where parties to the convention prepare the guidelines and methodologies on inventories.

II Trends in emissions

Acidifying gases

In 1990, the relative contribution in acid equivalents was almost equal for the three gases. In 2009, the most important acidification factor in Denmark is ammonia nitrogen and the relative contributions for SO_2, NO_X and NH_3 were 6 %, 36 % and 58 %, respectively. However, with regard to long-range transport of air pollution, SO_2 and NO_X are still the most important pollutants.

SO_2

The main part of the SO_2 emission originates from combustion of fossil fuels, i.e. mainly coal and oil, in public power and district heating plants. From 1980 to 2009, the total emission decreased by 97 %. The large reduction is mainly due to installation of desulphurisation plant and use of fuels with lower content of sulphur in public power and district heating plants. Despite the large reduction of the SO_2 emissions, these plants make up 33 % of the total emission. Also emissions from industrial combustion plants, non-industrial combustion plants and other mobile sources are important. National sea traffic (navigation and fishing) contributes with about 13 % of the total SO_2 emission in 2009. This is due to the use of residual oil with high sulphur content.

NO_x

The largest sources of emissions of NO_X are road transport followed by other mobile sources and combustion in energy industries (mainly public power and district heating plants). The transport sector is the sector contributing the most to the emission of NO_X and, in 2009, 45 % of the Danish emissions of NO_X stems from road transport, national navigation, railways and civil aviation. Also emissions from national fishing and off-road vehicles contribute significantly to the NO_X emission. For non-industrial combustion plants, the main sources are combustion of gas oil, natural gas and wood in residential plants. The emissions from energy industries have decreased by 77 % from 1985 to 2009. In the same period, the total emission decreased by 56 %. The reduction is due to the increasing use of catalyst cars and installation of low-NO_X burners and denitrifying units in power plants and district heating plants.

NH_3

Almost all atmospheric emissions of NH_3 result from agricultural activities. Only a minor fraction originates from road transport (2 %). This fraction is, however, increasing due to growing use of catalyst cars. The major part of the emission from agriculture stems from livestock manure (83 %) and the largest losses of ammonia occur during the handling of the manure in stables and in field application. Other contributions come from use of mineral fertilisers (6 %), N-excretion on pasture range and paddock (3 %), sewage sludge used as fertiliser, crops and ammonia used for straw treatment (7 %) and field burning (less than 1 %). The total ammonia emission decreased by 36 % from 1985 to 2009. This is due to the active national environmental policy efforts over the past twenty years.

Other air pollutants

NMVOC

The emissions of NMVOC originate from many different sources and can be divided into two main groups: incomplete combustion and evaporation. Road vehicles and other mobile sources such as national navigation vessels and off-road machinery are the main sources of NMVOC emissions from incomplete combustion processes. Road transportation vehicles are still the main contributors, even though the emissions have declined since the introduction of catalyst cars in 1990. The evaporative emissions mainly originate from the use of solvents and the extraction, handling and storage of oil and natural gas. The emissions from the energy industries have increased during the nineties due to the increasing use of stationary gas engines, which have much higher emissions of NMVOC than conventional boilers. The total anthropogenic emissions have decreased by 50 % from 1985 to 2009, largely due to the increased use of catalyst cars and reduced emissions from use of solvents.

CO

Other mobile sources and non-industrial combustion plants contribute significantly to the total emission of this pollutant. Transport is the second largest contributor to the total CO emission. In 1990 a law forbidding the burning of agricultural crop residues in the fields was implemented, which caused a significant reduction in CO emission. The emission decreased further by 40 % from 1990 to 2009, largely because of decreasing emissions from road transportation.

Particulate Matter

The particulate matter (PM) emission inventory has been reported for the years 2000-2009. The inventory includes the total emission of particles TSP (Total Suspended Particles), emission of particles smaller than 10 µm (PM_{10}) and emission of particles smaller than 2.5 µm ($PM_{2.5}$).

The largest $PM_{2.5}$ emission sources are residential plants (71 %), road traffic (12 %) and other mobile sources (10 %). For the latter, the most important sources are off-road vehicles and machinery in the industrial sector and in the agricultural/forestry sector (28 % and 40 %, respectively). For the road transport sector, exhaust emissions account for the major part (64 %) of the emissions. The $PM_{2.5}$ emission increased by 35 % from 2000 to 2009 due to an increasing wood consumption in the residential sector.

The largest TSP emission sources are the residential sector and the agricultural sector. The TSP emissions from transport are also important and include both exhaust emissions and the non-exhaust emissions from brake and tyre wear and road abrasion. The non-exhaust emissions account for 62 % of the TSP emission from road transport.

Heavy metals

In general, the most important sources of heavy metal emissions are combustion of fossil fuels and waste. The heavy metal emissions have decreased substantially in recent years, except for Cu. The reductions span from 30 % to 92 % for Zn and Pb, respectively. The reason for the reduced emissions is mainly increased use of gas cleaning devices at power and district heating plants (including waste incineration plants). The large reduction in the Pb emission is due to a gradual shift towards unleaded gasoline, the latter being essential for catalyst cars. The major source of Cu is automobile tyre and break wear (93 % in 2009) and the increase from 1990 to 2009 is caused by increasing mileage.

Cadmium

The main sources of emissions of Cd to air are combustion in energy industries (mainly combustion of wood, wood waste and municipal waste) and manufacturing industries (mainly combustion of residual oil). In the transport sector emissions from passenger cars is the main source contributing with 55 % of the sectoral emission in 2009. The emission from non-industrial combustion is dominated by wood combustion in residential plants which accounts for 76 % of the sectoral emission in 2009. Emissions from combustion in residential plants have increased by 99 % since 1990. The decreasing emission from energy industries are related to the decreasing combustion of coal.

Mercury

The largest sources of Hg emissions to air are waste incineration and coal combustion in energy industries. Due to improved flue gas cleaning and decreasing coal combustion the emissions from Energy industries decreased by 75 % from 1990-2000. Non-industrial combustion is dominated by wood combustion in residential plants while emissions from the waste sector mainly stems from cremation. The variations in emissions from industrial processes is caused by a shut down in 2002 followed by re-opening and a second shut in 2005 down of the electrosteelwork.

Lead

The main Pb emission sources are combustion in residential plants and energy industries and transport. In earlier years combustion of leaded gasoline was the major contributor to Pb emissions to air but the shift toward use of unleaded gasoline for transport have decreased the Pb emission from transport by 93 %. In the non-industrial combustion sector the dominant source is wood combustion in residential plants. The decrease in the Pb emission from non-industrial combustion from 1990 to 2009 at 16 % is due to the shift towards unleaded gasoline, as this sector includes other mobile sources in household, gardening, agriculture, forestry, fishing and military. The decreasing emission from Energy industries (96 % from 1990 to 2009) is caused by the deceasing coal combustion.

PAHs

The emission inventory for PAH (polycyclic aromatic hydrocarbons) includes four PAHs: benzo(a)-pyrene, benzo(b)-fluoranthene, benzo(k)-fluoranthene and indeno-(1,2,3-cd)pyrene. Benzo(b)fluoranthene and Benzo(a)pyrene contribute the major PAH emission by 32 % and 30 %, respectively. The most important source of PAH emissions is combustion of wood in the residential sector making up 84 % of the total emission in 2009. The increasing emission trend is due to increasing combustion of wood in the residential sector. The PAH emission from combustion in residential plants has increased by 15 % from 1990 to 2009.

Dioxins and furans

The major part of the dioxin emission owe to wood combustion in the residential sector, mainly in wood stoves and ovens without flue gas cleaning. Wood combustion in residential plants accounts for 53 % of the national dioxin emission in 2009. The contribution to the total dioxin emission from the waste sector (36 % in 2009) stems from accidental fires, especially building fires. The emission of dioxins from energy industries owe mainly to the combustion of biomass as wood, wood waste and to a less extend agricultural waste.

Hexachlorobenzene

Stationary combustion accounts for 98 % of the estimated national HCB emission in 2009. This is mainly due to combustion of municipal solid waste in heating and power plants. The HCB emission from stationary plants has decreased 83 % since 1990 mainly due to improved flue gas cleaning in MSW incineration plants. Wood combustion in households is an important source, too, and has increased by 264 % since 1990 due to increasing wood consumption.

III Recalculations and Improvements

In general, considerable work is being carried out to improve the inventories. Investigations and research carried out in Denmark and abroad produce new results and findings which are given consideration and, to the extent which is possible, are included as the basis for emission estimates and as data in the inventory databases. Furthermore, the updates of the EMEP/CORINAIR guidebook (Now the EMEP/EEA Guidebook), and the work of the Task Force on Emission Inventories and its expert panels are followed closely in order to be able to incorporate the best scientific information as the basis for the inventories.

The implementation of new results in inventories is made in a way so that improvements, as far as possible, better reflect Danish conditions and circumstances. This is in accordance with good practice. Furthermore, efforts are made to involve as many experts as possible in the reasoning, justification and feasibility of implementation of improvements.

In improving the inventories, care is taken to consider implementation of improvements for the whole time-series of inventories to make it consistent. Such efforts lead to recalculation of previously submitted inventories. This submission includes recalculated inventories for the whole time-series. The reasoning for the recalculations performed is to be found in the sectoral chapters of this report. The text below focuses on recalculations, in general, and further serves as an overview and summary of the relevant text in the sectoral chapters. For sector specific planned improvements please also refer to the relevant sectoral chapters.

Energy

Improvements and updates of the Danish energy statistics are made regularly by the producer of the statistics, the Danish Energy Agency (DEA). In close cooperation with the DEA, these improvements and updates are reflected in the emission inventory for the energy sector. The

Danish energy statistics have, for the most part, been aggregated to the SNAP categorisation. This, however, does not include energy statistics for fuel consumption data for specific industries.

The inventories are still being improved through work to increase the number of large point sources, e.g. power plants, included in the databases as individual point sources. Such an inclusion makes it possible to use plant-specific data for emissions etc. available, e.g. in annual environmental reports from the plants in question.

Stationary Combustion

Improvements and recalculations since the 2010 emission inventory submission include:

- The national energy statistics has been updated for the years 1980-2008. The update included both end use and transformation sectors as well as a source category update.
- The petroleum coke purchased abroad and combusted in Danish residential plants is no longer included in the inventory. The border trade was 628 TJ in 2009.
- Emission factors for metals have been updated. All emission factors that are not nationally referenced now refer to the EMEP/EEA Guidebook, 2009 update.

Mobile sources

Road transport

The total mileage per vehicle category from 2005-2008 have been updated based on new data prepared by DTU Transport. More accurate fleet and mileage figures are provided by the latter institution, split into the different vehicle layers of the emission model. An important change is the categorisation of fleet data for heavy duty trucks and buses into the numerous weight classes covered by the COPERT IV model.

National sea transport

Fuel consumption by vessels sailing between between Denmark and the North Sea off shore installations has been added to this category. Previously this fuel consumption was reported under international sea transport.

Fisheries

Due to the changes made in national sea transport, and the fuel transferral between national sea transport and fisheries made as an integral part of the Danish inventories, significant fuel consumption and emission changes have been made for the fishery sector accordingly, for 2001 onwards.

Agriculture

The stock of harvesters have been updated for the years 2001-2008, based on discussions with the Danish Knowledge Centre for Agriculture. For gasoline fuelled ATV's the stock has been updated for 2007 and 2008.

Military

Emission factors derived from the new road transport simulations have caused some emission changes from 1985-2008.

Residential
A split in activity codes has been made. In this way the majority of the fuel consumption and emissions previously reported under residential (SNAP code 0809; NFR code 1A4b) are now reported under commercial/institutional (SNAP code 0811; NFR code 1A4a ii).

No changes have been made in the estimated fuel consumption and emissions for Residential and Commercial/institutional as a sum.

Commercial/institutional
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No changes have been made in the estimated fuel consumption and emissions for Residential and Commercial/institutional as a sum.

Industrial non road machinery
The annual working hours for fork lifts in 2008 have been adjusted with a factor of 0.95 due to the decrease in activities caused by the global financial crisis. The total fuel consumption and emission changes in 2008 for industrial non road machinery are approximately -1 %.

Aviation
Very small emission changes between -2 % and 1 % occur for the years 2001-2008, due to inclusion of new aircraft types assigned to the representative aircraft types.

Fugitive emissions

Service stations:
The amounts of gasoline sales used for calculation of fugitive emissions from service stations (SNAP 050503) have been updated according to the Energy Statistics for 2009 1990-2008. The NMVOC emission in 2008 has thereby increased by 6 Mg corresponding to 0.5 %.

Extraction of oil and gas:
Fugitive emissions from extraction are calculated from the standard formula in the EMEP/EEA Guidebook based on the number of platforms. In 2009 the number of platforms has been corrected for 2007 and 2008. The NMVOC emission in 2008 has decreased by 20 Mg according to this correction corresponding to 1 %.

Gas distribution
Distribution amounts have been updated for one of three natural gas distribution companies for the years 2006-2008 due to new data availability. Due to this the NMVOC emission has decreased by 4 Mg in 2008 corresponding to 10 %.

Flaring in oil and gas extraction
The NMVOC emission in 2008 from flaring in the gas treatment plant has been updated for 2008 according to the environmental report leading to an increase of 2 Mg NMVOC. The increase corresponds to 12 % of the NMVOC emission from flaring in oil and gas extraction including offshore flaring.

Industrial processes

Recalculations have been done as a consequence of implementation of NFR 2009. Implementation of a more clear and logic distinction between energy and process related emissions are ongoing.

Improvement of emission factors within the sub-sector *Other production* (food and beverage) is ongoing. So far the emission factors for breweries and bakeries have been revised on order to reflect European conditions. The new emission factors are based on the EMEP/EEA guidebook.

Solvents

Improvements and additions are continuously being implemented due to the comprehensiveness and complexity of the use and application of solvents in industries and households. The main improvements in the 2011 reporting include the following:

- Further improvement of source allocation model, which combines information on Use Categories and NACE Industrial Use Categories from SPIN and use amounts from Statistics DK
- Implementation of correct 2008 import amounts for xylene, which has been verified by Statistics Denmark
- Inclusion of use of fireworks in Other Product Use (3D3)

Agriculture

Compared with the previous NH_3 and PM emissions inventory (submission 2010), some changes and updates have been made. These changes cause an increase in the NH_3 emission (1985 – 2008) and a decrease in the PM emission (2000 – 2008).

The main reason for the increase in NH_3 emission is due to an error in the calculations of NH_3 from sows 1985-2008 and this have led to an increase in the emission from animal manure of 6-11% in the period 1985-2008.

The PM emission mainly decreases because of changes in the calculation of the number of produced swine and poultry and thereby changes in production cycles. For the calculations of the number of produced fattening pigs and weaners slaughter data has been updated. Also the calculation of the number of produced laying hens has been changed, so now the number is based on the amount of eggs produced.

Waste

The calculation of emissions from accidental fires of both buildings and vehicles has been added the additional data year of 2009. This extra detailed dataset has influenced the activity data for building and vehicle fires for the years 1990-2005.

The activity data for accidental vehicle fires has. This increase is caused by a change in data delivery of the population of the different vehicle types.

Sammenfatning

I Baggrund for emissionsopgørelser

Årlig rapport

Denne rapport er Danmarks årlige rapport om emissionsopgørelser sendt til UNECE-konventionen om langtransporteret grænseoverskridende luftforurening (LRTAP) 15. marts 2011. Rapporten indeholder oplysninger om Danmarks opgørelser for alle år fra basisårene for protokollerne til 2009.

Gasserne der rapporteres til LRTAP-konventionen er SO_2, NO_x, NMVOC, CO, NH_3, As, Cd, Cr, Cu, Hg, Ni, Pb, Se, Zn, dioxiner/furaner, HCB, PAH, TSP, PM_{10} og $PM_{2,5}$.

Den årlige emissionsopgørelse for Danmark rapporteres i NFR 2009-formatet. Nye retningslinjer for rapportering blev vedtaget i december 2008, de nye retningslinjer indeholdt en række nye krav til udarbejdelsen af emissionsopgørelserne. Opfyldelsen af disse nye krav er endnu ikke implementeret, da de er væsentligt mere ressourcekrævende, og der ikke er afsat ressourcer hertil.

Emnerne behandlet i rapporten er: Udvikling i emissioner, beskrivelse af hver NFR-kategori, usikkerheder, rekalkulationer, planlagte forbedringer og procedure for kvalitetssikring og -kontrol. Strukturen i rapporten følger, så vidt muligt, den foreslåede disposition.

Denne rapport og NFR-tabellerne er tilgængelige for offentligheden på DMU's hjemmeside:
http://www.dmu.dk/Luft/Emissioner/Home+of+Inventory/

samt på Eionets hjemmeside:

http://cdr.eionet.europa.eu/dk/Air_Emission_Inventories/Submission_EMEP_UNECE

Ansvarlig institution

Danmarks Miljøundersøgelser (DMU), Aarhus Universitet, er på vegne af Miljøministeriet ansvarlig for udarbejdelse af den årlige danske emissionsrapport og opgørelserne i NFR. DMU deltager i møder under UNECEs arbejdsgruppe for emissionsopgørelser og –fremskrivninger samt ekspertpaneler, hvor parter i konventionen udarbejder retningslinjer og metoder for emissionsopgørelserne.

II Udviklingen i emissioner

Forsurende gasser

I 1990 var det relative bidrag af syreækvivalenter næsten ens for de tre gasarter. I 2009 var ammoniak den vigtigste forsurende faktor i Danmark og de relative bidrag for SO_2, NO_x og NH_3 var på henholdsvis 6 %, 36 % og 58 %. Med hensyn til langtransporteret luftforurening er det dog stadig SO_2 og NO_x der er de største kilder.

SO_2

Hovedparten af SO_2-emissionerne stammer fra forbrænding af fossile brændsler, dvs. primært kul og olie, på kraftværker, kraftvarmeværker og fjernvarmeværker. Fra 1980 til 2009 er den totale udledning reduceret med 97 %. Den store reduktion er primært opnået gennem installation af afsvovlingsanlæg og brug af brændsler med lavt svovlindhold på kraftværker og fjernvarmeværker. Trods den store reduktion er disse værker kilde til 33 % af den samlede udledning. Også emissioner fra industrielle forbrændingsanlæg, ikke-industrielle forbrændingsanlæg og andre mobile kilder er væsentlige bidragsydere til emissionen. National søfart (sejlads og fiskeri) bidrager med omkring 13 % af den totale SO_2-emission. Dette skyldes brug af fuelolie med et højt svovlindhold.

NO_x

Den største kilder til emissioner af NO_x er transportsektoren efterfulgt af andre mobile kilder og forbrænding i energisektoren (hovedsageligt kraftværker og fjernvarmeværker). Transportsektoren er den sektor der bidrager mest til udledningen af NO_x, og i 2009 stammede 45 % af de danske NO_x-emissioner fra vejtransport, national søfart, jernbaner og civil luftfart. Også emissioner fra nationalt fiskeri og off-road køretøjer (entreprenør-, landbrugsmaskiner, m.m.) bidrager betydeligt til NO_x-emissionen. For ikke-industrielle forbrændingsanlæg er de primære kilder forbrænding af gasolie, naturgas og træ i husholdninger. Emissionerne fra kraftværker og fjernvarmeværker er faldet med 77 % fra 1985 til 2009. I samme periode er den totale emission faldet med 56 %. Reduktionen skyldes øget brug af katalysatorer i biler og installation af lav-NO_x-brændere og de-NO_x-anlæg på kraftværker og fjernvarmeværker.

NH_3

Stort set alle atmosfæriske emissioner af NH_3 stammer fra aktiviteter i landbruget. Kun en mindre del skyldes vejtransport (2 %) og stationære kilder. Andelen fra transporten er dog stigende pga. den øgede brug af biler med katalysator. Hovedparten af emissionen fra landbruget stammer fra husdyrgødning (83 %) og de største tab af ammoniak optræder under håndtering af gødningen i stalden og under spredning på marken. Andre bidrag kommer fra brug af kunstgødning (6 %), N-udskillelse af græssende dyr (3 %), slam fra rensningsanlæg brugt som gødning, afgrøder og ammoniakbehandlet halm (7 %) og markafbrænding (< 1 %). Den totale ammoniakemission er faldet 36 % fra 1985-2009. Dette er et resultat af den nationale miljøpolitik, der er ført gennem de seneste 20 år.

Anden luftforurening

NMVOC

Emissionen af NMVOC stammer fra mange forskellige kilder og kan opdeles i to hovedgrupper: Ufuldstændig forbrænding og fordampning. Hovedkilderne til NMVOC-emissioner fra ufuldstændige forbrændingsprocesser er brændeovne, vejtrafik og andre mobile kilder, som national sejlads og ikke vejgående maskiner. Køretøjer til vejtransport er fortsat den største bidragsyder, selvom emissionerne er faldet siden introduktionen af biler med katalysator i 1990. Emissionerne fra fordampning stammer hovedsageligt fra brugen af opløsningsmidler. Emissionerne fra energisektoren er steget igennem 1990'erne pga. øget brug af stationære gasmotorer, som har meget højere emissioner af NMVOC end konventionelle kedler. De totale menneskeskabte emissioner er faldet med 50 % fra 1985 til 2009, primært som følge af øget brug af biler med katalysator og reducerede emissioner fra brug af opløsningsmidler.

CO

Selvom biler med katalysator blev introduceret i 1990, er vejtransport stadig årsag til den største del af den totale CO-emission. Også andre mobile kilder og ikke-industrielle forbrændingsanlæg bidrager betydeligt til den totale emission af denne gas. Faldet i emissioner i 1990 var en konsekvens af loven, der generelt forbyder markafbrænding af halm. Emissionen faldt med 40 % fra 1990 til 2009 hovedsageligt pga. faldende emissioner fra vejtransport.

Partikler

Emissionsopgørelsen for partikler (Particulate Matter, forkortet PM) er blevet rapporteret for årene 2000-2009. Opgørelsen inkluderer den totale emission af partikler TSP (Total Suspended Particles), emissionen af partikler mindre end 10 µm (PM_{10}) og emissionen af partikler mindre end 2,5 µm ($PM_{2,5}$).

De største kilder til $PM_{2,5}$-emission er husholdninger (71 %), vejtrafik (12 %) og andre mobile kilder (10 %). For den sidstes vedkommende er off-road-køretøjer i industrien samt landbrugs- og skovbrugsmaskiner de vigtigste kilder (hhv. 28 % og 40 %). I transportsektoren tegner udstødningsemissioner sig for størstedelen (64 %). $PM_{2.5}$-emissionen er steget med 35 % fra 2000 til 2009, hovedsageligt pga. det stigende træforbrug i husholdninger.

De største kilder til TSP-emission er landbrugssektoren og husholdningerne. TSP-emissionen fra transport er også vigtig og inkluderer både udstødningsemissioner og ikke-udstødningsrelaterede emissioner fra slid af bremser, dæk og vej. De ikke-udstødningsrelaterede emissioner udgør 62 % af TSP-emissionen fra transport.

Tungmetaller

Generelt er de vigtigste kilder til emissioner af tungmetaller forbrænding af fossile brændsler og affald. Emissionerne af tungmetaller er med undtagelse af kobber, faldet betydeligt de seneste år. Reduktionerne spænder fra 30 % til 92 % for henholdsvis Zn og Pb. Årsagen til de reducerede emissioner er hovedsageligt den øgede brug af røggasrensning på kraftværker og fjernvarmeværker (inklusive affaldsforbrændings-anlæg). Den store reduktion i emissionen af Pb skyldes et løbende skift til fordel for blyfri benzin, som er nødvendigt for biler med katalysator. Den største kilde til emission af kobber er slid af køretøjers dæk og bremser (93 % i 2009). Emissionen herfra er steget fra 1990 til 2009 pga. stigning i antal kørte kilometer.

Cadmium

De største kilder til Cd-emissioner er forbrænding i energisektoren (hovedsageligt forbrænding af træ og husholdningsaffald) og fremstillingsvirksomhed (hovedsageligt forbrænding af fuel olie). Emissioner fra personbiler er den dominerende kilde i transportsektoren, og udgør 55 % i 2009. Emissionen fra ikke-industriel forbrænding domineres af forbrænding af træ i husholdningsanlæg (76 % i 2009). Emissionen fra stationære anlæg i husholdninger er faldet med 99 % siden 1990. Faldet i emissionen fra energisektoren skyldes det faldende forbrug af kul.

Kviksølv

Den største kilde til Hg-emission er forbrænding af affald og kul i energisektoren. Forbedret røggasrensning og faldende kulforbrug har medført et fald i emissionen fra energisektoren på 75 % fra 1990 til 2009. Emissionen fra ikke-industriel forbrænding kan hovedsageligt tilskrives forbrænding af træ i stationære husholdningsanlæg mens den væsentligste kilde i affaldssektoren er kremering. Emissionerne fra industrielle processer varierer meget pga. lukning af elektro-stålvalseværket i 2002 efterfulgt af genåbning og endnu en lukning i 2005.

Bly

Den vigtigste kilde til emission af bly er forbrænding i husholdninger og energisektoren samt transport. I tidligere år var den største kilde forbrænding af blyholdigt benzin, men overgangen til blyfri benzin i transportsektoren har medført et fald i bly-emissionen på 93 % fra 1990 til 2009. Forbrænding af træ i husholdningsanlæg er den største kilde til emission af bly fra ikke-industriel forbrænding. Den faldende emission fra ikke-industriel forbrænding skyldes overgangen til blyfri benzin, da denne sektor omfatter mobile kilder i husholdninger, havebrug, landbrug, skovbrug, fiskeri og militær. Faldet udgør 16 % fra 1990 til 2009. Emissionen fra energifremstilling er faldet med 96 % i samme periode hovedsageligt pga. faldende forbrug af kul.

PAH'er

Den nuværende emissionsopgørelse for PAH (polycycliske aromatiske hydrocarboner) inkluderer de fire PAH'er: Benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene og indeno(1,2,3-cd)pyrene. Hovedparten af den samlede PAH-emission kan tilskrives benzo(b)fluoranthene og Benzo(a)pyrene der står for hhv. 32 % og 30 %. Den vigtigste kilde til emission af PAH er forbrænding af træ i husholdningerne der udgør 84 % af den samlede PAH-emission i 2009. De stigende emissioner skyldes øget forbrænding af træ i brændeovne og kedler i husholdningerne. Emissionen fra stationær forbrænding i husholdninger er steget med 15 % fra 1990 til 2009.

Dioxiner and furaner

Størstedelen af dioxinemissionen skyldes forbrænding i husholdninger, hovedsageligt forbrænding af træ i brændeovne og –kedler uden røggasrensning. Forbrænding af træ i stationære anlæg i husholdninger udgør 53 % af den nationale dioxin emission i 2009. Emissioner fra affaldssektoren udgør 36 % af den nationale total i 2009, og skyldes hovedsageligt brande i bygninger. Forbrænding af træ og halm er den største kilde til dioxin emission fra energifremstilling.

Hexachlorbenzen

98 % af den nationale HCB-emission i 2009 stammer fra stationær forbrænding, hovedsageligt forbrænding af husholdningsaffald til el- og varmeproduktion. HCB-emissionen fra stationær forbrænding er faldet 83 % siden 1990, hovedsageligt pga. forbedret røggasrensning på affaldsforbrændingsanlæg. Forbrænding i husholdninger er en anden vigtig kilde, der er steget 264 % siden 1990 pga. det stigende træforbrug.

III Genberegninger og forbedringer

Generelt pågår der et betydeligt arbejde med at forbedre emissionsopgørelserne. Nye undersøgelser og forskning fra Danmark og udlandet inkluderes så vidt muligt som basis for emissionsestimaterne. Desuden følges arbejdet med opdateringer af EMEP/CORINAIR Guidebook (Nu EMEP/EEA Guidebook) for emissionsopgørelser nøje, med henblik på at indarbejde de bedste videnskabelige informationer som basis for opgørelserne.

Opgørelserne opdateres løbende med ny viden, således at opgørelserne bedst mulig afspejler danske forhold. Ved forbedringer lægges vægt på at opdateringer omfatter hele tidsserier, for at sikre konsistente data. Disse tiltag medfører genberegning af tidligere indberettede opgørelser. Begrundelserne for genberegningerne er inkluderet i de enkelte sektorkapitler i denne rapport. De vigtigste genberegninger for de forskellige sektorer er nævnt i nedenstående.

Stationære forbrændingsanlæg

Den seneste officielle energistatistik er implementeret i opgørelsen. Der er for det meste tale om mindre ændringer.

Petroleumskoks købt i udlandet og brugt i danske husholdninger er fjernet fra opgørelsen i overensstemmelse med retningslinjerne for rapportering. Grænsehandelen med petroleumskoks var 628 TJ i 2009.

Emissionsfaktorerne for tungmetaller er blevet opdateret. Alle emissionsfaktorer, der ikke er nationale henviser nu til 2009 udgaven af EMEP/EEA Guidebook.

Transport

Vejtransport

Data for årskørsler for de forskellige køretøjskategorier er blevet opdateret for 2005 til 2008 baseret på nye data estimeret af DTU. En vigtig forbedring er en mere detaljeret opdeling af bestandsdata for tunge køretøjer (lastbiler og busser) i de mange forskellige vægtklasser inkluderet i COPERT IV modellen.

Søfart

Brændselsforbrug for skibe sejlende mellem danske havne og installationer på Nordsøen er blevet øget, som følge af en ændring af energistatistikken. Tidligere var en del af brændselsforbruget blevet rapporteret under international transport i energistatistikken.

Fiskeri

På grund af ændringerne for national søfart og den brændselsudveksling der foregår mellem disse kategorier er der foretaget betydelige ændringer for både brændselsforbrug og emissioner for fiskeri fra 2001 og fremefter.

Landbrugsmaskiner

Antallet af mejetærskere er blevet opdateret for 2001-2008 baseret på oplysninger fra Videncenter for Landbrug. For benzindrevne ATV'er er bestandsdata opdateret for 2007 og 2008.

Militær

Emissionsfaktorer afledt fra de nye modelsimulationer for vejtransport har medført små ændringer i emissionerne i perioden 1985-2008.

Husholdninger

Et split i aktivitetskoder er blevet foretaget. Det har medført at hovedparten af det brændselsforbrug og de emissioner, der tidliger er blevet rapporteret under husholdninger (SNAP kode 0809; NFR kode 1A4b) nu bliver rapporteret under handel & service (SNAP kode 0811; NFR kode 1A4a).

Der er ikke foretaget ændringer i det samlede brændselsforbrug eller emissioner, der er udelukkende tale om en ny allokering.

Handel & service

Et split i aktivitetskoder er blevet foretaget. Det har medført at hovedparten af det brændselsforbrug og de emissioner, der tidliger er blevet rapporteret under husholdninger (SNAP kode 0809; NFR kode 1A4b) nu bliver rapporteret under handel & service (SNAP kode 0811; NFR kode 1A4a).

Der er ikke foretaget ændringer i det samlede brændselsforbrug eller emissioner, der er udelukkende tale om en ny allokering.

Maskiner og redskaber i industrien

De årlige drifttimer for gaffeltrucks i 2008 er blevet justeret med en faktor på 0,95 pga. det faldende aktivitetsniveau forårsaget af den finansielle krise. Den totale ændring i brændselsforbrug og emissioner i 2008 er ca. -1 %.

Luftfart

For årene 2001-2008 er der små ændringer på mellem -2 % og 1 %. Dette skyldes inkluderingen af nye flytyper knyttet til repræsentative flytyper i emissionsberegningen.

Flygtige emissioner

Tankstationer

Mængden af benzin anvendt til beregning af flygtige emissioner fra tankstationer (SNAP 050503) er blevet opdateret for årene 1990-2008 i henhold til energistatistikken 2009. Emissionen af NMVOC fra benzinsalg i 2008 er som konsekvens øget med 6 ton svarende til 0,5 %.

Udvinding af olie og gas

Flygtige emissioner fra udvinding er beregnet på baggrund af formlen i EMEP/EEA Guidebook baseret på antallet af platforme. I 2009 er antallet af platforme blevet korrigeret for 2007 og 2008. Emissionen af NMVOC er som konsekvens faldet med 20 ton svarende til ca. 1 %.

Gas distribution

De distribuerede mængder er blevet opdateret for et af de tre naturgas distributionsselskaber for årene 2006-2008 pga. nye data. Emissionen af NMVOC er som konsekvens faldet med 4 ton i 2008 svarende til 10 %.

Flaring I forbindelse med lagring og behandling af naturgas

Emissionen af NMVOC i 2008 fra flaring i forbindelse med gasbehandling er blevet opdateret på baggrund af virksomhedens grønne regnskab. Dette har medført en stigning i NMVOC-emissionen på 2 tons svarende til en stigning for denne kategori på 12 %.

Industriprocesser

Genberegninger er foretaget på baggrund af indførelsen af NFR 2009. Implementeringen af en mere klar og logisk skelnen mellem energi- og procesrelaterede emissioner foretages løbende

Forbedring af emissionsfaktorer inden for sub-sektoren *Other production* (mad- og drikkevarer) foretages løbende. Indtil videre er emissionsfaktorerne for bryggerier og bagerier blevet revideret med henblik på at afspejle europæiske forhold. De nye emissionsfaktorer er udført på baggrund af EMEP/EEA guidebook.

Opløsningsmidler

Forbedringer og genberegninger finder løbende sted pga. den store udbredelse og kompleksitet af anvendelsen af opløsningsmidler i husholdninger og industrien. De største forbedringer i forbindelse med 2011 rapporteringen er:

- Fortsatte forbedringer i kilde allokeringsmodellen, som kombinerer informationer om anvendelseskategorier og NACE kategorier fra SPIN databasen og anvendte mængde fra Danmarks Statistik.
- Opdatering af værdien for import af xylen i 2008, der var fejlbehæftet. Ændringen er verificeret af Danmarks Statistik.
- Emissioner fra fyrværkeri er inkluderet for første gang.

Landbrug

Sammenlignet med 2010-rapporteringen er der foretaget nogle opdateringer i opgørelserne af NH_3 og partikler. Disse ændringer har medført en stigning i NH_3 emissionen for årene 1985-2008 og et fald i emissionen af partikler for årene 2000-2008.

Den største årsag til stigningen i NH_3-emissionen skyldes, at der er rettet en fejl i beregningen af emissionen fra søer. Dette har medført en stigning i emissionen fra gødningshåndtering fra søer på 6-11 % gennem tidsserien.

Ændringen i emissionen af partikler skyldes hovedsageligt ændringer i beregningsmetoden for antallet af producerede svin og fjerkræ og deraf følgende ændringer i produktionscyklus. For beregningen af antallet af producerede slagtesvin og smågrise er slagtedata blevet opdateret. Beregningsmetoden af antallet af producerede høns er ændret, således at beregningen nu er baseret på mængden af producerede æg.

Affald

Beregningen af emissioner fra ildebrande i bygninger og biler er blevet forbedret med inkluderingen af detaljerede data for 2009. Dette ekstra år med detaljerede data, har påvirket aktivitetsdata for ildebrande i perioden 1990-2005. Aktivitetsdata for bilbrande is opjusteret som følge af ændringer i oplysningen om bestandsdata for de forskellige køretøjskategorier.

1 Introduction

1.1 Background information on emission inventories

On behalf of the Ministry of the Environment and the Ministry of Climate and Energy NERI is responsible for the calculation and reporting of the Danish national emission inventory to EU and the UNFCCC (United Nations Framework Convention on Climate Change) and UNECE CLRTAP (Convention on Long Range Transboundary Air Pollution) conventions.

1.1.1 Annual report

According to the guidelines for reporting emission data under the Convention on Long-Range Transboundary Air Pollution (ECE/EB.AIR/97) prepared by the Task Force on Emission Inventories and Projections and approved by the Executive Body, countries party to the UNECE-Convention on Long-Range Transboundary Air Pollution should annually submit an informative inventory report to the Secretariat. The new reporting Guidelines (ECE/EB.AIR/97) were accepted at the meeting of the Executive Body in December 2008. Due to lack of resources, it has not been possible to incorporate the new elements of the new reporting guidelines in this submission.

This report is Denmark's Annual Informative Inventory Report due March 15, 2011. The report contains information on Denmark's inventories for all years from the base years of the protocols to 2009.

The annual emission inventory for Denmark is reported in the Nomenclature for Reporting (NFR) 2009 format.

The issues addressed in this report are: trends in emissions, description of each NFR category, uncertainty estimates, recalculations, planned improvements and procedures for quality assurance and control. The outline in annex V of the reporting guidelines is followed as far as possible.

This report and NFR tables are available to the public on NERI's homepage:

http://www.dmu.dk/Luft/Emissioner/Home+of+Inventory/

and on the Eionet central data repository:

http://cdr.eionet.europa.eu/dk/Air_Emission_Inventories/Submission_EMEP_UNECE

1.2 A description of the institutional arrangement for inventory preparation

The National Environmental Research Institute (NERI), Aarhus University, is responsible for the annual preparation and submission to the

UNECE-LRTAP Convention of the Annual Danish Emissions Report, and the inventories in the NFR Format in accordance with the guidelines. NERI participates in meetings under the UNECE Task Force on Emission Inventories and Projections and the related expert panels where parties to the convention prepare the guidelines and methodologies on inventories. NERI is also responsible for estimating emissions for reporting to the NEC Directive, but the Danish EPA is responsible for the reporting.

The work concerning the annual emissions inventory is carried out in cooperation with other Danish ministries, research institutes, organisations and companies:

Danish Energy Agency, Ministry of Climate and Energy: Annual energy statistics in a format suitable for the emission inventory work and fuel-use data for the large combustion plants.

Danish Environmental Protection Agency, Ministry of the Environment. Database on waste.

Statistics Denmark, Ministry of Economic and Business Affairs. Statistical yearbook, production statistics for manufacturing industries, agricultural statistics and import/export/production figures for solvents.

The Faculty of Agricultural Sciences, Aarhus University. Data on use of mineral fertiliser, feeding stuff consumption and nitrogen turnover in animals.

The Road Directorate, Ministry of Transport. Number of vehicles grouped in categories corresponding to the EU classification, mileage (urban, rural, highway), trip speed (urban, rural, highway).

Civil Aviation Agency of Denmark, Ministry of Transport. City-pair flight data (aircraft type and origin and destination airports) for all flights leaving major Danish airports.

Danish Railways, Ministry of Transport. Fuel-related emission factors for diesel locomotives.

Danish companies. Audited environmental reports and direct information gathered from producers and agency enterprises.

Formerly, the provision of data was on a voluntary basis, but more formal agreements are now prepared.

1.3 Brief description of the process of inventory preparation. Data collection and processing, data storage and archiving

The background data (activity data and emission factors) for estimation of the Danish emission inventories is collected and stored in central databases located at NERI. The databases are in Access format and handled with software developed by the European Environmental Agency and NERI. As input to the databases, various sub-models are used to estimate and aggregate the background data in order to fit the format and level in the central databases. The methodologies and data sources used for the different sectors are described in Chapter 1.4 and Chapters 3 to 7. As part of the QA/QC plan (Chapter 1.5), the data structure for data processing support the pathway from collection of raw data to data compilation, modelling and final reporting.

For each submission, databases and additional tools and submodels are frozen together with the resulting NFR-reporting format. This material is placed on central institutional servers, which are subject to routine back-up services. Material which has been backed up is archived safely. A further documentation and archiving system is the official journal for NERI, for which obligations apply to NERI, as a governmental institute. In this journal system, correspondence, both in-going and out-going, is registered, which in this case involves the registration of submissions and communication on inventories with the UNECE-LRTAP Secretariat, the European Commission, review teams, etc.

Figure 1.1 shows a schematic overview of the process of inventory preparation. The figure illustrates the process of inventory preparation from the first step of collecting external data to the last step, where the reporting schemes are generated for the UNFCCC and EU (in the CRF format (Common Reporting Format)) and to the United Nations Economic Commission for Europe/Cooperative Programme for Monitoring and Evaluation of the Long-range Transmission of Air Pollutants in Europe (UNECE/EMEP) (in the NFR format (Nomenclature For Reporting)). For data handling, the software tool is CollectER (Pulles et al., 1999) and for reporting the software tool is developed by NERI. Data files and programme files used in the inventory preparation process are listed in Table 1.1.

Table 1.1 List of current data structure; data files and programme files in use.

QA/QC Level	Name	Application type	Path	Type	Input sources
4 store	CFR Submissions (UNFCCC and EU) NFR Submissions (UNECE and EU)	External report	I:\ROSPROJ\LUFT_EMI\Inventory\AllYears\8_AllSectors\Level_4a_Storage\	MS Excel, xml	CRF Reporter
3 process	CRF Reporter	Management tool	Working path: local machine Archive path: I:\ROSPROJ\LUFT_EMI\Inventory\AllYears\8_AllSectors\Level_3b_Processes	(exe + mdb)	manual input and Importer2CRF
3 process	Importer2CRF	Help tool	I:\ROSPROJ\LUFT_EMI\Inventory\AllYears\8_AllSectors\Level_3b_Processes	MS Access	CRF Reporter, CollectEr2CRFand excel files
3 process	CollectER2CRF	Help tool	I:\ROSPROJ\LUFT_EMI\Inventory\AllYears\8_AllSectors\Level_3b_Processes	MS Access	NERIRep
2 process 3 store	NERIRep	Help tool	Working path: I:\ROSPROJ\LUFT_EMI\Inventory\AllYears\8_AllSectors\Level_3a_Storage	MS Access	CollectER databases; dk1972.mdb..dkxxxx.mdb
2 process	CollectER	Management tool	Working path: local machine Archive path: I:\ROSPROJ\LUFT_EMI\Inventory\AllYears\8_AllSectors\Level_2b_Processes	(exe +mdb)	manual input
2 store	dk1972.mdb.dkxxxx. mdb	Datastore	I:\ROSPROJ\LUFT_EMI\Inventory\AllYears\8_AllSectors\Level_2a_Storage	MS Access	CollectER

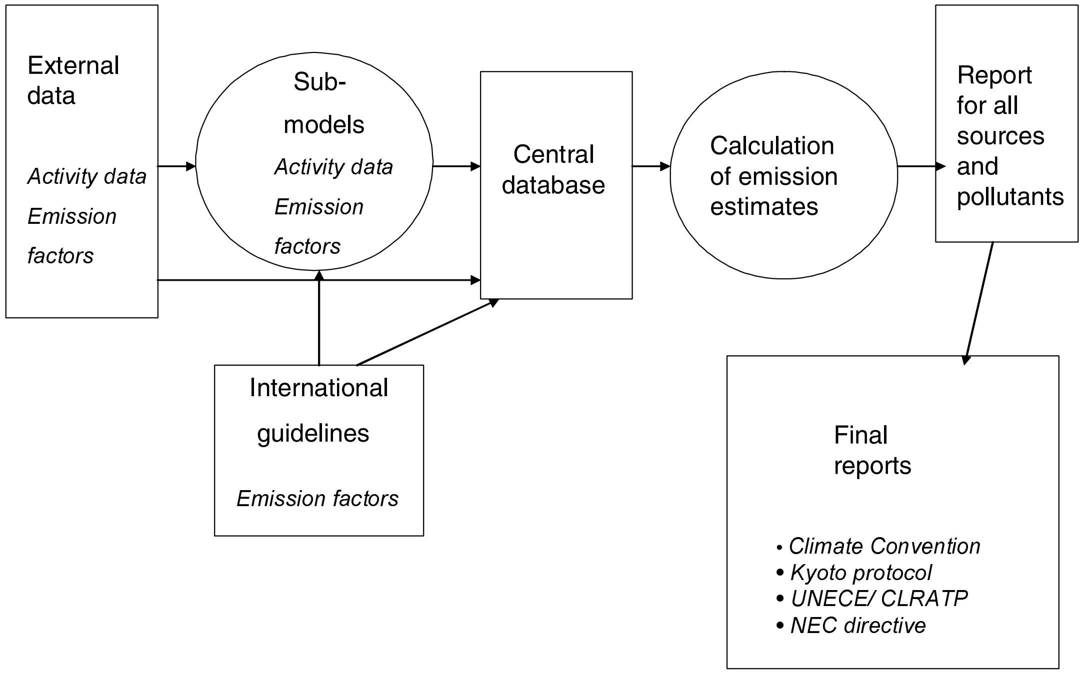

Figure 1.1 Schematic diagram of the process of inventory preparation.

1.4 Brief description of methodologies and data sources used

Denmark's air emission inventories are based on the Revised 1996 Intergovernmental Panel on Climate Change (IPCC) Guidelines for National Greenhouse Gas Inventories (IPCC, 1997), the Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories (IPCC, 2000) and the CORINAIR methodology. CORINAIR (COoRdination of INformation on AIR emissions) is a European air emission inventory programme for national sector-wise emission estimations, harmonised with the IPCC guidelines. In 2009 the EMEP/CORINAIR Guidebook changed name to the EMEP/EEA Guidebook. In this change the Guidebook switched nomenclature from SNAP to NFR. The Danish inventory is prepared at the more detailed SNAP level rather than at the NFR level that is only suitable for reporting. To ensure estimates are as timely, consistent, transparent, accurate and comparable as possible, the inventory programme has developed calculation methodologies for most subsectors and software for storage and further data processing.

A thorough description of the CORINAIR inventory programme used for Danish emission estimations is given in Illerup et al. (2000). The CORINAIR calculation principle is to calculate the emissions as activities multiplied by emission factors. Activities are numbers referring to a specific process generating emissions, while an emission factor is the mass of emissions pr unit activity. Information on activities to carry out the CORINAIR inventory is largely based on official statistics. The most consistent emission factors have been used, either as national values or default factors proposed by international guidelines.

A list of all subsectors at the most detailed level is given in Illerup et al. (2000) together with a translation between CORINAIR and IPCC codes for sector classifications.

1.4.1 The specific methodologies regarding stationary combustion

Stationary combustion plants are part of the CRF emission sources *1A1 Energy Industries*, *1A2 Manufacturing Industries* and *1A4 Other sectors*.

The Danish emission inventory for stationary combustion plants is based on the former CORINAIR system. In 2009 the Emission Inventory Guidebook was updated (EMEP/EEA, 2009). The inventory is based on activity rates from the Danish energy statistics and on emission factors for different fuels, plants and sectors.

The Danish Energy Authority aggregates fuel consumption rates in the official Danish energy statistics to SNAP categories.

For each of the fuel and SNAP categories (sector and e.g. type of plant), a set of general emission factors has been determined. Some emission factors refer to the EMEP/EEA guidebook and some are country specific and refer to Danish legislation, Danish research reports or calculations based on emission data from a considerable number of plants.

A number of large plants, e.g. power plants and municipal waste incineration plants are registered individually as large point sources and emission data from the actual plants are used. This enables use of plant-specific emission factors that refer to emission measurements stated in annual environmental reports. Emission factors of SO_2, NO_X, HM and PM are often plant specific.

Please refer to Chapter 3.2 and Annex 2A for further information on emission inventories for stationary combustion plants.

1.4.2 Specific methodologies regarding transport

The emissions from transport referring to SNAP category 07 (Road transport) and the sub-categories in 08 (Other mobile sources) are made up in the IPCC categories; 1A3b (Road transport), 1A2f (Industry-other), 1A3a (Civil aviation), 1A3c (Railways), 1A3d (Navigation), 1A4c (Agriculture/forestry/fisheries), 1A4b (Residential) and 1A5 (Other).

An internal NERI model with a structure similar to the European COPERT IV emission model (Ntziachristos, 2000) is used to calculate the Danish annual emissions for road traffic. The emissions are calculated for operationally hot engines, during cold start and fuel evaporation. The model also includes the emission effect of catalyst wear. Input data for vehicle stock and mileage is obtained from the Danish Road Directorate and Statistics Denmark, and is grouped according to average fuel consumption and emission behaviour. For each group, the emissions are estimated by combining vehicle type and annual mileage figures with hot emission factors, cold:hot ratios and evaporation factors (Tier 2 approach).

For air traffic, from 2001 onwards estimates are made on a city-pair level, using flight data from the Danish Civil Aviation Agency (CAA-DK), and LTO and distance-related emission factors from the CORINAIR guidelines (Tier 2 approach). For previous years, the background data consists of LTO/aircraft type statistics from Copenhagen Airport and total LTO numbers from CAA-DK. With appropriate assumptions, consistent time-series of emissions are produced back to 1990 and include the findings from a Danish city-pair emission inventory in 1998.

Off-road working machines and equipment are grouped in the following sectors: inland waterways (pleasure craft), agriculture, forestry, industry, and household and gardening. The sources for stock and operational data are various branch organisations and key experts. In general, the emissions are calculated by combining information on the number of different machine types and their respective load factors, engine sizes, annual working hours and emission factors (Tier 2 approach).

The inventory for navigation consists of regional ferries, local ferries and other national sea transport. For regional ferries, the fuel consumption and emissions are calculated as a product of number of round trips pr ferry route (Statistics Denmark), sailing time pr round trip, share of round trips pr ferry, engine size, engine load factor and fuel consumption/emission factor. The estimates take into account the changes in emission factors and ferry specific data during the inventory period.

For the remaining navigation categories, the emissions are calculated simply as a product of total fuel consumption and average emission factors. For each inventory year, this emission factor average comprises the emission factors for all present engine production years, according to engine life times.

Please refer to Chapter 3.3 and Annex 2B for further information on emissions from transport.

1.4.3 The specific methodologies regarding fugitive emissions

Fugitive emissions from oil (1.B.2.a)

Emissions from offshore activities are estimated according to the methodology described in the Emission Inventory Guidebook (EMEP/EEA, 2009). The sources include extraction of oil and gas, onshore oil tanks, and onshore and offshore loading of ships. Activity data is given in the Danish Energy Statistics by the Danish Energy Authority. The emission factors are based on the figures given in the guidebook except for in the case of onshore oil tanks where national values are used.

The VOC emissions from petroleum refinery processes cover non-combustion emissions from feed stock handling/storage, petroleum products processing, product storage/handling and flaring. SO_2 is also emitted from non-combustion processes and includes emissions from product processing and sulphur-recovery plants. The emission calculations are based on information from the Danish refineries and the energy statistics.

Fugitive emissions from natural gas (1.B.2.b)
Inventories of NMVOC emission from gas transmission and distribution are based on annual environmental reports from the Danish gas transmission company, DONG, and on a Danish inventory for the years 1999-2009 reported by the Danish gas sector (transmission and distribution companies).

Fugitive emissions from flaring (1.B.2.c)
Emissions from flaring offshore, in gas treatment and storage plants, and in refineries are included in the inventory. Emissions calculations are based on annual reports from the Danish Energy Agency and environmental reports from gas storage and treatment plants and the refineries. Calorific values are based on the reports for the EU ETS for offshore flaring, on annual gas quality data from Energinet.dk, and on additional data from the refineries. Emission factors are based on the Emission Inventory Guidebook (EMEP/EEA, 2009).

Please refer to Chapter 3.4 for further information on fugitive emissions from fuels.

1.4.4 Specific methodologies regarding industrial processes

Energy consumption associated with industrial processes and the emissions thereof is included in the inventory for stationary combustion plants. This is due to the overall use of energy balance statistics for the inventory.

Mineral products
The sub-sector includes production of cement, lime, container glass/glass wool, mineral wool, other production (consumption of lime), and roofing and road paving with asphalt. The activity data as well as emission data are primarily based on information from Environmental Reports (In Danish: "Grønne regnskaber") prepared by companies according to obligations under Danish law. The published information is supplemented with information obtained directly from companies or by use of standard emission factors. The distribution of TSP between PM_{10} and $PM_{2.5}$ is based on European average data.

Chemical industry
The sub-sector includes production of nitric acid, catalysts, fertilisers and pesticides. The activity data as well as emission data are based on information from the companies as accounted for and published in the Environmental Reports combined with information obtained by contact to the companies. The distribution of TSP between PM_{10} and $PM_{2.5}$ is based on European average data. Production of nitric acid ceased in the middle of 2004.

Metal production
The sub-sector includes production of steel sheets and bars, cast iron, aluminium, lead and lead products and various other metal products. The activity data as well as emission data for the steelworks are based on information from the companies as accounted for and published in the Environmental Reports, combined with information obtained by contact with the companies. The activity data or the other processes are based on information from Statistics Denmark combined with Danish

average emission factors and standard emission factors. The distribution of TSP between PM_{10} and $PM_{2.5}$ is based on European average data.

Other production

The sub-sector includes breweries and other activities within the food and drink sector. The activity data is obtained from Statistics Denmark and the emission factors are obtained from the EMEP/EEA Guidebook.

Please refer to Chapter 4 for further information on industrial processes.

1.4.5 Specific methodologies regarding solvent and other product use

The approach for calculating the emissions of Non-Methane Volatile Organic Carbon (NMVOC) from industrial and household use in Denmark focuses on single chemicals rather than activities. This leads to a clearer picture of the influence from each specific chemical, which enables a more detailed differentiation on products and the influence of product use on emissions. The procedure is to quantify the use of the chemicals and estimate the fraction of the chemicals that is emitted as a consequence of use.

The detailed approach in EMEP/EEA Guidebook (2009) is used. Here all relevant consumption data on all relevant solvents must be inventoried or at least those together representing more than 90 % of the total NMVOC emission. Simple mass balances for calculating the use and emissions of chemicals are set up 1) use = production + import – export, 2) emission = use emission factor. Production, import and export figures are extracted from Statistics Denmark, from which a list of 427 single chemicals, a few groups and products is generated. For each of these, a "use" amount in tonnes pr year (from 1995 to 2009) is calculated. For some chemicals and/or products, e.g. propellants used in aerosol cans, use amounts are obtained from the industry as the information from Statistics Denmark does not comply with required specificity. It is found that approx. 40 different NMVOCs comprise over 95 % of the total use and it is these 40 chemicals that are investigated further. The "use" amounts are distributed across industrial activities according to the Nordic SPIN (Substances in Preparations in Nordic Countries) database, where information on industrial use categories is available in a NACE coding system. The chemicals are also related to specific products according to the Use Category (UCN) system. Emission factors are obtained from regulators, literature or the industry.

Outputs from the inventory are: a list where the 40 most predominant NMVOCs are ranked according to emissions to air, specification of emissions from industrial sectors and from households, contribution from each chemical to emissions from industrial sectors and households. Furthermore tidal (annual) trend in NMVOC emissions expressed as total NMVOC and single chemical and specified in industrial sectors and households are shown.

For the first time in the 2011 reporting emissions from use of fireworks are included using the amount of fireworks used from Statistics Denmark combined with emission factors.

Please refer to Chapter 5 for further information on the emission inventory for solvents.

1.4.6 Specific methodologies regarding agriculture

The emissions from the agricultural sector include emissions of ammonia, NO_x, CO, NMVOC, SO_2, particulate matter, heavy metals, dioxin and PAH. The emissions are registered in NFR categories under 4B Manure Management, 4D Agricultural Soils and 4F Field Burning of Agricultural Wastes.

The calculations of all sources are based on the Emission Inventory Guidebook (EMEP/EEA, 2009). In Denmark, a model-based system is applied for calculation of ammonia emissions, particulate matter and greenhouse gases. This model is called IDA (Integrated Database model of Agricultural emissions), and data on activity and emissions are collected, evaluated and discussed in close corporation with the Faculty of Agricultural Sciences, Aarhus University and the Danish Agricultural Advisory Centre.

Livestock numbers and data concerning the land use and crop yield are based on the Agricultural Statistics published by Statistics Denmark. The emission factors used to calculate the emissions are primarily based on information from the Faculty of Agricultural Sciences, Aarhus University and the Danish Agricultural Advisory Centre. Furthermore, activity data from the Danish Environmental Protection Agency and the Danish Plant Directorate are used.

Uncertainties have been estimated. The estimated emissions for particulate matter are associated with very high uncertainties, which are estimated to be of several hundred percent. To ensure data quality, activity data and data for estimation of emission factors are collected and discussed in corporation with specialists and researchers at different institutes and research departments. This means that the emission inventories are continuously evaluated according to the latest knowledge and information. Furthermore, time-series of both emission factors and activity data are prepared, and considerable variations are checked and revised.

Please refer to Chapter 6 and Appendix 2C for further information on emission inventories for agriculture.

1.5 Key categories

The determination of key categories has not been made due to insufficient resources being available at the moment.

1.6 Information on the QA/QC plan including verification and treatment of confidential issues where relevant

In the Danish National Inventory Report to UNFCCC (Nielsen et al., 2010), the plan for Quality Control (QC) and Quality Assurance (QA) for greenhouse gas emission inventories prepared by the Danish National Environmental Research Institute is outlined. The plan is in accordance with the guidelines provided by the UNFCCC (IPCC, 1997) and the "Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories" (IPCC, 2000). The ISO 9000 standards are also used as important input for the plan. The plan also, to a limited extent, includes the gases reported to the UNECE-LRTAP Convention. Due to a lack of resources it has not been possible to extend the QA/QC system for the greenhouse gas inventory to also cover the air pollutants.

1.7 General uncertainty evaluation, including data on the overall uncertainty for the inventory totals

The uncertainty estimates are based on the simple Tier 1 approach in the EMEP/CorinAir *Good Practice Guidance for LRTAP Emission Inventories* (Pulles & Aardenne, 2001).

The uncertainty estimates are based on emission data for the base year and year 2009, and on uncertainties for activity rates and emission factors for each of the main SNAP sectors. For particulate matter, the year 2000 is considered as the base year, but for all other pollutants 1990 is used as the base year.

Uncertainty estimates include uncertainty of the total emission as well as uncertainty of the trend. The estimated uncertainties are shown in Table 1.2. The uncertainty estimates include the sectors: stationary combustion, transport, industry and agriculture.

Table 1.2 Danish uncertainty estimates, 2009.

Pollutant	Uncertainty Total emission [%]	Trend 1990[1)]-2009 [%]	Uncertainty Trend [%-age points]
SO_2	33	-92	±2.5
NO_x	37	-53	±7
NMVOC	23	-51	±9
CO	40	-45	±14
NH_3	30	-34	±15
TSP	259	1,8	±82
PM_{10}	302	2,7	±98
$PM_{2.5}$	364	5,1	±118
Arsenic	194	-77	±29
Cadmium	325	-81	±50
Chromium	283	-87	±31
Copper	936	36	±81
Mercury	130	-82	±18
Nickel	323	-73	±42
Lead	625	-92	±23
Selenium	402	-60	±97
Zinc	726	-30	±260
PCDD/F	585	-50	±208
Benzo(b)fluoranthene	906	109	±117
Benzo(k)fluoranthene	899	119	±180
Benzo(a)pyrene	928	120	±91
Indeno(1,2,3-c,d)pyrene	914	87	±74
HCB	718	-83	±46

[1]The base year for PM is 2000.

1.8 General assessment of the completeness

Annex 3 provides a full and comprehensive explanation on the use of notation keys in the Danish inventory. The Danish emissions inventory due 15 February 2011 includes all sources identified by the EMEP/EEA guidebook except the following.

1.8.1 Industrial processes

Categories reported as not estimated:

- Emissions from quarrying and mining of minerals other than coal have not been estimated.
- Emissions from construction and demolition are not estimated.
- Emissions from storage, handling and transport of mineral products are not estimated
- Emissions from storage, handling and transport of chemical products have not been estimated.
- Emissions from storage, handling and transport of metal products have not been estimated.
- Emissions from pulp and paper production have not been estimated.
- Emissions from wood processing have not been estimated.
- Emissions from production of POPs have not been estimated due to lack of emission factors.
- Emissions from consumption of POPs and heavy metals have not been estimated.

1.8.2 Agriculture

Categories reported as not estimated:
- Emissions from farm level agricultural operations are not estimated.
- Emissions from off-farm storage, handling and transport of agricultural products are not estimated.

1.8.3 Waste

Categories reported as not estimated:
- Emissions from solid waste disposal on land are not estimated.
- Emissions from waste-water handling are not estimated.
- Emissions from small scale waste burning are not estimated.

1.8.4 Categories reported as "included elsewhere"

The following table lists the categories reported as IE (included elsewhere) and provides information on where the associated emissions are reported, more detailed information is provided in Annex 3.

Table 1.1 List of categories reported as included elsewhere.

1 A 2 a Iron and steel	1 A 2 f i Manufacturing industries and construction, Other
1 A 2 b Non-ferrous metals	1 A 2 f i Manufacturing industries and construction, Other
1 A 2 c Chemicals	1 A 2 f i Manufacturing industries and construction, Other
1 A 2 d Pulp, Paper and Print	1 A 2 f i Manufacturing industries and construction, Other
1 A 2 e Food processing, beverages and tobacco	1 A 2 f i Manufacturing industries and construction, Other
1 A 5 a Other stationary (including military)	1 A 4 a i Commercial / institutional: Stationary
2 A 1 Cement production	1 A 2 f i Manufacturing industries and construction, Other
2 A 2 Lime production	1 A 2 f i Manufacturing industries and construction, Other
2 A 3 Limestone and dolomite use	1 A 2 f i Manufacturing industries and construction, Other
2 A 4 Soda ash production and use	1 A 2 f i Manufacturing industries and construction, Other
6 C a Clinical waste incineration (d)	1 A 1 a Public electricity and heat production
6 C b Industrial waste incineration (d)	1 A 1 a Public electricity and heat production
6 C c Municipal waste incineration (d)	1 A 1 a Public electricity and heat production

1.8.5 General description on the use of notation keys

The NFR as reported by Denmark makes use of five notation keys: NO (Not Occurring), NA (Not Applicable), NE (Not Estimated), IE (Included Elsewhere) and NR (Not Reported).

NO is used in instances where the activity does not occur in Denmark, e.g. adipic acid production.

NA is used in instances where the activity occurs in Denmark but the emission of a certain pollutant is not believed to be relevant, e.g. heavy metals from dairy cattle.

NE is used in instances where the activity occurs in Denmark and emissions of a certain pollutant are thought to occur but the emission has not been estimated, see Chapter 1.8.3 and Annex 3.

IE is used where emissions of a certain pollutant or the whole source category are reported under another source category, see Chapter 1.8.4 and Annex 3.

NR is used for pollutants prior to the base year, e.g. PM emissions prior to the year 2000.

1.9 References

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2 Trends in Emissions

2.1 Acidifying gases

Acid deposition of sulphur and nitrogen compounds mainly derives from emissions of SO_2, NO_X and NH_3. The effects of acidification may appear in a number of ways, including defoliation and reduced vitality of trees, and declining fish stocks in acid-sensitive lakes and rivers.

SO_2 and NO_X can be oxidised into sulphate (SO_4^{--}) and nitrate (NO_3^-) - either in the atmosphere or after deposition - resulting in the formation of two and one H^+, respectively. NH_3 may react with H^+ to form ammonium (NH_4^+) and, by nitrification in soil, NH_4^+ is oxidised to NO_3^- and H^+ ions are formed.

Weighting the individual substances according to their acidification effect, total emissions in terms of acid equivalents can be calculated as:

$$A = \frac{m_{SO_2}}{M_{SO_2}} \cdot 2 + \frac{m_{NO_x}}{M_{NO_x}} + \frac{m_{NH_3}}{M_{NH_3}} = \frac{m_{SO_2}}{64} \cdot 2 + \frac{m_{NO_x}}{46} + \frac{m_{NH_3}}{17}$$

where A is the acidification index in Mmole

m_i is the emission of pollutant *i* in tonnes

M_i is the mole weight [tonne/Mmole] of pollutant *i*

The actual effect of the acidifying substances depends on a combination of two factors: the amount of acid deposition and the natural capacity of the terrestrial or aquatic ecosystem to counteract the acidification. In areas where the soil minerals easily weather or have a high lime content, acid deposition will be relatively easily neutralised.

Figure 2.1 shows the emission of Danish acidifying gases in terms of acid equivalents. In 1990, the relative contribution in acid equivalents was almost equal for the three gases. In 2009, the most important acidification factor in Denmark is ammonia nitrogen and the relative contributions for SO_2, NO_X and NH_3 were 6 %, 36 % and 58 %, respectively. However, with regard to long-range transport of air pollution, SO_2 and NO_X are still the most important pollutants.

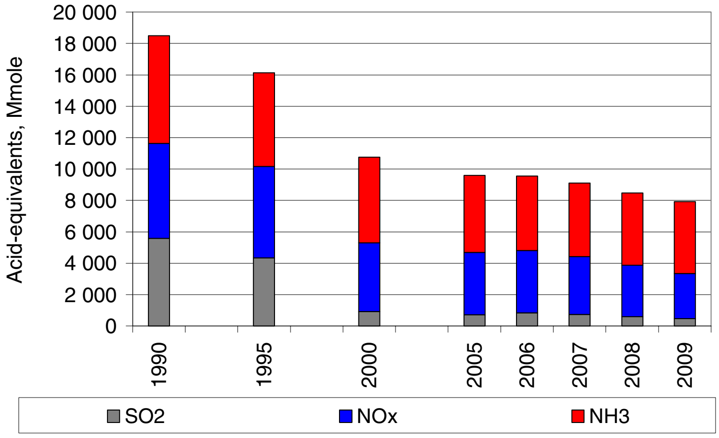


Figure 2.1 Emissions of NH_3, NO_X and SO_2 over time in acid equivalents.

2.2 Description and interpretation of emission trends by gas

2.2.1 SO_2

The main part of the SO_2 emission originates from combustion of fossil fuels, i.e. mainly coal and oil, in public power and district heating plants. From 1980 to 2009, the total emission decreased by 97 %. The large reduction is mainly due to installation of desulphurisation plant and use of fuels with lower content of sulphur in public power and district heating plants. Despite the large reduction of the SO_2 emissions, these plants make up 33 % of the total emission. Also emissions from industrial combustion plants, non-industrial combustion plants and other mobile sources are important. National sea traffic (navigation and fishing) contributes with about 13 % of the total SO_2 emission in 2009. This is due to the use of residual oil with high sulphur content.

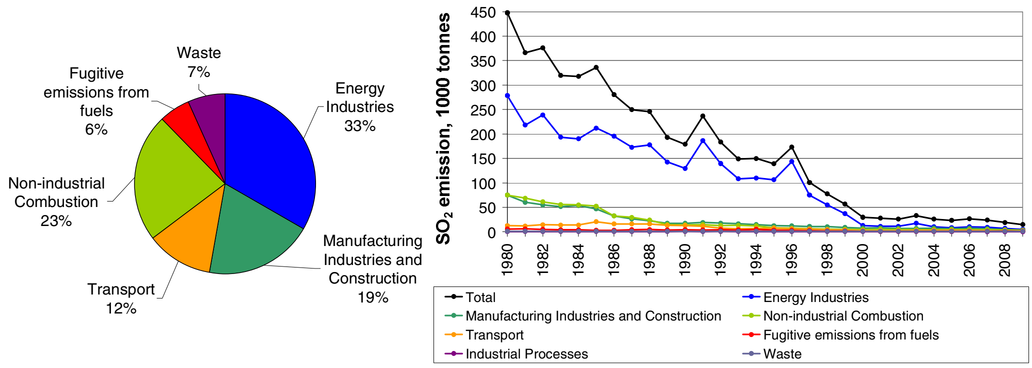


Figure 2.2 SO_2 emissions. Distribution according to the main sectors (2009) and time-series for 1980 to 2009.

2.2.2 NO_X

The largest sources of emissions of NO_X are road transport followed by other mobile sources and combustion in energy industries (mainly public power and district heating plants). The transport sector is the sector contributing the most to the emission of NO_X and, in 2009, 45 % of the Danish emissions of NO_X stems from road transport, national navigation, railways and civil aviation. Also emissions from national fishing and off-road vehicles contribute significantly to the NO_X emission. For non-industrial combustion plants, the main sources are combustion of gas oil, natural gas and wood in residential plants. The emissions from energy industries have decreased by 77 % from 1985 to 2009. In the same period, the total emission decreased by 56 %. The reduction is due to the increasing use of catalyst cars and installation of low-NO_X burners and denitrifying units in power plants and district heating plants.

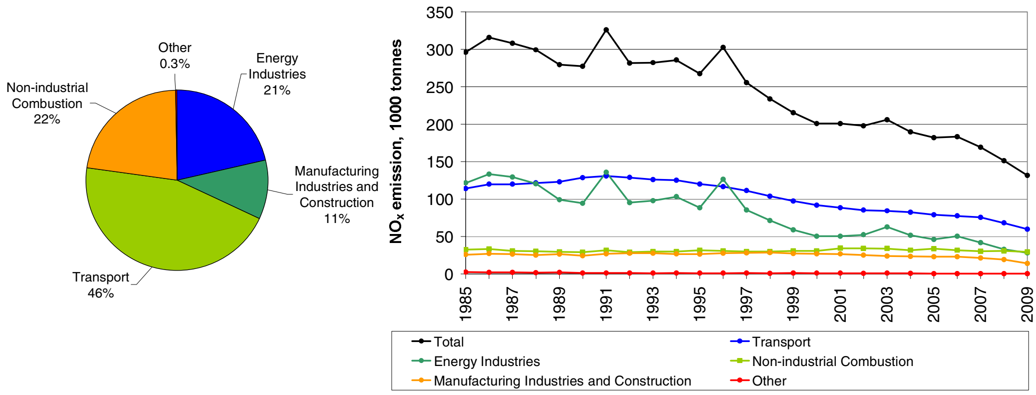


Figure 2.3 NO_X emissions. Distribution according to the main sectors (2009) and time-series for 1985 to 2009.

2.2.3 NH_3

Almost all atmospheric emissions of NH_3 result from agricultural activities. Only a minor fraction originates from road transport (2 %). This fraction is, however, increasing due to increasing use of catalyst cars. The major part of the emission from agriculture stems from livestock manure (83 %) and the largest losses of ammonia occur during the handling of the manure in stables and in field application. Other contributions come from use of mineral fertilisers (6 %), N-excretion on pasture range and paddock (3 %), sewage sludge used as fertiliser, crops and ammonia used for straw treatment (7 %) and field burning (less than 1 %). The total ammonia emission decreased by 36 % from 1985 to 2009. This is due to the active national environmental policy efforts over the past twenty years. Due to the action plans for the aquatic environment and the Ammonia Action Plan, a series of measures to prevent loss of nitrogen in agricultural production has been initiated. The measures have included demands for improved utilisation of nitrogen in livestock manure, a ban against application of livestock manure in winter, prohibition of broadspreading of manure, requirements for establishment of catch crops, regulation of the number of livestock pr hectare and a ceiling for the supply of nitrogen to crops. As a result, despite an increase in the production of pigs and poultry, the ammonia emission has been reduced considerably.

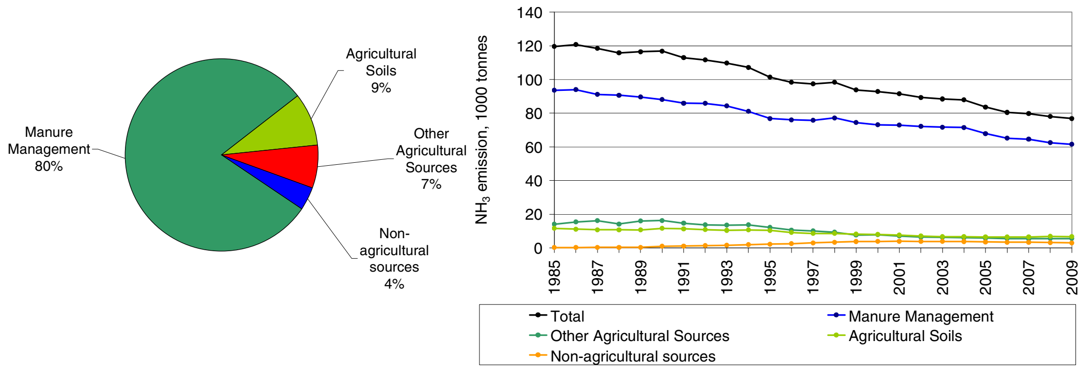


Figure 2.4 NH_3 emissions. Distribution on the main sectors (2009) and time-series for 1985 to 2009.

2.3 Other air pollutants

2.3.1 NMVOC

The emissions of NMVOC originate from many different sources and can be divided into two main groups: incomplete combustion and evaporation. Road vehicles and other mobile sources such as national navigation vessels and off-road machinery are the main sources of NMVOC emissions from incomplete combustion processes. Road transportation vehicles are still the main contributors, even though the emissions have declined since the introduction of catalyst cars in 1990. The evaporative emissions mainly originate from the use of solvents and the extraction, handling and storage of oil and natural gas. The emissions from the energy industries have increased during the nineties due to the increasing use of stationary gas engines, which have much higher emissions of NMVOC than conventional boilers. The total anthropogenic emissions have decreased by 50 % from 1985 to 2009, largely due to the increased use of catalyst cars and reduced emissions from use of solvents.

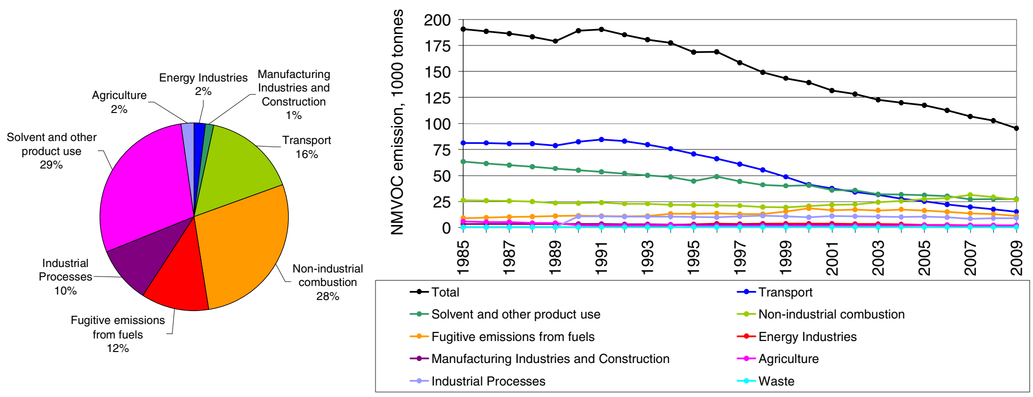


Figure 2.5 NMVOC emissions. Distribution according to the main sectors (2009) and time-series for 1985 to 2009.

2.3.2 CO

Other mobile sources and non-industrial combustion plants contribute significantly to the total emission of this pollutant. Transport is the second largest contributor to the total CO emission. In 1990 a law forbidding the burning of agricultural crop residues on fields was implemented this caused significant reduction in CO emission. The emission decreased further by 40 % from 1990 to 2009, largely because of decreasing emissions from road transportation.

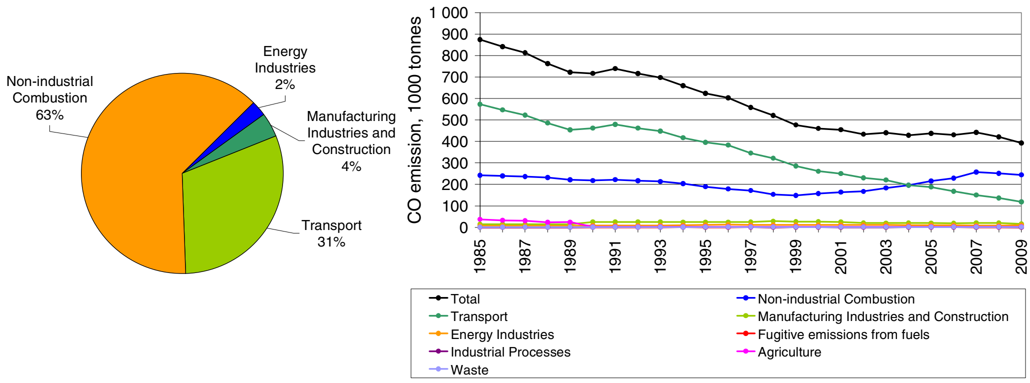


Figure 2.6 CO emissions. Distribution according to the main sectors (2009) and time-series for 1985 to 2009.

2.3.3 Particulate Matter

The particulate matter (PM) emission inventory has been reported for the years 2000-2009. The inventory includes the total emission of particles TSP (Total Suspended Particles), emission of particles smaller than 10 µm (PM_{10}) and emission of particles smaller than 2.5 µm ($PM_{2.5}$).

The largest $PM_{2.5}$ emission sources are residential plants (71 %), road traffic (12 %) and other mobile sources (10 %). For the latter, the most important sources are off-road vehicles and machinery in the industrial sector and in the agricultural/forestry sector (28 % and 40 %, respectively). For the road transport sector, exhaust emissions account for the major part (64 %) of the emissions. The $PM_{2.5}$ emission increased by 35 % from 2000 to 2009 due to an increasing wood consumption in the residential sector.

The largest TSP emission sources are the residential sector and the agricultural sector. The TSP emissions from transport are also important and include both exhaust emissions and the non-exhaust emissions from brake and tyre wear and road abrasion. The non-exhaust emissions account for 62 % of the TSP emission from road transport.

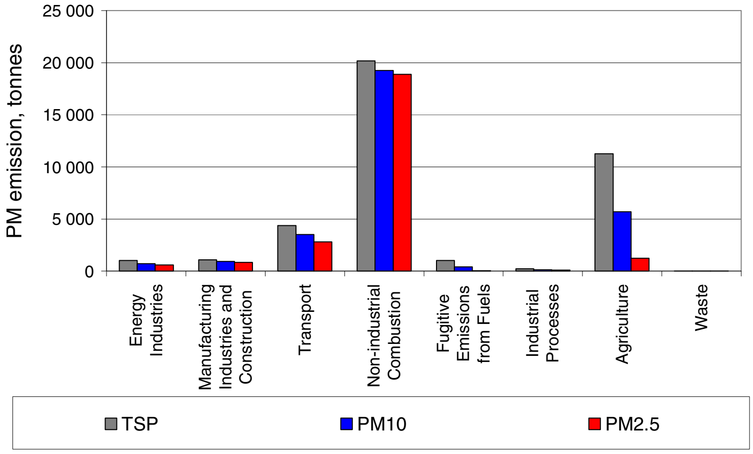


Figure 2.7 PM emissions pr sector for 2009.

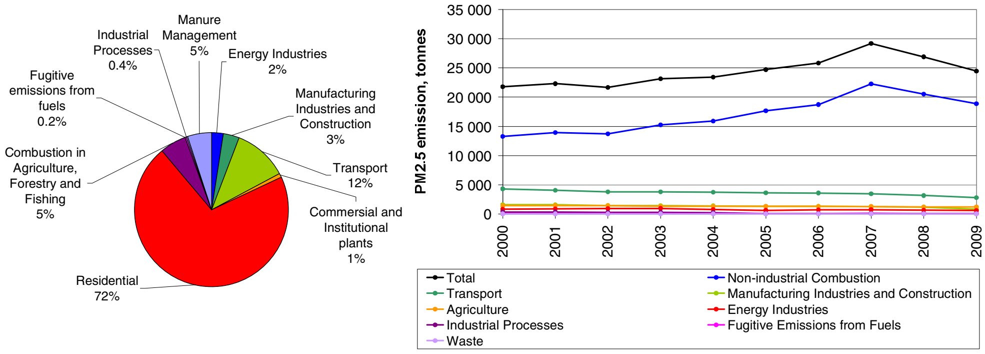


Figure 2.8 $PM_{2.5}$ emissions. Distribution according to the main sectors (2009) and time-series for 1985 to 2009.

2.3.4 Heavy metals

In general, the most important sources of heavy metal emissions are combustion of fossil fuels and waste. The heavy metal emissions have decreased substantially in recent years, except for Cu. The reductions span from 30 % to 92 % for Zn and Pb, respectively. The reason for the reduced emissions is mainly increased use of gas cleaning devices at power and district heating plants (including waste incineration plants). The large reduction in the Pb emission is due to a gradual shift towards unleaded gasoline, the latter being essential for catalyst cars. The major source of Cu is automobile tyre and break wear (93 % in 2009) and the increase from 1990 to 2009 owe to increasing mileage.

Table 2.1 Emissions of heavy metals.

Heavy metals, kilogramme	As	Cd	Cr	Cu	Hg	Ni	Pb	Se	Zn
1990	1 297	985	5 906	35 796	3 074	19 896	125 151	4 918	51 846
2009	299	191	759	48 788	515	4 895	10 425	1 414	36 420
Reduction, %	77	81	87	-36	83	75	92	71	30

According to the UNECE Heavy Metal Protocol, the priority metals are Pb, Cd and Hg and the objective is to reduce emissions of these heavy metals.

Cadmium

The main sources of emissions of Cd to air are combustion in energy industries (mainly combustion of wood, wood waste and municipal waste) and manufacturing industries (mainly combustion of residual oil). In the transport sector emissions from passenger cars is the main source contributing with 55 % of the sectoral emission in 2009. The emission from non-industrial combustion is dominated by wood combustion in residential plants which accounts for 76 % of the sectoral emission in 2009. Emissions from combustion in residential plants have increased by 99 % since 1990. The decreasing emission from energy industries are related to the decreasing combustion of coal.

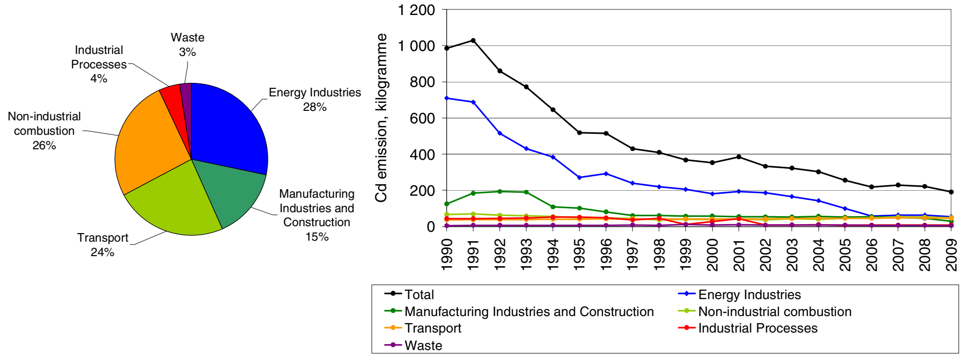


Figure 2.9 Cd emissions. Time-series for 1990 to 2009 and distribution by main sector for 2009.

Mercury

The largest sources of Hg emissions to air are waste incineration and coal combustion in energy industries. Due to improved flue gas cleaning and decreasing coal combustion the emissions from Energy industries decreased by 75 % from 1990-2000. Non-industrial combustion is dominated by wood combustion in residential plants while emissions from the waste sector mainly owe to cremation. The variations in emissions from industrial processes owe to shut down in 2002 followed by re-opening and a second shut in 2005 down of the electro-steelwork.

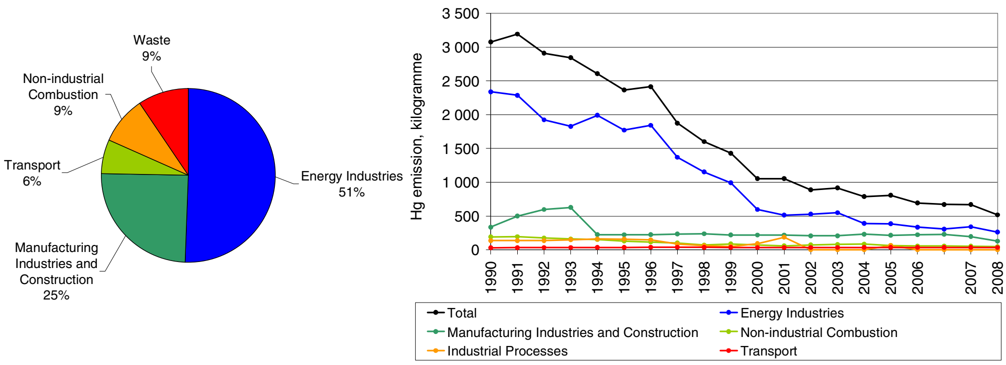


Figure 2.10 Hg emissions. Time-series for 1990 to 2009 and distribution by main sector for 2009.

Lead

The main Pb emission sources are combustion in residential plants and energy industries and transport. In earlier years combustion of leaded gasoline was the major contributor to Pb emissions to air but the shift toward use of unleaded gasoline for transport have decreased the Pb emission from transport by 93 %. In the non-industrial combustion sector the dominant source is wood combustion in residential plants. The decrease in the Pb emission from non-industrial combustion from 1990 to 2009 at 16 % owe to the shift towards unleaded gasoline, as this sector includes other mobile sources in household, gardening, agriculture, forestry, fishing and military. The decreasing emission from Energy industries (96 % from 1990 to 2009) is caused by the deceasing coal combustion.

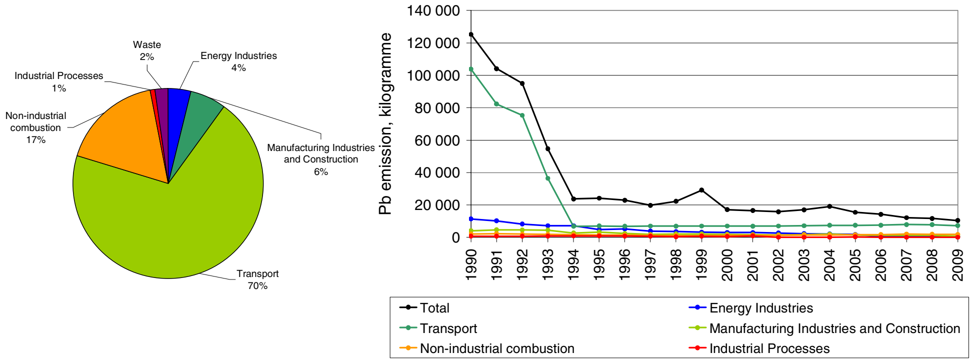


Figure 2.11 Pb emissions. Time-series for 1990 to 2009 and distribution by main sector for 2009.

2.3.5 PAHs

The present emission inventory for PAH (polycyclic aromatic hydrocarbons) includes four PAHs: benzo(a)-pyrene, benzo(b)-fluoranthene, benzo(k)fluoranthene and indeno-(1,2,3-cd)pyrene. Benzo(b)fluoranthene and Benzo(a)pyrene contribute the major PAH emission by 32 % and 30 %, respectively.

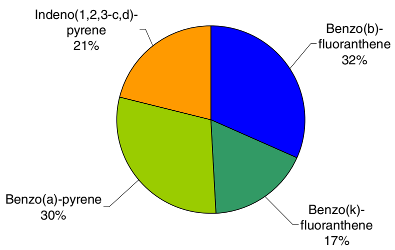


Figure 2.12 PAH emissions. Distribution according to the main sectors (2009) and time-series for 1990 to 2009.

The most important source of PAH emissions is combustion of wood in the residential sector making up 84 % of the total emission in 2009. The increasing emission trend is due to increasing combustion of wood in the residential sector. The PAH emission from combustion in residential plants has increased by 15 % from 1990 to 2009.

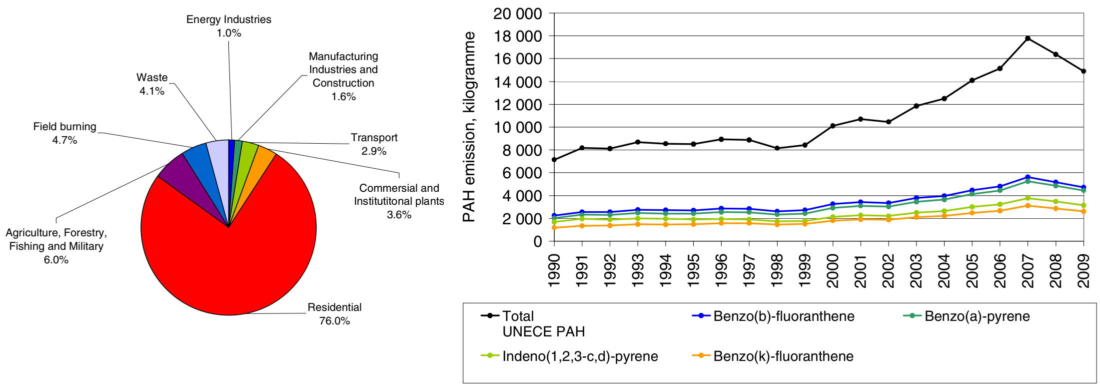


Figure 2.13 PAH emissions. Distribution according to the main sectors (2009) and time-series for 1990 to 2009.

2.3.6 Dioxins and furans

The major part of the dioxin emission owe to wood combustion in the residential sector, mainly in wood stoves and ovens without flue gas cleaning. Wood combustion in residential plants accounts for 53 % of the national dioxin emission in 2009. The contribution to the total dioxin emission from the waste sector (36 % in 2009) owe to accidental fires, especially building fires. The emission of dioxins from energy industries owe mainly to the combustion of biomass as wood, wood waste and to a less extend agricultural waste.

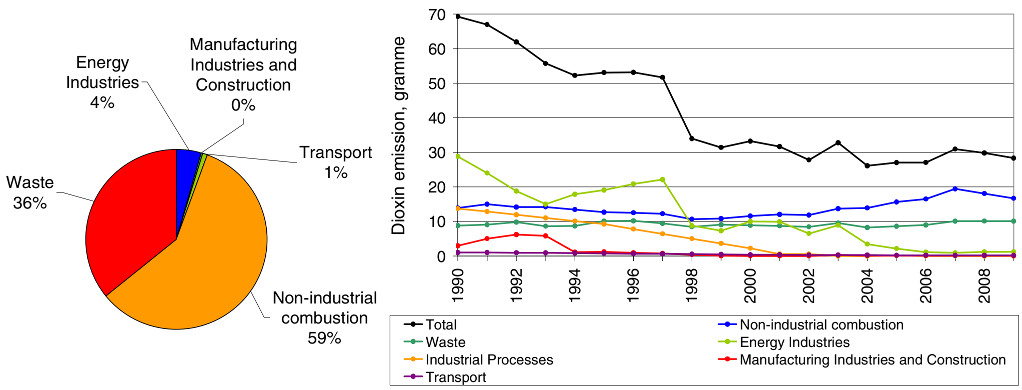


Figure 2.14 Emissions of dioxins and furans. Distribution according to the main sectors (2009) and time-series for 1990 to 2009.

2.3.7 Hexachlorobenzene

Stationary combustion accounts for 98 % of the estimated national HCB emission in 2009. This owe mainly to combustion of municipal solid waste in heating and power plants. Wood combustion in households is an important source, too, and has increased by 264 % since 190 due to increasing wood consumption. The HCB emission from stationary plants has decreased 83 % since 1990 mainly due to improved flue gas cleaning in MSW incineration plants. The emission from residential plants has increased due to increased wood consumption in this source category.

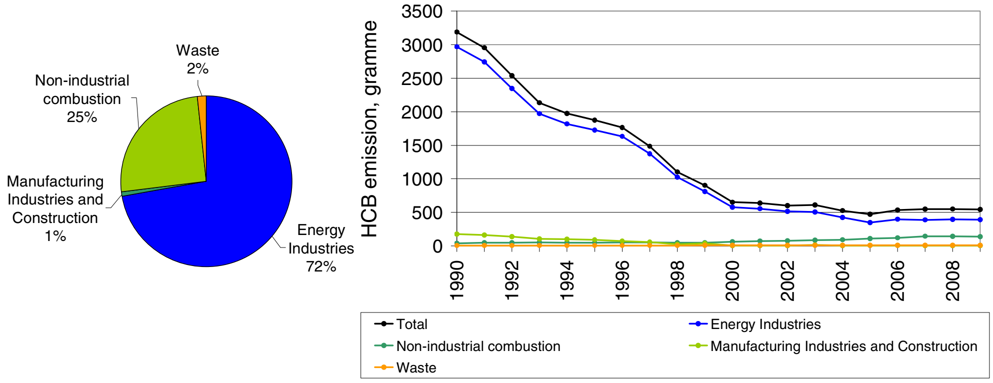


Figure 2.15 HCB emissions. Distribution according to the main sectors (2009) and time-series for 1990 to 2009.

3 Energy (NFR sector 1)

3.1 Overview of the sector

The energy sector is reported in three main chapters:

3.2 Stationary combustion plants (NFR sector 1A1, 1A2 and 1A4)

3.3 Transport (NFR sector 1A2, 1A3, 1A4 and 1A5)

3.4 Fugitive emissions (NFR sector 1B)

Although industrial combustion forms part of stationary combustion, detailed documentation for some of the specific industries is discussed in the industry chapters. The emissions are reported in NFR sector 1A2. Emissions from facilities with only fuel consumption in the industrial sector are included in the data presented in Chapter *3.2 Stationary Combustion*.

Table 3.1 shows detailed source categories for the energy sector and plant category in which the sector is discussed in this report.

Table 3.1 NFR source categories for the energy sector.

NFR id	NFR sector name	NERI documentation
1	Energy	Stationary combustion, Transport, Fugitive, Industry
1A	Fuel Combustion Activities	Stationary combustion, Transport, Industry
1A1	Energy Industries	Stationary combustion
1A1a	Electricity and Heat Production	Stationary combustion
1A1b	Petroleum Refining	Stationary combustion
1A1c	Solid Fuel Transf./Other Energy Industries	Stationary combustion
1A2	Fuel Combustion Activities/Industry (ISIC)	Stationary combustion, Transport, Industry
1A2a	Iron and Steel	Stationary combustion, Industry
1A2b	Non-Ferrous Metals	Stationary combustion, Industry
1A2c	Chemicals	Stationary combustion, Industry
1A2d	Pulp, Paper and Print	Stationary combustion, Industry
1A2e	Food Processing, Beverages and Tobacco	Stationary combustion, Industry
1A2f	Other (please specify)	Stationary combustion, Transport, Industry
1A3	Transport	Transport
1A3a	Civil Aviation	Transport
1A3b	Road Transportation	Transport
1A3c	Railways	Transport
1A3d	Navigation	Transport
1A3e	Other (please specify)	Transport
1A4	Other Sectors	Stationary combustion, Transport
1A4a	Commercial/Institutional	Stationary combustion, Transport
1A4b	Residential	Stationary combustion, Transport
1A4c	Agriculture/Forestry/Fishing	Stationary combustion, Transport
1A5	Other (please specify)	Stationary combustion, Transport
1A5a	Stationary	Stationary combustion
1A5b	Mobile	Transport
1B	Fugitive Emissions from Fuels	Fugitive
1B1	Solid Fuels	Fugitive
1B1a	Coal Mining	Fugitive
1B1a1	Underground Mines	Fugitive
1B1a2	Surface Mines	Fugitive
1B1b	Solid Fuel Transformation	Fugitive
1B1c	Other (please specify)	Fugitive
1B2	Oil and Natural Gas	Fugitive
1B2a	Oil	Fugitive
1B2a2	Production	Fugitive
1B2a3	Transport	Fugitive
1B2a4	Refining/Storage	Fugitive
1B2a5	Distribution of oil products	Fugitive
1B2a6	Other	Fugitive
1B2b	Natural Gas	Fugitive
1B2b1	Production/processing	Fugitive
1B2b2	Transmission/distribution	Fugitive
1B2c	Venting and Flaring	Fugitive
1B2c1	Venting and Flaring Oil	Fugitive
1B2c2	Venting and Flaring Gas	Fugitive
1B2d	Other	Fugitive

Summary tables for the emissions from the energy sector are shown below.

Table 3.2 SO$_2$, NO$_x$, NMVOC, CO and PM emission from the energy sector, 2009.

	NO$_x$	CO	NMVOC	SO$_x$	NH$_3$	TSP	PM$_{10}$	PM$_{2.5}$
	Gg NO$_2$	Gg	Gg	Gg SO$_2$	Gg	Gg	Gg	Gg
1A1 Energy Industries	28.1	9.4	2.0	4.9	0.0	1.0	0.7	0.6
1A2 Manufacturing industries and Construction	13.9	15.5	1.3	2.9	0.3	1.1	0.9	0.8
1A3 Transport	59.9	118.3	15.2	1.7	1.6	4.4	3.5	2.8
1A4 Other Sectors	28.8	244.0	26.7	3.4	0.2	20.2	19.2	18.9
1A5 Other	0.7	0.4	0.1	0.0	0.0	0.0	0.0	0.0
1B1 Fugitive Emissions from fuels, Solid Fuels	NA	NA	NA	NA	NA	1.0	0.4	0.0
1B2 Fugitive Emissions from fuels, Oil and Natural gas	0.1	0.1	11.1	0.8	0.0	0.0	0.0	0.0
Energy, Total	131.6	387.6	56.3	13.8	2.1	27.7	24.8	23.1

Table 3.3 HM emissions from the energy sector, 2009.

	Pb	Cd	Hg	As	Cr	Cu	Ni	Se	Zn
	Mg	Mg	Mg	Mg	Mg	Mg	Mg	Mg	Mg
1A1 Energy Industries	0.4	0.05	0.3	0.1	0.2	0.2	1.2	1.0	0.6
1A2 Manufacturing industries and Construction	0.6	0.03	0.1	0.1	0.1	0.1	1.3	0.3	1.5
1A3 Transport	7.2	0.05	0.03	0.04	0.2	45.7	1.8	0.1	26.3
1A4 Other Sectors	1.7	0.05	0.05	0.05	0.1	0.4	0.4	0.1	5.2
1A5 Other	0.1	0.0002	0.0001	0.000003	0.0007	0.001	0.0002	0.000003	0.04
1B1 Fugitive Emissions from fuels, Solid Fuels	NA	NA	NA	NA	NA	NA	NA	NA	NA
1B2 Fugitive Emissions from fuels, Oil and Natural gas	0.0008	0.002	0.0005	0.0004	0.003	0.002	0.004	0.00005	0.1
Energy, Total	10.1	0.2	0.5	0.3	0.7	46.3	4.7	1.4	33.7

Table 3.4 PAH, dioxin and HCB emission from the energy sector, 2008.

	benzo(a)-pyrene	benzo(b)-fluoranthene	benzo(k)-fluoranthene	Indeno-(1,2,3-c,d)-pyrene	Dioxin	HCB
	Mg	Mg	Mg	Mg	g I-Teq	kg
1A1 Energy Industries	0.008	0.03	0.02	0.01	1.2	0.4
1A2 Manufacturing industries and Construction	0.02	0.1	0.02	0.01	0.1	0.03
1A3 Transport	0.1	0.1	0.08	0.07	0.2	NE
1A4 Other Sectors	4.1	4.3	2.4	2.9	16.7	0.1
1A5 Other	0.0003	0.0006	0.0005	0.0003	0.001	NE
1B1 Fugitive Emissions from fuels, Solid Fuels	NA	NA	NA	NA	NA	NA
1B2 Fugitive Emissions from fuels, Oil and Natural gas	0.000003	0.000003	0.000003	0.000003	0.0001	NE
Energy, Total	4.22	4.46	2.47	2.96	18.23	0.53

3.2 Stationary combustion (NFR sector 1A1, 1A2 and 1A4)

This chapter includes stationary combustion plants in the NFR sectors 1A1, 1A2 and 1A4.

3.2.1 Source category description

Emission source categories and fuel consumption data are presented in this chapter.

Emission source categories

In the Danish emission database, all activity rates and emissions are defined in SNAP sector categories (Selected Nomenclature for Air Pollution) according to the CORINAIR system. The emission inventories are prepared from a complete emission database based on the SNAP sectors. Aggregation to the NFR sector codes is based on a correspondence list between SNAP and NFR enclosed in Annex 2A-1. Stationary combustion is defined as combustion activities in the SNAP sectors 01-03.

Stationary combustion plants are included in the emission source subcategories:

- 1A1 Energy, Fuel consumption, Energy Industries.
- 1A2 Energy, Fuel consumption, Manufacturing Industries and Construction.
- 1A4 Energy, Fuel consumption, Other Sectors.

The emission and fuel consumption data included in tables and figures in Chapter 3.2 only include emissions originating from stationary combustion plants of a given NFR sector. The NFR sector codes have been applied unchanged, but some sector names have been changed to reflect the stationary combustion element of the source.

Fuel consumption data

In 2009, the total fuel consumption for stationary combustion plants was 521 PJ of which 411 PJ was fossil fuels and 110 PJ was biomass.

Fuel consumption distributed according to the stationary combustion subcategories is shown in Figure 3.1 and Figure 3.2. The majority - 61 % - of all fuels is combusted in the source category, *Electricity and heat production.* Other source categories with high fuel consumption are *Residential* and *Industry*.

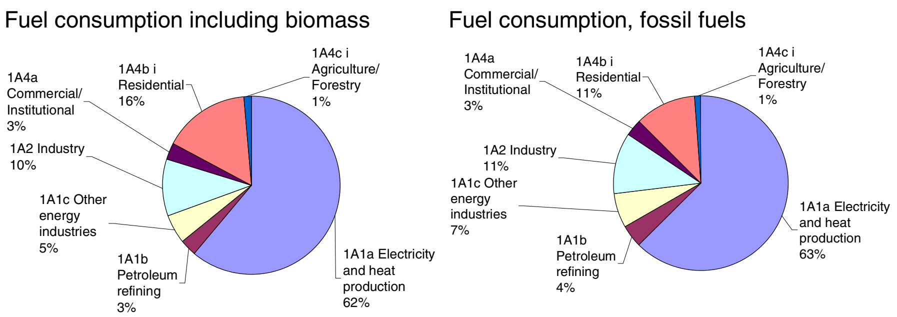
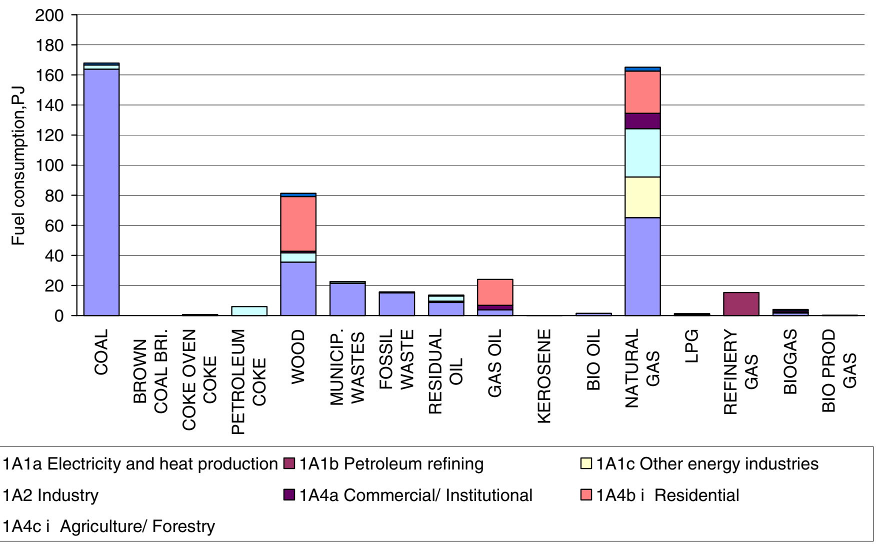


Figure 3.1 Fuel consumption of stationary combustion source categories, 2009 (based on DEA (2010a)).

Coal and natural gas are the most utilised fuels for stationary combustion plants. Coal is mainly used in power plants and natural gas is used in power plants and decentralised combined heating and power (CHP) plants, as well as in industry, district heating, residential plants and offshore gas turbines (see Figure 3.2).

Detailed fuel consumption rates are shown in Annex 2A-2.



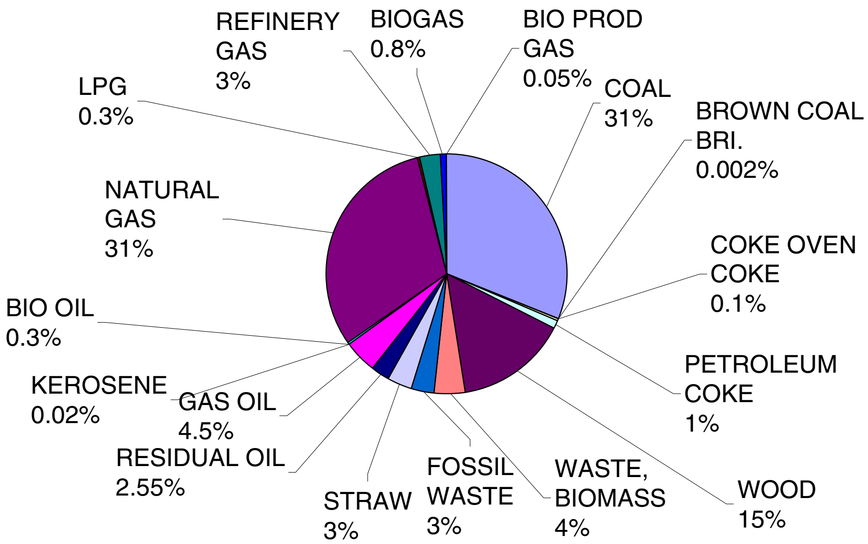


Figure 3.2 Fuel consumption of stationary combustion 2009, disaggregated to fuel type (based on DEA, 2010a).

Fuel consumption time-series for stationary combustion plants are presented in Figure 3.3[1]. The fuel consumption for stationary combustion was 5 % higher in 2009 than in 1990, while the fossil fuel consumption was 10 % lower and the biomass fuel consumption 158 % higher than in 1990.

The consumption of natural gas and biomass has increased since 1990 whereas coal consumption has decreased.

[1] Time-series 1980 onwards are included in Annex 2A-10.

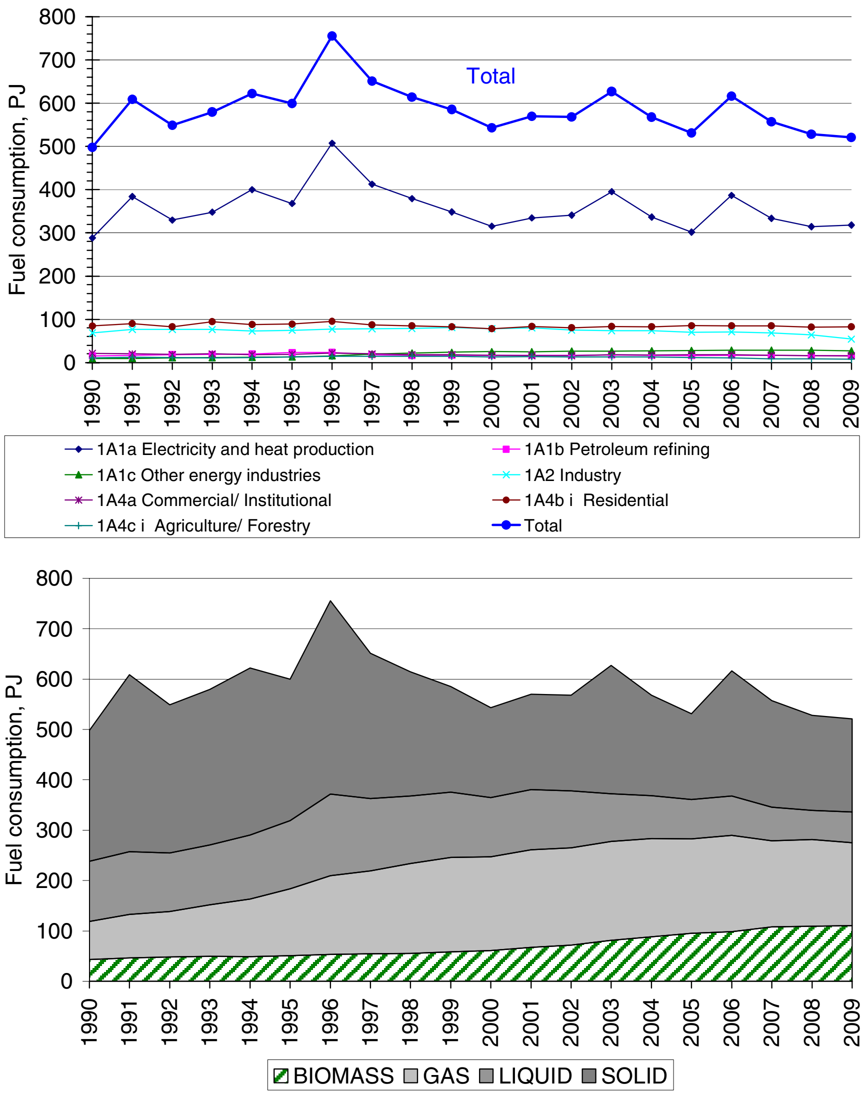


Figure 3.3 Fuel consumption time-series, stationary combustion (based on DEA, 2010a).

The fluctuations in the time-series for fuel consumption are mainly a result of electricity import/export, but also of outdoor temperature variations from year to year. This, in turn, leads to fluctuations in emission levels. The fluctuations in electricity trade, fuel consumption and NO_x emission are illustrated and compared in Figure 3.4. In 1990, the Danish electricity import was large causing relatively low fuel consumption, whereas the fuel consumption was high in 1996 due to a large electricity export. In 2009, the net electricity import was 1.2 PJ, whereas there was a 5.2 PJ electricity import in 2008. The large electricity export that occurs some years is a result of low rainfall in Norway and Sweden causing insufficient hydropower production in both countries.

To be able to follow the national energy consumption as well as for statistical and reporting purposes, the Danish Energy Agency produces a correction of the actual fuel consumption without random variations in electricity imports/exports and in ambient temperature. This fuel consumption trend is also illustrated in Figure 3.4. The corrections are included here to explain the fluctuations in the time-series for fuel rate and emission.

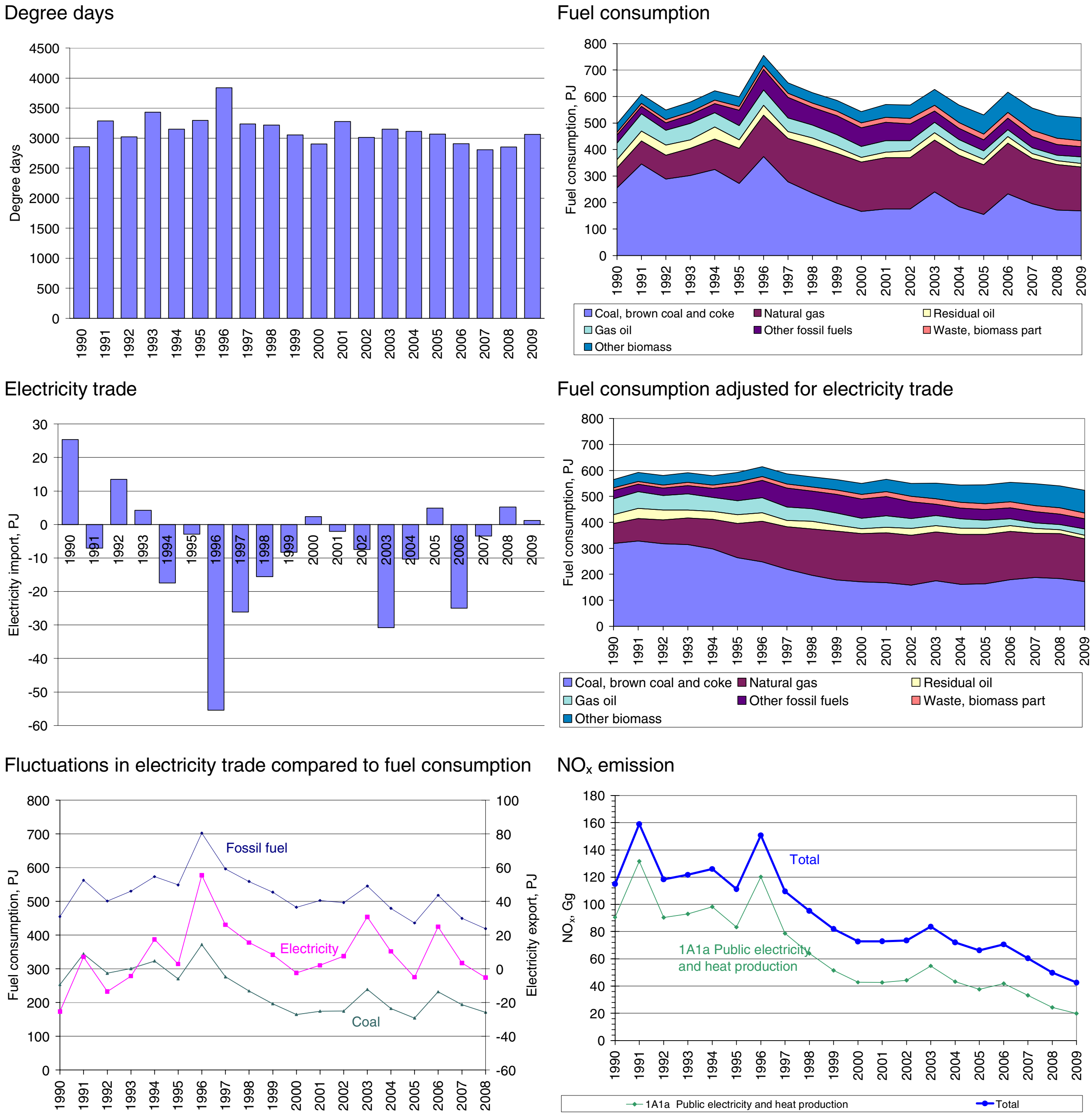


Figure 3.4 Comparison of time-series fluctuations for electricity trade, fuel consumption and NO_x emission (based on DEA 20010b).

Fuel consumption time-series for the subcategories to stationary combustion are shown in Figure 3.5 – 3.7.

Fuel consumption for *Energy Industries* fluctuates due to electricity trade as discussed above. The fuel consumption in 2009 was 16 % higher than in 1990. The fluctuation in electricity production is based on fossil fuel consumption in the subcategory *Electricity and Heat Production*. The energy consumption in *Other energy industries* is mainly natural gas used in gas turbines in the off-shore industry. The biomass fuel consumption in *Energy Industries* 2009 added up to 61 PJ, which is 3.5 times the level in 1990.

The fuel consumption in *Industry* was 21 % lower in 2009 than in 1990 (Figure 3.6). The fuel consumption in industrial plants has decreased considerably as a result of the financial crisis. The biomass fuel consumption in *Industry* in 2009 added up to 8 PJ which is a 10 % increase since 1990.

The fuel consumption in *Other Sectors* decreased 10 % since 1990 (Figure 3.7). The biomass part of the fuel consumption has increased from 16 % in 1990 to 39 % in 2009. Wood consumption in residential plants in 2009 was 2.3 times the consumption in year 2000.

Time-series for subcategories are shown in Chapter 3.2.3.

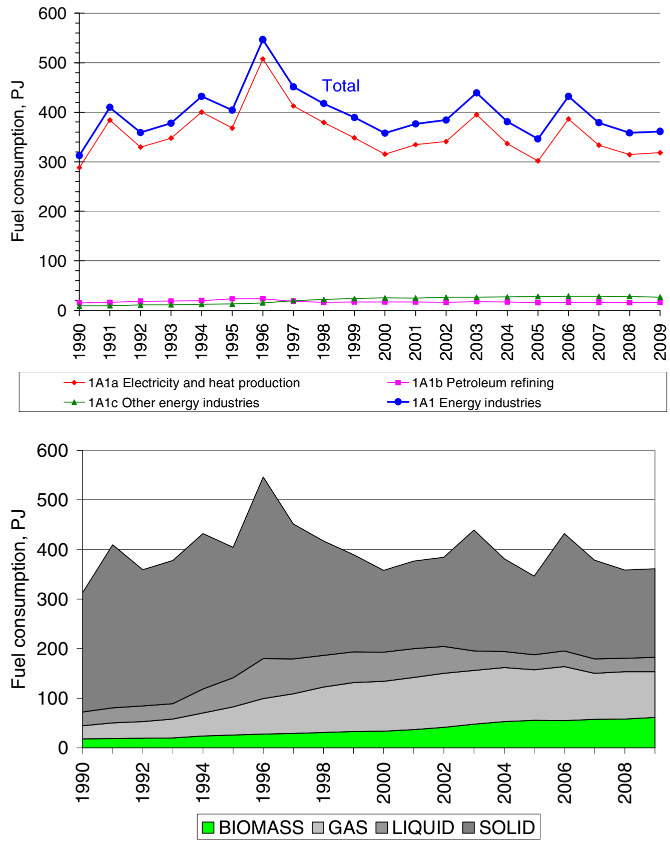


Figure 3.5 Fuel consumption time-series for subcategories - 1A1 Energy Industries.

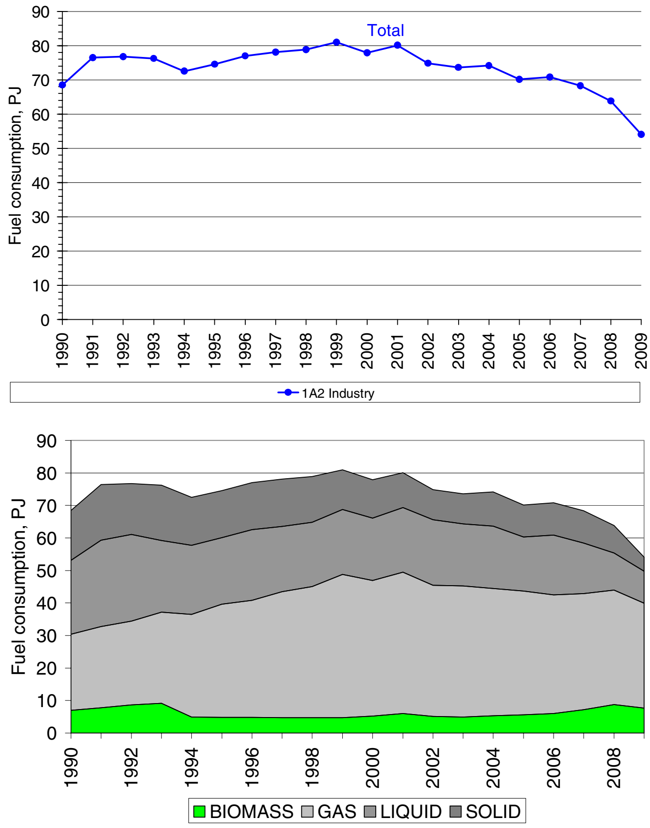


Figure 3.6 Fuel consumption time-series for subcategories - 1A2 Industry.

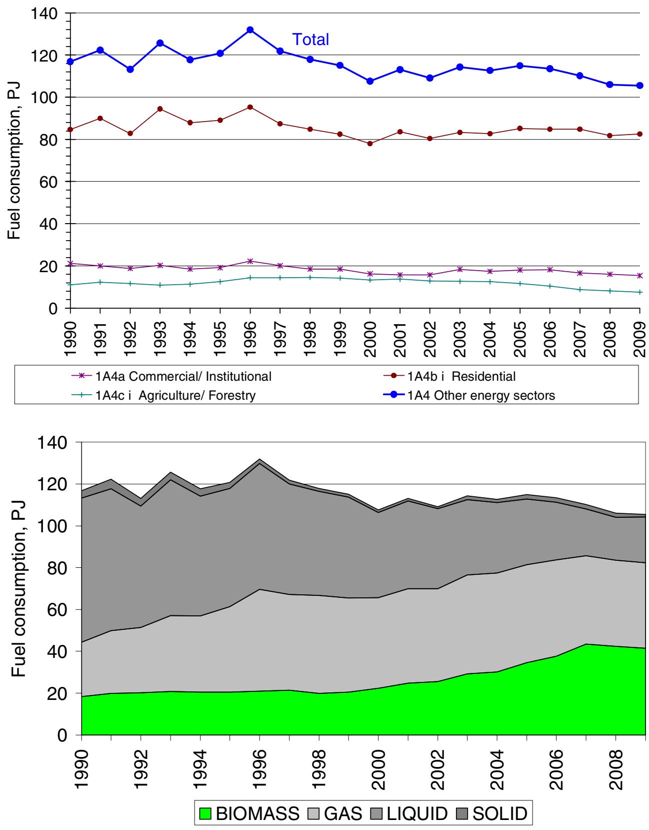


Figure 3.7 Fuel consumption time-series for subcategories - 1A4 Other Sectors.

3.2.2 Emissions

SO_2

Stationary combustion is the most important emission source for SO_2 accounting for 73 % of the national emission. Table 3.5 presents the SO_2 emission inventory for the stationary combustion subcategories.

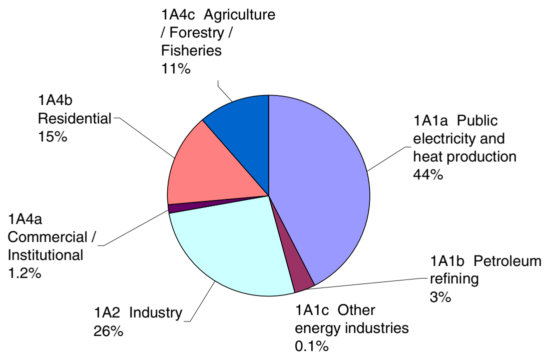
Electricity and heat production is the largest emission source accounting for 43 % of the emission. However, the SO_2 emission share is lower than the fuel consumption share for this source category, which is 61 %. This is a result of effective flue gas desulphurisation equipment installed in power plants combusting coal. In the Danish inventory, the source category *Electricity and heat production* is further disaggregated. Figure 3.8 shows the SO_2 emission from *Electricity and heat production* on a disaggregated level. Power plants >300MW$_{th}$ are the main emission source, accounting for 52 % of the emission.

The SO_2 emission from industrial plants is 26 %, a remarkably high emission share compared with fuel consumption. The main emission sources in the industrial category are combustion of coal and residual oil, but emissions from the cement industry is also a considerable emission source. Ten years ago SO_2 emission from the industrial category only accounted for a small part of the emission from stationary combustion, but as a result of reduced emissions from power plants the share has now increased.

Time-series for SO_2 emission from stationary combustion are shown in Figure 3.9. The SO_2 emission from stationary combustion plants has decreased by 93 % since 1990. The large emission decrease is mainly a result of the reduced emission from *Electricity and heat production*, made possible due to installation of desulphurisation plants and due to the use of fuels with lower sulphur content. Despite the considerable reduction in emission from electricity and heat production plants, these still account for 43 % of the emission from stationary combustion, as mentioned above. The emission from other source categories also decreased considerably since 1990. Time-series for subcategories are shown in Chapter 3.2.3.

Table 3.5 SO_2 emission from stationary combustion plants, 2009[1].

		SO_2 Mg
1A1a	Public electricity and heat production	4589
1A1b	Petroleum refining	341
1A1c	Other energy industries	8
1A2	Industry	2847
1A4a	Commercial/Institutional	130
1A4b	Residential	1636
1A4c	Agriculture/Forestry/Fisheries	1219
Total		10771



[1] Only emission from stationary combustion plants in the source categories is included.

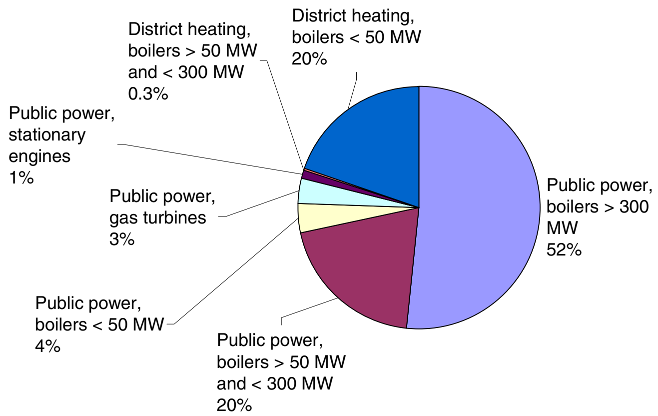


Figure 3.8 Disaggregated SO_2 emissions from 1A1a Energy and heat production.

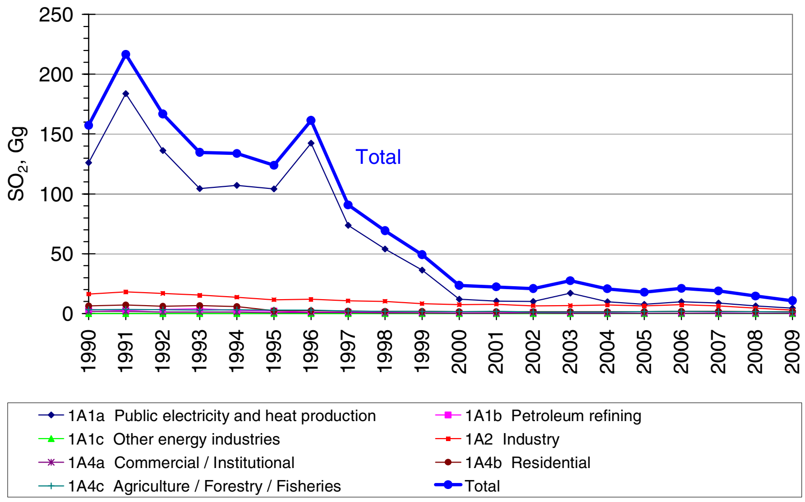


Figure 3.9 SO_2 emission time-series for stationary combustion.

NO_x

Stationary combustion accounts for 32 % of the national NO_x emission. Table 3.6 shows the NO_x emission inventory for stationary combustion subcategories.

Electricity and heat production is the largest emission source accounting for 47 % of the emission from stationary combustion plants. The emission from public power boilers > 300 MW_{th} accounts for 39 % of the emission in this subcategory.

Industrial combustion plants are also an important emission source accounting for 16 % of the emission. The main industrial emission source is cement production, which accounts for 57 % of the emission.

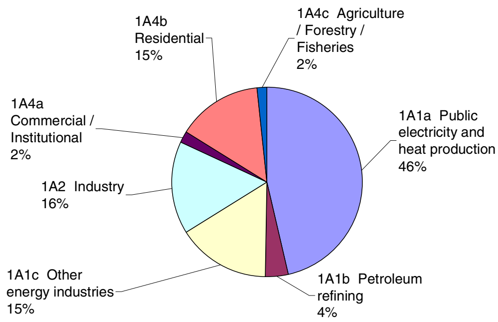
Residential plants account for 15 % of the NO_x emission. The fuel origin of this emission is mainly wood accounting for 65 % of the residential plant emission.

Other energy industries which is mainly off-shore gas turbines accounts for 16 % of the NO_x emission.

Time-series for NO_x emission from stationary combustion are shown in Figure 3.10. NO_x emission from stationary combustion plants has decreased by 63 % since 1990. The reduced emission is largely a result of the reduced emission from electricity and heat production due to installation of low NO_x burners, selective catalytic reduction (SCR) units and selective non-catalytic reduction (SNCR) units. The fluctuations in the time-series follow the fluctuations in electricity and heat production, which, in turn, result from electricity trade fluctuations.

Table 3.6 NO_x emission from stationary combustion plants, 2009[1)].

	NO_x Mg
1A1a Public electricity and heat production	19796
1A1b Petroleum refining	1610
1A1c Other energy industries	6686
1A2 Industry	6764
1A4a Commercial/Institutional	812
1A4b Residential	6192
1A4c Agriculture/Forestry/Fisheries	702
Total	42563



[1)] Only emission from stationary combustion plants in the source categories is included.

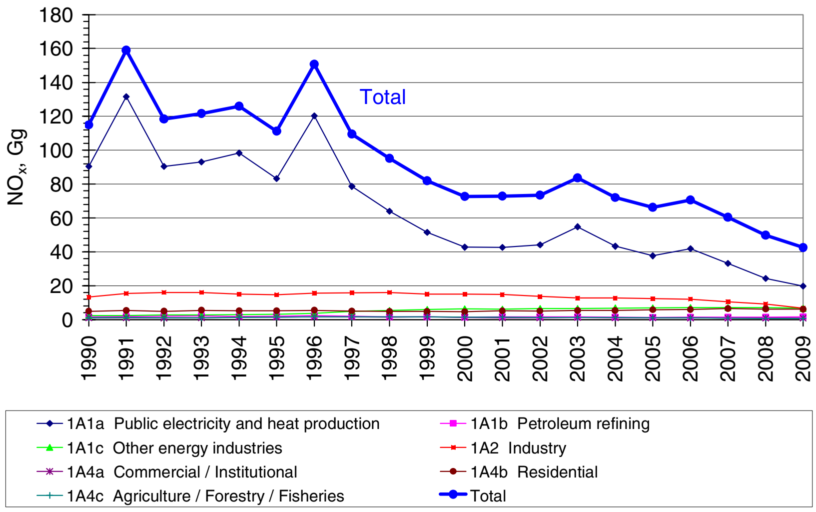


Figure 3.10 NO_x emission time-series for stationary combustion.

NMVOC

Stationary combustion plants account for 20 % of the national NMVOC emission. Table 3.7 presents the NMVOC emission inventory for the stationary combustion subcategories.

Residential plants are the largest emission source accounting for 84 % of the emission from stationary combustion plants. For residential plants NMVOC is mainly emitted from wood and straw combustion, see Figure 3.11.

Electricity and heat production is also a considerable emission source, accounting for 10 % of the emission. Lean-burn gas engines have a relatively high NMVOC emission factor and are the most important emission source in this subcategory (see Figure 3.11). The gas engines are either natural gas or biogas fuelled.

Time-series for NMVOC emission from stationary combustion are shown in Figure 3.12. The emission has increased by 31 % from 1990. The increased emission is mainly a result of the increasing wood consumption in residential plants and of the increased use of lean-burn gas engines in CHP plants.

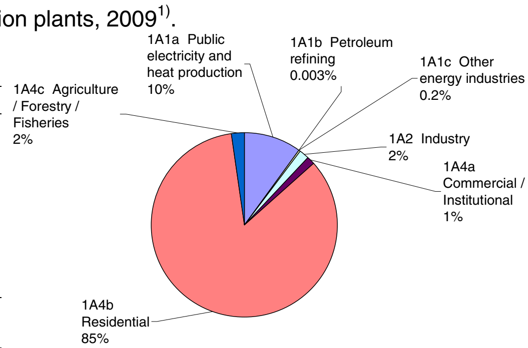
The emission from residential plants increased 34 % since 1990. The NMVOC emission from wood combustion in 2009 was 2.5 times the 1990 level due to increased wood consumption. However, the emission factor has decreased since 1990 due to installation of modern stoves and boilers with improved combustion technology. Further the emission from straw combustion in farmhouse boilers has decreased (75 %) over this period due to both a decreasing emission factor and decrease in straw consumption in this source category.

The use of wood in residential boilers and stoves was relatively low in 1998-99 resulting in a lower emission level.

The decrease of the NMVOC emission since 2007 is a result of both a decline of the consumption of wood in residential plants and a decreasing emission factor for firewood combustion in residential plants.

Table 3.7 NMVOC emission from stationary combustion plants, 2009[1].

		NMVOC Mg
1A1a	Public electricity and heat production	1938
1A1b	Petroleum refining	1
1A1c	Other energy industries	38
1A2	Industry	295
1A4a	Commercial/Institutional	275
1A4b	Residential	16245
1A4c	Agriculture/Forestry/Fisheries	444
Total		19236



[1] Only emission from stationary combustion plants in the categories is included.

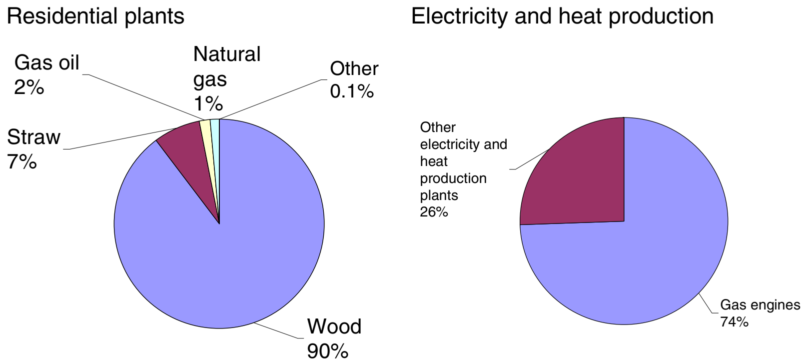


Figure 3.11 NMVOC emission from Residential plants and from Electricity and heat production, 2009.

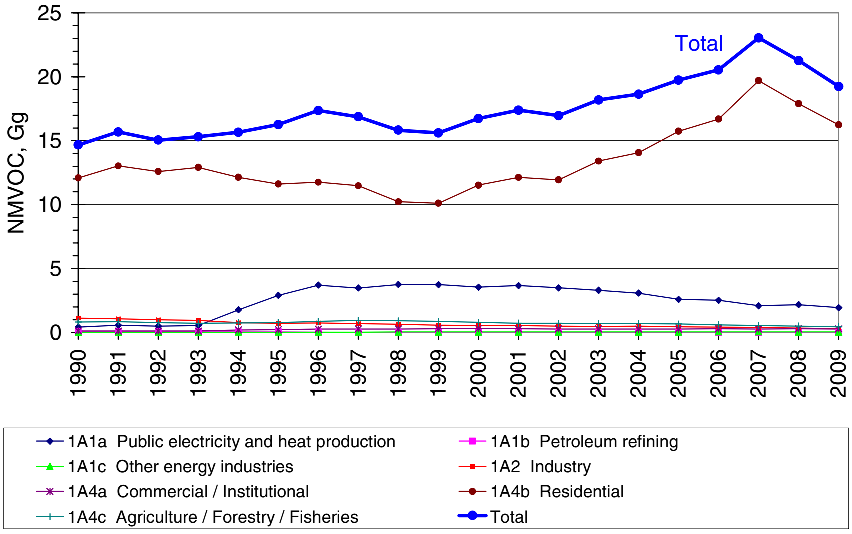


Figure 3.12 NMVOC emission time-series for stationary combustion.

CO

Stationary combustion accounts for 37 % of the national CO emission. Table 3.8 presents the CO emission inventory for stationary combustion subcategories.

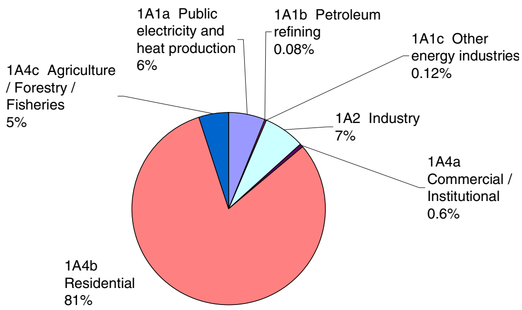
Residential plants are the largest emission source, accounting for 81 % of the emission. Wood combustion accounts for 89 % of the emission from residential plants, see Figure 3.13. This is in spite of the fact that the fuel consumption share is only 40 %. Combustion of straw is also a considerable emission source whereas the emission from other fuels used in residential plants is almost negligible.

Time-series for CO emission from stationary combustion are shown in Figure 3.14. The emission has increased by 3 % from 1990. The time-series for CO from stationary combustion plants follows the time-series for CO emission from residential plants. The decreased wood consumption in residential plants since 2007 has resulted in a decrease of CO emission from stationary combustion since 2007.

The consumption of wood in residential plants in 2009 was 3.7 times the 1990 level. However, the CO emission factor for wood has decreased since 1990 causing the CO emission from wood combustion in residential plants in 2009 to be only 2.8 times the 1990 level. Both straw consumption and CO emission factor for residential plants have decreased since 1990.

Table 3.8 CO emission from stationary combustion plants, 2009[1)].

	CO Mg
1A1a Public electricity and heat production	9079
1A1b Petroleum refining	118
1A1c Other energy industries	176
1A2 Industry	10330
1A4a Commercial/Institutional	865
1A4b Residential	118706
1A4c Agriculture/Forestry/Fisheries	7441
Total	146714



[1)] Only emission from stationary combustion plants in the source categories is included.

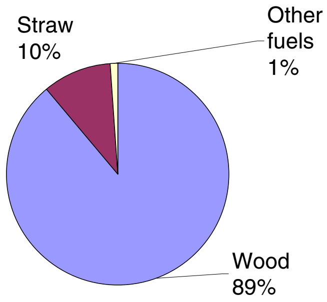


Figure 3.13 CO emission sources, residential plants, 2009.

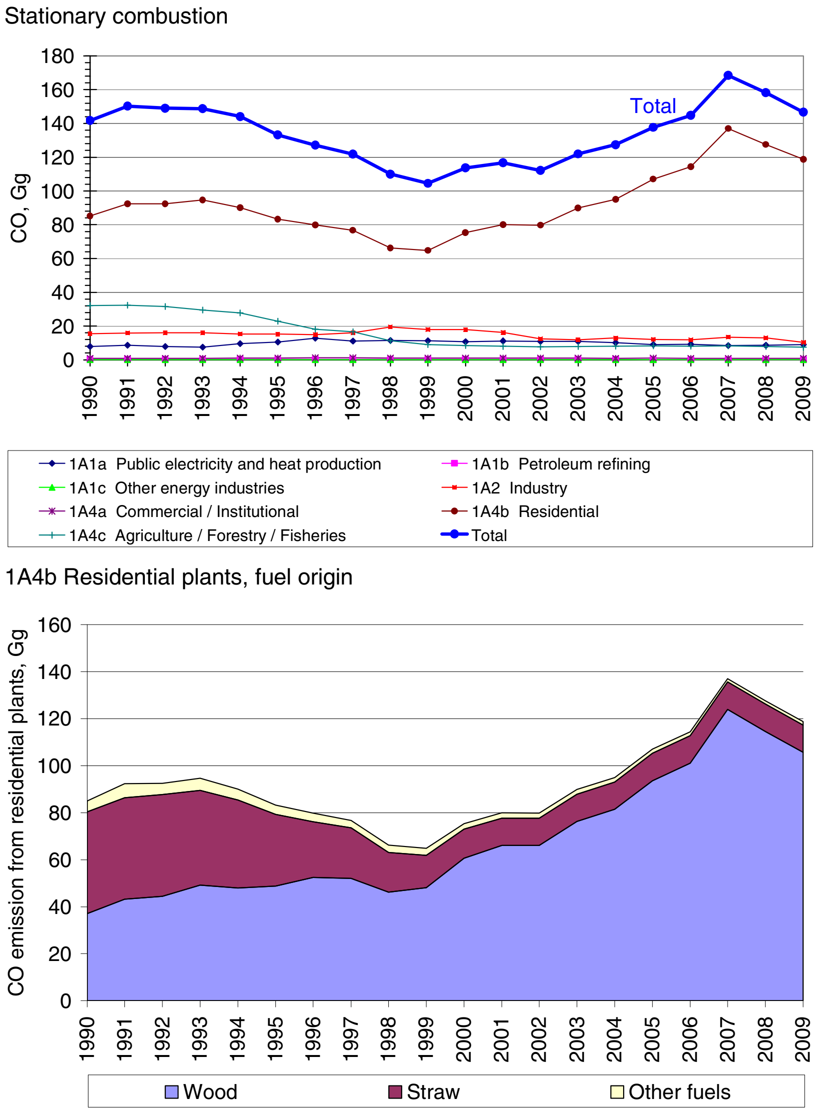


Figure 3.14 CO emission time-series for stationary combustion.

Particulate matter (PM)

TSP from stationary combustion accounts for 53 % of the national emission. The emission shares for PM_{10} and $PM_{2.5}$ are 63 % and 76 %, respectively.

Table 3.9 and Figure 3.15 show the PM emission inventory for the stationary combustion subcategories. Residential plants are the largest emission source accounting for 93 % of the $PM_{2.5}$ emission from stationary combustion plants.

The primary sources of PM emissions are:

- Residential boilers, stoves and fireplaces combusting wood
- Farmhouse boilers combusting straw
- Power plants primarily combusting coal
- Coal and residual oil combusted in industrial boilers and processes

The PM emission from wood combusted in residential plants is the predominant source. Thus 89 % of the $PM_{2.5}$ emission from stationary combustion is emitted from residential wood combustion. This corresponds to 68 % of the national emission. A literature review (Nielsen et al., 2003) and a Nordic Project (Sternhufvud et al., 2004) has demonstrated that the emission factor uncertainty for residential combustion of wood in stoves and boilers is notably high.

Figure 3.16 shows the fuel consumption and the $PM_{2.5}$ emission of residential plants. Wood combustion accounts for 96 % of the $PM_{2.5}$ emission from residential plants in spite of a wood consumption share of 40 %.

Emission inventories for PM have only been reported for the years 2000-2009. Time-series for PM emission from stationary combustion are shown in Figure 3.17. The emission of TSP, PM_{10} and $PM_{2.5}$ has increased 38 %, 40 % and 43 %, respectively, since year 2000. The increase is caused by the increased wood combustion in residential plants. However, the PM emission factors have decreased for this emission source category due to installation of modern stoves and boilers. The decreased wood consumption in residential plants since 2007 has resulted in a decrease of PM emission from stationary combustion since 2007.

The time-series for PM emission from stationary combustion plants follows the time-series for PM emission from residential plants.

Table 3.9 PM emission from stationary combustion plants, 2009[1].

		TSP, Mg	PM_{10}, Mg	$PM_{2.5}$, Mg
1A1a	Public electricity and heat production	903	608	496
1A1b	Petroleum refining	113	106	103
1A1c	Other energy industries	3	2	1
1A2	Industry	498	359	233
1A4a	Commercial/Institutional	172	170	161
1A4b	Residential	18533	17629	17296
1A4c	Agriculture/Forestry/Fisheries	389	361	335
Total		20610	19234	18625

[1] Only emission from stationary combustion plants in the source categories is included.

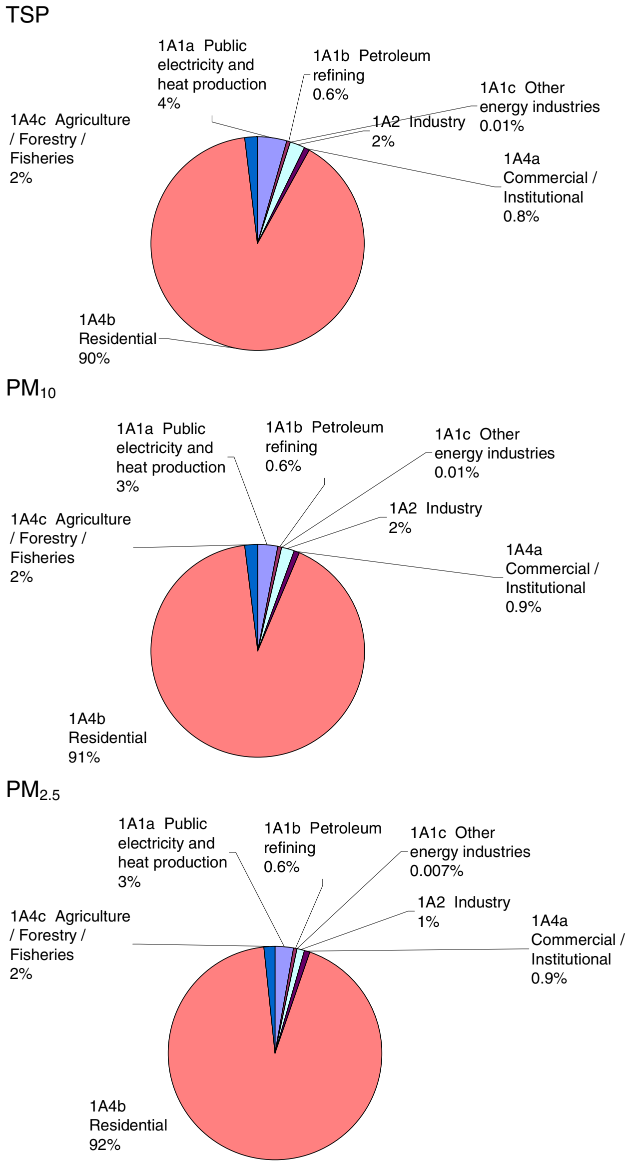


Figure 3.15 PM emission sources, stationary combustion plants, 2009.

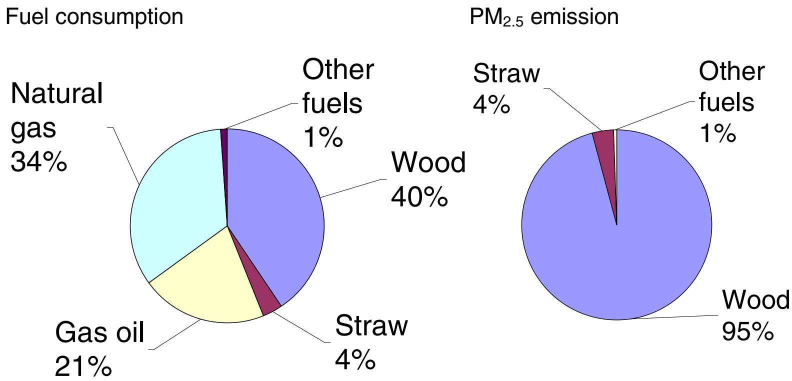


Figure 3.16 Fuel consumption and $PM_{2.5}$ emission from residential plants.

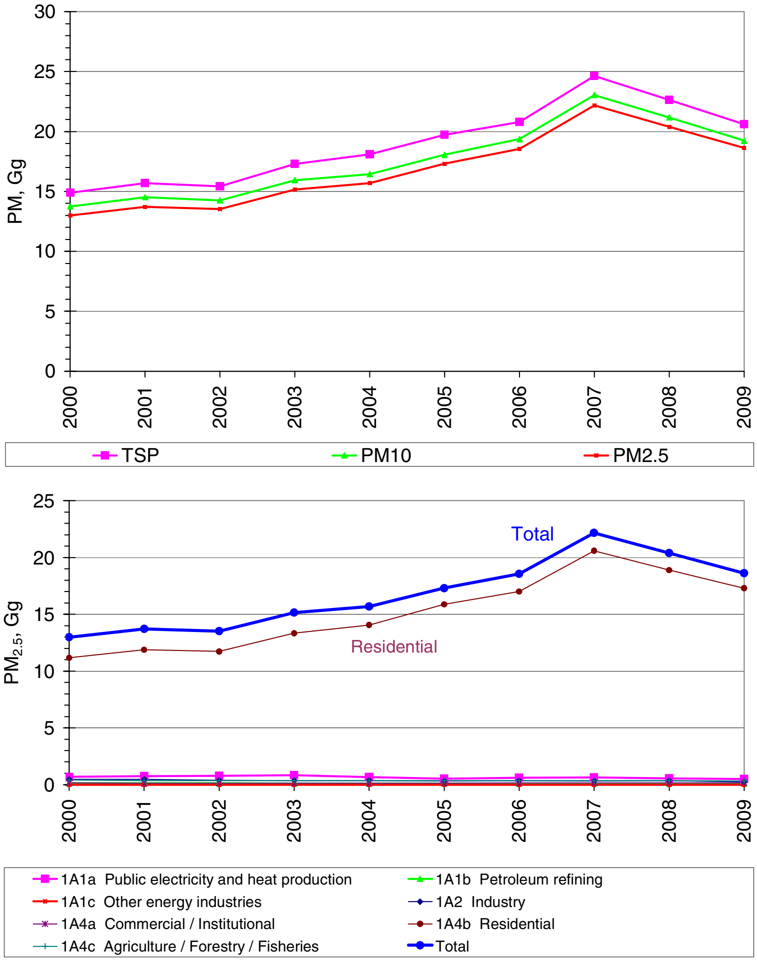


Figure 3.17 PM emission time-series for stationary combustion.

Heavy metals

Stationary combustion plants are among the most important emission sources for heavy metals. For Cu, Zn and Pb the emission share from stationary combustion plants is below 50 %, but for all other heavy metals, the emission share is more than 50 %.

Table 3.10 and Figure 3.18 present the heavy metal emission inventory for the stationary combustion subcategories. The source categories *Public electricity and heat production, Residential* and *Industry* have the highest emission shares. The emission share for MSW incineration plants, that was formerly a major emission source, is now below 10 % for all HMs. The emission share for MSW incineration plants has decreased considerably since year 2000.

Table 3.10 Heavy metal emission from stationary combustion plants, 2009[1)].

	As kg	Cd kg	Cr kg	Cu kg	Hg kg	Ni kg	Pb kg	Se kg	Zn kg
1A1a Public electricity and heat production	89	31	197	157	236	929	351	880	493
1A1b Petroleum refining	31	23	24	46	22	285	67	106	96
1A1c Other energy industries	3	0	0	0	3	0	0	0	0
1A2 Industry	80	27	110	94	126	1312	644	261	1077
1A4a Commercial/Institutional	3	0	4	4	3	15	4	1	14
1A4b Residential	23	38	79	295	20	85	1455	19	3734
1A4c Agriculture/Forestry/Fisheries	11	5	25	41	12	249	242	36	520
Total	239	124	438	636	421	2875	2762	1304	5934
Emission share from stationary combustion	80%	65%	58%	1%	82%	59%	26%	92%	16%

[1)] Only emission from stationary combustion plants in the source categories is included.

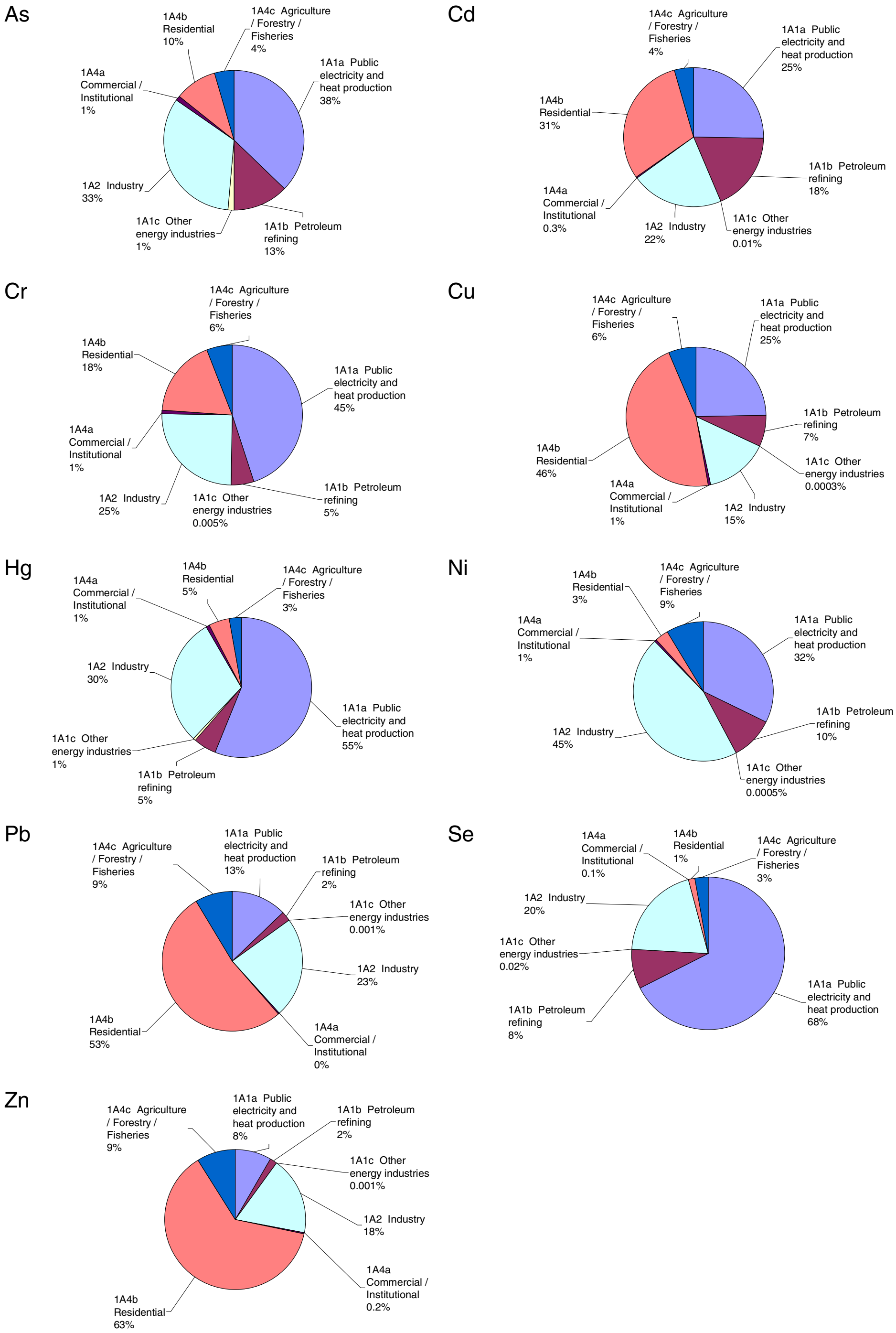


Figure 3.18 Heavy metal emission sources, stationary combustion plants, 2009.

Time-series for heavy metal emissions are provided in Figure 3.19. Emissions of all heavy metals have decreased considerably (73 % - 92 %) since 1990, see Table 3.11. Emissions have decreased despite increased incineration of municipal waste. This has been made possible due to installation and improved performance of gas cleaning devices in waste incineration plants and also in large power plants, the latter being a further important emission source.

Table 3.11 Decrease in heavy metal emission 1990-2009.

Pollutant	Decrease since 1990, %
As	80
Cd	86
Cr	92
Cu	83
Hg	85
Ni	82
Pb	84
Se	73
Zn	76

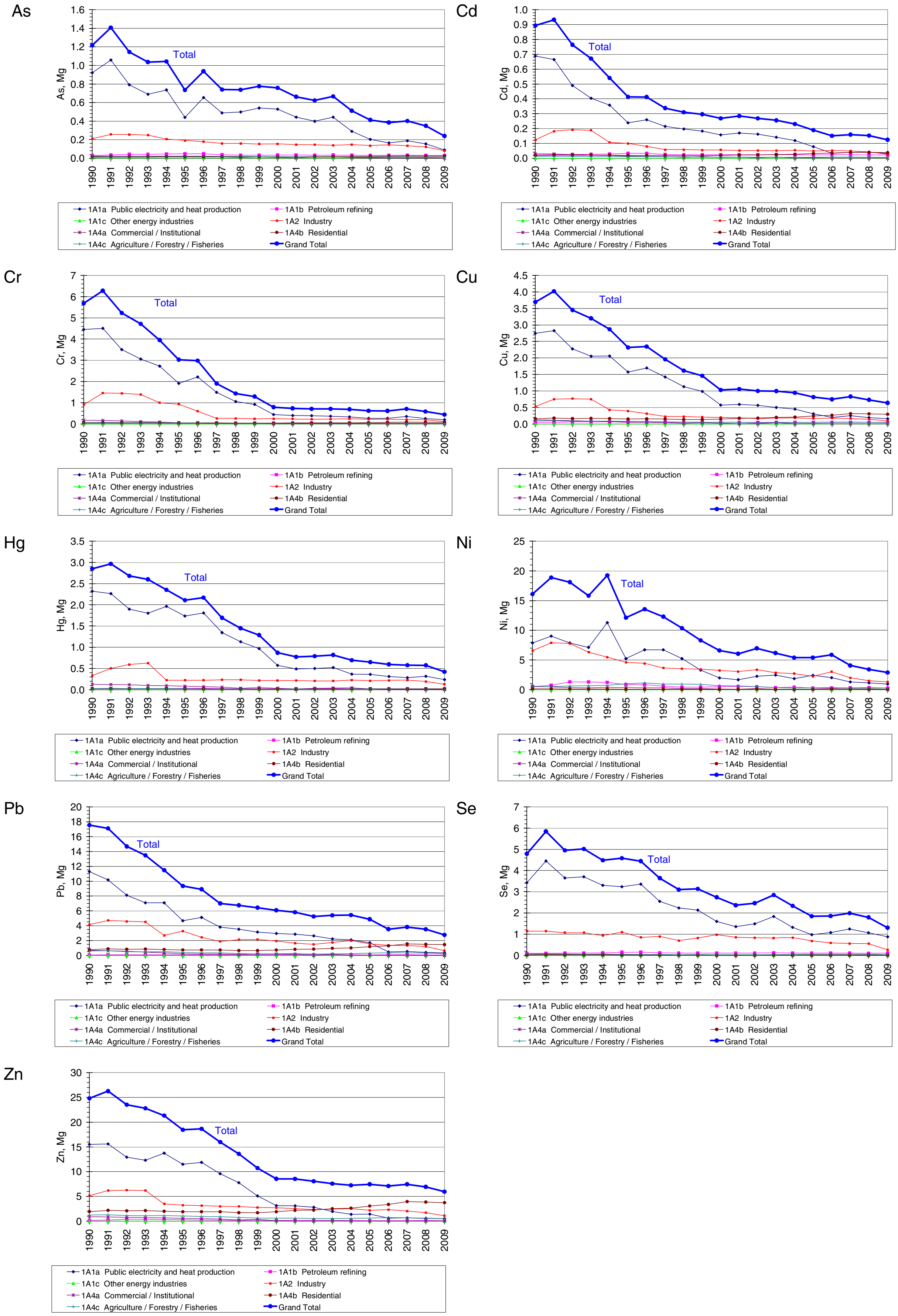


Figure 3.19 Heavy metal emission time-series, stationary combustion plants.

PAH

Stationary combustion plants accounted for more than 91 % of the PAH emission in 2009.

Table 3.12 and Figure 3.20 present the PAH emission inventories for the stationary combustion subcategories. Residential combustion is the largest emission source accounting for more than 89 % of the emission. Combustion of wood is the predominant source, accounting for more than 98 % of the PAH emission from residential plants, see Figure 3.21.

Time-series for PAH emissions are presented in Figure 3.22. The increasing (93 % - 135 %) emission trend for PAH is a result of the increased combustion of wood in residential plants. The time-series for wood combustion in residential plants is also provided in Figure 3.22. The decrease in residential wood combustion since 2007 is reflected in the PAH emission time-series.

Table 3.12 PAH emission from stationary combustion plants, 2009[1].

	Benzo(a)-Pyrene, kg	Benzo(b)-fluoranthene, kg	Benzo(k)-fluoranthene, kg	Indeno(1,2,3-c,d)pyrene, kg
1A1a Public electricity and heat production	8	33	18	7
1A1b Petroleum refining	0	0	0	0
1A1c Other energy industries	0	0	0	0
1A2 Industry	19	69	12	3
1A4a Commercial/Institutional	180	236	78	128
1A4b Residential	3833	3910	2242	2568
1A4c Agriculture/Forestry/Fisheries	110	119	18	172
Total	4151	4367	2369	2879
Emission share from stationary combustion, %	93	93	91	92

[1] Only emission from stationary combustion plants in the source categories is included.

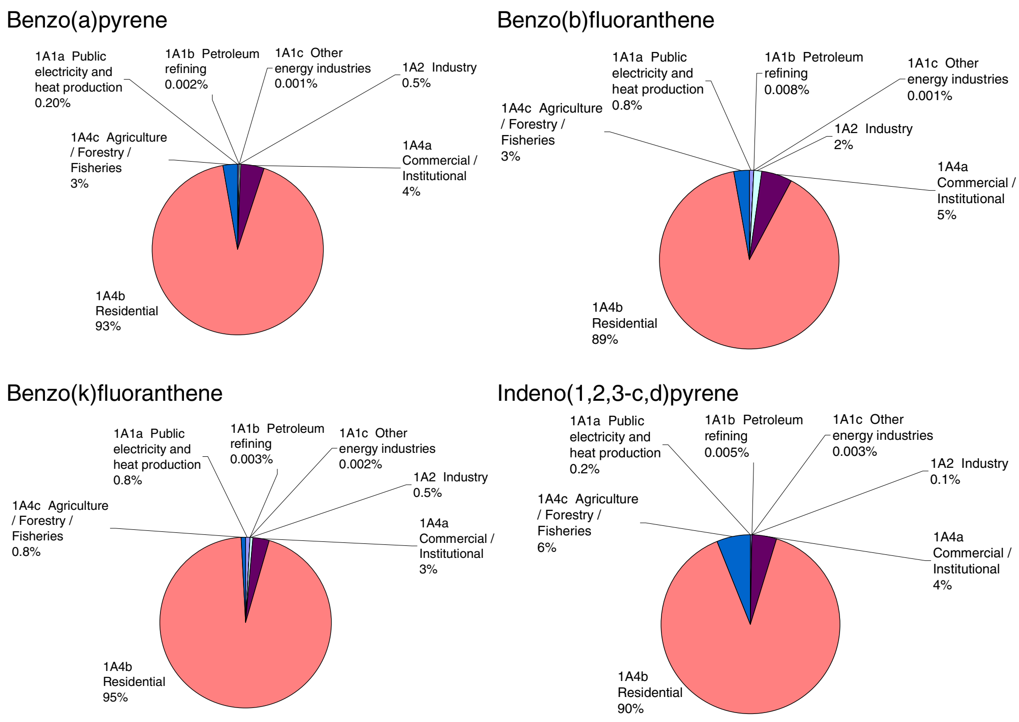


Figure 3.20 PAH emission sources, stationary combustion plants, 2009.

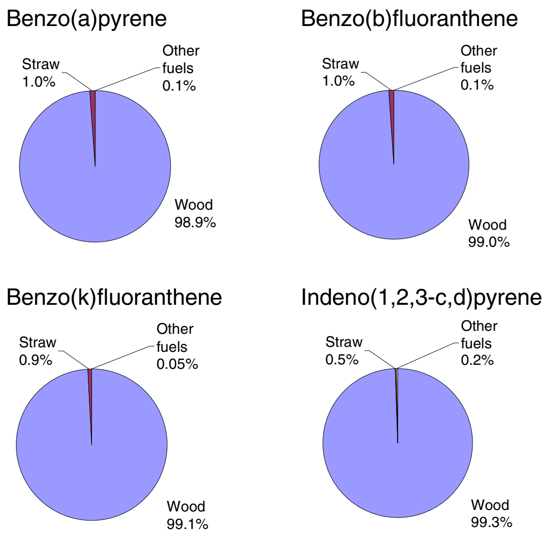


Figure 3.21 PAH emission from residential combustion plants (stationary), fuel origin.

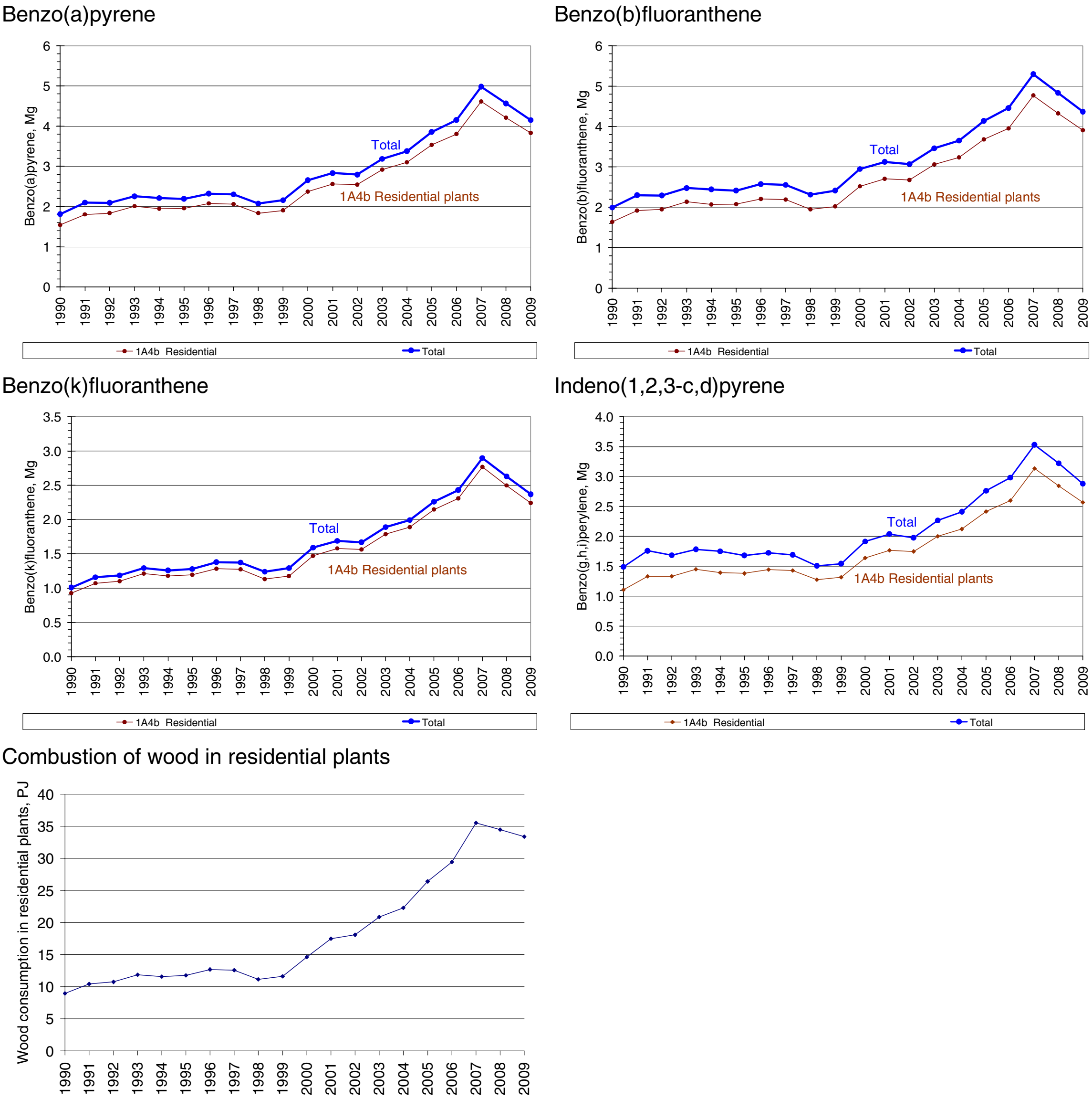


Figure 3.22 PAH emission time-series, stationary combustion plants. Comparison with wood consumption in residential plants.

Dioxin

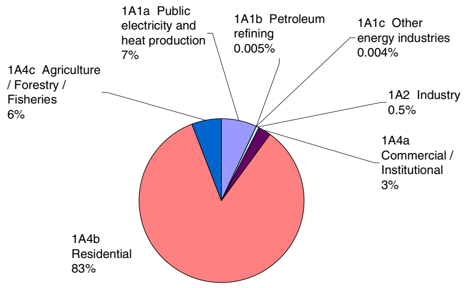
Stationary combustion plants accounted for 63 % of the national dioxin emission in 2009.

Table 3.13 presents the dioxin emission inventories for the stationary combustion subcategories. In 2009, the emission from residential plants accounts for 83 % of the emission. Combustion of wood is the predominant source accounting for 88 % of the emission from residential plants (Figure 3.23).

Time-series for dioxin emission are presented in Figure 3.24. The dioxin emission has decreased 62 % since 1990 mainly due to installation of dioxin filters in MSW incineration plants. The emission from residential plants has increased due to increased wood consumption in this source category.

Table 3.13 Dioxin emission from stationary combustion plants, 2009[1].

	Dioxin, g I-teq
1A1a Public electricity and heat production	1.2
1A1b Petroleum refining	0.0
1A1c Other energy industries	0.0
1A2 Industry	0.1
1A4a Commercial/Institutional	0.5
1A4b Residential	15.1
1A4c Agriculture/Forestry/Fisheries	1.0
Total	17.9



[1] Only emission from stationary combustion plants in the source categories is included.

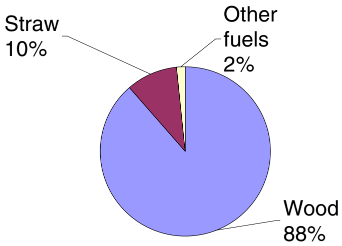


Figure 3.23 Dioxin emission from residential plants, fuel origin.

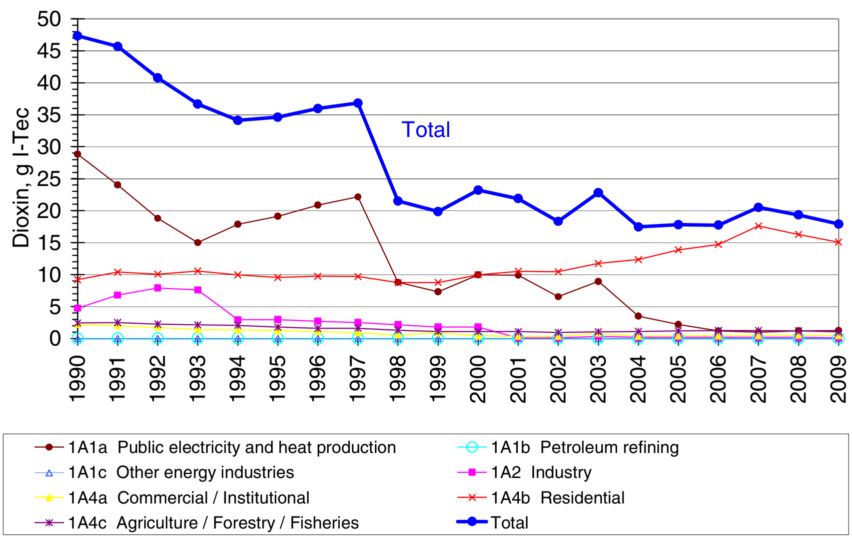


Figure 3.24 Dioxin emission time-series, stationary combustion plants.

HCB

The HCB emission has been estimated only for stationary combustion plants and for cremation. Stationary plants accounted for more than 98 % of the estimated national HCB emission in 2009.

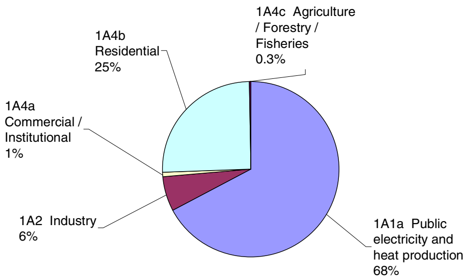
Table 3.14 shows the HCB emission inventory for the stationary combustion subcategories. *Public electricity and heat production* account for 67 % of the emission. Residential plants account for 25 % of the emission.

Time-series for HCB emission are presented in Figure 3.25. The HCB emission has decreased 83 % since 1990 mainly due to improved flue gas cleaning in MSW incineration plants. The emission from residential plants has increased due to increased wood consumption in this source category.

Part of the consumption of municipal waste for electricity and heat production has been included in source sector *Industry* in 1990-1993. This error causes incorrect time-series for these two sectors. However, the total emission of HCB is not affected by the error that will be corrected in the next inventory.

Table 3.14 HCB emission from stationary combustion plants, 2009[1)].

	HCB, kg
1A1a Public electricity and heat production	0.357
1A1b Petroleum refining	0.000
1A1c Other energy industries	0.034
1A2 Industry	0.005
1A4a Commercial/Institutional	0.134
1A4b Residential	0.002
1A4c Agriculture/Forestry/Fisheries	0.532
Total	0.357



[1)] Only the emission from stationary combustion plants in the source categories is included.

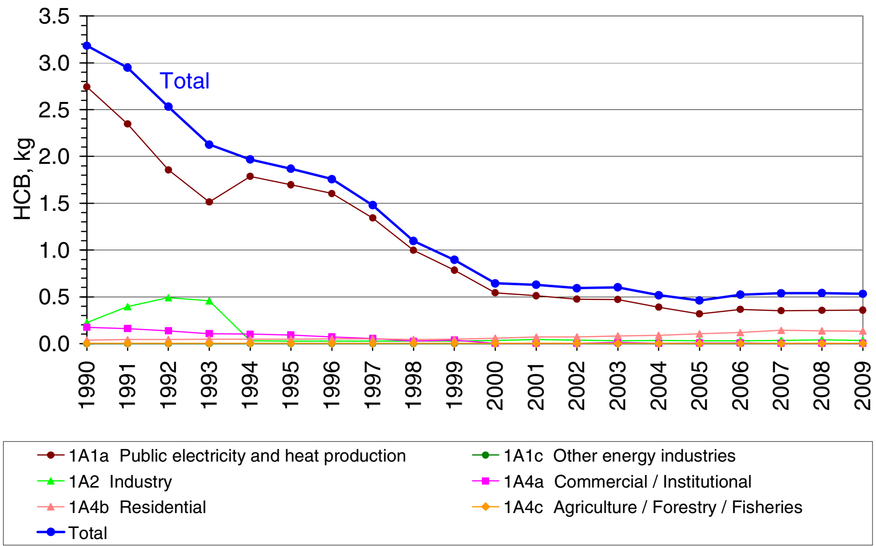


Figure 3.25 HCB emission time-series, stationary combustion plants.

NH_3

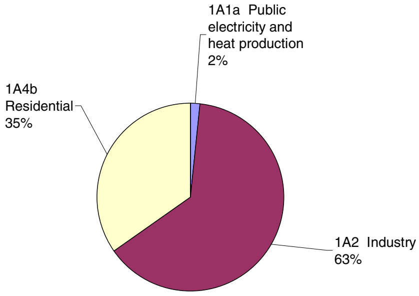
Stationary combustion plants accounted for only 0.7 % of the national NH_3 emission in 2009.

Table 3.15 shows the NH_3 emission inventory for the stationary combustion subcategories. *Industry* account for 63 % of the emission and the main industrial sources are industrial plants producing glass wool or mineral wool. Residential plants account for 35 % of the emission.

Time-series for the NH_3 emission are presented in Figure 3.26. The NH_3 emission was 8 % lower in 2009 than in 1990.

Table 3.15 NH_3 emission from stationary combustion plants, 2009[1)].

	NH_3, Mg
1A1a Public electricity and heat production	9
1A1b Petroleum refining	-
1A1c Other energy industries	-
1A2 Industry	324
1A4a Commercial/Institutional	-
1A4b Residential	178
1A4c Agriculture/Forestry/Fisheries	-
Total	511



1) Only the emission from stationary combustion plants in the source categories is included.

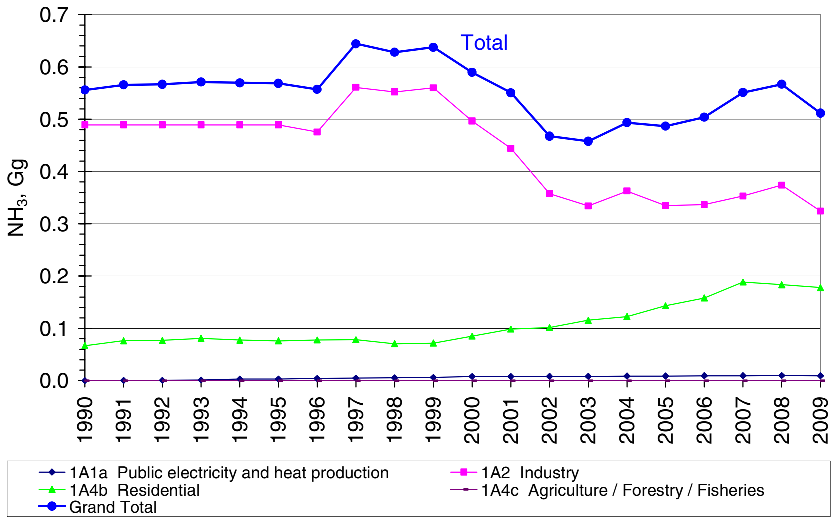


Figure 3.26 NH_3 emission time-series, stationary combustion plants.

3.2.3 Sectoral trend

In addition to the data for stationary combustion, this chapter presents and discusses data for each of the subcategories in which stationary combustion is included. Time-series are presented for fuel consumption and emissions.

1A1 Energy industries

The emission source category *1A1 Energy Industries* consists of the subcategories:

1. 1A1a Electricity and heat production.
2. 1A1b Petroleum refining.
3. 1A1c Other energy industries.

Figure 3.27 – 3.31 present time-series for the *Energy Industries*. *Electricity and heat production* is the largest subcategory accounting for the main part of all emissions. Time-series are discussed below for each subcategory.

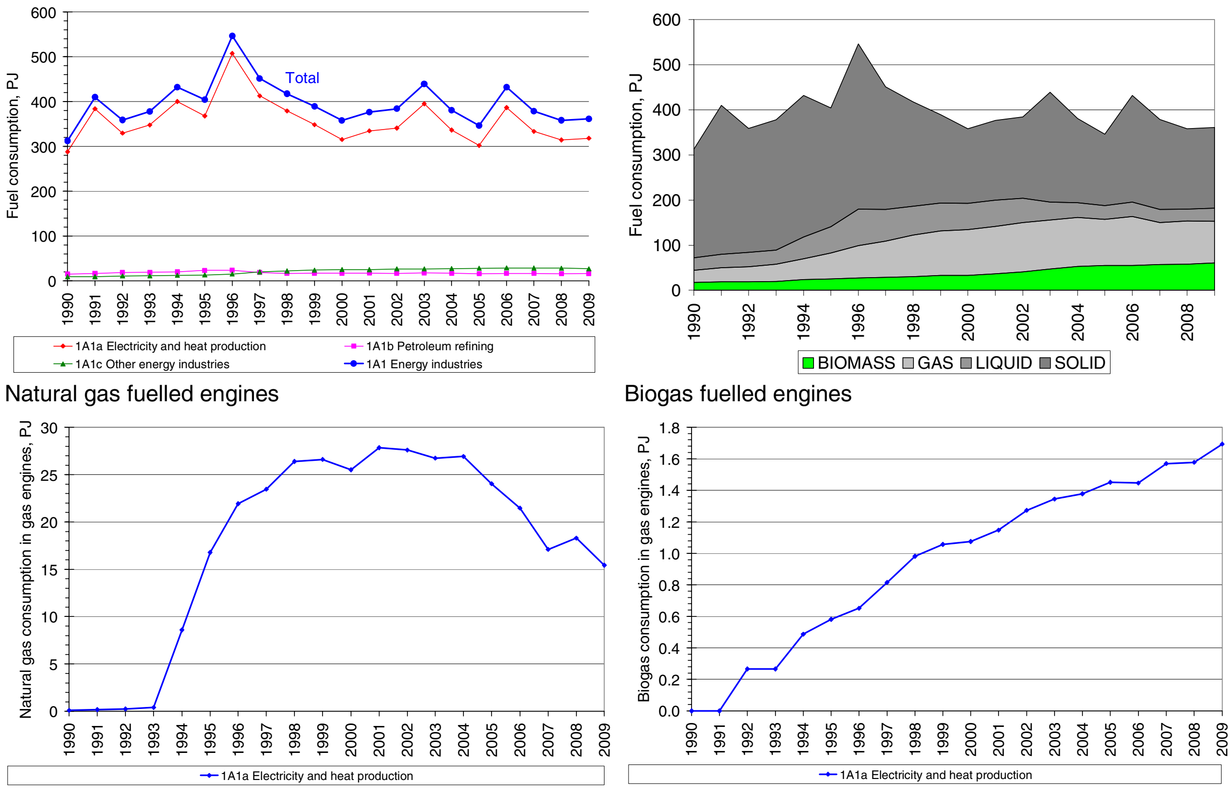


Figure 3.27 Time-series for fuel consumption, 1A1 Energy industries.

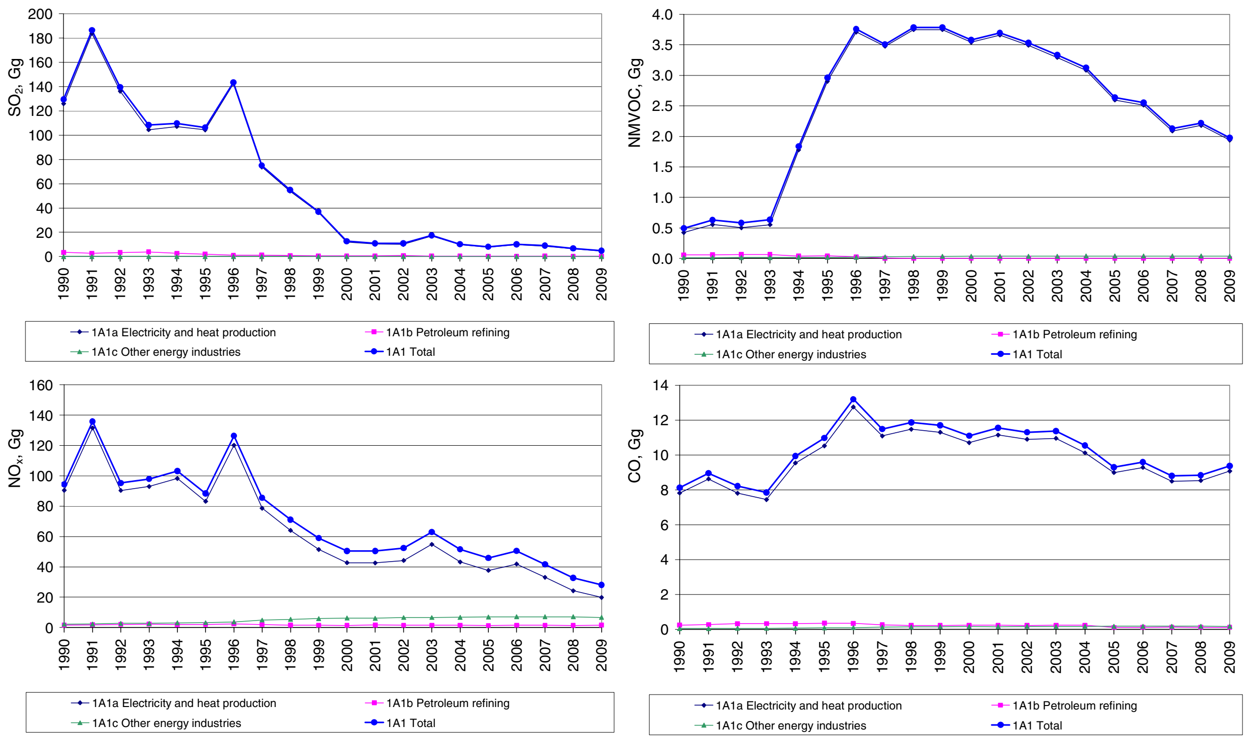


Figure 3.28 Time-series for SO_2, NO_x, NMVOC and CO emission, 1A1 Energy industries.

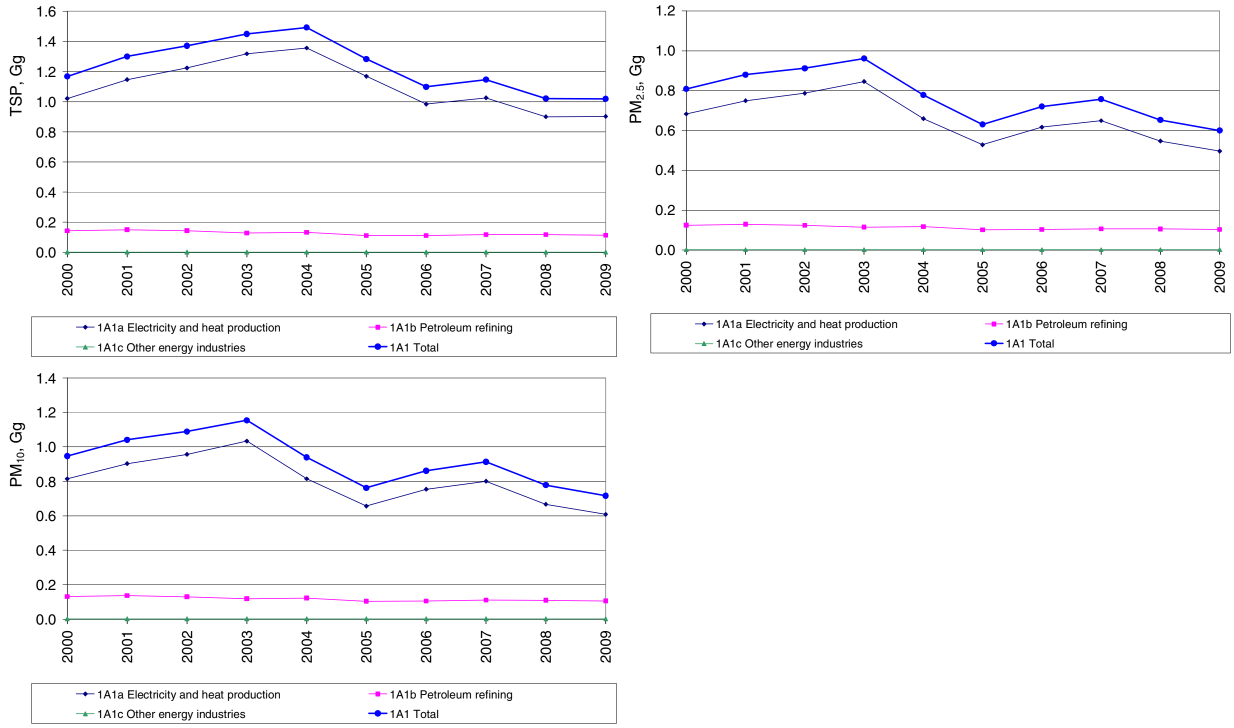


Figure 3.29   Time-series for PM emission, 1A1 Energy industries.

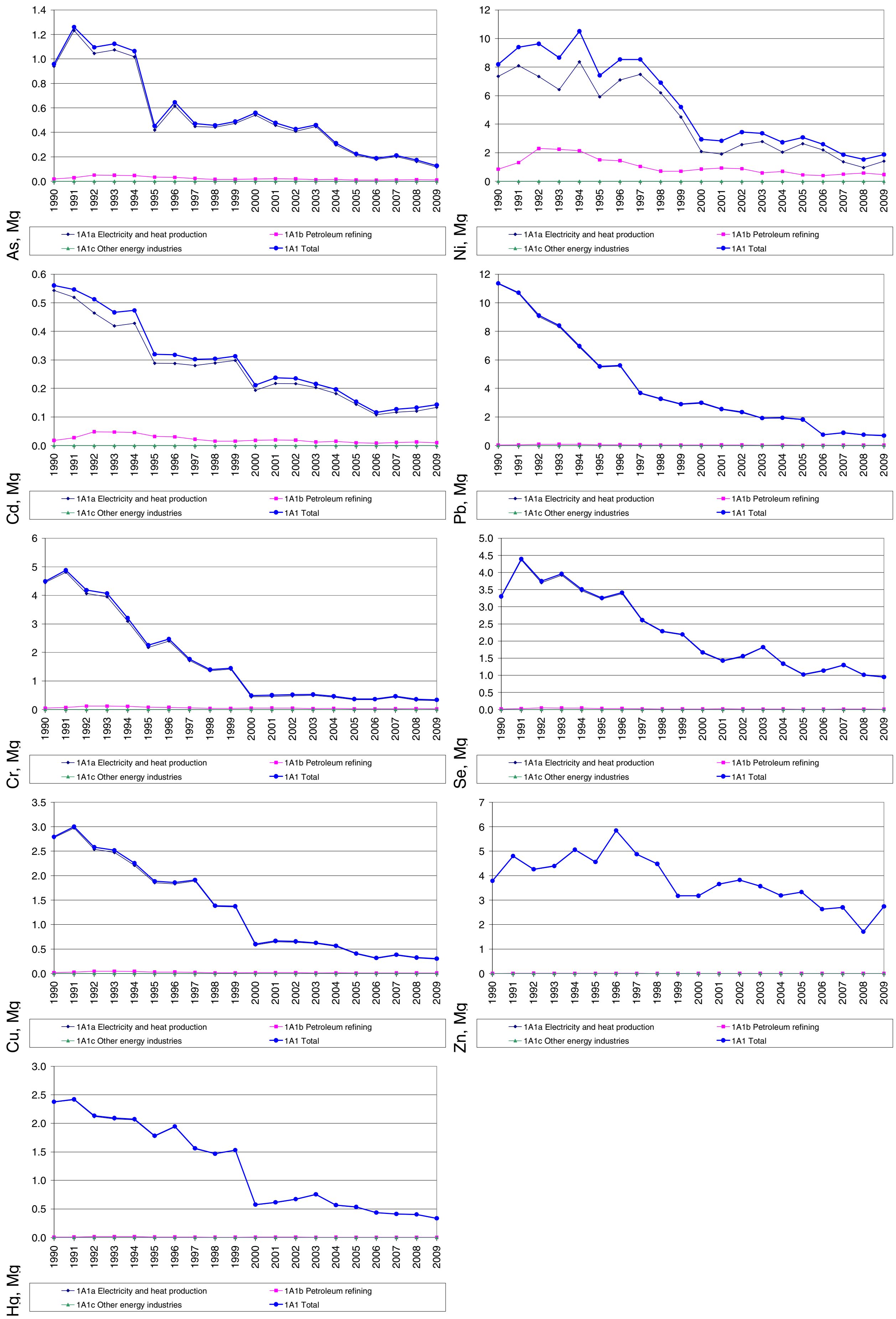


Figure 3.30 Time-series for HM emission, 1A1 Energy industries.

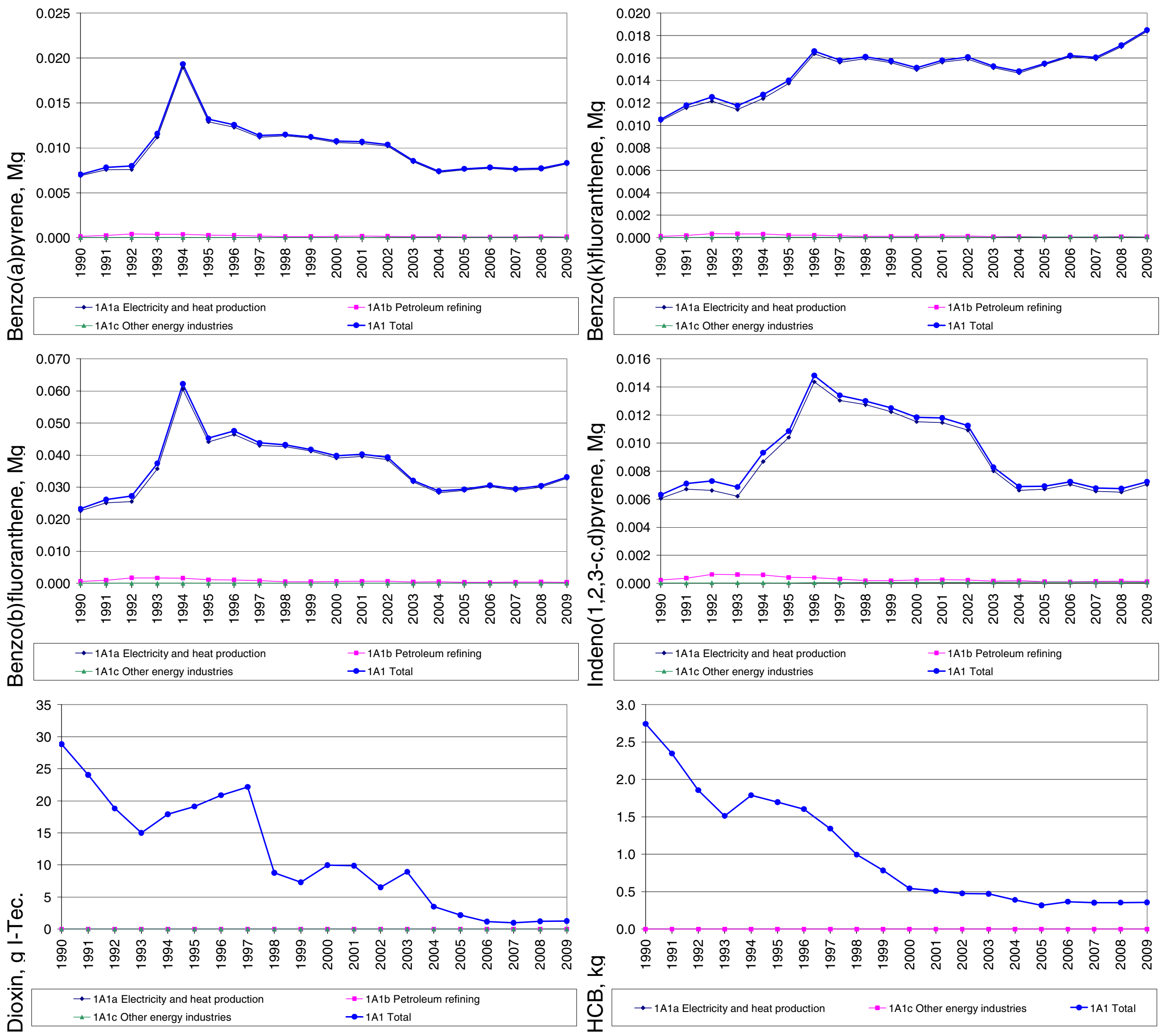


Figure 3.31 Time-series for PAH, dioxin and HCB emission, 1A1 Energy industries.

1A1a Electricity and heat production

Public electricity and heat production is the largest source category regarding fuel consumption for stationary combustion. Figure 3.32 shows the time-series for fuel consumption and emissions of SO_2, NO_x, NMVOC and CO.

The fuel consumption in electricity and heat production was 10 % higher in 2009 than in 1990. As discussed in Chapter 3.2.1 the fuel consumption fluctuates mainly as a consequence of electricity trade. Coal is the fuel that is affected the most by the fluctuating electricity trade. Coal is the main fuel in the source category even in years with electricity import. The coal consumption in 2009 was 31 % lower than in 1990. Natural gas is also an important fuel and the consumption of natural gas has increased since 1990, but decreased since 2003. A considerable part of the natural gas is combusted in gas engines (Figure 3.27). The consumption of municipal waste and biomass has increased.

The SO_2 emission has decreased 96 % since 1990. This decrease is a result of both lower sulphur content in fuels and installation and improved performance of desulphurisation plants.

The NO_x emission has decreased 78 % due to installation of low NO_x burners, selective catalytic reduction (SCR) units and selective non-catalytic reduction (SNCR) units. The fluctuations in time-series follow the fluctuations in fuel consumption and electricity trade.

The emission of NMVOC in 2009 was 4.6 times the 1990 emission level. This is a result of the large number of gas engines that has been installed in Danish CHP plants. The emission has decreased in resent years as a result of decreasing consumption of natural gas in gas engines.

The CO emission was 16 % higher in 2009 than in 1990. The fluctuations follow the fluctuations of the fuel consumption. In addition, the emission from gas engines is considerable.

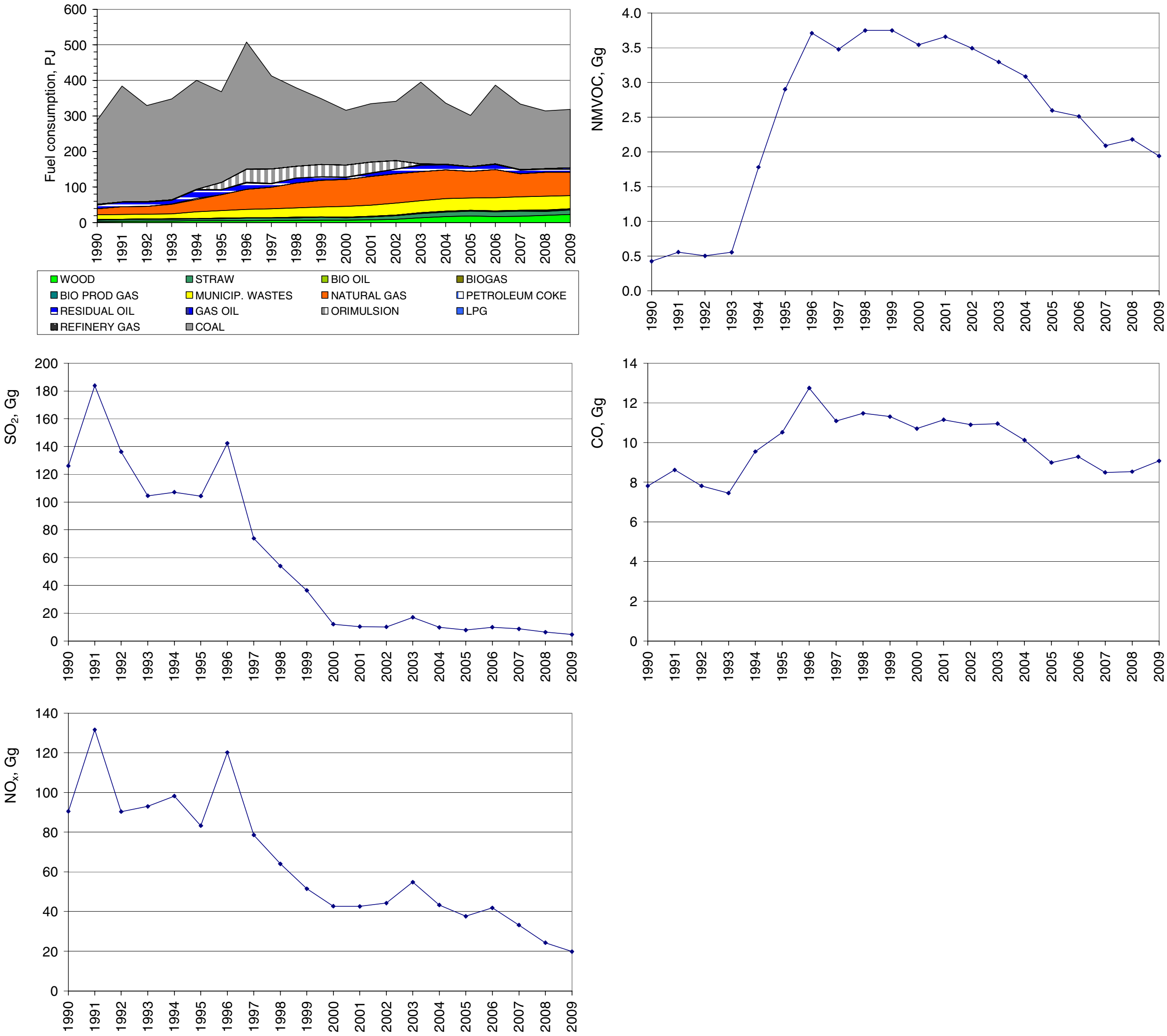


Figure 3.32 Time-series for 1A1a Electricity and heat production.

1A1b Petroleum refining

Petroleum refining is a small source category regarding both fuel consumption and emissions for stationary combustion. There are presently only two refineries operating in Denmark. Figure 3.33 shows the time-series for fuel consumption and emissions.

The significant decrease in both fuel consumption and emissions in 1996 is a result of the closure of a third refinery.

The fuel consumption has increased 6 % since 1990.

The emission of SO_2 has shown a pronounced decrease (90 %) since 1990, mainly because of technical improvements at the refineries. The NO_x emission in 2009 was equal to the emission in 1990. In recent years, data for both SO_2 and NO_x are plant specific data stated by the refineries.

A description of the Danish emission inventory for fugitive emissions from fuels is given in Plejdrup et al. (2009) and in IIR Chapter 3.4.

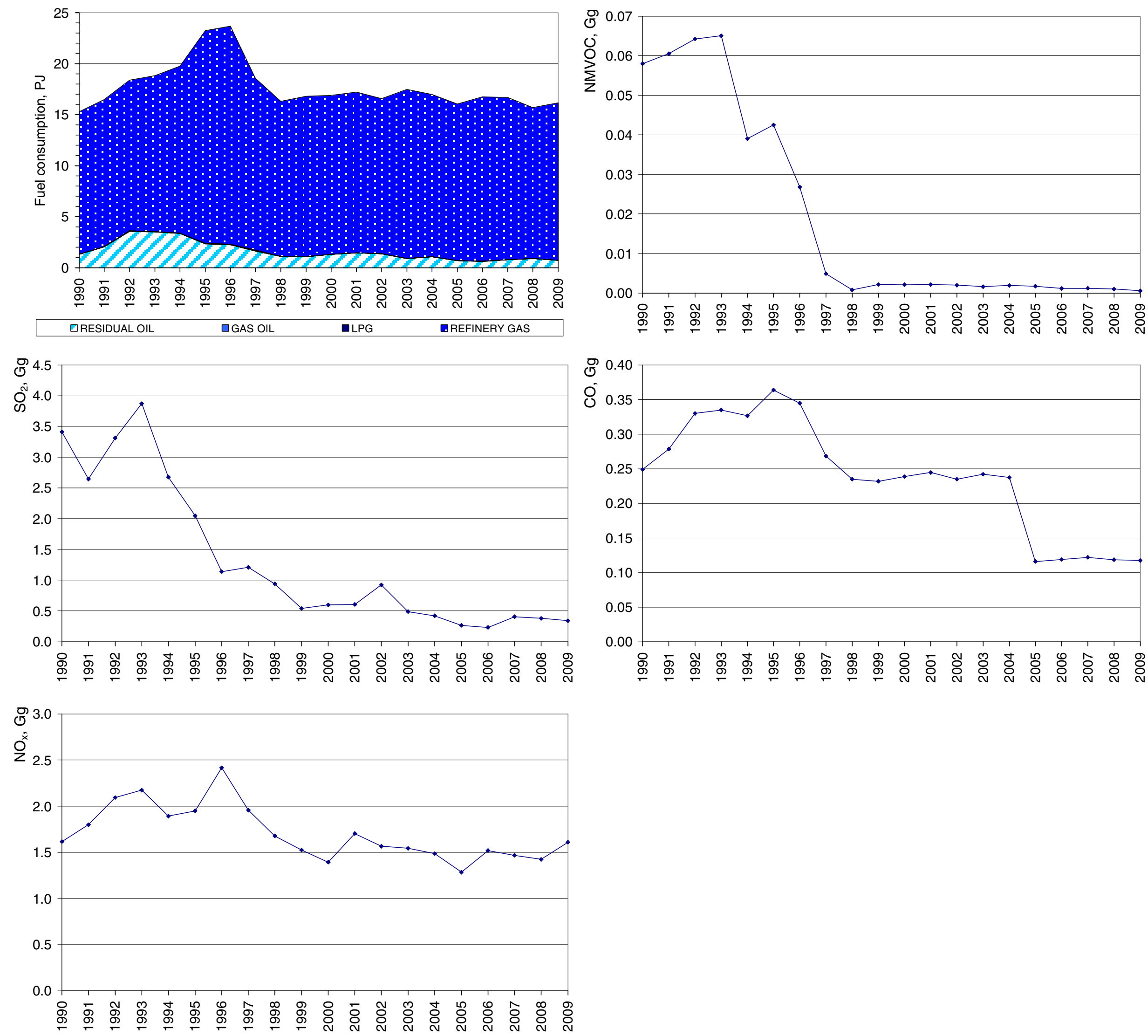


Figure 3.33 Time-series for 1A1b Petroleum refining.

1A1c Other energy industries

The source category *Other energy industries* comprises natural gas consumption in the off-shore industry. Gas turbines are the main plant type. Figure 3.34 shows the time-series for fuel consumption and emissions.

The fuel consumption in 2009 was three times the consumption in 1990.

The emissions follow the increase of fuel consumption.

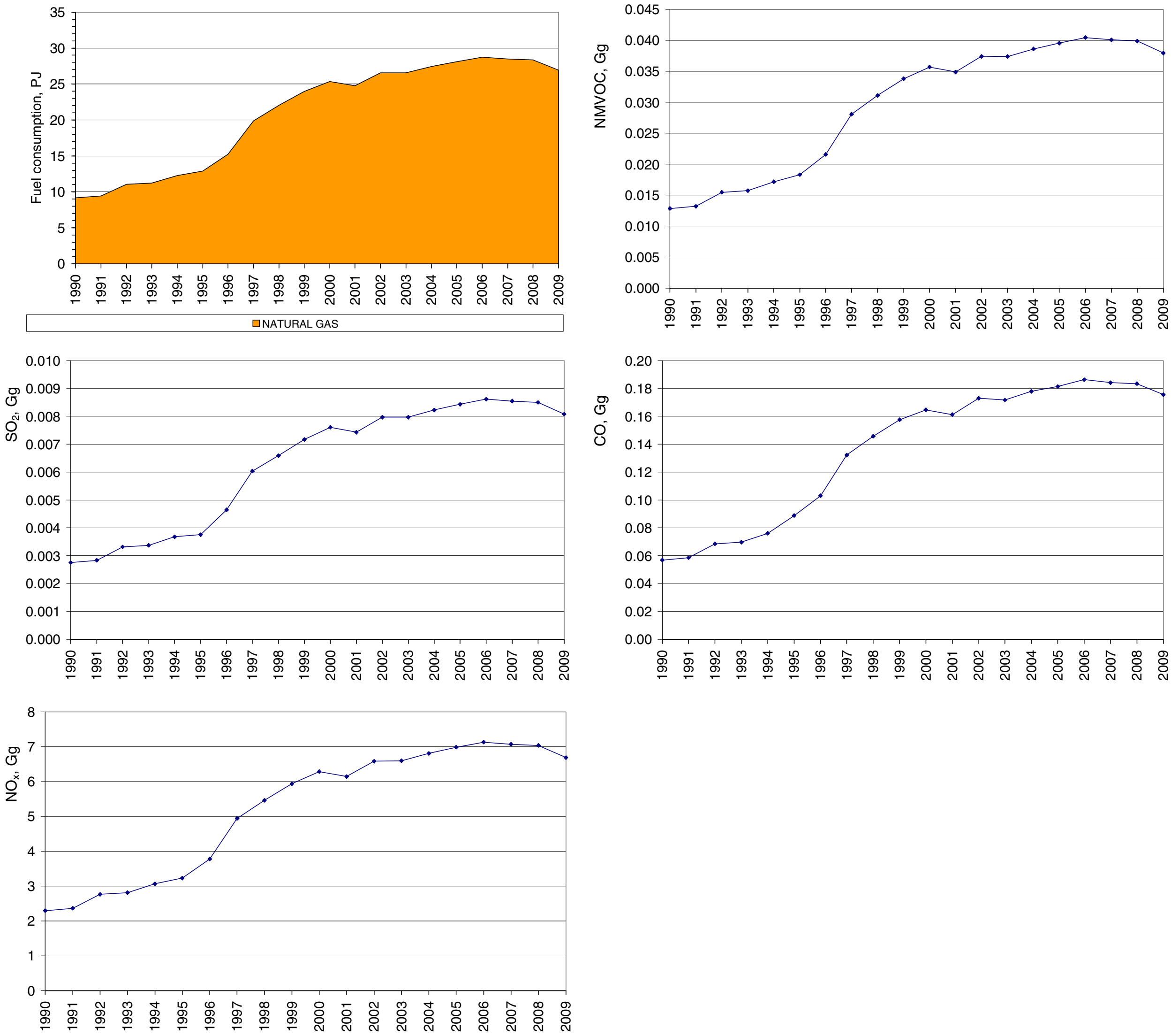


Figure 3.34 Time-series for 1A1c Other energy industries.

1A2 Industry

Manufacturing industries and construction (Industry) consists of both stationary and mobile sources. In this chapter, only stationary sources are included.

Figure 3.35 - 3.39 show the time-series for fuel consumption and emissions. The data have not been disaggregated to industrial subcategories due to the fact that the Danish inventory is based on data for the industrial plants as a whole.

The total fuel consumption in industrial combustion was 21 % lower in 2009 than in 1990. The fuel consumption has decreased considerably (24 %) since 2006 and the financial crisis has resulted in a remarkable decrease in 2009. The consumption of gas has increased since 1990 whereas the consumption of coal has decreased. The consumption of residual oil has decreased, but the consumption of petroleum coke increased. The biomass part of fuel has not changed considerably since 1990.

The SO_2 emission has decreased 83 % since 1990. This is mainly a result of lower consumption of residual oil in the industrial sector. Further, the sulphur content of residual oil and several other fuels has decreased since 1990 due to legislation and tax laws.

The NO_x emission fluctuations follow the fuel consumption in the cement production. However, the NO_x emission has decreased 49 % since 1990 due to the reduced emission from industrial boilers in general.

The NMVOC emission has decreased 74 % since 1990. The decrease is a mainly result of decreased emission factor for combustion of wood in industrial boilers. The emission from gas engines has however increased considerably after 1995 due to the increased fuel consumption that is a result of the installation of a large number of industrial CHP plants. The NMVOC emission factor for gas engines is much higher than for boilers regardless of the fuel.

The CO emission in 2009 was 34 % lower than in 1990. The main source of emission is combustion in mineral wool production. This emission follows the fuel consumption in the mineral wool production plants.

The time-series 1990-1993 for HCB, dioxin and HMs are strongly affected by the error discussed on page 71.

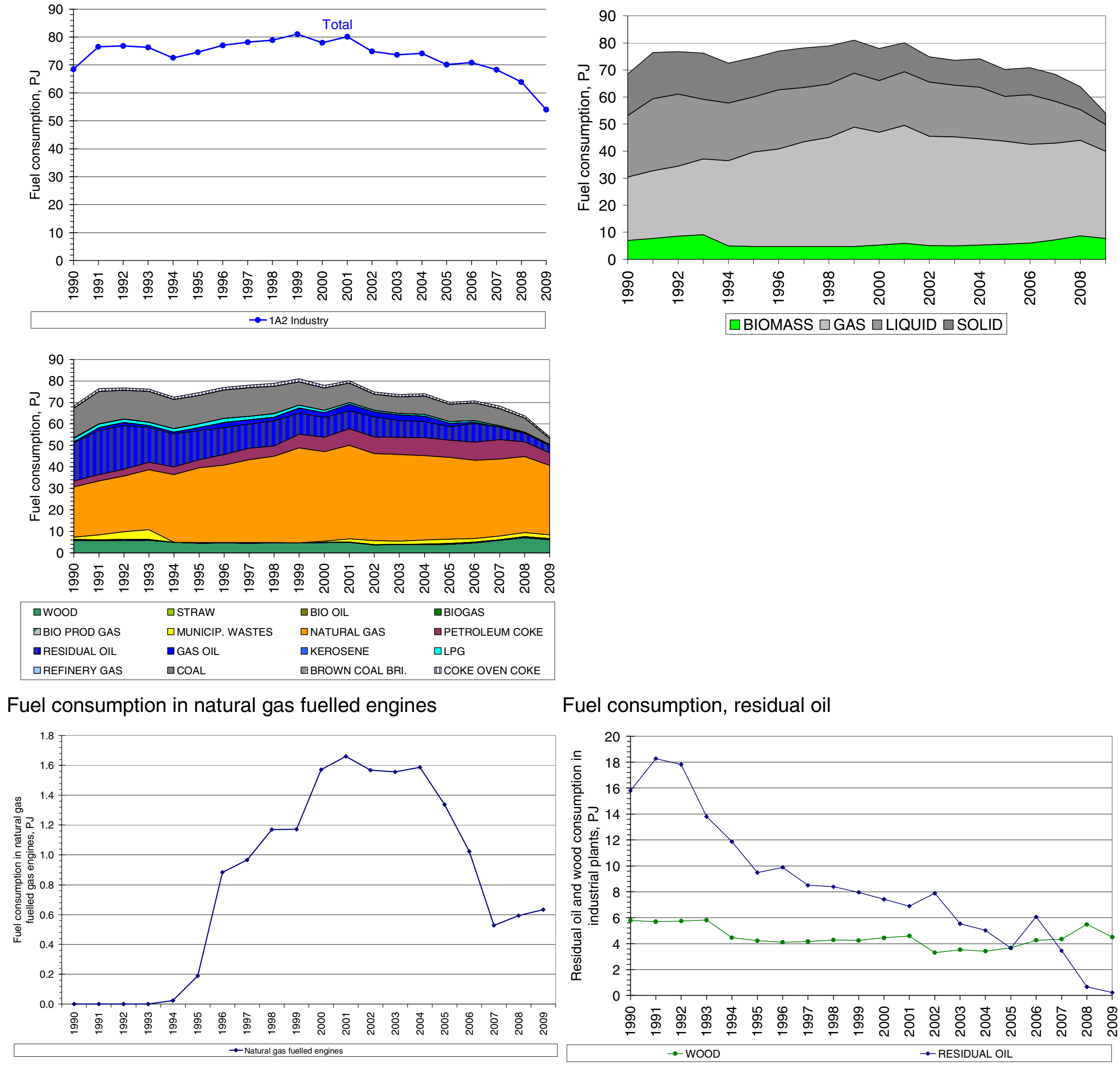


Figure 3.35   Time-series for fuel consumption, 1A2 Industry.

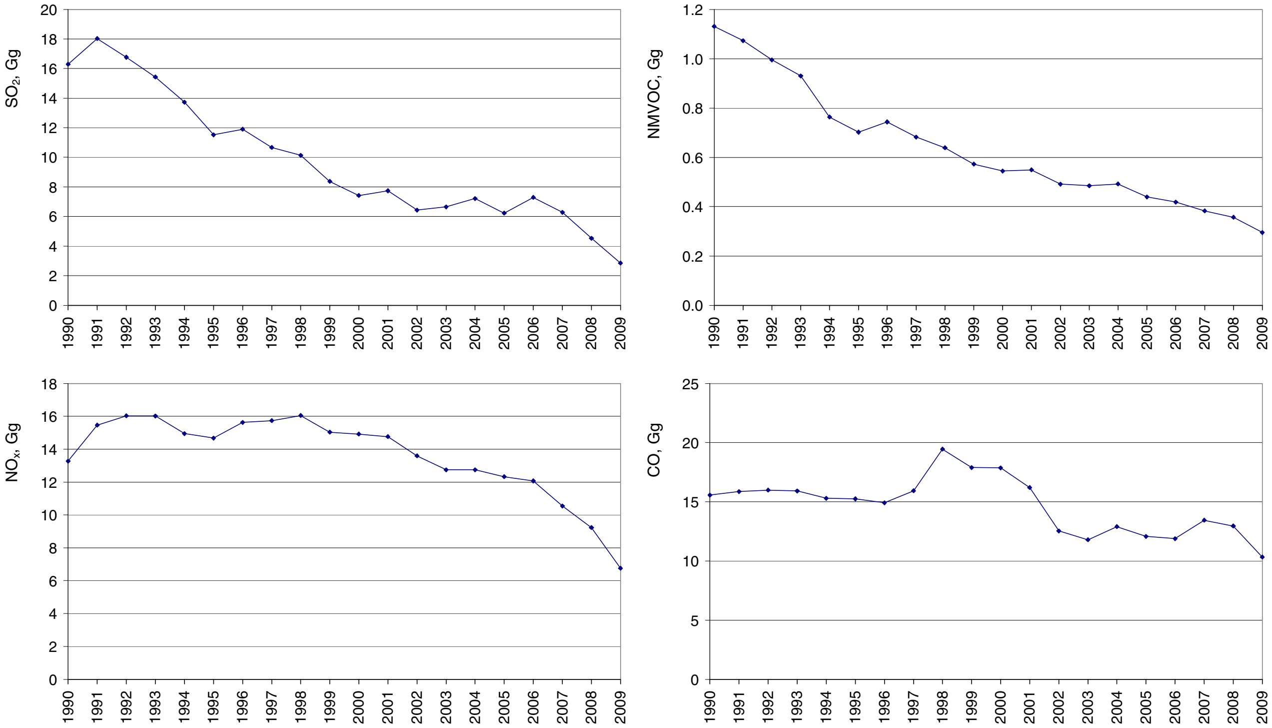


Figure 3.36 Time-series for SO_2, NO_x, NMVOC and CO emission, 1A2 Industry.

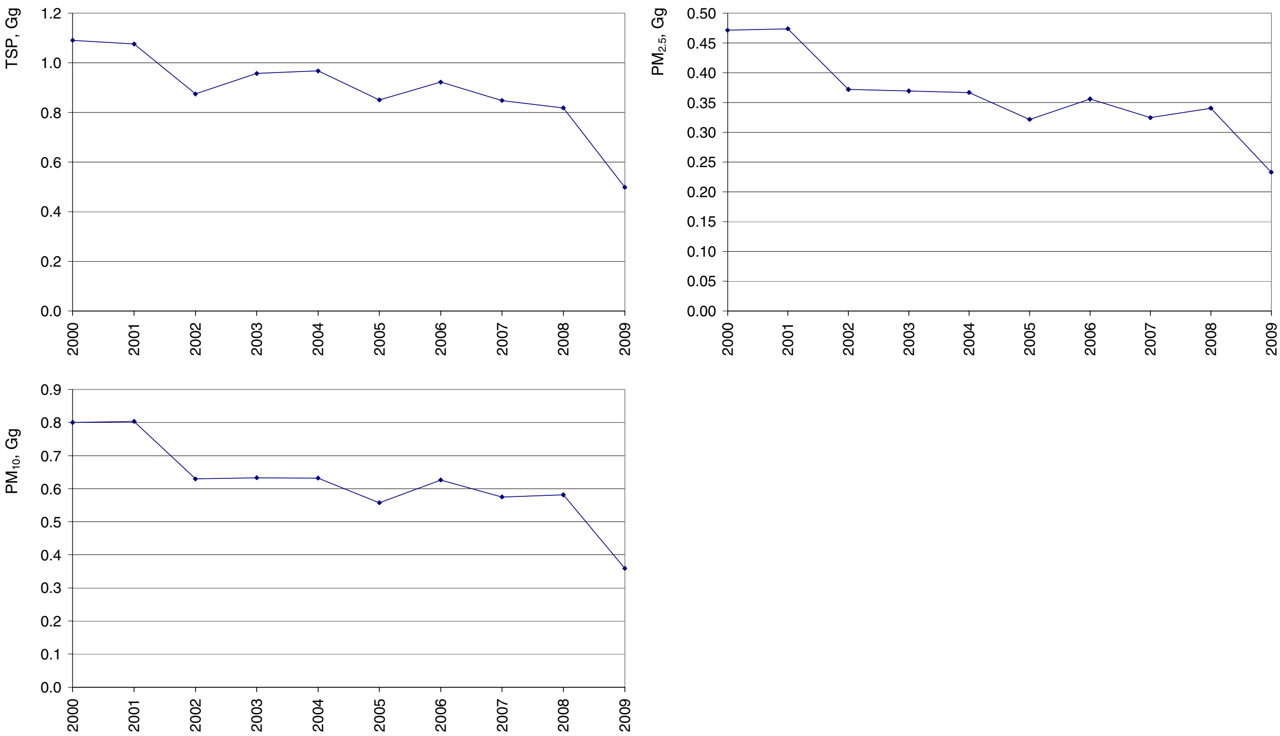


Figure 3.37 Time-series for PM emission, 1A2 Industry.

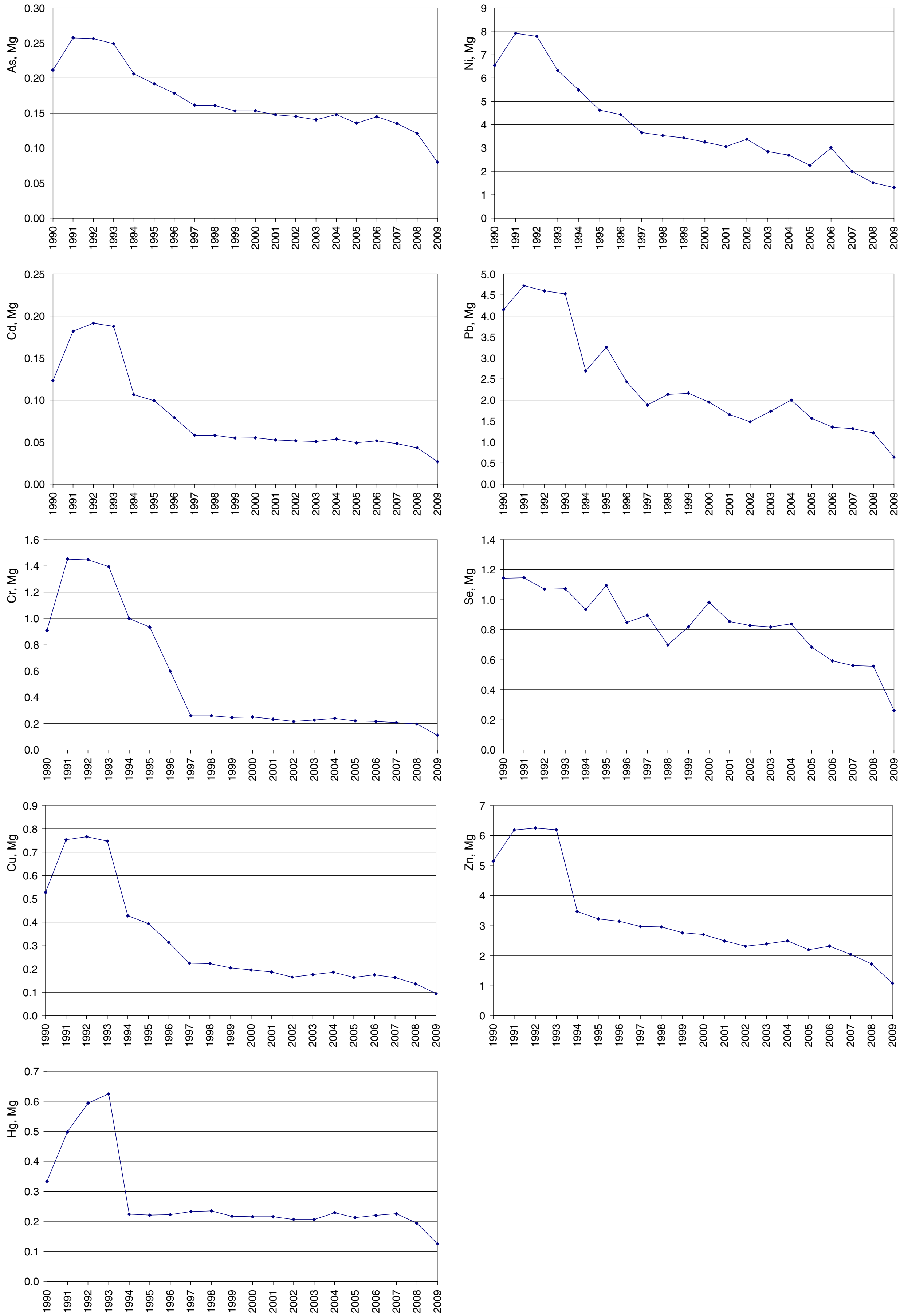


Figure 3.38 Time-series for HM emission, 1A2 Industry.

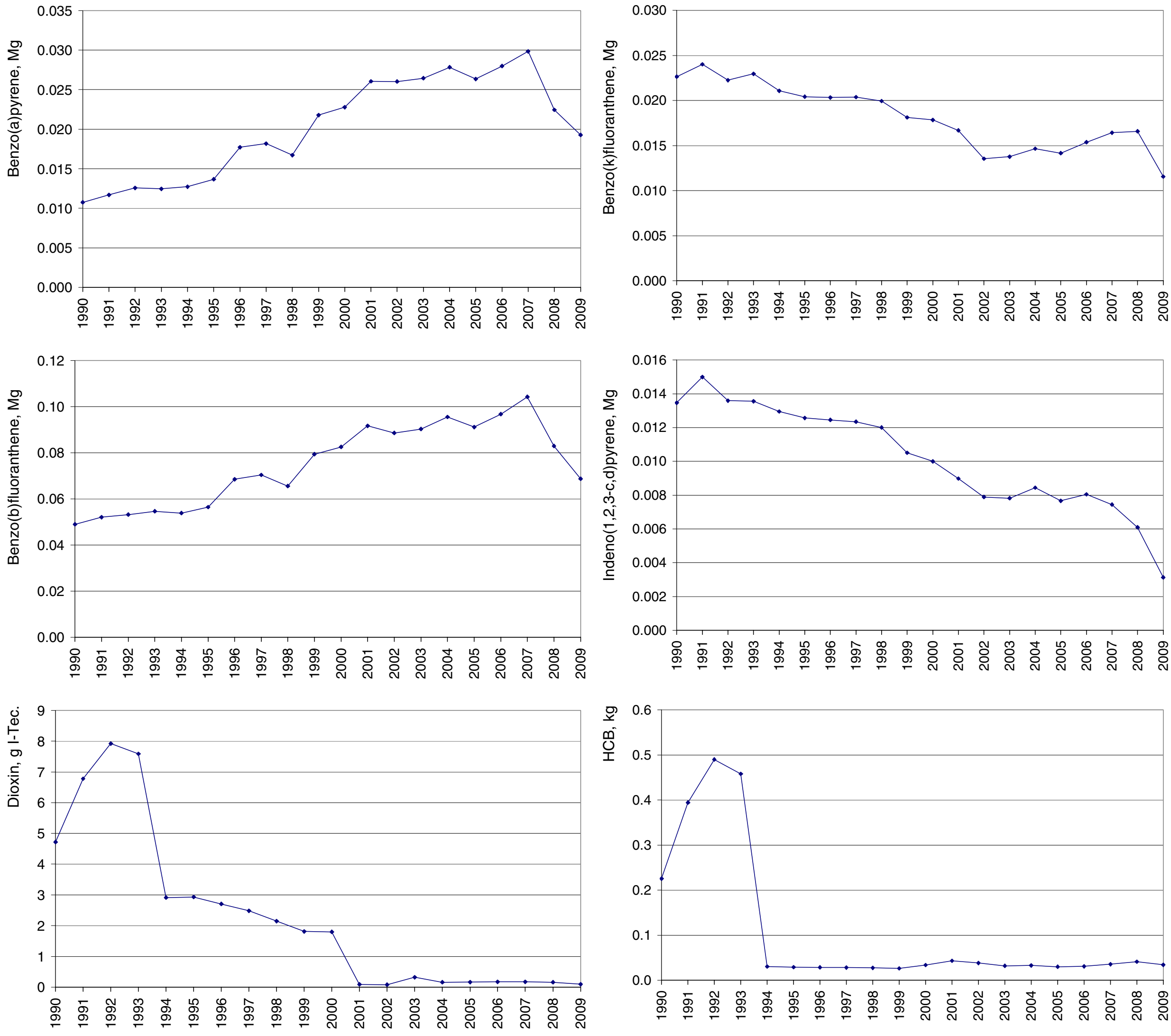


Figure 3.39 Time-series for PAH, dioxin and HCB emission, 1A2 Industry.

1A4 Other Sectors

The emission source category *1A4 Other Sectors* consists of the subcategories:

- 1A4a Commercial/Institutional plants.
- 1A4b Residential plants.
- 1A1c Agriculture/Forestry.

Figure 3.40 – 3.44 present time-series for this emission source category. *Residential plants* is the largest subcategory accounting for the largest part of all emissions. Time-series are discussed below for each subcategory.

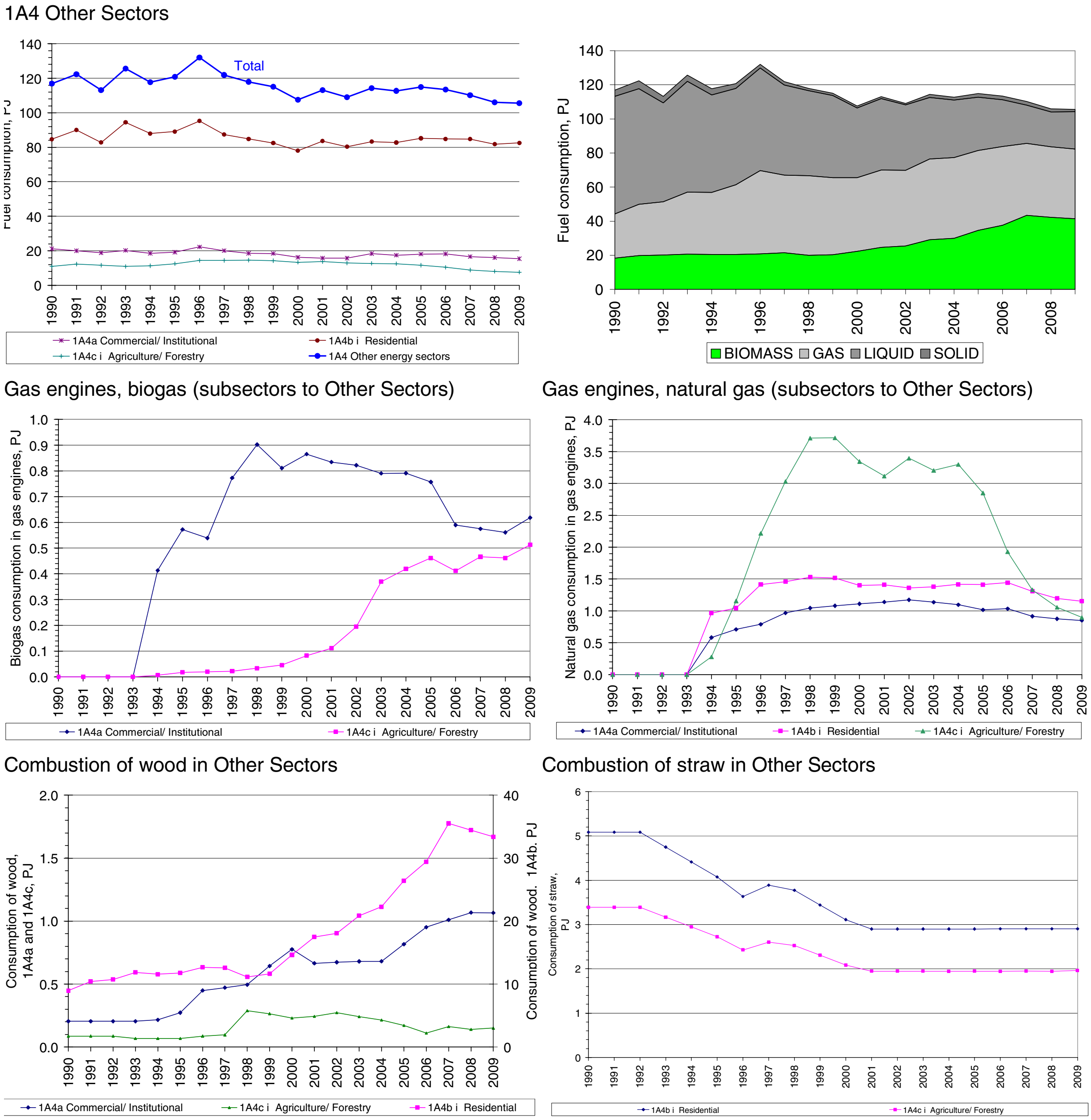


Figure 3.40 Time-series for fuel consumption, 1A4 Other Sectors.

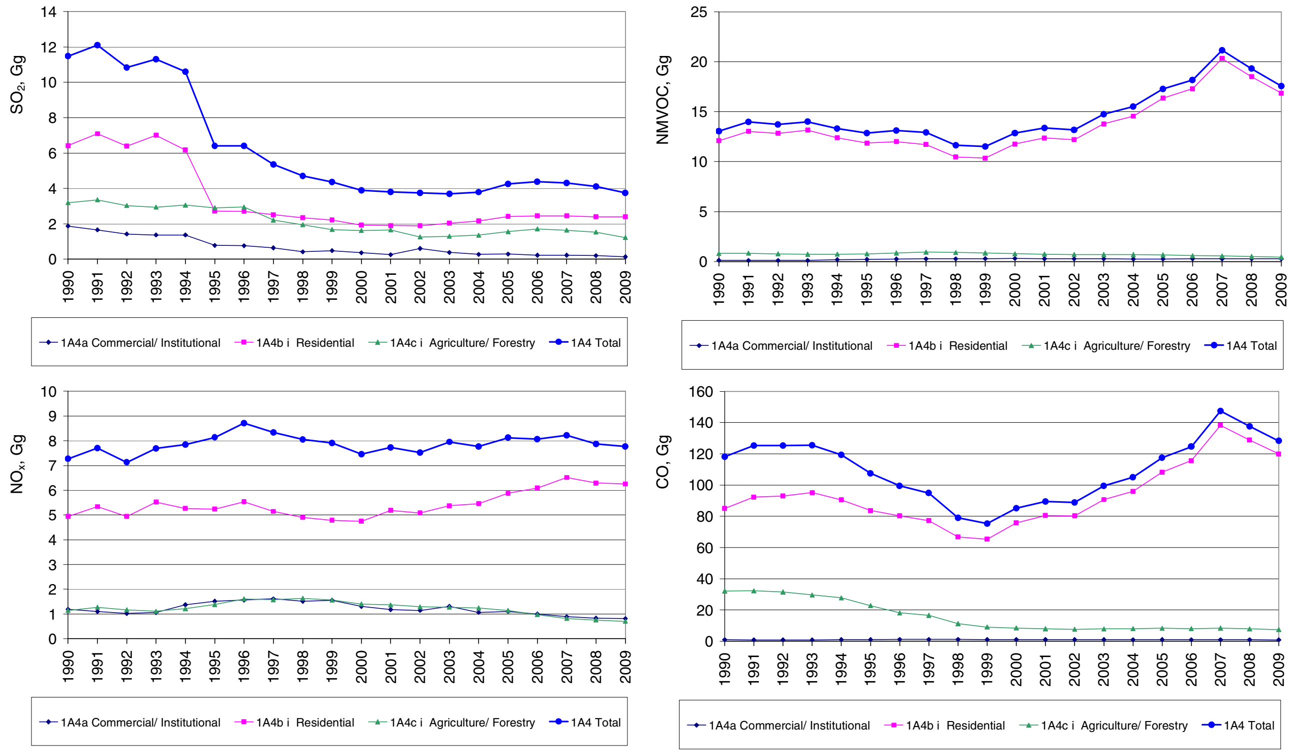


Figure 3.41 Time-series for SO_2, NO_x, NMVOC and CO emission, 1A4 Other Sectors.

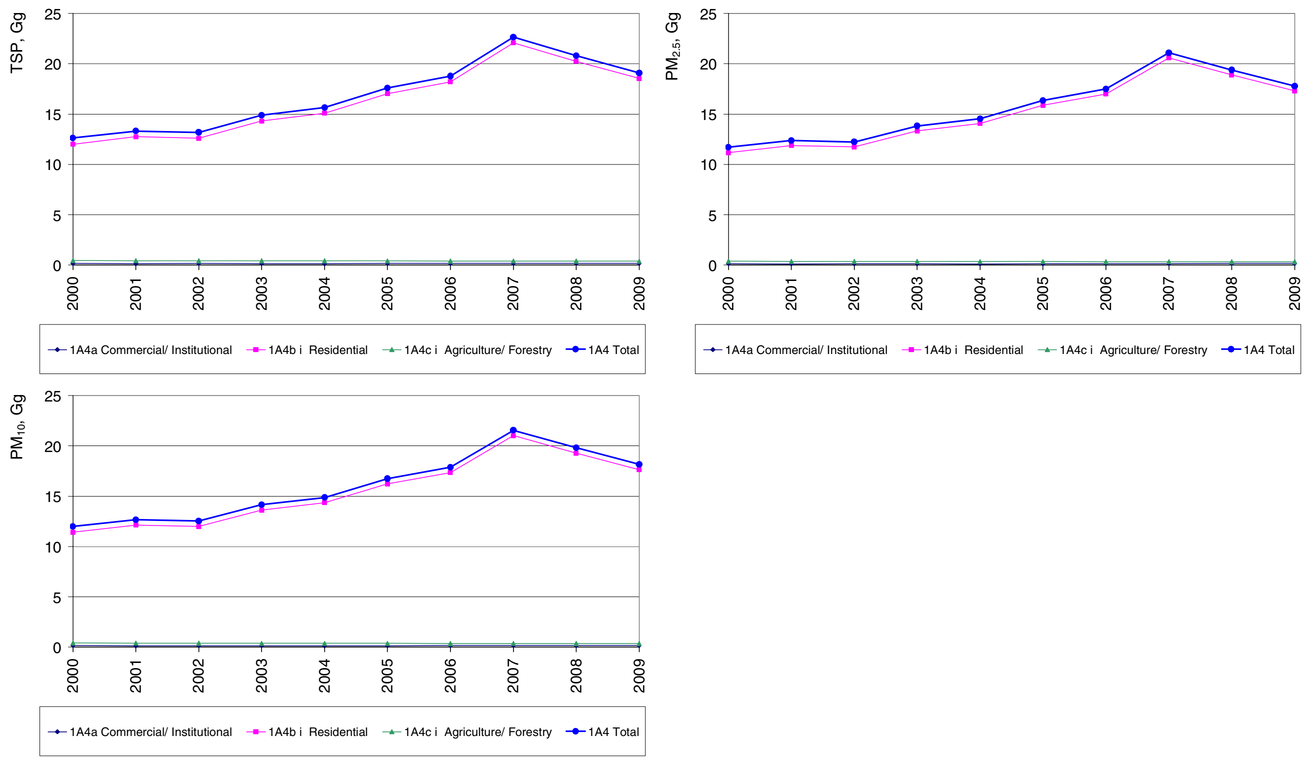


Figure 3.42 Time-series for PM emission, 1A4 Other Sectors.

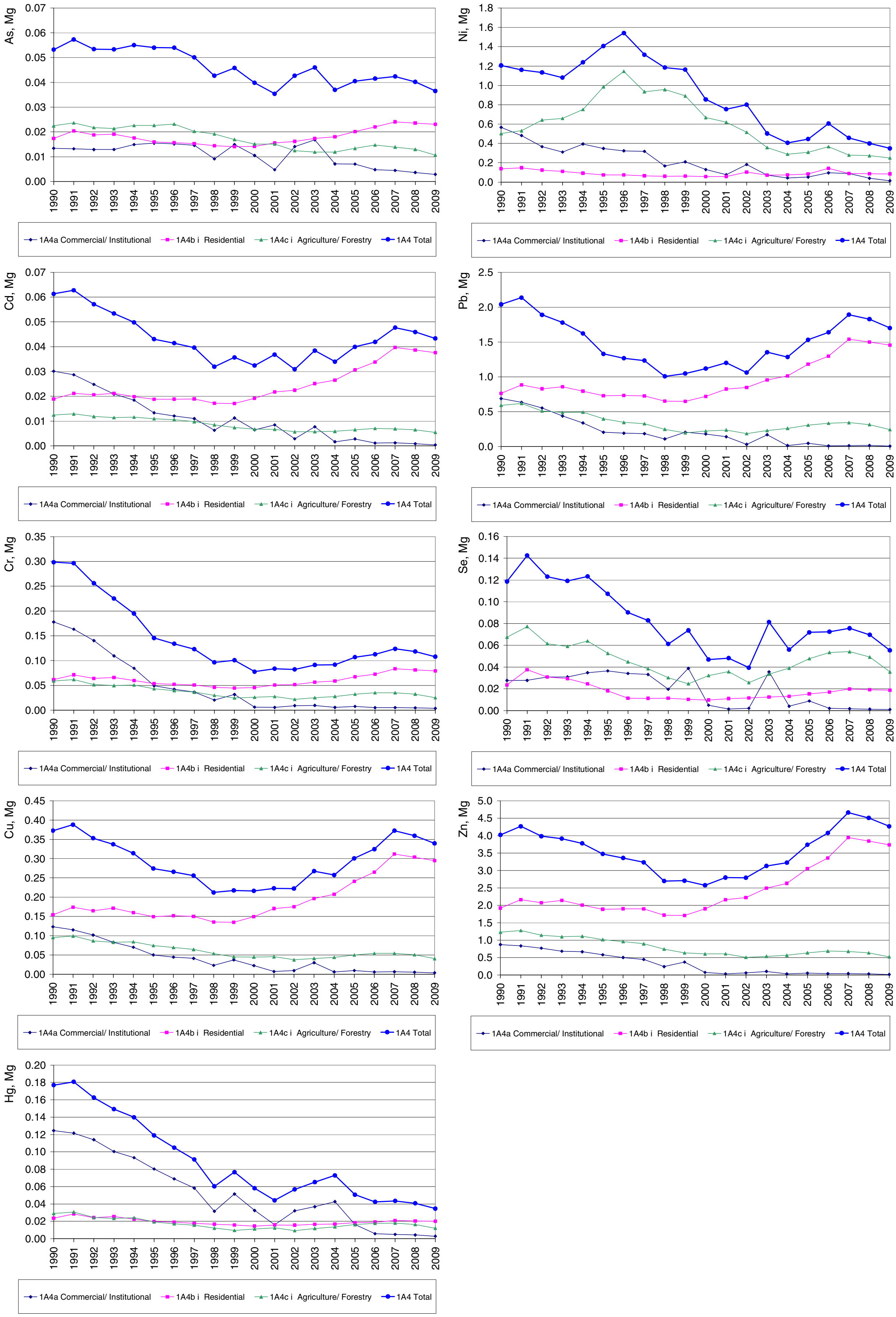


Figure 3.43 Time-series for HM emission, 1A4 Other Sectors.

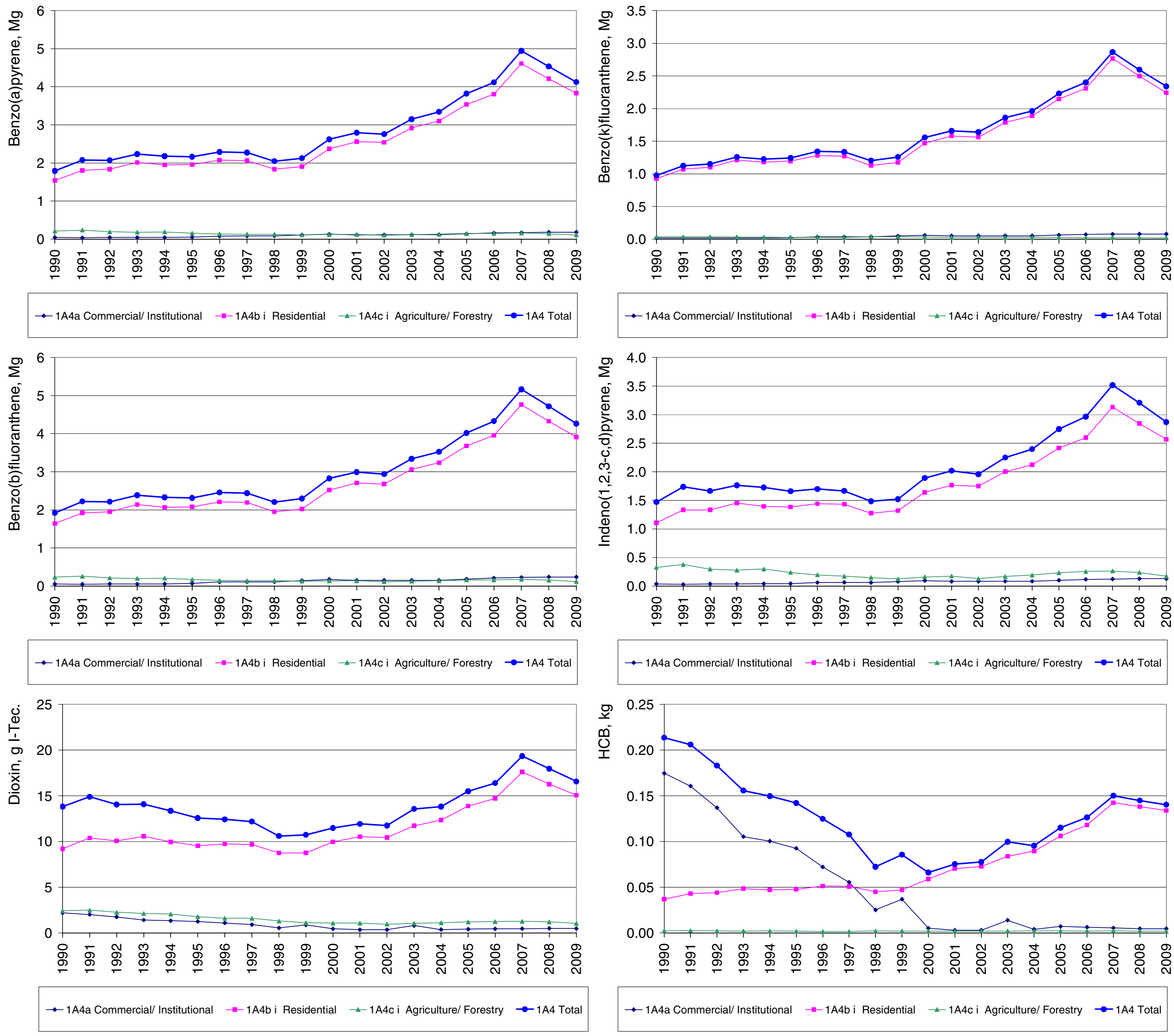


Figure 3.44 Time-series for PAH, dioxin and HCB emission, 1A4 Other Sectors.

1A4a Commercial and institutional plants

The subcategory *Commercial and institutional plants* has low fuel consumption and emissions compared to the other stationary combustion emission source categories. Figure 3.45 shows the time-series for fuel consumption and emissions.

The fuel consumption in commercial/institutional plants has decreased 27 % since 1990 and there has been a change of fuel type. The fuel consumption consists mainly of gas oil and natural gas. The consumption of gas oil has decreased and the consumption of natural gas has increased since 1990. The consumption of wood and biogas has also increased. The wood consumption in 2009 was five times the consumption in 1990.

The SO_2 emission has decreased 93 % since 1990. The decrease is a result of both the change of fuel from gas oil to natural gas and of the lower sulphur content in gas oil and in residual oil. The lower sulphur content (0.05 % for gas oil since 1995 and 0.7 % for residual oil since 1997) is a result of Danish tax laws (MST 1998).

The NO_x emission was 32 % lower in 2009 than in 1990. The decrease is mainly a result of the lower fuel consumption but also the change from gas oil to natural gas has contributed to the decrease. The emission from gas engines and wood combustion has increased.

The NMVOC emission in 2009 was 2.2 times the 1990 emission level. The large increase is a result of the increased combustion of wood that is the main source of emission. The increased consumption of natural gas in gas engines also contribute to the increased NMVOC emission.

The CO emission has decreased 3 % since 1990. The emission from wood and from natural gas fuelled engines and boilers has increased whereas the emission from gas oil has decreased. This is a result of the change of fuels applied in the sector.

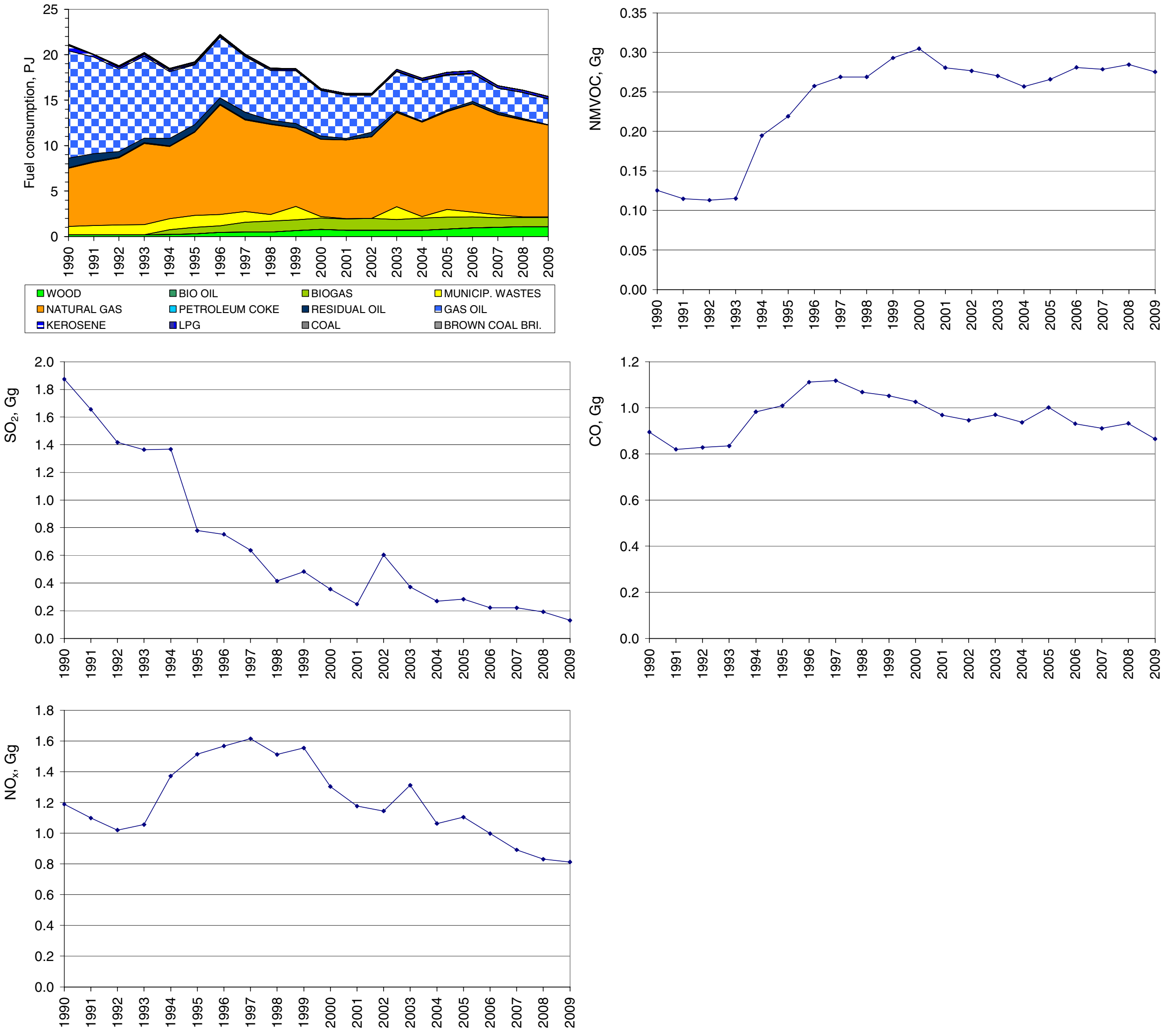


Figure 3.45 Time-series for 1A4a Commercial /institutional.

1A4b Residential plants

The emission source category *Residential plants* consists of both stationary and mobile sources. In this chapter, only stationary sources are included. Figure 3.46 shows the time-series for fuel consumption and emissions.

For residential plants, the total fuel consumption has been rather stable, and in 2009, the consumption was 2 % lower than in 1990. However, the consumption of gas oil has decreased since 1990 whereas the consumption of wood has increased considerably (four times the 1990 level). The consumption of natural gas has also increased since 1990.

The large decrease (63 %) of SO_2 emission from residential plants is mainly a result of a change of sulphur content in gas oil since 1995. The lower sulphur content (0.05 %) is a result of Danish tax laws (MST 1998). In addition, the consumption of gas oil has decreased and the consumption of natural gas that results in very low SO_2 emissions has increased.

The NO_x emission has increased by 27 % since 1990 due to the increased emission from wood combustion. The emission factor for wood is higher than for gas oil.

The emission of NMVOC has increased 39 % since 1990 as a result of the increased combustion of wood. The emission factor for wood has decreased since 1990, but not as much as the increase in consumption of wood. The emission factor for wood and straw is higher than for liquid or gaseous fuels.

The CO emission has increased 41 % due to the increased use of wood that is the main source of emission. The emission from combustion of straw has decreased since 1990.

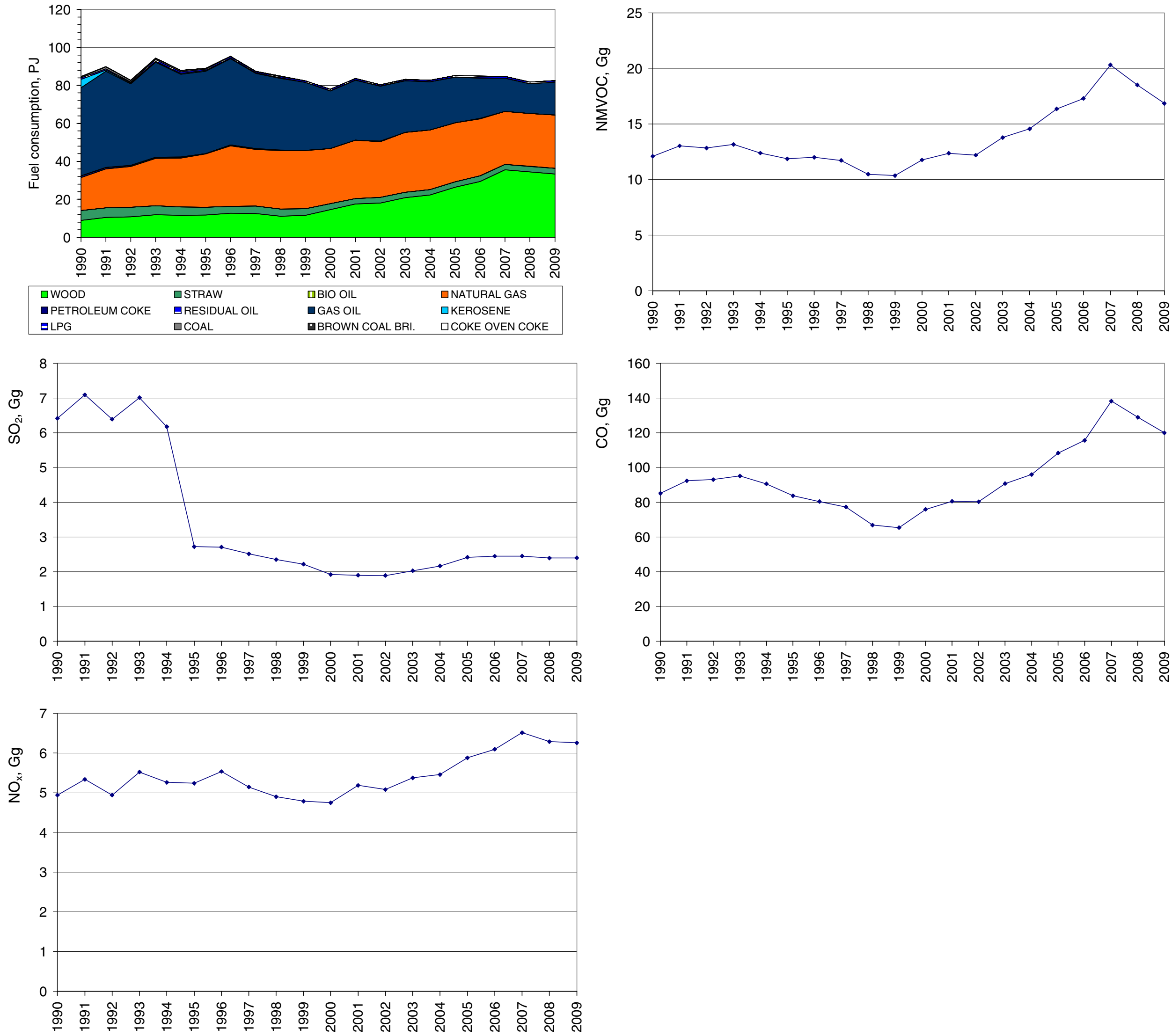


Figure 3.46 Time-series for 1A4b Residential plants.

1A4c Agriculture/forestry

The emission source category *Agriculture/forestry* consists of both stationary and mobile sources. In this chapter, only stationary sources are included. Figure 3.47 shows the time-series for fuel consumption and emissions.

For plants in agriculture/forestry, the fuel consumption has decreased 31 % since 1990. A remarkable decrease of fuel consumption has taken place since year 2000.

The type of fuel that has been applied has changed since 1990. In the years 1994-2004, the consumption of natural gas was high, but in recent years, the consumption decreased again. A large part of the natural gas consumption has been applied in gas engines (Figure 3.40). Most CHP plants in agriculture/forestry based on gas engines came in operation in 1995-1999. The decrease in later years is a result of the liberalisation of the electricity market.

The consumption of straw has decreased since 1990. The consumption of both residual oil and gas oil has increased after 1990 but has decreased again in recent years.

The SO_2 emission was 62 % lower in 2009 than in 1990. The emission decreased mainly in the years 1996-2002. The main emission sources are coal, residual oil and straw.

The emission of NO_x was 39 % lower in 2009 than in 1990. This is in line with the decrease of fuel consumption.

The emission of NMVOC has decreased 46 % since 1990. The major emission source is combustion of straw. The consumption of straw has decreased since 1990. The emission from gas engines has increased mainly due to increased fuel consumption.

The CO emission has decreased 77 % since 1990. The major emission source is combustion of straw. In addition to the decrease of straw consumption, the emission factor for straw has also decreased since 1990.

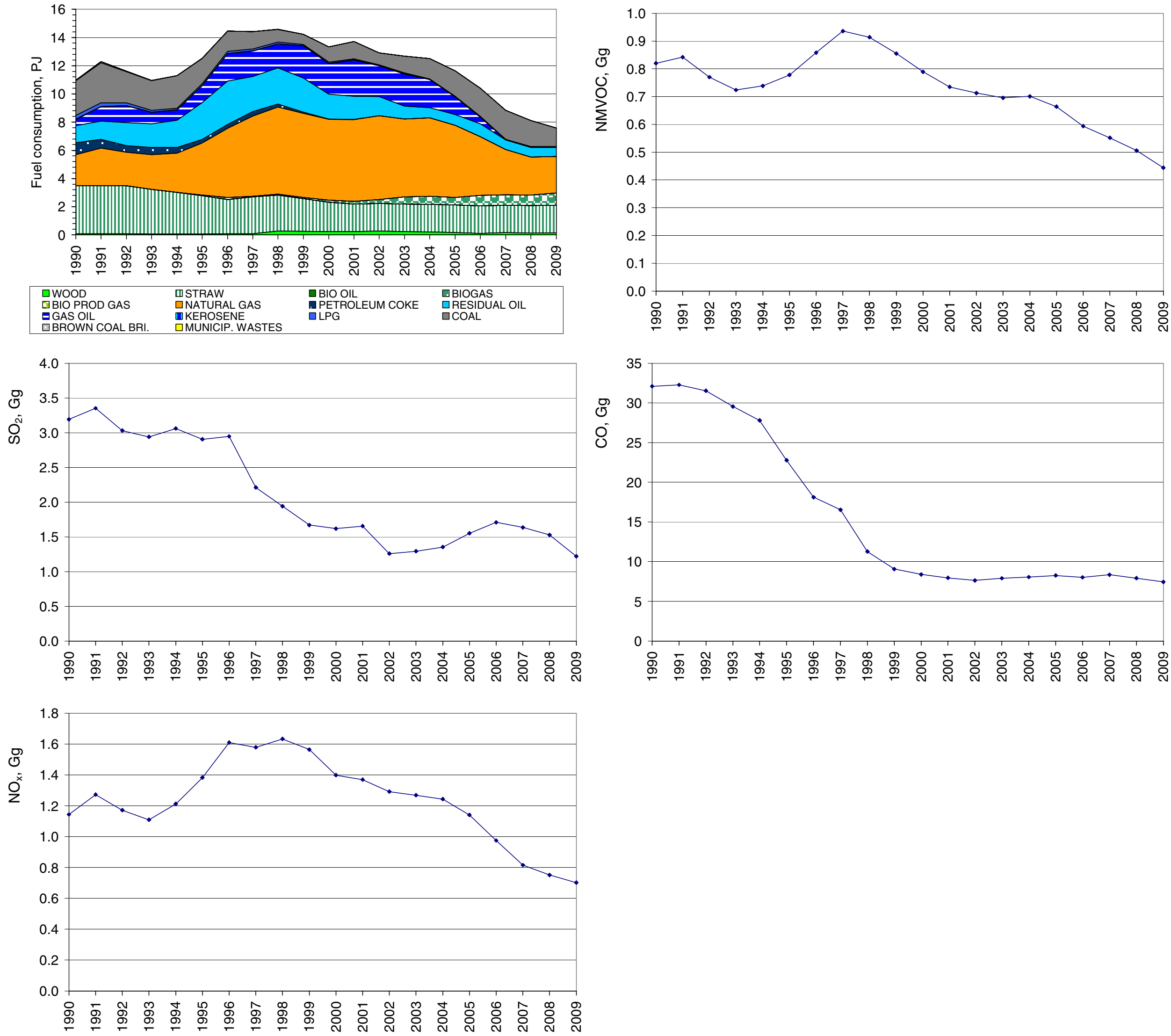


Figure 3.47 Time-series for 1A4c Agriculture/Forestry.

3.2.4 Methodological issues

The Danish emission inventory is based on the CORINAIR (CORe INventory on AIR emissions) system, which is a European program for air emission inventories. CORINAIR includes methodology structure and software for inventories. The methodology is described in the EMEP/CORINAIR Emission Inventory Guidebook 3rd edition, 2007 update, prepared by the UNECE/EMEP Task Force on Emissions Inventories and Projections (EEA 2007). Emission data are stored in an Access database, from which data are transferred to the reporting formats.

The emission inventory for stationary combustion is based on activity rates from the Danish energy statistics. General emission factors for various fuels, plants and sectors have been determined. Some large plants, such as power plants, are registered individually as large point sources and plant-specific emission data are used.

Tiers

The emission inventory is based on the methodology referred to as Tier 2 and Tier 3 in the IPCC Guidelines (IPCC 1996).

Large point sources

Large emission sources such as power plants, industrial plants and refineries are included as large point sources in the Danish emission database. Each point source may consist of more than one part, e.g. a power plant with several units. By registering the plants as point sources in the database, it is possible to use plant-specific emission factors.

In the inventory for the year 2009, 71 stationary combustion plants are specified as large point sources. These point sources include:

- Power plants and decentralised CHP plants (combined heat and power plants).
- Municipal waste incineration plants.
- Large industrial combustion plants.
- Petroleum refining plants.

The criteria for selection of point sources consist of the following:

- All centralized power plants, including smaller units.
- All units with a capacity of above 25 MW_e.
- All district heating plants with an installed effect of 50 MW_{th} or above and significant fuel consumption.
- All waste incineration plants obliged to report environmental data annually according to Danish law (MST 2010).
- Industrial plants,
  - with an installed effect of 50 MW_{th} or above and significant fuel consumption.
  - with a significant process related emission.

The fuel consumption of stationary combustion plants registered as large point sources in the 2009 inventory was 310 PJ. This corresponds to 60 % of the overall fuel consumption for stationary combustion.

A list of the large point sources for 2009 and the fuel consumption rates is provided in Annex 2A-6. The number of large point sources registered in the databases increased from 1990 to 2009.

The emissions from a point source are based either on plant specific emission data or, if plant specific data are not available, on fuel consumption data and the general Danish emission factors. Annex 2A-6 shows which of the emission data for large point sources are plant-specific and the corresponding share of the emission from stationary combustion.

SO_2 and NO_x emissions from large point sources are often plant-specific based on emission measurements. Emissions of CO, NMVOC, PM, heavy metals and dioxin are also plant-specific for some plants. Plant-specific emission data are obtained from:

- Annual environmental reports / environmental reporting available on the Danish EPA home page[2].
- Annual plant-specific reporting of SO_2 and NO_x from power plants >25MW$_e$ prepared for the Danish Energy Agency.
- Emission data reported by DONG Energy and Vattenfall, the two major electricity suppliers.
- Emission data reported from industrial plants.

Annual environmental reports for the plants include a considerable number of emission data sets. Emission data from annual environmental reports are, in general, based on emission measurements, but some emissions have potentially been calculated from general emission factors.

If plant-specific emission factors are not available, general area source emission factors are used.

Area sources

Fuels not combusted in large point sources are included as source category specific area sources in the emission database. Plants such as residential boilers, small district heating plants, small CHP plants and some industrial boilers are defined as area sources. Emissions from area sources are based on fuel consumption data and emission factors. Further information on emission factors is provided below.

Activity rates, fuel consumption

The fuel consumption rates are based on the official Danish energy statistics prepared by the Danish Energy Agency (DEA). NERI aggregates fuel consumption rates to SNAP categories. Some fuel types in the official Danish energy statistics are added to obtain a less detailed fuel aggregation level cf. Annex 2A-3. The calorific values on which the energy statistics are based are also enclosed in Annex 2A-3. The correspondence list between the energy statistics and SNAP categories is enclosed in Annex 2A-9.

The fuel consumption of the NFR category *Manufacturing industries and construction* (corresponding to SNAP category *03 Combustion in manufacturing industries)* is not disaggregated into specific industries in the NERI emission database. So far, disaggregation into specific industries is only estimated for the reporting to the Climate Convention.

[2] http://www3.mst.dk/Miljoeoplysninger/PrtrPublicering/Index

Both traded and non-traded fuels are included in the Danish energy statistics. Thus, for example, estimation of the annual consumption of non-traded wood is included.

Petroleum coke purchased abroad and combusted in Danish residential plants (border trade of 628 TJ in 2009) is not included in the Danish inventory. This is in agreement with the IPCC Guidelines (1996).

The fuel consumption data for large point sources refer to the EU Emission Trading Scheme (EU ETS) data for plants for which the Danish CO_2 emission inventory also refer to EU ETS.

For all other large point sources, the fuel consumption refers to a DEA database (DEA 2010c). The DEA compiles a database for the fuel consumption of each district heating and power-producing plant, based on data reported by plant operators.

The fuel consumption of area sources is calculated as total fuel consumption minus fuel consumption of large point sources.

The Danish national energy statistics includes three fuels used for non-energy purposes, bitumen, white spirit and lubricants. The total consumption for non-energy purposes is relatively low, e.g. 10.6 PJ in 2009. The use of white spirit is included in the inventory in *Solvent and other product use*. The emissions associated with the use of bitumen and lubricants are included in *Industrial Processes.*

In Denmark all municipal waste incineration are utilised for heat and power production. Thus, incineration of waste is included as stationary combustion in the source category *Energy* (subcategories *1A1*, *1A2* and *1A4)*.

Fuel consumption data are presented in Chapter 3.2.1.

Town gas

Town gas has been included in the fuel category natural gas. The consumption of town gas in Denmark is very low, e.g. 0.4 PJ in 2009. In 1990, the town gas consumption was 1.5 PJ and the consumption has been steadily decreasing through out the time-series.

In Denmark, town gas is produced based on natural gas. The use of coal for town gas production ceased in the early 1980s.

An indicative composition of town gas according to the largest supplier of town gas in Denmark is shown in Table 3.16 (KE, 2009).

Table 3.16 Composition of town gas currently used (KE, 2009).

Component	Town gas, % (mol.)
Methane	43.9
Ethane	2.9
Propane	1.1
Butane	0.5
Carbon dioxide	0.4
Nitrogen	40.5
Oxygen	10.7

In earlier years, the composition of town gas was somewhat different. Table 3.17 is constructed with the input from Københavns Energi (KE) (Copenhagen Energy) and Danish Gas Technology Centre (DGC), (Jeppesen 2009 and Kristensen 2007). The data refer to three measurements performed several years apart; the first in 2000 and the latest in 2005.

Table 3.17 Composition of town gas, information from the period 2000-2005.

Component	Town gas, % (mol.)
Methane	22.3-27.8
Ethane	1.2-1.8
Propane	0.5-0.9
Butane	0.13-0.2
Higher hydrocarbons	0-0.6
Carbon dioxide	8-11.6
Nitrogen	15.6-20.9
Oxygen	2.3-3.2
Hydrogen	35.4-40.5
Carbon monoxide	2.6-2.8

Due to the scarce data available and the very low consumption of town gas compared to consumption of natural gas, the methodology will be applied unchanged in future inventories.

Emission factors

For each fuel and SNAP category (sector and e.g. type of plant), a set of general area source emission factors has been determined. The emission factors are either nationally referenced or based on the international guidebooks: EEA/CORINAIR Guidebook (EEA 2009)[3] and IPCC Reference Manual (IPCC 1996).

A complete list of emission factors including time-series and references is provided in Annex 2A-4.

SO_2, NO_x, NMVOC and CO

Emission factors for SO_2, NO_x, NMVOC and CO are listed in Annex 2A-4. The appendix includes references and time-series.

The emission factors refer to:

- The EMEP/CORINAIR Guidebook (EEA, 2007 and EEA, 2009).
- The IPCC Guidelines, Reference Manual (IPCC, 1996).
- Danish legislation:
  - Miljøstyrelsen, 2001 (Danish Environmental Protection Agency).
  - Miljøstyrelsen, 1990 (Danish Environmental Protection Agency).
- Danish research reports including:
  - Two emission measurement programs for decentralised CHP plants (Nielsen et al. 2010; Nielsen & Illerup, 2003).
  - Research and emission measurements programs for biomass fuels:
    - Nikolaisen et al. (1998).
    - Jensen & Nielsen (1990).
    - Serup et al. (1999).

[3] And former editions of the EMEP/Corinair Guidebook.

    - Christiansen et al. (1997).
  - Research and environmental data from the gas sector:
    - Gruijthuijsen & Jensen (2000).
    - Danish Gas Technology Centre (DGC) (2001).
    - Wit & Andersen (2003).
- Aggregated emission factors for residential wood combustion based on technology distribution (Illerup et al. 2007) and technology specific emission factors (EEA 2009; DEPA 2010).
- Calculations based on plant-specific emissions from a considerable number of power plants.
- Calculations based on plant-specific emission data from a considerable number of municipal waste incineration plants. These data refer to annual environmental reports published by plant operators.
- Sulphur content data from oil companies and the Danish gas transmission company, Energinet.dk.
- Additional personal communication.

The emission factors for NMVOC that are not nationally referenced have been updated according to EEA (2009).

Emission factor time-series have been estimated for a considerable number of the emission factors. These are provided in Annex 2A-4.

Particulate matter (PM)

Emission factors for PM and references for the emission factors are listed in Annex 2A-4. The emission factors are based on:

- The TNO/CEPMEIP emission factor database (CEPMEIP 2001).

in addition, a considerable number of country-specific factors referring to:

- Danish legislation:
  - MST (2001), Luftvejledningen (legislation from Danish Environmental Protection Agency).
  - MST (1990), Bekendtgørelse 698 (legislation from Danish Environmental Protection Agency).
- Calculations based on plant-specific emission data from a considerable number of municipal waste incineration plants.
- Aggregated emission factors for residential wood combustion based on technology distribution (Illerup et al. 2007) and technology specific emission factors (EEA 2009; DEPA 2010).
- Two emission measurement programs for decentralised CHP plants (Nielsen et al. 2010; Nielsen & Illerup, 2003).
- An emission measurement program for large power plants (Livbjerg et al., 2001).
- Research leading to the first Danish PM emission inventory for stationary combustion (Nielsen et al. 2003)
- Additional personal communication concerning straw combustion in residential plants.

Emission factor time-series have been estimated for residential wood combustion and MSW incineration. All other emission factors have been considered constant in 2000-2009.

Heavy metals

Emission factors for 2009 for heavy metals (HM) are presented in Annex 2A-4. The appendix includes references and time-series. The emission factors refer to:

- Two emission measurement programs carried out on Danish decentralised CHP plants (Nielsen et al. 2010; Nielsen & Illerup, 2003).
- Implied Emission Factors for power plants based on plant specific data reported by the power plant owners.
- Research concerning heavy metal emission factors representative for Denmark (Illerup et al., 1999).
- A CONCAWE study (Denier van der Gon & Kuenen, 2009)
- Data for Danish natural gas (Gruijthuijsen (2001), Energinet.dk homepage)
- Emission factors without national reference all refer to EEA (2009).

Time-series have been estimated for coal and for municipal waste incineration. For all other sources the same emission factors have been applied for 1990-2009.

PAH

Emission factors 2009 for PAH are shown in Annex 2A-4. The appendix includes references. The PAH emission factors refer to:

- Research carried out by TNO (Berdowski et al., 1995).
- Research carried out by Statistics Norway (Finstad et al., 2001).
- An emission measurement program performed on biomass fuelled plants. The project was carried out for the Danish Environmental Protection Agency (Jensen & Nielsen, 1996).
- Two emission measurement programs carried out on Danish decentralised CHP plants (Nielsen et al. 2010; Nielsen & Illerup, 2003).
- Additional information from the gas sector (Jensen, 2001).
- For residential wood combustion country specific emission factors have been aggregated based on technology distribution in the sector (Illerup et al., 2007) and guidebook emission factors (EEA, 2009).

Emission factor time-series have been estimated for residential wood combustion, natural gas fuelled engines, biogas fuelled engines and MSW incineration plants. All other emission factors have been considered constant from 1990 to 2009. In general, emission factors for PAH are uncertain.

Dioxin

Emission factors 2009 for dioxin are shown in Annex 2A-4.

The emission factor for residential wood combustion refers to technology specific emission factors (EEA 2009; DEPA 2010) and to updated technology distribution data (Illerup et al., 2007).

The emission factors for decentralised CHP plants[4] refer to an emission measurement program for these plants (Nielsen et al. 2010).

All other emission factors refer to research regarding dioxin emission carried out by NERI to prepare a new dioxin emission inventory (Henriksen et al., 2006).

Time-series have been estimated for residential wood combustion and for combustion of municipal. For all other sources, the same emission factors have been applied for 1990-2009.

HCB

Emission factors 2009 for HCB are shown in Annex 2A-4. The emission factors for MSW incineration plants, CHP plants combusting straw, biogas fuelled engines, gas oil fuelled engines and engines combusting biomass producer gas refer to a Danish emission measurement programme for decentralised CHP plants (Nielsen et al. 2010). All other HCB emission factors refer to the EMEP/Corinair Guidebook (EEA, 2009). Time-series have been estimated for MSW incineration plants. All other emission factors have considered constant in 1990-2009.

NH_3

Emission factors have been included for residential wood combustion, residential straw combustion, MSW incineration in public power production and residential combustion of coal and coke oven coke. The emission factor for MSW incineration plants refers to a Danish emission measurement programme (Nielsen et al. 2010) and all other emission factors refer to the EMEP/EEA Guidebook (EEA 2009). Time-series have not been estimated.

Implied emission factors

A considerable part of the emission data for municipal waste incineration plants and large power plants are plant-specific. The area source emission factors do therefore not necessarily represent average values for these plant categories. To attain a set of emission factors that expresses the average emission for power plants combusting coal and for municipal waste incineration plants, implied emission factors have been calculated for these two plant categories. The implied emission factors are presented in Annex 2A-5. The implied emission factors are calculated as total emission divided by total fuel consumption.

Disaggregation to specific industrial subcategories

The national statistics, on which the emission inventories are based, do not include a direct disaggregation to specific industrial subsectors.

Disaggregation to specific industrial subsectors has only been estimated for the Climate Convention reporting.

[4] Natural gas fuelled engines, biogas fuelled engines, gasoil fuelled engines, engines fuelled by biomass producer gas, CHP plants combusting straw or wood and MSW incineration plants.

3.2.5 Uncertainty

According to the Good Practice Guidance for LRTAP Emission Inventories (Pulles & Aardenne, 2004) uncertainty estimates should be estimated.

Uncertainty estimates include uncertainty with regard to the total emission inventory as well as uncertainty with regard to trends.

Methodology

The Danish uncertainty estimates are based on the simple Tier 1 approach.

The uncertainty estimates are based on emission data for the base year and year 2009 as well as on uncertainties for fuel consumption and emission factors for each of the main SNAP source categories. For particulate matter, 2000 is considered to be the base year, but for all other pollutants, the base year is 1990. The applied uncertainties for activity rates and emission factors are default values referring to Pulles & Aardenne (2004). The uncertainty for PM is, however, estimated by NERI. The default uncertainties for emission factors are given in letter codes representing an uncertainty range. It has been assumed that the uncertainties were in the lower end of the range for all sources and pollutants. The applied uncertainties for emission factors are listed in Table 3.18. The uncertainty for fuel consumption in stationary combustion plants is assumed to be 2 %.

Table 3.18 Uncertainty rates for emission factors, %.

SNAP source category	SO_2	NO_x	NMVOC	CO	PM	HM	PAH	HCB	Dioxin	NH_3
01	10	20	50	20	50	100	100	1000	500	1000
02	20	50	50	50	500	1000	1000	1000	1000	1000
03	10	20	50	20	50	100	100	1000	1000	1000

Results

The uncertainty estimates for stationary combustion emission inventories are shown in Table 3.19. Detailed calculation sheets are provided in Annex 2A-7.

The total emission uncertainty is 7.8 % for SO_2, 16 % for NO_x, 44 % for NMVOC and 43 % for CO. For PM, heavy metals, HCB, dioxin and PAH the uncertainty estimates are larger than 100 %.

Table 3.19 Danish uncertainty estimates, tier 1 approach, 2009.

Pollutant	Uncertainty Total emission, %	Trend 1990-2009, %	Uncertainty Trend, %-age points
SO_2	7.8	-93	±0.4
NO_x	16	-63	±3
NMVOC	44	+31	±7
CO	43	+3	±3
NH_3	724	-8	±307
TSP [1)]	463	+38	±54
PM_{10} [1)]	472	+40	±50
$PM_{2.5}$ [1)]	478	+43	±39
As	164	-80	±22
Cd	353	-86	±39
Cr	252	-92	±15
Cu	535	-83	±75
Hg	107	-85	±5
Ni	136	-82	±9
Pb	616	-84	±79
Se	89	-73	±5
Zn	719	-76	±134
HCB	731	-83	±45
Dioxin	926	-62	±262
Benzo(b)fluoranthene	977	+119	±29
Benzo(k)fluoranthene	987	+135	±48
Benzo(a)pyrene	993	+129	±10
Indeno(1,2,3-c,d)pyrene	996	+93	±19

[1)] The base year for PM is year 2000.

3.2.6 Source specific QA/QC and verification

A QA/QC plan for the Danish emission inventories has been implemented. The quality manual (Sørensen et al. 2005) describes the concepts of quality work and definitions of sufficient quality, critical control points and a list of Point for Measuring (PM). Details about the source specific QA/QC is included in Annex 2A-11.

Documentation concerning verification of the Danish emission inventories has been published by Fauser et al. (2007).

Former editions of the sector report for stationary combustion (Nielsen et al. 2010) has been reviewed by external experts in 2005, 2007 and 2009.

3.2.7 Source specific improvements and recalculations

Improvements and recalculations since the 2009 emission inventory submission include:

- The national energy statistics has been updated for the years 1980-2008. The update included both end use and transformation sectors as well as a source category update.
- The petroleum coke purchased abroad and combusted in Danish residential plants is no longer included in the inventory. The border trade was 628 TJ in 2009.

- Emission factors for metals have been updated. All emission factors that are not nationally referenced now refer to the EMEP/EEA Guidebook, 2009 update.

3.2.8 Source specific planned improvements

A number of improvements are planned for the stationary combustion inventories:

1) Improved documentation for emission factors.

The reporting of, and references for, the applied emission factors will be further developed in future inventories.

2) Documentation concerning the HM emission factor update.

A report documenting the improved HM emission inventory is expected to be published in 2011.

3) Implementation of emission factors from EEA 2009.

Some emission factors still refer to older versions of the EMEP/CORINAIR Guidebook. These emission factors will be updated according to EEA (2009).

4) Improved uncertainty estimate.

The current uncertainty estimates are based on SNAP main categories and default uncertainties. The source categories will be changed to NFR categories and country specific uncertainty estimates included for some of the main emission sources.

3.2a References for stationary combustion (*Chapter 3.2*)

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3.3 Transport and other mobile sources (NFR sector 1A2, 1A3, 1A4 and 1A5)

The emission inventory basis for mobile sources is fuel use information from the Danish energy statistics. In addition, background data for road transport (fleet and mileage), air traffic (aircraft type, flight numbers, origin and destination airports) and non-road machinery (engine no., engine size, load factor and annual working hours) are used to make the emission estimates sufficiently detailed. Emission data mainly comes from the EMEP/EEA Air Pollutant Emission Inventory Guidebook. However, for railways, measurements specific to Denmark are used.

In the Danish emission database, all activity rates and emissions are defined in SNAP sector categories (Selected Nomenclature for Air Pollution), according to the CollectER system. The emission inventories are prepared from a complete emission database based on the SNAP sectors. The aggregation to the sector codes used for both the UNFCCC and UNECE Conventions is based on a correspondence list between SNAP and CFR/NFR classification codes shown in Table 3.20 below (mobile sources only).

Table 3.20 SNAP – NFR correspondence table for transport.

SNAP classification	CRF/NFR classification
07 Road transport	1A3b Transport-Road
0801 Military	1A5 Other
0802 Railways	1A3c Railways
0803 Inland waterways	1A3d Transport-Navigation
080402 National sea traffic	1A3d Transport-Navigation
080403 National fishing	1A4c Agriculture/forestry/fisheries
080404 International sea traffic	1A3d Transport-Navigation (international)
080501 Dom. airport traffic (LTO < 1000 m)	1A3a Transport-Civil aviation
080502 Int. airport traffic (LTO < 1000 m)	1A3a Transport-Civil aviation (international)
080503 Dom. cruise traffic (> 1000 m)	1A3a Transport-Civil aviation
080504 Int. cruise traffic (> 1000 m)	1A3a Transport-Civil aviation (international)
0806 Agriculture	1A4c Agriculture/forestry/fisheries
0807 Forestry	1A4c Agriculture/forestry/fisheries
0808 Industry	1A2f Industry-Other
0809 Household and gardening	1A4b Residential
0811 Commercial and institutional	1A4a Commercial and institutional

Military transport activities (land and air) refer to the CRF/NFR sector Other (1A5), while the Transport-Navigation sector (1A3d) comprises national sea transport (ship movements between two Danish ports) and recreational craft (SNAP code 0803).

For aviation, LTO (Landing and Take Off)[5] refers to the part of flying which is below 1000 m.

The working machinery and equipment in industry (SNAP code 0808) is grouped in Industry-Other (1A2f), while agricultural and forestry non-road machinery (SNAP codes 0806 and 0807) is accounted for in the Agriculture/forestry/fisheries (1A4c) sector together with fishing activities.

For mobile sources, internal NERI databases for road transport, air traffic, sea transport and non road machinery have been set up in order to produce the emission inventories. The output results from the NERI databases are calculated in a SNAP format, as activity rates (fuel consumption) and emission factors, which are then exported directly to the central Danish CollectER database.

Apart from national inventories, the NERI databases are used also as a calculation tool in research projects, environmental impact assessment studies, and to produce basic emission information which requires various aggregation levels.

3.3.1 Source category description

The following description of source categories explains the development in fuel consumption and emissions for road transport and other mobile sources.

[5] A LTO cycle consists of the flying modes approach/descent, taxiing, take off and climb out. In principle the actual times-in-modes rely on the actual traffic circumstances, the airport configuration, and the aircraft type in question.

Fuel consumption

Table 3.21 Fuel use (PJ) for domestic transport in 2009 in NFR sectors.

NFR ID	Fuel use (PJ)
Industry-Other (1A2f)	11.2
Civil Aviation (1A3a)	2.2
Road (1A3b)	165.1
Railways (1A3c)	3.1
Navigation (1A3d)	8.0
Comm./Inst. (1A4a)	2.4
Residential (1A4b)	0.9
Agri./for./fish. (1A4c)	24.9
Military (1A5)	2.2
Total	219.9

Table 3.21 shows the fuel use for domestic transport based on DEA statistics for 2009 in NFR sectors. The fuel use figures in time-series 1985-2009 are given in Annex 2.B.15 (NFR format) and are shown for 2009 in Annex 2.B.14 (CollectER format). Road transport has a major share of the fuel consumption for domestic transport. In 2009 this sector's fuel consumption share is 75 %, while the fuel consumption shares for Agriculture/forestry/fisheries and Industry-Other are 11 and 5 %, respectively. For the remaining sectors the total fuel consumption share is 9 %.

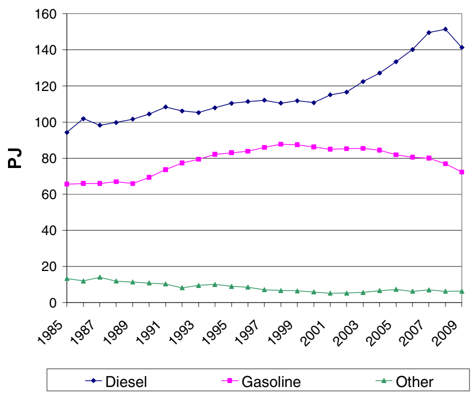


Figure 3.48 Fuel consumption pr fuel type for domestic transport 1985-2009.

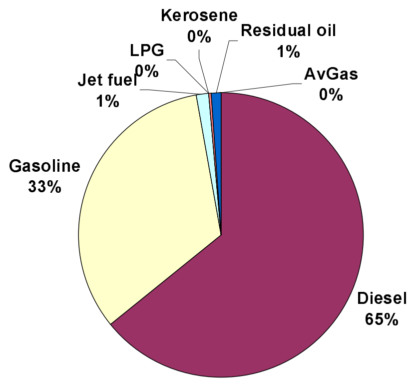


Figure 3.49 Fuel use share pr fuel type for domestic transport in 2009.

From 1985 to 2009, diesel and gasoline fuel use has increased by 50 % and 10 %, respectively, and in 2009 the fuel use shares for diesel and gasoline were 65 % and 33 %, respectively (Figures 3.48 and 3.49). Other fuels only have a 2 % share of the domestic transport total. Almost all gasoline is used in road transportation vehicles. Gardening machinery and recreational craft are merely small consumers. Regarding diesel, there is considerable fuel use in most of the domestic transport categories, whereas a more limited use of residual oil and jet fuel is being used in the navigation sector and by aviation (civil and military flights), respectively.

Road transport

As shown in Figure 3.50, the energy use for road transport has generally increased until 2007, except from a small fuel consumption decline noted in 2000. The impact of the global financial crisis on fuel consumption for road transport becomes visible for 2008 and 2009. The fuel consumption development is due to a slight decreasing trend in the use of gasoline fuels from 1999 onwards combined with a steady growth in the use of diesel until 2007. Within sub-sectors, passenger cars represent the most fuel-consuming vehicle category, followed by heavy-duty vehicles, light duty vehicles and 2-wheelers, in decreasing order (Figure 3.50).

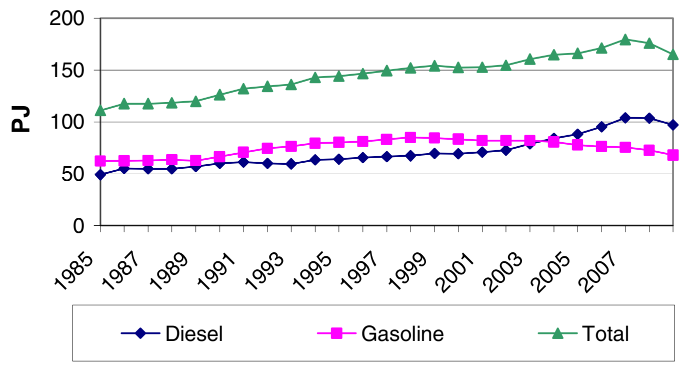


Figure 3.50 Fuel consumption pr fuel type and as totals for road transport 1985-2009.

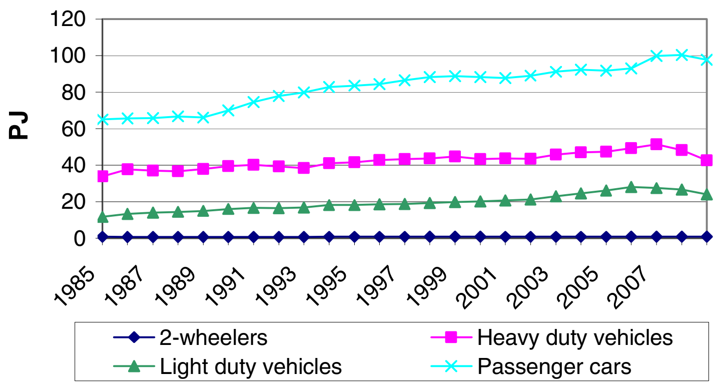


Figure 3.51 Total fuel consumption pr vehicle type for road transport 1985-2009.

As shown in Figure 3.52, fuel consumption for gasoline passenger cars dominates the overall gasoline consumption trend. The development in diesel fuel consumption in recent years (Figure 3.53) is characterised by increasing fuel consumption for diesel passenger cars, while declines in the fuel consumption for trucks and buses (heavy-duty vehicles) and light duty vehicles are noted for 2008 and 2009.

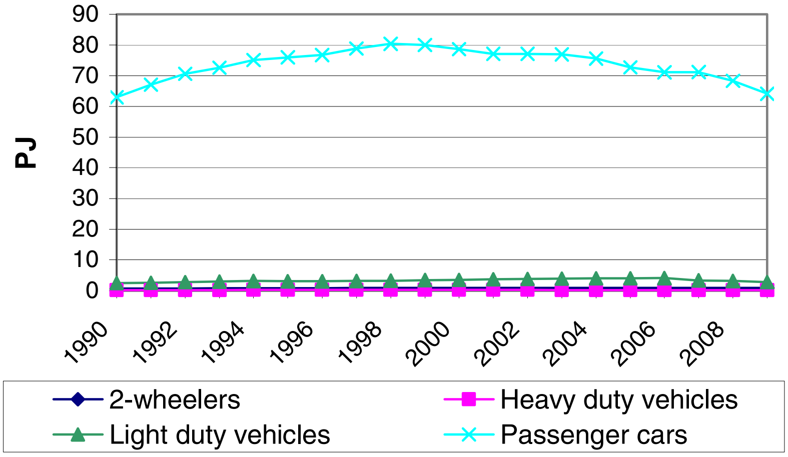


Figure 3.52 Gasoline fuel consumption pr vehicle type for road transport 1985-2009.

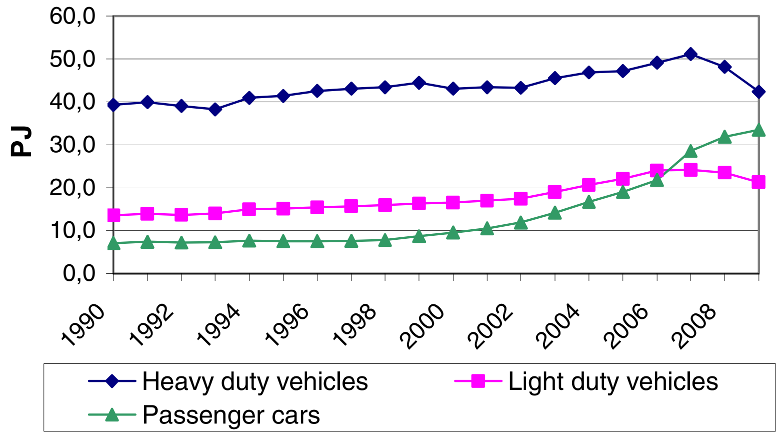


Figure 3.53 Diesel fuel consumption pr vehicle type for road transport 1985-2009.

In 2009, fuel consumption shares for gasoline passenger cars, heavy-duty vehicles, diesel passenger cars, diesel light duty vehicles and gasoline light duty vehicles were 38, 26, 20, 13 and 2 %, respectively (Figure 3.54).

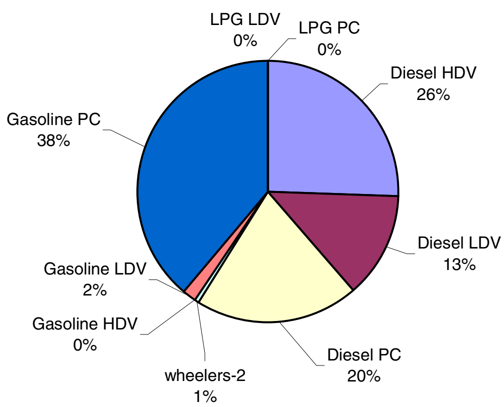


Figure 3.54 Fuel consumption share (PJ) pr vehicle type for road transport in 2009.

Other mobile sources

It must be noted that the fuel consumption figures behind the Danish inventory for mobile equipment in the agriculture, forestry, industry, household and gardening (residential), and inland waterways (part of navigation) sectors, are less certain than for other mobile sectors. For these types of machinery, the DEA statistical figures do not directly provide fuel consumption information, and fuel consumption totals are subsequently estimated from activity data and fuel consumption factors. For recreational craft the latest historical year is 2004.

As seen in Figure 3.55, classified according to CRF the most important sectors are Agriculture/forestry/fisheries (1A4c), Industry-other (mobile machinery part of 1A2f) and Navigation (1A3d). Minor fuel consuming sectors are Civil Aviation (1A3a), Railways (1A3c), Other (military mobile fuel consumption: 1A5), commercial/institutional (1A4a) and Residential (1A4b).

The 1985-2009 time-series are shown pr fuel type in Figures 3.56-3.59 for diesel, gasoline and jet fuel, respectively.

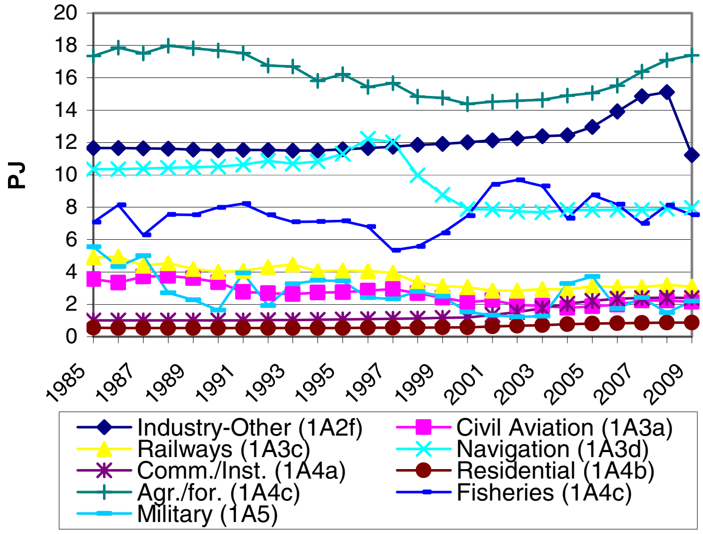


Figure 3.55 Total fuel consumption in CRF sectors for other mobile sources 1985-2009.

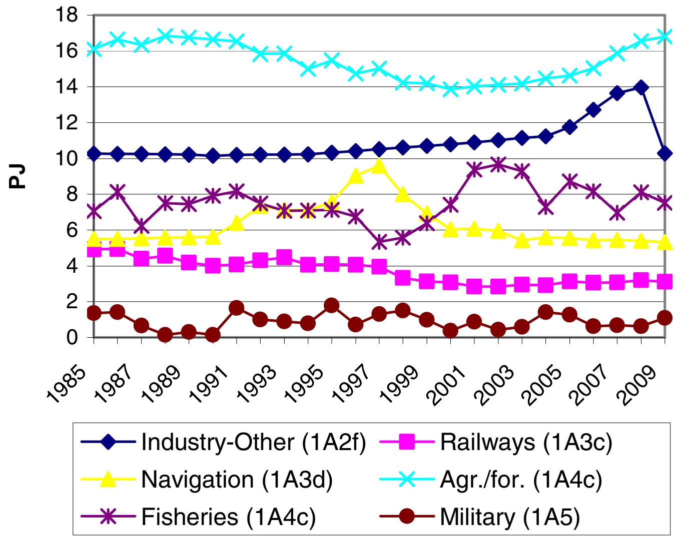


Figure 3.56 Diesel fuel consumption in CRF sectors for other mobile sources 1985-2009.

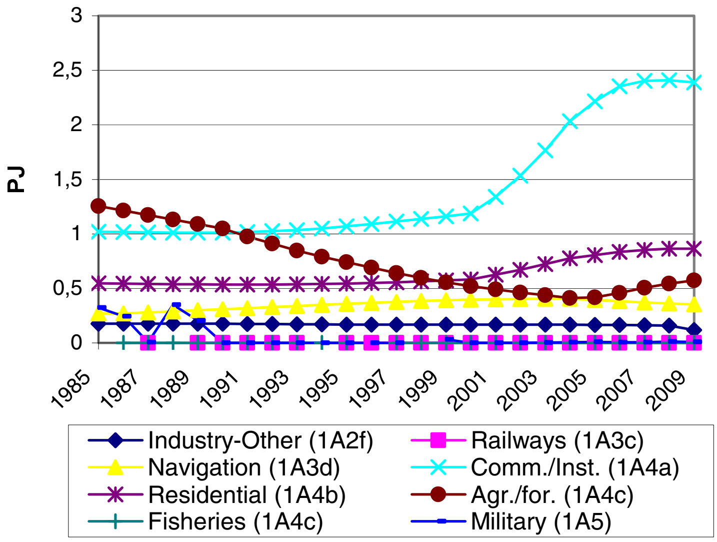


Figure 3.57 Gasoline fuel consumption in CRF sectors for other mobile source 1985-2009.

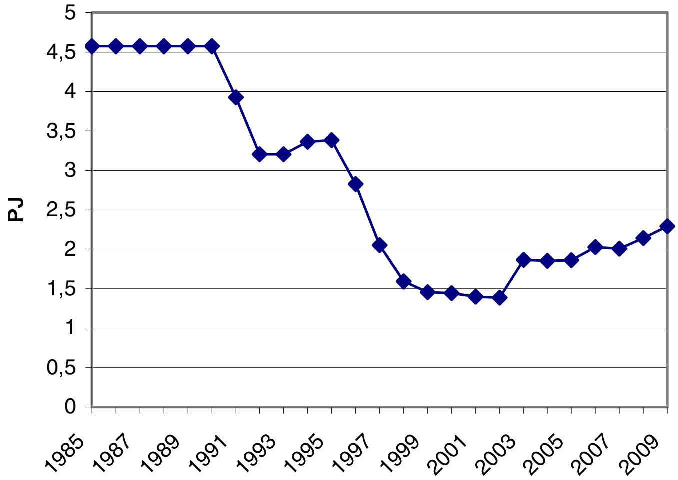


Figure 3.58 Residual oil fuel consumption in CRF sectors for other mobile sources 1985-2009.

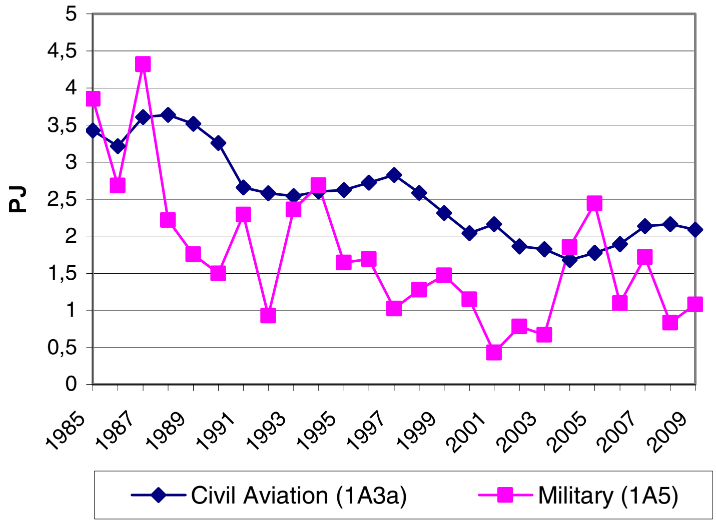


Figure 3.59 Jet fuel consumption in CRF sectors for other mobile sources 1985-2009.

In terms of diesel, the fuel consumption decreases for agricultural machines until 2000, due to fewer numbers of tractors and harvesters. After that, the increase in the engine sizes of new sold machines has more than outbalanced the trend towards smaller total stock numbers. The fuel consumption for industry has increased from the beginning of the 1990's, due to an increase in the activities for construction machinery. The fuel consumption increase has been very pronounced in 2005-2008, for 2009, however, the global financial crisis has a significant impact on the building and construction activities. For fisheries, the development in fuel consumption reflects the activities in this sector.

The Navigation sector comprises national sea transport (fuel consumption between two Danish ports) and recreational craft. For the latter category, fuel consumption has increased significantly from 1990 to 2004 due to the rising number diesel-fuelled private boats. For national sea transport, the diesel fuel consumption curve reflects the combination of traffic and ferries in use for regional ferries. From 1998 to 2000, a significant decline in fuel consumption is apparent. The most important explanation here is the closing of ferry service routes in connection with the opening of the Great Belt Bridge in 1997. For railways, the gradual shift towards electrification explains the lowering trend in diesel fuel consumption and the emissions for this transport sector. The fuel consumed (and associated emissions) to produce electricity is accounted for in the stationary source part of the Danish inventories.

The largest gasoline fuel use is found for household and gardening machinery in the Commercial/Institutional (1A4a) and Residential (1A4b) sectors. Especially from 2001-2006, a significant fuel consumption increase is apparent due to considerable growth in the machinery stock. The decline in gasoline fuel consumption for Agriculture/forestry/fisheries (1A4c) is due to the gradual phasing out of gasoline-fuelled agricultural tractors.

In terms of residual oil there has been a substantial decrease in the fuel consumption for regional ferries. The fuel consumption decline is most significant from 1990-1992 and from 1997-1999.

The considerable variations from one year to another in military jet fuel consumption are due to planning and budgetary reasons, and the passing demand for flying activities. Consequently, for some years, a certain amount of jet fuel stock-building might disturb the real picture of aircraft fuel consumption. Civil aviation has decreased until 2004, since the opening of the Great Belt Bridge in 1997, both in terms of number of flights and total jet fuel consumption. After 2004 an increase in the consumption of jet fuel is noted until 2007/2008.

Bunkers

The residual oil and diesel oil fuel consumption fluctuations reflect the quantity of fuel sold in Denmark to international ferries, international warships, other ships with foreign destinations, transport to Greenland and the Faroe Islands, tank vessels and foreign fishing boats. For jet petrol, the sudden fuel use drop in 2002 is explained by the recession in the air traffic sector due to the events of September 11, 2001 and structural changes in the aviation business. In 2009, the impact of the global financial crisis on flying activities becomes very visible.

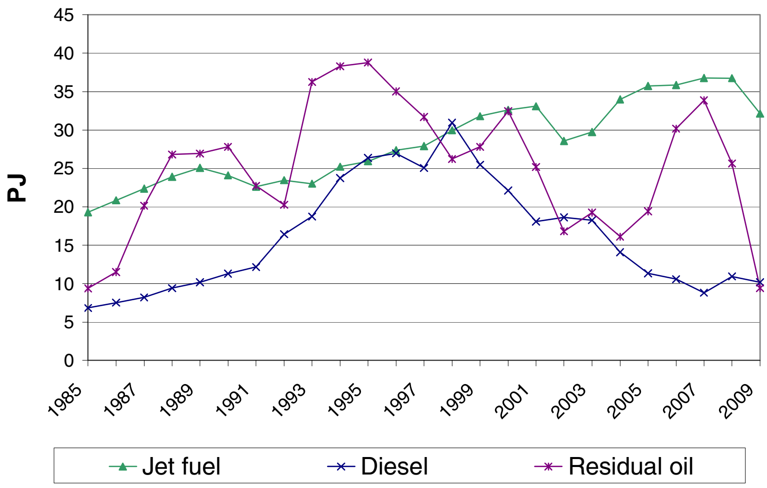


Figure 3.60 Bunker fuel consumption 1985-2009.

Emissions of SO_2, NO_X, NMVOC, CO, NH_3, TSP, PM_{10} and $PM_{2.5}$

In Table 3.22 the SO_2, NO_X, NMVOC, CO NH_3, TSP, PM_{10} and $PM_{2.5}$ emissions for road transport and other mobile sources are shown for 2009 in NFR sectors. For particulate matter (PM; TSP, PM_{10} and $PM_{2.5}$), only the exhaust emission contributions are included in Table 3.22. Non-exhaust TSP, PM_{10} and $PM_{2.5}$ emissions are treated in a separate section below. The emission figures in the time-series 1985-2009 are given in Annex 2.B.15 (NFR format) and are shown for 2009 in Annex 2.B.14 (CollectER format).

From 1985 to 2009, the road transport emissions of SO_2, NO_X, NMVOC, CO and PM (all size fractions) have decreased by 99, 50, 83, 80 and 65 %, respectively (Figures 3.61-3.65), whereas the NH_3 emissions have increased by 2546 % during the same time period (Figure 3.66).

For other mobile sources, the emission changes for SO_2, NO_X, NMVOC, CO and PM (all size fractions) are -87, -20, -23, -3 and -66 %, respectively (Figures 3.68)-3.72). The NH_3 emissions have increased by 13 % during the same time period (Figure 3.73).

Table 3.22 Emissions of SO_2, NO_X, NMVOC, CO NH_3, TSP, PM_{10} and $PM_{2.5}$ in 2009 for road transport and other mobile sources.

NFR ID	SO_2	NO_x	NMVOC	CO	NH_3	TSP	PM_{10}	$PM_{2.5}$
	tonnes	tonnes	tonnes	tonnes	tonnes	tonnes	tonnes	tonnes
Industry-Other (1A2f)	24	7 137	976	5 123	2	587	587	587
Civil Aviation (1A3a)	50	651	168	758	0	3	3	3
Railways (1A3c)	1	2 603	174	450	1	84	84	84
Navigation (1A3d)	1 593	9 534	1 013	6 213	0	327	324	323
Comm./Inst. (1A4a)	1	220	5 159	72 227	0	67	67	67
Residential (1A4b)	0	84	2 071	25 341	0	14	14	14
Ag./for./fish. (1A4c)	392	20 802	2 504	19 453	4	992	990	989
Military (1A5)	25	704	55	387	1	17	17	17
Total other mobile	2 086	41 735	12 120	129 953	8	2 091	2 087	2 085
Road (1A3b)	76	46 637	13 685	110 199	1 612	1 523	1 523	1 523
Total mobile	2 163	88 372	25 805	240 151	1 619	3 615	3 611	3 609

Road transport

The step-wise lowering of the sulphur content in diesel fuel has given rise to a substantial decrease in the road transport emissions of SO_2 (Figure 3.61). In 1999, the sulphur content was reduced from 500 ppm to 50 ppm (reaching gasoline levels), and for both gasoline and diesel the sulphur content was reduced to 10 ppm in 2005. Since Danish diesel and gasoline fuels have the same sulphur percentages, at present, the 2009 shares for SO_2 emissions and fuel use for passenger cars, heavy-duty vehicles, light-duty vehicles and 2-wheelers are the same in each case: 52, 31, 16 and 1 %, respectively (Figure3.67).

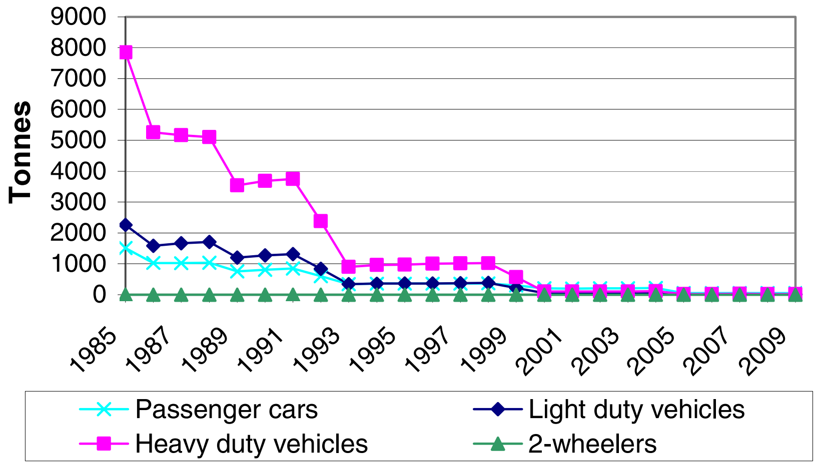


Figure 3.61 SO_2 emissions (tonnes) pr vehicle type for road transport 1985-2009.

Historically, the emission totals of NMVOC and CO have been very dominated by the contributions coming from private cars, as shown in Figures 3.63- 3.64. However, the NMVOC and CO (and NO_x) emissions from this vehicle type have shown a steady decreasing tendency since the introduction of private catalyst cars in 1990 (EURO I) and the introduction of even more emission-efficient EURO II, III and IV private cars (introduced in 1997, 2001 and 2006, respectively).

In the case of NO_x, the real traffic emissions for heavy duty vehicles do not follow the reductions as intended by the EU emission legislation. This is due to the so-called engine cycle-beating effect. Outside the legislative test cycle stationary measurement points, the electronic engine control for heavy duty Euro II and III engines switches to a fuel efficient engine running mode, thus leading to increasing NO_x emissions (Figure 3.62).

Exhaust particulate emissions from road transportation vehicles are well below $PM_{2.5}$. The emissions from light- and heavy-duty vehicles have significantly decreased since the mid-1990s due to gradually stricter EURO emission standards. The environmental benefit of introducing diesel private cars with lower particulate emissions since 1990 is more than outbalanced by an increase in sales of new vehicles in recent years (Figure 3.65).

An undesirable environmental side effect of the introduction of catalyst cars is the increase in the emissions of NH_3 from the first two generations of catalyst cars (Euro I and II) compared to conventional cars. The emission factors for later catalytic converter technologies are considerably lower than the ones for Euro I and II, thus causing the emissions to decrease from 2001 onwards (Figure 3.63).

The 2009 emission shares for heavy-duty vehicles, passenger cars, light-duty vehicles and 2-wheelers for NO_x (60, 28, 12 and 0 %), NMVOC (8, 64, 7 and 21 %), CO (6, 75, 7, 12 %), PM (37, 30, 31 and 2 %) and NH_3 (1, 95, 4 and 0 %), are also shown in Figure 3.67.

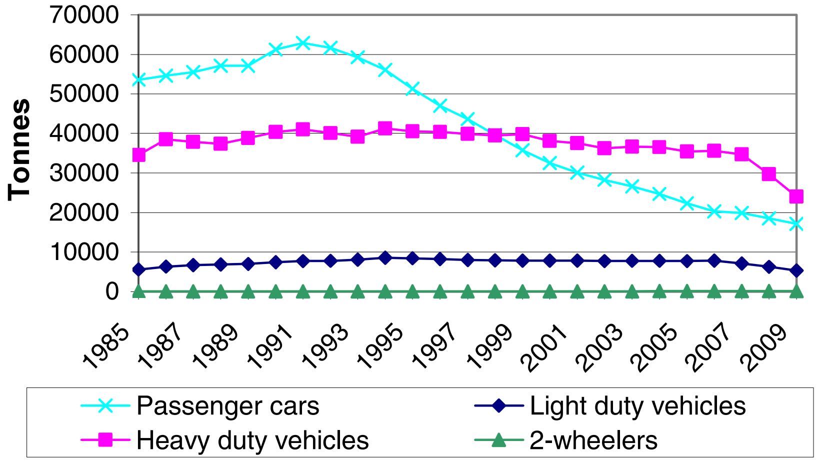


Figure 3.62 NO_X emissions (tonnes) pr vehicle type for road transport 1985-2009.

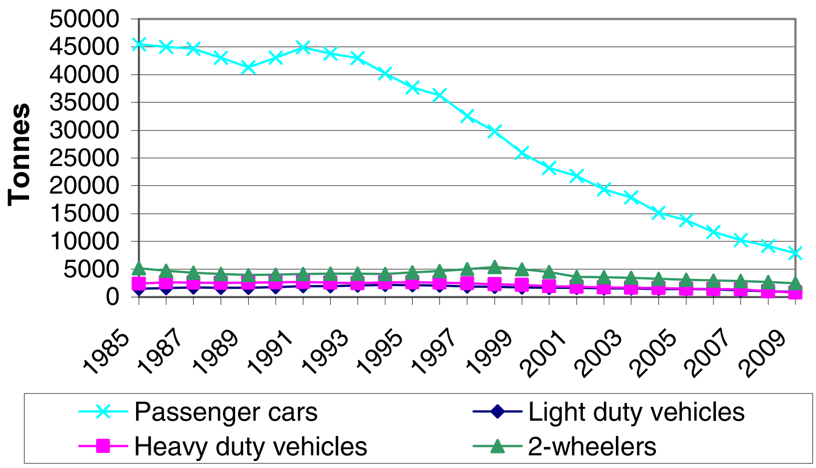


Figure 3.63 NMVOC emissions (tonnes) pr vehicle type for road transport 1985-2009.

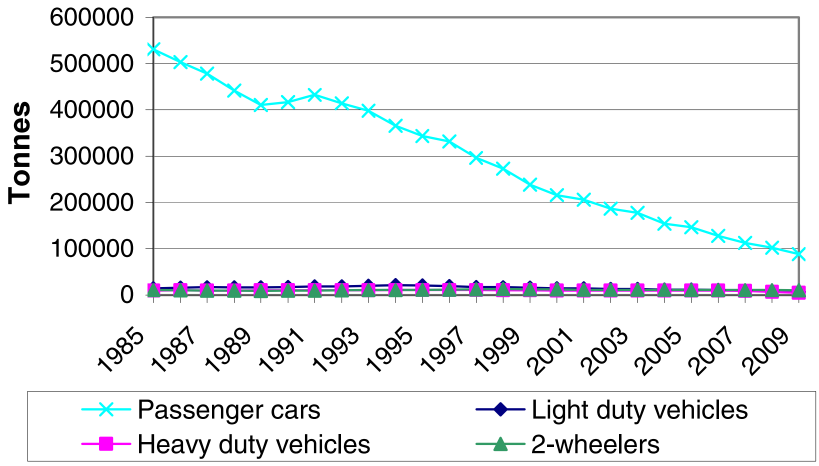


Figure 3.64 CO emissions (tonnes) pr vehicle type for road transport 1985-2009.

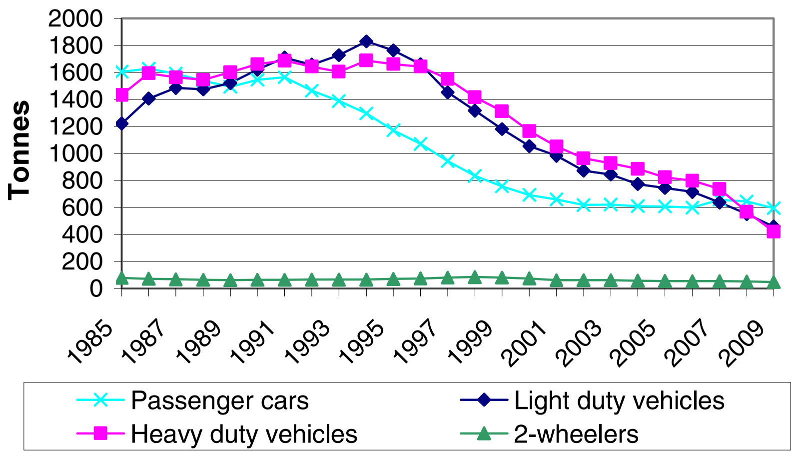


Figure 3.65 PM emissions (tonnes) pr vehicle type for road transport 1985-2009.

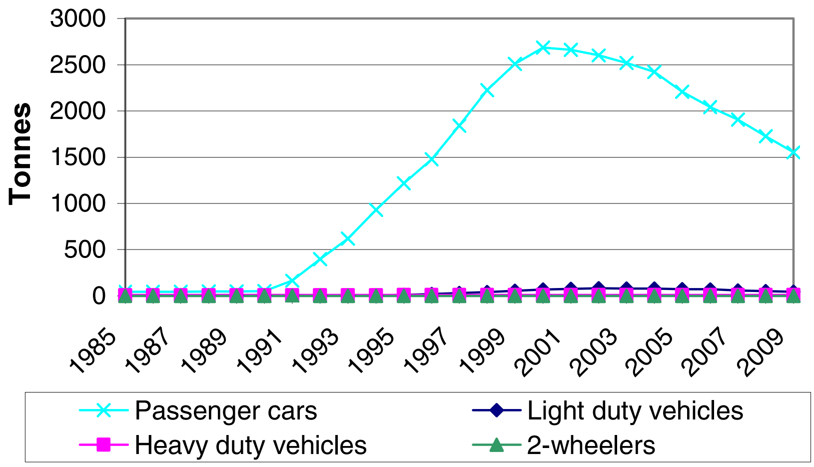


Figure 3.66 NH_3 emissions (tonnes) pr vehicle type for road transport 1985-2009.

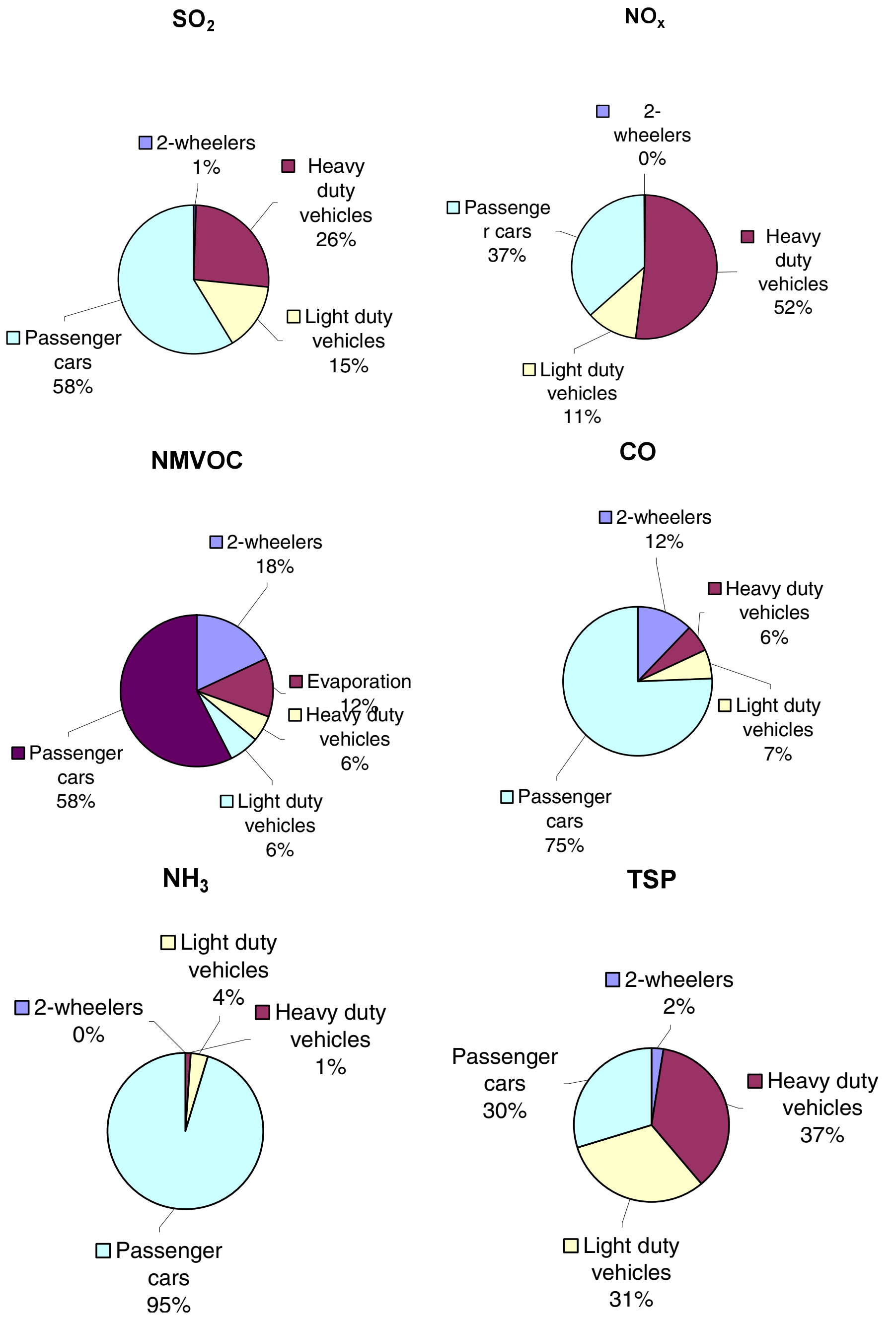


Figure 3.67 SO_2, NO_X, NMVOC, CO, NH_3 and PM emission shares pr vehicle type for road transport in 2009.

Other mobile sources

For SO_2 the trends in the Navigation (1A3d) emissions shown in Figure 3.68 mainly follow the development of the heavy fuel consumption (Figure 3.58). Though, from 1993 to 1995 relatively higher contents of sulphur in the fuel (estimated from sales) cause a significant increase in the emissions of SO_2. The SO_2 emissions for Fisheries (1A4c) correspond with the development in the consumption of marine gas oil. The main explanation for the development of the SO_2 emission curves for Railways (1A3c) and non-road machinery in Agriculture/forestry (1A4c) and Industry (1A2f), are the stepwise sulphur content reductions for diesel used by machinery in these sectors.

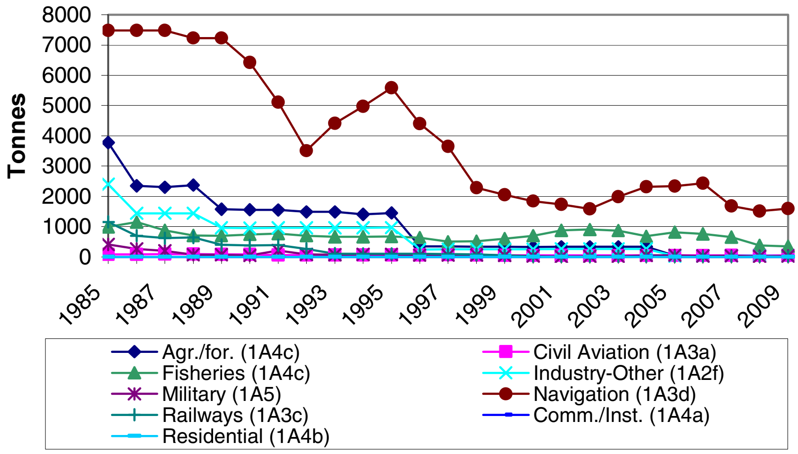


Figure 3.68 SO_2 emissions (k-tonnes) in NFR sectors for other mobile sources 1985-2009.

In general, the emissions of NO_X, NMVOC and CO from diesel-fuelled working equipment and machinery in agriculture, forestry and industry have decreased slightly since the end of the 1990s due to gradually strengthened emission standards given by the EU emission legislation directives. For industry, the emission impact from the global financial crisis becomes very visible for 2009.

NO_X emissions mainly come from diesel machinery, and the most important sources are Agriculture/forestry/fisheries (1A4c), Industry (1A2f), Navigation (1A3d) and Railways (1A3c), as shown in Figure 3.67. The 2009 emission shares are 49, 22, 20 and 6 %, respectively (Figure 3.70). Minor emissions come from the sectors, Civil Aviation (1A3a), Military (1A5) and Residential (1A4b).

The NO_X emission trend for Navigation, Fisheries and Agriculture is determined by fuel use fluctuations for these sectors, and the development of emission factors. For ship engines the emission factors tend to increase for new engines until mid-1990s. After that, the emission factors gradually reduce until 2000, bringing them to a level comparable with the emission limits for new engines in this year. For agricultural machines, there have been somewhat higher NO_x emission factors for 1991-stage I machinery, and an improved emission performance for stage I and II machinery since the late 1990s.

The emission development from 1985 to 2008 for industry NO_x is the product of a fuel consumption increase, most pronounced from 2005-2008, and a development in emission factors as explained for agricultural machinery. For railways, the gradual shift towards electrification explains the declining trend in diesel fuel use and NO_X emissions for this transport sector until 2001.

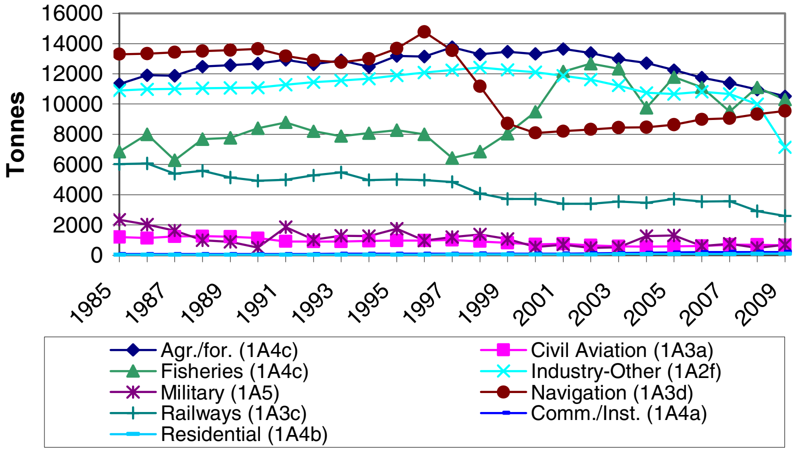


Figure 3.69 NO_X emissions (tonnes) in NFR sectors for other mobile sources 1985-2009.

The 1985-2009 time-series of NMVOC and CO emissions are shown in Figures 3.68 and 3.69 for other mobile sources. The 2009 sector emission shares are shown in Figure 3.74. For NMVOC, the most important sectors are Commercial/Institutional (1A4a), Agriculture/forestry/-fisheries (1A4c), Residential (1A4b), Industry (1A2f) and Navigation (1A3d), with 2009 emission shares of 44, 21, 17, 8 and 8 %, respectively. The same five sectors also contribute with most of the CO emissions. For Commercial/Institutional (1A4a), Residential (1A4b), Agriculture/forestry/fisheries (1A4c), Navigation (1A3d) and Industry (1A2f) the emission shares are 55, 20, 15 13, 5 and 4 %, respectively. Minor NMVOC and CO emissions come from Railways (1A3c), Civil Aviation (1A3a) and Military (1A5).

For NMVOC and CO, the significant emission increases for the comercial/institutional and residential sectors after 2000 are due to the increased number of gasoline working machines. Improved NMVOC emission factors for diesel machinery in agriculture and gasoline equipment in forestry (chain saws) are the most important explanations for the NMVOC emission decline in the Agriculture/forestry/fisheries sector. This explanation also applies for the industrial sector, which is dominated by diesel-fuelled machinery. From 1997 onwards, the NMVOC emissions from Navigation decrease due to the gradually phase-out of the 2-stroke engine technology for recreational craft. The main reason for the significant 1985-2006 CO emission decrease for Agriculture/forestry-/fisheries is the phasing out of gasoline tractors.

As shown in Figure 3.74, for other mobile sources the largest TSP contributors in 2009 are Agriculture/forestry/fisheries (1A4c), Industry (1A2f) and Navigation (1A3d), with emission shares of 47, 28 and 16 %, respectively. The remaining sectors: Railways (1A3c), Civil aviation (1A3a), Military (1A5) and Residential (1A4b) represent only minor emission sources.

The 1985-2009 TSP emissions for navigation and fisheries are determined by the fuel use fluctuations in these years, and the development of the emission factors, which to a major extent is a function of the fuel sulphur content. The emission development for Agriculture/forestry is determined by the generally decreasing total diesel fuel consumption and gradually reducing emission factors over the time period.

The TSP emission development for industrial non-road machinery is the product of a fuel consumption increase from 1985 to 2008 and a development in emission factors, as explained for agricultural machinery. The TSP emission explanations for railways are the same as for NO_x (Figure 3.69).

The amounts of NH_3 emissions calculated for other mobile sources are very small. The largest emission sources are Agriculture-/forestry/fisheries (1A4c), Industry (1A2f), Railways (1A3c) and Military (1A5), with emission shares of 49, 26, 8 and 8 %, respectively.

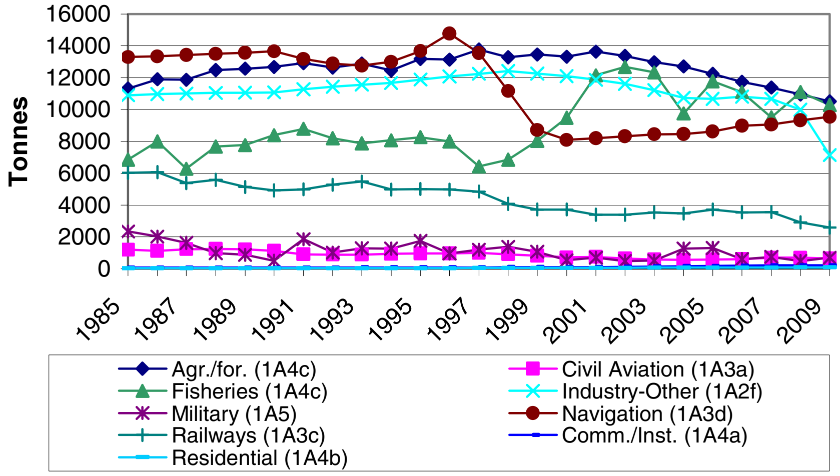


Figure 3.70 NMVOC emissions (tonnes) in NFR sectors for other mobile sources 1985-2009.

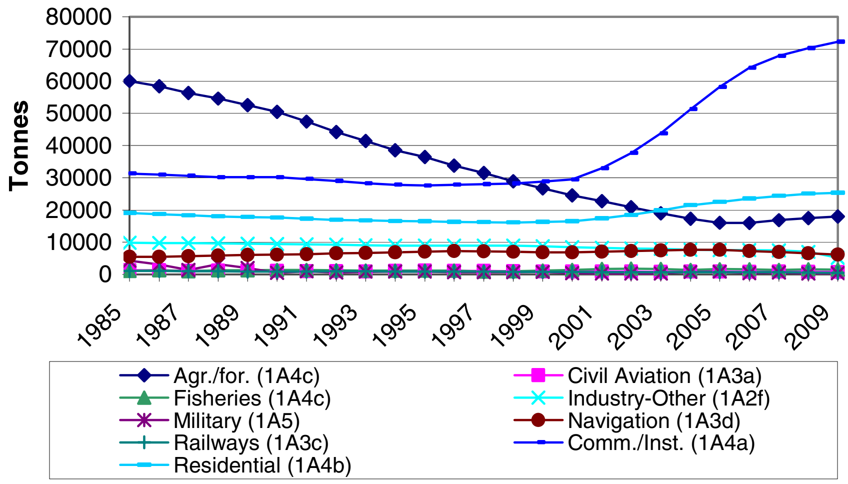


Figure 3.71 CO emissions (tonnes) in NFR sectors for other mobile sources 1985-2009.

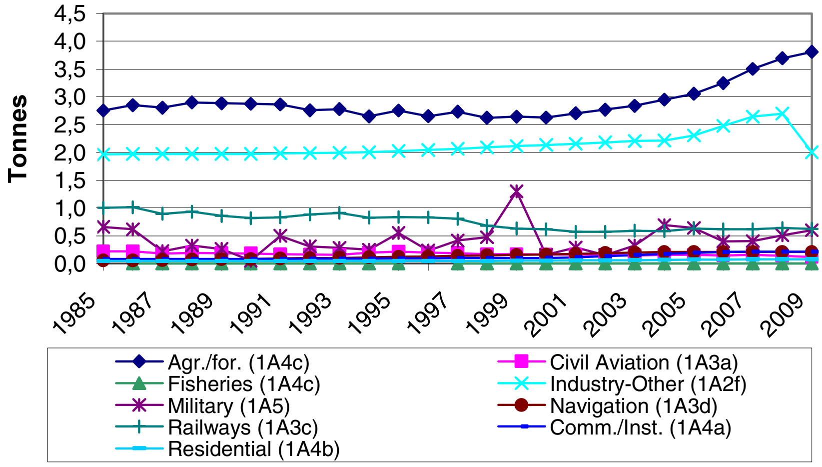


Figure 3.72 NH_3 emissions (tonnes) in NFR sectors for other mobile sources 1985-2009.

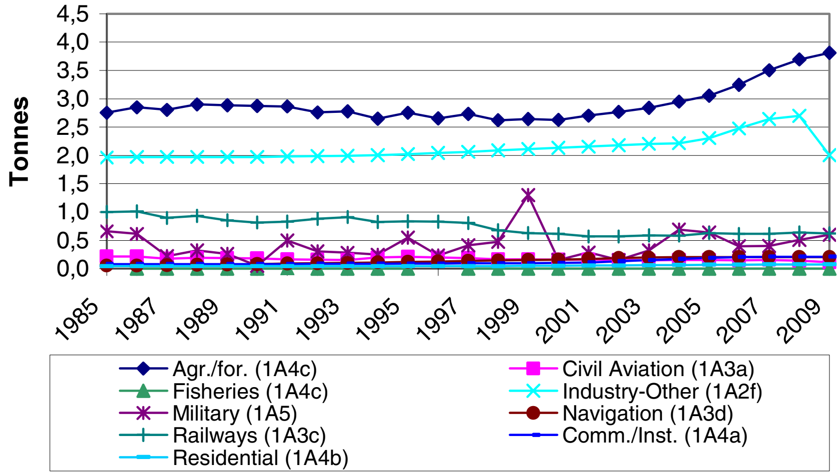


Figure 3.73 TSP emissions (tonnes) in NFR sectors for other mobile sources 1985-2009.

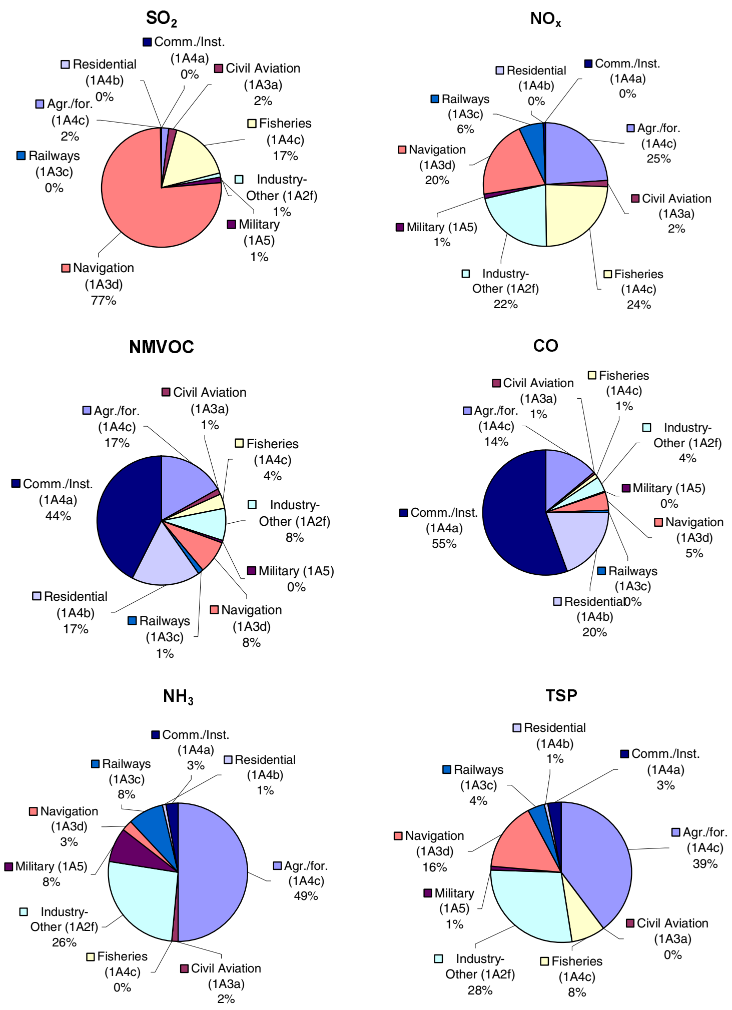


Figure 3.74 SO_2, NO_X, NMVOC, CO, NH_3 and PM emission shares pr vehicle type for other mobile sources in 2009.

Non-exhaust emissions of TSP, PM_{10} and $PM_{2.5}$

Apart from the exhaust emission estimates of particulate matter (PM), the Danish emission inventories also comprise the non-exhaust PM emissions coming from road transport brake and tyre wear, and road abrasion.

In Table 3.23, the non-exhaust TSP, PM_{10} and $PM_{2.5}$ emissions for road transport are shown for 2009 in NFR sectors. The activity data, emission factors are also shown in Annex 2.B.14.

Table 3.23 Emissions of TSP, PM_{10} and $PM_{2.5}$ in 2009 from road transport and other mobile sources.

NFR Sector	TSP	PM_{10}	$PM_{2.5}$
	tonnes	tonnes	tonnes
Road brake wear	848	509	356
Road tyre wear	564	553	220
Road abrasion	1 033	517	279
Total Road non-exhaust	2 445	1 578	855

The respective source category distributions for TSP, PM_{10} and $PM_{2.5}$ emissions are identical for each of the non-exhaust emission type's brake wear, tyre wear and road abrasion, and, hence, only the PM_{10} distributions are shown in Figure 3.75. Passenger cars caused the highest emissions in 2009, followed by trucks, light-duty vehicles, buses and 2-wheelers.

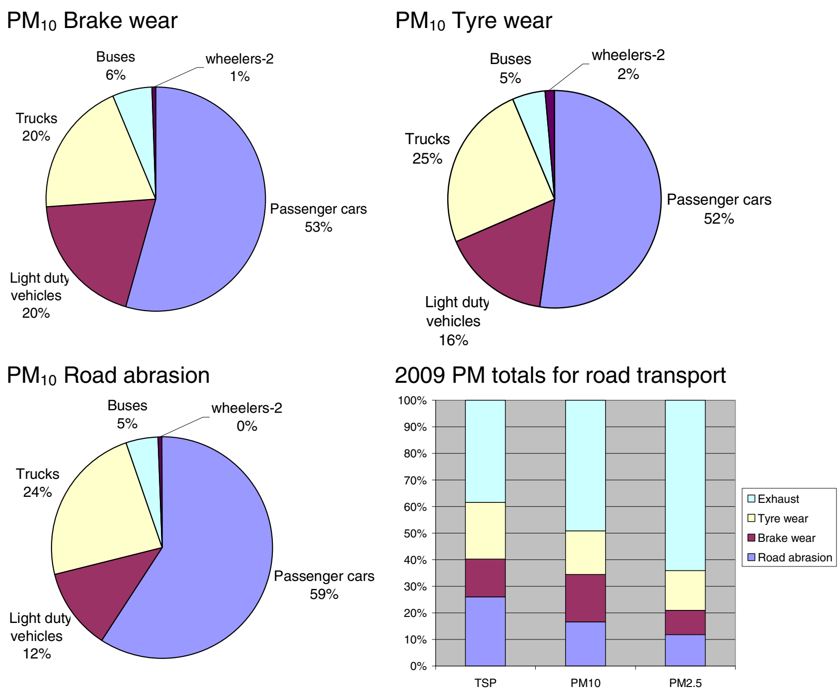


Figure 3.75 Brake and tyre wear and road abrasion PM_{10} emission shares and PM exhaust/non-exhaust distributions for road traffic in 2009.

Figure 3.75 also shows the exhaust/non-exhaust distribution of the total particulate emissions from road transport, for each of the size classes TSP, PM_{10} and $PM_{2.5}$. The exhaust emission shares of total road transport TSP, PM_{10} and $PM_{2.5}$ are 38, 49 and 64 %, respectively, in 2009. For brake and tyre wear and road abrasion the TSP shares are 14, 21 and 26 %, respectively. The same three sources have PM_{10} shares of 18, 16 and 17 %, respectively, and $PM_{2.5}$ shares of 9, 15 and 12 %, respectively. In general, the non-exhaust shares of total particulate emissions are expected to increase in the future as total exhaust emissions decline. The latter emission trend is due to the stepwise strengthening of exhaust emission standards for all vehicle types.

Heavy metals

In Table 3.24, the heavy metal emissions for road transport and other mobile sources are shown for 2009 in NFR sectors. The emission figures in the time-series 1990-2009 are given in Annex 2.B.15 (NFR format) and are shown for 1990 and 2009 in Annex 2.B.14 (CollectER format).

Table 3.24 Heavy metal emissions in 2009 for road transport and other mobile sources.

NFR Sector	As	Cd	Cr	Cu	Hg	Ni	Pb	Se	Zn
	kg	kg	kg	kg	kg	kg	kg	kg	kg
Industry-Other (1A2f)	0	2	7	5	1	2	12	0	411
Civil Aviation (1A3a)	0	0	0	0	0	0	991	0	4
Railways (1A3c)	0	1	2	1	0	1	3	0	116
Navigation (1A3d)	33	3	16	34	6	1 687	23	43	156
Comm./Inst. (1A4a)	0	1	1	2	0	1	2	0	121
Residential (1A4b)	0	0	0	1	0	0	1	0	44
Agric./forestry/fish. (1A4c)	9	5	18	17	11	16	37	35	744
Military (1A5)	0	0	1	1	0	0	66	0	42
Total other mobile	42	12	45	61	20	1 706	1 134	78	1 636
Road exhaust (1A3b)	1	35	89	111	25	39	161	1	7 052
Road Brake wear	1	2	3	13		22	68	17	9 273
Road Tyre wear	6	5	65	45 510		62	5 901	11	9 621
Road abrasion	0	0	21	10	0	16	49	0	78
Total Road non-exhaust	6	7	88	45 533	0	100	6 018	28	18 972
Total mobile	49	54	222	45 706	45	1 845	7 313	107	27 660

The heavy metal emission estimates for road transport are based on a national research study made by Winther and Slentø (2010). The latter study calculate the exhaust related emissions from fuel and engine oil as well as the wear related emissions from tyre, brake and road wear. Apart from Pb, the emission factors only deviate to a less extent due to changes in fleet and mileage composition over the years, which bring relative changes in fuel consumption per fuel type, engine oil use and aggregated emission factors for brake, tyre and road wear.

The most important exhaust related emissions for road transport are Cd, Cr, Hg and Zn. the most important wear related emissions are Cu and Pb almost solely coming from tyre wear, and Zn from brake and tyre wear. For other mobile sources, the most important emission contributions are calculated for Ni, Se and As, coming from the use of marine diesel oil in fisheries and navigation and residual oil in navigation.

The Figures 3.76 and 3.77 show the heavy metal emission distributions for all road transport sources split into vehicle categories, and for other mobile sectors, respectively.

For non road mobile machinery in agriculture, forestry, industry, commercial/institutional and recreational, as well as military and railways, fuel related emission factors from road transport are used derived for the year 2009.

For civil avation jet fuel no emissions are estimated due to lack of emission data, whereas for aviation gasoline fuel related emission factors for road transport gasoline is used derived for the year 2009, except for Pb where national data exist.

For navigation and fisheries, the heavy metal emission factors are fuel related, and are taken from the EMEP/EEA guidebook.

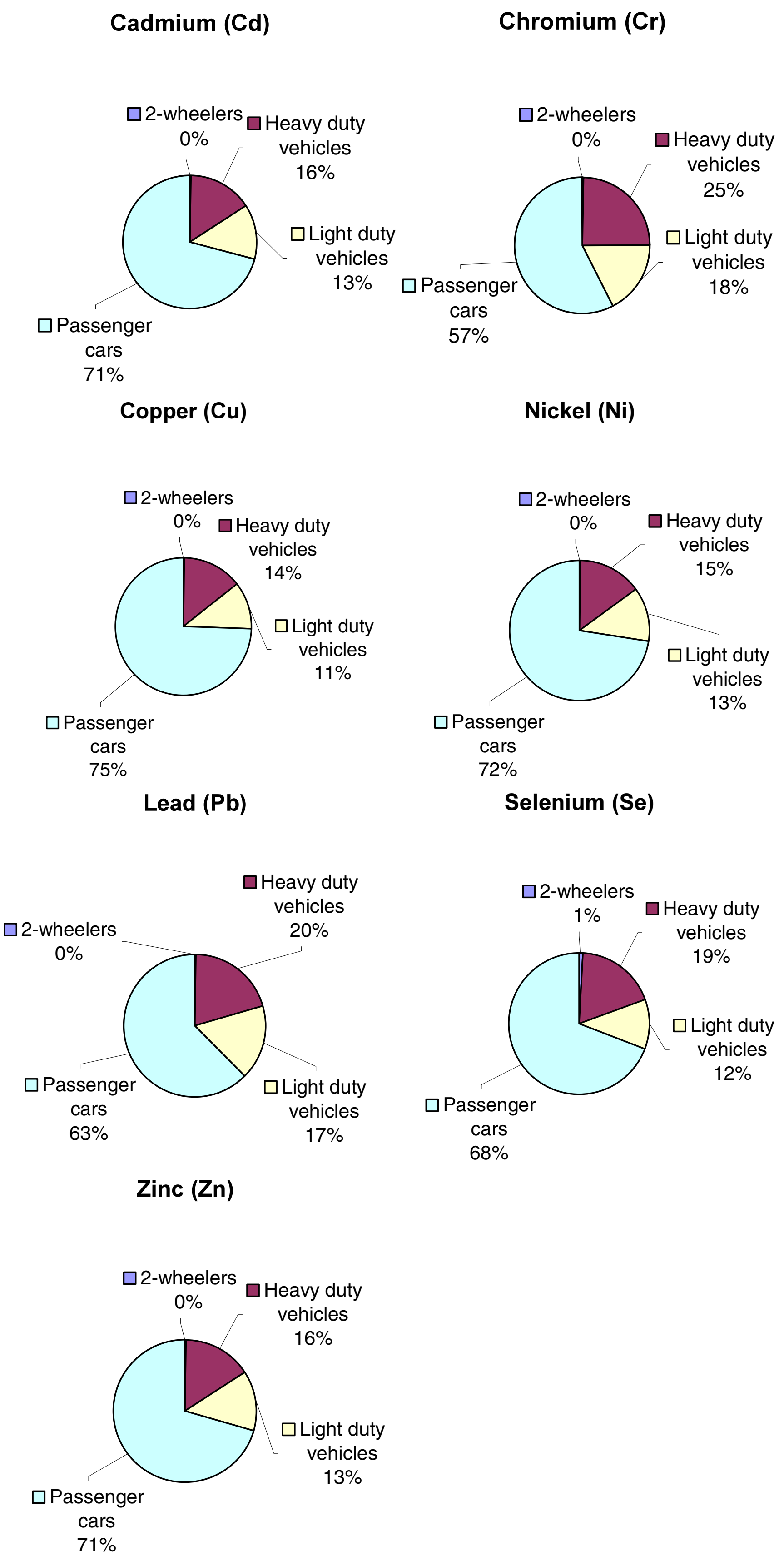


Figure 3.76 Heavy metal emission shares for road transport in 2009.

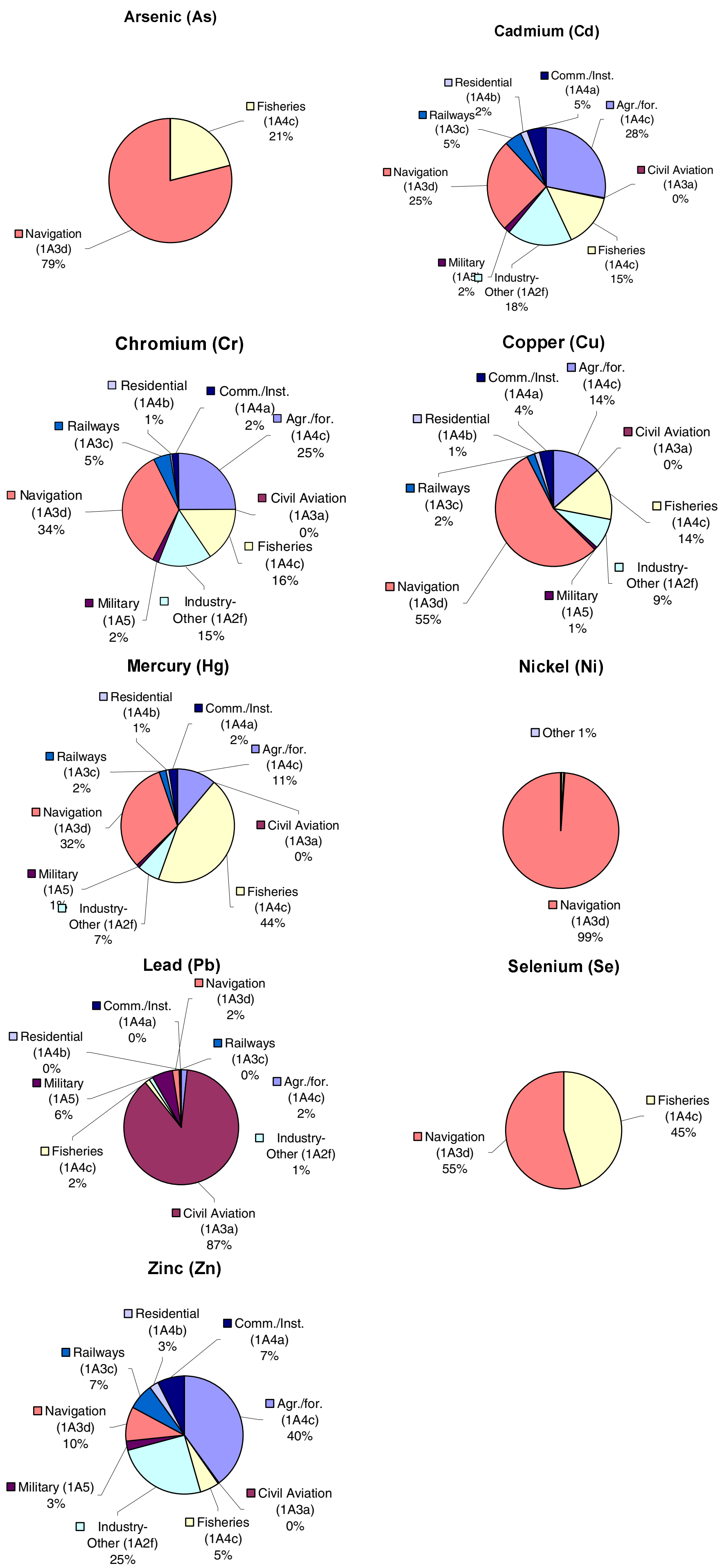


Figure 3.77 Heavy metal emission shares for other mobile sources in 2009.

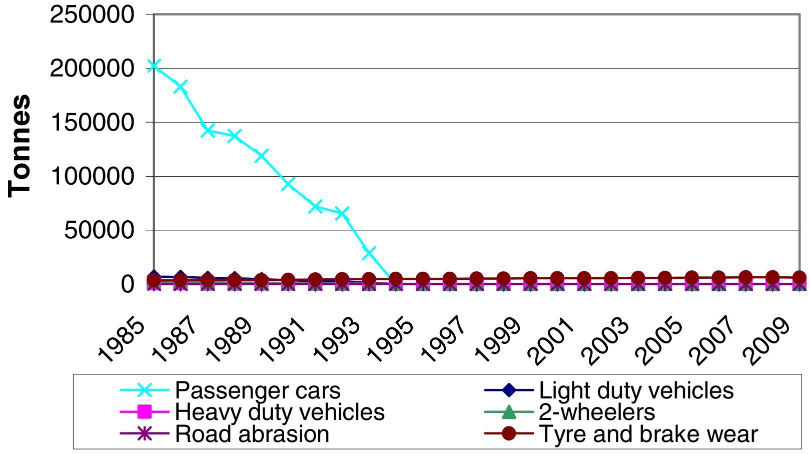


Figure 3.78 Pb emissions (kg) pr vehicle type for road transport 1985-2009.

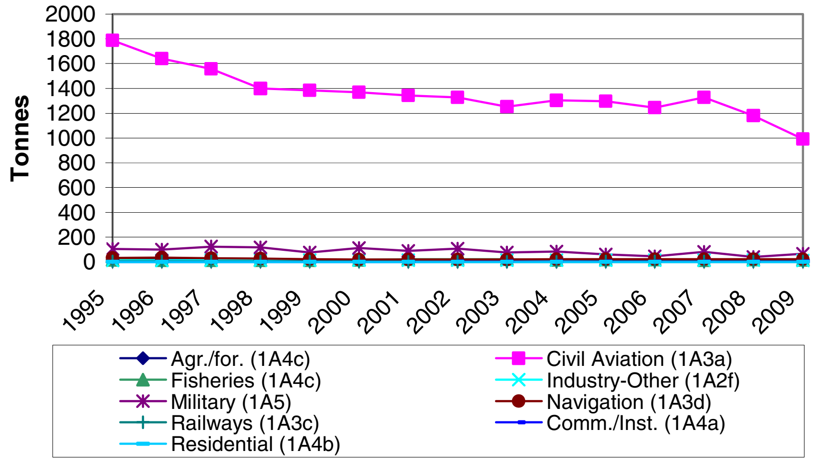


Figure 3.79 Pb emissions (kg) in NFR sectors for other mobile sources 1990-2009.

Dioxin and PAH

In Table 3.25, the dioxin and PAH emissions for road transport and other mobile sources are shown for 2009 in NFR sectors. The emission figures in the time-series 1990-2009 are given in Annex 2.B.15 (NFR format) and are shown for 1990 and 2009 in Annex 2.B.14 (CollectER format).

Table 3.25 Dioxin and PAH emissions in 2009 for road transport and other mobile sources.

NFR ID	Dioxins/ Furans	Flouran- thene	Benzo(b) flouran- thene	Benzo(k) flouran- thene	Benzo(a) pyrene	Benzo- (g,h,i) perylene	Indeno (1,2,3-c,d) pyrene
	g	kg	kg	kg	kg	kg	kg
Industry-Other (1A2f)	0.008	45	5	5	3	5	3
Civil Aviation (1A3a)	0.000	0	0	0	0	0	0
Railways (1A3c)	0.002	4	1	1	0	0	0
Navigation (1A3d)	0.085	50	4	2	1	7	6
Comm./Inst. (1A4a)	0.012	10	0	0	0	2	1
Residential (1A4b)	0.004	4	0	0	0	1	0
Agri./for./fish. (1A4c)	0.105	131	14	11	5	19	13
Military (1A5)	0.001	5	1	1	0	1	0
Total other mobile	0.218	250	25	20	10	34	23
Road (1A3b)	0.110	755	70	79	56	106	61
Total mobile	0.329	1005	95	99	66	140	84

For mobile sources, road transport displays the largest emission of dioxins and PAH. The dioxin emission share for road transport is 34 % of all mobile emissions in 2009, whereas Agriculture/forestry-/fisheries and Navigation have smaller shares of 32 and 26 %. For the different PAH components, road transport shares are around 80 % of total emissions for mobile sources. The remaining emissions almost solely come from Agriculture/forestry-/fisheries, Navigation and Industry with Agriculture/forestry/fisheries as the largest source.

Figures 3.80 and 3.81 show the dioxin and PAH emission distributions into vehicle categories and other mobile sectors, respectively.

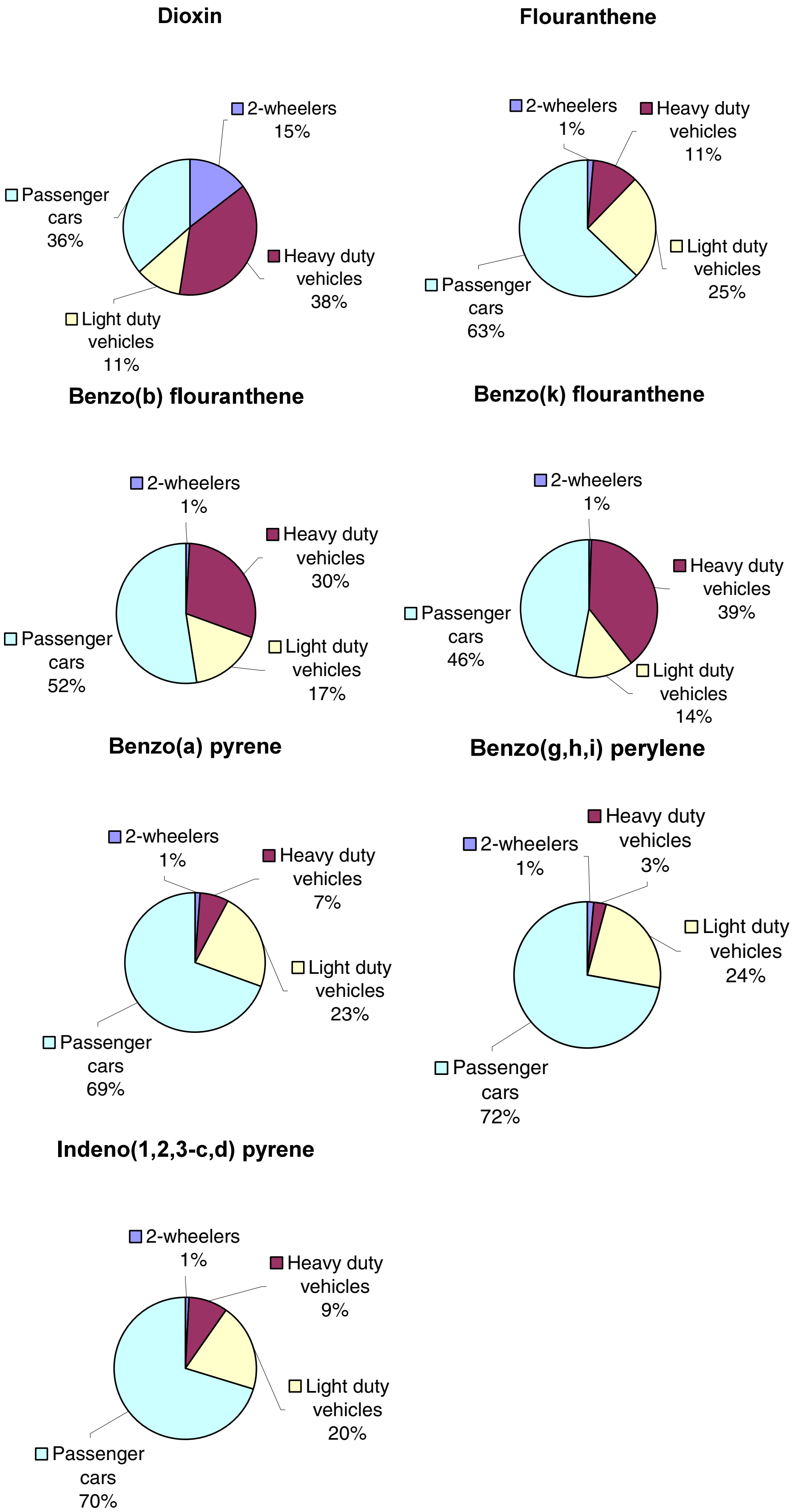


Figure 3.80 Dioxin and PAH emission shares for road transport in 2009.

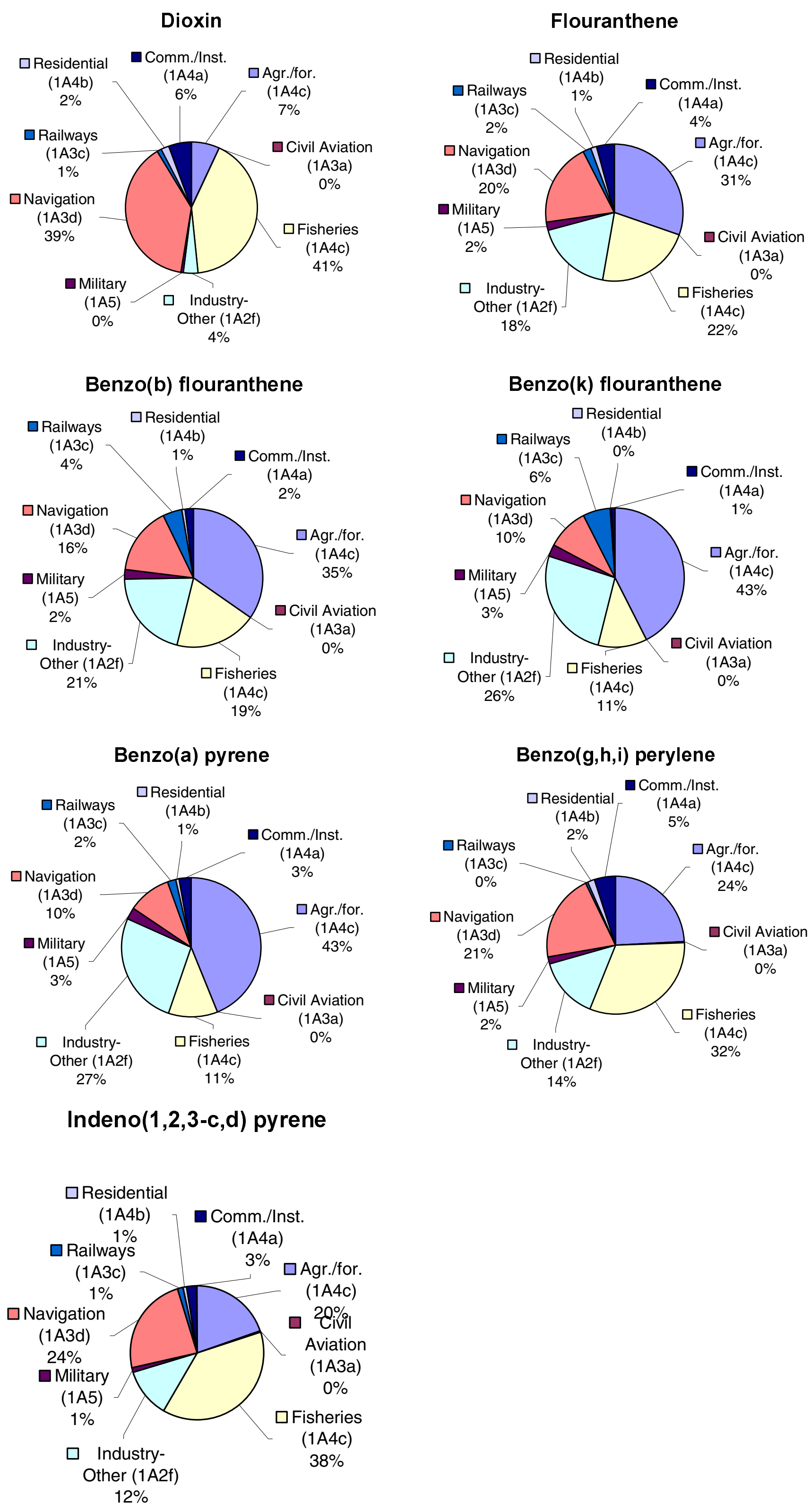


Figure 3.81 Dioxin and PAH emission shares for other mobile sources in 2009.

Bunkers

The most important emissions from bunker fuel use (fuel use for international transport) are SO_2, NOx and CO_2. However, compared with the Danish national emission total (all sources), the greenhouse gas emissions from bunkers are small. The bunker emission totals are shown in Table 3.26 for 2009, split into sea transport and civil aviation. All emission figures in the 1985-2009 time-series are given in Annex

2.B.16 (NFR format). In Annex 2.B.14, the emissions are also given in CollectER format for 2009.

Table 3.26 Emissions in 2009 for international transport.

CRF sector	SO_2	NO_X	NMVOC	CH_4	CO	CO_2	N_2O	NH_3	TSP
	tonnes	tonnes	tonnes	tonnes	tonnes	k-tonnes	tonnes	tonnes	tonnes
Navigation int. (1A3d)	7 383	35 658	1 160	3 826	1 487	94		820	7 383
Civil Aviation int. (1A3a)	739	9 854	503	1 791	2 314	79	0	37	739
International total	8 122	45 512	1 663	5 617	3 800	173	0	857	8 122

The differences in emissions between navigation and civil aviation are much larger than the differences in fuel consumption (and derived CO_2 emissions), and display a poor emission performance for international sea transport. In broad terms, the emission trends shown in Figure 3.82 are similar to the fuel-use development.

However, for navigation minor differences occur for the emissions of SO_2, NO_X and CO_2 due to varying amounts of marine gas oil and residual oil, and for SO_2 and NO_X the development in the emission factors also have an impact on the emission trends. For civil aviation, apart from the annual consumption of jet fuel, the development of the NO_X emissions is also due to yearly variations in LTO/aircraft type (earlier than 2001) and city-pair statistics (2001 onwards).

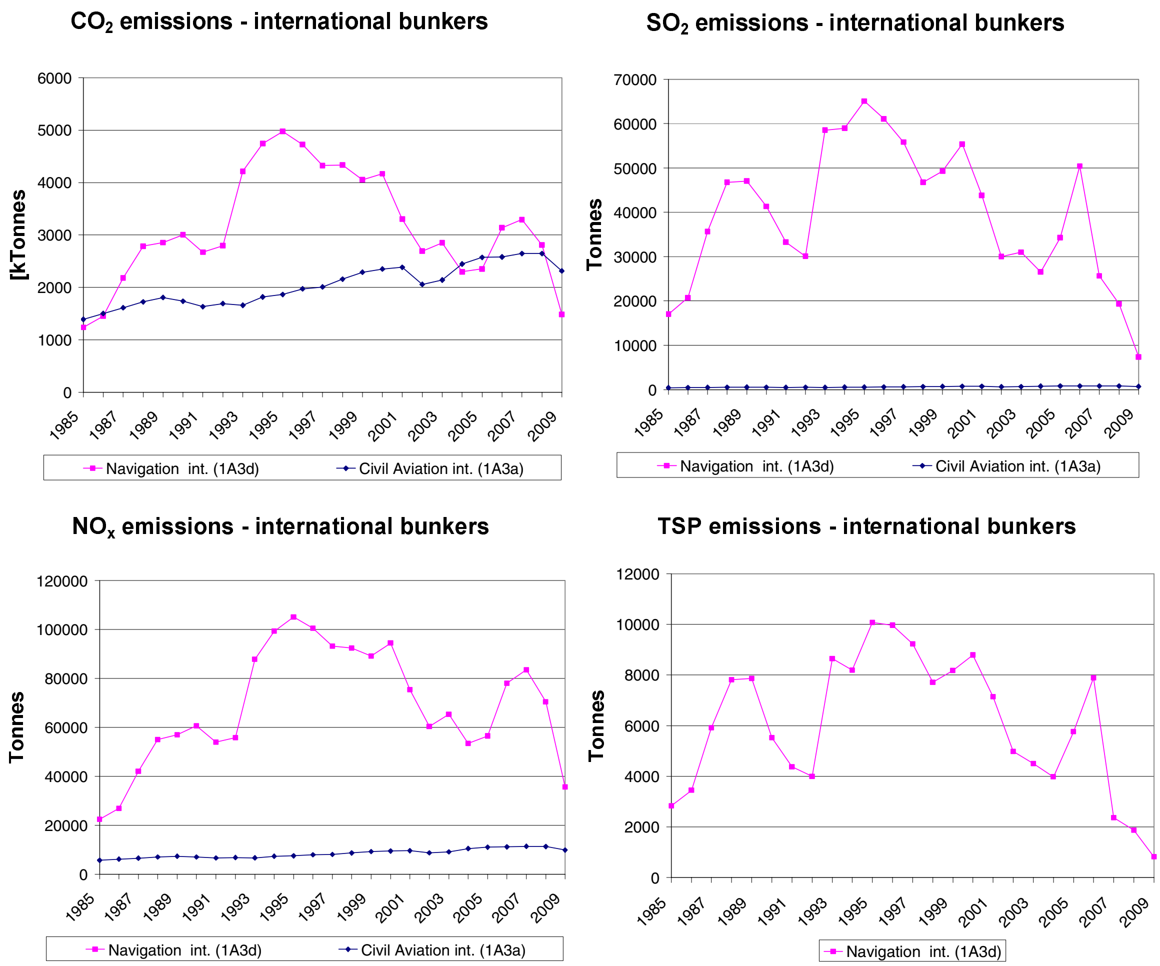


Figure 3.82 CO_2, SO_2, NO_X and TSP emissions for international transport 1985-2009.

3.3.2 Methodological issues

The description of methodologies and references for the transport part of the Danish inventory is given in two sections: one for road transport and one for the other mobile sources.

Methodology and references for Road Transport

For road transport, the detailed methodology is used to make annual estimates of the Danish emissions, as described in the EMEP/EEA Air Pollutant Emission Inventory Guidebook (EMEP/EEA, 2009). The actual calculations are made with a model developed by NERI, using the European COPERT IV model methodology explained by (EMEP/EEA, 2009). In COPERT, fuel use and emission simulations can be made for operationally hot engines, taking into account gradually stricter emission standards and emission degradation due to catalyst wear. Furthermore, the emission effects of cold-start and evaporation are simulated.

Vehicle fleet and mileage data

Corresponding to the COPERT IV fleet classification, all present and future vehicles in the Danish fleet are grouped into vehicle classes, sub-classes and layers. The layer classification is a further division of vehicle sub-classes into groups of vehicles with the same average fuel use and emission behaviour, according to EU emission legislation levels. Table 3.27 gives an overview of the different model classes and sub-classes, and the layer level with implementation years are shown in Annex 2.B.1.

Table 3.27 Model vehicle classes and sub-classes, trip speeds and mileage split.

			Trip speed [km pr h]		
Vehicle classes	Fuel type	Engine size/weight	Urban	Rural	Highway
PC	Gasoline	< 1.4 l.	40	70	100
PC	Gasoline	1.4 – 2 l.	40	70	100
PC	Gasoline	> 2 l.	40	70	100
PC	Diesel	< 2 l.	40	70	100
PC	Diesel	> 2 l.	40	70	100
PC	LPG		40	70	100
PC	2-stroke		40	70	100
LDV	Gasoline		40	65	80
LDV	Diesel		40	65	80
LDV	LPG		40	65	80
Trucks	Gasoline		35	60	80
Trucks	Diesel	Rigid 3,5 - 7,5t	35	60	80
Trucks	Diesel	Rigid 7,5 - 12t	35	60	80
Trucks	Diesel	Rigid 12 - 14 t	35	60	80
Trucks	Diesel	Rigid 14 - 20t	35	60	80
Trucks	Diesel	Rigid 20 - 26t	35	60	80
Trucks	Diesel	Rigid 26 - 28t	35	60	80
Trucks	Diesel	Rigid 28 - 32t	35	60	80
Trucks	Diesel	Rigid >32t	35	60	80
Trucks	Diesel	TT/AT 14 - 20t	35	60	80
Trucks	Diesel	TT/AT 20 - 28t	35	60	80
Trucks	Diesel	TT/AT 28 - 34t	35	60	80
Trucks	Diesel	TT/AT 34 - 40t	35	60	80
Trucks	Diesel	TT/AT 40 - 50t	35	60	80
Trucks	Diesel	TT/AT 50 - 60t	35	60	80
Trucks	Diesel	TT/AT >60t	35	60	80
Urban buses	Gasoline		30	50	70
Urban buses	Diesel	< 15 tonnes	30	50	70
Urban buses	Diesel	15-18 tonnes	30	50	70
Urban buses	Diesel	> 18 tonnes	30	50	70
Coaches	Gasoline		35	60	80
Coaches	Diesel	< 15 tonnes	35	60	80
Coaches	Diesel	15-18 tonnes	35	60	80
Coaches	Diesel	> 18 tonnes	35	60	80
Mopeds	Gasoline		30	30	-
Motorcycles	Gasoline	2 stroke	40	70	100
Motorcycles	Gasoline	< 250 cc.	40	70	100
Motorcycles	Gasoline	250 – 750 cc.	40	70	100
Motorcycles	Gasoline	> 750 cc.	40	70	100

To support the emission calculations a project has been carried out by DTU Transport, in order to provide fleet and annual mileage data for the vehicle categories present in COPERT IV (Jensen, 2009). The latter source also provides information of the mileage split between urban, rural and highway driving. The respective average speeds come from The Danish Road Directorate (Ekman, 2005). Additional data for the moped fleet and motorcycle fleet disaggregation information is given by The National Motorcycle Association (Markamp, 2009).

In addition new data prepared by DTU Transport for the Danish Infrastructure Commission has given information of the total mileage driven by foreign trucks on Danish roads. This mileage contribution has been added to the total mileage for Danish trucks on Danish roads, for trucks > 16 tonnes of gross vehicle weight. The data from DTU Transport was estimated for 2005, and by using appropriate assumptions the mileage have been backcasted to 1985 and forecasted to 2009.

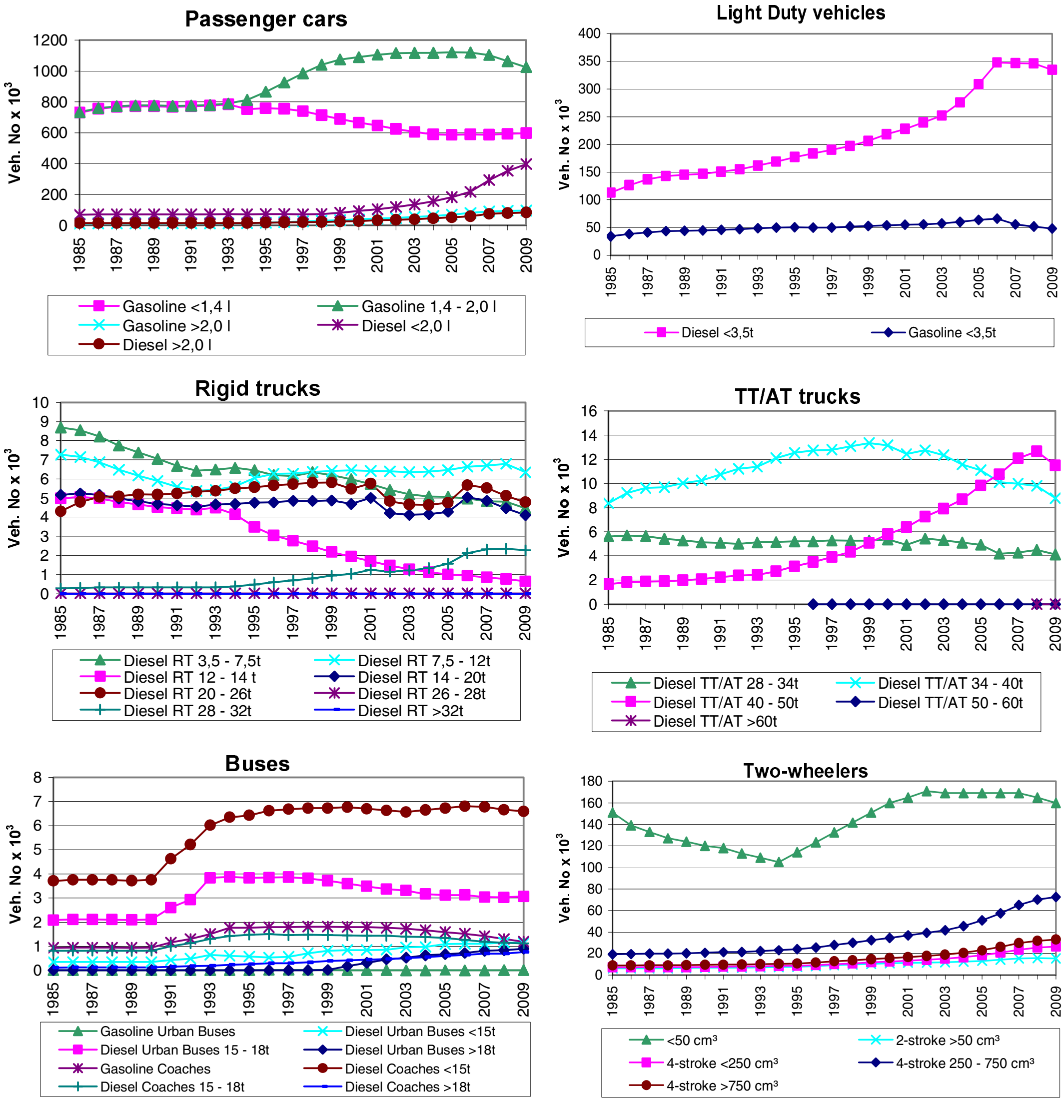


Figure 3.83 Number of vehicles in sub-classes in 1985-2009.

For passenger cars, the engine size differentiation is associated with some uncertainty. The increase in the total number of passenger cars is mostly due to a growth in the number of gasoline cars with engine sizes between 1.4 and 2 litres (from 1990-2002) and an increase in the number of gasoline cars (>2 litres) and diesel cars (< 2 litres). Until 2005, there has been a decrease in the number of cars with an engine size smaller than 1.4 litres.

There has been a considerable growth in the number of diesel light-duty vehicles from 1985 to 2006; the number of vehicles has however decreased somewhat after 2006.

For the truck-trailer and articulated truck combinations there is a tendency towards the use of increasingly larger trucks throughout the time period. The decline in fleet numbers for many of the truck categories in 2007/2008 and until 2009 is caused by the impact of the global financial crisis and the reflagging of Danish commercial trucks to companies based in the neighbouring countries.

The number of urban buses has been almost constant between 1985 and 2009. The sudden change in the level of coach numbers from 1994 to 1995 is due to uncertain fleet data.

The reason for the significant growth in the number of mopeds from 1994 to 2002 is the introduction of the so-called Moped 45 vehicle type. For motorcycles, the number of vehicles has grown in general throughout the entire 1985-2009 period. The increase is, however, most visible from the mid-1990s and onwards.

The vehicle numbers are summed up in layers for each year (Figure 3.84) by using the correspondence between layers and first year of registration:

$$N_{j,y} = \sum_{i=FYear(j)}^{LYear(j)} N_{i,y} \qquad (1)$$

Where N = number of vehicles, j = layer, y = year, i = first year of registration.

Weighted annual mileages pr layer are calculated as the sum of all mileage driven pr first registration year divided by the total number of vehicles in the specific layer.

$$M_{j,y} = \frac{\sum_{i=FYear(j)}^{LYear(j)} N_{i,y} \cdot M_{i,y}}{\sum_{i=FYear(j)}^{LYear(j)} N_{i,y}} \qquad (2)$$

For heavy duty trucks, there is a slight deviation from the strict correspondence between EU emission layers and first registration year.

In this case, specific Euro class information for most of the vehicles from 2001 onwards is incorporated into the fleet and mileage data model developed by Jensen et al. (2009). For inventory years before 2001, and for vehicles with no Euro information the normal correspondence between layers and first year of registration is used.

Vehicle numbers and weighted annual mileages pr layer are shown in Annex 2.B.1 and 3.B.2 for 1985-2009. The trends in vehicle numbers pr layer are also shown in Figure 3.84. The latter figure shows how vehicles complying with the gradually stricter EU emission levels (EURO I, II, III, IV etc.) have been introduced into the Danish motor fleet.

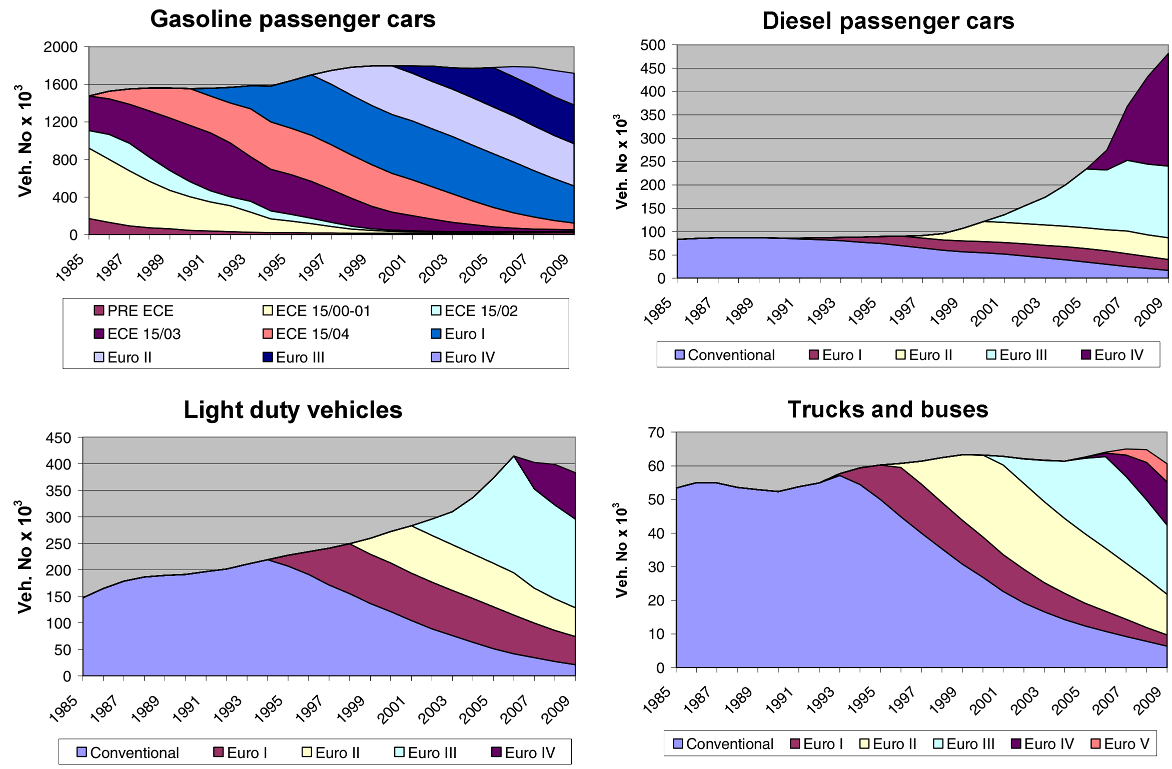


Figure 3.84 Layer distribution of vehicle numbers pr vehicle type in 1985-2009.

Emission legislation

For Euro 1-4 passenger cars and light duty trucks, the chassis dynamometer test cycle used in the EU for emission approval is the NEDC (New European Driving Cycle), see Nørgaard and Hansen (2004). The test cycle is also used also for fuel use measurements. The NEDC cycle consists of two parts, the first part being a 4-time repetition (driving length: 4 km) of the ECE test cycle. The latter test cycle is the so-called urban driving cycle[6] (average speed: 19 km pr h). The second part of the test is the run-through of the EUDC (Extra Urban Driving Cycle) test driving segment, simulating the fuel use under rural and highway driving conditions. The driving length of EUDC is 7 km at an average speed of 63 km pr h. More information regarding the fuel measurement procedure can be found in the EU-directive 80/1268/EØF.

For NO_x, VOC ($NMVOC + CH_4$), CO and PM, the emissions from road transport vehicles have to comply with the different EU directives listed in Table 3.28. The emission directives distinguish between three vehicle classes according to vehicle reference mass[7]: Passenger cars and light duty trucks (<1305 kg), light duty trucks (1305-1760 kg) and light duty trucks (>1760 kg).The specific emission limits are shown in Annex 2.B.3.

In practice, the emissions from vehicles in traffic are different from the legislation limit values and, therefore, the latter figures are considered to be too inaccurate for total emission calculations. A major constraint is that the emission approval test conditions reflect only to a small degree the large variety of emission influencing factors in the real traffic situa-

[6] For Euro 3 and on, the emission approval test procedure was slightly changed. The 40 s engine warm up phase before start of the urban driving cycle was removed.
[7] Reference mass: net vehicle weight + mass of fuel and other liquids + 100 kg.

tion, such as cumulated mileage driven, engine and exhaust after treatment maintenance levels and driving behaviour.

Therefore, in order to represent the Danish fleet and to support average national emission estimates, emission factors must be chosen which derive from numerous emissions measurements, using a broad range of real world driving patterns and a sufficient number of test vehicles. It is similar important to have separate fuel use and emission data for cold-start emission calculations and gasoline evaporation (hydrocarbons).

For heavy-duty vehicles (trucks and buses), the emission limits are given in g pr kWh and the measurements are carried out for engines in a test bench, using the EU ESC (European Stationary Cycle) and ETC (European Transient Cycle) test cycles, depending on the Euro norm and exhaust gas after-treatment system installed. A description of the test cycles is given by Nørgaard and Hansen, 2004). Measurement results in g pr kWh from emission approval tests cannot be directly used for inventory work. Instead, emission factors used for national estimates must be transformed into g pr km, and derived from a sufficient number of measurements which represent the different vehicle size classes, Euro engine levels and real world variations in driving behaviour.

In terms of the sulphur content in the fuels used by road transportation vehicles, the EU directive 2003/17/EF describes the fuel quality standards agreed by the EU. In Denmark, the sulphur content in gasoline and diesel was reduced to 10 ppm in 2005, by means of a fuel tax reduction for fuels with 10 ppm sulphur contents.

Table 3.28 Overview of the existing EU emission directives for road transport vehicles.

Vehicle category	Emission layer	EU directive	First reg. date
Passenger cars (gasoline)	PRE ECE		0
	ECE 15/00-01	70/220 - 74/290	1972[a]
	ECE 15/02	77/102	1981[b]
	ECE 15/03	78/665	1982[c]
	ECE 15/04	83/351	1987[d]
	Euro I	91/441	1.10.1990[e]
	Euro II	94/12	1.1.1997
	Euro III	98/69	1.1.2001
	Euro IV	98/69	1.1.2006
	Euro V	715/2007	1.1.2011
	Euro VI	715/2007	1.9.2015
Passenger cars (diesel and LPG)		Conventional	0
	ECE 15/04	83/351	1987[d]
	Euro I	91/441	1.10.1990[e]
	Euro II	94/12	1.1.1997
	Euro III	98/69	1.1.2001
	Euro IV	98/69	1.1.2006
	Euro V	715/2007	1.1.2011
	Euro VI	715/2007	1.9.2015
Light duty trucks (gasoline and diesel)		Conventional	0
	ECE 15/00-01	70/220 - 74/290	1972[a]
	ECE 15/02	77/102	1981[b]
	ECE 15/03	78/665	1982[c]
	ECE 15/04	83/351	1987[d]
	Euro I	93/59	1.10.1994
	Euro II	96/69	1.10.1998
	Euro III	98/69	1.1.2002
	Euro IV	98/69	1.1.2007
	Euro V	715/2007	1.1.2012
	Euro VI	715/2007	1.9.2016
Heavy duty vehicles	Euro 0	88/77	1.10.1990
	Euro I	91/542	1.10.1993
	Euro II	91/542	1.10.1996
	Euro III	1999/96	1.10.2001
	Euro IV	1999/96	1.10.2006
	Euro V	1999/96	1.10.2009
	Euro VI	595/2009	1.10.2014
Mopeds		Conventional	0
	Euro I	97/24	2000
	Euro II	2002/51	2004
Motor cycles		Conventional	0
	Euro I	97/24	2000
	Euro II	2002/51	2004
	Euro III	2002/51	2007

a,b,c,d: Expert judgement suggest that Danish vehicles enter into the traffic before EU directive first registration dates. The effective inventory starting years are a: 1970; b: 1979; c: 1981; d: 1986.
e: The directive came into force in Denmark in 1991 (EU starting year: 1993).

Fuel consumption and emission factors

Trip-speed dependent basis factors for fuel consumption and emissions are taken from the COPERT model using trip speeds as shown in Table 3.27. The factors are listed in Annex 2.B.4. For EU emission levels not represented by actual data, the emission factors are scaled according to the reduction factors given in Annex 2.B.5.

The fuel consumption and emission factors used in the Danish inventory come from the COPERT IV model. The scientific basis for COPERT IV is fuel consumption and emission information from the European 5th framework research projects ARTEMIS and Particulates. In cases where no updates are made for vehicle categories and fuel consumption/emission components, COPERT IV still uses COPERT III data; the source for these data are various European measurement programmes. In general the COPERT data are transformed into trip-speed dependent fuel consumption and emission factors for all vehicle categories and layers.

For passenger cars, real measurement results are behind the emission factors for Euro 1-4 vehicles (updated figures), and those earlier (COPERT III data). For light duty trucks the measurements represent Euro 1 and prior vehicle technologies from COPERT III. For mopeds and motorcycles, updated fuel consumption and emission figures are behind the conventional and Euro 1-3 technologies.

The experimental basis for heavy-duty trucks and buses is updated computer simulated emission factors for Euro 0-V engines.

For all vehicle categories/technology levels not represented by measurements, the emission factors are produced by using reduction factors. The latter factors are determined by assessing the EU emission limits and the relevant emission approval test conditions, for each vehicle type and Euro class.

Deterioration factors

For three-way catalyst cars the emissions of NO_X, NMVOC and CO gradually increase due to catalyst wear and are, therefore, modified as a function of total mileage by the so-called deterioration factors. Even though the emission curves may be serrated for the individual vehicles, on average, the emissions from catalyst cars stabilise after a given cut-off mileage is reached due to OBD (On Board Diagnostics) and the Danish inspection and maintenance programme.

For each forecast year, the deterioration factors are calculated pr first registration year by using deterioration coefficients and cut-off mileages, as given in EMEP/EEA (2009), for the corresponding layer. The deterioration coefficients are given for the two driving cycles: ”Urban Driving Cycle” (UDF) and ”Extra Urban Driving Cycle” (EUDF: urban and rural), with trip speeds of 19 and 63 km pr h, respectively.

Firstly, the deterioration factors are calculated for the corresponding trip speeds of 19 and 63 km pr h in each case determined by the total cumulated mileage less than or exceeding the cut-off mileage. The Formulas 3 and 4 show the calculations for the ”Urban Driving Cycle”:

$$UDF = U_A \cdot MTC + U_B \text{ , MTC < U}_{\text{MAX}} \tag{3}$$

$$UDF = U_A \cdot U_{MAX} + U_B \text{ , MTC >= U}_{\text{MAX}} \tag{4}$$

where UDF is the urban deterioration factor, U_A and U_B the urban deterioration coefficients, MTC = total cumulated mileage and U_{MAX} urban cut-off mileage.

In the case of trip speeds below 19 km pr h the deterioration factor, DF, equals UDF, whereas for trip speeds exceeding 63 km pr h, DF=EUDF. For trip speeds between 19 and 63 km pr h the deterioration factor, DF, is found as an interpolation between UDF and EUDF. Secondly, the deterioration factors, one for each of the three road types, are aggregated into layers by taking into account vehicle numbers and annual mileage levels pr first registration year:

$$DF_{j,y} = \frac{\sum_{i=FYear(j)}^{LYear(j)} DF_{i,y} \cdot N_{i,y} \cdot M_{i,y}}{\sum_{i=FYear(j)}^{LYear(j)} DF_{i,y} \cdot N_{i,y}} \tag{5}$$

where DF is the deterioration factor.

For N_2O and NH_3, COPERT IV takes into account deterioration as a linear function of mileage for gasoline fuelled EURO 1-4 passenger cars and light duty vehicles. The level of emission deterioration also relies on the content of sulphur in the fuel. The deterioration coefficients are given in EMEP/EEA (2009), for the corresponding layer. A cut-off mileage of 120.000 km (pers. comm. Ntziachristos, 2007) is behind the calculation of the modified emission factors, and for the Danish situation the low sulphur level interval is assumed to be most representative.

Emissions and fuel consumption for hot engines

Emissions and fuel-use results for operationally hot engines are calculated for each year and for layer and road type. The procedure is to combine fuel consumption and emission factors (and deterioration factors for catalyst vehicles), number of vehicles, annual mileage levels and the relevant road-type shares given in Table 3.27. For non-catalyst vehicles this yields:

$$E_{j,k,y} = EF_{j,k,y} \cdot S_k \cdot N_{j,y} \cdot M_{j,y} \tag{6}$$

Here E = fuel consumption/emission, EF = fuel consumption/emission factor, S = road type share and k = road type.

For catalyst vehicles the calculation becomes:

$$E_{j,k,y} = DF_{j,k,y} \cdot EF_{j,k,y} \cdot S_k \cdot N_{j,y} \cdot M_{j,y} \tag{7}$$

Extra emissions and fuel consumption for cold engines

Extra emissions of NO_X, VOC, CH_4, CO, PM, NH_3 and fuel consumption from cold start are simulated separately. For SO_2, the extra emissions are derived from the cold start fuel consumption results.

In terms of cold start data for NO_X, VOC, CO, PM and fuel consumption no updates are made to the COPERT IV methodology, and the calculation approach is the same as in COPERT III. Each trip is associated with a certain cold-start emission level and is assumed to take place under urban driving conditions. The number of trips is distributed evenly across the months. First, cold emission factors are calculated as the hot emission factor times the cold:hot emission ratio. Secondly, the extra emission factor during cold start is found by subtracting the hot emission factor from the cold emission factor. Finally, this extra factor is applied on the fraction of the total mileage driven with a cold engine (the β-factor) for all vehicles in the specific layer.

The cold:hot ratios depend on the average trip length and the monthly ambient temperature distribution. The Danish temperatures for 2009 are given in Cappelen et al. (2010). For previous years, temperature data are taken from similar reports available from www.dmi.dk. The cold:hot ratios are equivalent for gasoline fuelled conventional passenger cars and vans and for diesel passenger cars and vans, respectively, see Ntziachristos et al. (2000). For conventional gasoline and all diesel vehicles the extra emissions become:

$$CE_{j,y} = \beta \cdot N_{j,y} \cdot M_{j,y} \cdot EF_{U,j,y} \cdot (CEr - 1) \quad (8)$$

Where CE is the cold extra emissions, β = cold driven fraction, CEr = Cold:Hot ratio.

For catalyst cars, the cold:hot ratio is also trip speed dependent. The ratio is, however, unaffected by catalyst wear. The Euro I cold:hot ratio is used for all future catalyst technologies. However, in order to comply with gradually stricter emission standards, the catalyst light-off temperature must be reached in even shorter periods of time for future EURO standards. Correspondingly, the β-factor for gasoline vehicles is reduced step-wise for Euro II vehicles and their successors.

For catalyst vehicles the cold extra emissions are found from:

$$CE_{j,y} = \beta_{red} \cdot \beta_{EUROI} \cdot N_{j,y} \cdot M_{j,y} \cdot EF_{U,j,y} \cdot (CEr_{EUROI} - 1) \quad (9)$$

where β_{red} = the β reduction factor.

For CH_4, specific emission factors for cold driven vehicles are included in COPERT IV. The β and β_{red} factors for VOC is used to calculate the cold driven fraction for each relevant vehicle layer. The NMVOC emissions during cold start are found as the difference between the calculated results for VOC and CH_4.

For NH_3, specific cold start emission factors are also proposed by COPERT IV. For catalyst vehicles, however, just like in the case of hot emission factors, the emission factors for cold start are functions of cumulated mileage (emission deterioration). The level of emission deterioration also relies on the content of sulphur in the fuel. The deterioration coefficients are given in EMEP/EEA (2009), for the corresponding layer. For cold start, the cut-off mileage and sulphur level interval for hot engines are used, as described in the deterioration factors paragraph.

Evaporative emissions from gasoline vehicles

For each year, evaporative emissions of hydrocarbons are simulated in the forecast model as hot and warm running losses, hot and warm soak loss and diurnal emissions. For evaporation, no updates are made to the COPERT IV methodology, and the calculation approach is the same as in COPERT III. All emission types depend on RVP (Reid Vapour Pressure) and ambient temperature. The emission factors are shown in Ntziachristos et al. (2000).

Running loss emissions originate from vapour generated in the fuel tank while the vehicle is running. The distinction between hot and warm running loss emissions depends on engine temperature. In the model, hot and warm running losses occur for hot and cold engines, respectively. The emissions are calculated as annual mileage (broken down into cold and hot mileage totals using the β-factor) times the respective emission factors. For vehicles equipped with evaporation control (catalyst cars), the emission factors are only one tenth of the uncontrolled factors used for conventional gasoline vehicles.

$$R_{j,y} = N_{j,y} \cdot M_{j,y} \cdot ((1-\beta) \cdot HR + \beta \cdot WR) \tag{10}$$

where R is running loss emissions and HR and WR are the hot and warm running loss emission factors, respectively.

In the model, hot and warm soak emissions for carburettor vehicles also occur for hot and cold engines, respectively. These emissions are calculated as number of trips (broken down into cold and hot trip numbers using the β-factor) times respective emission factors:

$$S_{j,y}{}^{C} = N_{j,y} \cdot \frac{M_{j,y}}{l_{trip}} \cdot ((1-\beta) \cdot HS + \beta \cdot WS) \tag{11}$$

where S^C is the soak emission, l_{trip} = the average trip length, and HS and WS are the hot and warm soak emission factors, respectively. Since all catalyst vehicles are assumed to be carbon canister controlled, no soak emissions are estimated for this vehicle type. Average maximum and minimum temperatures pr month are used in combination with diurnal emission factors to estimate the diurnal emissions from uncontrolled vehicles $E^d(U)$:

$$E_{j,y}{}^{d}(U) = 365 \cdot N_{j,y} \cdot e^{d}(U) \tag{12}$$

Each year's total is the sum of each layer's running loss, soak loss and diurnal emissions.

Fuel use balance

The calculated fuel consumption in COPERT III must equal the statistical fuel sale totals according to the UNFCCC and UNECE emissions reporting format. The statistical fuel sales for road transport are derived from the Danish Energy Authority data (see DEA, 2010). The DEA data are further processed for gasoline in order to account for e.g. non road and recreational craft fuel consumption, which are not directly stated in the statistics, please refer to paragraph 1.1.4 for further information regarding the transformation of DEA fuel data.

The standard approach to achieve a fuel balance in annual emission inventories is to multiply the annual mileage with a fuel balance factor derived as the ratio between simulated and statistical fuel figures for gasoline and diesel, respectively. This method is also used in the present model.

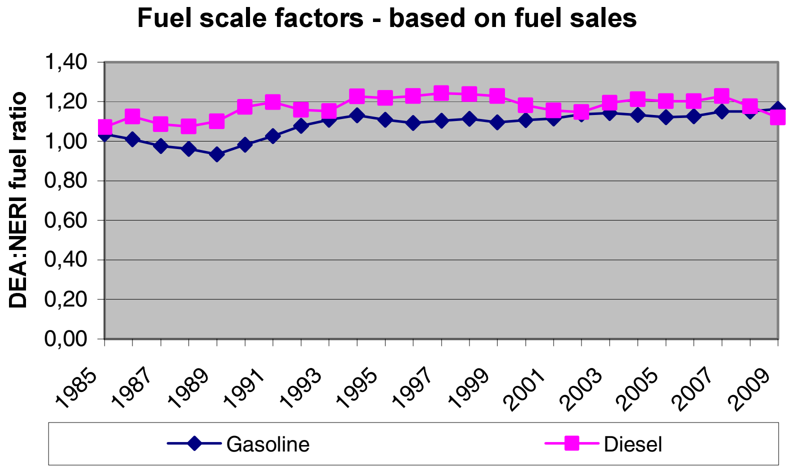


Figure 3.85 DEA:NERI Fuel ratios and diesel mileage adjustment factor based on DEA fuel sales data and NERI fuel consumption estimates.

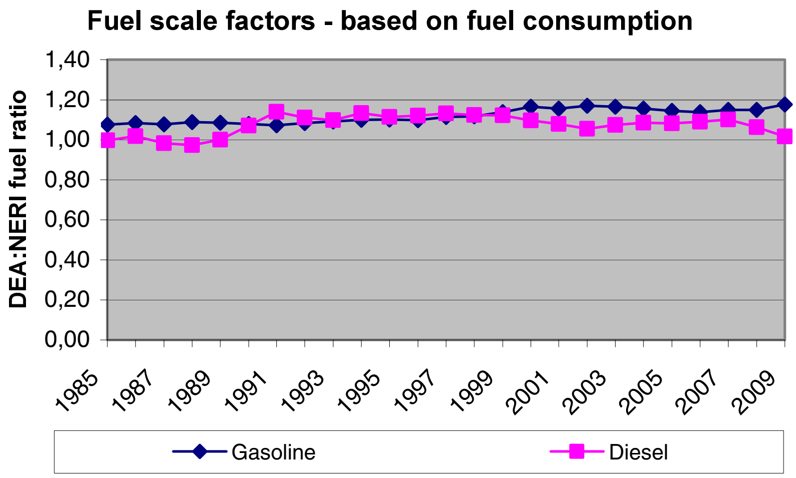


Figure 3.86 DEA:NERI Fuel ratios and diesel mileage adjustment factor based on DEA fuel consumption data and NERI fuel consumption estimates.

In the figures 3.85 and 3.86 the COPERT IV:DEA gasoline and diesel fuel use ratios are shown for fuel sales and fuel consumption from 1985-2009. The data behind the figures are also listed in Annex 3.B.8. The fuel consumption figures are related to the traffic on Danish roads by Danish vehicles and foreign trucks.

Pr fuel type, all mileage numbers are equally scaled in order to obtain fuel equilibrium, and hence the mileage factors used are the reciprocal values of the COPERT IV:DEA fuel consumption: fuel sales ratio.

The reasons for the differences between DEA sales figures and bottom-up fuel estimates are mostly due to a combination of the uncertainties related to COPERT IV fuel use factors, allocation of vehicle numbers in sub-categories, annual mileage, trip speeds and mileage splits for urban, rural and highway driving conditions.

The final fuel use and emission factors are shown in Annex 2.B.6 for 1985-2009. The total fuel use and emissions are shown in Annex 2.B.7, pr vehicle category and as grand totals, for 1985-2009 (and NFR format in Annex 2.B.15). In Annex 2.B.14, fuel-use and emission factors as well as total emissions are given in CollectER format for 2009.

In Table 3.29, the aggregated emission factors for SO_2, NO_X, NMVOC and TSP are shown in CollectER format for Danish road transport.

Table 3.29 Fuel-based emission factors for SO_2, NO_X, NMVOC, CO, NH_3 and TSP for road transport in Denmark (2007).

SNAP ID	Category	Fuel type	Mode	Emission factors[1] [g pr GJ]					
				SO_2	NO_X	NMVOC	CO	NH_3	TSP
70101	Passenger cars	Highway	Diesel	0.47	303.26	5.80	13.23	0.48	15.44
70101	Passenger cars	Highway	Gasoline	0.45	142.30	32.30	685.83	30.88	0.90
70101	Passenger cars	Highway	LPG	0.00	247.65	39.76	1443.35	0.00	10.05
70101	Passenger cars	Rural	Diesel	0.47	259.62	8.38	25.61	0.51	12.65
70101	Passenger cars	Rural	Gasoline	0.45	114.22	36.32	538.53	34.47	0.85
70102	Passenger cars	Rural	LPG	0.00	270.21	59.92	562.88	0.00	14.45
70102	Passenger cars	Urban	Diesel	0.47	258.88	23.86	65.93	0.38	19.84
70102	Passenger cars	Urban	Gasoline	0.45	132.47	221.92	2378.17	11.46	0.92
70102	Passenger cars	Urban	LPG	0.00	162.36	123.43	816.28	0.00	13.44
70102	Light duty vehicles	Highway	Diesel	0.47	227.43	21.27	129.50	0.37	21.83
70103	Light duty vehicles	Highway	Gasoline	0.45	160.23	18.87	543.60	22.77	1.39
	Light duty vehicles	Highway	LPG	0.00	74.28	10.46	860.66	0.00	10.04
70103	Light duty vehicles	Rural	Diesel	0.47	237.74	24.06	111.29	0.40	17.90
	Light duty vehicles	Rural	Gasoline	0.45	140.14	27.94	411.60	21.84	1.24
	Light duty vehicles	Rural	LPG	0.00	81.85	14.66	386.57	0.00	14.45
70103	Light duty vehicles	Urban	Diesel	0.47	227.90	40.68	136.49	0.29	24.98
70103	Light duty vehicles	Urban	Gasoline	0.45	119.52	148.31	2931.76	5.74	0.85
	Light duty vehicles	Urban	LPG	0.00	54.81	36.84	428.25	0.00	13.82
70201	Heavy duty vehicles	Highway	Diesel	0.47	552.97	12.59	89.59	0.31	9.16
70201	Heavy duty vehicles	Highway	Gasoline	0.45	1037.78	474.61	7610.35	0.28	55.35
70201	Heavy duty vehicles	Rural	Diesel	0.47	567.88	15.12	92.25	0.29	9.35
70202	Heavy duty vehicles	Rural	Gasoline	0.45	1141.55	820.40	8371.39	0.30	60.88
70202	Heavy duty vehicles	Urban	Diesel	0.47	572.06	19.24	106.84	0.22	10.85
70202	Heavy duty vehicles	Urban	Gasoline	0.45	456.62	696.09	7102.99	0.20	40.59
70203	Mopeds	Urban	Gasoline	0.45	129.62	8889.08	9581.58	1.24	139.02
70203	Motorcycles	Highway	Gasoline	0.45	269.39	854.98	12090.75	1.28	22.72
70203	Motorcycles	Rural	Gasoline	0.45	192.38	832.68	11313.83	1.56	27.72
70301	Motorcycles	Urban	Gasoline	0.45	118.86	1019.07	10859.93	1.52	27.03

[1] References. SO_2: Country specific; NO_X, NMVOC, CO, NH_3 and PM: COPERT IV.

Non-exhaust particulate emissions from road transport

The TSP, PM_{10} and $PM_{2.5}$ emissions arising from tyre and brake wear (SNAP 0707) and road abrasion (SNAP 0708) are estimated for the years 2000-2009 as prescribed by the UNECE convention reporting format. The emissions are calculated by multiplying the total annual mileage pr vehicle category with the correspondent average emission factors for each source type. The calculation procedure is consistent with the COPERT IV model approach used to estimate the Danish national emissions coming from exhaust. A more thorough explanation of the calculations is given by Winther and Slentø (2010). Emission factors are taken from EMEP/EEA (2009) and specific Danish tyre wear data are gathered by Winther and Slentø (2010). The emission factors and total emissions for 2009 are shown in Annex 2.B.14.

Methodologies and references for other mobile sources

Other mobile sources are divided into several sub-sectors: sea transport, fishery, air traffic, railways, military, and working machinery and materiel in the industry, forestry, agriculture and household and gardening sectors. The emission calculations are made using the detailed method as described in the EMEP/EEA Air Pollutant Emission Inventory Guidebook (EMEP/EEA, 2009) for air traffic, off-road working machinery and equipment, and ferries, while for the remaining sectors the simple method is used.

3.3.3 Activity data

Air traffic

The activity data for air traffic consists of air traffic statistics provided by the Danish Civil Aviation Agency (CAA-DK) and Copenhagen Airport. Fuel statistics for jet fuel use and aviation gasoline are obtained from the Danish energy statistics (DEA, 2009).

For 2001 onwards, pr flight records are provided by CAA-DK as data codes for aircraft type, and origin and destination airports (city-pairs).

Subsequently the aircraft types are separated by NERI into larger aircraft using jet fuel (jet engines, turbo props, helicopters) and small aircraft types with piston engines using aviation gasoline. This is done by using different aircraft dictionaries, internet look-ups and by communication with the CAA-DK. Each of the larger aircraft type is then matched with a representative type for which fuel consumption and emission data are available from the EMEP/EEA databank. Relevant for this selection is aircraft maximum take off mass, engine types, and number of engines. A more thorough explanation is given in Winther (2001a, b).

The ideal flying distance (great circle distance) between the city-pairs is calculated by NERI in a separate database. The calculation algorithm uses a global latitude/altitude coordinate table for airports. In cases when airport coordinates are not present in the NERI database, these are looked up on the internet and entered into the database accordingly.

For inventory years prior to 2001, detailed LTO/aircraft type statistics are obtained from Copenhagen Airport (for this airport only), while information of total take-off numbers for other Danish airports is provided by CAA-DK. The assignment of representative aircraft types for Copenhagen Airport is done as described above. For the remaining Danish airports representative aircraft types are not directly assigned. Instead appropriate average assumptions are made relating to the fuel consumption and emission data part.

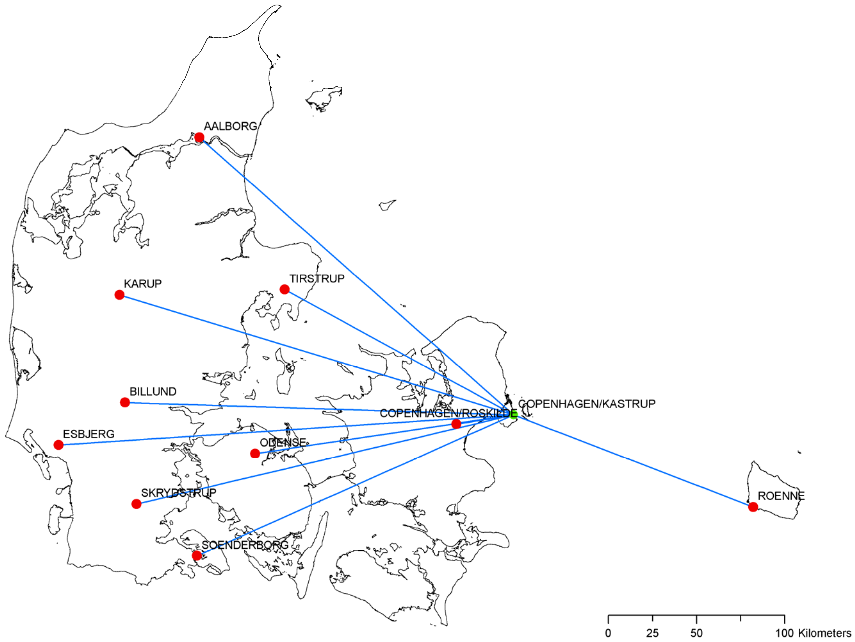


Figure 3.87 Most frequent domestic flying routes for large aircraft in Denmark.

Copenhagen Airport is the starting or end point for most of the domestic aviation made by large aircraft in Denmark (Figure 3.87). Even though many domestic flights not touching Copenhagen Airport are also reported in the flight statistics kept by CAA-DK, these flights, however, are predominantly made with small piston engine aircraft using aviation gasoline. Hence, the consumption of jet fuel by flights not using Copenhagen is merely marginal.

Non-road working machinery and equipment

Non-road working machinery and equipment are used in agriculture, forestry and industry, for household/gardening purposes and in inland waterways (recreational craft). Information on the number of different types of machines, their respective load factors, engine sizes and annual working hours has been provided by Winther et al. (2006). The stock development from 1985-2009 for the most important types of machinery are shown in Figures 3.88-3.95 below. The stock data are also listed in Annex 2.B.10, together with figures for load factors, engine sizes and annual working hours. As regards stock data for the remaining machinery types, please refer to (Winther et al., 2006).

It is important to note that from key experts in the field of industrial non road activities a significant decrease in the activities is assumed for 2009 due to the global financial crisis. This reduction is in the order of 25 % for 2009 for industrial non road in general (pers. comm. Per Stjernqvist, Volvo Construction Equipment 2010). For fork lifts, 5 % and 20 % reductions are assumed for 2008 and 2009, respectively (pers. comm. Peter H. Møller, Rocla A/S).

For agriculture, the total number of agricultural tractors and harvesters pr year are shown in the Figures 3.88-3.89, respectively. The figures clearly show a decrease in the number of small machines, these being replaced by machines in the large engine-size ranges.

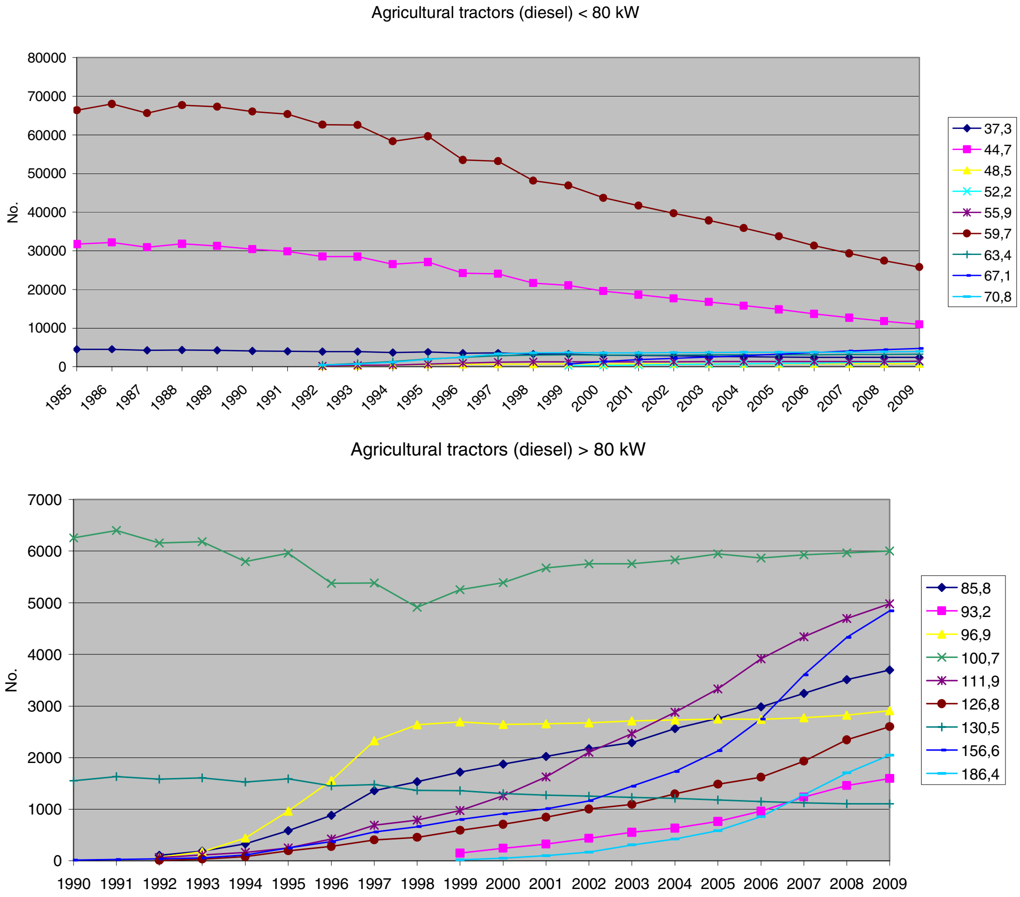


Figure 3.88 Total numbers in kW classes for tractors from 1985 to 2009.

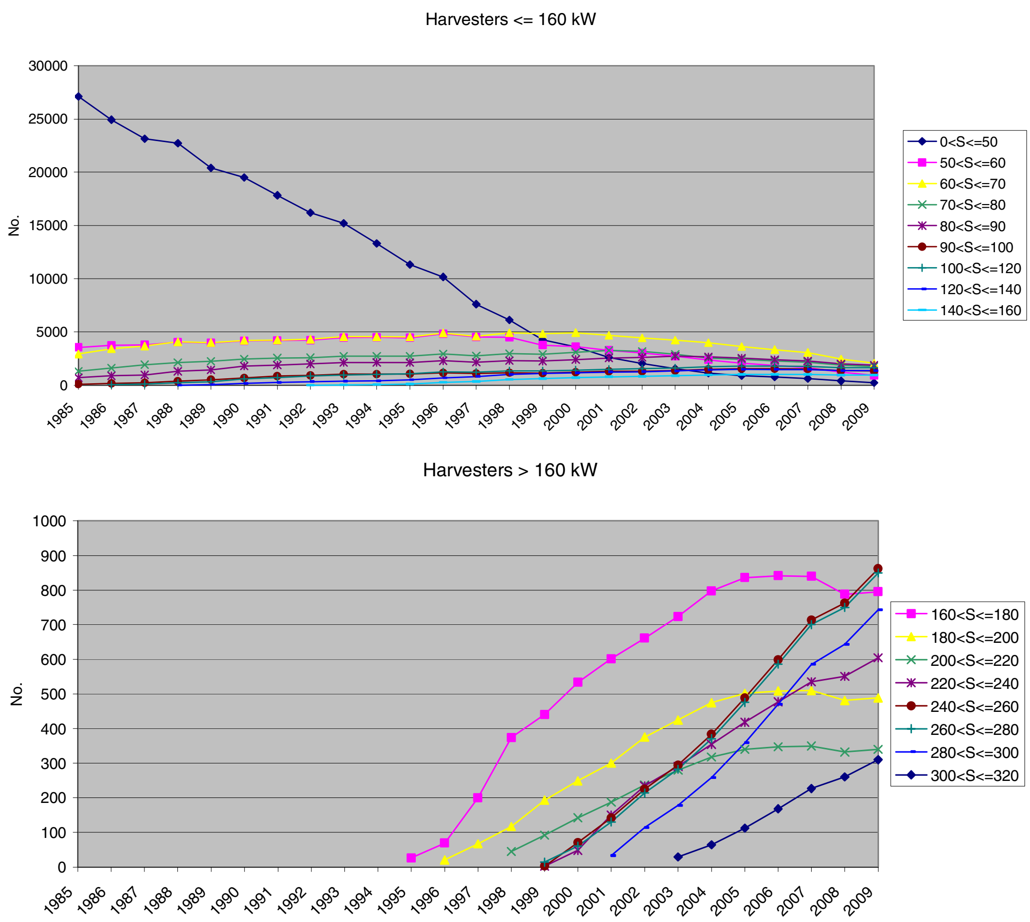
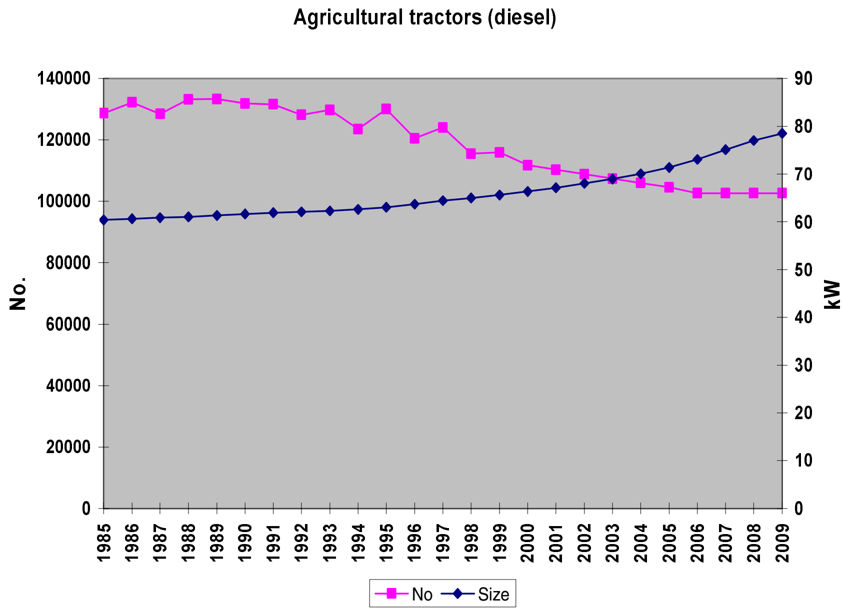


Figure 3.89 Total numbers in kW classes for harvesters from 1985 to 2009.

The tractor and harvester developments towards fewer vehicles and larger engines, shown in Figure 3.90, are very clear. From 1985 to 2009, tractor and harvester numbers decrease by around 20 % and 52 %, respectively, whereas the average increase in engine size for tractors is 30 %, and 161 % for harvesters, in the same time period.



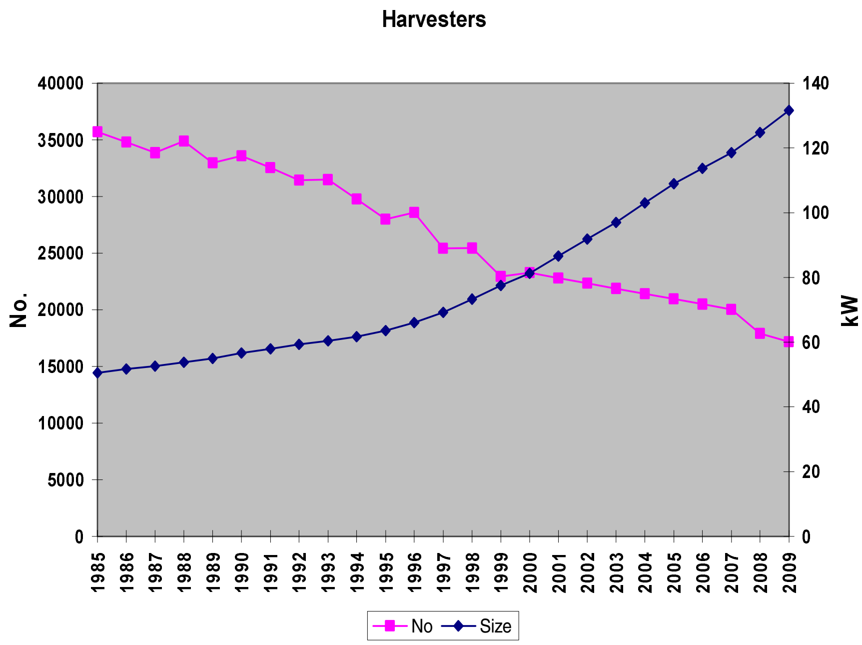


Figure 3.90 Total numbers and average engine size for tractors and harvesters from 1985 to 2009.

The most important machinery types for industrial use are different types of construction machinery and fork lifts. The Figures 3.91 and 3.92 show the 1985-2009 stock development for specific types of construction machinery and diesel fork lifts. Due to lack of data, the construction machinery stock for 1990 is used also for 1985-1989. For most of the machinery types there is an increase in machinery numbers from 1990 onwards, due to increased construction activities. It is assumed that track type excavators/wheel type loaders (0-5 tonnes), and telescopic loaders first enter into use in 1991 and 1995, respectively.

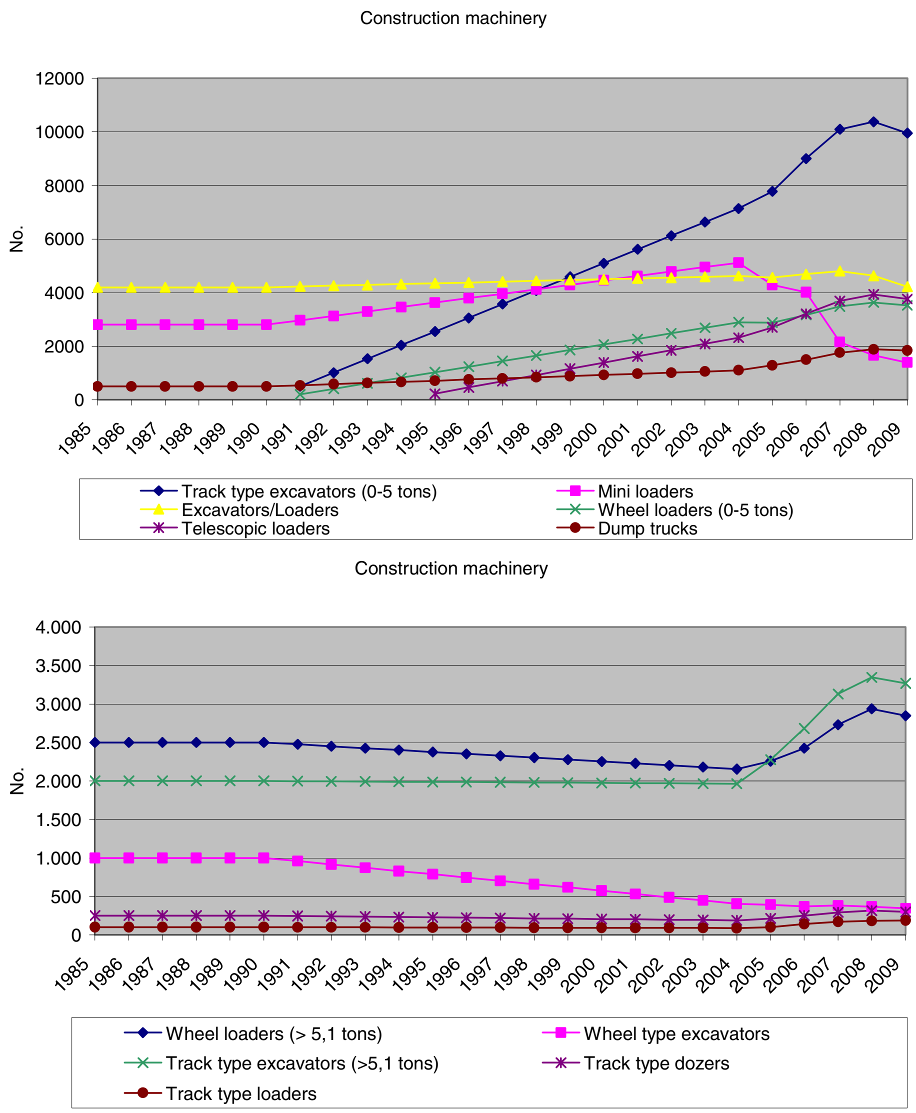


Figure 3.91 1985-2009 stock development for specific types of construction machinery.

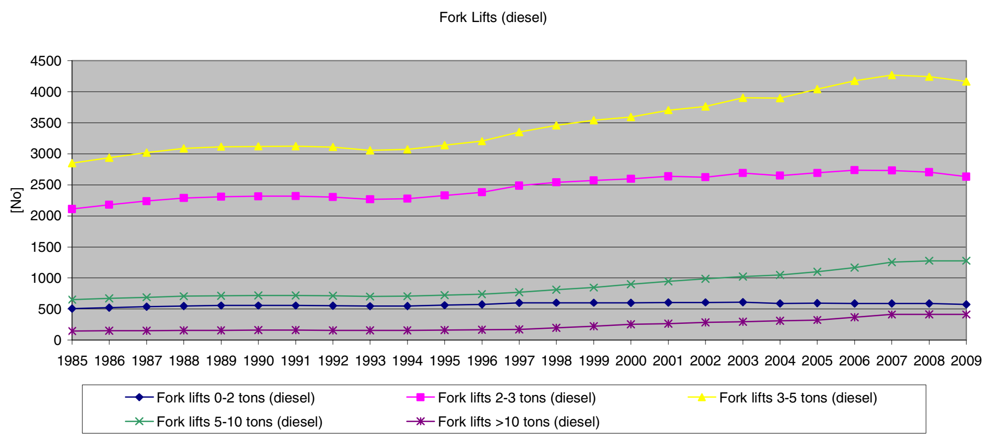


Figure 3.92 Total numbers of diesel fork lifts in kW classes from 1985 to 2009.

The emission level shares for tractors, harvesters, construction machinery and diesel fork lifts are shown in Figure 3.93, and present an overview of the penetration of the different pre-Euro engine classes, and engine stages complying with the gradually stricter EU stage I and II emission limits. The average lifetimes of 30, 25, 20 and 10 years for tractors, harvesters, fork lifts and construction machinery, respectively, influence the individual engine technology turn-over speeds.

The EU emission directive Stage I and II implementation years relate to engine size, and for all four machinery groups the emission level shares for the specific size segments will differ slightly from the picture shown in Figure 3.93. Due to scarce data for construction machinery, the emission level penetration rates are assumed to be linear and the general technology turnover pattern is as shown in Figure 3.93.

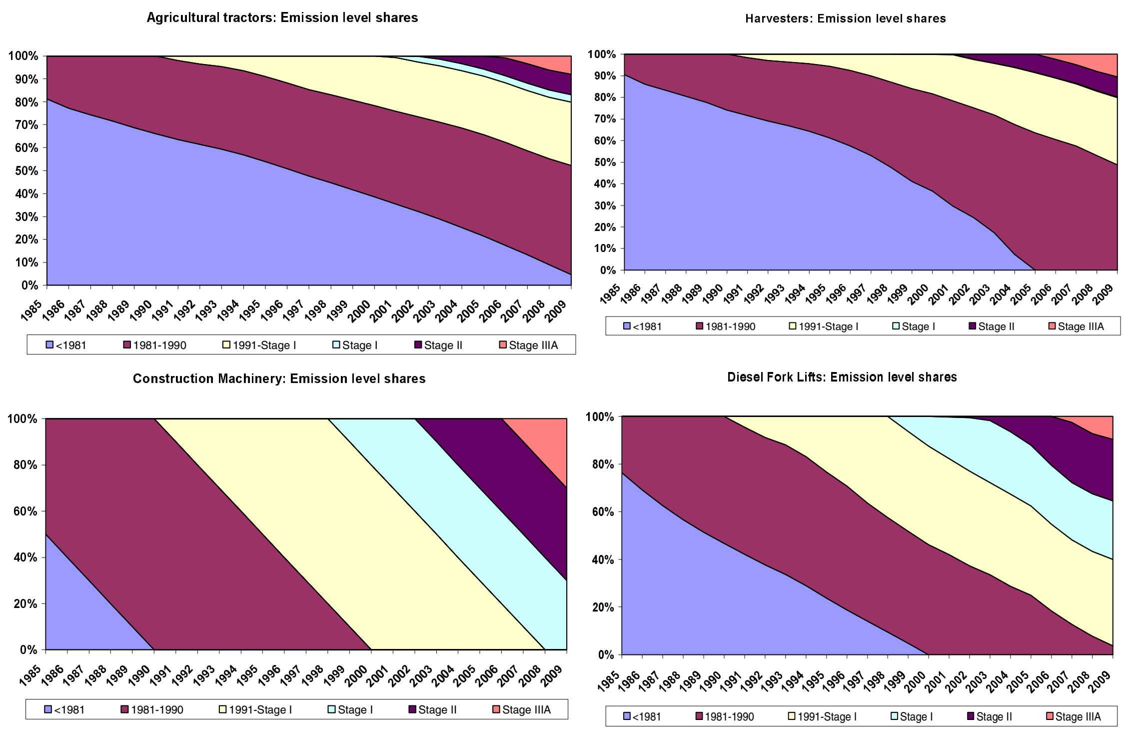


Figure 3.93 Emission level shares for tractors, harvesters, construction machinery and diesel fork lifts (1985 to 2009).

The 1985-2009 stock development for the most important household and gardening machinery types is shown in Figure 3.94.

For lawn movers and cultivators, the machinery stock remains approximately the same for all years, whereas the stock figures for riders, chain saws, shrub clearers, trimmers and hedge cutters increase from 1990 onwards. The yearly stock increases, in most cases, become larger after 2000. The lifetimes for gasoline machinery are short and, therefore, there new emission levels (not shown) penetrate rapidly.

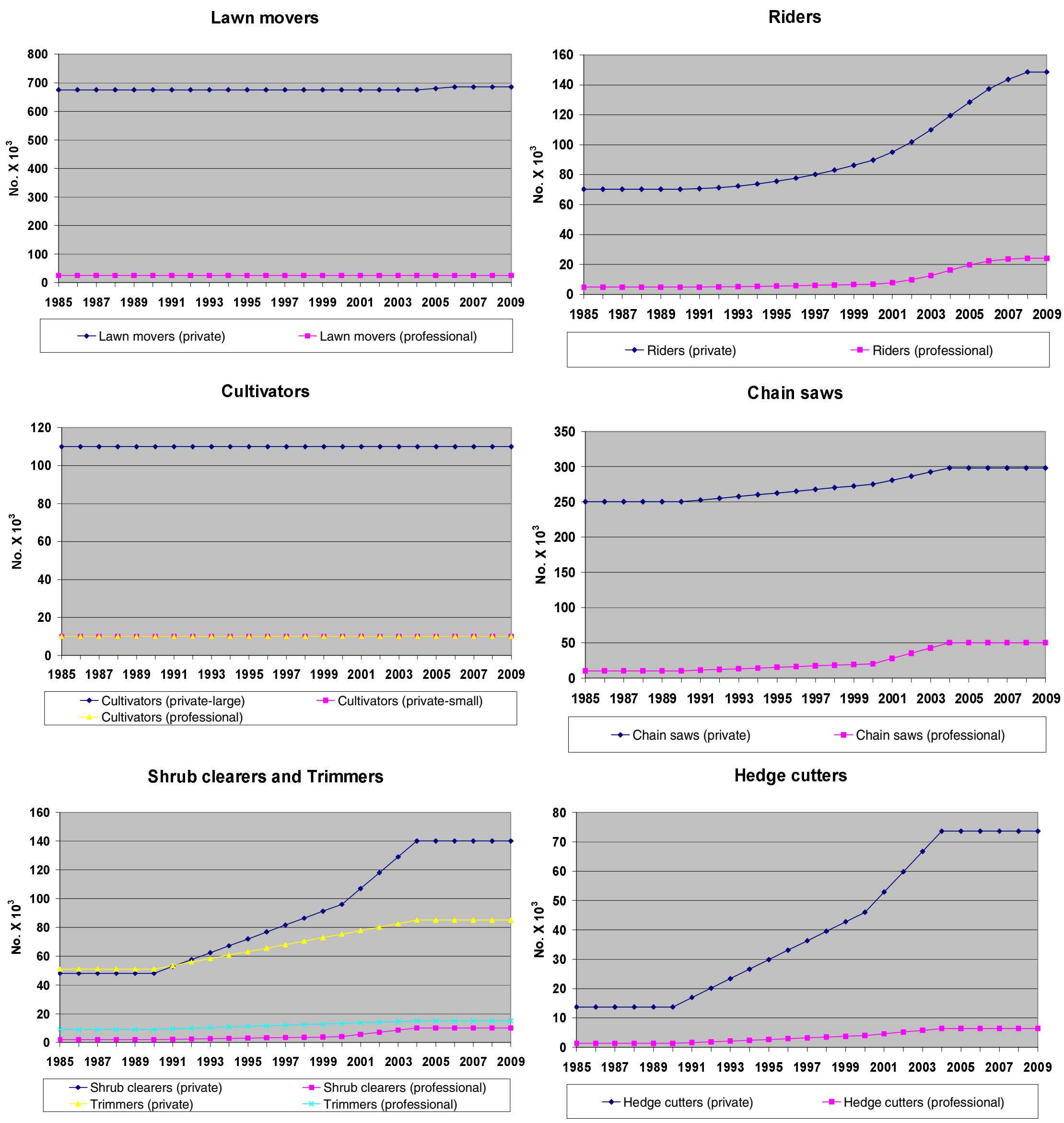


Figure 3.94 Stock development 1985-2009 for the most important household and gardening machinery types.

Figure 3.95 shows the development in numbers of different recreational craft from 1985-2009. The 2004 stock data for recreational craft are repeated for 2005-2009, since no new fleet information has been obtained.

For diesel boats, increases in stock and engine size are expected during the whole period, except for the number of motor boats (< 27 ft.) and the engine sizes for sailing boats (<26 ft.), where the figures remain unchanged. A decrease in the total stock of sailing boats (<26 ft.) by 21 % and increases in the total stock of yawls/cabin boats and other boats (<20 ft.) by around 25 % are expected. Due to a lack of information specific to Denmark, the shifting rate from 2-stroke to 4-stroke gasoline engines is based on a German non-road study (IFEU, 2004).

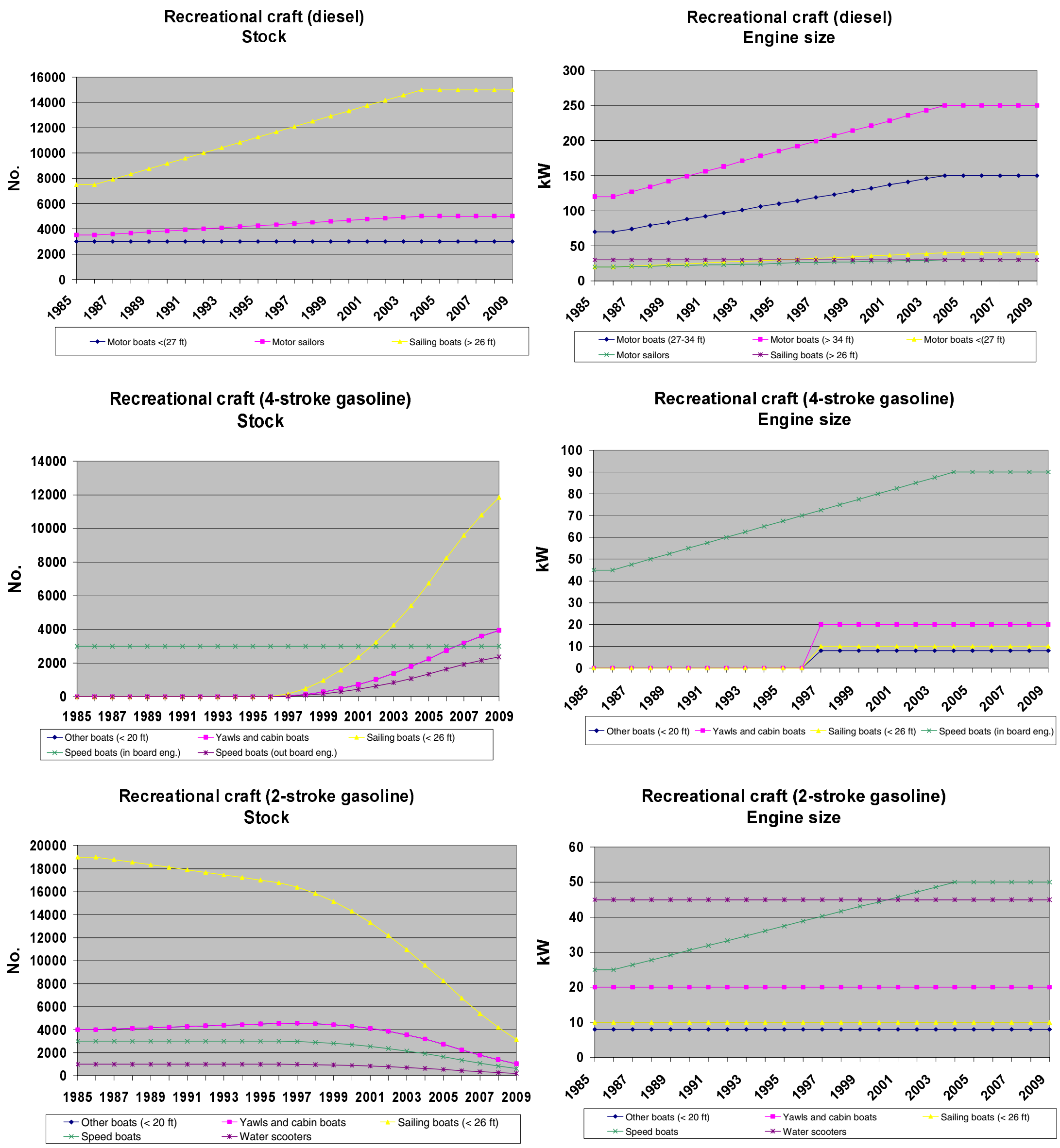


Figure 3.95 1985-2009 Stock and engine size development for recreational craft.

National sea transport

A new methodology is used to estimate the fuel consumption figures for national sea transport, based on fleet activity estimates for regional ferries, local ferries and other national sea transport (Winther, 2008a).

Table 3.30 lists the most important domestic ferry routes in Denmark in the period 1990-2009. For these ferry routes and the years 1990-2005, the following detailed traffic and technical data have been gathered by Winther (2008a): Ferry name, year of service, engine size (MCR), engine type, fuel type, average load factor, auxiliary engine size and sailing time (single trip).

For 2006-2009, the above mentioned traffic and technical data for specific ferries have been provided by Kristensen (2010) in the case of Mols-Linien (Sjællands Odde-Ebeltoft, Sjællands Odde-Århus, Kalundborg-Århus), by Hjortberg (2010) for Bornholmstrafikken (Køge-Rønne) and by Simonsen (2010) for Langelandstrafikken A/S (Tårs-Spodsbjerg). For Esbjerg-Torshavn and Hanstholm-Torshavn traffic and technical data have been provided by Dávastovu (2010).

Table 3.30 Domestic ferry routes comprised in the Danish inventory.

Ferry service	Service period
Esbjerg-Torshavn	1990-1995, 2009
Halsskov-Knudshoved	1990-1999
Hanstholm-Torshavn	1991-1992, 1999-2009
Hundested-Grenaa	1990-1996
Kalundborg-Juelsminde	1990-1996
Kalundborg-Samsø	1990-
Kalundborg-Århus	1990-
Korsør-Nyborg, DSB	1990-1997
Korsør-Nyborg, Vognmandsruten	1990-1999
København-Rønne	1990-2004
Køge-Rønne	2004-
Sjællands Odde-Ebeltoft	1990-
Sjællands Odde-Århus	1999-
Tårs-Spodsbjerg	1990-

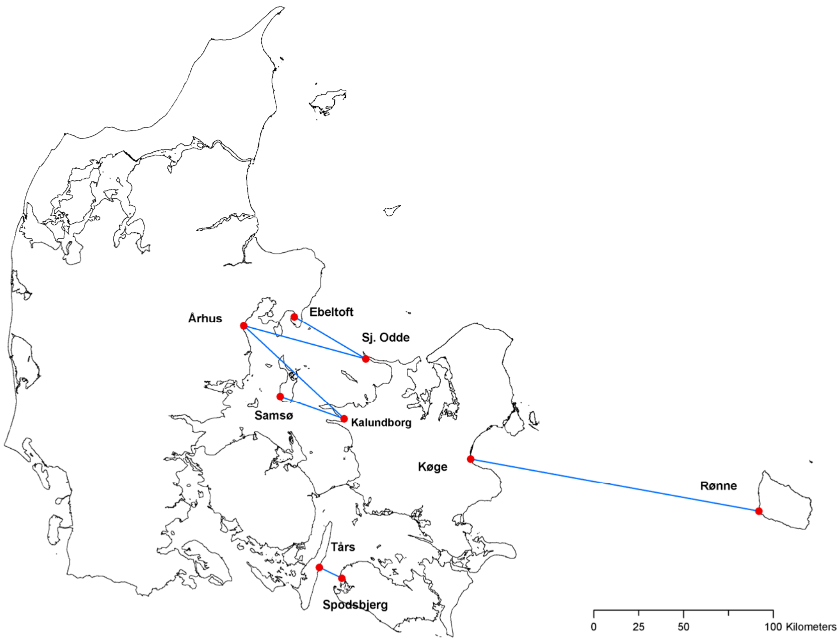
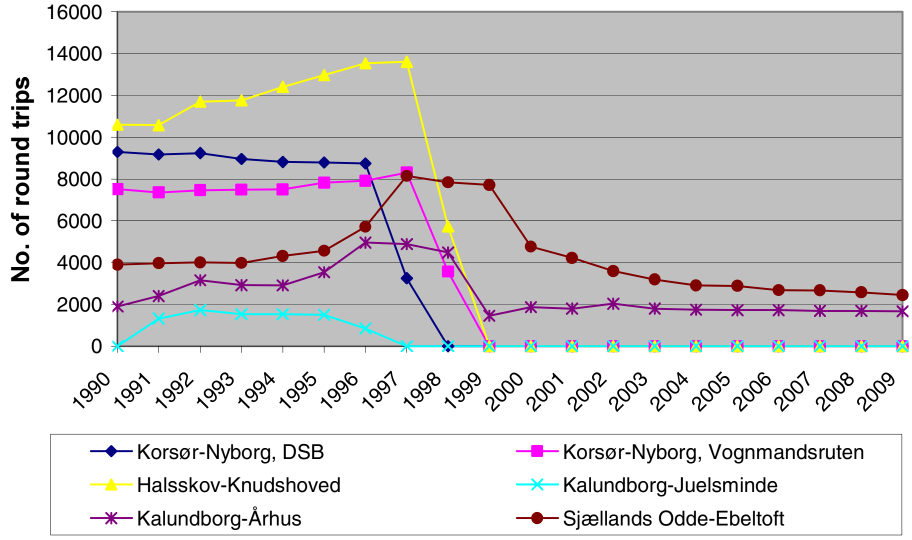


Figure 3.96 Domestic regional ferry routes in Denmark (2009).

The number of round trips pr ferry route from 1990 to 2009 is provided by Statistics Denmark (2010), see Figure 3.97 (Esbjerg/Hanstholm-Torshavn not shown). The traffic data are also listed in Annex 3.B.11, together with different ferry specific technical and operational data.

For each ferry, Annex 3.B.12 lists the relevant information as regards ferry route, name, year of service, engine size (MCR), engine type, fuel type, average load factor, auxillary engine size and sailing time (single trip). There is a lack of historical traffic data for 1985-1989, and hence, data for 1990 is used for these years, to support the fuel use and emission calculations.



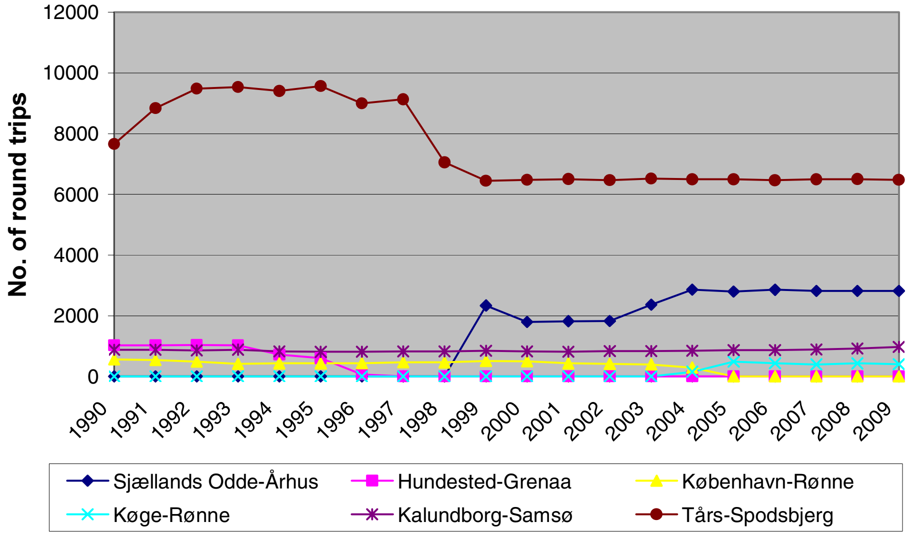


Figure 3.97 No. of round trips for the most important ferry routes in Denmark 1990-2009.

It is seen from Table 3.30 (and Figure 3.97) that several ferry routes were closed in the time period from 1996-1998, mainly due to the opening of the Great Belt Bridge (connecting Zealand and Funen) in 1997. Hundested-Grenaa and Kalundborg-Juelsminde was closed in 1996, Korsør-Nyborg (DSB) closed in 1997, and Halsskov-Knuds-hoved and Korsør-Nyborg (Vognmandsruten) was closed in 1998. The ferry line København-Rønne was replaced by Køge-Rønne in 2004 and from 1999 a new ferry connection was opened between Sjællands Odde and Århus.

For the local ferries, a bottom-up estimate of fuel consumption for 1996 has been taken from the Danish work in Wismann (2001). The latter project calculated fuel consumption and emissions for all sea transport in Danish waters in 1995/1996 and 1999/2000. In order to cover the entire 1990-2006 inventory period, the fuel figure for 1996 has been adjusted according to the developments in local ferry route traffic shown in Annex 3.B.11.

Fuel sold for freight transport by Royal Arctic Line between Aalborg (Denmark) and Greenland and by Eim Skip - East route between Aarhus (Denmark) and Torshavn (Faroe Islands) are included under other national sea transport in the Danish inventories. In both cases all fuel is being bought in Denmark (Rasmussen, 2010 and Thorarson, 2010).

For the remaining part of the traffic between two Danish ports, other national sea transport, new bottom-up estimates for fuel consumption have been calculated for the years 1995 and 1999 by Wismann (2007). The calculations use the database set up for Denmark in the Wismann (2001) study, with actual traffic data from the Lloyd's LMIS database (not including ferries). The database was split into three vessel types: bulk carriers, container ships, and general cargo ships; and five size classes: 0-1000, 1000-3000, 3000-10000, 10000-20000 and >20000 DTW. The calculations assume that bulk carriers and container ships use heavy fuel oil, and that general cargo ships use gas oil. For further information regarding activity data for local ferries and other national sea transport, please refer to Winther (2008a).

Other sectors

The activity data for military, railways, international sea transport and fishery consists of fuel consumption information from DEA (2010). For international sea transport, the basis is in principle fuel sold in Danish ports for vessels with a foreign destination, as prescribed by the IPCC guidelines.

However, it must be noted that fuel sold for sailing activities between Denmark and Greenland/Faroe Islands are reported as international in the DEA energy statistics. Hence, for inventory purposes in order to follow the IPCC guidelines the bottom-up fuel estimates for the ferry routes Esbjerg/Hanstholm-Torshavn, and fuel reports from Royal Arctic Line and Eim Skip is being subtracted from the fuel sales figures for international sea transport prior to inventory fuel input.

For fisheries, the calculation methodology described by Winther (2008a) remains fuel based. However, the input fuel data differ from the fuel sales figures previously used. The changes are the result of further data processing of the DEA reported gas oil sales for national sea transport and fisheries, prior to inventory input. For years when the fleet activity estimates of fuel consumption for national sea transport (not including are smaller than reported fuel sold, fuel is added to fisheries in the inventory. Conversely, lower fuel sales in relation to bottom-up estimates for national sea transport means that fuel is being subtracted from the original fisheries fuel sales figure in order to make up the final fuel consumption input for fisheries.

The updated fuel consumption time-series for national sea transport lead, in turn, to changes in the energy statistics for fisheries (gas oil), industry (heavy fuel oil), and international sea transport, so the national energy balance can remain unchanged.

For all sectors, fuel-use figures are given in Annex 2.B.14 for 2009 in CollectER format.

Emission legislation

For non-road working machinery and equipment, and recreational craft and railway locomotives/motor cars, the emission directives list specific emission limit values (g pr kWh) for CO, VOC, NO_x (or VOC +

NO_x) and TSP, depending on engine size (kW for diesel, ccm for gasoline) and date of implementation (referring to engine market date).

For diesel, the directives 97/68 and 2004/26 relate to non-road machinery other than agricultural and forestry tractors, and the directives have different implementation dates for machinery operating under transient and constant loads. The latter directive also comprises emission limits for railway machinery. For tractors the relevant directives are 2000/25 and 2005/13. For gasoline, the directive 2002/88 distinguishes between hand-held (SH) and not hand-held (NS) types of machinery.

For engine type approval, the emissions (and fuel use) are measured using various test cycles (ISO 8178). Each test cycle consists of a number of measurement points for specific engine loads during constant operation. The specific test cycle used depends on the machinery type in question and the test cycles are described in more details in the directives.

Table 3.31 Overview of EU emission directives relevant for diesel fuelled non-road machinery.

Stage/Engine size [kW]	CO	VOC	NO_x	VOC+NO_x	PM	Diesel machinery			Tractors	
							Implement. date		EU	Implement.
	[g pr kWh]					EU Directive	Transient	Constant	directive	date
Stage I										
37<=P<75	6.5	1.3	9.2	-	0.85	97/68	1/4 1999	-	2000/25	1/7 2001
Stage II										
130<=P<560	3.5	1	6	-	0.2	97/68	1/1 2002	1/1 2007	2000/25	1/7 2002
75<=P<130	5	1	6	-	0.3		1/1 2003	1/1 2007		1/7 2003
37<=P<75	5	1.3	7	-	0.4		1/1 2004	1/1 2007		1/1 2004
18<=P<37	5.5	1.5	8	-	0.8		1/1 2001	1/1 2007		1/1 2002
Stage IIIA										
130<=P<560	3.5	-	-	4	0.2	2004/26	1/1 2006	1/1 2011	2005/13	1/1 2006
75<=P<130	5	-	-	4	0.3		1/1 2007	1/1 2011		1/1 2007
37<=P<75	5	-	-	4.7	0.4		1/1 2008	1/1 2012		1/1 2008
19<=P<37	5.5	-	-	7.5	0.6		1/1 2007	1/1 2011		1/1 2007
Stage IIIB										
130<=P<560	3.5	0.19	2	-	0.025	2004/26	1/1 2011	-	2005/13	1/1 2011
75<=P<130	5	0.19	3.3	-	0.025		1/1 2012	-		1/1 2012
56<=P<75	5	0.19	3.3	-	0.025		1/1 2012	-		1/1 2012
37<=P<56	5	-	-	4.7	0.025		1/1 2013	-		1/1 2013
Stage IV										
130<=P<560	3.5	0.19	0.4	-	0.025	2004/26	1/1 2014		2005/13	1/1 2014
56<=P<130	5	0.19	0.4	-	0.025		1/10 2014			1/10 2014

Table 3.32 Overview of the EU Emission Directive 2002/88 for gasoline fuelled non-road machinery.

	Category	Engine size [ccm]	CO [g pr kWh]	HC [g pr kWh]	NO_x [g pr kWh]	HC+NO_x [g pr kWh]	Implementation date
	Stage I						
Hand held	SH1	S<20	805	295	5.36	-	1/2 2005
	SH2	20=<S<50	805	241	5.36	-	1/2 2005
	SH3	50=<S	603	161	5.36	-	1/2 2005
Not hand held	SN3	100=<S<225	519	-	-	16.1	1/2 2005
	SN4	225=<S	519	-	-	13.4	1/2 2005
	Stage II						
Hand held	SH1	S<20	805	-	-	50	1/2 2008
	SH2	20=<S<50	805	-	-	50	1/2 2008
	SH3	50=<S	603	-	-	72	1/2 2009
Not hand held	SN1	S<66	610	-	-	50	1/2 2005
	SN2	66=<S<100	610	-	-	40	1/2 2005
	SN3	100=<S<225	610	-	-	16.1	1/2 2008
	SN4	225=<S	610	-	-	12.1	1/2 2007

For recreational craft, Directive 2003/44 comprises the emission legislation limits for diesel engines, and for 2-stroke and 4-stroke gasoline engines, respectively. The CO and VOC emission limits depend on engine size (kW) and the inserted parameters presented in the calculation formulas in Table 3.33. For NO_x, a constant limit value is given for each of the three engine types. For TSP, the constant emission limit regards diesel engines only.

Table 3.33 Overview of the EU Emission Directive 2003/44 for recreational craft.

Engine type	Impl. date	$CO=A+B/P^n$			$HC=A+B/P^n$			NO_x	TSP
		A	B	n	A	B	n		
2-stroke gasoline	1/1 2007	150.0	600.0	1.0	30.0	100.0	0.75	10.0	-
4-stroke gasoline	1/1 2006	150.0	600.0	1.0	6.0	50.0	0.75	15.0	-
Diesel	1/1 2006	5.0	0.0	0	1.5	2.0	0.5	9.8	1.0

Tabel 3.34 Overview of the EU Emission Directive 2004/26 for railway locomotives and motorcars.

	Engine size [kW]		CO [g pr kWh]	HC [g pr kWh]	NOx [g pr kWh]	HC+NO_X [g pr kWh]	PM [g pr kWh]	Implementation date
Locomotives	Stage IIIA							
	130<=P<560	RL A	3.5	-	-	4	0.2	1/1 2007
	560<P	RH A	3.5	0.5	6	-	0.2	1/1 2009
	2000<=P and piston displacement >= 5 l/cyl.	RH A	3.5	0.4	7.4	-	0.2	1/1 2009
	Stage IIIB	RB	3.5	-	-	4	0.025	1/1 2012
Motor cars	Stage IIIA							
	130<P	RC A	3.5	-	-	4	0.2	1/1 2006
	Stage IIIB							
	130<P	RC B	3.5	0.19	2	-	0.025	1/1 2012

Aircraft engine emissions of NO_x, CO, VOC and smoke are regulated by ICAO (International Civil Aviation Organization). The engine emission certification standards are contained in Annex 16 — Environmental Protection, Volume II — Aircraft Engine Emissions to the Convention on International Civil Aviation (ICAO Annex 16, 1993). The emission standards relate to the total emissions (in grams) from the so-called LTO (Landing and Take Off) cycle divided by the rated engine thrust (kN). The ICAO LTO cycle contains the idealised aircraft movements below 3000 ft (915 m) during approach, landing, airport taxiing, take off and climb out.

For smoke all aircraft engines manufactured from 1 January 1983 have to meet the emission limits agreed by ICAO. For NO_x, CO, VOC The emission legislation is relevant for aircraft engines with a rated engine thrust larger than 26.7 kN. In the case of CO and VOC, the ICAO regulations apply for engines manufactured from from 1 January 1983.

For NO_x, the emission regulations fall in four categories

a) For engines of a type or model for which the date of manufacture of the first individual production model is on or before 31 December 1995, and for which the production date of the individual engine is on or before 31 December 1999.
b) For engines of a type or model for which the date of manufacture of the first individual production model is after 31 December 1995, or for individual engines with a production date after 31 December 1999.
c) For engines of a type or model for which the date of manufacture of the first individual production model is after 31 December 2003.
d) For engines of a type or model for which the date of manufacture of the first individual production model is after 31 December 2007.

The regulations published by ICAO are given in the form of the total quantity of pollutants (D_p) emitted in the LTO cycle divided by the maximum sea level thrust (F_{oo}) and plotted against engine pressure ratio at maximum sea level thrust.

The limit values for NO_x are given by the formulae in Table 3.35.

Table 3.35 Current certification limits for NO_x for turbo jet and turbo fan engines.

	Engines first produced before 31.12.1995 & for engines manufactured up to 31.12.1999	Engines first produced after 31.12.1995 & for engines manufactured after 31.12.1999	Engines for which the date of manufacture of the first individual production model was after 31 December 2003	Engines for which the date of manufacture of the first individual production model was after 31 December 2007
Applies to engines >26.7 kN	$Dp/F_{oo} = 40 + 2\pi_{oo}$	$Dp/F_{oo} = 32 + 1.6\pi_{oo}$		
Engines of pressure ratio less than 30				
Thrust more than 89 kN			$Dp/F_{oo} = 19 + 1.6\pi_{oo}$	$Dp/F_{oo} = 16.72 + 1.4080\pi_{oo}$
Thrust between 26.7 kN and not more than 89 kN			$Dp/F_{oo} = 37.572 + 1.6\pi_{oo} - 0.208F_{oo}$	$Dp/F_{oo} = 38.54862 + (1.6823\pi_{oo}) - (0.2453F_{oo}) - (0.00308\pi_{oo}F_{oo})$
Engines of pressure ratio more than 30 and less than 62.5				
Thrust more than 89 kN			$Dp/F_{oo} = 7+2.0\pi_{oo}$	$Dp/F_{oo} = -1.04+ (2.0*\pi_{oo})$
Thrust between 26.7 kN and not more than 89 kN			$Dp/F_{oo} = 42.71 +1.4286\pi_{oo} -0.4013F_{oo} +0.00642\pi_{oo}F_{oo}$	$Dp/F_{oo} = 46.1600 + (1.4286\pi_{oo}) - (0.5303F_{oo}) - (0.00642\pi_{oo}F_{oo})$
Engines with pressure ratio 82.6 or more			$Dp/F_{oo} = 32+1.6\pi_{oo}$	$Dp/F_{oo} = 32+1.6\pi_{oo}$

Source: International Standards and Recommended Practices, Environmental Protection, ICAO Annex 16 Volume II Part III Paragraph 2.3.2, 2nd edition July 1993, plus amendments: Amendment 3 (20 March 1997),Amendment 4 (4 November 1999),Amendment 5 (24 November 2005).

where:

D_p = the sum of emissions in the LTO cycle in g.

F_{oo} = thrust at sea level take-off (100 %).

π_{oo} = pressure ratio at sea level take-off thrust point (100 %).

The equivalent limits for HC and CO are D_p/F_{oo} = 19.6 for HC and D_p/F_{oo} = 118 for CO (ICAO Annex 16 Vol. II paragraph 2.2.2). Smoke is limited to a regulatory smoke number = 83 $(F_{oo})^{-0.274}$ or a value of 50, whichever is the lower.

A further description of the technical definitions in relation to engine certification as well as actual engine exhaust emission measurement data can be found in the ICAO Engine Exhaust Emission Database. The latter database is accessible from http://www.caa.co.uk, hosted by the UK Civil Aviation Authority.

For seagoing vessels, NO_x emissions are regulated as explained in Marpol 73/78 Annex VI, formulated by IMO (International Maritime Organisation). The legislation is relevant for diesel engines with a power output higher than 130 kW, which are installed on a ship constructed on or after 1 January 2000 and diesel engines with a power output higher than 130 kW which undergo major conversion on or after 1 January 2000.

The NO_x emission limits for ship engines in relation to their rated engine speed (n) given in RPM (Revolutions Pr Minute) are the following:

- 17 g pr kWh, n < 130 RPM
- 45 x n-0.2 g pr kWh, 130 ≤ n < 2000 RPM
- 9.8 g pr kWh, n ≥ 2000 RPM

Further, the Marine Environment Protection Committee (MEPC) of IMO has agreed amendments to MARPOL Annex VI in October 2008 in order to strengthen the emission standards for NO_x and the sulphur contents of heavy fuel oil used by ship engines.

For NO_x emission regulations, a three tiered approach is considered, which comprises the following:

- Tier I: Diesel engines (> 130 kW) installed on a ship constructed on or after 1 January 2000 and prior to 1 January 2011.
- Tier II: Diesel engines (> 130 kW) installed on a ship constructed on or after 1 January 2011.
- Tier III[8]: Diesel engines (> 130 kW) installed on a ship constructed on or after 1 January 2016.

As for the existing NO_x emission limits, the new Tier I-III NO_x legislation values rely on the rated engine speeds. The emission limit equations are shown in Table 3.36.

Table 3.36 Tier I-III NOx emission limits for ship engines (amendments to MARPOL Annex VI).

	NO_x limit	RPM (n)
Tier I	17 g pr kWh	$n < 130$
	$45 \cdot n^{-0.2}$ g pr kWh	$130 \leq n < 2000$
	9,8 g pr kWh	$n \geq 2000$
Tier II	14.4 g pr kWh	$n < 130$
	$44 \cdot n^{-0.23}$ g pr kWh	$130 \leq n < 2000$
	7.7 g pr kWh	$n \geq 2000$
Tier III	3.4 g pr kWh	$n < 130$
	$9 \cdot n^{-0.2}$ g pr kWh	$130 \leq n < 2000$
	2 g pr kWh	$n \geq 2000$

The Tier I emission limits are identical with the existing emission limits from MARPOL Annex VI.

Also agreed by IMO in October 2008, the NO_x Tier I limits are to be applied for existing engines with a power output higher than 5000 kW and a displacement per cylinder at or above 90 litres, installed on a ship constructed on or after 1 January 1990 but prior to 1 January 2000.

In relation to the sulphur content in heavy fuel and marine gas oil used by ship engines, Table 3.37 shows the current legislation in force, and the amendment of MARPOL Annex VI agreed by IMO in October 2008.

[8] For ships operating in a designated Emission Control Area. Outside a designated Emission Control Area, Tier II limits apply.

Table 3.37 Current legislation in relation to marine fuel quality.

Legislation		Heavy fuel oil		Gas oil	
		S- %	Impl. date (day/month/year)	S- %	Impl. date
EU-directive 93/12		None		0.2[1]	1.10.1994
EU-directive 1999/32		None		0.2	1.1.2000
EU-directive 2005/33[2]	SECA - Baltic sea	1.5	11.08.2006	0.1	1.1.2008
	SECA - North sea	1.5	11.08.2007	0.1	1.1.2008
	Outside SECA's	None		0.1	1.1.2008
MARPOL Annex VI	SECA – Baltic sea	1.5	19.05.2006		
	SECA – North sea	1.5	21.11.2007		
	Outside SECA	4.5	19.05.2006		
MARPOL Annex VI amendments	SECA's	1	01.03.2010		
	SECA's	0.1	01.01.2015		
	Outside SECA's	3.5	01.01.2012		
	Outside SECA's	0.5	01.01.2020[3]		

[1] Sulphur content limit for fuel sold inside EU.

[2] From 1.1.2010 fuel with a sulphur content higher than 0.1 % must not be used in EU ports for ships at berth exceeding two hours

[3] Subject to a feasibility review to be completed no later than 2018. If the conclusion of such a review becomes negative the effective date would default 1 January 2025.

For non-road machinery, the EU directive 2003/17/EC gives a limit value of 50 ppm sulphur in diesel (from 2005).

Emission factors

The SO_2 emission factors are fuel related, and rely on the sulphur contents given in the relevant EU fuel directives or in the Danish legal announcements. However, for jet fuel the default factor from IPCC (1996) is used. Road transport diesel is assumed to be used by engines in military and railways, and road transport gasoline is assumed to be used by non road working machinery and recreational craft. Hence, these types of machinery have the same SO_2 emission factors, as for road transport.

For all mobile sources, the emission factor source for NH_3, heavy metals and PAH is the EMEP/EEA guidebook (EMEP/EEA, 2009). The heavy metal emission factors for road transport and other mobile sources except national sea transport and fisheries originate from Winther and Slentø (2010). For civil aviation jet fuel, no heavy metal emission factors are proposed due to lack of data.

For military ground equipment, aggregated emission factors for gasoline and diesel are derived from road traffic emission simulations. For piston engine aircraft using aviation gasoline, aggregated emission factors for conventional cars are used.

For railways, specific Danish measurements from the Danish State Railways (DSB) (Delvig, 2009) are used to calculate the emission factors of NO_x, VOC, CO and TSP, and a NMVOC/CH_4 split is made based on own judgment.

For agriculture, forestry, industry, household gardening and inland waterways, the NO_x, VOC, CO and TSP emission factors are derived from various European measurement programmes; see IFEU (2004) and Winther et al. (2006). The NMVOC/CH_4 split is taken from USEPA (2004).

For national sea transport and fisheries, the NO_x emission factors predominantly come from the engine manufacturer MAN Diesel, as a function of engine production year. The CO, VOC and TSP emission factors come from the Danish TEMA2000 emission model (Trafikministeriet, 2000), whereas the PM_{10} and $PM_{2.5}$ size fractions are obtained from MAN Diesel.

Specifically for the ferries used by Mols Linjen new NO_x, VO and CO emission factors are provided by Kristensen (2008), originating from measurement results by Hansen et al. (2004), Wismann (1999) and PHP (1996).

For ship engines VOC/CH_4 splits are taken from EMEP/EEA (2009), and all emission factors are shown in Annex 2.B.12.

The source for aviation (jet fuel) emission factors is the EMEP/EEA guidebook (EMEP/EEA, 2009).

For all sectors, emission factors are given in CollectER format in Annex 2.B.14 for 2009. Table 3.38 shows the emission factors for SO_2, NO_X, NMVOC, CO, NH_3 and TSP in CollectER format used to calculate the emissions from other mobile sources in Denmark.

Factors for deterioration, transient loads and gasoline evaporation for non road machinery

The emission effects of engine wear are taken into account for diesel and gasoline engines by using the so-called deterioration factors. For diesel engines alone, transient factors are used in the calculations, to account for the emission changes caused by varying engine loads. The evaporative emissions of NMVOC are estimated for gasoline fuelling and tank evaporation. The factors for deterioration, transient loads and gasoline evaporation are taken from IFEU(2004), and are shown in Annex 2.B.9. For more details regarding the use of these factors, please refer to paragraph 3.1.4 or Winther et al. (2006).

Table 3.38 Fuel based emission factors for SO_2, NO_X, NMVOC, CO, NH_3 and TSP for other mobile sources in Denmark (2009).

			Emission factors[1] [g pr GJ]					
SNAP ID	Category	Fuel type	SO_2	NO_X	NMVOC	CO	NH_3	TSP
080100	Military	AvGas	22.99	859.00	1242.60	6972.00	1.60	10.00
080100	Military	Diesel	0.47	389.51	18.42	82.75	0.35	14.50
080100	Military	Gasoline	0.46	129.33	175.09	1503.62	23.22	1.69
080100	Military	Jet fuel	22.99	250.57	24.94	229.89	0.00	1.16
080200	Railways	Diesel	0.47	836.81	55.89	144.66	0.20	27.13
080300	Inland waterways	Diesel	46.84	842.80	162.30	445.05	0.17	99.56
080300	Inland waterways	Gasoline	0.46	517.18	1365.08	13946.94	0.10	47.96
080402	National sea traffic	Diesel	46.84	970.74	52.37	86.75	0.00	21.55
080402	National sea traffic	Residual oil	586.80	1886.45	62.25	205.36	0.00	51.05
080403	Fishing	Diesel	46.84	1367.70	57.22	188.76	0.00	21.55
080403	Fishing	LPG	0.00	1249.00	384.94	443.00	0.00	0.20
080404	International sea traffic	Diesel	46.84	1562.60	56.55	186.57	0.00	21.55
080404	International sea traffic	Residual oil	733.50	2100.18	62.13	204.97	0.00	63.83
080501	Air traffic, Dom. < 3000 ft.	AvGas	22.83	859.00	1242.60	6972.00	1.60	10.00
080501	Air traffic, Dom. < 3000 ft.	Jet fuel	22.99	299.23	71.46	192.55	0.00	1.16
080502	Air traffic, Int. < 3000 ft.	AvGas	22.83	859.00	1242.60	6972.00	1.60	10.00
080502	Air traffic, Int. < 3000 ft.	Jet fuel	22.99	294.91	23.08	176.23	0.00	1.16
080503	Air traffic, Dom. > 3000 ft.	Jet fuel	22.99	275.78	19.38	113.69	0.00	1.16
080504	Air traffic, Int. > 3000 ft.	Jet fuel	22.99	238.94	7.14	54.53	0.00	1.16
080600	Agriculture	Diesel	2.34	623.15	61.56	350.97	0.18	48.30
080600	Agriculture	Gasoline	0.46	111.21	1198.25	21741.45	1.52	31.17
080700	Forestry	Diesel	2.34	453.17	33.45	248.17	0.18	27.86
080700	Forestry	Gasoline	0.46	76.20	6037.15	17249.02	0.09	79.13
080800	Industry	Diesel	2.34	586.11	65.50	332.21	0.18	56.52
080800	Industry	Gasoline	0.46	207.71	1551.34	13776.12	0.10	16.59
080800	Industry	LPG	0.00	1328.11	146.09	104.85	0.21	4.89
080900	Household and gardening	Gasoline	0.46	97.45	2401.47	29381.95	0.09	16.51
081100	Commercial/Institutional	Gasoline	0.46	92.03	2160.09	30239.09	0.09	27.90
080501	Air traffic, Dom. < 3000 ft.	AvGas	22.83	859.00	1242.60	6972.00	1.60	10.00
080501	Air traffic, Dom. < 3000 ft.	Jet fuel	22.99	285.51	108.59	263.98	0.00	1.16
080502	Air traffic, Int. < 3000 ft.	AvGas	22.83	859.00	1242.60	6972.00	1.60	10.00
080502	Air traffic, Int. < 3000 ft.	Jet fuel	22.99	337.22	72.55	272.32	0.00	1.16
080503	Air traffic, Dom. > 3000 ft.	Jet fuel	22.99	280.51	18.06	61.14	0.00	1.16
080504	Air traffic, Int. > 3000 ft.	Jet fuel	22.99	310.99	10.91	33.10	0.00	1.16

[1] References. SO_2: Country-specific; Military: Aggregated emission factors for road transport; Railways (NO_x, NMVOC and TSP): Danish State Railways; Agriculture, forestry, industry, household gardening and inland waterways (NO_x, VOC and TSP): IFEU (2004); National sea transport and fishing: MAN B&W (NO_x) and TEMA2000 (NMVOC, TSP); Aviation - jet fuel (NO_X, NMVOC and TSP): EMEP/EEA; Aviation - av.gasoline: Aggregated emission factors for conventional gasoline cars.

3.3.4 Calculation method

Air traffic

For aviation, the domestic and international estimates are made separately for landing and take-off (LTOs < 3000 ft), and cruising (> 3000 ft).

The fuel consumption for one LTO cycle is calculated according to the following sum formula:

$$FC^{a}_{LTO} = \sum_{m=1}^{4} t_m \cdot ff_{a,m} \quad (13)$$

Where FC = fuel consumption (kg), m = LTO mode (approach/landing, taxiing, take off, climb out), t = times in mode (s), ff = fuel flow (kg pr s), a = representative aircraft type.

The emissions for one LTO cycle are estimated as follows:

$$E_{LTO}^{a} = \sum_{m=1}^{4} FC_{a,m} \cdot EI_{a,m} \quad (14)$$

Due to lack of specific airport data, for approach/descent, take off and climb out, standardised times-in-modes of 4, 0.7 and 2.2 mins are used as defined by ICAO (ICAO, 1995), whereas for taxiing the appropriate time interval is 13 mins in Copenhagen Airport and 5 mins in other airports present in the Danish inventory.

To estimate cruise results, fuel consumption and emissions for standard flying distances from EMEP/EEA (2009) are interpolated or extrapolated – in each case determined by the great circle distance between the origin and the destination airports.

If the great circle distance, y, is smaller than the maximum distance for which fuel consumption and emission data are given in the EMEP/EEA data bank the fuel consumption or emission E (y) becomes:

$$E(y) = E_{x_i} + \frac{(y - x_i)}{x_{i+1} - x_i} \cdot (E_{x_{i+1}} - E_{x_i}) \quad y<x_{max},\ i = 0,1,2\ldots max-1 \quad (15)$$

In (5.3) x_i and x_{max} denominate the separate distances and the maximum distance, respectively, with known fuel use and emissions. If the flight distance y exceeds x_{max} the maximum figures for fuel use and emissions must be extrapolated and the equation then becomes:

$$E(y) = E_{x_{max}} + \frac{(y - x_{max})}{x_{max} - x_{max-1}} \cdot (E_{x_{max}} - E_{x_{max-1}}) \quad y>x_{max} \quad (16)$$

Total results are summed up and categorised according to each flight's airport and country codes.

The overall fuel precision in the model is around 0.8, derived as the fuel ratio between model estimates and statistical sales. The fuel difference is accounted for by adjusting cruising fuel use and emissions in the model according to domestic and international cruising fuel shares.

Prior to 2001, the calculation procedure was first to estimate each year's fuel use and emissions for LTO. Secondly, total cruising fuel use was found year by year as the statistical fuel use total minus the calculated fuel use for LTO. Lastly, the cruising fuel use was split into a domestic and international part by using the results from a Danish city-pair emission inventory in 1998 (Winther, 2001a). For more details of this latter fuel allocation procedure, see Winther (2001b).

Non-road working machinery and recreational craft

Prior to adjustments for deterioration effects and transient engine operations, the fuel use and emissions in year X, for a given machinery type, engine size and engine age, are calculated as:

$$E_{Basis}(X)_{i,j,k} = N_{i,j,k} \cdot HRS_{i,j,k} \cdot P \cdot LF_i \cdot EF_{y,z} \quad (17)$$

where E_{Basis} = fuel use/emissions in the basic situation, N = number of engines, HRS = annual working hours, P = average rated engine size in kW, LF = load factor, EF = fuel use/emission factor in g pr kWh, i = machinery type, j = engine size, k = engine age, y = engine-size class and z = emission level. The basic fuel use and emission factors are shown in Annex 2.B.9.

The deterioration factor for a given machinery type, engine size and engine age in year X depends on the engine-size class (only for gasoline), y, and the emission level, z. The deterioration factors for diesel and gasoline 2-stroke engines are found from:

$$DF_{i,j,k}(X) = \frac{K_{i,j,k}}{LT_i} \cdot DF_{y,z} \quad (18)$$

where DF = deterioration factor, K = engine age, LT = lifetime, i = machinery type, j = engine size, k = engine age, y = engine-size class and z = emission level.

For gasoline 4-stroke engines the deterioration factors are calculated as:

$$DF_{i,j,k}(X) = \sqrt{\frac{K_{i,j,k}}{LT_i}} \cdot DF_{y,z} \quad (19)$$

The deterioration factors inserted in (18) and (19) are shown in Annex 2.B.9. No deterioration is assumed for fuel use (all fuel types) or for LPG engine emissions and, hence, DF = 1 in these situations.

The transient factor for a given machinery type, engine size and engine age in year X, relies only on emission level and load factor, and is denominated as:

$$TF_{i,j,k}(X) = TF_z \quad (20)$$

Where i = machinery type, j = engine size, k = engine age and z = emission level.

The transient factors inserted in (20) are shown in Annex 2.B.9. No transient corrections are made for gasoline and LPG engines and, hence, TF_z = 1 for these fuel types.

The final calculation of fuel use and emissions in year X for a given machinery type, engine size and engine age, is the product of the expressions 17-20:

$$E(X)_{i,j,k} = E_{Basis}(X)_{i,j,k} \cdot TF(X)_{i,j,k} \cdot (1 + DF(X)_{i,j,k}) \quad (21)$$

The evaporative hydrocarbon emissions from fuelling are calculated as:

$$E_{Evap,fueling,i} = FC_i \cdot EF_{Evap,fueling} \quad (22)$$

Where $E_{Evap,fueling}$, = hydrocarbon emissions from fuelling, i = machinery type, FC = fuel consumption in kg, $EF_{Evap,fueling}$ = emission factor in g NMVOC pr kg fuel.

For tank evaporation, the hydrocarbon emissions are found from:

$$E_{Evap,\tan k,i} = N_i \cdot EF_{Evap,\tan k,i} \quad (23)$$

Where $E_{Evap,tank,i}$ = hydrocarbon emissions from tank evaporation, N = number of engines, i = machinery type and $EF_{Evap,fueling}$ = emission factor in g NMVOC pr year.

Ferries, other national sea transport and fisheries

The fuel use and emissions in year X, for regional ferries are calculated as:

$$E(X) = \sum_i N_i \cdot T_i \cdot S_{i,j} \cdot P_i \cdot LF_j \cdot EF_{k,l,y} \quad (24)$$

Where E = fuel use/emissions, N = number of round trips, T = sailing time pr round trip in hours, S = ferry share of ferry service round trips, P = engine size in kW, LF = engine load factor, EF = fuel use/emission factor in g pr kWh, i = ferry service, j = ferry, k = fuel type, l = engine type, y = engine year.

For the remaining navigation categories, the emissions are calculated using a simplified approach:

$$E(X) = \sum_i EC_{i,k} EF_{k,l,y} \quad (25)$$

Where E = fuel use/emissions, EC = energy consumption, EF = fuel use/emission factor in g pr kg fuel, i = category (local ferries, other national sea, fishery, international sea), k = fuel type, l = engine type, y = average engine year.

The emission factor inserted in (25) is found as an average of the emission factors representing the engine ages which are comprised by the average lifetime in a given calculation year, X:

$$EF_{k,l,y} = \frac{\sum_{year=X}^{year=X-LT} EF_{k,l}}{LT_{k,l}} \quad (26)$$

Other sectors

For military and railways, the emissions are estimated with the simple method using fuel-related emission factors and fuel use from the DEA:

$$E = FC \cdot EF \quad (27)$$

where E = emission, FC = fuel consumption and EF = emission factor. The calculated emissions for other mobile sources are shown in CollectER format in Annex 2.B.14 for the years 2009 and as time-series 1985-2009 in Annex 2.B.15 (NFR format).

Energy balance: DEA statistics and NERI estimates

Following convention rules, the DEA statistical fuel sales figures are behind the full Danish inventory. However, in some cases for mobile sources the DEA statistical sectors do not fully match the inventory sectors. This is the case for non road machinery, where relevant DEA statistical sectors also include fuel consumed by stationary sources.

In other situations, fuel consumption figures estimated by NERI from specific bottom-up calculations are regarded as more reliable than DEA reported sales. This is the case for national sea transport.

In the following the transferral of fuel consumption data from DEA statistics into inventory relevant categories is explained for national sea transport and fisheries, non road machinery and recreational craft, and road transport. A full list of all fuel consumption data, DEA figures as well as intermediate fuel consumption data, and final inventory input figures is shown in Annex 2.B.13.

National sea transport and fisheries

For national sea transport in Denmark, the fuel consumption estimates obtained by NERI (see 1.1.3 Activity data – national sea transport) are regarded as much more accurate than the DEA fuel sales data, since the large fluctuations in reported fuel sales cannot be explained by the actual development in the traffic between different national ports. As a consequence, the new bottom-up estimates replace the previous fuel based figures for national sea transport.

There are different potential reasons for the differences between estimated fuel consumption and reported sales for national sea transport in Denmark. According to the DEA, the latter fuel differences are most likely explained by inaccurate costumer specifications made by the oil suppliers. This inaccuracy can be caused by a sector misallocation in the sales statistics between national sea transport and fisheries for gas oil, and between national sea transport and industry for heavy fuel oil (Peter Dal, DEA, personal communication, 2007). Further, fuel sold for vessels sailing between Denmark and Greenland/Faroe Islands are reported as international in the DEA statistics, and this fuel categorisation is different from the IPCC guideline definitions (see following paragraph "Bunkers").

Following this, for fisheries and industry the updated fuel consumption time-series for national sea transport lead, in turn, to changes in the fuel activity data for fisheries (gas oil), industry (heavy fuel oil) and international sea transport, so the national energy balance can remain unchanged.

For fisheries, fuel investigations made prior to the initiation of the work made by Winther (2008a) have actually pointed out a certain area of inaccuracy in the DEA statistics. No engines installed in fishing vessels use heavy fuel oil, even though a certain amount of heavy fuel oil is listed in the DEA numbers for some statistical years (H. Amdissen, Danish Fishermen's Association, personal communication, 2006). Hence, for fisheries small amounts of fuel oil are transferred to national sea transport, and in addition small amounts of gasoline and diesel are transferred to recreational craft.

Non road machinery and recreational craft

For diesel and LPG, the non-road fuel consumption estimated by NERI is partly covered by the fuel-use amounts in the following DEA sectors: agriculture and forestry, market gardening, and building and construction. The remaining quantity of non-road diesel and LPG is taken from the DEA industry sector.

For gasoline, the DEA residential sector, together with the DEA sectors mentioned for diesel and LPG, contribute to the non-road fuel consumption total. In addition, a certain amount of fuel from road transport is needed to reach the fuel-use goal.

The amount of diesel and LPG in DEA industry not being used by non-road machinery is included in the sectors, "Combustion in manufacturing industry" (0301) and "Non-industrial combustion plants" (0203) in the Danish emission inventory.

For recreational craft, the calculated fuel-use totals for diesel and gasoline are subsequently subtracted from the DEA fishery sector. For gasoline, the DEA reported fuel consumption for fisheries is far too small to fill the fuel gap, and hence the missing fuel amount is taken from the DEA road transport sector.

Bunkers

The distinction between domestic and international emissions from aviation and navigation should be in accordance with the Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories. For the national emission inventory this, in principle, means that fuel sold (and associated emissions) for flights/sea transportation starting from a seaport/airport in the Kingdom of Denmark, with destinations inside or outside the Kingdom of Denmark, are regarded as domestic or international, respectively.

Aviation

For aviation, the emissions associated with flights inside the Kingdom of Denmark are counted as domestic. The flights from Denmark to Greenland and the Faroe Islands are classified as domestic flights in the inventory background data. In Greenland and the Faroe Islands, the jet fuel sold is treated as domestic. This decision can be considered sensible since in the real world almost no fuel is bunkered in Greenland/Faroe Islands by flights other than those going to Denmark.

Navigation

In DEA statistics, the domestic fuel total consists of fuel sold to Danish ferries and other ships sailing between two Danish ports. The DEA international fuel total consists of the fuel sold in Denmark to international ferries, international warships, other ships with foreign destinations, transport to Greenland and the Faroe Islands, tank vessels and foreign fishing boats.

In order to follow the IPCC guidelines the bottom-up fuel estimates for the ferry routes between Denmark and the Faroe Islands, and freight transport between Denmark and Greenland/Faroe Islands are being subtracted from the fuel sales figures for international sea transport prior to inventory fuel input.

In Greenland, all marine fuel sales are treated as domestic. In the Faroe Islands, fuel sold in Faroese ports for Faroese fishing vessels and other Faroese ships is treated as domestic. The fuel sold to Faroese ships bunkering outside Faroese waters and the fuel sold to foreign ships in Faroese ports or outside Faroese waters is classified as international (Lastein and Winther, 2003).

Conclusively, the domestic/international fuel split (and associated emissions) for navigation is not determined with the same precision as for aviation. It is considered, however, that the potential of incorrectly allocated fuel quantities is only a small part of the total fuel sold for navigational purposes in the Kingdom of Denmark.

3.3.5 Uncertainties and time-series consistency

Emission uncertainty estimates are made for road transport and other mobile sources using the guidelines formulated in the Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories (IPCC, 2000). However, for TSP the latter source indicates no uncertainty factor and, instead, this factor is based on own judgement.

The activity data uncertainty factor is assumed to be 2 and 10 % for road transport and other mobile sources, respectively, based on own judgement.

The uncertainty estimates should be regarded as preliminary only and may be subject to changes in future inventory documentation. The calculations are shown in Annex 2.B.16 for all emission components.

Table 3.39 Uncertainties for activity data, emission factors and total emissions in 2009 and as a trend.

	Emission factor uncertainties [%]		Emission uncertainties [%]	
Pollutant	Road	Other	Overall 2009	Trend
SO_2	50	50	49	4
NO_x	50	100	55	10
NMVOC	50	100	54	10
CO	50	100	59	16
NH_3	1000	1000	995	2316
TSP	50	100	48	3
PM_{10}	50	100	50	5
$PM_{2.5}$	50	100	54	7
Arsenic	1000	1000	869	67
Cadmium	1000	1000	813	150
Chromium	1000	1000	822	186
Copper	1000	1000	999	5
Mercury	1000	1000	713	121
Nickel	1000	1000	928	35
Lead	1000	1000	854	14
Selenium	1000	1000	778	125
Zinc	1000	1000	943	40
Dioxins	1000	1000	744	178
Flouranthene	1000	1000	791	5
Benzo(b) flouranthene	1000	1000	782	41
Benzo(k) flouranthene	1000	1000	825	68
Benzo(a) pyrene	1000	1000	863	64
Benzo(g,h,i) perylene	1000	1000	796	51
indeno(1,2,3-c,d) pyrene	1000	1000	775	152

As regards time-series consistency, background flight data cannot be made available on a city-pair level from 2000 or earlier. However, aided by LTO/aircraft statistics for these years and the use of proper assumptions, a sound level of consistency is still obtained in this part of the transport inventory.

The time-series of emissions for mobile machinery in the agriculture, forestry, industry, household and gardening (residential), and inland waterways (part of navigation) sectors are less certain than time-series for other sectors, since DEA statistical figures do not explicitly provide fuel use information for working equipment and machinery.

3.3.6 Quality assurance/quality control (QA/QC)

It is the intention to publish every second year a sector report for road transport and other mobile sources. The last sector report concerned the 2006 inventory (Winther, 2008b).

The QA/QC descriptions of the Danish emission inventories for transport are given in Nielsen et al. (2010).

3.3.7 Recalculations

The following recalculations and improvements of the emission inventories have been made since the emission reporting in 2009.

Road transport

The total mileage per vehicle category from 2005-2008 have been updated based on new data prepared by DTU Transport. More accurate fleet and mileage figures are provided by the latter institution, split into the different vehicle layers of the emission model. An important change is the categorisation of fleet data for heavy duty trucks and buses into the numerous weight classes covered by the COPERT IV model.

The minimum and maximum percentage difference and year of numeric maximum differences (min %, max %, year of max %) for the different emission components are: Particulates (-23.5 %,1.2 %, 2003), NOx (-10.9 %, 3.5 %, 2008), SO_2 (0 %, - 0.1 %, 2008), NMVOC (-10.7 %, -0.2 %, 2007), CO (-8.5 %, 0.7 %, 2008) and NH_3 (-26.3 %, 14.2 %, 1991).

National sea transport

Fuel consumption by vessels sailing between Denmark and Greenland/Faroe Islands, and between Denmark and the North Sea off shore installations has been added to this category. Previously this fuel consumption was reported under international sea transport. The corresponding minimum and maximum percentage difference and year of numeric maximum differences (min %, max %, year of max %) for the different emission components are: Particulates (15 %, 44 %, 2006), NOx (13 %, 56 %, 2008), SO_2 (18 %, 131 %, 2008), NMVOC (3 %, 11 %, 2008), CO (3 %, 6 %, 2008) and NH_3 (0 %).

Fisheries

Due to the changes made in national sea transport, and the fuel transferral between national sea transport and fisheries made as an integral part of the Danish inventories, significant fuel consumption and emission changes have been made for the fishery sector accordingly, for 2001 onwards. The corresponding minimum and maximum percentage difference and year of numeric maximum differences (min %, max %, year of max %) are (27 %, 39 %, 2006), for all emission components.

Agriculture

The stock of harvesters have been updated for the years 2001-2008, based on discussions with the Danish Knowledge Centre for Agriculture. For gasoline fuelled ATV's the stock has been updated for 2007 and 2008. The corresponding minimum and maximum percentage difference and year of numeric maximum differences (min %, max %, year of max %) for SO_2, NOx and Particulates are (0 %, 2 %, 2006), NMVOC (0 %, 8 %, 2008), CO (0 %, 13 %, 2008) and NH_3 (0 %, 5 %, 2008).

Agriculture/forestry/fisheries

The total consequences for agriculture/forestry/fisheries, expressed as minimum and maximum percentage difference and year of numeric maximum differences (min %, max %, year of max %) for the different emission components are: Particulates (3.9 %, 6.5 %, 2006), NO_x (11.9 %, 16.9 %, 2006), SO_2 (18.8 %, 36.7 %, 2006), NMVOC (3.9 %, 10.2 %, 2008), CO (1.8 %, 13.0 %, 2008) and NH_3 (0.2 %, 5.3 %, 2008).

Military

Emission factors derived from the new road transport simulations have caused some emission changes from 1985-2008. The minimum and maximum emission differences (min %, max %) for the different emission components are: Particulates (-24 %, 1 %), NO_x (-7 %, 1 %), SO_2 (0 %), NMVOC (-9 %, 0 %), CO (-5 %, 0 %) and NH_3 (-5 %, 7 %).

Residential

A split in activity codes has been made. In this way the majority of the fuel consumption and emissions previously reported under residential (SNAP code 0809; NFR code 1A4b) are now reported under commercial/institutional (SNAP code 0811; NFR code 1A4a ii).

No changes have been made in the estimated fuel consumption and emissions for Residential and Commercial/institutional as a sum.

Commercial/institutional

A split in activity codes has been made. The majority of the fuel consumption and emissions previously reported under residential (SNAP code 0809; NFR code 1A4b) are now reported under commercial/institutional (SNAP code 0811; NFR code 1A4a ii).

No changes have been made in the estimated fuel consumption and emissions for Residential and Commercial/institutional as a sum.

Industrial non road machinery

The annual working hours for fork lifts in 2008 have been adjusted with a factor of 0.95 due to the decrease in activities caused by the global financial crisis. The total fuel consumption and emission changes in 2008 for industrial non road machinery are approximately -1 %.

Aviation

Very small emission changes between -2 % and 1 % occur for the years 2001-2008, due to inclusion of new aircraft types assigned to the representative aircraft types.

3.3.8 Improvements

Fuel consumption and emission factors for road transport vehicles will be updated by the time when new data becomes available from COPERT model updates.

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3.4 Fugitive emissions (NFR sector 1B)

This chapter includes fugitive emissions in the NFR sector 1B.

3.4.1 Source category description

According to the categorization in the reporting format for the UNECE CLRTAP fugitive emissions is a sub-category under the main-category Energy (Sector 1). Fugitive emissions (Sector 1B) is segmented into sub-categories covering emissions from solid fuels (1B1), oil (1B2a), natural gas (1B2b) and from venting and flaring (1B2c). The sub-sectors relevant for the Danish emission inventory are shortly described below according to Danish conditions:

- 1B1c Fugitive emission from solid fuels: Emissions from solid fuels are only relevant for the Danish national emission inventories in the case of particulate emissions. Other components are not occurring, as these emissions should be included in the inventory for the nation housing the coalmines.

- 1B2a Fugitive emissions from oil include emissions from offshore activities and refineries.
- 1B2b Fugitive emissions from natural gas include emissions from transmission and distribution of natural gas. Emissions from gas storage are included in the transmission.
- 1B2c Venting and flaring include activities onshore and offshore. Flaring occur both offshore and onshore in gas treatment and storage plants and in refineries. Venting occur in gas storage plants. Venting of gas is assumed to be negligible in extraction and in refineries as controlled venting enters the gas flare system.

Activity data, emission factors and emissions are stored in the Danish emission database on SNAP sector categories (Selected Nomenclature for Air Pollution). In Table 3.40 the corresponding SNAP codes and NFR sectors relevant to fugitive emissions are shown. Further, the table holds the SNAP names for the SNAP codes and the overall activity (e.g. oil and natural gas).

Table 3.40 List of NFR sectors relevant for fugitive emissions, and the corresponding SNAP codes and emission sources.

NFR sector	SNAP ID	SNAP name	Source
	04	Production processes	
1 B 2 a	040101	Petroleum products processing	Oil
1 B 2 a	040103	Sulfur Recovery Plants	Oil
1 B 2 a	040104	Storage and handling of petroleum products in refinery	Oil
	05	Extraction and distribution of fossil fuels and geothermal energy	
1 B 1 a	050103	Storage of solid fuel	Coal mining and handling
1 B 2 a	050201	Land-based activities	Oil
1 B 2 a	050202 *	Off-shore activities	Oil
1 B 2 a	050503	Service stations (including refuelling of cars)	Oil
1 B 2 b	050601	Pipelines	Natural gas / transmission
1 B 2 b	050602	Distribution networks	Natural gas / distribution
	09	Waste treatment and disposal	
1 B 2 c	050699	Venting in gas treatment facilities	Venting and flaring
1 B 2 c	090203	Flaring in oil refinery	Venting and flaring
1 B 2 c	090206	Flaring in oil and gas extraction	Venting and flaring

* In the Danish emission inventory emissions from extraction of gas are united under “Extraction, 1st treatment and loading of liquid fossil fuels / Off-shore activities” (NFR 1B2a / SNAP 050202).

Table 3.41 summarizes the Danish fugitive emissions in 2009. The methodologies, activity data and emission factors used for calculation are described in the following chapters.

Table 3.41 Summary of the Danish fugitive emission in 2009. P refers to point source and A to area source.

IPCC code	SNAP code	Source	Pollutant	Emission	Unit
1B2a iv	040101	P	SO_2	0*	Mg
1B2a iv	040101	P	NMVOC	3994	Mg
1B2a iv	040103	P	SO_2	375	Mg
1B2a iv	040104	A	NMVOC	0**	Mg
1B1a	050103	A	TSP	1007	Mg
1B1a	050103	A	PM_{10}	403	Mg
1B1a	050103	A	$PM_{2.5}$	40	Mg
1B2a i	050201	A	NMVOC	3818	Mg
1B2a i	050202	A	NMVOC	2018	Mg
1B2a v	050503	A	NMVOC	1171	Mg
1B2b	050601	A	NMVOC	2	Mg
1B2b	050603	A	NMVOC	32	Mg
1B2c	050699	P	NMVOC	17	Mg
1B2c	090203	P	SO_2	453	Mg
1B2c	090203	P	NO_x	17	Mg
1B2c	090203	P	NMVOC	23	Mg
1B2c	090203	P	CO	53	Mg
1B2c	090203	P	TSP	0.3	Mg
1B2c	090203	P	PM_{10}	0.3	Mg
1B2c	090203	P	$PM_{2.5}$	0.3	Mg
1B2c	090203	P	As	0.0	kg
1B2c	090203	P	Cd	0.1	kg
1B2c	090203	P	Cr	0.2	kg
1B2c	090203	P	Cu	0.1	kg
1B2c	090203	P	Hg	< 0.1	kg
1B2c	090203	P	Ni	0.3	kg
1B2c	090203	P	Pb	0.1	kg
1B2c	090203	P	Se	< 0.1	kg
1B2c	090203	P	Zn	4.2	kg
1B2c	090203	P	Dioxin	< 0.01	g
1B2c	090203	P	Benzo(b)flouranthene	< 0.01	kg
1B2c	090203	P	Benzo(k)flouranthene	< 0.01	kg
1B2c	090203	P	Benzo(a)pyrene	< 0.01	kg
1B2c	090203	P	Indeno(1,2,3-c,d)pyrene	< 0.01	kg
1B2c	090206	A	SO_2	1.2	Mg
1B2c	090206	A	NO_x	105	Mg
1B2c	090206	A	NMVOC	9	Mg
1B2c	090206	A	CO	85	Mg
1B2c	090206	A	TSP	4	Mg
1B2c	090206	A	PM_{10}	4	Mg
1B2c	090206	A	$PM_{2.5}$	4	Mg
1B2c	090206	A	As	0.3	kg
1B2c	090206	A	Cd	2.0	kg
1B2c	090206	A	Cr	2.7	kg
1B2c	090206	A	Cu	1.5	kg
1B2c	090206	A	Hg	0.4	kg
1B2c	090206	A	Ni	3.9	kg
1B2c	090206	A	Pb	0.8	kg
1B2c	090206	A	Se	< 0.1	kg
1B2c	090206	A	Zn	54.6	kg
1B2c	090206	A	Dioxin	< 0.01	g
1B2c	090206	A	Benzo(b)flouranthene	< 0.01	kg
1B2c	090206	A	Benzo(k)flouranthene	< 0.01	kg

Continued					
1B2c	090206	A	Benzo(a)pyrene	< 0.01	kg
1B2c	090206	A	Indeno(1,2,3-c,d)pyrene	< 0.01	kg
1B2c	090206	P	SO_2	< 0.1	Mg
1B2c	090206	P	NO_x	6	Mg
1B2c	090206	P	NMVOC	14	Mg
1B2c	090206	P	CO	1	Mg
1B2c	090206	P	TSP	< 0.1	Mg
1B2c	090206	P	PM_{10}	< 0.1	Mg
1B2c	090206	P	$PM_{2.5}$	< 0.1	Mg
1B2c	090206	P	As	< 0.1	kg
1B2c	090206	P	Cd	< 0.1	kg
1B2c	090206	P	Cr	< 0.1	kg
1B2c	090206	P	Cu	< 0.1	kg
1B2c	090206	P	Hg	< 0.1	kg
1B2c	090206	P	Ni	< 0.1	kg
1B2c	090206	P	Pb	< 0.1	kg
1B2c	090206	P	Se	< 0.1	kg
1B2c	090206	P	Zn	0.6	kg
1B2c	090206	P	Dioxin	< 0.01	g
1B2c	090206	P	Benzo(b)flouranthene	< 0.01	kg
1B2c	090206	P	Benzo(k)flouranthene	< 0.01	kg
1B2c	090206	P	Benzo(a)pyrene	< 0.01	kg
1B2c	090206	P	Indeno(1,2,3-c,d)pyrene	< 0.01	kg

* SO_2 from SNAP 040101 is included in SNAP 010306.

** Not occurring in 2009.

3.4.2 Methodological issues

The following chapters give descriptions on the methods of calculation used in the Danish emission inventory. Further, the activity data and emission factors that form the basis for the calculations are described according to data source and values.

Fugitive emissions from solid fuels

The emissions of particulate matter from storage of coal are estimated on basis of the imported amount of coal (equation 3.4.1).

$$E_{coal\_storage} = EMF_{coal\_storage} \cdot I_{coal} \qquad \text{(Eq. 3.4.1)}$$

where $EMF_{coal\_storage}$ is the emission factor for storage of coal in coal piles and I_{coal} is the amount of coal imported in the actual year.

Fugitive emissions from oil

The emissions from oil derive from offshore activities, service stations and refineries. Emissions from offshore activities include emissions from extraction, onshore oil tanks and onshore and offshore loading of ships. In the case of service stations emissions from reloading of tankers and refuelling of vehicles are included. The emissions from refineries derive from petroleum products processing (oil refining). Emissions from flaring in refineries are included in the chapters concerning flaring.

Offshore activities

Fugitive emissions from oil include emissions from offshore extraction, from onshore oil tanks and from onshore and offshore loading of ships.

The total emission can be expressed as:

$$E_{total} = E_{extraction} + E_{ship} + E_{oil\ tanks} \qquad \text{(Eq. 3.4.2)}$$

Fugitive emissions from extraction

According to the EMEP/EEA Guidebook (EMEP/EEA, 2009) the total fugitive emissions of volatile organic components (VOC) from extraction of oil and gas can be estimated by means of equation 3.4.3.

$$E_{extraction,VOC} = 40.2 \cdot N_P + 1.1 \cdot 10^{-2} P_{gas} + 8.5 \cdot 10^{-6} \cdot P_{oil} \qquad \text{(Eq. 3.4.3)}$$

where $E_{extraction,VOC}$ is the emission of VOC in Mg/year, N_P is the number of platforms, P_{gas} is the production of gas, 10^6 Nm^3 and P_{oil} is the production of oil, 10^6 tonnes.

It is assumed that the VOC contains 75 % CH_4 and 25 % NMVOC and in consequence the total emission of NMVOC for extraction of oil and gas can be calculated as:

$$E_{extraction,NMVOC} = 0.25 \cdot E_{extraction,VOC} \qquad \text{(Eq. 3.4.4)}$$

Loading of ships

Fugitive emissions of NMVOC from loading of ships include the transfer of oil from storage tanks or directly from the well into ships. The activity also includes losses during transport. When oil is loaded hydrocarbon vapour will be displaced by oil and new vapour will be formed, both leading to emissions. The emissions from ships are calculated by equation 3.4.5.

$$E_{ships} = EMF_{ships,onshore} \cdot L_{oil,onshore} + EMF_{ships,offshore} \cdot L_{oil,ofshore} \qquad \text{(Eq. 3.4.5)}$$

where EMF_{ships} is the emission factor for loading of ships and L_{oil} is the amount of oil loaded.

Oil tanks

The NMVOC emissions for storage of oil are given in the environmental reports from DONG Energy for 2009 (DONG Energy, 2010b). An implied emission factor is calculated on the basis of the amount of oil transported in pipelines according to equation 3.4.6.

$$IEF_{tanks} = E_{tanks} \div T_{oil} \qquad \text{(Eq. 3.4.6)}$$

where IEF_{tanks} is the implied emission factor for storage of raw oil in tanks, E_{tanks} is the emission and T_{oil} is the amount of oil transported in pipelines.

Service stations

NMVOC emissions from service stations are estimated as outlined in equation 3.4.7.

$$E_{service\ stations} = \left(EMF_{reloading} \cdot T_{fuel}\right) + \left(EMF_{refuelling} \cdot T_{fuel}\right) \quad \text{(Eq. 3.4.7)}$$

where $EMF_{reloading}$ is the emission factor for reloading of tankers to underground storage tanks at the service stations, $EMF_{refuelling}$ is the emission factor for refuelling of vehicles and T_{fuel} is the amount of gasoline used for road transport.

Oil refining

When oil is processed in the refineries, part of the volatile organic components (VOC) is emitted to the atmosphere. The VOC emissions from the petroleum refinery process include non-combustion emissions from handling and storage of feedstock (raw oil), from the petroleum product processing and from handling and storage of products. Emissions from flaring in refineries are included under "Flaring". Emissions related to process furnaces in refineries are included in stationary combustion with the relevant emission factors. In cases where only the total VOC emission is given by the refinery the emission of NMVOC is estimated due to the assumption that 1 % of VOC is CH_4 and the remaining 99 % is NMVOC.

Both the non-combustion processes including product processing and sulphur recovery plants emit SO_2. The SO_2 emissions are calculated by the refineries and implemented in the emission inventory without further calculation.

Transmission and distribution of gas

The fugitive emission from transmission, storage and distribution is based on information from the gas companies. The transmission and distribution companies give data on the transported amount and length and material of the pipeline systems. The fugitive losses from pipelines are only given for some companies, here among the transmission company. The available distribution data are used for the remaining companies too. From the fugitive losses from transmission and distribution pipelines the emissions of NMVOC are calculated due to the gas quality measured by Energinet.dk.

Flaring

Emissions from flaring are estimated from the amount of gas flared offshore, in gas treatment/storage plants and in refineries and from the corresponding emission factors. From 2006 offshore flaring is given in the reports for the European Union Greenhouse Gas Emission Trading System (EU ETS) and thereby flaring can be split to the individual production units. Before 2006 only the summarized flared amount are available.

3.4.3 Activity data

Coal storage

The activity data is the imported amounts and the calorific values of coal (Danish Energy Agency, 2010b). In 2009 the imported amount was 6 710 Gg (Figure 3.98) which is a decrease since 2008.

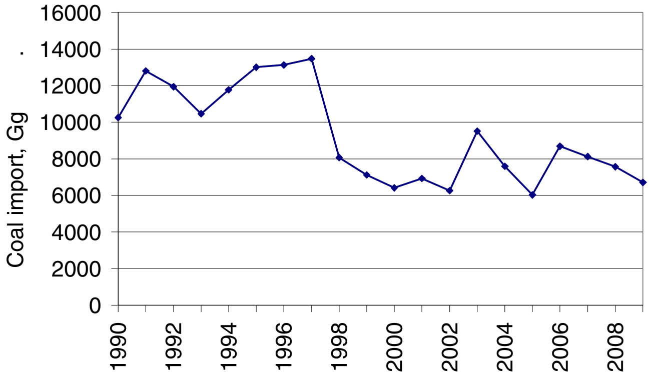

Figure 3.98 Amounts of imported coal.

Extraction of oil and gas and loading of ships

Activity data used in the calculations of the emissions from oil and gas production and loading of ships are shown in Table 3.42. Data are based on information from the Danish Energy Agency (2010a) and from the environmental reports from DONG Energy (DONG Energy, 2010b).

Table 3.42 Activity data for 2009.

Activity	Symbols	Amounts	Data source
Number of platforms	N_p	54	Danish Energy Agency, 2010a
Produced gas, 10^6 Nm^3	P_{gas}	8 559	Danish Energy Agency, 2010a
Produced oil, 10^3 m^3	$P_{oil,vol}$	15 169	Danish Energy Agency, 2010a
Produced oil, 10^3 tonnes	P_{oil}	13 045	Danish Energy Agency, 2010a
Oil loaded, 10^3 m^3	$L_{oil\ off\text{-}shore}$	1 687	Danish Energy Agency, 2010a
Oil loaded, 10^3 tonnes	$L_{oil\ off\text{-}shore}$	1 451	Danish Energy Agency, 2010a
Oil loaded, 10^3 m^3	$L_{oil\ on\text{-}shore}$	10 000	DONG Energy, 2010b
Oil loaded, 10^3 tonnes	$L_{oil\ on\text{-}shore}$	8 600	DONG Energy, 2010b

Mass weight raw oil = 0.86 tonnes per m^3

As seen in Figure 3.99 the production of oil and gas in the North Sea has generally increased in the years 1990-2004. Since 2004 the production has decreased. The number of platforms is yet still increasing (Figure 3.100). Five major platforms were completed in 1997-1999, which is the main reason for the great increase in the oil production in the years 1998-2000.

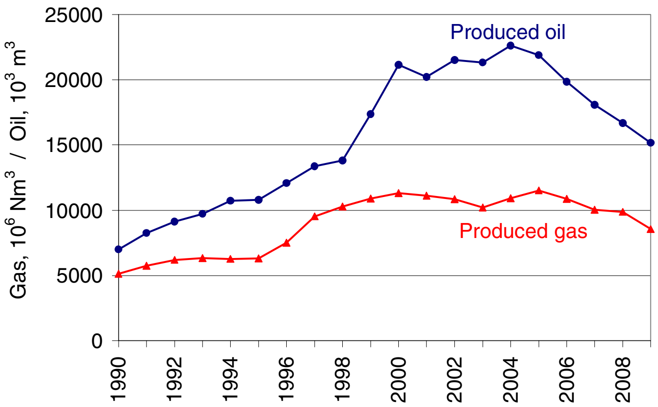

Figure 3.99 Production of oil and gas in the Danish part of the North Sea.

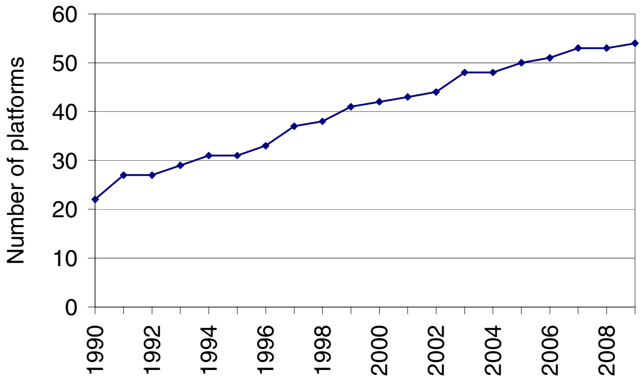

Figure 3.100 The number of platforms in the Danish part of the North Sea.

The amounts of oil loaded offshore on ships roughly follow the trend of the oil and gas production (Figure 3.101). In case of onshore loading of ships the trend is more smoothed.

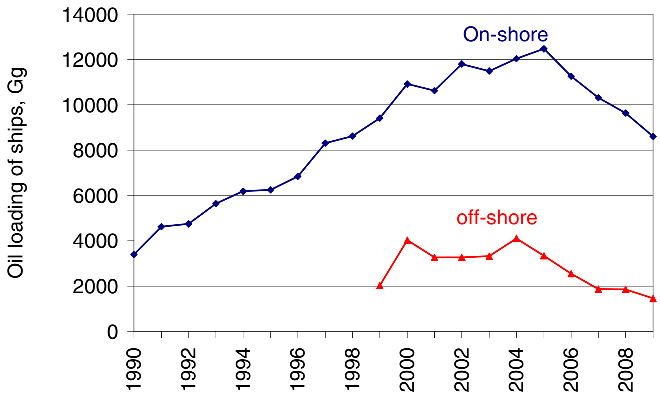

Figure 3.101 Onshore and offshore loading of ships.

Oil refining

Data on the amount of crude oil processed in the two Danish refineries are given by the refineries in their annual environmental report (A/S Dansk Shell, 2010 and Statoil A/S, 2010). Data are shown in Figure 3.102. In the last years the amount of crude oil being processed has been slightly decreasing to 7 978 Gg in 2009.

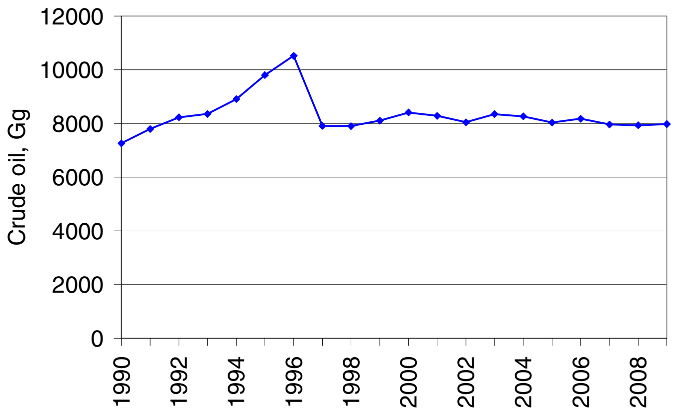

Figure 3.102 Oil refineries. Processed crude oil in the two Danish refineries.

Service stations

The Danish Energy statistics holds data on the sale of gasoline that is the basis for estimating emissions of NMVOC from service stations. The gasoline sales show an increase from 1990-1998 and a slightly decreasing trend from 1999-2009 as shown in Figure 3.103. In 2009 the gasoline sale was 1 665 317 Mg.

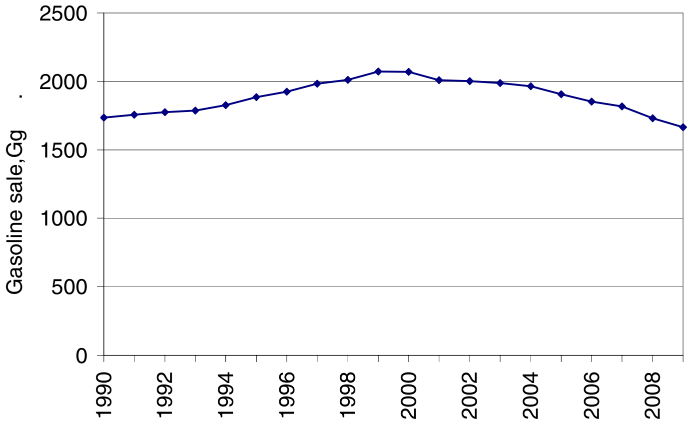

Figure 3.103 Gasoline sales in Denmark 1990-2009.

Transmission, storage and distribution of gas

The activity data used in the calculation of the emissions from natural gas is shown in Table 3.43. Transmission rates for 1990-1997 refer to the Danish energy statistics and to the annual environmental report of DONG Energy for 1998. The distribution rates for 1990-1998 are estimated according to the transmission rates. Transmissions and distribution rates for 1999-2006 refers to Dong Energy, Danish Gas Technology Centre and the Danish gas distribution companies. In 2007-2009 the transmission rate stems from the annual environmental report by Energinet.dk (DONG Energy, 2010c). The distribution rates for 2007-2009 are given by the distribution companies, either in their annual reports or through personal communication.

Table 3.43 Activity data on transmission and distribution of gas. Town gas is included in distribution.

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Transmission, Mm^3 *	2 739	3 496	3 616	3 992	4 321	4 689	5 705	6 956	6 641	6 795
Distribution, Mm^3 **	1 905	2 145	2 252	2 516	2 693	3 089	3 585	3 607	3 734	3 627
Continued	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Transmission, Mm^3 *	7 079	7 289	7 287	7 275	7 384	7 600	7 600	6 400	7 565	6 500
Distribution, Mm3 **	3 511	4 005	3 749	3 749	3 579	3 297	3 460	3 160	3 135	2 890

* In 1990-1997 transmission rates refer to Danish energy statistics, in 1998 the transmission rate refers to the annual environmental report of DONG Energy, in 1999-2006 emissions refer to DONG/Danish Gas Technology Centre (Karll 2003, Karll 2005, Oertenblad 2006, Oertenblad 2007). Since 2007 transmission data refer to the annual environmental report by Energinet.dk.

**) In 1990-98 distribution rates are estimated from the Danish energy statistics. Distribution rates are assumed to equal total Danish consumption rate minus the consumption rates of sectors that receive the gas at high pressure. The following consumers are assumed to receive high pressure gas: town gas production companies, production platforms and power plants. In 1999-2006 distribution rates refer to DONG Energy / Danish Gas Technology Centre / Danish gas distribution companies (Karll 2003, Karll 2005, Oertenblad 2006, Oertenblad 2007). Since 2007 the distribution rates are given by the companies. The distribution of town gas is based on the available data from the Danish town gas distribution companies of which more are closed down today.

In 2009 the gas transmission rate was 6 500 Mm^3 and the distribution rate was 2 890 Mm_n^3, hereof 20 Mm_n^3 town gas (Figure 3.104). The variation over the time-series owes mainly to variations in the winter temperature and to the variation of import/export of electricity from Norway and Sweden.

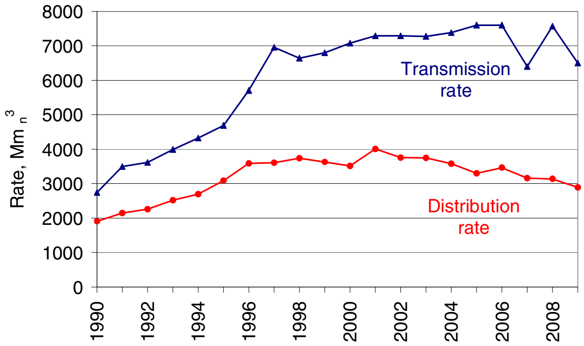

Figure 3.104 Rates for transmission and distribution of gas. Distribution covers both natural gas and town gas.

Data on the transmission pipelines excluding offshore pipelines and on the distribution network are given by Energinet.dk, DGC and the distribution companies concerning length and material. In 2009 the length of the transmission pipelines was 860 km. Because the distribution system in Denmark is relatively new most of the distribution network is made of plastic. In 2009 the length of the distribution network was 23 402 km. The major part is made of plastic (approximately 90 %) and the remaining part is made of steel. For this reason the fugitive emission is negligible under normal circumstances as the plastic distribution system is basically tight with only minimal fugitive losses. However, the plastic pipes are vulnerable and therefore most of the fugitive emissions from the pipes are caused by losses due to excavation damages and construction and maintenance activities performed by the gas companies. These losses are either measured or estimated by calculation in each case by the gas companies. About 5 % of the distribution network is used for town gas. This part of the network is older and the fugitive losses are greater. The fugitive losses from this network are associated with more uncertainty as it is estimated as a percentage (15 %) of the meter differential. This assumption is based on expert judgement from one of the town gas companies. It must be noted that more town gas distribution companies are now closed (one in 2004 and another in 2006), and therefore the data availability is scarce.

In Denmark there are two natural gas storage facilities. Both are obligated to make an environmental report on annual basis. Data on gas input and withdrawal are included and were 793 Mm^3 and 743 Mm^3 in 2009, respectively. Until 2000 emissions from storage of gas were included in transmission in the inventories.

Venting and Flaring

Venting at the two Danish gas storage plants are included in the inventory. Venting of gas is assumed to be negligible in extraction and in refineries as controlled venting enters the gas flare system. Venting rates are shown in Figure 3.105. As venting rates are not available before 1995 the mean value for the following three years are adopted as basis for the emission calculation for the years 1990-1994.

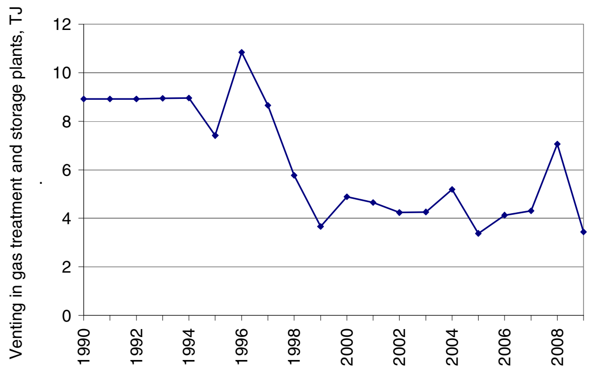

Figure 3.105 Amount vented in gas treatment and storage plants.

Offshore flaring amounts are given in Denmark's oil and gas production (Danish Energy Agency, 20010a) while flaring in treatment/storage plants are given in DONG Energy's environmental reports (Dong Energy, 2010a). Flaring rates for the two Danish refineries are given in their environmental reports and additional data. From 2006 flaring amounts are given in the EU ETS reporting.

The flaring rates are shown in Figure 3.106 and 3.107. Flaring rates in gas treatment and gas storage plants are not available until 1995. The mean value for the following ten years (1995 to 2004) has been adopted as basis for the emission calculation for the years 1990-1994.

The amount of flared gas is high in 2007 because of larger maintenance work at the gas treatment plant. In 2008 there has also been one situation with flaring of a larger amount of gas.

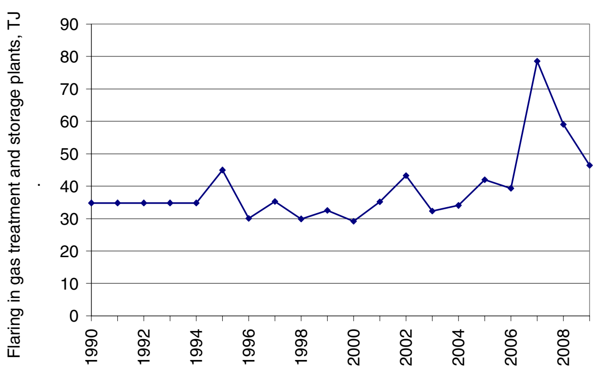

Figure 3.106 Amount flared in gas treatment and storage plants.

The offshore flaring amounts have been decreasing over the last years in accordance with the decrease in production as seen in Figure 3.99. Further, there is focus on reduction of the amount being flared for environmental reasons.

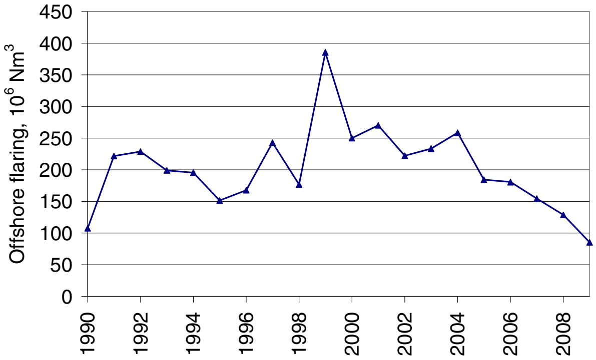

Figure 3.107 Amounts of gas flared in offshore exploration.

3.4.4 Emission factors

Coal storage

Emissions of particulate matter (PM) from coal storage are estimated by the emission factors used in the emission inventory of Poland (Olendry´nski et al., 2004). The emission factors are listed in Table 3.44.

Table 3.44 Emission factors used to estimate particulate emissions from coal storage.

Emission factor	TSP	PM_{10}	$PM_{2.5}$
Emission factor, g pr Mg	150	60	6

Loading of ships

In the EMEP/EEA Guidebook standard emission factors for different countries are given. In the Danish emission inventory the Norwegian emission factors are used for estimation of fugitive emissions from loading of ships onshore and offshore (EMEP/EEA, 2009). The emission factors are listed in Table 3.45.

Table 3.45 Emission factors for loading of ships onshore and offshore.

	NMVOC, fraction of loaded	Reference
Ships off-shore	0.001	EMEP/EEA, 2009
Ships on-shore	0.0002	EMEP/EEA, 2009

Oil refining

The refineries deliver information on consumption of fuel gas and fuel oil. The calorific values are given by the refineries in the reporting for EU ETS from 2006. Before 2006 the calorific values given by the refineries were used when available. When not available standard calorific values given in the basic data tables from the Danish Energy Agency combined with the conversion factor between fuel gas and fuel oil given by the refinery were used for calculation.

Emissions of SO_2, NO_x and VOC are given by the refineries. Only one of the two refineries has made a split between NMVOC and CH_4. For the other refinery it is assumed that 1 % of the VOC emission is CH_4 and the remaining 99 % is NMVOC.

Service stations

NMVOC from service stations is calculated by use of different emission factors for the time-series as shown in Table 3.46. In 1994 the emission factors for NMVOC from service stations were investigated by Fenhann and Kilde (1994) for the years 1990, 1991 and 1992, individually. The emission factors reported for reloading and refuelling for 1990 were used for the years 1985-1990, while the emission factors for 1991 was used for that year only. For the years 1992-1995 only emission factor for refuelling reported by Fenhann and Kilde (1994) was used in the Danish emission inventory. For reloading of tankers the British emission factor - as given in the UK Emission Factor Database - was adopted for the years 1992-2000. From 2008 the emission factors from the EMEP/EEA guidebook 2009 are used for reloading and refuelling. For the years 2001-2007 and 1996-2007 the emission factors for reloading and refuelling, respectively, are estimated by using interpolation.

Table 3.46 Emission factors used for estimating NMVOC from service stations.

Year	Reloading of tankers, kg NMVOC pr tonnes gasoline	Refuelling of vehicles, kg NMVOC pr tonnes gasoline	Sum of reloading and refuelling, kg NMVOC pr tonnes gasoline	Source
1985-1990	1.28	1.52	2.80	Fenhann & Kilde,1994
1991	0.64	1.52	2.16	Fenhann & Kilde,1994
1992-1995	0.08	1.52	1.60	UK emf. database / Fenhann & Kilde,1994
1996	0.08	1.45	1.53	UK emf. database / interpolation 1995-2008
1997	0.08	1.39	1.47	UK emf. database / interpolation 1995-2008
1998	0.08	1.32	1.40	UK emf. database / interpolation 1995-2008
1999	0.08	1.25	1.33	UK emf. database / interpolation 1995-2008
2000	0.08	1.19	1.27	UK emf. database / interpolation 1995-2008
2001	0.077	1.12	1.20	Interpolation 2000-2008 / 1995-2008
2002	0.073	1.05	1.13	Interpolation 2000-2008 / 1995-2008
2003	0.070	0.99	1.05	Interpolation 2000-2008 / 1995-2008
2004	0.067	0.92	0.98	Interpolation 2000-2008 / 1995-2008
2005	0.063	0.85	0.91	Interpolation 2000-2008 / 1995-2008
2006	0.060	0.78	0.84	Interpolation 2000-2008 / 1995-2008
2007	0.056	0.72	0.77	Interpolation 2000-2008 / 1995-2008
2008	0.053	0.65	0.70	EMEP/EEA 2009
2009	0.053	0.65	0.70	EMEP/EEA 2009

Transmission, storage and distribution of gas

The fugitive emissions from transmission, storage and distribution of natural gas are based on data on gas losses from the companies and on the average annual natural gas composition given by Energinet.dk.

Flaring

Flaring in refineries

The composition of fuel gas is given for 2008 by one of the two refineries. As the composition for fuel gas is marked different than the composition of natural gas, which has been used in earlier year's calculations, the same fuel gas composition is used in calculations for the other Danish refinery.

The emission factor for NMVOC have been included in the inventory for all years (1990-2009) as the 2008 fuel gas composition is assumed to be more accurate for the emission calculation than the annual composition for natural gas being distributed in Denmark used in previous emission inventories. For NO_x and CO the emission factors from the EMEP/EEA guidebook 2009 are used. For trace metals, dioxin and PAHs the emission factors given in the guidebook (EMEP/EEA, 2009) for stationary combustion Tier 1 are adopted for flaring in refineries. The refinery emission factors are listed in Table 3.47.

Table 3.47 Emission factors for flaring in refineries.

Pollutant	Emission factor	Unit
NO_x *	32.2	g pr GJ
NMVOC	76.5	g pr GJ
CO	177	g pr GJ
TSP	0.90	g pr GJ
PM_{10}	0.90	g pr GJ
$PM_{2.5}$	0.90	g pr GJ
As	0.09	mg pr GJ
Cd	0.50	mg pr GJ
Cr	0.70	mg pr GJ
Cu	0.40	mg pr GJ
Hg	0.10	mg pr GJ
Ni	1.00	mg pr GJ
Pb	0.20	mg pr GJ
Se	0.01	mg pr GJ
Zn	14.0	mg pr GJ
Dioxin	0.03	ng pr GJ
Benzo(b)fluoranthene	0.08	µg pr GJ
Benzo(k)fluoranthene	0.08	µg pr GJ
Benzo(a)pyrene	0.06	µg pr GJ
Indeno(1,2,3-c,d)pyrene	0.08	µg pr GJ

*The emission of NO_x is given for one refinery why the emission factor is used for one refinery only.

Flaring offshore

The emission factors for offshore flaring are shown in Table 3.48. The dioxin emission factor originates from a Danish study by Henriksen et al. (2006) and is, like emission factors for PM and SO_2, the same as the emission factors used for combustion of natural gas in Danish public power plants.

The NO_x emission factor is based on the conclusion in a Danish study of NO_x emissions from offshore flaring carried out by the Danish Environmental Protection Agency (2008). The recommended NO_x emission factor (31 008 g pr GJ or 0.0015 tonnes NO_x pr tonnes gas) corresponds well with the emission factors used to estimate NO_x emission in other countries with oil production in the North Sea (Netherlands: approximately 0.0014 tonnes NO_x pr tonnes gas and United Kingdom: approximately 0.0013 tonnes NO_x pr tonnes gas). Emission factors for NMVOC and CO are based on the EMEP/EEA Guidebook.

For trace metals, dioxin and PAH's the emission factors given in the guidebook (EMEP/EEA, 2009) for stationary combustion Tier 1 are adopted for flaring in refineries. Emissions from flaring in gas treatment and storage plants are calculated from the same emission factors which are used for offshore flaring.

Table 3.48 Emission factors for offshore flaring.

Pollutant	Emission factor	Unit
SO_2	0.014	g pr Nm^3
NO_x	1.227	g pr Nm^3
NMVOC	0.100	g pr Nm^3
CO	1.000	g pr Nm^3
TSP	0.041	g pr Nm^3
PM_{10}	0.041	g pr Nm^3
$PM_{2.5}$	0.041	g pr Nm^3
As	0.004	mg pr Nm^3
Cd	0.023	mg pr Nm^3
Cr	0.032	mg pr Nm^3
Cu	0.018	mg pr Nm^3
Hg	0.005	mg pr Nm^3
Ni	0.046	mg pr Nm^3
Pb	0.009	mg pr Nm^3
Se	0.0005	mg pr Nm^3
Zn	0.639	mg pr Nm^3
Dioxin	0.023	ng pr Nm^3
Benzo(b)fluoranthene	0.037	µg pr Nm^3
Benzo(k)fluoranthene	0.037	µg pr Nm^3
Benzo(a)pyrene	0.027	µg pr Nm^3
Indeno(1,2,3-c,d)pyrene	0.037	µg pr Nm^3

3.4.5 Emissions

Coal storage

The emission from storage of coal is 1 007 Mg TSP in 2009 (403 Mg PM_{10} and 40 Mg $PM_{2.5}$). The coal consumption and the related emissions vary from year to year mainly due to the extent of electricity import/export and temperature variations (Table 3.49). Note that PM was only included in the inventory from 2000.

Table 3.49 PM_{10} from storage of solid fuels.

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
PM_{10}, Mg	385	415	376	571	456	362	521	487	454	403

Extraction of oil and gas and loading of ships

From the activity data in Table 3.42, equation 3.4.3 the fugitive emissions of NMVOC from extraction are calculated. Corresponding emissions from loading of ships can be estimated by Table 3.42, Table 3.46 and equation 3.4.5. The emissions are listed in Table 3.50 along with the emissions from storage of oil given in the environmental reports from DONG Energy (2010b).

Table 3.50 NMVOC emissions for 2009.

	NMVOC, Mg
Onshore loading of ships	1 720
Oil tanks	2 098
Fugitive emissions from extraction	568
Offshore loading of ships	1 451
Total	5 837

The emissions from extraction of oil and gas are aggregated in two sources; emissions related to onshore and offshore activities, respectively. The time-series for onshore and offshore activities related to extraction of oil and natural gas are shown in Table 3.51 and Table 3.52.

Table 3.51 NMVOC from onshore activities related to extraction of oil and natural gas (onshore loading of ships and oil tanks).

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
NMVOC, Mg	2 404	2 961	3 199	3 520	3 876	3 913	4 304	4 918	5 078	5 582
Continued	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
NMVOC, Mg	6 183	6 126	6 761	6 698	6 908	6 994	6 403	5 981	5 551	3 818

Table 3.52 NMVOC from offshore activities related to extraction of oil and natural gas (offshore loading of ships and extraction).

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
NMVOC, Mg	236	288	289	310	330	330	353	400	412	2 465
Continued	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
NMVOC, Mg	4 476	3 726	3 742	3 836	4 620	3 873	3 087	2 422	2 417	2 018

The increase for NMVOC emission from offshore activities in 1999-2000 owe to offshore loading as there were no offshore loading in the years 1990-1998.

Oil refining

In Table 3.53 the emissions of NMVOC from oil refining at the two Danish refineries are listed for the years 1990-2008. Further, the emissions of SO_2 from oil refining and sulphur recovery in refineries are shown. The emission of SO_2 has shown a pronounced decrease since 1990 because of technical improvements at the refineries. Note that SO_2 from refining and recovery prior to 1994 was summarized and reported as an area source in category 1B2a vi. Note also that SO_2 from oil refining from 2001 are included in stationary combustion.

Table 3.53 Oil Refineries. Emissions of NMVOC and SO_2 from oil refining and SO_2 from sulphur recovery.

	1990[1]	1991[1]	1992[1]	1993[1]	1994	1995	1996	1997	1998	1999
NMVOC, Mg	3 667	3 937	4 203	4 219	5 855	5 885	5 875	4 547	4 558	4 558
SO_2, oil refining, Mg					934	585	167	216	253	234
SO_2, sulphur recovery, Mg	3 335	2 713	3 147	2 526	3 332	2 437	2 447	1 766	1 188	1 125
Continued	2000	2001[2]	2002[2]	2003[2]	2004[2]	2005[2]	2006[2]	2007[2]	2008[2]	2009[2]
NMVOC, Mg	4 983	4 338	4 302	3 708	3 732	3 550	3 837	3 761	3 784	3994
SO_2, oil refining Mg	178									
SO2, sulphur recovery Mg	803	672	332	246	119	255	679	610	794	375

1) Prior to 1994 SO_2 emissions from oil refining and sulphur recovery are reported as area sources in category 1B2a vi.

2) From 2001 SO_2 emissions from oil refining are included in stationary combustion.

Service stations

Emissions from service stations are calculated using the emission factors in Table 3.46 and the sales of gasoline given by the Danish Energy statistics. The NMVOC emissions are listed in Table 3.54.

Table 3.54 Emissions of NMVOC from service stations 1990-2008.

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
NMVOC, Mg	4 856	3 792	2 832	2 854	2 916	3 016	2 949	2 906	2 813	2 760
Continued	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
NMVOC, Mg	2 616	2 399	2 252	2 094	1 933	1 742	1 563	1 405	1 216	1 171

Transmission, storage and distribution of gas

The gas transmission company gives emissions of CH_4. The CH_4 emissions for transmission are estimated on the basis of registered loss in the transmission grid and the emission from the natural gas consumption in the pressure regulating stations. The distribution companies give data on fugitive losses, and the CH_4 emissions are estimated due to the gas quality given by Energinet.dk. The emissions of NMVOC are calculated on the basis of the CH_4 emission according to the gas quality measured by Energinet.dk (equation 3.4.8).

$$E_{NMVOC} = E_{CH_4} \times \left(w_{NMVOC} / w_{CH_4} \right) \qquad \text{(eq. 3.4.8)}$$

where w_{NMVOC} is the weight-% NMVOC and w_{CH4} is the weight-% CH_4 according to the gas quality of the current year.

Before 2000 emissions from transmission and storage have not been estimated separately and storage is included in the transmission category. The decrease in NMVOC emission from transmission in 2007 is caused by the completion of a greater construction work and rerouting of a major pipeline (Table 3.55). As the pipelines in Denmark are relatively new, most emissions are due to construction and maintenance. There have been no significant construction or renovation work in 2007-2009 and therefore a low emission.

The increased emission from distribution in 2004 owes to venting of the distribution network. The reason for the decrease in 2007 is not mentioned in the environmental report for the given company.

Table 3.55 NMVOC emission from transmission, storage and distribution. NMVOC emissions are estimated from the CH_4 emission according to the gas quality given by Energinet.dk.

NMVOC emission	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Transmission, Mg	74	94	28	57	46	163	63	72	45	56
Storage, Mg										
Distribution, Mg	57	62	62	61	61	71	72	55	56	61
Continued	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Transmission, Mg	26	45	23	25	23	36	37	2	4	2
Storage, Mg	25	21	20	19	23	14	18	18	27	17
Distribution, Mg	59	62	57	53	75	59	63	65	38	32

Flaring

As shown in Figure 3.108 there was a marked increase in the amount of offshore flaring in 1997 and especially in 1999. The increase in 1997 was due to the new Dan field and the completion of the Harald field. The increase in 1999 was due to the opening of the three new fields Halfdan, Siri and Syd Arne.

The time-series for the emission of CO_2 from offshore flaring fluctuates due to the fluctuations in the fuel rate and to a minor degree due to the

CO_2 emission factor. The latter rests on gas quality measurements. From 2006 the calorific values for flaring are given at installation level in the EU ETS and this information is incorporated in the inventory for the years 2006 and onwards. This has lead to an increase of the CO_2 emission factor. The average of the emission factors for 2006-2008 is adopted for 1990-2005. Fuel rate and CO_2 emission are shown in Figure 3.108.

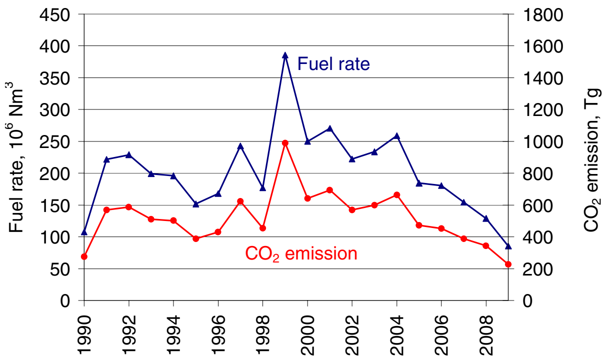

Figure 3.108 Fuel rate and CO_2 emission from offshore flaring of gas 1990-2009.

The emissions from offshore flaring are estimated from the same set of emission factors for all years in the time-series and the variations reflect only the variations in the flared amounts. Emissions of selected components from flaring in oil and gas extraction including offshore flaring and flaring in gas treatment and storage facilities are shown in Table 3.56.

Table 3.56 Emissions from flaring in oil and gas extraction.

Year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
	tonnes	tonnes	tonnes	tonnes	tonnes	tonnes	tonnes	tonnes	tonnes	tonnes
SO_2	2	3	3	3	3	2	2	3	2	5
NO_x	132	272	281	244	240	187	211	303	221	476
NMVOC	11	22	23	20	20	19	19	27	20	41
CO	108	222	229	199	196	153	169	244	178	386
Continued	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
	tonnes	tonnes	tonnes	tonnes	tonnes	tonnes	tonnes	tonnes	tonnes	Tonnes
SO_2	4	4	3	3	4	3	3	2	2	1
NO_x	310	335	277	290	321	231	226	197	165	111
NMVOC	28	30	26	26	29	21	21	22	19	23
CO	251	271	223	234	260	185	182	156	130	86

Besides in the offshore sector flaring also takes place in refineries. Flaring in refineries is a significant fugitive emission source for SO_2. In 1990-1993 emissions from petroleum product processing were included in emissions from flaring in refineries (1B2c). From 1994 the data delivery format was changed, which made it possible to split the emissions into contributions from flaring and processing, respectively. Emissions from processing are from 1994 included in 1B2a iv.

Emissions of selected components are shown in Table 3.57. Until 1996 a third refinery was in operation in Denmark leading to larger emissions in 1990-1996. The decreasing emissions of SO_2 from 1996 to 1998 are due to technical improvements of the sulphur recovery system at one of the two Danish refineries. The large emissions from 2005 and onwards owe to shut-downs due to maintenance and accidents. Further, construction and initialisation of new facilities and problems related to the ammoniumthiosulfat (ATS) plant has lead to increased emissions. In 2007 the capacity of the ATS plant was increased followed by commissioning difficulties.

Table 3.57 Emissions from flaring in refineries.

Year	1990*	1991*	1992*	1993*	1994	1995	1996	1997	1998	1999
	tonnes	tonnes	tonnes	tonnes	tonnes	tonnes	tonnes	tonnes	tonnes	tonnes
SO_2 *	943	926	935	1 190	520	203	218	138	70	50
NO_x	41	41	41	41	217	23	23	9	11	10
NMVOC	34	34	34	34	32	32	32	20	26	25
CO	5	5	5	5	49	49	49	47	60	57
Continued	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
	tonnes	tonnes	tonnes	tonnes	tonnes	tonnes	tonnes	tonnes	tonnes	tonnes
SO_2	51	46	68	96	53	296	257	526	380	453
NO_x	11	7	13	8	10	26	22	24	26	17
NMVOC	26	17	31	19	24	32	31	33	38	23
CO	60	39	72	44	56	73	73	77	88	53

*In 1990-1993 emissions from petroleum product processing were included in flaring in refineries due to the data delivery form. From 1994 emissions from petroleum product processing were given in 1B2a iv.

3.4.6 Uncertainties and time-series consistency

Methodology

The applied methodology for uncertainty estimates refers to Pulles & Aardenne (2004). The Danish uncertainty estimates are based on the simple Tier 1 approach described in IPCC Good Practice Guidance (IPCC, 2000).

The uncertainty estimates are based on the calculated emissions for the base year and for the latest inventory year and on the uncertainty rates for both activity data and emission factors. Data is aggregated for the NFR category 1 B - Fugitive Emissions from Fuels. Base year refers to 2000 for particulate matter and to 1990 for the remaining components.

The uncertainty rates are based on the EMEP/EEA emission inventory guidebook (2009), on uncertainty estimates from a minor number of companies and on estimates and assumptions by NERI. The applied uncertainty levels for activity data and emission factors are given in Table 3.58. The uncertainty rates vary between pollutants because the emission sources vary as well.

Table 3.58 Uncertainty levels for activity data and emission factors.

Pollutant	Activity Data Uncertainty level %	Emission Factor Uncertainty level %
SO_2	10	25
NO_x	8	15
NMVOC	15	40
CO	8	125
TSP	2	50
PM_{10}	2	50
$PM_{2.5}$	2	50
As	8	225
Cd	8	225
Cr	8	225
Cu	8	125
Hg	8	75
Ni	8	125
Pb	8	225
Se	8	200
Zn	8	200
Benzo(b)	8	200
Benzo(k)	8	200
Benzo(a)	8	200
Indeno	8	200

Results

The uncertainty model estimates uncertainty for both the emission and the trend. The emission uncertainty for SO_2, NO_x, NMVOC and CO is 27 %, 17 %, 43 % and 125 %, respectively. For PM the uncertainty is 50 % and for most heavy metals and PAHs the uncertainty is around 200 %. A list of the individual uncertainty estimates for the fugitive emission inventory is shown in Table 3.59.

Table 3.59 Estimated emission uncertainty and trend uncertainty for fugitive emissions. The trend refers to the years 1990-2009 for all pollutants except PM where the trend refers to 2000-2009.

Pollutant	Emission uncertainty %	Trend uncertainty %
SO_2	27	3
NO_x	17	8
NMVOC	43	21
CO	125	13
TSP	50	3
PM_{10}	50	3
$PM_{2.5}$	50	3
As	225	9
Cd	225	9
Cr	225	9
Cu	125	9
Hg	75	9
Ni	125	9
Pb	225	9
Se	200	9
Zn	200	9
Benzo(b)	200	9
Benzo(k)	200	9
Benzo(a)	200	9
Indeno	200	9

3.4.7 Source specific QA/QC and verification

In relation to fugitive emissions the following procedures are carried out to ensure the data quality:

- Checking of time-series in the IPCC and SNAP source categories. Considerable changes are controlled and explained.
- Comparison with the inventory of the previous year. Any major changes are verified.
- Total emission, when aggregated to IPCC and LRTAP reporting tables, is compared with totals based on SNAP source categories (control of data transfer).
- A manual log table in the emission databases is applied to collect information about recalculations.
- The emission from the large point sources (refineries, gas treatment and gas storage plants) are compared with the emission reported the previous year.
- Some automated checks have been prepared for the emission databases:
  - Check of units for fuel rate, emission factor and plant-specific emissions
  - Check of emission factors for large point sources. Emission factors for pollutants that are not plant-specific should be the same as those defined for area sources.
  - Additional checks on database consistency
- Most emission factor references are now incorporated in the emission database, itself.
- Most data sources are implemented in the fugitive emission model.

- Annual environmental reports are kept for subsequent control of plant-specific emission data.

The QC work will continue in future years.

Data deliveries

Table 3.60 lists the external data deliveries used for the inventory of fugitive emissions. Further the table holds information on the contacts at the data delivery companies.

Table 3.60 List of external data sources.

Source	Data description	Activity data, emission factors or emissions	Reference	Contact(s)	Data agreement/ Comment
Offshore extraction	Gas and oil production. Dataset for production of oil, gas and number of platforms. CRF 1B2a	Activity data	The Danish Energy Agency (DEA)	Jan H. Andersen	No formal data agreement.
Gas distribution	Natural gas from the distribution company, sales and losses (meter differences)	Activity data	DONG Energy, HNG and MN,	Ida Pernille Schou,	No formal data agreement.
			Naturgas Fyn	Gert Nielsen	
Gas transmission	Natural gas from the transmission company, sales and losses (meter differences)	Activity data	Energinet.dk	Christian Friberg B. Nielsen	Not necessary due to obligation by law
Environmental report from DONG Energy	Environmental report from DONG Energy. Oil and gas production. The amount of oil loaded onshore and emissions from raw oil tanks. CRF 1B2a	Activity data and emission data	DONG Energy		Not necessary due to obligation by law
Refineries	Fuel consumption and emission data. CRF 1B2a.	Activity data and emission data	Statoil A/S, A/S Dansk Shell	Anette Holst, Lis Rønnow Rasmussen	No formal data agreement.
Service stations	Data on gasoline sales from the Danish energy statistics.	Activity data	The Danish Energy Agency (DEA)		Data agreement
Storage and treatment of gas	Environmental reports from plants defined as large point sources (Lille Torup, Stenlille, Nybro)	Activity data	Various plants.		Not necessary due to obligation by law
Offshore flaring	Flaring offshore in oil and gas extraction	Activity data	The Danish Energy Agency		Data agreement
Emission factors	Emission factors origin from a large number of sources	Emission factors	See chapter regarding emission factors		

3.4.8 Source specific recalculations

In the emission inventory for 2009 there have been some recalculations as listed below.

Service stations: The amounts of gasoline sales used for calculation of fugitive emissions from service stations (SNAP 050503) have been updated according to the Energy Statistics for 2009 1990-2008. The NMVOC emission in 2008 has thereby increased by 6 Mg corresponding to 0.5 %.

Extraction of oil and gas: fugitive emissions from extraction are calculated from the standard formula in the EMEP/EEA Guidebook (EMEP/EEA, 2009) based on the number of platforms. In 2009 the number of platforms has been corrected for 2007 and 2008. The NMVOC emission in 2008 has decreased by 20 Mg according to this correction corresponding to 1 %.

Gas distribution: distribution amounts have been updated for one of three natural gas distribution companies for the years 2006-2008 due to new data availability. The NMVOC emission has decreased by 4 Mg in 2008 due to this corresponding to 10 %.

Flaring in oil and gas extraction: The NMVOC emission in 2008 from flaring in the gas treatment plant has been updated for 2008 according to the environmental report leading to an increase of 2 Mg NMVOC. The increase corresponds to 12 % of the NMVOC emission from flaring in oil and gas extraction including offshore flaring

3.4.9 Source specific planned improvements

The following future improvements are suggested.

Emissions from storage of fuels in tank facilities: The recent edition of the Danish emission inventory holds emissions from extraction of fuels, combustion of fuels and from service stations. To make the inventory complete emissions from storage of fuels in tank facilities should be included in the future if data is available. Work is going on to locate greater tank facilities in Denmark and collect the available data. In cases where no emission estimates or measurements are available a set of emission factors have to be set up.

Emissions from offshore extraction of oil and gas: The fugitive emissions from extraction of oil and gas are based on a standard formula. If a better estimate becomes available it will be implemented.

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4 Industrial processes (NFR sector 2)

4.1 Overview of the sector

The present sector *"Industrial processes"* (NFR sector 2) comprises combustion processes combined with *"process emissions"* (combustion in manufacturing industry - processes with contact) as well as process emissions without any contact with energy-related emissions. This means that the energy source may be power from central power plants or process heat from e.g. natural gas-fired boilers, turbines or stationary engines. The presentation is outlined as follows:

- Mineral products (NFR 2A) including "Other" (NFR 1A2f).
- Chemical industry (NFR 2B).
- Metal production (NFR 2C) including "Iron and steel" (NFR 1A2a) and "Non-ferrous metals" (NFR 1A2b).
- Other production i.e. food and drink (NFR 2D).
- Other production, consumption, storage, transportation or handling of bulk products (NFR 2G).

The industrial processes included in the Danish inventory are those in large companies, e.g. cement factories or steelworks, as well as a number of smaller companies e.g. iron foundries.

Table 4.1 presents a survey of sources and groups of pollutants included in the present survey as well as pollutants and sources that will be included in the survey. Explanations to the abbreviations are given below the table. Table 4.1 indicates that some groups of substances are planned to be included in the inventory. In addition to the indicated groups of substances some groups do not include all relevant substances or the time-series are not complete. Detailed information on this subject can be found in the following table with an indication of which substances that will be completed/improved in the inventory.

Table 4.1 Survey of industrial sector with SNAP-code and NFR-code included in the Danish inventory.

Industrial sector	SNAP	NFR	Energy	$SO_X/NO_X/NH_3$	NMVOC/CO	$TSP/PM_{10/2.5}$	HM	POP
Grey iron foundries	030303	1A2a	i.e.	+	+	x	x	-
Secondary lead production	030307	1A2b	i.e.	-	-	x	x	-
Secondary zinc production	030308	1A2b	i.e.	-	-	x	+	-
Secondary aluminium production	030310	1A2b	i.e.	-	-	x	+	-
Cement	030311	1A2f	y	x	x	x	x	-
Lime (incl. iron, steel and paper pulp industry)	030312	1A2f	i.e.	+	-	x	+	-
Asphalt concrete plants	030313	1A2f	i.e	+	+	+	-	+/?
Container glass	030315	1A2f	y	x	x	x	x	-
Glass wool	030316	1A2f	i.e.	x/+	-	x	+	-
Mineral wool	030318	1A2f	y	x/+	x	x	+	-
Paper mill industry	030321	1A2d	y	-	+	x	-	-
Electric arc furnace	040207	2C1	-	-	-	x	x	+/?
Allied metal manufacturing	040306	2C5	-	-	-	+	x	-
Sulphuric acid	040401	2B5	-	x	-	-	-	-
Nitric acid	040402	2B2	y	x	-	x	-	-
NPK-fertiliser	040407	2B5	-	x	i.e.	x	i.e.	-
Other (catalysts)	040416	2B5	y	x	-	x	-/?	-
Pesticide production	040525	2B5	-	+	x	+	-	+/?
Biscuits, cakes and other bakery products	040605	2D2	i.e.	-	x	-	-	-
Bread (rye and wheat)	040605	2D2	i.e.	-	x	-	-	-
Beer	040607	2D2	i.e.	-	x	-	-	-
Ethanol, technical	040608	2D2	i.e.	-	x	-	-	-
Spirits, other	040608	2D2	i.e.	-	x	-	-	-
Sugar production	040608	2D2	y	-	x	-	-	-
Meat curing, fish and shellfish	040627	2D2	i.e.	-	x	-	-	-
Meat curing, meat	040627	2D2	i.e.	-	x	-	-	-
Meat curing, poultry	040627	2D2	i.e.	-	x	-	-	-
Margarine and solid cooking fats	040698	2D2	i.e.	-	x	-	-	-
Coffee roasting	040699	2D2	i.e.	-	x	-	-	-
Roof covering with asphalt materials	040610	2A5	-	-	x	-	-	+/?
Road paving with asphalt	040611	2A6	-	+	x	-	-	+/?
Cement (decarbonising)	040612	2A1	-	i.e.	-	-	+	-
Glass (decarbonising)	040613	2A7	-	i.e.	-	-	+	-
Lime (decarbonising)	040614	2A2	-	i.e.	-	-	+	-
Other (chemical ingredients, slaughterhouse waste)	040617	2G	y	x/+	x	x	-	+/?
Limestone and dolomite use	040618	2A3	-	i.e.	+	i.e.	i.e.	-

x Included in the present inventory.
\+ Will be included.
\- Not included/not relevant.
i.e. Included elsewhere.
y Included in the present inventory.

4.2 Mineral products (NFR 1A2f/2A)

4.2.1 Source category description

The sub-sector *Mineral products* (NFR 1A2f/2A) cover the following processes:

- Production of cement (SNAP 030311/040612).
- Production of lime (quicklime) (SNAP 030312/040614).

- Production of container glass/glass wool (SNAP 030315/030316/ 040613).
- Production of mineral wool (SNAP 030318).
- Limestone and dolomite use (SNAP 040618).
- Roof covering with asphalt (SNAP 040610).
- Road paving with asphalt (SNAP 040611).

The time-series for emission of acidifying substances, heavy metals, NMVOC and particulate matter from *Mineral products* (NFR 1A2f/2A) are presented in Table 4.2 and Table 4.3.

The emission of SO_2, NO_X and CO from the production of cement depends on raw materials, fuels and combustion conditions. Emissions of NO_X are, among other things, a consequence of high temperature processes and the emission shows only minor fluctuations. The emission follows the activity, with a minor decrease in recent years. The emission of SO_2 depends on the S-content in fuels and raw materials. However, the process acts as a sink for acidifying gases due to the alkaline conditions in the rotary kiln; see Figure 4.1. The emission of CO displays significant fluctuations that cannot be explained by known factors.

The emission of NO_X from production of container glass is increasing slightly until 2004 and thereafter decreasing significantly whereas the emission of CO is decreasing in the period 1990-2009. In the same period of time, the activity is nearly constant. Emissions of both substances are related to combustion/process conditions and will be investigated further. Emissions of the heavy metals lead, selenium and zinc are related to the raw materials used. Recycled glass constitutes a considerable part of raw materials and, therefore, the quality/purity of the glass is a determining factor. Emission of lead shows a decreasing trend that is in accordance with the attempts to avoid lead in glass as well as in wine bottle seals.

Production of glass wool is expected to result in emission of approximately the same pollutants as in production of container glass. NH_3 shows a decreasing trend from 1996-2007 as can be verified by the decreasing emission pr amount produced. However, the emission has been stabilised on a higher level in 2008 and 2009. Emission of NO_X has been included for 2009 and the time-series will be completed. CO and heavy metals are planned to be investigated and included in the inventory.

Table 4.2 Time-series for pollutants from *Mineral products 1A2f* (combustion/process emissions; metals: kg and other pollutants: tonnes).

Pollutants	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
SO_2	2 128	2 467	2 655	2 680	2 682	2 706	2 804	3 631	3 372	2 186
NO_x	6 953	8 468	9 329	9 450	9 443	9 569	10 138	10 306	10 478	9 583
NMVOC	107	126	136	136	144	151	151	157	155	145
NH_3	489	489	489	489	489	489	475	561	552	560
CO	12 260	12 601	12 795	12 822	12 820	12 848	12 462	13 506	16 993	15 353
TSP										
PM_{10}										
$PM_{2.5}$										
As	52.1	78.1	79.1	78.6	80.9	82.9	68.8	58.3	59.3	55.5
Cd	35.9	61.7	59.0	57.9	60.8	59.6	39.5	20.7	21.1	19.8
Cr	410	783	718	697	743	707	372	39.8	41.1	39.5
Cu	115	211	196	191	203	207	124	43.5	45.2	43.6
Hg	105	136	147	149	150	158	159	171	173	162
Ni	344	644	595	579	616	590	326	66.5	68.2	64.6
Pb	1 180	1 101	950	879	879	1 660	843	324	580	726
Se	339	316	276	255	271	466	229	292	93.1	238
Zn	245	243	227	211	217	469	368	347	378	379
Continued	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
SO_2	1 692	2 156	1 431	1 470	1 929	1 827	2 209	2 161	1 875	1 251
NO_x	10 451	10 300	9 417	8 624	8 685	8 660	8 378	7 348	6 178	4 154
NMVOC	146	144	141	131	145	140	151	159	125	85.9
NH_3	497	444	358	334	363	335	337	353	374	324
CO	15 302	13 545	10 340	9 574	10 754	9 927	9 656	11 029	10 234	7 900
TSP	532	567	446	429	422	368	427	381	368	209
PM_{10}	467	497	386	373	369	321	374	332	322	181
$PM_{2.5}$	270	287	235	234	232	203	224	196	190	116
As	56.2	57.0	57.3	53.9	60.7	57.3	60.1	62.6	54.3	35.9
Cd	20.0	20.2	20.3	19.1	21.5	20.3	21.3	22.2	19.3	12.7
Cr	38.9	38.5	37.6	34.8	39.6	37.0	38.7	41.3	36.1	24.9
Cu	42.6	42.1	40.7	37.6	42.9	40.0	41.8	44.8	39.2	27.4
Hg	164	167	168	158	178	168	177	184	159	105
Ni	64.5	64.7	64.2	59.9	67.8	63.7	66.8	70.3	61.2	41.2
Pb	483	317	304	390	574	274	143	163	148	117
Se	360	291	291	253	247	127	80.3	75.2	65.3	37.8
Zn	376	335	317	291	331	308	320	348	309	231

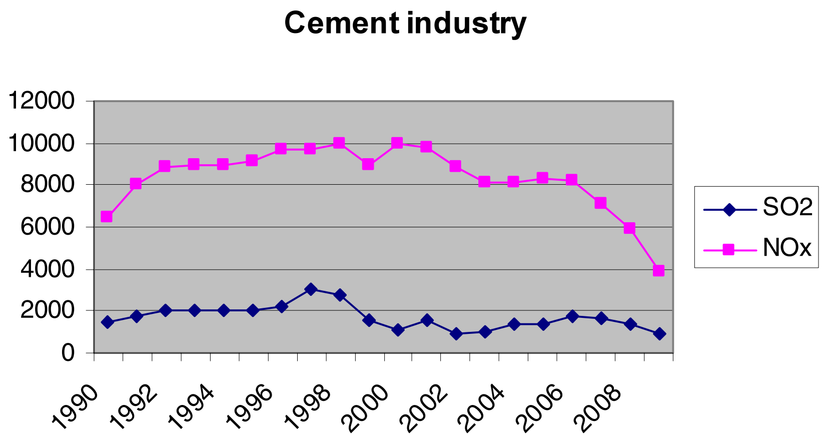

Figure 4.1 Emission of NO_x and SO_2 from cement production.

Table 4.3 Time-series for pollutants from *Mineral products 2A* (process emissions; tonnes).

Pollutants	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
CO	241	241	252	263	237	245	245	245	215	234
NMVOC	554	555	556	558	554	555	556	555	551	555
TSP										
PM_{10}										
$PM_{2.5}$										
Continued	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
CO	223	196	196	199	278	275	274	349	311	188
NMVOC	554	547	545	546	562	562	562	578	570	542
TSP	-[1]	-[1]	-[1]	-[1]	-[1]	-[1]	-[1]	-[1]	-[1]	-[1]
PM_{10}	-[1]	-[1]	-[1]	-[1]	-[1]	-[1]	-[1]	-[1]	-[1]	-[1]
$PM_{2.5}$	-[1]	-[1]	-[1]	-[1]	-[1]	-[1]	-[1]	-[1]	-[1]	-[1]

1) Emission of TSP, PM_{10}, $PM_{2.5}$ are related to energy consumption from 2000.

4.2.2 Methodological issues

The emissions of SO_2, NO_X, CO and TSP from the production of cement are measured yearly from 1997 to 2009 (TSP from 2000 to 2009) (Aalborg Portland, 2010). PM_{10} and $PM_{2.5}$ are estimated from the distribution between TSP, PM_{10} and $PM_{2.5}$ from CEPMEIP (2003). For the years 1990-1996, the emission has been estimated from the production of cement, expressed as TCE (total cement equivalents[9]), and emission factors from the company Aalborg Portland (Aalborg Portland, 2010). The emissions of heavy metals are measured in 1997 (Illerup et al., 1999) and estimated for the other years from emission factors (based on the measurements) and TCE. The activity has increased from 1.6 million tonne TCE in 1990 to 2.9 million tonne TCE in 2007 and thereafter decreased to 1.7 million tonne TCE in 2009 due to the financial crisis.

The emission of NO_X, CO, TSP, lead, selenium, and zinc from production of container glass is measured yearly from 1997 to 2009 (TSP from 2000 to 2009) (Ardagh Glass Holmegaard, 2010). PM_{10} and $PM_{2.5}$ are estimated from the distribution between TSP, PM_{10} and $PM_{2.5}$ from CEPMEIP (2003). For 1990 to 1996, emissions of arsenic, cadmium, chromium, copper, mercury and nickel are estimated from standard emission factors and activity data. For 1997 to 2009, the energy related emissions are estimated from emission factors and the actual energy consumption. This change in methodology results in inconsistency in the emission trend that cannot be explained by natural factors. Emission factors for lead, selenium, and zinc from 1990 to 1996 are estimated by interpolation from the 1990 and 1997 figures (Illerup et al., 1999).

The emission of NH_3 and TSP from the production of glass wool has been measured yearly from 1996 to 2009 (TSP from 2000 to 2009) (Saint-Gobain Isover, 2010). PM_{10} and $PM_{2.5}$ are estimated from the distribution between TSP, PM_{10} and $PM_{2.5}$ from CEPMEIP (2003). The activity has varied between 33 600 and 41 318 tonnes glass wool from 1996 to 2008 and, with a significant decrease in 2009 to 33 066 tonnes due to the

[9] TCE (total cement equivalent) express the total amount of cement produced for sale and the theoretical amount of cement from the produced amount of clinker for sale.

financial crises. During the same period, the emission decreased from approximately 300 to 152 tonne NH_3.

The emissions from asphalt roofing and road paving have been estimated from production statistics compiled by Statistics Denmark and default emission factors presented by IPCC/Corinair. The default emission factors are presented in Table 4.4.

Table 4.4 Default emission factors for application of asphalt products.

		Road paving with asphalt	Use of cutback asphalt	Asphalt roofing
CH_4	g pr tonnes	5	0	0
CO	g pr tonnes	75	0	10
NMVOC	g pr tonnes	15	64 935	80
Carbon content fraction of NMVOC	%	0.667	0.667	0.8

4.2.3 Uncertainties and time-series consistency

The time-series are presented in Table 4.2 and Table 4.3. The methodologies applied for the different sources within *Mineral products* are considered to be consistent either as measurements or emission factors based on the measurements. However, not all the sources are considered to be complete regarding pollutants and these are expected to be completed in the next inventory, either by use of company-specific information or by application of general emission factors.

The time-series for emissions from production of cement are based on measurements combined with emissions factors based on the measurements.

4.2.4 Source specific QA/QC and verification

The emission factors have been verified and the order of magnitude confirmed by comparison with standard emission factors (EMEP/-CORINAIR, 2007; CEPMEIP, 2003). Detailed discussion of QA/QC can be found in Nielsen et al. (2008).

4.2.5 Source specific recalculations

Production of chemical ingredients and treatment of slaughterhouse waste are transferred from *Mineral products* to *Other production, consumption, storage, transportation or handling of bulk products* (NFR 2G).

4.2.6 Source specific planned improvements

The inventory will be improved regarding coverage of pollutants included. Especially glass wool and mineral wool will be extended. The incomplete time-series will also be completed. The inconsistent methodology applied for emission of As, Cd, Cr, Cu, Hg, and Ni from glass production will be improved.

4.3 Chemical industry (NFR 2B)

4.3.1 Source category description

The sub-sector *Chemical industry* (NFR 2B) covers the following processes:

- Production of sulphuric acid (SNAP 040401)
- Production of nitric acid/fertiliser (SNAP 040402/040407)
- Production of catalysts/fertilisers (SNAP 040416/040407)
- Production of pesticides (SNAP 040525)

The time-series for emission of acidifying substances, NMVOC and particulate matter from *Chemical industry* (NFR 2B) are presented in Table 4.5.

Table 4.5 Time-series for pollutants from *Chemical industry 2B* (tonnes).

Pollutant	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
SO_2	636	496	600	461	514	406	247	397	408	487
NO_x	842	778	691	619	636	648	543	611	472	509
NH_3	25.0	35.0	48.0	62.0	104	75.0	75.0	50.0	25.0	33.0
NMVOC	390	150	62.0	40.0	54.0	57.0	113	44.0	40.0	41.0
TSP										
PM_{10}										
$PM_{2.5}$										
Continued	2000	2001	2002	2003	2004[1]	2005	2006	2007	2008	2009
SO_2	421	449	436	321	340	402	258	36.0	13.0	20.0
NO_x	447	422	419	475	302	30.2	37.0	18.0	19.0	18.0
NH_3	27.0	101	93.0	113	101	79.0	88.0	107	111	165
NMVOC	29.0	29.0	26.7	25.4	31.4	25.7	25.3	24.0	23.9	18.0
TSP	381	365	329	334	204	23.0	12.0	25.0	26.0	16.0
PM_{10}	305	292	263	267	163	18.0	10.0	20.0	21.0	13.0
$PM_{2.5}$	228	219	197	201	122	14.0	7.00	15.0	16.0	10.0

1) Nitric acid production ceased in 2004.

The time-series for SO_2 follows the amount of sulphuric acid produced, i.e. the fluctuation follows the activity until the activity ceased in 1997. The same is the case for NO_X from production of nitric acid; however, the emission of NO_X pr amount produced is decreasing from 1994 to 2004; see Figure 4.2. The emission of NH_3 does not follow the activity as it appears from the fluctuation in the emission pr amount produced. The production of nitric acid and fertiliser stopped in the middle of 2004.

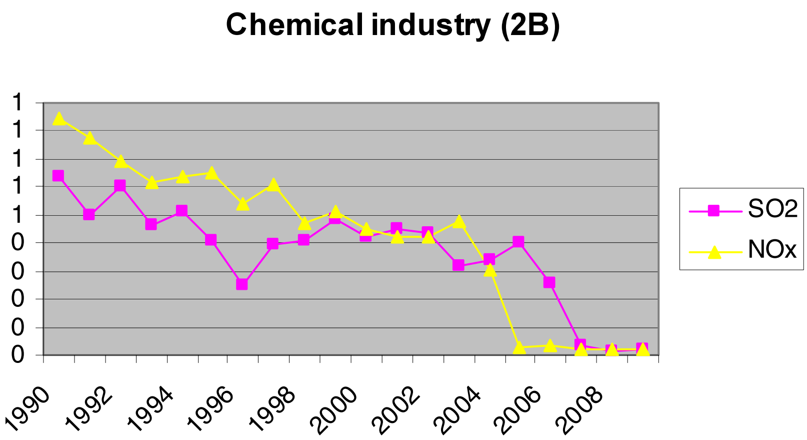

Figure 4.2 Emission of NO_x and SO_2 from Chemical industry (2B).

The emission of NO_X from production of catalysts/fertilisers decreases from 1996 to 2009, whereas the emission of NH_3 increases. Fluctuations and the increase in the "emission factor" can explain the increase in NH_3 emission.

The emission of NMVOC from production of pesticides reduced significantly from 1990 to 2009 (Cheminova, 2010). The decrease can probably be explained by introduction of flue gas cleaning equipment rather than any decrease in activity. The emission of SO_2 is from the sulfur regeneration plant (Claus plant).

The time-series will be explained further in the following section.

4.3.2 Methodological issues

The emission of SO_2, NO_X, NH_3 and TSP from production of sulfuric acid, nitric acid and fertiliser is measured yearly or estimated, from 1990 to 2004 (TSP from 2000 to 2004) (Kemira GrowHow, 2005). PM_{10} and $PM_{2.5}$ are estimated from the distribution between TSP, PM_{10} and $PM_{2.5}$ from CEPMEIP (2003). The emission for SO_2 and NO_X for 1991 to 1993 was estimated by using interpolated emission factors and activity data. Production of sulphuric acid was stopped in 1997 and production of nitric acid was stopped in 2004. The emission factor for SO_2 fluctuated and the emission factor for NO_X decreased from 1990 to 2004. Production of sulphuric acid decreased from approximately 150 000 to 60 000 tonnes from 1990 to 1996, and production of nitric acid decreased from approximately 450 000 to 229 000 tonnes from 1990 to 2004. Overall, production of fertiliser decreased from approximately 800 000 to approximately 395 000 tonnes from 1990 to 2004.

The emission of NH_3, NO_X and TSP from production of catalysts and fertilisers is measured yearly from 1996 to 2009 (TSP from 2000 to 2009) (Haldor Topsøe, 2010). PM_{10} and $PM_{2.5}$ are estimated from the distribution between TSP, PM_{10} and $PM_{2.5}$ from CEPMEIP (2003). The process-related NO_X emission has been estimated as 80 % of the total NO_X emission; Haldor Topsøe reports this assumption in their environmental report. The emission of NH_3 shows an increasing trend and varies between 13 and 165 tonne from 1990 to 2009. In the same period, the production of catalysts and fertilisers increased from approximately 33 000 to 45 000 tonnes.

The emission of NMVOC from production of pesticides is measured yearly from 1990 to 2000 (Cheminova, 2010) and estimated for 2001 to 2009. An emission factor based on 2000 figures is used for estimation of 2001 to 2009 emissions. The emission of NMVOC shows a decreasing trend from 1990 to 2009.

4.3.3 Uncertainties and time-series consistency

The time-series are either based on specific measurements or by using company-specific emission factors and activity data. Therefore, the time-series are considered to be consistent.

4.3.4 Source specific QA/QC and verification

The emission factors for production of nitric acid and sulphuric acid have been verified by comparison with standard emission factors (EMEP/CORINAIR, 2007). Detailed discussion of QA/QC can be found in Nielsen et al. (2008).

4.3.5 Source specific recalculations

No source specific recalculation has been performed for the sector *Chemical industry*.

4.3.6 Source specific planned improvements

No source specific improvements are planned.

4.4 Metal production (NFR 1A2/2C)

4.4.1 Source category description

The sub-sector *Metal production* (NFR 1A2/2C) covers the following processes:

- Steelworks (SNAP 040207)
- Iron foundries (SNAP 030303)
- Secondary lead production (SNAP 030307)
- Secondary zinc production (SNAP 030308)
- Secondary aluminium production (SNAP 030310)
- Allied metal manufacturing (SNAP 040306)

The time-series for emission of heavy metals and particulate matter from *Metal production* (NFR 1A2/2C) are presented in Table 4.6 and Table 4.7.

The emission inventory for metal production is based on specific emissions from steelworks and secondary aluminium manufacturing as well as average emission factors for iron foundries, secondary lead and zinc manufacturing, and allied metal manufacturing. Regarding the steelworks that use iron and steel scrap as raw material, the emissions to a large degree depend on the quality of the scrap. This fact may result in large annual variations for one or more of the heavy metals. This may be the case for iron foundries, as they also use scrap as raw material, but they have not been subject to the same requirements to analyse emissions of heavy metals to air.

Table 4.6 Time-series for pollutants from *Metal production 1A2ab* (combustion/process emissions; metals: kg and other pollutants: tonnes).

Pollutant	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
TSP										
PM_{10}										
$PM_{2.5}$										
As	30.9	30.1	29.3	28.6	27.8	27.1	26.3	25.5	25.7	25.8
Cd	14.4	14.1	13.7	13.3	13.0	12.6	12.3	11.9	12.0	12.0
Cr	113	110	108	105	102	99.2	96.4	93.6	94.4	94.6
Ni	134	131	127	124	121	117	114	111	112	112
Pb	742	723	704	686	667	649	631	613	618	619
Se	515	502	489	477	464	451	438	426	429	430
Zn	515	502	489	477	464	451	438	426	429	430
Continued	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
TSP	193	171	175	175	181	175	157	148	161	68.4
PM_{10}	57.8	51.4	52.4	52.4	54.4	52.4	47.1	44.5	48.2	20.5
$PM_{2.5}$	8.68	7.71	7.86	7.86	8.15	7.85	7.07	6.67	7.24	3.08
As	28.9	25.7	26.2	26.2	27.2	26.2	23.6	22.2	24.1	10.3
Cd	13.5	12.0	12.2	12.2	12.7	12.2	11.0	10.4	11.3	4.79
Cr	106	94.3	96.0	96.0	99.7	96.0	86.4	81.5	88.4	37.6
Ni	125	111	113	113	118	113	102	96.4	105	44.5
Pb	694	617	629	629	652	628	566	534	579	246
Se	482	429	437	437	453	436	393	371	402	171
Zn	482	429	437	437	453	436	393	371	402	171

Table 4.7 Time-series for pollutants from *Metal production 2C* (process emissions; metals: kg and other pollutants: tonnes).

Pollutant	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
TSP										
PM_{10}										
$PM_{2.5}$										
Cd	42.7	42.8	42.8	46.4	49.9	49.6	46.5	34.6	42.7	7.05
Cr	6.75	6.75	6.75	7.35	7.95	7.89	7.00	0.00	1.00	0.00
Cu	40.1	41.0	41.9	42.8	43.7	44.6	45.1	46.4	46.4	46.4
Hg	136	136	136	148	160	158	147	84.0	60.6	49.5
Ni	272	272	272	296	320	318	294	228	112	86.1
Pb	740	742	743	804	865	860	803	713	450	743
Zn	5 891	5 905	5 917	6 404	6 892	6 852	6 398	5 656	3 050	2 755
Continued	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
TSP	75	128	32.6	25.8	22.9	30.5	35.1	38.9	30.2	2.72
PM_{10}	70	119	29.4	23.3	20.6	27.4	31.6	35.0	27.1	2.40
$PM_{2.5}$	39	70	13.5	10.7	9.66	12.7	14.6	16.1	12.6	1.48
Cd	24.6	40.6	4.62	4.62	4.62	4.62	4.62	4.62	4.62	4.62
Cr	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Cu	46.4	46.4	46.4	46.4	46.4	46.4	46.4	46.4	46.4	46.4
Hg	90.0	184	-[1]	-[1]	-[1]	63.9	-[1]	-[1]	-[1]	-[1]
Ni	60.0	123	-[1]	-[1]	-[1]	42.6	-[1]	-[1]	-[1]	-[1]
Pb	517	948	76.7	76.7	76.7	378	76.7	76.7	76.7	76.7
Zn	2 024	3 420	634	634	634	1 600	634	634	634	634

1) The electro steelwork was closed 2002-2004 and from 2006.

The steelwork was closed in the beginning of 2002 and re-opened at the end of 2004. The electro steelwork has been closed again from 2006; whereas manufacturing of steel sheets has continued separated from the electro steelwork. Melting of secondary aluminium was stopped in the end of 2008.

4.4.2 Methodological issues

The emission of heavy metals and TSP from the production of steel bars and sheets from steel scrap are based on measurements from the company Stålvalseværket (Stålvalseværket, 2002). PM_{10} and $PM_{2.5}$ are estimated from the distribution between TSP, PM_{10} and $PM_{2.5}$ from CEPMEIP (2003). The distribution of metals for 1995/96 (Illerup et al., 1999) is used in estimation of the different metals for the following years. The activity has varied between approximately 600 000 and 800 000 tonnes from 1990 to 2001. The production ceased in the beginning of 2002 and restarted at the end of 2004 with regard to melting of steel scrap in the electric arc furnace. The production of steel bars at the steelwork is assumed to be 1/3 of the production in 2001; the steelwork has been closed from end of 2005/beginning of 2006.

The emission of heavy metals from iron foundries is based on standard emission factors and yearly production statistics from The Association of Danish Foundries. The emission of TSP and distribution between TSP, PM_{10} and $PM_{2.5}$ is obtained from CEPMEIP (2003).

The emission of heavy metals from production of secondary lead and allied metal manufacturing is based on average emission factors for Danish producers (Illerup et al., 1999) and activity data from Statistics

Denmark. The emission of TSP and distribution between TSP, PM_{10} and $PM_{2.5}$ is obtained from CEPMEIP (2003).

4.4.3 Uncertainties and time-series consistency

The time-series are either based on specific measurements, company-specific emission factors combined with activity data or on standard emission factors combined with public statistics. The same methodology has been applied for the entire time-series and, therefore, the time-series are considered to be consistent.

4.4.4 Source specific recalculations

No source specific recalculation has been performed for the sector *Metal production*.

4.4.5 Source specific QA/QC and verification

Detailed discussion of QA/QC can be found in Nielsen et al. (2008).

4.4.6 Source specific planned improvements

The time-series will be completed and new emission factors for the latest years will be established, if possible. Especially for secondary aluminium and zinc production, potential emissions of heavy metals will be investigated.

4.5 Other production (NFR 2D)

4.5.1 Source category description

The sub-sector *Other production* (NFR 2D) covers the following process:

- Bread (SNAP 040605).
- Beer (SNAP 040607).
- Spirits (SNAP 040608).
- Sugar production (SNAP 040625).
- Meat (fish etc. frying/curing) (SNAP 040627).
- Margarine and solid cooking fats (SNAP 040698).
- Coffee roasting (SNAP 040699).

Table 4.1 and Table 4.2 present the emission of NMVOC from production of food and beverage. The emissions are presented for relevant subsectors.

Table 4.1 Emission of NMVOC from production of beer and spirits (tonne NMVOC).

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Beer	326	339	342	330	329	347	336	321	282	287
Spirits	32.1	31.7	29.9	29.9	38.7	31.3	29.2	26.7	26.4	23.9
Ethanol, technical	51.9	53.8	67.7	73.0	80.8	77.4	88.8	88.2	85.3	69.1
Sum	410	424	440	433	449	455	454	436	393	380
Continued	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Beer	261	253	287	292	299	304	286	268	227	211
Spirits	23.6	23.4	25.0	25.5	23.8	22.1	20.1	16.6	11.9	10.9
Ethanol, technical	72.2	78.2	76.7	72.4	70.7	83.1	81.3	62.7	76.8	63.6
Sum	357	355	389	390	394	409	387	347	315	286

Table 4.2 Emission of NMVOC from production of bread and cookies, meat curing (meat, poultry, fish, and shellfish), production of margarine and solid cooking fats, roasting of coffee (tonne NMVOC).

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Biscuits, cookies and other bakery products	98.6	123	129	136	138	148	164	163	150	131
Bread (rye and wheat)	853	923	880	936	981	1 038	957	1 078	1 113	1 054
Meat	443	465	499	539	539	528	527	535	564	565
Poultry	39.4	41.7	46.5	50.2	51.8	51.9	51.0	52.8	57.2	60.7
Fish and shellfish	493	582	674	578	669	708	580	641	572	544
Liquid fats and oils										
Solid fats and oils	2 307	2 360	2 379	2 210	2 005	1 983	1 934	2 171	2 269	2 045
Coffee, not roasted, not decaffeinated, supply	28.6	27.8	30.6	30.3	30.4	26.9	30.3	28.7	30.3	33.1
Total emission	4 263	4 523	4 639	4 479	4 414	4 484	4 243	4 670	4 755	4 433
Continued	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Biscuits, cookies and other bakery products	138	146	151	156	165	157	149	136	124	115
Bread (rye and wheat)	1 098	1 218	1 135	1 110	1 151	1 158	1 217	1 153	1 145	1 201
Meat	559	587	601	599	615	603	587	605	574	536
Poultry	60.5	64.8	65.3	59.9	57.9	56.3	51.3	51.7	52.9	50.6
Fish and shellfish	578	569	552	450	453	405	371	314	295	316
Liquid fats and oils										
Solid fats and oils	1 957	1 782	2 250	2 090	2 103	2 002	1 817	1 914	1 911	1 752
Coffee, not roasted, not decaffeinated, supply	30.6	32.4	31.3	28.1	30.1	20.1	19.3	18.2	18.5	18.8
Total emission	4 422	4 399	4 785	4 493	4 576	4 401	4 211	4 192	4 120	3 990

The emission of NMVOC from production of food and beverage follows the activity as the same emission factors have been used for the entire period. The emission factors are presented in Table 4.3

4.5.2 Methodological issues

The emission of NMVOC from production of food and beverage is estimated from production statistics (Statistics Denmark) and standard emission factors from the IPCC guidelines (IPCC (1997) Vol. 3, Table 2-24/2-25) combined with the UNECE Guidebook (EMEP/EEA, 2009); see Table 4.3.

Table 4.3 Emission factors for NMVOC applied within production of food and beverage; activity is given as 1 000 l or tonne of product.

Beverage	kg NMVOC/1 000 l
Beer	0.35
Spirits	4
Ethanol, technical	4
Food	kg NMVOC/tonne
Meat, fish and poultry	0.3
Sugar	10
Margarine and solid cooking fats	10
Cakes, biscuits and breakfast cereals	1
Bread	4.5
Coffee roasting	0.55

The activity data used in the estimates are presented in Table 4.4 and Table 4.5.

Table 4.4 Production of beer and spirits (1000 l) (Statistics Denmark, 2009).

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Beer	930 405	967 177	977 541	943 504	941 020	990 321	959 132	918 055	804 354	820 502
Spirits	8 026	7 933	7 474	7 472	9 684	7 823	7 303	6 687	6 596	5 969
Ethanol, technical	12 977	13 444	16 936	18 245	20 204	19 338	22 190	22 056	21 336	17 276
Continued	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Beer	745 492	723 311	820 242	835 184	854 988	868 041	816 890	765 789	647 402	603 797
Spirits	5 893	5 861	6 240	6 379	5 943	5 518	5 018	4 140	2 976	2 721
Ethanol, technical	18 059	19 556	19 183	18 097	17 686	20 780	20 336	15 663	19 195	15 896

Table 4.5 Production statistics for production (or supply of) of bread and cookies, meat curing (meat, poultry, fish, and shellfish), production of margarine and solid cooking fats, roasting of coffee (tonne) (Statistics Denmark, 2009).

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Biscuits, cookies and other bakery products	98 574	123 393	128 792	135 796	138 136	148 247	163 634	162 958	149 580	130 944
Bread (rye and wheat)	189 562	205 111	195 648	207 987	217 932	230 762	212 701	239 621	247 309	234 153
Meat	1 477 700	1 549 400	1 664 300	1 795 000	1 796 600	1 758 800	1 756 200	1 782 700	1 880 500	1 884 900
Poultry	131 400	138 900	155 100	167 300	172 500	173 000	170 100	175 900	190 500	202 400
Fish and shellfish	1 643 648	1 940 020	2 247 327	1 927 206	2 228 849	2 360 076	1 934 419	2 137 490	1 905 973	1 812 459
Liquid fats and oils	348 919	402 268	407 585	404 052	427 384	494 388	425 774	357 637	386 604	389 959
Solid fats and oils	230 705	236 014	237 921	221 026	200 548	198 274	193 380	217 120	226 929	204 485
Coffee, not roasted, not decaffeinated, supply	52 086	50 588	55 725	55 126	55 235	48 870	55 097	52 177	55 169	60 243
Continued	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Biscuits, cookies and other bakery products	138 488	145 566	150 596	156 018	165 139	157 214	148 683	136 397	124 170	115 496
Bread (rye and wheat)	244 060	270 707	252 163	246 639	255 813	257 444	270 493	256 265	254 373	266 886
Meat	1 864 000	1 957 600	2 002 500	1 997 600	2 051 500	2 009 400	1 958 200	2 016 100	1 912 800	1 785 300
Poultry	201 700	216 100	217 600	199 700	192 900	187 500	171 100	172 400	176 200	168 800
Fish and shellfish	1 926 516	1 895 372	1 838 940	1 500 075	1 508 929	1 348 424	1 235 158	1 046 152	984 407	1 054 914
Liquid fats and oils	386 832	313 581	338 622	411 321	497 364	539 074	622 761	595 785	534 976	499 979
Solid fats and oils	195 679	178 171	225 037	208 980	210 337	200 170	181 654	191 405	191 082	175 192
Coffee, not roasted, not decaffeinated, supply	55 617	58 947	56 857	51 009	54 638	36 555	35 134	33 121	33 720	34 176

4.5.3 Uncertainties and time-series consistency

The time-series is based on the same methodology throughout, using public statistics and standard emission factors. Therefore, the time-series is considered to be consistent.

4.5.4 Source specific recalculations

Some of the emission factors applied within the sector *Other production* has been revised. Regarding breweries, the default emission factor for beer has been adopted (EMEP/EEA, 2009). Regarding bread, the default emission factor for typical European bread has been adopted (EMEP/EEA, 2009).

4.5.5 Source specific QA/QC and verification

No source specific QA/QC and verification has been performed for the sector *Other production*.

4.5.6 Source specific planned improvements

The time-series has been improved with spirits/ethanol, bread, meat etc., fats and coffee. However, investigation of potential country specific emission factors is still ongoing.

4.6 Other production, consumption, storage, transportation or handling of bulk products (NFR 2G)

4.6.1 Source category description

The sub-sector *Other production, consumption, storage, transportation or handling of bulk products* (NFR 2G) covers the following processes:

- Other (SNAP 040617; Danisco ingredients/Slaughterhouse waste).

Table 4.6 present the emission of NH_3 and NMVOC from production of chemical ingredients and treatment of slaughterhouse waste.

Table 4.6 Emission of NH_3 and NMVOC from production of chemical ingredients and treatment of slaughterhouse waste (tonne).

Year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
NH_3	24.2	32.4	32.2	35.1	32.1	31.5	31.2	30.0	31.4	36.3
NMVOC	100	100	100	100	100	100	100	93.0	103	62.0
Continued	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
NH_3	34.0	31.9	47.9	157	167	132	96.4	112	112	92.5
NMVOC	40.0	18.0	18.0	15.0	16.0	14.0	15.0	17.0	15.0	12.0

The emission of NMVOC from production of chemical ingredients shows a decreasing trend and can probably be explained by the decreasing emission pr amount produced.

4.6.2 Methodological issues

The emission of NMVOC from production of chemical ingredients has been measured from 1996 to 2009 (Danisco Grindsted, 2010). The emission has decreased from 100 to 12 tonnes NMVOC in this period. However, no explanation can be given on these conditions, as information on activity is not available.

The emission of NH_3 from treatment of slaughterhouse waste has been calculated from an average emission factor based on measurements from Danish plants (daka, 2010). Activity data are obtained from production statistics (Statistics Denmark, 2010).

4.6.3 Uncertainties and time-series consistency

The time-series is based on the same methodology throughout, using public statistics and standard emission factors. Therefore, the time-series is considered to be consistent.

4.6.4 Source specific recalculations

No source specific recalculation has been performed for the sector *Other production, consumption, storage, transportation or handling of bulk products.*

4.6.5 Source specific QA/QC and verification

No source specific QA/QC and verification has been performed for the sector *Other production, consumption, storage, transportation or handling of bulk products.*

4.6.6 Source specific planned improvements

No source specific improvements are planned.

4.7 Uncertainty estimates

Uncertainty estimates for industrial processes (SNAP 04) are presented in Table 4.9. The uncertainty estimates are based on standard uncertainty factors (EMEP/EEA, 2009).

Table 4.9 Uncertainty estimates for industrial processes (%).

	Activity data uncertainty	Emission factor uncertainty	Overall 2009	Trend
SO_2	2	20	20.100	0.281
NO_x	2	50	50.040	0.060
NMVOC	50	50	70.711	64.275
CO	50	100	50.040	2.211
NH_3	2	1000	1000.002	14.79
Cadmium	2	1000	1000.002	0.299
Copper	2	1000	1000.002	3.291
Lead	2	1000	1000.002	0.064
Zinc	2	1000	1000.002	0.305

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5 Solvents and Other Product Use (NFR sector 3)

5.1 Overview of the sector

This report presents the Danish methodology used for calculating pollutant emissions from use of solvents and other products in industrial processes and households that are related the source categories Paint application (NFR sector 3A), Degreasing and dry cleaning (NFR sector 3B), Chemical products, manufacture and processing (NFR sector 3C) and Other (NFR sector 3D). At present NMVOCs, N_2O and CO_2 are included, and more recently fireworks has been introduced under other product use, which comprises SO_x, CO, particles, As, Cd, Cr, Cu, Hg, Ni, Pb and Zn.

Solvents are chemical compounds that are used on a global scale in industrial processes and as constituents in final products to dissolve, e.g. paint, cosmetics, adhesives, ink, rubber, plastic, pesticides, aerosols or are used for cleaning purposes, i.e. degreasing. NMVOCs are main components in solvents - and solvent use in industries and households is typically the dominant source of anthropogenic NMVOC emissions (UNFCCC, 2008; Pärt, 2005; Karjalainen, 2005). In industrial processes where solvents are produced or used NMVOC emissions to air and as liquid can be recaptured and either used or destroyed. Solvent containing products are used indoor and outdoor and the majority of solvent sooner or later evaporate. A small fraction of the solvent ends up in waste or as emissions to water and may finally also contribute to air pollution by evaporation from these compartments. Emission inventories for solvents are based on model estimates, as direct and continuous emissions are only measured from a limited number of pollutants and sources, e.g. SO_2 and NO_x from central power plants.

In this section the methodology for the Danish NMVOC emission inventory for solvent use is presented and the results for the period 1995 – 2009 are summarised. The method is based on the detailed approach described in EMEP/CORINAIR (2004) and emissions are calculated for industrial sectors, households in the NFR sectors mentioned above, as well as for individual chemicals.

5.2 Source category emissions

Table 5.1 and Figure 5.1 show the emissions of chemicals from 1985 to 2009, where the used amounts of single chemicals have been assigned to specific products and NFR sectors. The methodological approach for finding emissions in the period 1995 - 2009 is described in the following section. A linear extrapolation is made for the period 1985–1994. A general decrease is seen throughout the sectors. Table 5.2 shows the used amounts of chemicals for the same period. Table 5.1 is derived from Table 5.2 by applying emission factors relevant to individual chemicals and production or use activities. Table 5.3 showing the used amount of products is derived from Table 5.2, by assessing the amount of chemicals that is comprised within products belonging to each of the four source categories. The CO_2 conversion factor for each chemical is shown in Table 5.4.

In Table 5.4 the emission for 2009 is split into individual chemicals. The most abundantly used solvents are ethanol, turpentine, or white spirit defined as a mixture of stoddard solvent and solvent naphtha and propylalcohol. Ethanol is used as solvent in the chemical industry and as windscreen washing agent. Turpentine is used as thinner for paints, lacquers and adhesives. Propylalcohol is used in cleaning agents in the manufacture of electrical equipment, flux agents for soldering, as solvent and thinner and as windscreen washing agent. Household emissions are dominated by propane and butane, which are used as aerosols in spray cans, primarily in cosmetics. For some chemicals the emission factors are precise but for others they are rough estimates. Emission factors are divided into four categories: 1) chemical industry (lowest EF), 2) other industry, 3) non-industrial activities, 4) domestic and other diffuse use (highest EF). This implies that high emission factors are applicable for use of solvent containing products and lower emission factors are applicable for use in industrial processes.

Table 5.1 Emission of chemicals in Gg pr year.

Total emissions Gg pr year	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
Paint application (3A)	11.6	11.3	11.0	10.6	10.3	9.93	9.59	9.24	8.90	8.56
Degreasing and dry cleaning (3B)	1.04E-04	9.98E-05	9.55E-05	9.13E-05	8.7E-05	8.28E-05	7.85E-05	7.42E-05	7E-05	6.57E-05
Chemical products, manufacturing and processing (3C)	11.2	11.0	10.7	10.4	10.1	9.83	9.55	9.26	8.98	8.70
Other (3D)	40.4	39.4	38.4	37.3	36.3	35.3	34.3	33.3	32.3	31.3
Total NMVOC	63.3	61.6	60.0	58.4	56.7	55.1	53.5	51.8	50.2	48.6
Total CO_2	156	151	148	143	139	135	131	127	122	119
Continued	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Paint application (3A)	6.89	8.46	7.16	6.99	7.55	7.44	6.08	6.08	5.95	5.40
Degreasing and dry cleaning (3B)	7.67E-05	7.38E-05	4.46E-05	5.48E-05	3.45E-05	2.93E-05	1.25E-05	2.98E-05	2.89E-05	2.4E-05
Chemical products, manufacturing and processing (3C)	9.11	9.20	7.82	7.45	7.07	6.74	6.10	6.39	4.76	5.90
Other (3D)	28.7	31.2	29.3	26.6	25.6	26.5	23.7	23.3	21.3	20.5
Total NMVOC	44.7	48.8	44.2	41.0	40.2	40.6	35.9	35.7	32.0	31.8
Total CO_2	107	119	107	99.8	98.8	98.8	86.9	87.1	78.9	77.0
Continued	2005	2006	2007	2008	2009					
Paint application (3A)	4.89	4.07	3.39	3.66	3.32					
Degreasing and dry cleaning (3B)	1.83E-05	1.46E-05	2.17E-05	1.5E-05	1.31E-05					
Chemical products, manufacturing and processing (3C)	6.12	5.94	6.07	5.84	4.90					
Other (3D)	19.9	20.2	17.6	17.9	19.1					
Total NMVOC	31.0	30.2	27.0	27.4	27.4					
Total CO_2	74.4	70.6	63.2	64.6	64.4					

Table 5.2 Used amounts of chemicals in Gg pr year.

Used amounts of chemical Gg pr year	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
Paint application (3A)	24.8	24.1	23.5	22.8	22.1	21.5	20.8	20.2	19.5	18.9
Degreasing and dry cleaning (3B)	1.04	1.00	0.959	0.917	0.874	0.832	0.789	0.746	0.704	0.661
Chemical products, manufacturing and processing (3C)	53.4	57.2	60.9	64.6	68.4	72.1	75.9	79.6	83.3	87.1
Other (3D)	63.0	61.6	60.3	58.9	57.6	56.2	54.9	53.6	52.2	50.9
Total NMVOC	142	144	146	147	149	151	152	154	156	157
Continued	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Paint application (3A)	15.3	18.5	16.0	16.2	16.8	17.3	14.2	14.3	13.4	12.8
Degreasing and dry cleaning (3B)	0.767	0.738	0.446	0.548	0.345	0.293	0.125	0.298	0.289	0.240
Chemical products, manufacturing and processing (3C)	101	105	104	106	97.7	114	110	108	103	127
Other (3D)	47.8	50.0	48.0	45.1	43.4	44.4	39.8	42.3	35.5	35.2
Total NMVOC	165	174	168	167	158	175	165	165	152	175
Continued	2005	2006	2007	2008	2009					
Paint application (3A)	12.1	10.2	8.76	9.10	8.04					
Degreasing and dry cleaning (3B)	0.183	0.146	0.217	0.150	0.131					
Chemical products, manufacturing and processing (3C)	148	150	163	155	137					
Other (3D)	39.7	35.1	31.8	32.9	35.0					
Total NMVOC	200	196	204	197	180					

Table 5.3 Used amounts of products in Gg pr year.

Used amounts of products Gg pr year	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
Paint application (3A)	165	161	156	152	148	143	139	135	130	126
Degreasing and dry cleaning (3B)	2.09	2.00	1.92	1.83	1.75	1.66	1.58	1.49	1.41	1.32
Chemical products, manufacturing and processing (3C)	267	286	305	323	342	361	379	398	417	435
Other (3D)	315	308	301	295	288	281	274	268	261	254
Total products	749	757	764	772	779	787	794	802	809	817
Continued	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Paint application (3A)	102	123	107	108	112	115	94.7	95.4	89.5	85.2
Degreasing and dry cleaning (3B)	1.53	1.48	0.892	1.10	0.690	0.586	0.251	0.597	0.578	0.481
Chemical products, manufacturing and processing (3C)	505	524	519	528	488	568	552	541	514	635
Other (3D)	239	250	240	225	217	222	199	211	178	176
Total products	848	898	867	863	818	905	846	848	781	896
Continued	2005	2006	2007	2008	2009					
Paint application (3A)	80.9	67.7	58.4	60.6	53.6					
Degreasing and dry cleaning (3B)	0.366	0.292	0.433	0.299	0.263					
Chemical products, manufacturing and processing (3C)	742	751	816	773	683					
Other (3D)	199	176	159	165	175					
Total products	1021	995	1034	999	912					

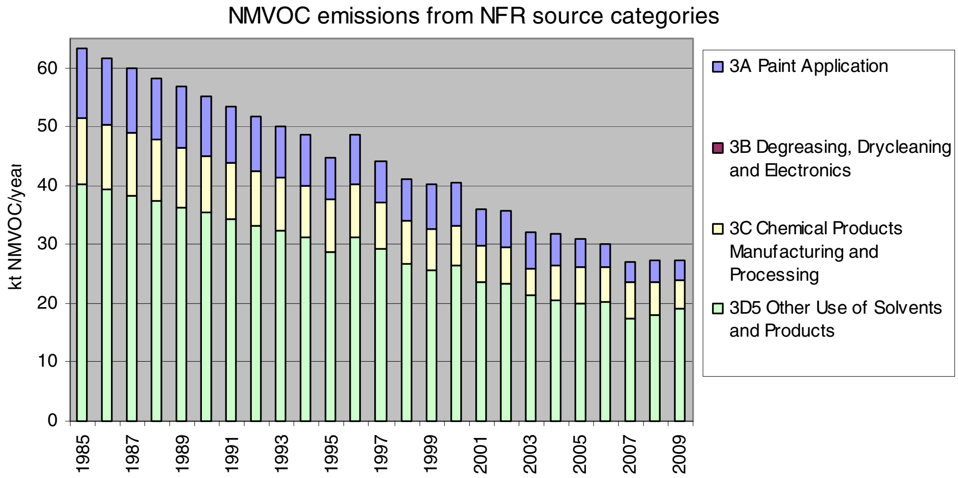

Figure 5.1 Emissions of chemicals in ktonnes pr year (equal to Gg pr year). The methodological approach for finding emissions in the period 1995 – 2009 is described in the text, and a linear extrapolation is made for 1985 – 1994. Figures can be seen in Table 5.1.

Table 5.4 Chemicals with highest emissions 2009, and CO_2 conversion factors assuming that all carbon molecules in the NMVOC molecule are converted to CO_2.

Chemical	CAS no	Emissions 2009 (tonnes)	CO_2-conversion factor (g CO_2 pr g NMVOC)
ethanol	64-17-5	8047	1.91
turpentine (white spirit: stoddard solvent and solvent naphtha)	64742-88-7 8052-41-3	6525	2.79
propylalcohol	67-63-0	3253	2.20
cyanates	79-10-7	1974	1.83
pentane	109-66-0	1472	3.06
acetone	67-64-1	892	2.28
methanol	67-56-1	839	1.38
propylenglycol	57-55-6	833	1.74
xylene	1330-20-7 95-47-6 108-38-3 106-42-3	736	3.32
propane	74-98-6	654	2.86
butane	106-97-8	654	2.93
butanone	78-93-3	533	2.45
phenol	108-95-2	361	2.81
ethylenglycol	107-21-1	212	1.42
formaldehyde	50-00-0	196	1.47
toluene	108-88-3	157	3.35
cyclohexanones	108-94-1	149	2.69
glycolethers	110-80-5 107-98-2 108-65-6 34590-94-8 112-34-5 and others	141	1.95
1-butanol	71-36-3	114	2.38
acyclic aldehydes	78-84-2 111-30-8 and others	109	2.31
methyl methacrylate	80-62-6	103	2.20
ethylacetate	141-78-6	47.1	2.00
butanoles	78-92-2 2517-43-3 and others	38.9	2.24
styrene	100-42-5	33.9	3.39
butylacetate	123-86-4	16.6	2.28
naphthalene	91-20-3	16.2	3.44
tetrachloroethylene	127-18-4	2.16	0.531
Total 2007		27351	

5.3 Other use (N_2O)

Five companies sell N_2O in Denmark and only one company produces N_2O. N_2O is primarily used in anaesthesia by dentists, veterinarians and in hospitals and in minor use as propellant in spray cans and in the production of electronics. Due to confidentiality no data on produced amount are available and thus the emissions related to N_2O production are unknown. An emission factor of 1 is assumed for all uses, which equals the sold amount to the emitted amount. Sold amounts are obtained from the respective companies and the produced amount is estimated from communication with the company.

Total sold and estimated produced NO_2 for sale in Denmark, which equals the emissions, is shown in Table 5.5.

Table 5.5 N_2O emissions. EF = 1, i.e. sale in Denmark equals emissions.

	2005	2006	2007	2008	2009
N_2O sale = emissions, (Gg)	0.0453	0.122	0.119	0.0881	0.109

5.4 Methodology

Until 2002 the Danish solvent emission inventory was based on questionnaires, which were sent to selected industries and sectors requiring information on solvent use. In 2003 it was decided to implement a method that is more complete, accurate and transparent with respect to including the total amount of used solvent, attributing emissions to industrial sectors and households and establishing a reliable model that is readily updated on a yearly basis.

Emission modelling of solvents can basically be done in two ways: 1) By estimating the amount of (pure) solvents consumed, or 2) By estimating the amount of solvent containing products consumed, taking account of their solvent content (EMEP/CORINAIR, 2004).

In 1) all relevant solvents must be estimated, or at least those together representing more than 90 % of the total NMVOC emission, and in 2) all relevant source categories must be inventoried or at least those together contributing more than 90 % of the total NMVOC emission. A simple approach is to use a pr capita emission for each category, whereas a detailed approach is to get all relevant consumption data (EMEP/CORINAIR, 2004).

The detailed method 1) is used in the Danish emission inventory for solvent use, thus representing a chemicals approach, where each chemical (NMVOC) is estimated separately. The sum of emissions of all estimated NMVOCs used as solvents equals the NMVOC emission from solvent use.

5.4.1 Chemical list

Some of the chemical compounds that are stated for reporting to the Climate and CLRTAP Conventions are not relevant for use of solvents. NMVOC is the most important chemical group especially in relation to the CLRTAP. There is also some use of N_2O and due to the high greenhouse warming potential (GWP) of N_2O, yielding a CO_2-equivalent of 1 g N_2O = 310 g CO_2 (IPCC 2000), N_2O is important in relation to the Climate Convention. Only NMVOC, N_2O and CO_2 are considered in the present reporting to the Climate Convention, CLRTAP and the NEC Directive. However, minor emissions may apply to use of other chemicals and e.g. mercury, PAHs, dioxins and PCBs will be assessed in coming inventories.

The definitions of solvents and VOC that are used in the Danish inventory (Nielsen et al., 2009) are as defined in the solvent directive (Directive 1999/13/EC) of the EU legislation: "Organic solvent shall mean any VOC, which is used alone or in combination with other agents, and without undergoing a chemical change, to dissolve raw materials, products or waste materials, or is used as a cleaning agent to dissolve contaminants, or as a dissolver, or as a dispersion medium, or as a viscosity adjuster, or as a surface tension adjuster, or a plasticiser, or as a preservative". VOCs are defined as follows: "Volatile organic compound shall mean any organic compound having at 293,15 K a vapour pressure of 0,01 kPa or more, or having a corresponding volatility under the particular condition of use".

This implies that some chemicals, e.g. ethylenglycol, that have vapour pressures just around 0.01 kPa at 20 ^{o}C, may only be defined as VOCs at use conditions with higher temperature. However, use conditions under elevated temperature are typically found in industrial processes. Here the capture of solvent fumes is often efficient, thus resulting in small emissions (communication with industries).

The Danish list of chemicals comprises 33 chemicals or chemical groups representing more than 95 % of the total NMVOC emission from solvent use of the known NMVOCs, cf. Table 5.4. CO_2 conversion factors, where all C-molecules in a NMVOC molecule are converted to CO_2, are also listed in Table 5.4.

5.4.2 Activity data

For each chemical a mass balance is formulated:

Consumption = (production + import) – (export + destruction/disposal + hold-up) (Eq. 1)

Data concerning production, import and export amounts of solvents and solvent containing products are collected from StatBank DK (2008), which contains detailed statistical information on the Danish society. Manufacturing and trading industries are committed to reporting production and trade figures to the Danish Customs & Tax Authorities in accordance with the Combined Nomenclature. Import and export figures are available on a monthly basis from 1995 to present and contain trade information from 272 countries world-wide. Production figures are reported quarterly as "industrial commodity statistics by commodity group and unit" from 1995 to present.

Destruction and disposal of solvents lower the NMVOC emissions. In principle this amount must be estimated for each NMVOC in all industrial activity and for all uses of NMVOC containing products. At present the solvent inventory only considers destruction and disposal for a limited number of NMVOCs. For some NMVOCs it is inherent in the emission factor and for others the reduction is specifically calculated from information obtained from the industry or literature.

Hold-up is the difference in the amount in stock in the beginning and at the end of the year of the inventory. No information on solvents in stock has been obtained from industries. Furthermore, the inventory spans over several years so there will be an offset in the use and production, import and export balance over time.

In some industries the solvents are consumed in the process, e.g. in the graphics and plastic industry, whereas in the production of paints and lacquers the solvents are still present in the final product. These products can either be exported or are used domestically. In order not to double count consumption amounts of NMVOCs it is important to keep track of total solvent use, solvents not used in products and use of solvent containing products. Furthermore some chemicals may be represented as individual chemicals and also in chemical groups, e.g. "o-xylene", "mixture of xylenes" and "xylene". Some chemicals are better inventoried as a group of NMVOCs rather than individual NMVOCs, due to missing information on use or emission for the individual NMVOCs. The Danish inventory considers single NMVOCs with a few exceptions.

Activity data for chemicals are thus primarily calculated from Equation 1 with input from StatBank DK (2008). When StatBank (2008) holds no information on production, import and export or when more reliable information is available from industries, scientific reports or expert judgements the data can be adjusted or even replaced.

5.4.3 Emission factors

For each chemical the emission is calculated by multiplying the consumption with the fraction emitted (emission factor), according to:

Emission = consumption * emission factor

The present Danish method uses emission factors that represent specific industrial activities, such as processing of polystyrene, dry cleaning etc. or that represent use categories, such as paints and detergents. Some chemicals have been assigned emission factors according to their water solubility. Higher hydrophobicity yields higher emission factors, since a lower amount ends in waste water, e.g. ethanol (hydrophilic) and turpentine (hydrophobic).

Emission factors are categorised in four groups in ascending order:

- Lowest emission factors in the chemical industry, e.g. lacquer and paint manufacturing, due to emission reducing abatement techniques and destruction of solvent containing waste.
- Other industrial processes, e.g. graphic industry, have higher emission factors.
- Non-industrial use, e.g. auto repair and construction, have even higher emission factors.
- Diffuse use of solvent containing products, e.g. painting, where practically all the NMVOC present in the products will be released during or after use.

For a given chemical the consumed amount can thus be attributed with two or more emission factors; one emission factor representing the emissions occurring at a production or processing plant and one emission factor representing the emissions during use of a solvent containing product. If the chemical is used in more processes and/or is present in several products more emission factors are assigned to the respective chemical amounts.

Emission factors can be defined from surveys of specific industrial activities or as aggregated factors from industrial branches or sectors. Furthermore, emission factors may be characteristic for the use pattern of certain products. The emission factors used in the Danish inventory also rely on the work done in the joint Nordic project (Fauser et al. 2009).

5.4.4 Source allocation

The Danish Working Environment Authority (WEA) is administrating the registrations of chemicals and products to the Danish product register. All manufacturers and importers of products for occupational and commercial use are obliged to register. The following products are comprised in the registration agreement:

- Chemicals and materials that are classified as dangerous according to the regulations set up by the Danish Environmental Protection Agency (EPA).
- Chemicals and materials that are listed with a limit value on the WEA "limit value list".
- Materials, containing 1 % or more of a chemical, which is listed on the WEA "limit value list".
- Materials, containing 1 % or more of a chemical, which are classified as hazardous to humans or the environment according to the EPA rules on classification.

There are the following important exceptions for products, which does not need to be registered:

- Products exclusively for private use.
- Pharmaceuticals ready for use.
- Cosmetic products.

The Danish product register does therefore not comprise a complete account of used chemicals. Source allocations of exceptions from the duty of declaration are done based on information from trade organisations, industries, scientific reports and information from the internet.

Outputs from the inventory are

- a list where the 34 most predominant NMVOCs are ranked according to emissions to air,
- specification of emissions from industrial sectors and from households,
- contribution from each NMVOC to emissions from industrial sectors and households,
- yearly trend in NMVOC emissions, expressed as total NMVOC and single chemical, and specified in industrial sectors and households.

5.5 Uncertainties and time-series consistency

Uncertainties are expressed as ± 95%-confidence interval limits in percentage relative to the calculated mean 2009 emission.

Table 5.6 Tier 1 and Tier 2 uncertainty estimates, expressed as 95 %-confidence intervals relative to the mean emissions for 1990 and 2009, respectively. Input uncertainties follow normal distribution in 1990 and log-normal distribution in 2009.

Table 5.6 Tier 1 and Tier 2 level and trend uncertainties for solvent and other product use sector.

	Tier 1		Tier 2		
	2009	Trend 1990-2009	1990	2009	Trend 1990-2009
Excl. N_2O	22 %	6.9 %	-13 %; +16 %	-14 %; +17 %	-1.2 %; +5.0 %
Incl. N_2O	15 %	-	-	-9.2 %; +11 %	-

No N_2O data for 1990.

Important uncertainty issues related to the mass-balance approach are:

(i) Identification of chemicals that qualify as NMVOCs. Although a tentative list of 650 chemicals from NAEI (2000) has been used, it is possible that relevant chemicals are not included, e.g. chemicals that are not listed with their name in Statistics Denmark (StatBank DK, 2008) but as a product.

(ii) Collection of data for quantifying production, import and export of single chemicals and products where the chemicals are comprised. For some chemicals no data are available in StatBank DK (2008). This can be due to confidentiality or that the amount of chemicals must be derived from products wherein they are comprised. For other chemicals the amount is the sum of the single chemicals *and* product(s) where they are included. The data available in StatBank DK (2008) is obtained from Danish Customs & Tax Authorities and they have not been verified in this assessment.

(iii) Distribution of chemicals on products, activities, sectors and households. The present approach is based on amounts of single chemicals. To differentiate the amounts into industrial sectors it is necessary to identify and quantify the associated products and activities and assign these to the industrial sectors and households. No direct link is available between the amounts of chemicals and products or activities. From the Nordic SPIN database it is possible to make a relative quantification of products and activities used in industry, and combined with estimates and expert judgement these products and activities are differentiated into sectors. The contribution from households is also based on estimates. If the household contribution is set too low, the emission from industrial sectors will be too high and vice versa. This is due to the fact that the total amount of chemical is constant. A change in distribution of chemicals between industrial sectors and households will, however, affect the total emissions, as different emission factors are applied in industry and households, respectively.

A number of activities are assigned as “other”, i.e. activities that can not be related to the comprised source categories. This assignment is based on expert judgement but it is possible that the assigned amount of chemicals may more correctly be included in other sectors. More detailed information from the industrial sectors is continuously being implemented.

(iv) Rough estimates and assumed emission factors are used for some chemicals. For some chemicals more reliable information has been obtained from the literature and from communication with industrial sectors. In some cases it is more appropriate to define emission factors for sector specific activities rather than for the individual chemicals.

A quantitative measure of the uncertainty has not been assessed. Single values have been used for emission factors and activity distribution ratios etc. A Tier 2 assessment is currently being implemented in the Danish inventory.

5.6 QA/QC and verification

Please refer to the Danish National Inventory Report reported to the UNFCCC (Nielsen et al., 2009).

5.7 Recalculations

Improvements and additions are continuously being implemented due to the comprehensiveness and complexity of the use and application of solvents in industries and households. The main improvements in the 2011 reporting include the following:

- Further improvement of source allocation model, which combines information on Use Categories and NACE Industrial Use Categories from SPIN and use amounts from Statistics DK.
- Implementation of correct 2008 import amounts for xylene, which has been verified by Statistics Denmark.
- Inclusion of Firework in Other Product Use.

5.8 Planned improvements

- Based on the results from a joint Nordic project in 2011 PAH, PCB, dioxin and mercury use and emissions will be implemented.
- Chemicals that are listed as products in Statistics Denmark, e.g. cosmetics, will be assessed.
- Extrapolation of emissions in the period 1985-1994 will be reassessed.

5.9 Fireworks

The use of fireworks is in general limited to a short period around New Years Eve. This section contains calculations of the annual aggregated emissions.

In general fireworks consist of a container of papers and polymers, a propeller in form of black powder and for fireworks like e.g. rockets there is a content of different compounds for colours and effects. Black powder consists of about 75 % oxidizer, most commonly potassium nitrate but also potassium perchlorate or, less commonly, chlorate. The remaining components in black powder are a fuel (carbon), and an accelerant (sulfur). The combustion of black powder commonly produces carbon dioxide, potassium sulfide and nitrogen (Vecchi et al., 2008; Paster P., 2009).

Different compounds produces different colours and effects, red, green, blue, yellow and purple fireworks can be made from Sr, Ba, Cu, Na and K respectively. Different Ba compounds can give the green colour, but measurements performed on nights with fireworks indicate that $Ba(ClO_3)_2$ is more likely used than other compounds. Mg gives origin to bright electric white fireworks, often together with Al, Mg is used also as metallic fuel (Vecchi et al., 2008; and therein cited literature, Danish Pyrotechnical Association, 2009).

5.9.1 Methodology

In November 2004 a terrible accident occurred in a residential area in Denmark, resulting in the explosive burning of vast amounts of fireworks. It was estimated that the explosion involved around 284 Mg net explosive mass (NEM). This episode led to a wide evaluation of the laws on use and storage of fireworks (Ministry of Economic and Business Affairs, 2005). Since November 2005 the use of fireworks has only been legal in the period December 1st to January 5th or with special permission by the local municipality (Politi, 2005). Only persons over the age of 18 are allowed to buy fireworks with the exception of smaller devices such as party poppers, crackers and sparklers which are also allowed all year (Politi, 2007).

Regarding storage, the Danish Safety Technology Authority states that it is illegal to store more than 5 kg NEM.

The heavy metal content in fireworks like Hg, Pb and As and toxic compounds like HCB have been greatly reduced over the last decade and are legally banned, but there are still cases where an alarming content has been detected during random checks. This was the case with HCB in 2008 (Danish Pyrotechnical Association, 2010). Other compounds like Cu have had increasing application in production of fireworks; Cu have to some extent replaced Pb in its uses. Compounds like Ni and Zn are primarily use in alloys; traces of Cd are assumably caused by contamination of some ingredients since they have no use in fireworks. Compounds that are still widely used in different amounts and for different applications are: S, C, Cu and Cl (resulting in a small PCDD/F emission). It is however very difficult to find estimations of the emitted amounts. Futhermore, N and O are widely used in many different combinations of nitrates, oxider, carbonates, sulfates, chlorates and more (Danish Pyrotechnical Association, 2009; Fyrverkeriers miljöpåverkan, 1999; von Oertzen et al. 2003). Emissions from fireworks are calculated by multiplying the activity data with selected emission factors. Emissions are calculated for the compounds SO_x, CO, particles, As, Cd, Cr, Cu, Hg, Ni, Pb and Zn.

5.9.2 Activity data

The cross-border shopping and use of illegal fireworks are assumed negligible. Activity data for the years 1988-2009 are collected from Statistics Denmark, these data are based on information on import and export. Data for the years 1980-1987 are estimated from the linear regression of 1988-1990 data. The Danish Pyrotechnical Association agrees that it is a fair estimation to presume that production of fireworks in Denmark is negligible. It is also assumed that the effect from irregular stock control is negligible.

Figure 5.2 and Table 5.7 show the national trend of import minus export of fireworks. 1988-2003 shows an increasing trend with only 1999 as an outlier, the strong increase in consumed fireworks in 1999 were caused by the celebration of the new millennium. As mentioned above, 2004 were the year of a terrible accident where around 284 Mg NEM corresponding to a gross weight of about 1,500 Mg exploded (Ministry of Economic and Business Affairs, 2005). This of course contributed greatly to the consumption of fireworks in 2004. In 2005 much awareness and many restrictions dominated the subject of fireworks causing the national consumption to drop. Since 2005 the trend has once again been steadily increasing.

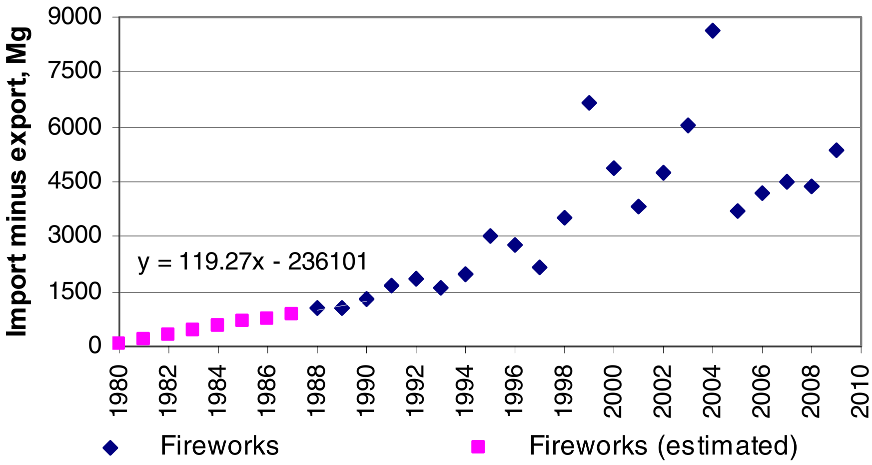

Figure 5.2 Trend of activity data for fireworks 1980-2009 (Statistics Denmark).

Table 5.7 Activity data for the national use of fireworks (Statistics Denmark).

Year		1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
Fireworks	Gg	0.25	0.17	0.29	0.41	0.53	0.65	0.77	0.89	1.04	1.04
Continued		1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Fireworks	Gg	1.28	1.69	1.83	1.62	1.96	3.00	2.75	2.16	3.52	6.67
Continued		2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Fireworks	Gg	4.85	3.83	4.74	6.05	8.64	3.68	4.21	4.47	4.37	5.38

5.9.3 Emission factors

In the evaluation of suitable emission factors many sources have been researched. Netherlands National Water Board (2008), which is based on Brouwer et al. (1995), is chosen as the source for SO_2 and CO emission factors, NAEI (2007) provides an emission factor for CO of 3.62 kg pr Mg but since there are no references or comments related to this source, it cannot be used.

Passant et al. (2003) and Fyrverkeriers miljöpåverkan (1999) presents emission factors in kg pr Mg NEM, this unit is recalculated to match the activity data (mass of emitted compound pr total mass of firework articles). It was found that the average NEM content in fireworks is 20 %, and the recalculation of units is therefore done by dividing with 5. The value of 20 % is validated both by the Report Seest (2005), Passant et al. (2003) and by measurements performed by Fyrverkeriers miljöpåverkan (1999).

Both Fyrverkeriers miljöpåverkan (1999) and Passant et al. (2003) provides emission factors for As, Cd, Cr, Cu and Pb, the latter source is chosen as the best suitable because it is the most recent and also Danish. Emission factors for Hg, Ni, Pb and Zn are also provided by Fyrverkeriers miljöpåverkan (1999); the factor for Pb is however only used for the years 1980-1999.

Particles are calculated based on Klimont et al. (2002). It is assumed that PM_{10} and $PM_{2.5}$ correspond to 50 % and 35 % of TSP, respectively.

All imported fireworks must comply with the DS/EN-14035.

Table 5.8 Emission factors for use of fireworks.

Pollutant	Unit	Value	Source
SO_2	Kg pr Mg	1.935	Netherlands National Water Board (2008)
NO_x		NAV	
NMVOC		NAV	
CO	Kg pr Mg	6.9	Netherlands National Water Board (2008)
NH_3		NAV	
TSP	Kg pr Mg	39.66	Klimont, Z. et al. (2002)
PM_{10}	kg pr Mg	19.83	Klimont, Z. et al. (2002)
$PM_{2.5}$	kg pr Mg	13.88	Klimont, Z. et al. (2002)
As	g pr Mg	1.333	Passant, N. et al. (2003)
Cd	g pr Mg	0.667	Passant, N. et al. (2003)
Cr	g pr Mg	15.56	Passant, N. et al. (2003)
Cu	g pr Mg	444.4	Passant, N. et al. (2003)
Hg, 1980-2002	g pr Mg	0.064	Fyrverkeriers miljöpåverkan (1999)
Hg, 2003-2009		NO	
Ni	g pr Mg	30	Fyrverkeriers miljöpåverkan (1999)
Pb, 1980-1999	g pr Mg	2200	Fyrverkeriers miljöpåverkan (1999)
Pb, 2000-2006	g pr Mg	666.7	Passant, N. et al. (2003)
Pb, 2007-2009		NO	
Se		NAV	
Zn	g pr Mg	260	Fyrverkeriers miljöpåverkan (1999)
HCB		NAV	
PCDD/Fs		NAV	
Flouranthene		NAV	
Benzo[b]fluoranthene		NAV	
Benzo[k]fluoranthene		NAV	
Benzo[a]pyrene		NAV	
Benzo[ghi]perylene		NAV	
Indeno[1,2,3-cd]pyrene		NAV	
PCBs		NAV	

NAV = not available, NO = not occurring.

5.9.4 Emissions

Table 5.9 shows the national emissions from fireworks for the years 1980, 1990, 2000 and 2009. Please note that the emission factor for Pb was changed in 2000 and that Hg and Pb along with any compounds derived here from were forbidden in 2003 and 2006, respectively, and therefore are noted as not occurring for these years and forward.

Table 5.9 Emission from fireworks.

	Unit	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
SO_2	Mg	0.10	0.3	0.6	0.8	1.0	1.3	1.5	1.7	2.0	2.0
CO	Mg	0.37	1.2	2.0	2.8	3.7	4.5	5.3	6.1	7.2	7.2
TSP	Mg	2.13	6.9	11.6	16.3	21.0	25.8	30.5	35.2	41.3	41.4
PM_{10}	Mg	1.06	3.4	5.8	8.2	10.5	12.9	15.3	17.6	20.6	20.7
$PM_{2.5}$	Mg	0.74	2.4	4.1	5.7	7.4	9.0	10.7	12.3	14.4	14.5
As	kg	0.07	0.2	0.4	0.5	0.7	0.9	1.0	1.2	1.4	1.4
Cd	kg	0.04	0.1	0.2	0.3	0.4	0.4	0.5	0.6	0.7	0.7
Cr	kg	0.83	2.7	4.5	6.4	8.3	10.1	12.0	13.8	16.2	16.2
Cu	kg	23.8	76.8	129.8	182.8	235.8	288.8	341.8	394.8	462.4	463.7
Hg	kg	0.00	0.01	0.02	0.03	0.03	0.04	0.05	0.06	0.07	0.07
Ni	kg	1.61	5.2	8.8	12.3	15.9	19.5	23.1	26.7	31.2	31.3
Pb	kg	118	380	643	905	1167	1430	1692	1955	2289	2295
Zn	kg	14	45	76	107	138	169	200	231	271	271
Continued	Unit	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
SO_2	Mg	2.5	3.3	3.5	3.1	3.8	5.8	5.3	4.2	6.8	12.9
CO	Mg	8.8	11.7	12.6	11.2	13.5	20.7	19.0	14.9	24.3	46.0
TSP	Mg	50.7	67.1	72.6	64.1	77.8	118.9	109.1	85.8	139.7	264.6
PM_{10}	Mg	25.4	33.6	36.3	32.1	38.9	59.4	54.5	42.9	69.9	132.3
$PM_{2.5}$	Mg	17.8	23.5	25.4	22.4	27.2	41.6	38.2	30.0	48.9	92.6
As	kg	1.7	2.3	2.4	2.2	2.6	4.0	3.7	2.9	4.7	8.9
Cd	kg	0.9	1.1	1.2	1.1	1.3	2.0	1.8	1.4	2.3	4.4
Cr	kg	19.9	26.3	28.5	25.2	30.5	46.6	42.8	33.7	54.8	103.8
Cu	kg	568	752	813	718	872	1332	1222	962	1566	2966
Hg	kg	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.1	0.2	0.4
Ni	kg	38.4	50.8	54.9	48.5	58.9	89.9	82.5	64.9	105.7	200.2
Pb	kg	2814	3724	4025	3557	4318	6595	6050	4762	7753	14681
Zn	kg	333	440	476	420	510	779	715	563	916	1735
Continued	Unit	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
SO_2	Mg	9.4	7.4	9.2	11.7	16.7	7.1	8.1	8.7	8.5	10.4
CO	Mg	33.5	26.4	32.7	41.8	59.6	25.4	29.0	30.9	30.1	37.1
TSP	Mg	192.5	151.9	187.9	240.0	342.7	146.1	166.9	177.4	173.3	213.4
PM_{10}	Mg	96.3	76.0	93.9	120.0	171.4	73.0	83.5	88.7	86.6	106.7
$PM_{2.5}$	Mg	67.4	53.2	65.8	84.0	119.9	51.1	58.4	62.1	60.6	74.7
As	kg	6.5	5.1	6.3	8.1	11.5	4.9	5.6	6.0	5.8	7.2
Cd	kg	3.2	2.6	3.2	4.0	5.8	2.5	2.8	3.0	2.9	3.6
Cr	kg	75.5	59.6	73.7	94.2	134.5	57.3	65.5	69.6	68.0	83.7
Cu	kg	2157	1703	2106	2690	3840	1637	1871	1988	1942	2392
Hg	kg	0.3	0.2	0.3	NO	NO	NO	NO	NO	NO	NO
Ni	kg	145.6	114.9	142.1	181.6	259.3	110.5	126.3	134.2	131.1	161.5
Pb	kg	3237	2554	3159	4035	5762	2456	NO	NO	NO	NO
Zn	kg	1262	996	1232	1574	2247	958	1095	1163	1136	1399

5.9.5 Uncertainties and time-series consistency

The uncertainty of the activity data for import and export of fireworks provided by Statistics Denmark is small, but it is difficult to identify the uncertainty of the assumed negligible parts of the activity (Danish production and import of illegal fireworks).

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6 Agriculture (NFR sector 4)

6.1 Overview of the sector

The emission from agricultural activities covers ammonia (NH_3) emission from manure management and agricultural soils, PM emission from animal production and emission from field burning of straw includes NH_3, PM, NO_x, CO, NMVOC, SO_2, heavy metals, dioxin and PAH.

6.1.1 Ammonia

The majority of the Danish NH_3 emission, corresponding to 96 %, originates from the agricultural sector. The remaining 4 % originates from traffic and industrial process. Figure 6.1 shows the distribution of sources of NH_3 emission from the agricultural sector 2009. The main part of the agricultural emission is related to manure management, corresponding to 84 % and 3% from grassing animals. Emissions from use of synthetic fertiliser and crops contribute with 6 % and 7 %, respectively. Emissions from NH_3-treated straw, field burning of agricultural wastes and sewage sludge used as fertiliser amount to less than 1 %.

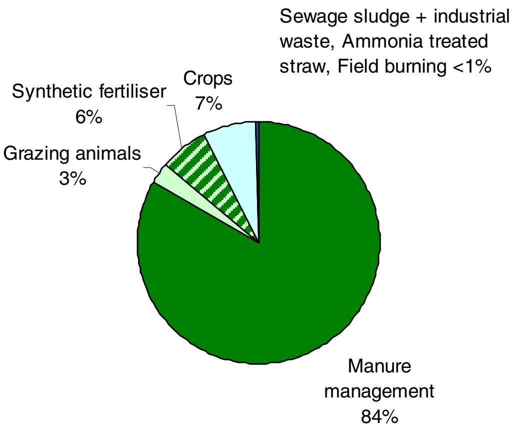

Figure 6.1 NH_3 emissions from the agricultural sector, 2009.

The NH_3 emission from the agricultural sector 1985 to 2009 has decreased from 119.31 Gg NH_3 to 73.83 Gg NH_3, corresponding to a 38 % reduction (Table 6.1). The significant decrease in NH_3 emissions is a consequence of an active national environmental policy. A string of measures have been introduced by action plans to prevent the loss of nitrogen from agriculture to the aquatic environment, for example the NPO (Nitrogen, phosphor, organic matter) Action Plan (1986), Action Plans for the Aquatic Environment (1987, 1998, 2004), the Action Plan for Sustainable Agriculture (1991) and the Ammonia Action Plan (2001). These measures have brought about a decrease in animal nitrogen excretion, improvement in use of nitrogen in manure and a fall in the use of synthetic fertiliser, all of which have helped reduce the overall NH_3 emission significantly.

Table 6.1 Total NH_3 emissions from the agricultural sector 1985 to 2009, Gg NH_3.

Year		1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
NFR		Gg NH_3									
4B	Manure management	93.61	93.99	91.22	90.67	89.59	88.12	85.95	85.86	84.32	81.02
4D1	Synthetic N-fertiliser	8.48	8.04	7.83	7.83	7.80	8.68	8.33	7.81	7.34	7.64
4D2c	Grazing animals	3.13	3.06	2.94	2.90	2.90	2.92	2.99	2.99	3.04	2.97
4F	Field burning of agricultural Waste	1.53	1.32	1.25	0.93	0.98	0.08	0.08	0.08	0.08	0.08
4G	Crops	5.97	5.97	5.96	5.91	5.88	5.92	5.88	5.85	5.77	5.36
4G	NH_3 treated straw	6.54	8.04	8.92	7.25	9.00	10.19	8.64	7.67	7.58	8.10
4G	Sewage sludge used as fertiliser	0.05	0.05	0.05	0.05	0.06	0.07	0.07	0.09	0.11	0.10
4.	Agricultural sector - total	119.31	120.47	118.17	115.54	116.20	115.98	111.95	110.34	108.24	105.27
Continued		1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
NFR		Gg NH_3									
4B	Manure management	76.81	76.06	75.72	77.17	74.48	73.06	72.90	72.15	71.68	71.50
4D1	Synthetic N-fertiliser	7.27	6.16	5.59	5.63	5.23	5.07	4.66	4.15	4.06	4.31
4D2c	Grazing animals	3.03	3.05	2.98	2.96	2.90	2.92	2.97	2.86	2.57	2.36
4F	Field burning of agricultural Waste	0.09	0.09	0.10	0.12	0.12	0.11	0.12	0.10	0.12	0.13
4G	Crops	5.28	5.31	5.44	5.41	5.25	5.21	5.25	5.26	5.24	5.27
4G	NH_3 treated straw	6.63	5.06	4.48	3.70	2.08	2.47	1.62	0.94	0.80	0.53
4G	Sewage sludge used as fertiliser	0.11	0.10	0.09	0.09	0.08	0.08	0.08	0.08	0.07	0.06
4.	Agricultural sector - total	99.22	95.84	94.39	95.07	90.14	88.92	87.61	85.54	84.55	84.16
Continued		2005	2006	2007	2008	2009					
NFR		Gg NH_3									
4B	Manure management	67.90	65.17	64.49	62.51	61.53					
4D1	Synthetic N-fertiliser	4.27	4.33	4.48	4.86	4.72					
4D2c	Grazing animals	2.21	2.09	1.99	1.99	2.00					
4F	Field burning of agricultural Waste	0.13	0.13	0.11	0.10	0.12					
4G	Crops	5.34	5.34	5.26	5.41	5.41					
4G	NH_3 treated straw	0.26	0.00	0.00	0.00	0.00					
4G	Sewage sludge used as fertiliser	0.05	0.05	0.05	0.05	0.05					
4.	Agricultural sector - total	80.15	77.10	76.38	74.94	73.83					

The main part of the emission from the agricultural sector is related to livestock production and, hence, the management of manure has to be considered as the most important emission source. Most of the emission from manure originates from the production of pigs and cattle, which contributed, respectively with, 44 % and 36 %.

It is noteworthy that the overall emission from pigs has decreased by 38 % from 1985 to 2009 despite a considerable increase in pork production from 14.7 million produced fattening pigs in 1985 to 20.9 million in 2009. One of the most important reasons for this is the improvement in feed efficiency. In 1985, the nitrogen excretion for a fattening pig was an estimated 5.09 kg N (Poulsen & Kristensen, 1997). In 2009, that figures were considerably lower at 2.94 kg N per fattening pig produced (Poulsen, 2010). Due to the large contribution from the pig production, the lower level of N-excretion has a significant influence on total agricultural emissions.

Another important cause of the significant decrease in the NH_3 emission since 1985 is changes in practice of manure application to the fields where considerable changes have taken place. From the beginning of the 1990s slurry has increasingly been spread using trailing hoses. From the late 1990s the practice of slurry injection or mechanical incorporation into the soil has increased. This development is a consequence of a ban on broad spreading but it is also a consequence of the general requirement to improve the utilisation of nitrogen in the manure - e.g. requirements to a larger part of the nitrogen in manure has to be included in the farmers nitrogen accounting. This has forced farmers to consider the manure as a resource instead of a waste product.

Particulate matter

In NFR, the emission of particulate matter (PM) is registered for the years 2000 to 2009. The emission from the agricultural sector includes the emission of dust from animal housing systems, which include emission from cattle, pigs, poultry, horses, sheep and goats. Furthermore, the emission from field burning of agricultural wastes is calculated.

Present, the Danish inventory do not include emission from plant production, which means activities related to field operations as harvesting and cultivation of the soil.

TSP emission from the agricultural sector contributes 28 % to the national TSP emission in 2009 and the emission shares for PM_{10} and $PM_{2.5}$ are only 17 % and 4 % respectively. Most of this comes from animal production. The emission from the field burning of agricultural residues, contributes less than 1 % to the agricultural emission.

The same emission factor is used for all years. So changes in the total PM emissions for each livestock category is mainly reflecting the changes in number of animal, but also effected by the distribution of the subcategories and changes in the housing type.

The PM emission from agricultural activities, given in TSP, has decreased from by 10 % which is mainly due to a fall in the emission from swine (Figure 6.2). A decrease in emission from swine is a result of changes in housing system towards slurry based systems, which has a lover emission factor than solid based system. Another reason is changes in the fraction of subcategories. An increase in production of weaners has taken place from 2000-2009 and upper site situation for fattening pigs, where the emission factor is higher.

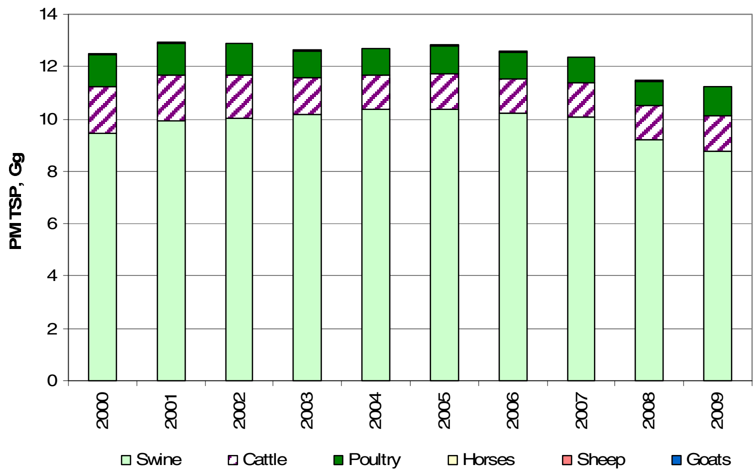

Figure 6.2 Emission of particulate matter (TSP) from the agricultural sector 2000 to 2009.

6.1.2 References – sources of information

Data on activity and emissions are collected, evaluated and discussed in cooperation with Statistics Denmark, the Danish Institute of Agricultural Sciences, the Danish Agricultural Advisory Service, Danish Environmental Protection Agency and the Danish Plant Directorate. It means that both the data and the methods used are evaluated continuously according to latest knowledge and information. Table 6.2 shows the source of data input from the different institutes.

Table 6.2 List of institutes involved in the emission inventory.

References	Abbreviation	Data / information
National Environmental Research Institute, University of Aarhus (http://www.dmu.dk)	NERI	-reporting -data collecting
Statistics Denmark - Agricultural Statistics (http://www.dst.dk)	DSt	-livestock production -milk yield -slaughtering data -land use -crop production -crop yield
Faculty of Agricultural Sciences, University of Aarhus (http://www.agrsci.dk)	DJF	-N-excretion -feeding situation -NH_3 emissions factor -PM emissions factor
The Danish Agricultural Advisory Service (http://www.lr.dk)	DAAS	-housing type (until 2004) -grazing situation -manure application time and methods -field burning of agricultural residue
Danish Environmental Protection Agency (http://www.mst.dk)	EPA	-sewage sludge used as fertiliser
The Danish Plant Directorate (http://www.plantedirektoratet.dk)	PD	-synthetic fertiliser -housing type (from 2005)

Methods

The calculation of the emission is based on the EMEP/EEA Emission Inventory Guidebook.

The emissions from agricultural activities include NFR Table 4B Manure Management, Table 4D Agricultural Soils, Table 4F Field Burning of Agricultural Wastes and Table 4G Agriculture Other. In general the field burning of agricultural wastes has been prohibited since 1989. However, burning of straw may only take place in connection with continuously cultivation of seed grass or wet or broken bales of straw.

The emission is calculated as the sum of activities (a_i) multiplied by the implied emission factor (IEF) for each activity, *i*.

$$E_{total} = \sum a_i \bullet IEF_i$$

The emissions from the agricultural sector are calculated in a comprehensive agricultural model complex called IDA (Integrated Database model for Agricultural emissions). The model complex is designed in a relational database system (MS Access). Input data are stored in tables in one database called IDA_Backend and the calculations are carried out as queries in another linked database called IDA. The model, as shown in Figure 6.3, is implemented in great detail and it is used to cover emissions of NH_3, PM, NO_x, CO, NMVOC, SO_2, heavy metals, dioxin, PAH and greenhouse gases (N_2O and CH_4). Thus, there is direct coherence between the NH_3 emission and the emission of N_2O.

The National Environmental Research Institute (NERI), which is responsible for the emission inventory, has established data agreements with the institutes and organisations to assure that the necessary data is available for timely completion of the emission inventory. The main part of the emission is related to livestock production and much of the data is based on Danish standards. The Faculty of Agricultural Sciences, University of Aarhus (DJF) delivers Danish standards relating to feeding consumption, manure type in different housing types, nitrogen content in manure, etc. Previously, the standards were updated and published every third or fourth year – the last one is Poulsen et al. from 2001. From year 2001, NERI receives updated data annually directly from DJF in the form of spreadsheets. These standards have been described and published in English in Poulsen & Kristensen (1998).

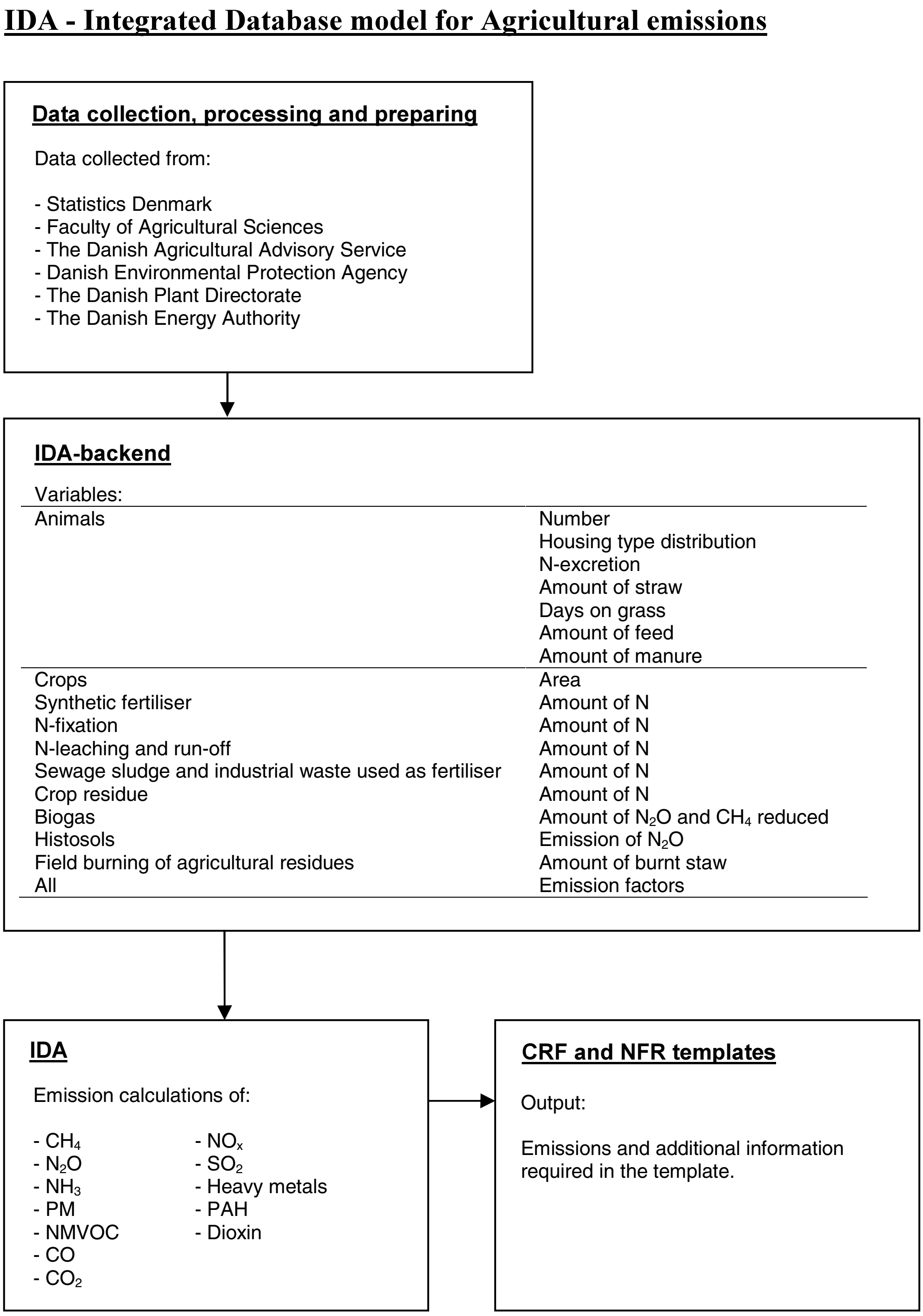

Figure 6.3 Overview of the data process for calculation of agricultural emissions.

IDA includes approximately 38 different livestock categories, dependent on livestock category, weight class and age. Each of these subcategories is subdivided according to housing type and manure type, which results in the region of 200 different combinations of subcategories and housing type (Table 6.3). The emission is calculated from each of these subcategories and then aggregated in accordance with the livestock categories given in the NFR. It is important to point out that changes in the emission and the implied emission factor over the years are not only a result of changes in the number of animals, but also depend on changes in the allocation of subcategories, changes in feed consumption, changes in housing type and changed practices with regard to the handling of livestock manure in relation to storage and application.

Table 6.3 Livestock categories and subcategories.

NFR 4B	Animal categories	Includes	No. of subcategories in IDA, animal type/housing system
4B 1a	Dairy Cattle[1]	Dairy Cattle	28
4B 1b	Non-dairy Cattle[1]	Calves (<½ yr), heifers, bulls, suckling cattle	96
4B 3	Sheep	including lambs	1
4B 4	Goats	Including kids (meet, dairy and mohair)	3
4B 6	Horses	<300 kg, 300 - 500 kg, 500 - 700 kg, >700 kg	4
4B 8	Swine	Sows, weaners, fattening pigs	26
4B 9	Poultry	Hens, pullet, broilers, turkey, geese, ducks, ostrich, pheasant	28
4B 13	Other	Fur farming, deer	6

1) For all subcategories, large breed and jersey cattle are distinguished from each other.

6.2 NH_3 emission from Manure Management – NFR 4.B

6.2.1 Description

The main part of the NH_3 emission 83% is related to manure management. Figure 6.4 shows the emission from manure management (NFR category 4.B) distributed according to the different livestock categories in 2009. The main part of the emission is related to cattle and pig production, corresponding to 79 %.

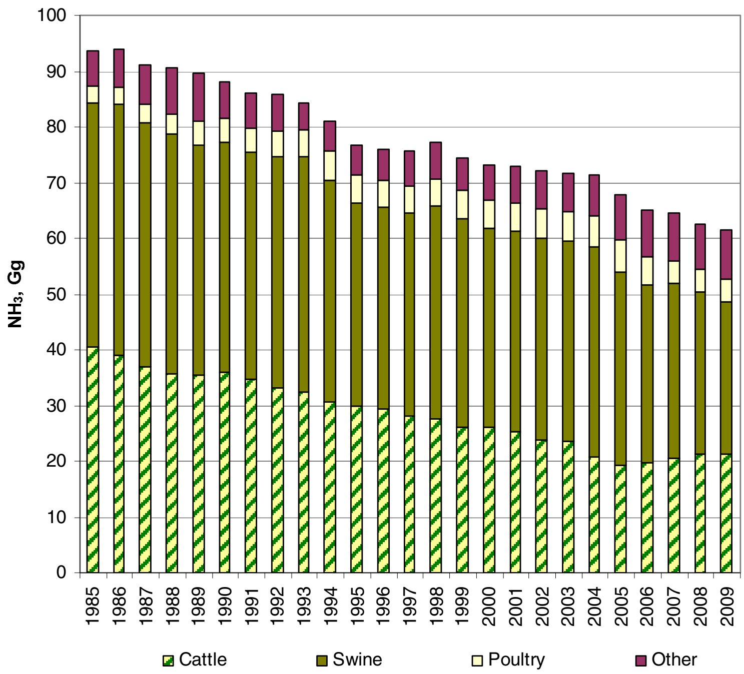

Figure 6.4 NH_3 emission from manure management 1985 to 2009.

6.2.2 Methodological issues

Activity data

Table 6.4 shows the development in livestock production 1985-2009 based on the Agricultural Statistics (Statistics Denmark). The number of animal corresponds to average annual production (AAP), which means the average number of animals, present within the year as described in EMEP/EEA Emission Inventory Guidebook (2009).

The emission from pigs and poultry is based on slaughter data from the Agricultural Statistics. Only farms larger than 5 hectares are included in the annual census. An approximation of number of horses, goats and sheep on small farms is added to the numbers in the Agricultural Statistics, in agreement with DAAS. The largest difference is found for horses. In the agricultural census, the number of horses is estimated as 58 000 in 2009. The total number of horses in 2009, however, including horses placed at small farms and riding schools, is approximately 177 500. Data on the number of sheep and goats is based on the Central House-animal farm Register (CHR) which is the central register of farms and animal of the Ministry of Food, Agriculture and Fisheries. The number of deer and ostriches is also based on CHR because these are not included in Statistics Denmark. The number of pheasants is based on expert judgement from NERI and pheasant breeding association.

Since 1985, the production of pigs has increased practically. This is contrary to the production of cattle, which has decreased as a result of rising milk yields. Buffalo, camels and llamas, mules and donkeys do not occur in Denmark.

Table 6.4 Livestock production 1985 to 2009 given in AAP, 1000 head - NFR category 4B.

NFR	Animal category	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
4B 1a	Dairy Cattle	896	864	811	774	759	753	742	712	714	700	702	701	670
4B 1b	Non-dairy cattle	1 721	1 631	1 540	1 488	1 462	1 486	1 480	1 478	1 481	1 405	1 388	1 393	1 334
4B 3	Sheep*	40	52	59	73	83	92	107	102	88	80	81	94	96
4B 4	Goats*	8	8	8	8	8	7	7	7	7	7	7	7	7
4B 6	Horses*	140	139	138	137	136	135	137	138	140	141	143	144	146
4B 8	Swine	9 089	9 321	9 266	9 217	9 190	9 497	9 783	10 455	11 568	10 923	11 084	10 842	11 383
4B 9a	Laying hens	5 577	5 588	5 017	5 436	5 406	5 696	5 067	5 639	5 517	6 932	6 088	6 317	5 645
4B 9b	Broilers	8 490	8 420	9 602	9 332	10 860	9 802	10 020	12 619	13 399	12 023	12 585	12 907	12 510
4B 9c	Turkeys	393	489	345	246	312	213	389	225	504	368	449	317	469
4B 9d	Other poultry	1 822	1 785	1 638	1 572	1 678	1 600	1 519	1 620	1 541	1 594	1 563	1 413	1 437
4B 13	Other;													
4B 13	Fur farming	1 906	2 194	2 402	2 877	3 055	2 264	2 112	2 283	1 537	1 828	1 850	1 918	2 212
4B 13	Deer	9	10	10	10	10	10	10	10	10	10	10	10	10

Continued

NFR	Animal category	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
4B 1a	Dairy Cattle	669	640	636	623	610	596	563	564	550	545	558	563
4B 1b	Non-dairy cattle	1 308	1 247	1 232	1 284	1 187	1 128	1 082	1 006	984	1 021	1 006	977
4B 3	Sheep*	101	106	112	119	117	121	124	126	128	124	117	116
4B 4	Goats*	8	8	8	9	9	10	11	11	12	13	14	16
4B 6	Horses*	147	149	150	155	160	165	170	175	180	185	190	178
4B 8	Swine	12 095	11 626	11 922	12 608	12 732	12 949	13 233	13 534	13 361	13 723	12 738	12 369
4B 9a	Laying hens	4 906	5 045	4 935	4 750	4 605	4 941	4 850	5 168	3 902	4 209	4 973	4 437
4B 9b	Broilers	13 118	14 923	16 047	15 597	15 129	12 211	11 286	11 905	12 924	11 758	9 737	14 787
4B 9c	Turkeys	312	616	546	547	552	376	149	116	122	194	169	165
4B 9d	Other poultry	1 407	1 497	1 374	1 415	1 363	1 383	1 431	1 509	1 543	1 644	1 590	1 350
4B 13	Other;												
4B 13	Fur farming	2 345	2 089	2 199	2 304	2 422	2 361	2 471	2 552	2 708	2 837	2 747	2 677
4B 13	Deer	10	10	10	11	10	10	10	10	10	10	10	9

*Includes animals on small farms (less than 5 ha), which are not included in Statistics Denmark figures.

Implied emission factor

Table 6.5 shows the implied emission factor for each NFR livestock category from 1990 to 2009. The implied emission factor expresses the average emission of NH_3 per AAP (annual average production) per year. The implied emission factor is changing from year to year depending on a combination of several factors, such as:

- change in number of animal or change in the share of different sub-categories,
- change in fodder condition and N-excretion,
- change in housing type,
- change in handling of manure in relation to storage and application.

It should be mentioned here that the emission from manure deposited by grazing animals is included in the emission from agricultural soils (NFR – 4.D2c).

In annex 2C1, more detailed information about N-excretion and housing type for some livestock categories, 1985–2009, used in the Danish emission inventory are given. Furthermore, tables show the Danish standards for emission factors used to calculate the ammonia emission in housings and in relation to storage and application of manure.

For most of the animal categories, the implied emission factor has decreased from 1985 to 2009, which is the result of measures in relation to implementation of the action plans for the aquatic environment and the Ammonia Action Plan. Increasingly strict requirements to improve the utilisation of nitrogen in manure have resulted in reduction of N-excretion, especially for fattening pigs. Changes in manure management in relation to spreading are another important factor which has reduced the emission. Measures include a requirement for a minimum 9-month manure storage capacity, requirement that manure applied to soil be ploughed down within six hours, a ban on the spreading of manure in winter and, from 1 August 2003, broad spreading is no longer allowed. From 2003 slurry tanks have to be covered with supernatant or safety access cover. From 2006 it is prohibited to treat straw with ammonia.

Table 6.5 Implied emission factor, manure management 1985 to 2009, kg NH_3 pr AAP pr yr (NFR category 4B).

NFR	Animal category	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
4b 1a	Dairy cattle	30.94	31.36	31.78	32.22	32.68	33.36	32.67	32.05	31.29	30.70	29.97	29.60	29.53
4b 1b	Non-dairy cattle	7.43	7.35	7.31	7.24	7.20	7.32	7.09	6.93	6.75	6.50	6.27	6.23	6.14
4B 3	Sheep	1.93	1.91	1.89	1.87	1.84	1.85	1.86	1.86	1.87	1.88	1.88	1.73	1.58
4B 4	Goats	1.93	1.91	1.89	1.87	1.84	1.85	1.86	1.86	1.87	1.88	1.88	1.73	1.58
4B 6	Horses	7.62	7.53	7.44	7.35	7.26	7.10	6.95	6.79	6.63	6.48	6.32	6.30	6.28
4B 8	Swine	4.83	4.82	4.71	4.65	4.51	4.35	4.17	3.99	3.67	3.64	3.30	3.33	3.21
4B 9a	Laying hens	0.21	0.22	0.25	0.25	0.26	0.26	0.27	0.27	0.28	0.28	0.30	0.30	0.30
4B 9b	Broilers	0.18	0.18	0.18	0.22	0.21	0.24	0.24	0.20	0.20	0.23	0.21	0.20	0.21
4B 9c	Turkeys	0.45	0.48	0.37	0.49	0.55	0.66	0.52	0.91	0.72	0.87	0.75	0.99	1.02
4B 9d	Other poultry	0.12	0.11	0.11	0.11	0.13	0.11	0.12	0.11	0.11	0.13	0.16	0.12	0.12
4B 13	Other	2.62	2.58	2.54	2.50	2.46	2.44	2.41	2.39	2.36	2.35	2.32	2.33	2.33

Continued

NFR	Animal category	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
4b 1a	Dairy cattle	29.24	28.65	28.66	27.43	26.78	27.62	24.98	24.92	25.93	26.59	26.57	25.75
4b 1b	Non-dairy cattle	6.08	6.24	6.47	6.50	6.26	6.20	6.14	5.10	5.53	5.93	6.29	7.04
4B 3	Sheep	1.43	1.30	1.45	1.45	1.46	1.45	1.45	1.44	1.44	1.32	1.32	1.32
4B 4	Goats	1.43	1.30	1.45	1.45	1.41	1.41	1.40	1.39	1.39	1.23	1.28	1.28
4B 6	Horses	6.26	6.41	6.27	6.28	6.32	6.29	6.27	6.23	6.20	5.71	5.71	5.71
4B 8	Swine	3.16	3.21	2.98	2.83	2.86	2.79	2.85	2.57	2.39	2.28	2.29	2.21
4B 9a	Laying hens	0.31	0.31	0.32	0.32	0.33	0.37	0.37	0.39	0.45	0.39	0.35	0.36
4B 9b	Broilers	0.21	0.20	0.19	0.20	0.21	0.25	0.29	0.28	0.23	0.18	0.21	0.13
4B 9c	Turkeys	1.34	0.51	0.60	0.59	0.58	0.62	2.18	3.19	1.93	1.32	1.60	1.80
4B 9d	Other poultry	0.13	0.13	0.12	0.14	0.14	0.11	0.10	0.09	0.10	0.04	0.04	0.04
4B 13	Other	2.32	2.32	2.34	2.34	2.33	2.39	2.53	2.69	2.60	2.59	2.46	2.88

Time-series

The ammonia emission from manure management is estimated to 61.53 Gg NH_3 in 2009 (table 6.6). From 1985 to 2009, the emission is reduced by 34 %. As mentioned in section 1.1.1 this development is mainly due to an active environmental policy to reduce nitrogen losses from the agricultural production.

The number of cattle has decreased as a result of a growth in milk yield. In 2009, cattle production contributes with 36 % of the total emission from manure management. The pig production contributes in 2009 with 43 % of the total emission from manure management. The production of fattening pigs has increased by more than 50 % compared with 1985. However, despite this development the emission from pigs is still decreasing. This is due to measures focused on the biological development and improvement in fodder efficiency.

Table 6.6 Emission of NH_3 from manure 1985 to 2009, Gg NH_3.

NFR	Animal category	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
4b 1a	Dairy cattle	27.73	27.10	25.77	24.95	24.82	25.12	24.23	22.82	22.35	21.48	21.05	20.74	19.79
4b 1b	Non-dairy cattle	12.78	11.99	11.25	10.77	10.53	10.88	10.49	10.24	10.00	9.13	8.70	8.68	8.19
4B 3	Sheep	0.08	0.10	0.11	0.14	0.15	0.17	0.20	0.19	0.17	0.15	0.15	0.16	0.15
4B 4	Goats	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
4B 6	Horses	1.07	1.05	1.03	1.01	0.99	0.96	0.95	0.94	0.93	0.91	0.90	0.91	0.91
4B 8	Swine	43.88	44.92	43.63	42.90	41.44	41.28	40.75	41.68	42.44	39.77	36.59	36.13	36.51
4B 9a	Laying hens	1.15	1.23	1.23	1.36	1.42	1.49	1.39	1.53	1.57	1.92	1.82	1.92	1.71
4B 9b	Broilers	1.49	1.47	1.75	2.01	2.31	2.32	2.42	2.58	2.67	2.80	2.67	2.55	2.61
4B 9c	Turkeys	0.18	0.24	0.13	0.12	0.17	0.14	0.20	0.21	0.36	0.32	0.34	0.31	0.48
4B 9d	Other poultry	0.22	0.20	0.18	0.18	0.22	0.18	0.19	0.18	0.17	0.21	0.25	0.17	0.17
4B 13	Other	5.02	5.68	6.12	7.23	7.53	5.56	5.11	5.49	3.66	4.31	4.32	4.49	5.17
Manure Management - total emission		93.61	93.99	91.22	90.67	89.59	88.12	85.95	85.86	84.32	81.02	76.81	76.06	75.72

Continued

NFR	Animal category	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
4b 1a	Dairy cattle	19.56	18.34	18.21	17.10	16.32	16.46	14.07	14.06	14.27	14.50	14.83	14,50
4b 1b	Non-dairy cattle	7.95	7.78	7.98	8.34	7.43	7.00	6.65	5.13	5.45	6.05	6.33	6,88
4B 3	Sheep	0.14	0.14	0.16	0.17	0.17	0.18	0.18	0.18	0.18	0.16	0.16	0,15
4B 4	Goats	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.02	0.02	0.02	0,02
4B 6	Horses	0.92	0.95	0.94	0.97	1.01	1.04	1.07	1.09	1.12	1.06	1.08	1,01
4B 8	Swine	38.20	37.31	35.47	35.71	36.35	36.07	37.73	34.72	32.00	31.31	29.23	27,31
4B 9a	Laying hens	1.52	1.58	1.56	1.54	1.54	1.81	1.78	2.02	1.76	1.63	1.76	1,59
4B 9b	Broilers	2.79	3.02	3.07	3.12	3.12	3.07	3.25	3.28	2.91	2.06	2.00	1,98
4B 9c	Turkeys	0.42	0.31	0.33	0.32	0.32	0.23	0.32	0.37	0.24	0.26	0.27	0,30
4B 9d	Other poultry	0.18	0.19	0.16	0.19	0.19	0.16	0.15	0.14	0.15	0.06	0.06	0,05
4B 13	Other	5.47	4.86	5.17	5.41	5.67	5.65	6.28	6.90	7.08	7.38	6.78	7,73
Manure Management - total emission		77,17	74.48	73.06	72.90	72.15	71.68	71.50	67.90	65.17	64.49	62.51	61.53

Figure 6.5 shows the percentage distribution of the NH_3 emission in housings, storage, spreading of manure in fields and in deposits to grass. The main part of the reduction in NH_3 emission has taken place in connection with the spreading of manure in fields, due to changes in manure application practice. There has been a reduction in emissions in relation to storage as a result of improved covering of slurry tanks. From 1985 to 2009, the emission relating to manure management in housings increased from 38 % to 56 %. In future, the possibilities for NH_3 reduction will be likely to be focused on measurements in housings.

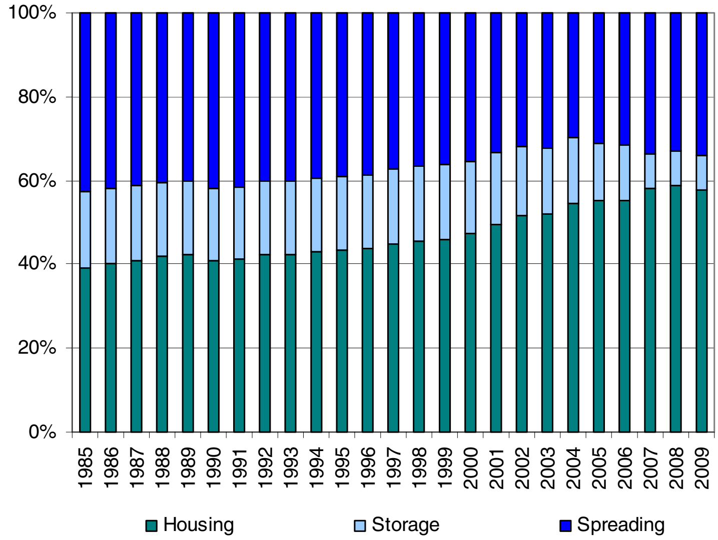

Figure 6.5 The percentage distribution of the NH_3 emission in the agricultural production 1985 to 2009.

6.3 NH_3 emission from agricultural soils – NFR 4.D

6.3.1 Description

NH_3 emission from agricultural soils contributes with 9% of the total emission from the agricultural sector and includes emission from use of synthetic fertiliser and emission from nitrogen deposited by grazing animals. In 2009 approximately 70 % of the emission from agricultural soils originates from synthetic fertiliser.

6.3.2 Methodological issues

More detailed description covering the calculation of the emission sources and information about activity data and emission factors used is given in annex 2C2.

Activity data

At present, farmed area covers about 60 % of the total land area in Denmark. In recent decades, farmed area has decreased, being replaced by forest, semi-natural, road and built-up areas and this development is expected to continue. Table 6.7 shows the activity data used in calculation of the NH_3 emission from agricultural soils. The amount of nitrogen used in synthetic fertiliser is based on information from the Danish Plant Directorate. The use of fertiliser has decreased considerably – consumption in 2009 is almost half that in 1985. The increase of fertiliser from 2007 to 2008 can mainly be explained by expectations of rising prices and cultivation of fallow fields, which also can explain the decrease in 2009.

Table 6.7 Activity data used to estimate the NH_3 emission from agricultural soils 1985 to 2009.

NFR 4.D Activity data	Unit	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
N in fertiliser	M kg N	398	382	381	367	377	400	395	370	333	326
N deposit on grass	M kg N	37	36	35	34	34	34	35	35	36	35
NFR 4.D Activity data	Unit	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
N in fertiliser	M kg N	316	291	288	283	263	251	234	211	201	207
N deposit on grass	M kg N	36	36	35	35	34	34	35	34	30	28
NFR 4.D Activity data	Unit	2005	2006	2007	2008	2009					
N in fertiliser	M kg N	206	192	195	220	200					
N deposit on grass	M kg N	26	25	23	23	23					

Implied emission factor

The implied emission factors, 1985-2009, in relation to agricultural soils are given in table 6.8.

The implied emission factors relating to use of synthetic fertiliser depend on consumption and type of fertiliser and remain almost the same for all years. The implied emission factors for grazing animals remain unaltered.

Table 6.8 Implied emission factors used to estimate the NH_3 emission from agricultural soils.

NFR 4.D Source	Unit	1985	1985	1987	1988	1999	1990	1991	1992	1993	1994
Fertiliser	% of total N	1.8	1.7	1.7	1.8	1.7	1.8	1.7	1.7	1.8	1.9
N grass	% of total N	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0
NFR 4.D Source	Unit	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Fertiliser	% of total N	1.9	1.7	1.6	1.6	1.6	1.7	1.6	1.6	1.7	1.7
N grass	% of total N	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0
NFR 4.D Source	Unit	2005	2006	2007	2008	2009					
Fertiliser	% of total N	1.7	1.9	1.9	1.8	1.9					
N grass	% of total N	7.0	7.0	7.0	7.0	7.0					

6.3.3 Time-series

From 1985 to 2009 the NH_3 emission from agricultural soils decreased from 11.61 Gg NH_3 to 6.72 Gg NH_3, which corresponds to a 42 % reduction (Table 6.9). A considerable decrease in the use of fertiliser has, in particular, been important for this development.

As mentioned, there has been an active effort in recent decades to reduce nitrogen leaching by means of action plans. This focus on environmental impact in agricultural production has led to an improvement in the utilisation of nitrogen in manure. A consequence of this development is that the use of fertiliser and, in turn, the NH_3 emission has been reduced.

Table 6.9 Emission of NH_3 from Agricultural Soils from 1985 to 2009, Gg NH_3.

NFR 4.D										
Agricultural Soils	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
Use of fertiliser	8.48	8.04	7.83	7.83	7.80	8.68	8.33	7.81	7.34	7.64
N excretion on pasture	3.13	3.06	2.94	2.90	2.90	2.92	2.99	2.99	3.04	2.97
Emission - total	11.61	11.11	10.76	10.73	10.70	11.60	11.32	10.79	10.38	10.61
NFR 4.D										
Agricultural Soils	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Use of fertiliser	7.27	6.16	5.59	5.63	5.23	5.07	4.66	4.15	4.06	4.31
N excretion on pasture	3.03	3.05	2.98	2.96	2.90	2.92	2.97	2.86	2.57	2.36
Emission - total	10.30	9.21	8.57	8.59	8.13	7.99	7.64	7.01	6.63	6.68
NFR 4.D										
Agricultural Soils	2005	2006	2007	2008	2009					
Use of fertiliser	4.27	4.33	4.48	4.86	4.72					
N excretion on pasture	2.21	2.09	1.99	1.99	2.00					
Emission - total	6.48	6.42	6.47	6.85	6.72					

6.4 NH_3 emission from agriculture other – NFR 4.G

6.4.1 Description

Emissions reported in NFR table 4G include three emissions sources; emission from growing crops, sewage sludge used as fertilizer and NH_3 treated straw. NH_3 emission from these sources contributes in 2009 with 7 % of the total emission from the agricultural sector and the most important ones are emission from growing crops.

6.4.2 Methodological issues

More detailed description covering emission factors used for crops and NH_3 treated straw is given in Annex 2C3.

Activity data

Information on farmed area and cultivation of different crop types is collected by Statistics Denmark. Information on amount of sewage sludge, N-content and NH_3 emission factor is obtained from reports prepared by the Danish Protection Agency. The activity data is given in Table 6.10. The amount of sewage sludge has increased from 1985 until 1995. In the following years to 2009 the amount of sludge used as fertiliser has fallen as a result of increasing request from the industrial sector. The sludge is used in industrial process e.g. in the cement production and production of sandblasting material.

Table 6.10 Activity data used to estimate the NH_3 emission from agriculture other 1985 to 2009.

NFR 4.G											
Activity data	Unit	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
Crops:											
Cultivated area	1000 ha	2 834	2 819	2 798	2 787	2 774	2 788	2 770	2 756	2 739	2 691
Sewage sludge:											
Amount of sludge applied on soil	Tonnes of dry matter	50 000	50 000	52 380	58 200	69 840	77 883	80 181	96 174	123 382	111 155
N-content	Percent	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4,00	4.00
N applied on soil	Tonnes N	2 000	2 000	2 095	2 328	2 794	3 115	3 207	3 847	4 935	4 446
NH_3 treated straw:	Tonnes NH_3-N	8 285	10 186	11 305	9 181	11 399	12 912	10 951	9 722	9 600	10 264

NFR 4.G											
Activity data	Unit	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Crops:											
Cultivated area	1000 ha	2 726	2 716	2 688	2 672	2 644	2 647	2 676	2 666	2 658	2 645
Sewage sludge:											
Amount of sludge applied on soil	Tonnes of dry matter	112 235	104 010	50 000	87 209	85 733	83 727	80 877	81 623	69 661	57 700
N-content	Percent	4.13	4.37	4.00	4.30	4.28	4.33	4.35	4.41	4.52	4.64
N applied on soil	Tonnes N	4 635	4 545	2 000	3 750	3 669	3 625	3 518	3 600	3 151	2 675
NH_3 treated straw:	Tonnes NH_3-N	8 406	6 412	5 672	4 685	2 630	3 125	2 050	1 191	1 017	666

NFR 4.G						
Activity data	Unit	2005	2006	2007	2008	2009
Crops:						
Cultivated area	1000 ha	2 707	2 711	2 663	2 668	2 606
Sewage sludge:						
Amount of sludge applied on soil	Tonnes of dry matter	45 738	45 427	45 623	50 401	50 000
N-content	Percent	4.75	4.75	4.75	4.75	4.75
N applied on soil	Tonnes N	2 173	2 158	2 167	2 394	2 375
NH_3 treated straw:	Tonnes NH_3-N	329	0	0	0	0

Implied emission factor

The implied emission factors relating to crops are expressed as total emission divided by total area under cultivation, and are decreasing due to the growth in set-a-side area. The implied emission factors for sewage sludge and NH_3 used for straw treatment remain unaltered.

Table 6.11 Implied emission factors used to estimate the NH_3 emission from agriculture other.

NFR 4.G														
Source	Unit	1985	1985	1987	1988	1999	1990	1991	1992	1993	1994	1995	1996	1997
Crops	kg NH_3-N pr hectare	1.7	1.7	1.8	1.7	1.7	1.7	1.7	1.7	1.7	1.6	1.6	1.6	1.7
Sewage sludge	kg NH_3-N pr kg N	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9
NH_3 treated straw	% of total NH_3-N	65	65	65	65	65	65	65	65	65	65	65	65	65

NFR 4.G													
Source	Unit	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Crops	kg NH_3–N pr hecta-re	1.7	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.7	1.7
Sewage sludge	kg NH_3-N pr kg N	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9
NH_3 treated straw	% of total NH_3-N	65	65	65	65	65	65	65	65	65	65	65	65

6.4.3 Time-series

From 1985 to 2009 the NH_3 emission from agriculture other decreased from 12.56 Gg NH_3 to 5.46 Gg NH_3, which corresponds to a 56 % reduction (table 6.12). The decrease is mainly due to a decrease of NH_3 used for treatment of straw, which were prohibited by law in 2006.

Table 6.12 Emission of NH_3 from agriculture other 1985 to 2009, Gg NH_3.

NFR 4.G	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
Crops	5.97	5.97	5.96	5.91	5.88	5.92	5.88	5.85	5.77	5.36	5.28	5.31	5.44
Sewage sludge	0.05	0.05	0.05	0.05	0.06	0.07	0.07	0.09	0.11	0.10	0.11	0.10	0.09
NH_3 treated straw	6.54	8.04	8.92	7.25	9.00	10.19	8.64	7.67	7.58	8.10	6.63	5.06	4.48
Emission - total	12.56	14.06	14.93	13.21	14.94	16.18	14.60	13.61	13.46	13.56	12.02	10.48	10.00
NFR 4.G	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	
Crops	5.41	5.25	5.21	5.25	5.26	5.24	5.27	5.34	5.34	5.26	5.41	5.41	
Sewage sludge	0.09	0.08	0.08	0.08	0.08	0.07	0.06	0.05	0.05	0.05	0.05	0.05	
NH_3 treated straw	3.70	2.08	2.47	1.62	0.94	0.80	0.53	0.26	0.00	0.00	0.00	0.00	
Emission - total	9.19	7.41	7.76	6.95	6.28	6.12	5.86	5.65	5.39	5.31	5.47	5.46	

6.5 PM emission from housings – NFR 4.B

This chapter only describes the PM emission related to the animal production. The calculation of PM emission in connection to filed burning of agricultural wastes is included in Chapter 6.6.

6.5.1 Description

Investigations have shown that farmers, as well as livestock, are subject to an increased risk of developing lung and respiratory related diseases due to the particulate emissions (Hartung and Seedorf, 1999). This is since the particles are able to carry bacteria, viruses and other organic compounds. Presently, only the emission from 2000 to 2009 is given in NFR.

In 2009 the PM emission from housings, given in TSP, is estimated to 11 255. Of this, 78 % relates to swine production. The emission from cattle and poultry contributes with 12 % and 10 %, respectively and the remainder less than 1 %.

6.5.2 Methodological issues

The estimation of PM emission is based on the EMEP-CLRTAP Emission Inventory Guidebook chapter B1010, where the scientific data mainly is based on an investigation of PM emission in North European housings (Takai et al. 1998).

The particle emission includes primary particles in the form of dust from housings. The inventory operates with PM emission from cattle, swine, poultry, horses, sheep and goats (Table 6.11). Some animal categories are divided into subcategories and for each category it is distinguished between solid and slurry based housing systems.

The PM emission is related to the number of annual average population (AAP) and to the time the animal is housed. The PM emission from grassing animals is considered as negligible.

Table 6.13 Livestock categories used in the PM emission inventory.

Livestock categories as given in NFR	Subcategories as given in the EMEP-CLRTAP Emission Inventory Guidebook	Danish inventory	Grassing days
Cattle			
Dairy Cattle	Dairy cattle	Dairy cattle	18
Non-Dairy Cattle	Calves	Calves < ½ yr	0
	Beef cattle	Bulls	0
		Heifer	132
		Suckling cattle	224
Swine	Sows	Sows (incl piglets until 7 kg)	0
	Weaners	Weaners (7-30 kg)	0
	Fattening pigs	Fattening pigs (30-105 kg)	0
Poultry	Laying hens	Laying hens	0
	Broilers	Broilers	0
	Turkeys	Turkeys	0
	Other poultry	Ducks	0
		Geese	365
Horses	Horses	Horses	183
Sheep	Sheep	Sheep	265
Goats	Goats	Goats	265

Activity data

Livestock production data is based on Statistics Denmark, Agricultural Statistics (www.dst.dk) – Table 6.14.

Table 6.14 Livestock production 2000 – 2009, 1000 head AAP (Annual average production).

NFR	Animal category	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
4B 1a	Dairy Cattle	636	623	610	596	563	564	550	545	558	563
4B 1b	Non-dairy cattle	1 232	1 284	1 187	1 128	1 082	1 006	984	1 021	1 006	977
4B 3	Sheep	112	119	117	121	124	126	128	124	117	116
4B 4	Goats	8	9	9	10	11	11	12	13	14	16
4B 6	Horses	150	155	160	165	170	175	180	185	190	178
4B 8	Swine	11 922	12 608	12 732	12 949	13 233	13 534	13 361	13 723	12 738	12 369
4B 9a	Laying hens	4 935	4 750	4 605	4 941	4 850	5 168	3 902	4 209	4 973	4 437
4B 9b	Broilers	16 047	15 597	15 129	12 211	11 286	11 905	12 924	11 758	9 737	14 787
4B 9c	Turkeys	546	547	552	376	149	116	122	194	169	165
4B 9d	Other poultry3	1 374	1 415	1 363	1 383	1 431	1 509	1 543	1 644	1 590	1 350

Emission factor

Emission factor for TSP, PM_{10} and $PM_{2.5}$ is based on the EMEP/EEA emission inventory guidebook 2009. However, calves and weaners are not included and therefore guidebook 2005 is used. Emission factors for sheep and goats are based on Fontelle et al., 2009. The same emissions factors are used for all years.

In Takai et al. (1998), dust emission from housings is estimated as "inhalable dust". This is defined as particles that can be transported into the body via the respiratory system. Approximately, "inhalable dust" equates to TSP (Hinz. T., 2002). Estimation of TSP is based on the transformation factors for the conversion of inhalable dust into PM_{10} given in inventory guidebook 2005 table B3 in appendix B.

Table 6.15 Emission factor for particle emission from animal housing system.

Livestock category	Housing system	Emission factor PM_{10} kg pr AAP pr yr	$PM_{2.5}$ kg pr AAP pr yr	TSP kg pr AAP pr yr	Transformation factor PM_{10} to TSP kg pr AAP pr yr
Cattle:					
Dairy cattle	Solid	0.36	0.23	0.29	0.46
	Slurry	0.70	0.45	0.30	0.46
Calves < ½ yr	Solid	0.16	0.10	0.29	0.46
	Slurry	0.15	0.10	0.31	0.46
Beef cattle	Solid	0.24	0.16	0.31	0.46
	Slurry	0.32	0.21	0.30	0.46
Heifer[1)]	Solid	0.26	0.17	0.30	0.46
	Slurry	0.43	0.28	0.30	0.46
Suckling cattle[2)]	Solid	0.24	0.16	0.31	0.46
	Slurry	0.32	0.21	0.30	0.46
Swine:					
Sows	Solid	0.58	0.09	0.07	0.45
	Slurry	0.45	0.07	0.07	0.45
Weaners	Solid[3)]	0.18	0.03	0.07	0.45
	Slurry	0.18	0.03	0.07	0.45
Fattening pigs	Solid	0.50	0.08	0.07	0.45
	Slurry	0.42	0.07	0.07	0.45
Poultry:					
Laying hens, cages	Solid	0.017	0.002	0.12	1.00
Laying hens, pechery	Solid	0.084	0.016	0.19	1.00
Broilers	Solid	0.052	0.007	0.13	1.00
Turkeys, ducks and gees	Solid	0.032	0.004	0.13	1.00
Horses	Solid	0.18	0.12	0.31	0.46
Sheep	Solid	0.06	0.02	0.14	0.46
Goats	Solid	0.06	0.02	0.14	0.46

1) Average of "calves" and "dairy cattle".

2) Assumed the same value as for "Beef cattle".

3) Same as slurry based systems.

6.5.3 Time-series

Table 6.16 shows the PM emission, given in TSP, PM_{10} and $PM_{2.5}$ for each animal category in the period 2000 to 2009. It is seen that the main part of the emission originates from swine housings. In the period 2000 to 2009, the total agricultural emission has decreased by 10 % mainly due to a fall in the emission from production of swine. This is mainly due to change in housing system to more slurry based systems and to change in share of weaners and fattening pigs.

Table 6.16 PM emission from housings 2000 – 2009, Mg PM_{10}, $PM_{2.5}$ and TSP.

	Mg TSP	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
NFR	Animal Category										
4B 1a	Dairy	945	914	882	870	833	859	856	836	847	850
4B 1b	Non-dairy	845	860	792	501	491	480	485	502	492	512
4B 3	Sheep	4	4	4	4	5	5	5	4	4	4
4B 4	Goats	0	0	0	0	0	0	0	0	1	1
4B 6	Horses	29	30	31	32	33	34	35	36	37	35
4B 8	Swine	9 440	9 911	10 018	10 184	10 355	10 373	10 203	10 060	9 187	8 757
4B 9a	Laying hens	392	375	361	404	381	434	305	307	368	307
4B 9b	Broilers	818	811	787	635	587	619	672	611	505	769
4B 9c	Turkeys	15	14	14	10	14	17	10	13	14	16
4B 9d	Other poultry	8	9	10	9	9	8	9	5	5	4
4B 13	Other	0	0	0	0	0	0	0	0	0	0
	TSP total	12 496	12 929	12 900	12 651	12 708	12 829	12 581	12 376	11 462	11 255
	Mg PM_{10}	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
NFR	Animal Category										
4B 1a	Dairy	435	420	406	400	383	395	394	385	390	391
4B 1b	Non-dairy	389	395	365	231	226	221	223	231	226	236
4B 3	Sheep	2	2	2	2	2	2	2	2	2	2
4B 4	Goats	0	0	0	0	0	0	0	0	0	0
4B 6	Horses	14	14	14	15	15	16	16	17	17	16
4B 8	Swine	4 248	4 460	4 508	4 583	4 660	4 668	4 592	4 527	4 134	3 941
4B 9a	Laying hens	392	375	361	404	381	434	305	307	368	307
4B 9b	Broilers	818	811	787	635	587	619	672	611	505	769
4B 9c	Turkeys	15	14	14	10	14	17	10	13	14	16
4B 9d	Other poultry	8	9	10	9	9	8	9	5	5	4
4B 13	Other	0	0	0	0	0	0	0	0	0	0
	PM_{10} total	6 319	6 501	6 467	6 289	6 277	6 379	6 223	6 098	5 663	5 682
	Mg $PM_{2.5}$	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
NFR	Animal Category										
4B 1a	Dairy	279	270	261	257	246	254	253	247	250	251
4B 1b	Non-dairy	249	253	233	149	146	142	144	149	146	152
4B 3	Sheep	1	1	1	1	1	1	1	1	1	1
4B 4	Goats	0	0	0	0	0	0	0	0	0	0
4B 6	Horses	9	9	10	10	10	11	11	11	11	11
4B 8	Swine	693	727	735	747	760	761	748	738	674	643
4B 9a	Laying hens	75	72	69	77	73	83	58	59	71	59
4B 9b	Broilers	107	106	103	83	77	81	88	80	66	101
4B 9c	Turkeys	2	2	2	1	2	2	1	2	2	2
4B 9d	Other poultry	1	1	1	1	1	1	1	1	1	1
4B 13	Other	0	0	0	0	0	0	0	0	0	0
	$PM_{2.5}$ total	1 415	1 441	1 414	1 326	1 315	1 336	1 305	1 287	1 222	1 219

6.6 Field burning of agricultural wastes – NFR 4F

Field burning of agricultural wastes has in Denmark been prohibited since 1990 and may only take place in connection to production of grass seeds on fields with repeated production and in cases of wet or broken bales of straw. The amount of burnt straw from the grass seed production is estimated as 20 - 15 % of the total amount produced. The amount of burnt bales of or wet straw is estimated as 0.1 % of total amount of straw. Both estimates are based on an expert judgement by the Danish Agricultural Advisory Service. The total amounts are based on data from Statistics Denmark. An EMEP EEA Emission Inventory Guidebook (2009) default value for the emission factors for field burning of agricultural wastes is used.

Emissions of NH_3, NO_x, CO, NMVOC, SO_2, PM, heavy metals, dioxin and PAH is included under the NFR category 4F. The emission of NH_3 and PM from field burning contribute in 2009 with less than 1 % of the agricultural emission. NMVOC from field burning contributes with 15 % of the agricultural emission. The emission of NO_x, CO, SO_2, heavy metals and dioxin from field burning contribute with less than 1 % of the total national emission, while the emission of PAH contribute with around 3 % of the national emission. From 1989 to 1990 decreases all emissions significantly due to the prohibition, see annex 2C.4.

6.7 NMVOC emissions from agriculture other – NFR 4G

Around 2 % of the NMVOC emission originates from the agricultural sector, which, in the Danish emission inventory, includes emission from arable land crops and grassland, and field burning of agricultural wastes, see chapter 6.6. Activity data is obtained from Statistics Denmark. The emission factor for crops and grassland is for land with arable crops is 393 g NMVOC pr ha and for grassland, 2 120 g NMVOC pr ha (Fenhann & Kilde 1994; Priemé & Christensen 1991).

Table 6.17 NMVOC emission from agricultural soils 1990 – 2009.

Year	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
Arable crops, 1000 ha	2 336	2 341	2 340	2 314	2 303	2 322	2 307	2 293	2 254	2 044	2 064	2 075	2 138
Grassland, 1000 ha	498	478	458	473	472	466	462	463	484	647	446	450	403
NMVOC emission, Gg	1.97	1.93	1.89	1.91	1.90	1.90	1.89	1.88	1.91	2.18	1.76	1.77	1.69
Continued													
Year	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	
Arable crops, 1000 ha	2 125	2 064	2 043	2 060	2 065	2 062	2 079	2 086	2 083	2 050	2 107	2 103	
Grassland, 1000 ha	405	398	413	414	396	390	369	446	460	459	490	497	
NMVOC emission, Gg	1.69	1.65	1.68	1.69	1.65	1.64	1.60	1.77	1.79	1.78	1.87	1.88	

6.8 Uncertainties

Table 6.18 shows the estimated uncertainties for the pollutants.

6.8.1 NH_3

4B Manure management

Uncertainties regarding animal production, such as number of animals, feeding consumption, normative figures etc. are low. Number of animals is estimated by Statistic Denmark and for each animal category an uncertainty estimate is given. For the large animal groups such as cattle and swine the uncertainty is very low, while it for the smaller groups is a little higher. The uncertainty for animals overall is estimated to 2 %.

The Danish Normative System for animal excretions is based on data from the Danish Agricultural Advisory Service (DAAS), which is the central office for all Danish agricultural advisory services. DAAS engages in a great deal of research as well as the collection of efficacy reports from Danish farmers for dairy production, meat production, swine production, etc to optimise productivity in Danish agriculture. In total, feeding plans from 15-18 % of Danish dairy production, 25-30 % of pig production, 80-90 % of poultry production and approximately 100 % of fur production are collected annually. These basic feeding plans are used to develop the standard values of the "Danish Normative System".

The normative figures (Poulsen et al. 2001, Poulsen, 2010) are comprised of arithmetic means. Based on feeding plans, the standard deviation in N-excretion rates between farms can be estimated to ±20 % for all animal types (Hanne D. Poulsen, DJ,. pers. comm). However, due to the large number of farms included in the norm figures the arithmetic mean, it can be assumed as a very good estimate with a low uncertainty.

The combined effect of low uncertainty in actual animal numbers, the relatively low uncertainty for feed consumption and excretion rates gives a low uncertainty in the activity data as a whole and is estimated to 10 %. The major uncertainty, therefore, relates to the emission factors.

4D1a Synthetic N-fertilizers

The activity data for the emission from synthetic fertiliser is the amount of sold fertiliser given by the Danish Plant Directorate. Uncertainty for this is considered to be low. The uncertainty for the emission factors is based on expert judgement.

4D2c N-excretion on pasture range and paddock

The number of days and the N-excretion on grass is estimated by DAAS and DJF. The overall uncertainty for the activity is estimated to 5 %, while the uncertainty for the emission factor is considered higher, 25 %.

4G Other

Under Table 4G emissions from three sources are reported, crops, sewage sludge and NH_3 treated straw. The uncertainty of activity data for crops is very low, while it for sewage sludge and NH_3 treated straw is higher. For the uncertainty of the emission factor for the three sources a high uncertainty is seen for crops and NH_3 treated straw, while it for sewage sludge is lower. For both activity and emission factor an overall uncertainty is estimated.

6.8.2 PM

Previously the uncertainties fore the PM emission factors have been considered to be very high. From this year the estimates of the uncertainties fore the PM emission factors is based on EMEP/EEA Emission Inventory Guidebook and have been lowered.

6.8.3 Other pollutants

For the NMVOC emission from 4G Other the activity data is hectares of arable crops and grassland. Data for hectares under cultivation is estimated by Statistic Denmark and the uncertainties is based on there calculations and they are very low. The uncertainty for the emission factors is based on expert judgment and is consider to be very high. For the NMVOC emission from field burning the uncertainty of the emission factor is based on EMEP/EEA Emission Inventory Guidebook.

Emission of NO_x, CO, SO_2, heavy metals, dioxin and PAH from the agricultural sector originate from field burning of agricultural wastes. The uncertainty for activity data fore these emissions is a combination of the uncertainty for crop production which is low and the uncertainty of the amount of burned straw which is high. The uncertainties for the emission factors are based on EMEP/EEA Emission Inventory Guidebook. All uncertainties for field burning are relatively high.

Table 6.18 Estimated uncertainty associated with activities and emission factors for the agricultural sector.

	Sector	Emission	Activity data %	Emission factor %	Combined uncertainty %	Total uncertainty %
NO_x, Gg	4.F Field burning	0.12	25	25	35	35
CO, Gg	4.F Field burning	2.98	25	100	103	103
NMVOC, Gg	4.G Other	1.88	2	500	500	428
	4.F Field burning	0.32	25	100	103	
SO_2, Gg	4.F Field burning	0.02	25	100	103	103
NH_3, Gg	4.B Manure management	61.53	10	20	22	19
	4 D1a Synthetic N-fertilizers	4.72	3	25	25	
	4 D2c N-excretion on pasture range and paddock unspecified	2.00	5	25	25	
	4.F Field burning	0.12	25	50	56	
	4.G Other	5.46	20	50	54	
TSP, Mg	4.B Manure management	11 251	2	300	300	300
	4.F Field burning	0.29	25	50	56	
PM_{10}, Mg	4.B Manure management	5 678	2	300	300	300
	4.F Field burning	0.29	25	50	0	
$PM_{2.5}$, Mg	4.B Manure management	1 218	2	300	300	300
	4.F Field burning	0.28	25	50	56	
Pb, Mg	4.F Field burning	0.04	25	50	56	56
Cd, Mg	4.F Field burning	0.00	25	100	103	103
Hg, Mg	4.F Field burning	0.00	25	200	202	202
As, Mg	4.F Field burning	0.00	25	100	103	103
Cr, Mg	4.F Field burning	0.01	25	200	202	202
Cu, Mg	4.F Field burning	0.00	25	200	202	202
Ni, Mg	4.F Field burning	0.01	25	200	202	202
Se, Mg	4.F Field burning	0.00	25	100	103	103
Zn, Mg	4.F Field burning	0.00	25	200	202	202
Dioxin, g I-Teq	4.F Field burning	0.03	25	500	501	501
Benzo(a)pyrene, Mg	4.F Field burning	0.14	25	500	501	501
Benzo(b)fluoranthen, Mg	4.F Field burning	0.14	25	500	501	501
Benzo(k)fluoranthen, Mg	4.F Field burning	0.05	25	500	501	501

6.9 Quality assurance and quality control (QA/QC)

A general QA/QC and verification plan for the agricultural sector is still under development, but some measures have been formulated as general lines for the further work. The objectives for the quality planning, as given in the CLRTAP Emission Inventory Guidebook, which is closely related to the IPCC Good Practice Guidance, are to improve the transparency, consistency, comparability, completeness and confidence.

To ensure consistency in the inventory, certain time-series have been prepared for both the activity data, the emission factors and implied emission factors, 1985 - 2009. Considerable variation between years can reveal miscalculations or changes in methods. These variations are checked and errors have been rectified. There have been some problems related to the implementation of the new database system IDA – especially in connection to the data of nitrogen. Now a quality check procedure are provided which include annually check for all activity data, emission factor and implied emission factors.

Activity data and emission factors are collected and discussed in cooperation with specialists and researchers at different institutes and research sections. As a consequence, both data and methods are evaluated continuously according to latest knowledge and information. A more detailed description of quality assurance and quality control is given in the Denmark´s National Inventory Report 2010 - submitted under the United Nations Framework Convention on Climate Change (http://www.dmu.dk/Pub/FR784.pdf).

6.10 Recalculations

Compared with the previous NH_3 and PM emissions inventory (submission 2010), some changes and updates have been made. These changes cause an increase in the NH_3 emission (1985 – 2008) and a decrease in the PM emission (2000 – 2008), see Table 6.19.

The main reason for the increase in NH_3 emission is due to and error in the calculations of NH_3 from sows 1985-2008 and this have led to an increase in the emission from animal manure of 6-11% in the period 1985-2008.

The PM emission mainly decreases because of changes in the calculation of the number of produced swine and poultry and thereby changes in production cycles. For the calculations of the number of produced fattening pigs and weaners slaughter data has been updated. Also the calculation of the number of produced laying hens has been changed, so now the number is based on the amount of eggs produced.

Table 6.19 Changes in NH_3 emission and PM emission in the agricultural sector compared to NFR reported last year.

NH_3 emission (Gg NH_3)	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
Previous	114.21	115.06	112.29	109.77	110.73	110.04	106.48	104.97	102.68	100.07	93.91	90.89
Updated	119.31	120.47	118.17	115.54	116.20	115.98	111.95	110.34	108.24	105.27	99.22	95.84
Difference (pct)	4.5	4.7	5.2	5.3	4.9	5.4	5.1	5.1	5.4	5.2	5.7	5.5
NH_3 emission (Gg NH_3)	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Previous	89.56	89.92	84.56	84.30	81.63	79.48	77.23	76.94	73.24	71.20	71.61	71.35
Updated	94.39	95.07	90.14	88.92	87.61	85.54	84.55	84.16	80.15	77.10	76.38	74.94
Difference (pct)	5.4	5.7	6.6	5.5	7.3	7.6	9.5	9.4	9.4	8.3	6.6	5.0

PM emission (Mg TSP)	2000	2001	2002	2003	2004	2005	2006	2007	2008
Previous	13 511	13 456	13 127	13 419	12 937	13 185	12 831	12 631	11 855
Updated	12 496	12 929	12 900	12 651	12 708	12 829	12 581	12 376	11 462
Difference (pct)	-7.5	-3.9	-1.7	-5.7	-1.8	-2.7	-1.9	-2.0	-3.3

There have been no changes in the methodology.

In the following some further changes are mentioned which has minor influence on the total emissions:

The number of produced broilers, ducks and turkeys has been changed due to a double counting of N-excretion from animals dying under production. This also influences the production cycles and therefore the PM emission.

Emission factor for loss of NH_3 from liquid manure in housings have been lowered for cattle, swine and fur farming. This was done because of an error.

New data for sewage sludge for the year 2008 have led to an increase in emission of NH_3 from sewage sludge of 25 %.

New data for the distribution of animals on different housings in 2008 have been implemented.

Normative figures for horses < 500 kg in the years 1985-2002 have been adjusted to even out the gab from 2002 to 2003 where normative figures for horses < 500 kg is divided in to two groups < 300 kg and 300 - 500 kg.

The number of cattle in the years 1985-2002 has been changed, due to a discovery of an error in a spread sheet construction.

6.11 Planned improvements

Until now the number of bulls is based on the annually census. Instead, it is planned to use information on slaughtering data received from Statistics Denmark, which better reflects the year production. At the same time the exported animals will be included.

In recent years, there has been focus on reduction of the NH_3 emission and especially the possibilities for emission reduction in housings. A number of investigations to estimate the effects from technical measures on the emission have been initiated. However, very little housings have implemented NH_3 reduction technologies, although these probably will be an important issue in future. When data is available, it is planned to implement the reduction effect in the emission inventory.

It is planned to include the dust emission from arable farming – i.e. harvesting and field preparation by machines. At the moment there are not resources to implement this, but DK has noticed that ERT strongly encourage making further efforts to include it.

The QA/QC plan for the agricultural sector is still under development. First step will focus on improvement of the procedure of intern quality check of both data input and output. It is planned to provide a check list of all activity data, emission factor, implied emission factor and other important key parameters. The annual change for each emission source on activity will be checked for significant differences and if necessary explained. Next step includes control of the inventory data calculations. This mean to identify the possibility to compare the calculations made by other institutions or organisations e.g. calculation of total N-excretion made by the Faculty of Agricultural Science. The third step is to consider how to provide a quality assurance procedure for the entire inventory.

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7 Waste (NFR sector 6)

The waste sector consists of the four main NFR categories 6A Solid waste disposal on land, 6B Waste-Water handling, 6C Waste incineration and 6D Other waste. Table 7.1 below shows the relevant SNAP codes for the waste sector.

Table 7.1 Link between SNAP codes and NFR sectors.

SNAP code	SNAP name	NFR code
090401	Managed Waste Disposal on Land	6A
090402	Unmanaged Waste Disposal Sites	6A
090403	Other	6A
091001	Waste water treatment in industry	6B
091007	Latrines	6B
091002	Waste water treatment in residential/commercial sect.	6B
090201	Incineration of domestic or municipal wastes	6C
090202	Incineration of industrial wastes (except flaring)	6C
090204	Flaring in chemical industries	6C
090205	Incineration of sludge from waste water treatment	6C
090207	Incineration of hospital wastes	6C
090208	Incineration of waste oil	6C
090901	Incineration of corpses	6C
090902	Incineration of carcasses	6C
090700	Open burning of agricultural wastes	6C
091003	Sludge spreading	6D
091005	Compost production	6D
091006	Biogas production	6D
091008	Other production of fuel (refuse derived fuel)	6D
091009	Accidental fires	6D

Incineration of waste in Denmark is done with energy recovery and therefore the emissions are included under the relevant sectors under NFR sector 1A. The documentation for waste incineration is included in Chapter 3.2.

The waste sector is presently only a key source for dioxin due to the emissions from accidental fires. It is unsure whether NMVOC from waste disposal and waste-water handling, which is to be included in the inventory, will be key categories in the future.

7.1 Solid waste disposal on land

Major emissions from waste disposal are emissions of greenhouse gases. It is assumed that waste disposal also leads to emission of small quantities of NMVOC, CO, NH_3 and NO_X. PM emissions are emitted from waste handling as well, but no emission factors are available.

For the 2011 submission Denmark has not estimated emissions of air pollutants from solid waste disposal. The draft EMEP/EEA Guidebook contains a default NMVOC emission factor, however due to limited resources it has not been possible to estimate the emissions.

7.2 Waste-water handling

According to the EMEP/EEA Guidebook waste-water handling can be a source for emissions of POPs, NMVOC, NH_3 and CO. Of these pollutants only NMVOC is thought to be significant.

For the current submission Denmark has not estimated emissions of air pollutants from waste-water handling. The EMEP/EEA Guidebook contains a default NMVOC emission factor for latrines and waste-water handling, however due to limited resources it has not been possible to estimate the emissions.

7.3 Waste incineration

Incineration of municipal, industrial and clinical waste take place with energy recovery, therefore the emissions are included in the relevant subsectors under NFR sector 1A. For documentation please refer to chapter 3.2. Flaring off-shore and in refineries are included under NFR sector 1B2c, for documentation please refer to chapter 3.4. No flaring in chemical industry occurs in Denmark.

Human cremation

The incineration of human bodies is a common practice that is performed on an increasing part of the yearly deceased. All Danish incineration facilities use optimised and controlled combustions, with temperatures reaching 800-850 °C, secondary combustion chambers, controlled combustion air flow and regulations for coffin materials.

However the emissions of especially Hg caused by cremations can still contribute to a considerable part of the total national emissions. In addition to the most frequently discussed emissions of Hg and PCDD/Fs (dioxins and furans), are the emissions of compounds like SO_2, NO_x, VOC, CO, other heavy metals (As, Cd, Cr, Cu, Ni, Pb, Se, Zn), particulate matter, HCB, PAHs and PCBs.

Crematoria are usually located within cities, close to residential areas and normally, their stacks are relatively low. Therefore environmental and human exposure is likely to occur as a result of emissions from cremation facilities.

Animal cremation

The burning of animal carcasses in animal crematoria follows much the same procedure as human cremation. Animal cremation facilities use similar two chambered furnaces and controlled combustion. However animals are burned in special designed plastic (PE) bags rather than coffins.

Emissions from animal cremation are also similar to that of human cremation, with the exception of heavy metals.

Animal cremations are performed in two ways, individually where the owner often pays for receiving the ashes in an urn or collectively which is most often the case with animal carcasses that are left at the veterinarian.

7.3.1 Methodology

Human cremation

There are 31 crematoria in Denmark, some with multiple furnaces, 21 facilities are run by the church and 10 by the local authorities (DKL, 2010, KM, 2006).

During the 1990es all Danish crematoria were rebuilt to meet new standards. This included installation of secondary combustion chambers and in most cases, replacement of old primary incineration chambers (Schleicher et al., 2001). All Danish cremation facilities are therefore performing controlled incinerations with a good burn-out of the gases, and a low production of pollutants. But only a very few crematoria are equipped with flue gas cleaning (bag filters with activated carbon).

Following the development of new technology, the emission limits for crematoria are lowered again in 1/2011. These new standard terms were originally expected from 1/2009 but have been postponed two years for existing crematoria. Table 7.2 shows a comparison of the emission limits from 2/1993 and the new standard limits.

Table 7.2 Emission limit values mg pr Nm^3 at 11 % O_2 (Schleicher & Gram, 2008).

Component	Report 2/1993	Standard terms (1/2011)
	Emission limit value mg/normal m^3 at 11 % O_2	
Total dust	80	10
CO	50	50
Hg	No demands	0.1
Other demands:		
Stack height	3 m above rooftop	3 m above rooftop
Temperature in stack	Minimum 150 °C	Minimum 110 °C
Flue gas flow in stack	8 – 20 m/s	No demands
Temperature in after burner	850 °C	800 °C
Residence time in after burner	2 seconds	2 seconds
Odour	The crematory must not cause noticeable odour in the surroundings	The crematory must not cause odour nuisance outside the crematory perimeter, that is significant according to the supervisory authority

The use of air pollution control devices, and activated carbon, for the removal of Hg is expected to also reduce the flue gas concentration of dioxins, PAHs and odour. Existing knowledge on the reduction efficiencies justifies that no emission limits are necessary (Schleicher & Gram, 2008).

Animal cremation

Open burning of animal carcasses is illegal in Denmark and is not occurring, and small-scale incinerators are not known to be used at Danish farms. Livestock that is diseased or in other ways unfit for consumption is disposed of through rendering plants, incineration of livestock carcasses is illegal and these carcasses are therefore commonly used in the production of fat and soap at Daka Bio-industries.

The only animal carcasses that are approved for cremation in Denmark are deceased pets and animals used for experimental purposes, where the burning must take place at a specialised animal crematorium. There are four animal crematoria in Denmark but one of these is situated at the AVV waste incineration site. The special designed cremation furnaces are at this location connected to the flue gas cleaning equipment of the waste incineration plant and the emission from the cremations are included in the yearly inventory from AVV and consequently included under waste incineration with energy recovery in this report. Therefore only three animal crematoria are discussed in this section.

Animal by-products are considered waste, and emission from animal crematoria must therefore comply with the EU requirements for waste incineration. The EU directive (2000/76/EF) on waste incineration has been transferred in to Danish law (Statutory order nr.162[10]).

The incineration of animal carcasses is, as the incineration of human corpses, performed in special furnaces. All furnaces at Danish pet crematoria have primary incineration chambers with temperatures around 850 ºC and secondary combustion chambers with temperatures around 1100 ºC. The fuel used at the Danish facilities is natural gas.

Emissions from pet cremations are calculated for SO_2, NO_x, NMVOC, CO, NH_3, particles, heavy metals (As, Cd, Cr, Cu, Ni, Pb, Se, Zn), HCB, dioxins/furans, PAHs and PCBs. For the compounds SO_2, NO_x, CO, As, Se, HCB and PCB emissions are estimated by using the same emission factors as for human cremation.

7.3.2 Activity data

Human cremation

Table 7.3 shows the development in total number of nationally deceased persons, number of cremations and the development in the fraction of cremated corpses from the total number of deceased. Data for the total number of nationally deceased persons are collected from (Danmarks Statistik, 2010). The data describing the number of cremations and the cremation fraction in the period 1984-2009 are gathered from the Association of Danish Crematoria (DKL, 2010). By assuming that the development of the cremation fraction is constant back to the year 1980, the fraction from 1980-1983 can be calculated from the trend of the development of 1984-2009. An estimation of the number of yearly cremations from 1980-1983 is then found by multiplying the calculated cremation fraction with the number of nationally deceased persons.

Table 7.3 Data human cremations (DKL 2010).

	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
Nationally deceased	55939	56359	55368	57156	57109	58378	58100	58136	58984	59397
Cremations	33986	34556	34256	35681	34811	36705	36805	37652	38711	39231
Cremation fraction, %	60.8	61.3	61.9	62.4	61.0	62.8	62.8	64.7	65.6	66.1
Continued	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Nationally deceased	60926	59581	60821	62809	61099	63127	61043	59898	58453	59179
Cremations	40991	40666	41455	43194	42762	43847	43262	42891	41660	42299
Cremation fraction, %	67.3	68.3	68.2	68.8	70.0	69.5	70.8	71.6	69.1	74.4
Continued	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Nationally deceased	57998	58355	58610	57574	55806	54962	55477	55604	54591	54872
Cremations	41651	41707	42539	41997	41555	40758	41233	41766	41788	42408
Cremation fraction, %	71.8	71.5	72.6	72.9	74.5	74.2	74.3	75.1	76.6	77.3

[10] Bekendtgørelse nr. 162 of 11 March 2003 on waste incineration plants.

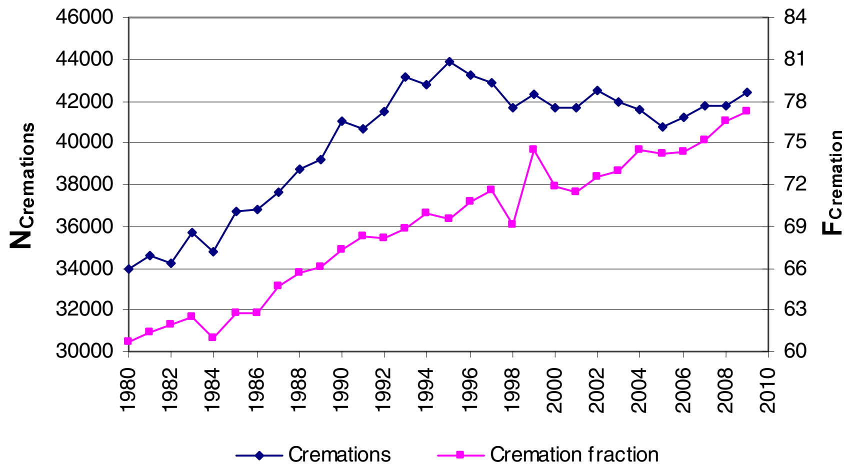

Figure 7.1 Illustration of the development in cremations (DKL 2010), where the number of cremations, $N_{cremations}$, is shown at the left Y-axis. The cremation percentage, $F_{cremations}$, shows the percent of cremated deceased of the total deceased from the year 1984 to 2009. Data for 1980-1983 are estimated values.

Even though the total number of yearly cremations is fluctuating, the cremation percentage has been steadily increasing since 1984, and is likely to continue to increase.

The average body weight of cremated corpses is assumed to be 65 kg.

Figure 7.2 presents the trend of the national number of deceased persons together with the activity data for human cremation. The figure shows a direct connection between the number of deceased and the activity of human cremation as the two trends are quite similar. Figure 7.2 also shows the effect of the increasing fraction of cremated bodies, as the number of cremations is not decreasing along with the number of deceased. The cremation fraction has increased from 67 % in 1990 to 77 % in 2009; the trend of this fraction is shown in Figure 7.1.

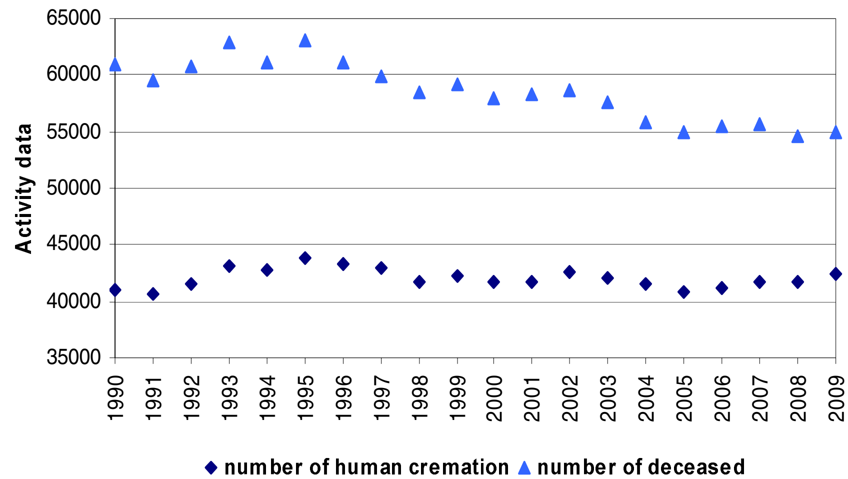

Figure 7.2 Trends of the activity data for cremation of human corpses and the national number of deceased persons.

Animal cremation

Activity data for the incineration of animal carcasses are gathered directly from the pet crematoria. There is no national statistics available on the activity from these facilities. The precision of activity data therefore depends on the information provided by the crematoria.

The following Table 7.4 lists the four Danish pet crematoria, their foundation year and provides each crematorium with an id letter.

Table 7.4 Animal crematoria I Denmark.

Id	Name of crematorium	Founded in
A	Dansk Dyrekremering ApS	May 2006
B	Ada's Kæledyrskrematorium ApS	Unknown, existed in more than 25 years, assumed 1980
C	Kæledyrskrematoriet	2006
D	Kæledyrskrematoriet v. Modtagestation Vendsyssel I/S	-

Crematoria D is situated at the AVV waste incineration site and the emission from this site is, as previously mentioned, included in the yearly inventory from AVV and consequently included under waste incineration in this report. From here on only crematoria A-C are considered.

Table 7.5 lists the activity data for crematoria A, B, C and the total national cremated amount for the years 1980-2009.

Table 7.5 Activity data, (direct contact with all Danish pet crematoria).

	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
Crematorium A, Mg	-	-	-	-	-	-	-	-	-	-
Crematorium B, Mg	50	60	70	80	90	100	110	120	130	140
Crematorium C, Mg	-	-	-	-	-	-	-	-	-	-
Total, Mg	50	60	70	80	90	100	110	120	130	140
	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Crematorium A, Mg	-	-	-	-	-	-	-	-	-	-
Crematorium B, Mg	150	160	170	180	190	200	210	220	235	368
Crematorium C, Mg	-	-	-	-	-	-	-	-	-	-
Total, Mg	150	160	170	180	190	200	210	220	235	368
	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Crematorium A, Mg	-	-	-	-	-	-	300	450	450	450
Crematorium B, Mg	443	452	451	462	571	762	798	802	848	853
Crematorium C, Mg	-	-	-	-	-	-	18	32	40	36
Total, Mg	443	452	451	462	571	762	1116	1284	1338	1339

Crematorium A delivered activity data for 2009 as the interval 400-500 Mg, the exact value is assumed to be the average of this interval and the rate is assumed to be constant back to the year 2006. The activity data for Crematoria A in 2006 is rated according to the founding of the site in May of this year.

Crematorium B delivered exact yearly activity data for the years 1998-2009. They were not certain about the founding year but have existed for more than 25 years. It is assumed that crematorium B was founded in January 1980. These activity data are shown as the thick line in Figure 7.2 and added a trendline and the equation of the trendline.

It is not possible to extrapolate data back to 1980 because the activity, due to the steep trendline, in this case would become negative from 1993 and back in time.

Statistic data describing the national consumption for pets including food and equipment for pets was evaluated as surrogate data. These statistic data show an increase of consumption of 6 % from 1998 to 2000, in the same period the national amount of cremated animal carcasses increased with 89 % and no correlation seems to be present. Since there are no other available data on the subject of pets, it is concluded that there are no surrogate data available. The activity data for the period of 1980-1997 are estimated by en expert judgement. The estimated data are shown in Table 7.5 and the following Figure 7.3.

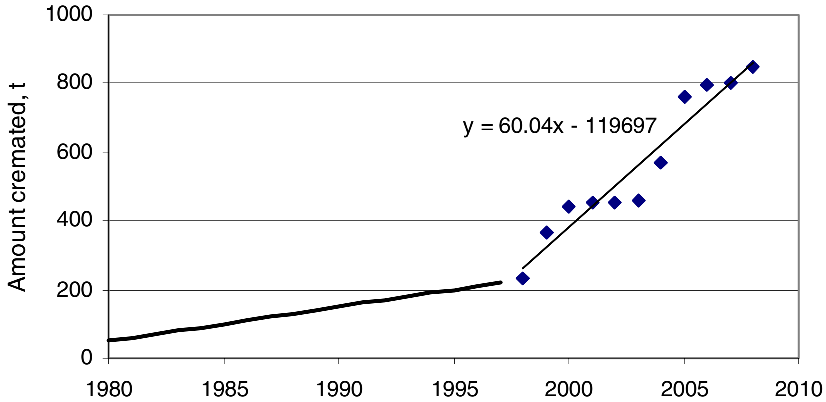

Figure 7.3 The amount of cremated carcasses in Mg at crematorium B, which is the oldest and largest crematorium in Denmark. Data from 1998-2009 are delivered by the crematorium and is considered to be exact; these data are marked as points. Data from 1980-1997 are estimated and are shown as the thick line in the figure.

7.3.3 Emission factors

Human cremation

For crematoria, emissions are calculated by multiplying the total number of cremations by the emission factors. Since there are no measurements available of the yearly emission from Danish crematoria, the estimation of emissions is based on emission factors from literature. The estimation is based on the measurements performed in countries that are comparable with Denmark. By comparable is meant countries that use similar incineration processes, similar cremation techniques including support fuel and have a similar composition of sources to lifetime exposure, lifetimes and coffins.

Table 7.6 lists the emission factors and their respective references.

Table 7.6 Emission factors for human cremation with references.

Pollutant name	Unit	Emission factor*	Reference
SO_2	g/body	54.4	US-EPA
NO_X	g/body	308.5	US-EPA
NMVOC	g/body	13.0	CANA, 1993
CO	g/body	10.8	Schleicher et al., 2001
NH_3		NA	
TSP	g/body	43.5	WEBFIRE
PM_{10}	g/body	39.2	WEBFIRE
$PM_{2.5}$	g/body	39.2	WEBFIRE
As	µg/body	10.98	US-EPA
Cd	µg/body	3.11	US-EPA
Cr	µg/body	8.44	US-EPA
Cu	µg/body	7.71	US-EPA
Hg	g/body	1.12	Kriegbaum et al.
Ni	µg/body	10.8	US-EPA
Pb	µg/body	18.6	US-EPA
Se	g/body	0.0223	WEBFIRE
Zn	g/body	0.181	WEBFIRE
HCB	µg/body	151.6	Eisaku TODA
PCDD/F	µg I-TEQ/body**	0.950	Henriksen et al.
Flouranthene	µg/body	0.059	US-EPA
Benzo(b)flouranthene	µg/body	8.14	WEBFIRE
Benzo(k)flouranthene	µg/body	7.27	WEBFIRE
Benzo(a)pyrene	µg/body	0.010	US-EPA
Benzo(g,h,i)perylene	µg/body	14.9	WEBFIRE
Indeno(1,2,3-c-d)pyrene	µg/body	7.88	WEBFIRE
PCB	µg/body	413.5	Eisaku TODA

*NA = not available.

** I-TEQ: International Toxicity Equivalents.

Danish measurements of dioxin emissions from three furnaces in two different crematoria in 2001 showed concentration ranges of 0.2 – 0.7 ng I-TEQ pr m^3 (n.t.10 % O_2) and emission factor in the range of 180 - 930 ng I-TEQ pr cremation. The calculated average emission factor is 350 ng I-TEQ pr cremation, and the average concentration is 0.3 ng I-TEQ pr m^3 (n.t.10 %O_2). The measurements are assumed representative for all Danish crematory furnaces (Schleicher & Gram, 2008).

A Danish substance flow analysis from 2003 estimated the dioxin emission factor from crematoria to be in the range of 6-70 mg I-TEQ pr year (90 % confidence level), with an average value of 950 ng I-TEQ pr cremation (Henriksen et al., 2006). The estimate from Henriksen et al., 2006 is the based on the latest dated measurements and is the one chosen for this inventory.

It has not been possible to find data for ammonia. Ammonia might appear in lesser amounts, but will most likely be converted to NO_X at the high incineration temperatures.

For the compounds Se, PCB, HCB, benzo(b)- and (k)-flouranthene, benzo(g,h,i)perylene and indeno(1,2,3-c-d)pyrene, it has not been possible to find any additional data to validate the emission factors. Only in the case of PCB, Thomsen et al. (2009) provides an emission factor for PCB of 0.4 mg pr tonnes and assuming a body mass of 70 kg this gives an emission factor of 28 µg pr body. The Japanese reference Eisaku TODA (2006) may be overestimated due to differences in sources to the total exposure in Japan and in Denmark and due to a higher technological development and use of air pollution devices. Still, the Japanese emission factor was selected in the inventory of this year as this data source represents newest knowledge and refers to real measurements.

For the compounds As, Cd, Cr, Cu, Ni, benzo(a)pyrene and flouranthene, the emission factors from US EPA 1996 were compared with data found in the database provided by US EPA (WEBFIRE, 1992). The two data sources present emission factors that differ significantly for these compounds. Since no other data is available, the most resent estimated emission factor is chosen.

In addition to the two US data sources (WEBFIRE and US-EPA, 1996), emission factors for Pb and Zn were found in a scientific paper by Santarsiero et al. (2005) and, for Pb, also in a Swiss report Heldstab et al. (2008). These data corresponds well with the emission factors of the WEBFIRE database, which are therefore applied for Pb and Zn.

Since emission factors are country specific, Danish estimated data is selected whenever available. Ten data sources were found providing emission factors for CO, Hg and PCDD/F and amongst these were data from the Danish EPA and the National Environmental Research Institute (NERI). The selected Danish emission factors were verified by comparability to values provided by the US database WEBFIRE and the Swiss report by Heldstab et al. (2008).

Five data sources to information and estimates of emission factors for SO_2, NO_x and NMVOC showed very similar values. Since none of these data sources are based on Danish estimates, the most common (US-EPA, 1996) and (CANA, 1993) referenced by the EMEP/Corinair Guidebook 2007 are selected.

There are also several data sources to the emission factor of TSP. The WEBFIRE database provides the one referred to in most of the scientific literature, and was therefore selected for this inventory. The particulate matter fractions of PM_{10} and $PM_{2.5}$ are both calculated from TSP, as it is assumed that PM_{10} and $PM_{2.5}$ are 90 % of the total TSP (Fontelle et al., 2008).

Animal cremation

Concerning the burning of animal carcasses in animal crematoria there is not much literature to be found. NAEI, 2007 provides emission factors with the unit kt, but since no explanation is provided as to that amount this emission factor is valid for, the database is not of any use as a source.

The Guidebook, 2009 is the only available source to emission factors for NMVOC, NH_3, TSP, PM_{10}, $PM_{2.5}$ and PCDD/F. It also provides an emission factor for PAHs but does not specify on the single compounds. Neither do the emission factor provided by Chen et al. (2003), but this source divides the compounds into two categories according to weight and is generally more detailed. Chen et al. (2003) is therefore chosen to supply the PAH emission factor. The following Table 7.7 lists the two PAH categories given by Chen et al. (2003).

Table 7.7 PAH groups, Chen et al. (2003).

Molecular weight	Description	Compounds	Value, mg pr. t
Middle	4-ringed PAHs	Fluoranthene*, Pyrene, Benzo(a)anthracene, Chrysene	234
High	5-, 6- and 7-ringed PAHs	Cyclopenta(c,d)pyrene, Benzo(b)fluoranthene*, Benzo(k)fluoranthene*, Benzo(e)yrene, Benzo(a)pyrene*, Perylene, Benzo(ghi)perylene*, Indeno(1,2,3,-c,d)pyrene*, Dibenzo(a,h)anthrance, Benzo(b)chrycene, Coronene	198
Total			432

* Compounds which are normally provided with emission factors (P11-16).

Chen et al. (2004) is the only available source to emission factors for the heavy metals Cd, Cr, Cu, Ni, Pb and Zn.

The emission factors of the remaining compounds SO_2, NO_x, CO, As, Se, HCB and PCB are collected from the section on human cremation, and it is assumed that humans and animals are similar in composition for this purpose.

There is a good compliance between the emission factors for animal and human incineration for PCDD/F and a relatively good compliance for NMVOC, TSP, PM_{10} and $PM_{2.5}$. Emission factors for PAHs are not comparable because Chen et al. (2003) does not supply data for the individual PAHs, and the two categories middle and high molecular weight contains more compounds than the six standard PAHs (P11-16) which are accessible for human cremations.

The emission factors given by Chen et al. (2004) for heavy metals are at least a factor 100 larger than those accepted for human cremations with the exception of that of Zn which is much higher for the incineration of corpses.

No data was available for the emission of Hg in animal cremations. The emission factor accepted for human incineration is not accepted in the case of Hg, because the Hg emission from human cremations primarily stems from tooth fillings.

Table 7.8 states the best available emission factors for animal cremations.

Table 7.8 Emission factors for animal cremation with references.

Pollutant	Unit	Emission factor	Source
SO_2	g/Mg	837*	US-EPA
NO_X	g/Mg	4 746*	US-EPA
NMVOC	g/Mg	2 000	Guidebook, 2009
CO	g/Mg	166*	Schleicher et al., 2001
NH_3	g/Mg	1 900	Guidebook, 2009
TSP	g/Mg	2 180	Guidebook, 2009
PM_{10}	g/Mg	1 530	Guidebook, 2009
$PM_{2.5}$	g/Mg	1 310	Guidebook, 2009
As	mg/Mg	0.17*	US-EPA
Cd	mg/Mg	10	Chen et al., 2004
Cr	mg/Mg	70	Chen et al., 2004
Cu	mg/Mg	20	Chen et al., 2004
Hg	-	NAV	-
Ni	mg/Mg	60	Chen et al., 2004
Pb	mg/Mg	180	Chen et al., 2004
Se	mg/Mg	343*	WEBFIRE
Zn	mg/Mg	190	Chen et al., 2004
HCB	mg/Mg	2.33*	Eisaku TODA
PCDD/F	ng I-TEQ/Mg	10 000	Guidebook, 2009
MM-PAHs	mg/Mg	234	Chen et al., 2003
HM-PAHs	mg/Mg	198	Chen et al., 2003
PCB	mg/Mg	6.37*	Eisaku TODA

* Emission factors from human cremations.

7.3.4 Emissions

Human cremation

Tables 7.9a, b and c show the total national emissions from the years 1980-2009. The dioxin emission is given in I-TEQ; i.e. International Toxicity Equivalents which is a weighted addition of congener toxicity with reference to 2,3,7,8-TCDD (Seveso-dioxin).

Table 7.9a Total national emissions from incineration of corpses – 1980 to 1989.

	Unit	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
SO_2	Mg	1.85	1.88	1.86	1.94	1.89	2.00	2.00	2.05	2.11	2.14
NO_X	Mg	10.48	10.66	10.57	11.01	10.74	11.32	11.35	11.62	11.94	12.10
NMVOC	Mg	0.442	0.449	0.445	0.464	0.453	0.477	0.478	0.489	0.503	0.510
CO	Mg	0.366	0.372	0.369	0.384	0.375	0.395	0.396	0.405	0.417	0.422
TSP	Mg	1.48	1.50	1.49	1.55	1.51	1.60	1.60	1.64	1.68	1.71
PM_{10}	Mg	1.33	1.35	1.34	1.40	1.36	1.44	1.44	1.47	1.52	1.54
$PM_{2.5}$	Mg	1.33	1.35	1.34	1.40	1.36	1.44	1.44	1.47	1.52	1.54
As	g	0.373	0.379	0.376	0.392	0.382	0.403	0.404	0.413	0.425	0.431
Cd	g	0.106	0.107	0.106	0.111	0.108	0.114	0.114	0.117	0.120	0.122
Cr	g	0.287	0.292	0.289	0.301	0.294	0.310	0.311	0.318	0.327	0.331
Cu	g	0.262	0.266	0.264	0.275	0.268	0.283	0.284	0.290	0.299	0.303
Hg	kg	38.0	38.7	38.3	39.9	39.0	41.1	41.2	42.1	43.3	43.9
Ni	g	0.365	0.371	0.368	0.384	0.374	0.395	0.396	0.405	0.416	0.422
Pb	g	0.632	0.643	0.637	0.664	0.647	0.683	0.685	0.700	0.720	0.730
Se	g	758	771	765	796	777	819	821	840	864	876
Zn	kg	6.14	6.24	6.19	6.45	6.29	6.63	6.65	6.80	6.99	7.09
HCB	g	5.15	5.24	5.19	5.41	5.28	5.56	5.58	5.71	5.87	5.95
PCDD/F	mg	32.3	32.8	32.5	33.9	33.1	34.9	35.0	35.8	36.8	37.3
flouranthene	mg	2.00	2.04	2.02	2.10	2.05	2.16	2.17	2.22	2.28	2.31
benzo(b)flouranthene	mg	277	281	279	290	283	299	300	306	315	319
benzo(k)flouranthene	mg	247	251	249	259	253	267	268	274	281	285
benzo(a)pyrene	mg	0.351	0.357	0.354	0.369	0.360	0.380	0.381	0.389	0.400	0.406
benzo(g,h,i)perylene	mg	506	515	510	531	519	547	548	561	577	584
indeno(1,2,3-c-d)pyrene	mg	268	272	270	281	274	289	290	297	305	309
PCB	g	14.1	14.3	14.2	14.8	14.4	15.2	15.2	15.6	16.0	16.2

Table 7.9b Total national emissions from incineration of corpses – 1990 to 1999.

	Unit	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
SO_2	Mg	2.23	2.21	2.26	2.35	2.33	2.39	2.35	2.33	2.27	2.30
NO_X	Mg	12.65	12.55	12.79	13.33	13.19	13.53	13.35	13.23	12.85	13.05
NMVOC	Mg	0.533	0.529	0.539	0.562	0.556	0.570	0.562	0.558	0.542	0.550
CO	Mg	0.441	0.438	0.446	0.465	0.461	0.472	0.466	0.462	0.449	0.456
TSP	Mg	1.78	1.77	1.80	1.88	1.86	1.91	1.88	1.87	1.81	1.84
PM_{10}	Mg	1.61	1.59	1.62	1.69	1.67	1.72	1.69	1.68	1.63	1.66
$PM_{2.5}$	Mg	1.61	1.59	1.62	1.69	1.67	1.72	1.69	1.68	1.63	1.66
As	g	0.450	0.446	0.455	0.474	0.469	0.481	0.475	0.471	0.457	0.464
Cd	g	0.127	0.126	0.129	0.134	0.133	0.136	0.134	0.133	0.129	0.131
Cr	g	0.346	0.343	0.350	0.364	0.361	0.370	0.365	0.362	0.351	0.357
Cu	g	0.316	0.314	0.320	0.333	0.330	0.338	0.334	0.331	0.321	0.326
Hg	kg	45.9	45.5	46.4	48.3	47.9	49.1	48.4	48.0	46.6	47.3
Ni	g	0.441	0.437	0.446	0.464	0.460	0.471	0.465	0.461	0.448	0.455
Pb	g	0.762	0.756	0.771	0.803	0.795	0.816	0.805	0.798	0.775	0.787
Se	g	915	908	925	964	954	979	965	957	930	944
Zn	kg	7.41	7.35	7.49	7.80	7.73	7.92	7.82	7.75	7.53	7.64
HCB	g	6.21	6.16	6.28	6.55	6.48	6.65	6.56	6.50	6.31	6.41
PCDD/F	mg	38.9	38.6	39.4	41.0	40.6	41.7	41.1	40.7	39.6	40.2
flouranthene	mg	2.42	2.40	2.44	2.55	2.52	2.59	2.55	2.53	2.46	2.49
benzo(b)flouranthene	mg	334	331	337	352	348	357	352	349	339	344
benzo(k)flouranthene	mg	298	296	301	314	311	319	314	312	303	307
benzo(a)pyrene	mg	0.424	0.420	0.429	0.447	0.442	0.453	0.447	0.443	0.431	0.437
benzo(g,h,i)perylene	mg	611	606	617	643	637	653	644	639	621	630
indeno(1,2,3-c-d)pyrene	mg	323	321	327	340	337	346	341	338	328	333
PCB	g	17.0	16.8	17.1	17.9	17.7	18.1	17.9	17.7	17.2	17.5

Table 7.9c Total national emissions from incineration of corpses – 2000 to 2009.

	Unit	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
SO_2	Mg	2.27	2.27	2.32	2.29	2.26	2.22	2.24	2.27	2.27	2.31
NO_X	Mg	12.85	12.87	13.12	12.96	12.82	12.57	12.72	12.88	12.89	13.08
NMVOC	Mg	0.541	0.542	0.553	0.546	0.540	0.530	0.536	0.543	0.543	0.551
CO	Mg	0.449	0.449	0.458	0.452	0.448	0.439	0.444	0.450	0.450	0.457
TSP	Mg	1.81	1.81	1.85	1.83	1.81	1.77	1.79	1.82	1.82	1.85
PM_{10}	Mg	1.63	1.63	1.67	1.64	1.63	1.60	1.61	1.64	1.64	1.66
$PM_{2.5}$	Mg	1.63	1.63	1.67	1.64	1.63	1.60	1.61	1.64	1.64	1.66
As	g	0.457	0.458	0.467	0.461	0.456	0.447	0.453	0.458	0.459	0.466
Cd	g	0.129	0.130	0.132	0.130	0.129	0.127	0.128	0.130	0.130	0.132
Cr	g	0.351	0.352	0.359	0.354	0.351	0.344	0.348	0.352	0.353	0.358
Cu	g	0.321	0.322	0.328	0.324	0.320	0.314	0.318	0.322	0.322	0.327
Hg	kg	46.6	46.7	47.6	47.0	46.5	45.6	46.1	46.7	46.8	47.5
Ni	g	0.448	0.448	0.457	0.451	0.447	0.438	0.443	0.449	0.449	0.456
Pb	g	0.775	0.776	0.791	0.781	0.773	0.758	0.767	0.777	0.777	0.789
Se	g	930	931	949	937	927	910	920	932	933	946
Zn	kg	7.53	7.54	7.69	7.59	7.51	7.36	7.45	7.55	7.55	7.66
HCB	g	6.31	6.32	6.45	6.37	6.30	6.18	6.25	6.33	6.33	6.43
PCDD/F	mg	39.6	39.6	40.4	39.9	39.5	38.7	39.2	39.7	39.7	40.3
flouranthene	mg	2.46	2.46	2.51	2.48	2.45	2.40	2.43	2.46	2.46	2.50
benzo(b)flouranthene	mg	339	339	346	342	338	332	336	340	340	345
benzo(k)flouranthene	mg	303	303	309	305	302	296	300	304	304	308
benzo(a)pyrene	mg	0.431	0.431	0.440	0.434	0.430	0.421	0.426	0.432	0.432	0.438
benzo(g,h,i)perylene	mg	620	621	634	626	619	607	614	622	622	632
indeno(1,2,3-c-d)pyrene	mg	328	329	335	331	328	321	325	329	329	334
PCB	g	17.2	17.2	17.6	17.4	17.2	16.9	17.1	17.3	17.3	17.5

Animal cremation

For the burning of animal carcasses, emissions are calculated by multiplying the amount of incinerated animals by the emission factors.

National emissions are shown in the following Tables 7.10a, b and c.

Table 7.10a Total national emissions from incineration of carcasses – 1980 to 1989.

Pollutant name	unit	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
SO_2	Mg	0.04	0.05	0.06	0.07	0.08	0.08	0.09	0.10	0.11	0.12
NO_X	Mg	0.24	0.28	0.33	0.38	0.43	0.47	0.52	0.57	0.62	0.66
NMVOC	Mg	0.10	0.12	0.14	0.16	0.18	0.20	0.22	0.24	0.26	0.28
CO	Mg	0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.02	0.02	0.02
NH_3	Mg	0.10	0.11	0.13	0.15	0.17	0.19	0.21	0.23	0.25	0.27
TSP	Mg	0.11	0.13	0.15	0.17	0.20	0.22	0.24	0.26	0.28	0.31
PM_{10}	Mg	0.08	0.09	0.11	0.12	0.14	0.15	0.17	0.18	0.20	0.21
$PM_{2.5}$	Mg	0.07	0.08	0.09	0.10	0.12	0.13	0.14	0.16	0.17	0.18
As	g	0.01	0.010	0.012	0.014	0.015	0.017	0.019	0.020	0.022	0.024
Cd	g	0.50	0.60	0.70	0.80	0.90	1.00	1.10	1.20	1.30	1.40
Cr	g	3.50	4.20	4.90	5.60	6.30	7.00	7.70	8.40	9.10	9.80
Cu	g	1.00	1.20	1.40	1.60	1.80	2.00	2.20	2.40	2.60	2.80
Ni	g	3.00	3.60	4.20	4.80	5.40	6.00	6.60	7.20	7.80	8.40
Pb	g	9.00	10.80	12.60	14.40	16.20	18.00	19.80	21.60	23.40	25.20
Se	g	17.17	20.60	24.03	27.47	30.90	34.33	37.77	41.20	44.63	48.07
Zn	g	9.50	11.40	13.30	15.20	17.10	19.00	20.90	22.80	24.70	26.60
HCB	g	0.12	0.14	0.16	0.19	0.21	0.23	0.26	0.28	0.30	0.33
PCDD/F	mg	0.50	0.60	0.70	0.80	0.90	1.00	1.10	1.20	1.30	1.40
MM-PAHs	g	11.70	14.04	16.38	18.72	21.06	23.40	25.74	28.08	30.42	32.76
HM-PAHs	g	9.90	11.88	13.86	15.84	17.82	19.80	21.78	23.76	25.74	27.72
PCB	g	0.32	0.38	0.45	0.51	0.57	0.64	0.70	0.76	0.83	0.89

Table 7.10b Total national emissions from incineration of carcasses – 1990 t0 1999.

	unit	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
SO_2	Mg	0.13	0.13	0.14	0.15	0.16	0.17	0.18	0.18	0.20	0.31
NO_X	Mg	0.71	0.76	0.81	0.85	0.90	0.95	1.00	1.04	1.11	1.75
NMVOC	Mg	0.30	0.32	0.34	0.36	0.38	0.40	0.42	0.44	0.47	0.74
CO	Mg	0.02	0.03	0.03	0.03	0.03	0.03	0.03	0.04	0.04	0.06
NH_3	Mg	0.29	0.30	0.32	0.34	0.36	0.38	0.40	0.42	0.45	0.70
TSP	Mg	0.33	0.35	0.37	0.39	0.41	0.44	0.46	0.48	0.51	0.80
PM_{10}	Mg	0.23	0.24	0.26	0.28	0.29	0.31	0.32	0.34	0.36	0.56
$PM_{2.5}$	Mg	0.20	0.21	0.22	0.24	0.25	0.26	0.28	0.29	0.31	0.48
As	g	0.025	0.027	0.029	0.030	0.032	0.034	0.035	0.037	0.040	0.062
Cd	g	1.50	1.60	1.70	1.80	1.90	2.00	2.10	2.20	2.35	3.68
Cr	g	10.50	11.20	11.90	12.60	13.30	14.00	14.70	15.40	16.43	25.78
Cu	g	3.00	3.20	3.40	3.60	3.80	4.00	4.20	4.40	4.69	7.37
Ni	g	9.00	9.60	10.20	10.80	11.40	12.00	12.60	13.20	14.08	22.10
Pb	g	27.00	28.80	30.60	32.40	34.20	36.00	37.80	39.60	42.24	66.30
Se	g	51.50	54.94	58.37	61.80	65.24	68.67	72.10	75.54	80.57	126.46
Zn	g	28.50	30.40	32.30	34.20	36.10	38.00	39.90	41.80	44.59	69.98
HCB	g	0.35	0.37	0.40	0.42	0.44	0.47	0.49	0.51	0.55	0.86
PCDD/F	mg	1.50	1.60	1.70	1.80	1.90	2.00	2.10	2.20	2.35	3.68
MM-PAHs	g	35.10	37.44	39.78	42.12	44.46	46.80	49.14	51.48	54.91	86.18
HM-PAHs	g	29.70	31.68	33.66	35.64	37.62	39.60	41.58	43.56	46.46	72.92
PCB	g	0.96	1.02	1.08	1.15	1.21	1.27	1.34	1.40	1.49	2.35

Table 7.10c Total national emissions from incineration of carcasses – 2000 to 2009.

	unit	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
SO_2	Mg	0.37	0.38	0.38	0.39	0.48	0.64	0.93	1.08	1.12	1.12
NO_X	Mg	2.10	2.15	2.14	2.19	2.71	3.62	5.30	6.10	6.35	6.35
NMVOC	Mg	0.89	0.90	0.90	0.92	1.14	1.52	2.23	2.57	2.68	2.68
CO	Mg	0.07	0.07	0.07	0.08	0.09	0.13	0.18	0.21	0.22	0.22
NH_3	Mg	0.84	0.86	0.86	0.88	1.09	1.45	2.12	2.44	2.54	2.54
TSP	Mg	0.97	0.99	0.98	1.01	1.25	1.66	2.43	2.80	2.92	2.92
PM_{10}	Mg	0.68	0.69	0.69	0.71	0.87	1.17	1.71	1.96	2.05	2.05
$PM_{2.5}$	Mg	0.58	0.59	0.59	0.60	0.75	1.00	1.46	1.68	1.75	1.75
As	g	0.074	0.076	0.076	0.078	0.096	0.129	0.189	0.217	0.226	0.226
Cd	g	4.43	4.52	4.51	4.62	5.71	7.62	11.16	12.84	13.38	13.39
Cr	g	31.04	31.66	31.59	32.31	39.98	53.36	78.14	89.89	93.68	93.72
Cu	g	8.87	9.05	9.02	9.23	11.42	15.25	22.33	25.68	26.77	26.78
Ni	g	26.61	27.14	27.07	27.70	34.27	45.74	66.98	77.05	80.30	80.33
Pb	g	79.82	81.41	81.22	83.09	102.80	137.22	200.94	231.16	240.89	241.00
Se	g	152.25	155.30	154.92	158.49	196.09	261.75	383.29	440.93	459.50	459.70
Zn	g	84.25	85.94	85.73	87.71	108.51	144.85	212.11	244.00	254.28	254.39
HCB	g	1.03	1.05	1.05	1.08	1.33	1.78	2.60	2.99	3.12	3.12
PCDD/F	mg	4.43	4.52	4.51	4.62	5.71	7.62	11.16	12.84	13.38	13.39
MM-PAHs	g	103.76	105.84	105.59	108.02	133.64	178.39	261.23	300.51	313.16	313.30
HM-PAHs	g	87.80	89.56	89.34	91.40	113.08	150.94	221.04	254.27	264.98	265.10
PCB	g	2.82	2.88	2.87	2.94	3.64	4.86	7.11	8.18	8.52	8.53

7.3.5 Uncertainties and time-series consistency

The uncertainty of the number of human cremations is miniscule, however for the purpose of the calculation it has been set to 1 %.

The uncertainty of the activity data from animal cremations is also minimal for the most recent years (1998-2009) but is increasing back in time (to 200 % in 1980). The uncertainty is set to 80 % for all years. Emission factor uncertainties are set at 500 for all three sources, Chen et al. (2003), Chen et al. (2004) and Guidebook (2009).

The uncertainties on the emission factors used in this inventory, and at the present level of available information, are shown in Table 7.11.

Table 7.11 Estimated uncertainty rates for activity data and emission factors, %.

	Human cremation		Animal cremation	
Pollutant	Activity data	Emission factor	Activity data	Emission factor
SO_2	1	100	80	100*
NO_x	1	150	80	150*
NMVOC	1	100	80	300
CO	1	150	80	150*
NH_3	-	-	80	300
TSP	1	500	80	300
PM_{10}	1	500	80	300
$PM_{2.5}$	1	500	80	300
As	1	1000	80	1 000*
Cd	1	1000	80	500
Cr	1	1000	80	500
Cu	1	1000	80	500
Hg	1	150	80	NAV
Ni	1	1000	80	500
Pb	1	600	80	500
Se	1	1000	80	1 000*
Zn	1	1000	80	500
HCB	1	500	80	500*
PCDD/F	1	300	80	300
Flouranthene	1	1000		
Benzo(b)flouranthene	1	1000		
Benzo(k)flouranthene	1	1000		
Benzo(a)pyrene	1	1000		
Benzo(g,h,i)perylene	1	1000		
Indeno(1,2,3-c,d)pyrene	1	1000		
PCB	1	1000	80	1 000*

*Uncertainties for emission factors for human cremations.

Uncertainty results

The tier 1 uncertainty estimates for waste incineration emission inventories are calculated from 95 % confidence interval uncertainties, results are shown in Table 7.12.

Table 7.12 National tier 1 uncertainty estimates for waste incineration.

Pollutant	Total emission uncertainty, %	Trend 1990-2009 (2000-2009), %	Trend Uncertainty, %-age points
SO_2	±79.3	45.5	±77.7
NO_x	±115.2	45.5	±99.8
NMVOC	±258.0	287.7	±678.6
CO	±115.2	45.5	±99.8
NH_3	±310.5	792.6	±1009.8
TSP	±271.5	71.4	±288.8
PM_{10}	±282.2	60.6	±260.8
$PM_{2.5}$	±290.8	54.4	±241.9
As	±748.7	45.5	±562.9
Cd	±501.5	730.8	±1126.7
Cr	±504.4	767.4	±1014.7
Cu	±500.4	717.4	±1187.7
Hg	±150.0	3.5	±1.5
Ni	±503.5	755.8	±1039.3
Pb	±504.7	770.9	995.7
Se	±748.7	45.5	562.9
Zn	±968.0	6.5	±33.7
HCB	±375.0	45.5	±285.3
PCDD/F	±238.1	32.7	±124.7
Flouranthene	±1000.0	3.5	±1.5
Benzo(b)flouranthene	±1000.0	3.5	±1.5
Benzo(k)flouranthene	±1000.0	3.5	±1.5
Benzo(a)pyrene	±1000.0	3.5	±1.5
Benzo(g,h,i)perylene	±1000.0	3.5	±1.5
Indeno(1,2,3-c,d)pyrene	±1000.0	3.5	±1.5
PCB	±748.6	45.6	±563.4

7.3.6 QA/QC and verification

QA/QC-procedure

The methodology for estimating emissions from waste incineration was introduced for the first time in the inventory submission in 2008. Data in this methodology currently involves activity data for 1980-2009 as presented in the preceding sections. No changes have been made in this methodology for the current submission.

In general terms, for this part of the inventory, the Data Storage (DS) Level 1 and 2 and the Data Processing (DP) Level 1 can be described as follows:

Data Storage Level 1

The external data level refers to the placement of original data for human cremation and input data used for deriving yearly activity for animal cremation.

Table 7.13 Overview of yearly stored external data sources at DS level1.

http, file or folder name	Description	AD or EF	Reference	Contact	Data agreement/ Comment
http://www.dkl.dk/statistik_1990_1999.aspx and http://www.dkl.dk/statistik_2000_2009.aspx	Number for cremations	AD	Association of Danish Crematories	Hanne Ring hr@dkl.dk	Public access
http://www.statistikbanken.dk/BEF5	Population statistics	AD	Statistics Denmark	Katja Hjelgaard kahj@dmu.dk	Public access
	Cremated animal carcasses	AD	Dansk Dyrekremering ApS	Knud Ribergaard info@danskdyrekremering.dk	Personal contact
	Cremated animal carcasses	AD	Ada's Kæledyrskrematorium ApS	Frederik Møller frederik@adakrem.dk	Personal contact
	Cremated animal carcasses	AD	Kæledyrskrematoriet	Annette Laursen dyrepension@skylinemail.dk	Personal contact

Data Processing Level 1

This level, for waste incineration, comprises a stage where the external data are treated internally. Adjusting the emission factors to match the country-specific average weight for human bodies and estimating the unavailable activity data for animal cremation.

Data Storage Level 2

Data Storage Level 2 is the placement of selected output data from the multiplication of activity data and emission factors as inventory data on SNAP levels in the Access (CollectER) database.

Points of measurement

The present stage of QA/QC for the Danish emission inventories for waste incineration is described below for DS and DP level 1 Points of Measurement (PMs). This is to be seen in connection with the general QA/QC description in Section 1.6.

Data Storage level 1	1. Accuracy	DS.1.1.1	General level of uncertainty for every dataset including the reasoning for the specific values

Tier 1 uncertainty calculations have been performed. The level of uncertainty is generally low for activity data but higher for emission factors. The general level of uncertainty for waste incineration could be improved if fluegas measurements were performed.

Data Storage Level 1	1. Accuracy	DS.1.1.2	Quantification of the uncertainty level of every single data value including the reasoning for the specific values.

There are no available uncertainties from the IPCC GL or the sources used to calculate the emission inventories for waste incineration. All uncertainties are achieved by expert judgements.

Data Storage level 1	2.Comparability	DS.1.2.1	Comparability of the data values with similar data from other countries, which are comparable with Denmark, and evaluation of discrepancy.

Some comparison of Danish data values with data sources from other countries has been carried out for activity data and emission factors.

Data Storage level 1	3.Completeness	DS.1.3.1	Documentation showing that all possible national data sources are included by setting down the reasoning behind the selection of datasets.

The following external data sources are used for the inventory on waste incineration (refer also to the table above):

- Tables from Association of Danish Crematories available online.
- Direct contact with the Danish animal crematories.
- Emission factors from literature.

Data from the Association of Danish Crematories is based on yearly reporting from all Danish crematories. Specific reported data is available for the complete time-series.

Data Storage level 1	4.Consistency	DS.1.4.1	The origin of external data has to be preserved whenever possible without explicit arguments (referring to other PMs).

The origin of external activity data has been preserved as much as possible. Files are saved for each year of reporting, in this way changes to previously received data and calculations is reflected and explanations are given.

Data Storage level 1	6.Robustness	DS.1.6.1	Explicit agreements between the external institution holding the data and NERI about the conditions of delivery.

No explicit agreement has been made. The collecting of data for the emission inventories of waste incineration is unproblematic.

Data Storage level 1	7.Transparency	DS.1.7.1	Summary of each dataset including the reasoning for selecting the specific dataset

The data set can be seen in section 7.3.2 - 7.3.4. For the reasoning behind the selection of the specific dataset, refer to DS 1.3.1.

Data Storage level 1	7.Transparency	DS.1.7.3	References for citation for any external dataset have to be available for any single value in any dataset.

These references exist in the description given in the Section 7.3.1, under methodology

Data Storage level 1	7.Transparency	DS.1.7.4	Listing of external contacts for every dataset

Contact persons related to the delivery of data for waste incineration are, respectively, Hanne Ring from the Association of Danish Crematories (hr@dkl.dk), Knud Ribergaard from Dansk Dyrekremering ApS (info@danskdyrekremering.dk), Frederik Møller from Ada's Kæledyrskrematorium ApS (frederik@adakrem.dk) and Annette Laursen from Kæledyrskrematoriet (dyrepension@skylinemail.dk).

Data Processing level 1	1. Accuracy	DP.1.1.1	Uncertainty assessment for every data source as input to Data Storage level 2 in relation to type of variability. (Distribution as: normal, log normal or other type of variability)

Tier 1 uncertainty calculations are made. The use of the Tier 1 methodology presumes a normal distribution of activity data and emission factor variability. Uncertainties are reported in section 7.3.5.

Data Processing level 1	1. Accuracy	DP.1.1.2	Uncertainty assessment for every data source as input to Data Storage level 2 in relation to scale of variability (size of variation intervals)

The uncertainty assessment has been given in Section 7.3.5.

Data Processing level 1	1. Accuracy	DP.1.1.3	Evaluation of the methodological approach using international guidelines

There is no available information in the international guidelines for the emission inventories of waste incineration.

Data Processing level 1	1. Accuracy	DP.1.1.4	Verification of calculation results using guideline values

There are no useful guideline values.

Data Processing level 1	2.Comparability	DP.1.2.1	The inventory calculation has to follow the international guidelines suggested by the UNFCCC and IPCC.

The inventory calculations are a simple multiplication of activity data and emission factors

Data Processing level 1	3.Completeness	DP.1.3.1	Assessment of the most important quantitative knowledge which is lacking.

Emission factors are gathered from literature studies. There is no Danish literature or measurements available on emissions from crematories

Data Processing level 1	3.Completeness	DP.1.3.2	Assessment of the most important cases where access is lacking with regard to critical data sources that could improve quantitative knowledge.

There is no direct data to elucidate the points mentioned under DP.1.3.1.

Data Processing level 1	4.Consistency	DP.1.4.1	In order to keep consistency at a high level, an explicit description of the activities needs to accompany any change in the calculation procedure.

There is no change in calculation procedure during the time-series and the activity data is, as far as possible, kept consistent for the calculation of the time-series.

Data Processing level 1	5.Correctness	DP.1.5.1	Show at least once, by independent calculation, the correctness of every data manipulation.

No data manipulation has been performed.

Data Processing level 1	5.Correctness	DP.1.5.2	Verification of calculation results using time-series

The time-series of activities and emissions in the output, in the SNAP source categories and in the NFR format have been prepared. The time-series are examined and significant changes are checked and explained.

Data Processing level 1	5.Correctness	DP.1.5.3	Verification of calculation results using other measures

The correct interpretation in the calculation of the methodology has been checked

Data Processing level 1	5.Correctness	DP.1.5.4	Shows one-to-one correctness between external data sources and the databases at Data Storage level 2

Data transfer control is made from the external data sources and to the SNAP source categories at level 2. This control is carried on further to the aggregated NFR source categories.

Data Processing level 1	7.Transparency	DP.1.7.1	The calculation principle and equations used must be described

The calculation principle and equations are described in Section 7.3.1.

Data Processing level 1	7.Transparency	DP.1.7.2	The theoretical reasoning for all methods must be described

The calculation principle and equations are described in Section 7.3.1.

Data Processing level 1	7.Transparency	DP.1.7.3	Explicit listing of assumptions behind all methods

The average weight of a human corps is assumed to be 65 kg.

Data Processing level 1	7.Transparency	DP.1.7.4	Clear reference to dataset at Data Storage level 1

Refer to the Table 7.13 and DS.1.1.1 above.

Data Processing level 1	7.Transparency	DP.1.7.5	A manual log to collect information about recalculations

Recalculation changes in the emission inventories are described in the IIR. The logging of the changes takes place in the yearly model file.

Data Storage level 2	5.Correctness	DS.2.5.1	Documentation of a correct connection between all data types at level 2 to data at level 1

The full documentation for the correct connection exists through the yearly model file, its output and report files made by the CollectER database system.

Data Storage level 2	5.Correctness	DS.2.5.2	Check if a correct data import to level 2 has been made

This check is performed, comparing model output and report files made by the CollectER database system, refer to DS.2.5.1.

Source-specific recalculations
No recalculations have been performed

Source-specific planned improvements
There are currently no planned improvements for this section

Source-specific performed improvements
Source-specific QA/QC and verification is now included in this section.

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7.4 Other waste

This category is a catch all for the waste sector. Emissions in this category could stem from sludge spreading, compost production, accidental fires, biogas production and other combustion without energy recovery.

7.4.1 Sludge spreading

Sludge from waste water treatment plants is only spread out in the open with the purpose of fertilising crop fields. Emissions that derive from this activity are covered in Chapter 6.

7.4.2 Compost production

This section covers the biological treatment of solid wastes called composting. Pollutants that escape from this treatment are ammonia (NH_3) and carbon monoxide (CO).

Methodology

Emissions from composting have been calculated according to a country specific method.

In Denmark, composting of solid biological waste includes composting of:

- garden and park waste (GPW),
- organic waste from households and other sources,
- sludge and,
- home composting of garden and vegetable food waste.

In 2001, 123 composting facilities treated only garden and park waste (type 2 facilities), nine facilities treated organic waste mixed with GPW or other organic waste (type 1 facilities) and 10 facilities treated GPW mixed with sludge and/or "other organic waste" (type 3 facilities). 92 % of these facilities consisted entirely of windrow composting which is a low technology composting method with natural access to air. It is assumed that all facilities can be considered as using windrow composting.

Composting is performed with low technology in Denmark this means that temperature, moisture and aeration is not consistently controlled or regulated. Temperature is measured but not controlled, moisture is regulated by watering the windrows in respect to weather conditions and aeration is assisted by turning the windrows.
(Petersen & Hansen, 2003)

During composting a fraction of the degradable organic carbon (DOC) in the waste material is converted into CO. Even though the windrows are regularly turned to support aeration, anaerobic sections are inevitable and will probably cause a small emission of CH_4. In the same manner, aerobic biological digestion of N leads to an emission of NO_X, while the anaerobic decomposition leads to the emission of NH_3. (Guidelines, 2006)

Activity data

All Danish waste treatment plants are obligated to statutory registration and reporting of all wastes entering and leaving the plants. All waste streams are weighed, categorised with a waste type and a type of treatment and registered to the ISAG waste information system. (Affaldsstatistik, 2006).

Figure 7.3 illustrates the nationally composted amount of waste divided in the four categories mentioned earlier.

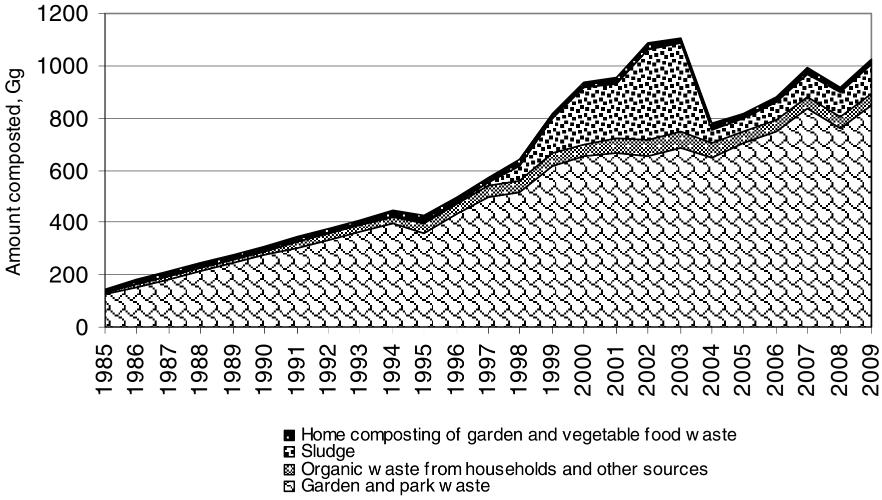

Figure 7.4 National amount of composted waste, these data are also shown in Table 7.15.

The Danish legislation on sludge (slambekendtgørelsen) was implemented in the summer of 2003. This stated that composted sludge may only be used as a fertilizer on areas not attended for growing foods of any kind in at least 2-3 years. This restriction caused the amount of composted sludge to drop drastically from 2003 to 2004.

Activity data for the years 1995-2008 stems from ISAG data for the categories: sludge and organic waste from households and other sources. Activities for 2009 are calculated by using the development trend from earlier years.

The development in composting of sludge does not demonstrate a convincing trend that can be used for estimation of activity data for previous years. Since there is no surrogate data available for the years 1990-1994, activity data for these years are "not available".

The amounts of organic waste from households composted in the years 1985-1994 are estimated by multiplying the number of facilities treating this type of waste with the average amount composted pr facility in the years 1995-2001 (2.6-3.8 Gg pr facility pr year). The following Table 7.14 shows the number of composting sites divided in the three types described in "Methodology".

Table 7.14 Number of composting facilities in the years 1985-2001.

Facility type	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
Type 1	2	2	3	3	4	5	6	7	8	9
Type 2	6	10	14	18	22	38	54	70	86	102
Type 3	0	0	0	0	0	1	2	2	3	4
Total	8	12	17	21	26	44	62	79	97	115

Continued

Facility type	1995	1996	1997	1998	1999	2000	2001
Type 1	13	14	13	14	13	11	9
Type 2	113	108	99	102	111	115	123
Type 3	9	9	11	10	10	7	10
Total	136	133	126	130	139	138	149

Type 1 waste treatment sites normally includes biogas producing facilities, but these are not included in Table 7.14.

Petersen (2001) and Petersen og Hansen (2003) provides 1997-2001 activity data for the composting of garden and park waste (GPW). Activity data for GPW for the years 1985-1996 and 2002-2009 are estimated from the surrogate data gathered from the waste statistic reports, Waste Statistics 2007 and 2008 (and earlier years).

The waste statistics provides the development in composting and wood chipping of GPW for 1995-2008, and by looking at the trend of this development the remaining years 1985-1994 and 2009 are estimated. This data series is used as surrogate data for the estimation of activity data for composting of GPW.

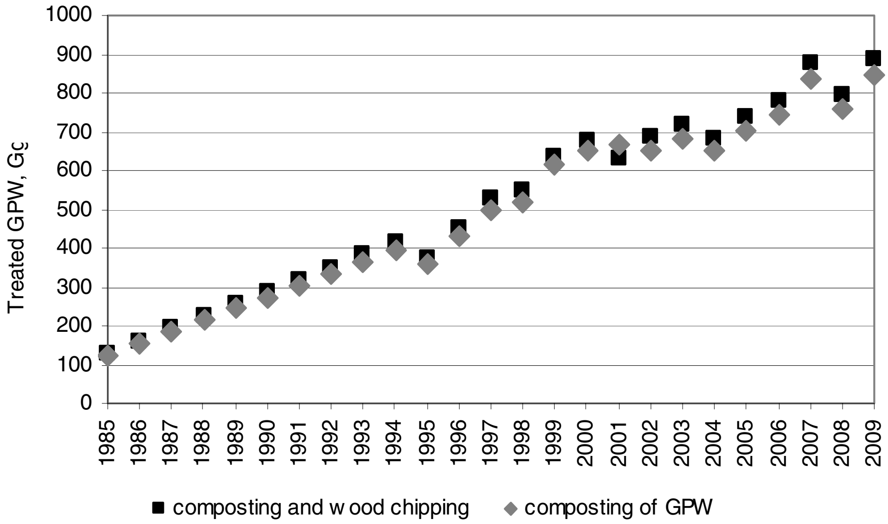

Figure 7.5 Composted amount of GPW.

The last waste category involved in composting is home composting of garden waste and vegetable waste. The activity data for this category is known from Petersen og Kielland (2003) to be 21.4 Gg in 2001. It is assumed that the following estimates made by Petersen & Kielland (2003) are valid for all years 1985-2009.

- 28 % of all residential buildings with private gardens (including weekend cabins) are actively contributing to home composting.
- 14 % of all multi-dwelling houses are actively contributing to home composting.

- 50 kg waste pr year will in average be composted at every contributing residential building.
- 10 kg waste pr year will in average be composted at every contributing multi-dwelling house.

The total number of occupied residential buildings, weekend cabins and multi-dwelling houses are found at the Statistics Denmark website. The calculated activity data for home composting of garden and vegetable waste are shown in Table 7.15.

Table 7.15 Activity data composting, Gg.

	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
Composting of garden and park waste	124	154	184	214	244	274	304	335	365	395
Composting of organic waste from households and other sources	5	7	9	11	13	16	19	23	26	29
Composting of sludge	NAV	NAV	NAV	NAV	NAV	NAV	NAV	NAV	NAV	NAV
Home composting of garden and vegetable food waste	19	19	19	20	20	20	20	20	20	21
Continued	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Composting of garden and park waste	358	431	496	517	614	653	669	653	682	650
Composting of organic waste from households and other sources	40	38	47	43	49	47	52	63	66	53
Composting of sludge	7	6	7	57	134	218	211	348	336	53
Home composting of garden and vegetable food waste	21	21	21	21	21	21	21	22	22	22
Continued	2005	2006	2007	2008	2009					
Composting of garden and park waste	702	745	835	757	846					
Composting of organic waste from households and other sources	45	48	44	46	48					
Composting of sludge	50	67	91	94	108					
Home composting of garden and vegetable food waste	22	22	22	22	23					

NAV = Not available.

Emission factors

The emission from composting strongly depends on both the composition of the treated waste and on process conditions such as aeration, mechanical agitation, moisture control and temperature pattern. (Amlinger et al., 2008).

The emission factors stated in Table 7.16 are considered the best available for the calculation of Danish national emissions from composting.

Table 7.16 Composting emission factors.

	Composting of garden and park waste (GPW)	Composting of organic waste	Composting of sludge	Home composting of garden and vegetable food waste
Unit	Kg pr Mg	Kg pr Mg	Kg pr Mg	Kg pr Mg
CO	0.563	NAV	NAV	0.075
NH_3	0.66	0.190	0.022	0.630
Source	Boldrin et al. 2009	Amlinger et al. 2008	Amlinger et al. 2008	Boldrin et al. 2009

Emission factors for composting of GPW waste and for home composting of garden and vegetable food waste are derived from Boldrin et al.

(2009). No other sources were found that describe the emission from home composting.

Two other sources provide emission factors for composting of GPW; Amlinger et al. (2008) and Hellebrand (1998). All three sources give very similar data. Boldrin et al. (2009) is the chosen source since this is a Danish report based on experiments from Danish waste and composting methods.

Emissions from Boldrin et al. (2009) are given in percentage of total degraded carbon or nitrogen respectively. The factors shown in Table 7.16 are calculated by assuming 37.5 % DOC in dry matter, 2 % N in dry matter and 50 % moisture in the waste.

Emission factors for composting of organic municipal waste and sludge are given by Amlinger et al. (2008). Pagans et al. (2006) delivers similar emissions for NH_3 from these waste categories but do not consider any other pollutants. Amlinger et al. (2008) is chosen as the most recent and thorough source to these data.

Emissions

Table 7.17a, b and c shows the total national emissions from composting for the years 1985-2009.

Table 7.17a National emissions from composting – 1985 to 1994, Mg.

	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
CO	71.0	88.0	104.9	121.9	138.8	155.8	172.7	189.7	206.6	223.6
NH_3	95.1	115.8	136.4	157.1	177.7	198.7	219.7	240.7	261.7	282.6

Table 7.17b National emissions from composting – 1995 to 2004, Mg.

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
CO	203.0	243.8	280.6	292.4	347.1	368.7	377.7	368.7	385.3	367.1
NH_3	262.2	309.4	355.4	369.2	437.1	463.7	475.7	471.7	491.9	460.4

Table 7.17c National emissions from composting – 2005 to 2009, Mg.

	2005	2006	2007	2008	2009
CO	396.6	420.7	471.1	427.7	477.8
NH_3	492.5	522.2	580.7	530.5	590.4

7.4.3 References

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7.4.4 Biogas production

Emissions from biogas production are divided and reported in different sections of this inventory according to use.

For the biogas production from organic waste with the purpose of energy production, the fuel consumption rate of the biogas production plants refers to the Danish energy statistics. The applied emission factors are the same as for biogas boilers. See this IIR Chapter 3, Energy.

Biogas production from manure is included in Chapter 6, Agriculture.

The fugitive emissions of NMVOC and NH_3 from the production of biogas from sludge from waste water treatment should be investigated and possibly added to the IIR Chapter 7.2.

Biogas production in this section only covers fugitive emissions from the handling of biological waste, sludge and manure. This includes activities like storage, pre- and after-treatment and fugitive emissions from the anaerobic digestion that is the actual production. However, emissions on these activities are considered negligible.

7.4.5 Accidental fires

Accidental fires cover fires in vehicles, buildings and landfill fires.

Methodology

Building fires

Emissions from building fires are calculated by multiplying the number of building fires with selected emission factors. Four types of buildings are separated with different emission factors: detached houses, undetached houses, apartment buildings and industrial buildings.

Emissions from building fires are calculated for SO_2, NO_x, NMVOC, CO, particles, heavy metals (As, Cd, Cr, Cu, Hg, Pb), dioxins/furans, PAHs and PCB.

Activity data for building fires are classified in three categories: large, medium and small. The emission factors comply for full scale building fires and the activity data is therefore recalculated as a full scale equivalent where it is assumed that a medium and a small fire leads to 50 %

and 5 % of a large fire respectively, and that a large fire is a full scale fire.

Vehicle fires

Emissions from vehicle fires are calculated by multiplying the number of vehicle fires with selected emission factors. Emission factors are not available for different vehicle types, whereas it is assumed that all the different vehicle types leads to similar emissions. The activity data is recalculated as an yearly combusted mass by multiplying the number of different vehicles fires with the Danish registered average weight of the given vehicle type.

Emissions from vehicle fires are calculated for SO_2, NO_x, NMVOC, CO, particles, heavy metals (As, Cd, Cr, Cu, Ni, Pb, Zn), dioxins/furans and PAHs.

Landfill fires

Accidental landfill fires have not been calculated for this year's inventory, this category is under development.

Activity data

In January 2005 it became mandatory for the local authorities to register every rescue assignment in the *online data registration- and reporting system* called ODIN, ODIN is developed and run by the Danish Emergency Management Agency (DEMA). As a result of this, some activity data from 2005 and forth can not be directly compared with older data. For example, some specific rescue assignments were not registered prior to the year 2005, and a compilation of data might therefore give the impression of a certain development, even though it is not actually the case. (DEMA 2007). All activity data are calculated from surrogate data and data from ODIN, 2006-2009 for building fires and 2007-2009 for vehicle fires.

Table 7.18 shows the occurrence of fires in general, building fires and vehicle fires registered at DEMA.

Table 7.18 Occurrence of building and vehicle fires.

Year	All fires	Building fires	Vehicle fires
1980	-	7046	2274
1981	-	7050	2242
1982	-	7053	2209
1983	-	7057	2176
1984	-	7061	2144
1985	-	7065	2185
1986	-	7069	2000
1987	-	7073	2018
1988	-	7076	2015
1989	18784	7496	2010
1990	17025	6794	1995
1991	17589	7019	2006
1992	19124	7632	2016
1993	16803	6705	2042
1994	16918	6751	2041
1995	19543	7799	2120
1996	19756	7884	2197
1997	18236	7277	2266
1998	16320	6513	2332
1999	17538	6999	2388
2000	17174	6854	2428
2001	16894	6742	2462
2002	16362	6529	2496
2003	18443	7360	2507
2004	15927	6356	2541
2005	16551	6605	2597
2006	16965	6770	2661
2007	18529	7855	2385
2008	20973	7967	2940
2009	19276	7583	2904

The total number of fires has been adjusted by DEMA for 2007 and 2008 by adding 10 and 58 fires to the total respectively. The activity data for building and vehicle fires is adjusted for all years 1990-2005 because the calculation is now also based on the detailed data for year 2009. The total number of building fires has with this recalculation increased with 0.69 – 0.70 %.

The total number of vehicle fires has increased more drastically with the peek of 7.1 % in 1993. This increase is caused by a change in data delivery of the population of the different vehicle types. This change in input data is also described in chapter 3.3 Transport and other mobile sources.

Building fires

Activity data for accidental building fires is given by The Danish Emergency Management Agency (DEMA). Fires are categorised to three extents, large, medium and small. A large fire is in this context defined as a fire that involves the use of two or more fire hoses for fire extinguishing and is assumed to typically involve a complete house, one or more apartments, or at least part of an industrial complex. A medium size fire is in this context defined as a fire involving the use of only 1 fire hose for fire-fighting and will typically involve a part of a single room in an apartment or house. And a small size fire is in this context defined as a fire that was extinguished before the arrival of the fire service, extinguished by small tools or a chimney fire.

The total number of registered fires is known for the years 1989-2009. For the years 2006-2009 the total number of registered building fires are known, and by assuming that the share of building fires in respect to the total number of registered fires, can be considered as constant for every year back to 1989, the total number of building fires can be calculated for the years 1989-2005.

Furthermore the building fires that occurred in the years 2006-2009 are subcategorised into industrial building, detached house, undetached house and apartment building fires. And by once again assuming that the average of these shares are representative for the years 1989-2005, the building fires from the earlier years are also subdivided into these four building types.

Table 7.19 states the registered activity data for building fires for the years 2006-2009, divided in both size and building type. The calculated averages describes the average share of building fires from 2006-2009 of a certain type and size, in relation to all fires (building and non-building) of the same size and during the same four years period.

Table 7.19 Registered occurrence of building fires.

	Size	Industry	Detached	Undetached	Apartment	All building fires
	large	186	821	205	101	1,313
	medium	211	824	300	542	1,877
	small	442	1,482	384	985	3,293
2006	all	839	3,127	889	1,629	6,483
	large	268	988	239	152	1,647
	medium	324	1,021	391	720	2,456
	small	369	1,432	717	932	3,450
2007	all	961	3,441	1,347	1,804	7,553
	large	244	1,153	206	145	1,748
	medium	216	1,153	306	796	2,471
	small	443	1,491	445	1,008	3,387
2008	all	903	3,797	957	1,949	7,606
	large	282	1,222	173	169	1,846
	medium	246	945	196	638	2,025
	small	507	1,404	399	1,072	3,382
2009	all	1,035	3,571	768	1,879	7,253
	large	27.39	31.11	20.12	8.27	22.75
Average, %	medium	27.11	28.86	29.07	38.25	31.44
	small	45.50	40.03	50.81	53.48	45.81

As mentioned above, it is assumed that the average percentages provided by the years 2006-2009 are compliable for the years 1989-2005. Hereby, similar activity data can be estimated back to 1989. Activity data from 1980-1988 are estimated based on the trend provided by the years 1989-2009.

It is furthermore assumed that a medium size fire has a damage rate of 50 % compared to a large (full scale) fire and that a small size fire leads to the emission of 5 % of a large fire. From these damage rates, a full scale equivalent can be determined from the earlier calculated activity data, results are shown in the following Table 7.20.

Table 7.20 Full scale equivalent activity data for accidental building fires from the years 1980-2009 (DEMA).

	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
Industry	377	377	378	378	378	378	378	379	379	401
Detached	1547	1548	1549	1550	1550	1551	1552	1553	1554	1646
Undetached	344	344	344	345	345	345	345	345	345	366
Apartment	510	510	510	511	511	511	512	512	512	542
Continued	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Industry	364	376	409	359	361	418	422	390	349	375
Detached	1492	1541	1676	1472	1482	1712	1731	1598	1430	1537
Undetached	332	343	373	327	330	381	385	355	318	342
Apartment	492	508	552	485	489	564	570	527	471	506
Continued	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Industry	367	361	350	394	340	354	355	448	374	430
Detached	1505	1480	1434	1616	1396	1450	1483	1 570	1804	1765
Undetached	335	329	319	359	310	322	432	470	381	291
Apartment	496	488	472	533	460	478	473	559	593	542

The amount of detailed activity data is still limited due to the few years of reported data in the ODIN system, during the next years more data will become available providing a better basis for extrapolating back in time.

Vehicle fires

Activity data for accidental vehicle fires is, like accidental building fires, given by The Danish Emergency Management Agency (DEMA). The activity data is categorised in cars (lighter than 3500 kg), buses, trucks, vans, motor homes, mobile homes, motorcycles/mopeds and tankers. These are gathered in five categories; passenger cars, buses, light duty vehicles (vans, motor homes, mobile homes), heavy duty vehicles (trucks and tankers) and motorcycles/mopeds.

The total number of registered vehicles is known for all years 1985-2009 (Statistics Denmark), but the number of vehicle fires is only known for the years 2007-2009. By assuming that the share of vehicle fires in relation to the total number of registered vehicles of the respective categories can be counted as constant, the number of vehicle fires is estimated for the years 1985-2006. The numbers of vehicle from 1980 to 1984 are extrapolated based on the years 1985 to 1989, where a clear trend has been visible this trend has been extrapolated (e.g. passenger cars), otherwise the average value of 1985 to 1989 has been used (e.g. buses). Table 7.21 states the total number of national registered vehicles, the number of vehicle fires and the average share of burned vehicles from 1980-2009.

Table 7.21 Different types of nationally registered vehicles and yearly numbers of vehicle fires.

	Passenger cars			Buses			Light duty vehicles		
Year	Registered nationally	Share, %	Fires	Registered nationally	Share, %	Fires	Registered nationally	Share, %	Fires
1980	1 475 109	0.086	1 272	8 070	0.432	35	169 728	0.033	56
1981	1 496 849	0.086	1 291	8 070	0.432	35	182 154	0.033	60
1982	1 518 590	0.086	1 310	8 070	0.432	35	194 579	0.033	64
1983	1 540 331	0.086	1 329	8 070	0.432	35	207 005	0.033	68
1984	1 562 072	0.086	1 347	8 070	0.432	35	219 431	0.033	72
1985	1 564 449	0.086	1 350	8 010	0.432	35	227 037	0.033	75
1986	1 617 832	0.086	1 396	8 105	0.432	35	246 427	0.033	81
1987	1 645 057	0.086	1 419	8 110	0.432	35	261 928	0.033	86
1988	1 654 128	0.086	1 427	8 093	0.432	35	271 541	0.033	90
1989	1 655 005	0.086	1 428	8 031	0.432	35	276 609	0.033	91
1990	1 645 587	0.086	1 420	8 109	0.432	35	280 081	0.033	92
1991	1 649 301	0.086	1 423	9 989	0.432	43	286 919	0.033	95
1992	1 659 929	0.086	1 432	11 259	0.432	49	294 006	0.033	97
1993	1 679 055	0.086	1 448	13 513	0.432	58	304 909	0.033	101
1994	1 672 177	0.086	1 442	14 261	0.432	62	314 193	0.033	104
1995	1 733 405	0.086	1 495	14 371	0.432	62	323 907	0.033	107
1996	1 793 158	0.086	1 547	14 594	0.432	63	331 998	0.033	109
1997	1 841 075	0.086	1 588	14 690	0.432	63	340 694	0.033	112
1998	1 878 032	0.086	1 620	14 894	0.432	64	351 765	0.033	116
1999	1 906 153	0.086	1 644	14 953	0.432	65	364 067	0.033	120
2000	1 916 686	0.086	1 653	15 051	0.432	65	379 322	0.033	125
2001	1 932 741	0.086	1 667	15 005	0.432	65	391 955	0.033	129
2002	1 946 353	0.086	1 679	14 971	0.432	65	406 576	0.033	134
2003	1 948 966	0.086	1 681	14 988	0.432	65	422 951	0.033	139
2004	1 967 642	0.086	1 697	14 991	0.432	65	452 945	0.033	149
2005	2 012 397	0.086	1 736	15 126	0.432	65	494 016	0.033	163
2006	2 064 000	0.086	1 780	15 148	0.432	65	540 454	0.033	178
2007	2 151 334	0.077	1 658	14 983	0.367	55	534 166	0.027	144
2008	2 182 217	0.091	1 991	14 802	0.459	68	535 452	0.037	197
2009	2 199 435	0.090	1 990	14 715	0.469	69	523 508	0.035	184

	Heavy duty vehicles			Motorcycles/mopeds		
Year	Registered nationally	Share, %	Fires	Registered nationally	Share, %	Fires
1980	47 428	0.320	152	410 461	0.185	759
1981	47 428	0.320	152	380 457	0.185	704
1982	47 428	0.320	152	350 453	0.185	648
1983	47 428	0.320	152	320 449	0.185	593
1984	47 428	0.320	152	290 446	0.185	537
1985	46 962	0.320	150	311 000	0.185	575
1986	48 431	0.320	155	180 395	0.185	334
1987	48 382	0.320	155	174 868	0.185	324
1988	46 980	0.320	150	169 456	0.185	314
1989	46 386	0.320	148	166 450	0.185	308
1990	45 664	0.320	146	163 255	0.185	302
1991	45 494	0.320	145	162 111	0.185	300
1992	45 510	0.320	146	158 362	0.185	293
1993	46 228	0.320	148	155 024	0.185	287
1994	47 329	0.320	151	152 405	0.185	282
1995	48 077	0.320	154	163 543	0.185	303
1996	48 319	0.320	155	174 479	0.185	323
1997	48 785	0.320	156	187 263	0.185	346

Continued						
1998	49 697	0.320	159	201 531	0.185	373
1999	50 443	0.320	161	214 820	0.185	397
2000	50 227	0.320	161	229 231	0.185	424
2001	49 885	0.320	160	238 695	0.185	442
2002	49 208	0.320	157	249 390	0.185	461
2003	48 616	0.320	155	251 731	0.185	466
2004	48 285	0.320	154	256 779	0.185	475
2005	49 286	0.320	158	256 779	0.185	475
2006	50 659	0.320	162	256 779	0.185	475
2007	51 716	0.263	136	256 779	0.153	392
2008	50 471	0.361	182	252 779	0.199	502
2009	46 464	0.336	156	247 779	0.204	505

The average weight of a passenger car, bus, light commercial vehicle and truck are known for every year back to 1993 (Statistics Denmark). The corresponding weights from 1980 to 1992 and the average weight of a unit from the category "motorcycles/mopeds" are estimated by an expert judgment. The total amount of vehicle involved in fires can then be calculated from the number of vehicle fires and the average weights of the different vehicle types. It is assumed that only 70 % of the total vehicle mass involved in a fire actually burns, see Table 7.22.

Table 7.22 Average vehicle mass involved in fires.

Year	**Passenger car fires**	Average weight, kg	**Bus fires**	Average weight, kg	**Light duty vehicle fires**	Average weight, kg
1980	1 272	850	35	10 000	56	2 000
1981	1 291	850	35	10 000	60	2 000
1982	1 310	850	35	10 000	64	2 000
1983	1 329	850	35	10 000	68	2 000
1984	1 347	850	35	10 000	72	2 000
1985	1 350	850	35	10 000	75	2 000
1986	1 396	850	35	10 000	81	2 000
1987	1 419	850	35	10 000	86	2 000
1988	1 427	850	35	10 000	90	2 000
1989	1 428	850	35	10 000	91	2 000
1990	1 420	850	35	10 000	92	2 000
1991	1 423	850	43	10 000	95	2 000
1992	1 432	850	49	10 000	97	2 000
1993	1 448	901	58	10 068	101	2 297
1994	1 442	908	62	10 512	104	2 382
1995	1 495	923	62	10 807	107	2 492
1996	1 547	935	63	10 899	109	2 638
1997	1 588	948	63	10 950	112	2 746
1998	1 620	964	64	10 960	116	2 848
1999	1 644	982	65	11 140	120	2 964
2000	1 653	999	65	11 195	125	3 103
2001	1 667	1 012	65	11 312	129	3 238
2002	1 679	1 024	65	11 387	134	3 333
2003	1 681	1 039	65	11 479	139	3 442
2004	1 697	1 052	65	11 572	149	3 561
2005	1 736	1 068	65	11 560	163	3 793
2006	1 780	1 086	65	11 684	178	4 120
2007	1 658	1 105	55	11 753	144	4 505
2008	1 991	1 122	68	11 700	197	4 710
2009	1 990	1 134	69	11 642	184	4 682

Year	**Heavy duty vehicle fires**	Average weight, kg	**Motorcycle/ moped fires**	Average weight, kg	**Total vehicle mass involved in fires, Mg**	**Total vehicle mass burnt, Mg**
1980	152	15 000	759	80	3 878	2 714
1981	152	15 000	704	80	3 897	2 728
1982	152	15 000	648	80	3 917	2 742
1983	152	15 000	593	80	3 937	2 756
1984	152	15 000	537	80	3 956	2 769
1985	150	15 000	575	80	3 941	2 759
1986	155	15 000	334	80	4 048	2 834
1987	155	15 000	324	80	4 076	2 853
1988	150	15 000	314	80	4 020	2 814
1989	148	15 000	308	80	3 992	2 795
1990	146	15 000	302	80	3 956	2 769
1991	145	15 000	300	80	4 036	2 825
1992	146	15 000	293	80	4 103	2 872
1993	148	14 732	287	85	4 325	3 028
1994	151	14 674	282	86	4 449	3 115
1995	154	14 801	303	86	4 619	3 233
1996	155	14 928	323	86	4 756	3 329
1997	156	14 987	346	88	4 878	3 414
1998	159	15 111	373	90	5 032	3 522
1999	161	15 223	397	92	5 182	3 627

Continued						
2000	161	15 214	424	93	5 250	3 675
2001	160	14 888	442	94	5 255	3 679
2002	157	14 486	461	95	5 226	3 658
2003	155	14 026	466	96	5 194	3 636
2004	154	13 599	475	97	5 212	3 649
2005	158	13 258	475	99	5 364	3 755
2006	162	13 179	475	103	5 616	3 931
2007	136	13 268	392	107	4 973	3 481
2008	182	13 246	502	113	6 425	4 498
2009	156	12 802	505	117	5 977	4 184

Emission factors

Building fires

For building fires, emissions are calculated by multiplying the number of full scale equivalent fires by the emission factors. The estimation of emissions is based on emission factors from literature. The estimation is based on the measurements and estimations performed in countries that are comparable with Denmark. By comparable is meant countries that have similar building traditions, in relation to the material used in building structure and interior.

In the process of selecting the best reliable emission factors for the calculation of the emissions from Danish accidental building fires, a range of different sources have been studied. Unfortunately it is difficult to do an interrelated comparison of the different sources because they all establish emission factors on different assumptions and many of these assumptions are not fully accounted for. Table 7.23 lists the emission factors that were chosen as the best reliable and their respective references.

Table 7.23 Emission factors building fires.

Emission	Unit	Detached houses	Undetached houses	Apartment buildings	Industrial buildings	Source
SO_2	kg pr fire	258.5	213.6	123.6	802.9	Blomqvist et al., 2002
NO_X	kg pr fire	19.3	15.9	8.0	45.0	NAEI, 2007
NMVOC	kg pr fire	96.5	79.5	40.2	225.0	NAEI, 2007
CO	kg pr fire	270.1	222.7	112.5	630.0	NAEI, 2007
NH_3	-	NA	NA	NA	NA	-
TSP	g pr fire	143.8	61.6	43.8	27.2	EEA, 2009
PM_{10}	g pr fire	143.8	61.6	43.8	27.2	EEA, 2009
$PM_{2.5}$	g pr fire	143.8	61.6	43.8	27.2	EEA, 2009
As	mg pr fire	1.35	0.58	0.41	0.25	EEA, 2009
Cd	mg pr fire	0.85	0.36	0.26	0.16	EEA, 2009
Cr	mg pr fire	1.29	0.55	0.39	0.24	EEA, 2009
Cu	mg pr fire	2.99	1.28	0.91	0.57	EEA, 2009
Hg	mg pr fire	0.85	0.36	0.26	0.16	EEA, 2009
Ni	-	NAV	NAV	NAV	NAV	-
Pb	mg pr fire	0.42	0.18	0.13	0.08	EEA, 2009
Se	-	NAV	NAV	NAV	NAV	-
Zn	-	NAV	NAV	NAV	NAV	-
HCB	-	NAV	NAV	NAV	NAV	-
PCDD/F	mg pr fire	3.05	2.52	1.27	7.13	Hansen, 2000
Benzo(b)fluoranthene	g pr fire	12.22	10.07	5.09	28.50	NAEI, 2007
Benzo(k)fluoranthene	g pr fire	4.31	3.55	1.79	10.05	NAEI, 2007
Benzo(a)pyrene	g pr fire	7.72	6.36	3.21	18.00	NAEI, 2007
Benzo(g,h,i)perylene	g pr fire	8.36	6.89	3.48	19.50	NAEI (2007)
Indeno(1,2,3-cd)pyrene	g pr fire	8.36	6.89	3.48	19.50	NAEI, 2007
PCB	-	NAV	NAV	NAV	NAV	-

NAV = not available, NA = not applicable.

Emission factors from the EMEP/EEA Guidebook (EEA, 2009) have not been altered as they were already specified for the four building types; detached houses, undetached houses, apartment buildings and industrial buildings.

A number of assumptions and factors that are non-accounted for were used to reach the emission factors in Claire (1999). The article only considers one building type of 1300 square feet, and the emission factors were therefore altered into matching the four building types stated in Table 7.19, 7.20 and 7.25. This alternation was performed simply by adjusting the average floor space for each of the four building types respectively, whereas factors like loss rate and pounds of combustible contents per square foot are not altered.

The average floor space in Danish buildings is stated in Table 7.24. The data is collected from Statistics Denmark and takes into account possible multiple building floors but not attics and basements. The average floor space in industrial buildings, schools etc. is estimated to 500 square meters for all years.

Table 7.24 Average floor space in building types.

Year	Detached	Undetached	Apartment
1980	154	130	74
1981	154	130	74
1982	154	130	74
1983	154	130	74
1984	154	130	75
1985	154	130	75
1986	155	129	75
1987	156	129	75
1988	156	129	75
1989	156	129	75
1990	156	129	75
1991	156	128	75
1992	155	128	75
1993	155	128	75
1994	155	128	75
1995	155	129	75
1996	155	129	75
1997	155	129	75
1998	155	130	75
1999	155	130	75
2000	156	131	75
2001	160	131	75
2002	161	131	75
2003	162	131	75
2004	163	132	75
2005	162	131	76
2006	163	132	76
2007	160	132	76
2008	161	133	77
2009	162	133	77

Statistics Denmark, BOL51 and BOL 511.

The Swedish source Persson et al. (1998) gives emission factors for NO_x and CO expressed as kg pr Mg of object burned and divided in three different objects; house, apartment and schools of average Swedish sizes. The data is based on the distribution of combustible material in the interior of the different building types, and does not take into account the combustible material in the structure itself. These emission factors are recalculated using Danish data for average building sizes, resulting in the subdivision of building types in detached, undetached, apartment and industrial buildings.

Persson et al. (1998) sets a rate of weight loss at 12.4 %, but does not specify any further on different building types. It seems quite unrealistic that the same rate of weight loss applies for houses and industrial buildings, resulting in the conclusion that there is most likely an overestimation on the emission factors for industrial buildings.

In 2002 a report on the further development of this data Blomqvist et al. (2002) was published, this report added data for the amount of combustible material in the building structure. The emission factors from this source is calculated by combining the estimated amount of combustible material in the building structure itself, with the amount of combustible material estimated in Persson et al. (1998) to be in the interior of the different building types. Again, Danish data for the average floor space in different building types is used to divided the emission factors into the four categories; detached houses, undetached houses, apartment buildings and industrial buildings.

The emission factors from both Persson et al. (1998) and Blomqvist et al. (2002) are probably overestimated due to building traditions, because wood is use to a further extent in Sweden and Norway contra Denmark.

The last three sources that were considered are all presented in mass emission per mass burned. For the calculation of these emission factors to a unit that is comparable with those of the emission factors from the other sources, the building masses are estimated using the same methodology as Hansen, 2000 and stated in Table 7.25 for 2009.

Table 7.25 Building mass pr building type.

	Unit	Detached house	Undetached house	Apartment building	Industry building
Average floor area*	m^2	162	133	77	500
Building mass pr floor area	kg/m^2	40	40	35	30
Total building mass	Mg/fire	6.5	5.3	2.7	15.0

* 2009 numbers

EIIP, 2001 gathers emission factors from the Californian EPA and the U.S. EPA, NAEI, 2007 represents the UK National Atmospheric Emissions Inventory and the UNEP toolkit.

Emission factors for particulate matter are available from the EMEP/EEA Guidebook (hereafter the Guidebook), EIIP (2001), Claire (1999) and NAEI (2007), giving four emission factors that vary from 0.14-51.4 kg PM per full scale fire of a detached house. The best reliable source in this case is believed to be the Guidebook which states both the PM_{10} and the $PM_{2.5}$ to be equal to the TSP. There is however the quite questionable relationship between the different building types that is claimed by the Guidebook. Comparing with the average floor areas shown in Table 7.24 and 7.25, it seems illogical that a fire in a detached house will cause more than twice the emission of a fire in an undetached house. That a full scale fire in an apartment building is expected to cause less than a third of the emission of that in a detached house, and that a large fire in an industrial building should cause less than a firth of the emission from a detached house, even keeping in mind an expected difference in the composition of the interior.

The Guidebook is the only found source of emission factors for the heavy metals arsenic, cadmium, cobber, chrome, lead and mercury, no emission factors were found for Ni, Se and Zn.

For the emission factor of dioxins and furans there are three sources. Hansen (2000) and UNEP toolkit provides data that are very similar with 50-1000 and 400 µg pr Mg respectively. In addition the Guidebook gives an emission factor of 0.0014 mg pr fire. Hansen (2000) is chosen as the best reliable source with an average of 475 µg pr Mg, translating to 3.05 mg pr fire for full scale detached house fires.

NAEI (2007) is the only source that provides data for PAHs, and that gives an emission factor for NMVOC. The total PAH emission factor sums the emissions of: benzo(b)flouranthene, benzo(k)flouranthene, benzo(a)pyrene, indeno(1,2,3-c,d)pyrene and benzo(ghi)perylene.

Being that Persson et al. (1998) and Blomqvist et al. (2002) are the only sources to a SO_x emission factor, Blomqvist et al. (2002) is the best available source as this provides a more recent and more detailed method.

Emission factors for NO_x and CO are provided by several sources EIIP (2001), Persson et al. (1998), Blomqvist et al. (2002), Claire (1999) and NAEI (2007). In the case of both compounds there is a good compliance between the emission factors provided by EIIP (2001), Claire (1999) and NAEI (2007). And in both cases the more recent factors of NAEI (2007) are selected.

No data was available for HCB and PCB. NH_3 is assumed not to be emitted.

Vehicle fires

In the process of selecting the best reliable emission factors for the calculation of the emissions from Danish vehicle fires, a range of different sources have been studied. Unfortunately it is difficult to do an interrelated comparison of the different sources because they all establish emission factors on different assumptions and many of these assumptions are not fully accounted for. Table 7.26 lists the accessible emission factors and their respective references.

Table 7.26 Emission factors vehicle fires.

	unit	Emission factor	Source
SO_2	kg pr Mg	5	Lönnermark et al., 2004
NO_x	kg pr Mg	2	Lemieux et al., 2004
NMVOC	kg pr Mg	8.5	Lönnermark et al., 2004
CO	kg pr Mg	63	Lönnermark et al., 2004
NH_3	-	NA	-
TSP	kg pr Mg	2.05	EEA, 2009
PM_{10}	kg pr Mg	2.05	EEA, 2009
$PM_{2.5}$	kg pr Mg	2.05	EEA, 2009
As	g pr Mg	0.26	Lönnermark et al., 2004
Cd	g pr Mg	1.7	Lönnermark et al., 2004
Cr	g pr Mg	3.8	Lönnermark et al., 2004
Cu	g pr Mg	27	Lönnermark et al., 2004
Hg	-	NAV	-
Ni	g pr Mg	2.8	Lönnermark et al., 2004
Pb	g pr Mg	820	Lönnermark et al., 2004
Se	-	NAV	-
Zn	g pr Mg	3 200	Lönnermark et al., 2004
HCB	-	NAV	-
PCDD/F	mg I-TEQ/Mg	0.0428	Hansen, 2000
Benzo(b)fluoranthene	g pr Mg	32.3	Lemieux et al., 2004
Benzo(k)fluoranthene	g pr Mg		Lemieux et al., 2004
Benzo(a)pyrene	g pr Mg	14.7	Lemieux et al., 2004
Benzo(g,h,i)perylene	g pr Mg	6.3	Lemieux et al., 2004
Indeno(1,2,3-cd)pyrene	g pr Mg	23.3	Lemieux et al., 2004
PCB	-	NAV	-

NAV = not available, NA = not applicable.

Being that NAEI (2007) has no references as to where they have collected data, this source of emission factors can not be counted as an additional indication in the cases where it shows a direct compliance with other sources. This leaves only the emission factors of NMVOC and PAHs. In the case of PAHs the experimentally obtained emission factors of Lemieux et al. (2004) is considered to be the best available.

In the case of NMVOC the best available source to an emission factor is considered to be Lönnermark et al. (2004).

PCDD/F has the best documented emission factor as eight sources were found for this group of compounds. The Guidebook gives an emission factor that is a factor 1000 lower than the other sources and Lönnermark et al. (2004) and Lemieux et al. (2004) give factors that are a factor 1000 and 100,000 higher than the major of the sources respectively. There is a very good compliance between the remaining five sources; Hansen (2000), UNEP toolkit (2005), NAEI (2007), Blomqvist et al. (2002) and Schleicher et al. (2004). Hansen (2000) is chosen as the source for the calculation of the PCDD/F emission from vehicle fires.

Lönnermark et al. (2004) is the only available source to emission factors for heavy metals (As, Cd, Cr, Cu, Hg, Ni, Pb, Se, Zn). Emission factors from this source were derived by both small-scale and full-scale tests.

There are three sources to particle matter emission factors: the EMEP/EEA Guidebook, Lönnermark et al. (2004) and Lemieux et al.

(2004). The two latter provides data of 38 and 50 kg pr Mg combusted vehicle respectively. The emission factor supplied by the Guidebook is given in kg pr fire and is therefore divided by the average weight of a passenger car in 2009, to give a factor that is better comparable; the resulting emission factor is of 2.0 kg pr Mg.

Persson et al. (1998) and Lönnermark et al. (2004) are the only available sources to SO_2 emission factors for vehicle fires. Since Lönnermark et al. (2004) is the more resent source and establishes its emission factors on experimental data, this is chosen as the best reliable source.

Persson et al. (1998) and Lemieux et al. (2004) delivers very similar emission factors for NO_x, the more resent Lemieux et al. (2004) is chosen as the most reliable.

Emission factors for CO are available from the same two sources and from Lönnermark et al. (2004); in this case Lönnermark et al. (2004) and Lemieux et al. (2004) deliver the same factor. Lönnermark et al. (2004) is chosen as the best available source since it is based on experimental data.

No data was available for Hg, Se, HCB and PCB. NH_3 is assumed not to be emitted.

Emissions

The dioxin emission is given in I-TEQ; i.e. International Toxicity Equivalents, which is a weighted addition of congener toxicity with reference to 2,3,7,8-TCDD (Seveso-dioxin).

Building fires

Table 7.27a, b and c shows the total national emissions from building fires from the years 1980-2009.

Table 7.27a National emissions from building fires – 1980 to 1989.

	unit	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
SO_2	Mg	839.31	839.76	840.22	840.68	841.14	841.59	842.05	842.51	842.96	892.94
NO_x	Mg	56.39	56.42	56.45	56.48	56.51	56.54	56.57	56.60	56.63	59.99
NMVOC	Mg	281.94	282.09	282.24	282.40	282.55	282.70	282.86	283.01	283.16	299.95
CO	Mg	789.42	789.85	790.28	790.71	791.14	791.57	792.00	792.43	792.86	839.86
TSP	Mg	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.29
PM_{10}	Mg	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.29
$PM_{2.5}$	Mg	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.29
As	kg	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003
Cd	kg	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002
Cr	kg	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.003
Cu	kg	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006
Hg	kg	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002
Pb	kg	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
PCDD/F	g I-TEQ	8.93	8.93	8.94	8.94	8.95	8.95	8.96	8.96	8.97	9.50
Benzo(b)fluoranthene	kg	35.71	35.73	35.75	35.77	35.79	35.81	35.83	35.85	35.87	37.99
Benzo(k)fluoranthene	kg	12.59	12.60	12.61	12.61	12.62	12.63	12.63	12.64	12.65	13.40
Benzo(a)pyrene	kg	22.55	22.57	22.58	22.59	22.60	22.62	22.63	22.64	22.65	24.00
Benzo(g,h,i)perylene	kg	24.43	24.45	24.46	24.47	24.49	24.50	24.51	24.53	24.54	26.00
Indeno(1,2,3-cd)pyrene	kg	24.43	24.45	24.46	24.47	24.49	24.50	24.51	24.53	24.54	26.00

Table 7.27b National emissions from building fires – 1990 to 1999.

	unit	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
SO_2	Mg	809.32	836.13	909.10	798.77	804.23	929.02	939.14	866.89	775.81	833.71
NO_x	Mg	54.37	56.17	61.08	53.66	54.03	62.41	63.09	58.24	52.12	56.01
NMVOC	Mg	271.86	280.87	305.38	268.32	270.15	312.07	315.47	291.20	260.61	280.05
CO	Mg	761.22	786.43	855.07	751.29	756.43	873.80	883.32	815.36	729.69	784.15
TSP	Mg	0.27	0.28	0.30	0.26	0.26	0.31	0.31	0.29	0.26	0.27
PM_{10}	Mg	0.27	0.28	0.30	0.26	0.26	0.31	0.31	0.29	0.26	0.27
$PM_{2.5}$	Mg	0.27	0.28	0.30	0.26	0.26	0.31	0.31	0.29	0.26	0.27
As	kg	0.002	0.003	0.003	0.002	0.002	0.003	0.003	0.003	0.002	0.003
Cd	kg	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002
Cr	kg	0.002	0.002	0.003	0.002	0.002	0.003	0.003	0.003	0.002	0.002
Cu	kg	0.006	0.006	0.006	0.005	0.006	0.006	0.006	0.006	0.005	0.006
Hg	kg	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002
Pb	kg	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
PCDD/F	g I-TEQ	8.61	8.89	9.67	8.50	8.55	9.88	9.99	9.22	8.25	8.87
Benzo(b)fluoranthene	kg	34.44	35.58	38.68	33.99	34.22	39.53	39.96	36.89	33.01	35.47
Benzo(k)fluoranthene	kg	12.14	12.55	13.64	11.98	12.07	13.94	14.09	13.01	11.64	12.51
Benzo(a)pyrene	kg	21.75	22.47	24.43	21.47	21.61	24.97	25.24	23.30	20.85	22.40
Benzo(g,h,i)perylene	kg	23.56	24.34	26.47	23.25	23.41	27.05	27.34	25.24	22.59	24.27
Indeno(1,2,3-cd)pyrene	kg	23.56	24.34	26.47	23.25	23.41	27.05	27.34	25.24	22.59	24.27

Table 7.27c National emissions from building fires – 2000 to 2009.

	unit	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
SO_2	Mg	816.40	803.09	777.80	876.73	757.12	786.79	818.61	935.53	921.63	930.89
NO_x	Mg	54.85	53.95	52.26	58.90	50.87	52.86	55.22	62.44	62.47	62.39
NMVOC	Mg	274.24	269.77	261.28	294.51	254.33	264.29	276.11	312.21	312.37	311.96
CO	Mg	767.88	755.36	731.57	824.62	712.12	740.02	773.10	874.19	874.65	873.49
TSP	Mg	0.27	0.26	0.26	0.29	0.25	0.26	0.27	0.29	0.32	0.31
PM_{10}	Mg	0.27	0.26	0.26	0.29	0.25	0.26	0.27	0.29	0.32	0.31
$PM_{2.5}$	Mg	0.27	0.26	0.26	0.29	0.25	0.26	0.27	0.29	0.32	0.31
As	kg	0.003	0.002	0.002	0.003	0.002	0.002	0.003	0.003	0.003	0.003
Cd	kg	0.002	0.002	0.002	0.002	0.001	0.002	0.002	0.002	0.002	0.002
Cr	kg	0.002	0.002	0.002	0.003	0.002	0.002	0.002	0.003	0.003	0.003
Cu	kg	0.006	0.005	0.005	0.006	0.005	0.005	0.006	0.006	0.007	0.006
Hg	kg	0.002	0.002	0.002	0.002	0.001	0.002	0.002	0.002	0.002	0.002
Pb	kg	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
PCDD/F	g I-TEQ	8.68	8.54	8.27	9.33	8.05	8.37	8.74	9.89	9.89	9.88
Benzo(b)fluoranthene	kg	34.74	34.17	33.09	37.30	32.22	33.48	34.97	39.55	39.57	39.52
Benzo(k)fluoranthene	kg	12.25	12.05	11.67	13.15	11.36	11.81	12.33	13.95	13.95	13.93
Benzo(a)pyrene	kg	21.94	21.58	20.90	23.56	20.35	21.14	22.09	24.98	24.99	24.96
Benzo(g,h,i)perylene	kg	23.77	23.38	22.64	25.52	22.04	22.91	23.93	27.06	27.07	27.04
Indeno(1,2,3-cd)pyrene	kg	23.77	23.38	22.64	25.52	22.04	22.91	23.93	27.06	27.07	27.04

Vehicle fires

Table 7.28a, b and c shows the total national emissions from vehicle fires from the years 1980-2009.

Table 7.28a National emissions from vehicle fires – 1980 to 1989.

	unit	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
SO_2	Mg	13.57	13.64	13.71	13.78	13.85	13.79	14.17	14.26	14.07	13.97
NO_X	Mg	5.43	5.46	5.48	5.51	5.54	5.52	5.67	5.71	5.63	5.59
NMVOC	Mg	23.07	23.19	23.31	23.42	23.54	23.45	24.09	24.25	23.92	23.75
CO	Mg	171.00	171.87	172.74	173.61	174.48	173.81	178.54	179.74	177.28	176.06
TSP	Mg	5.56	5.59	5.62	5.65	5.68	5.65	5.81	5.85	5.77	5.73
PM_{10}	Mg	5.56	5.59	5.62	5.65	5.68	5.65	5.81	5.85	5.77	5.73
$PM_{2.5}$	Mg	5.56	5.59	5.62	5.65	5.68	5.65	5.81	5.85	5.77	5.73
As	kg	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04
Cd	kg	0.25	0.25	0.25	0.25	0.25	0.25	0.26	0.26	0.26	0.26
Cr	kg	0.54	0.55	0.55	0.55	0.55	0.55	0.57	0.57	0.56	0.56
Cu	kg	4.07	4.09	4.11	4.13	4.15	4.14	4.25	4.28	4.22	4.19
Ni	kg	0.41	0.41	0.41	0.41	0.42	0.41	0.43	0.43	0.42	0.42
Pb	kg	119.43	120.04	120.64	121.25	121.86	121.39	124.69	125.53	123.81	122.96
Zn	kg	469.58	471.97	474.35	476.74	479.12	477.29	490.27	493.56	486.80	483.46
PCDD/F	g I-TEQ	0.11	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12
Benzo(b)fluoranthene	kg	43.84	44.06	44.28	44.50	44.73	44.56	45.77	46.08	45.44	45.13
Benzo(k)fluoranthene	kg	43.84	44.06	44.28	44.50	44.73	44.56	45.77	46.08	45.44	45.13
Benzo(a)pyrene	kg	39.90	40.10	40.31	40.51	40.71	40.56	41.66	41.94	41.36	41.08
Benzo(g,h,i)perylene	kg	17.10	17.19	17.27	17.36	17.45	17.38	17.85	17.97	17.73	17.61
Indeno(1,2,3-cd)pyrene	kg	63.24	63.57	63.89	64.21	64.53	64.28	66.03	66.47	65.56	65.11

Table 7.28b National emissions from vehicle fires – 1990 to 1999.

	unit	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
SO_2	Mg	13.85	14.13	14.36	15.14	15.57	16.17	16.65	17.07	17.61	18.14
NO_X	Mg	5.54	5.65	5.74	6.06	6.23	6.47	6.66	6.83	7.04	7.25
NMVOC	Mg	23.54	24.01	24.42	25.74	26.47	27.48	28.30	29.02	29.94	30.83
CO	Mg	174.45	177.99	180.96	190.75	196.22	203.69	209.74	215.10	221.91	228.52
TSP	Mg	5.68	5.79	5.89	6.21	6.38	6.63	6.82	7.00	7.22	7.43
PM_{10}	Mg	5.68	5.79	5.89	6.21	6.38	6.63	6.82	7.00	7.22	7.43
$PM_{2.5}$	Mg	5.68	5.79	5.89	6.21	6.38	6.63	6.82	7.00	7.22	7.43
As	kg	0.04	0.04	0.04	0.04	0.04	0.05	0.05	0.05	0.05	0.05
Cd	kg	0.25	0.26	0.26	0.28	0.29	0.30	0.31	0.31	0.32	0.33
Cr	kg	0.55	0.57	0.57	0.61	0.62	0.65	0.67	0.68	0.70	0.73
Cu	kg	4.15	4.24	4.31	4.54	4.67	4.85	4.99	5.12	5.28	5.44
Ni	kg	0.42	0.42	0.43	0.45	0.47	0.48	0.50	0.51	0.53	0.54
Pb	kg	121.84	124.31	126.39	133.22	137.04	142.26	146.48	150.23	154.99	159.60
Zn	kg	479.06	488.76	496.93	523.81	538.83	559.34	575.95	590.68	609.38	627.53
PCDD/F	g I-TEQ	0.12	0.12	0.12	0.13	0.13	0.14	0.14	0.14	0.15	0.15
Benzo(b)fluoranthene	kg	44.72	45.63	46.39	48.90	50.30	52.22	53.77	55.14	56.89	58.58
Benzo(k)fluoranthene	kg	44.72	45.63	46.39	48.90	50.30	52.22	53.77	55.14	56.89	58.58
Benzo(a)pyrene	kg	40.71	41.53	42.23	44.51	45.79	47.53	48.94	50.19	51.78	53.32
Benzo(g,h,i)perylene	kg	17.45	17.80	18.10	19.08	19.62	20.37	20.97	21.51	22.19	22.85
Indeno(1,2,3-cd)pyrene	kg	64.52	65.83	66.93	70.55	72.57	75.33	77.57	79.55	82.07	84.52

Table 7.28c National emissions from vehicle fires – 2000 to 2009.

	unit	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
SO_2	Mg	18.37	18.39	18.29	18.18	18.24	18.77	19.66	17.41	22.49	20.92
NO_X	Mg	7.35	7.36	7.32	7.27	7.30	7.51	7.86	6.96	9.00	8.37
NMVOC	Mg	31.24	31.27	31.09	30.91	31.01	31.92	33.41	29.59	38.23	35.56
CO	Mg	231.52	231.75	230.45	229.06	229.87	236.56	247.66	219.31	283.34	263.60
TSP	Mg	7.53	7.54	7.50	7.45	7.48	7.70	8.06	7.13	9.22	8.58
PM_{10}	Mg	7.53	7.54	7.50	7.45	7.48	7.70	8.06	7.13	9.22	8.58
$PM_{2.5}$	Mg	7.53	7.54	7.50	7.45	7.48	7.70	8.06	7.13	9.22	8.58
As	kg	0.05	0.05	0.05	0.05	0.05	0.05	0.06	0.05	0.06	0.06
Cd	kg	0.34	0.34	0.34	0.33	0.34	0.35	0.36	0.32	0.41	0.38
Cr	kg	0.73	0.74	0.73	0.73	0.73	0.75	0.79	0.70	0.90	0.84
Cu	kg	5.51	5.52	5.49	5.45	5.47	5.63	5.90	5.22	6.75	6.28
Ni	kg	0.55	0.55	0.55	0.55	0.55	0.56	0.59	0.52	0.67	0.63
Pb	kg	161.70	161.86	160.95	159.98	160.54	165.22	172.97	153.17	197.89	184.10
Zn	kg	635.76	636.39	632.82	629.02	631.22	649.61	680.09	602.23	778.07	723.85
PCDD/F	g I-TEQ	0.16	0.16	0.15	0.15	0.15	0.16	0.17	0.15	0.19	0.18
Benzo(b)fluoranthene	kg	59.35	59.41	59.08	58.72	58.93	60.64	63.49	56.22	72.63	67.57
Benzo(k)fluoranthene	kg	59.35	59.41	59.08	58.72	58.93	60.64	63.49	56.22	72.63	67.57
Benzo(a)pyrene	kg	54.02	54.08	53.77	53.45	53.64	55.20	57.79	51.17	66.11	61.51
Benzo(g,h,i)perylene	kg	23.15	23.18	23.04	22.91	22.99	23.66	24.77	21.93	28.33	26.36
Indeno(1,2,3-cd)pyrene	kg	85.62	85.71	85.23	84.72	85.01	87.49	91.60	81.11	104.79	97.49

7.4.6 References

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7.4.7 Other combustion

Other combustion sources include open burning of yard waste and wild fires.

In Denmark, the open burning of private yard waste is under different restrictions according to the respective municipality. These restrictions involve what can be burned but also the quantity, how, when and where or in some cases a complete banning. There is no registration of private waste burning and the activity data on this subject are very difficult to estimate. People are generally appealed to compost their yard waste or to dispose of it through one of the many waste disposal/recycling sites.

The occurrence of bonfires at midsummer night and in general are likewise not registered, therefore it has not been possible to obtain activity data.

Due to the cold and wet climate conditions in Denmark wild fires very seldom occurs. Controlled burnings are completely prohibited and the occasional wild fires are of such a small scale that this activity is assumed negligible.

7.4.8 Uncertainties and time-series consistency

Compost production

The following Table 7.29 lists the uncertainties for composting activity data and emission factors.

Table 7.29 Uncertainties composting.

Pollutant	Activity data, %	Emission factor, %
CO	50	100
NH_3	50	100

Accidental fires

The uncertainty of the total number of accidental fires is miniscule, but the division into building and transportation types might lead to a small uncertainty, primarily caused by the category "other". The uncertainty for both building and vehicle activity data is therefore set to 10 %. The uncertainty is lowest for recent years. The uncertainties on the emission factors used in this inventory, and at the present level of available information, are shown in Table 7.30.

Table 7.30 Uncertainties Accidental fires.

Pollutant	Activity data, %	Building fires, %	Vehicle fires, %
SO_2	10	500	500
NO_x	10	700	500
NMVOC	10	700	500
CO	10	700	500
TSP	10	700	700
PM_{10}	10	700	700
$PM_{2.5}$	10	700	700
As	10	700	500
Cd	10	700	500
Cr	10	700	500
Cu	10	700	500
Hg	10	700	-
Ni	10	-	500
Pb	10	700	500
Zn	10	-	500
PCDD/F	10	100	100
Benzo(b)fluoranthene	10	700	500
Benzo(k)fluoranthene	10	700	500
Benzo(a)pyrene	10	700	500
Benzo(g,h,i)perylene	10	700	500
Indeno(1,2,3-cd)pyrene	10	700	500
PCB	10	-	-

Uncertainty results

Table 7.31 Uncertainty results for waste other

Pollutant	Uncertainty total emission [%]	Trend 1990-2009 (2000-2009) [%]	Uncertainty trend [%-age points]
SO_2	±489.2	15.6	±16.5
NO_x	±620.1	18.1	±30.0
NMVOC	±630.5	17.6	±27.3
CO	±390.3	46.9	±160.2
NH_3	±111.8	188.4	±203.9
TSP	±676.3	13.9	±15.6
PM_{10}	±676.3	13.9	±15.6
$PM_{2.5}$	±676.3	13.9	±15.6
±As	±477.8	48.9	±26.6
Cd	±497.8	50.9	±21.3
Cr	±498.5	50.9	±21.3
Cu	±499.6	51.1	±21.3
Hg	±700.1	15.3	±16.3
Ni	±500.1	51.1	±21.4
Pb	±500.1	51.1	±21.4
Zn	±500.1	51.1	±21.4
PCDD/F	±98.7	15.2	±16.0
benzo(b)flouranthene	±407.8	35.3	±77.8
benzo(k)flouranthene	±431.5	43.3	±55.0
benzo(a)pyrene	±409.1	38.4	±72.2
benzo(g,h,i)perylene	±432.0	30.2	±77.1
indeno(1,2,3-c,d)pyrene	±420.0	41.4	±63.1

7.4.9 QA/QC and verification

QA/QC-procedure

The methodology for estimating emissions from other waste was introduced for the first time in the inventory submission in 2009. Data in this methodology currently involves activity data for 1990-2009 as presented in the preceding sections.

In general terms, for this part of the inventory, the Data Storage (DS) Level 1 and 2 and the Data Processing (DP) Level 1 can be described as follows:

Data Storage Level 1

The external data level refers to the placement of input data used for deriving yearly activity and emission factors; references in terms of report and databases used for deriving input for the emission calculations. Reports and a list of links to external data sources are stored in a common data storage system including all sectors of the yearly NIRs.

Table 7.32 Overview of yearly stored external data sources at DS level1.

http, file or folder name	Description	AD or EF	Reference	Contact	Data agreement/ Comment
http://www.statistikbanken.dk/BOL511	Average floor space in buildings	AD	Statistics Denmark	Katja Hjelgaard kahj@dmu.dk	Public access
https://statistikbank.brs.dk/sb/main/p/a0109	Categorised fires	AD	The Danish Emergency Management Agency	Steen Hjere Nonnemann shn@beredskabsstyrelsen.dk	Public access
http://www.statistikbanken.dk/BOL11 http://www.statistikbanken.dk/BOL3 http://www.statistikbanken.dk/BOL33 http://www.statistikbanken.dk/BYGB11	Building type statistics	AD	Statistics Denmark	Katja Hjelgaard kahj@dmu.dk	Public access
http://www.statistikbanken.dk/BIL10 http://www.statistikbanken.dk/BIL12 http://www.statistikbanken.dk/BIL15 http://www.statistikbanken.dk/BIL18	Weight categorisation of vehicles (passenger cars, busses, vans and trucks)	AD	Statistics Denmark	Katja Hjelgaard kahj@dmu.dk	Public access
http://www2.mst.dk/udgiv/publikationer/2010/978-87-92668-21-9/pdf/978-87-92668-22-6.pdf	Waste categories for composting	AD	Danish Environmental Protection Agency (DEPA), Waste Statistics	Katja Hjelgaard kahj@dmu.dk	Public access

Data Processing Level 1

This level, for waste other, comprises a stage where the external data are treated internally, adjusting the activity data to match the available emission factors.

Points of measurement

The present stage of QA/QC for the Danish emission inventories for waste other is described below for DS and DP level 1 Points of Measurement (PMs). This is to be seen in connection with the general QA/QC description in Section 1.6.

Data Storage level 1	1. Accuracy	DS.1.1.1	General level of uncertainty for every dataset including the reasoning for the specific values

Tier 1 uncertainty calculations have been performed. The level of uncertainty is generally low for activity data but higher for emission factors.

Data Storage Level 1	1. Accuracy	DS.1.1.2	Quantification of the uncertainty level of every single data value including the reasoning for the specific values.

There are no available uncertainties from the IPCC GL or GPG or the sources used to calculate the emission inventories for waste other. All uncertainties are achieved by expert judgements.

Data Storage level 1	2.Comparability	DS.1.2.1	Comparability of the data values with similar data from other countries, which are comparable with Denmark, and evaluation of discrepancy.

Some comparison of Danish data values with data sources from other countries has been carried out for activity data and emission factors.

Data Storage level 1	3.Completeness	DS.1.3.1	Documentation showing that all possible national data sources are included by setting down the reasoning behind the selection of datasets.

This category is a catch all for the waste sector and there are still sources that are not covered.

Data Storage level 1	4.Consistency	DS.1.4.1	The origin of external data has to be preserved whenever possible without explicit arguments (referring to other PMs).

The origin of external activity data has been preserved as much as possible. Files are saved for each year of reporting, in this way changes to previously received data and calculations is reflected and explanations are given.

Data Storage level 1	6.Robustness	DS.1.6.1	Explicit agreements between the external institution holding the data and NERI about the conditions of delivery.

No explicit agreement has been made. The data collected for the emission inventories of waste other are publicly available.

Data Storage level 1	7.Transparency	DS.1.7.1	Summary of each dataset including the reasoning for selecting the specific dataset

A summary of the data set can be seen in section 7.4.2 and 7.4.4. For the reasoning behind the selection of the specific dataset, refer to DS 1.3.1.

Data Storage level 1	7.Transparency	DS.1.7.3	References for citation for any external dataset have to be available for any single value in any dataset.

These references exist in the description given in the Section 7.4.2 and 7.4.4, under methodology.

Data Storage level 1	7.Transparency	DS.1.7.4	Listing of external contacts for every data-set

Contact persons related to the delivery of data for waste other are, Steen Hjere Nonnemann from The Danish Emergency Management Agency (shn@beredskabsstyrelsen.dk), all data used for the emission calculations in this category are accessible to the public and contact persons have therefore not been established.

Data Processing level 1	1. Accuracy	DP.1.1.1	Uncertainty assessment for every data source as input to Data Storage level 2 in relation to type of variability. (Distribution as: normal, log normal or other type of variability)

Tier 1 uncertainty calculations are made. The use of the Tier 1 methodology presumes a normal distribution of activity data and emission factor variability. Uncertainties are reported in section 7.4.6.

Data Processing level 1	1. Accuracy	DP.1.1.2	Uncertainty assessment for every data source as input to Data Storage level 2 in relation to scale of variability (size of variation intervals)

The uncertainty assessment has been given in Section 7.4.6.

Data Processing level 1	1. Accuracy	DP.1.1.3	Evaluation of the methodological approach using international guidelines

There is no available information in the international guidelines for the emission inventories of waste other.

Data Processing level 1	1. Accuracy	DP.1.1.4	Verification of calculation results using guideline values

There are no useful guideline values.

Data Processing level 1	2.Comparability	DP.1.2.1	The inventory calculation has to follow the international guidelines suggested by the UNFCCC and IPCC.

The inventory calculations are a simple multiplication of activity data and emission factors.

Data Processing level 1	3.Completeness	DP.1.3.1	Assessment of the most important quantitative knowledge which is lacking.

Activity data for accidental fires for the years 1990-2005 are not subcategorised into vehicles, buildings or sizes. Emission factors for calculation of emissions could always be newer and better.

Data Processing level 1	3.Completeness	DP.1.3.2	Assessment of the most important cases where access is lacking with regard to critical data sources that could improve quantitative knowledge.

There is no direct data to elucidate the points mentioned under DP.1.3.1.

Data Processing level 1	4.Consistency	DP.1.4.1	In order to keep consistency at a high level, an explicit description of the activities needs to accompany any change in the calculation procedure.

There is no change in calculation procedure during the time-series and the activity data is, as far as possible, kept consistent for the calculation of the time-series.

Data Processing level 1	5.Correctness	DP.1.5.1	Show at least once, by independent calculation, the correctness of every data manipulation.

The calculations have been checked by comparing with the similar calculations from other countries.

Data Processing level 1	5.Correctness	DP.1.5.2	Verification of calculation results using time-series

The time-series of activities and emissions in the output, in the SNAP source categories and in the NFR format have been prepared. The time-series are examined and significant changes are checked and explained.

Data Processing level 1	5.Correctness	DP.1.5.3	Verification of calculation results using other measures

The correct interpretation in the calculation of the methodology has been checked.

Data Processing level 1	5.Correctness	DP.1.5.4	Shows one-to-one correctness between external data sources and the databases at Data Storage level 2

Data transfer control is made from the external data sources and to the SNAP source categories at level 2. This control is carried on further to the aggregated NFR source categories.

Data Processing level 1	7.Transparency	DP.1.7.1	The calculation principle and equations used must be described

The calculation principle and equations are described in Section 7.4.2 and 7.4.4.

Data Processing level 1	7.Transparency	DP.1.7.2	The theoretical reasoning for all methods must be described

The calculation principle and equations are described in Section 7.4.2 and 7.4.4.

Data Processing level 1	7.Transparency	DP.1.7.3	Explicit listing of assumptions behind all methods

For the emission calculation for compost production it is assumed that:

- all facilities can be considered as using windrow composting,
- 28 % of all residential buildings with private gardens (including weekend cabins) are actively contributing to home composting,
- 14 % of all multi-dwelling houses are actively contributing to home composting,
- 50 kg waste pr year will in average be composted at every contributing residential building,
- 10 kg waste pr year will in average be composted at every contributing multi-dwelling house,
- there is 37.5 % DOC in dry matter, 2 % N in dry matter and 50 % moisture in the waste.

For the emission calculation for accidental building fires it is assumed that:

- a medium and a small fire leads to 50 % and 5 % of a large fire respectively, and that a large fire is a full scale fire,
- a large fire is a fire that involves the use of two or more fire hoses for fire extinguishing and that it typically involve a complete house, one or more apartments, or at least part of an industrial complex,
- a medium size fire is a fire involving the use of only 1 fire hose for fire-fighting and that it will typically involve a part of a single room in an apartment or house,
- a small size fire is a fire that was extinguished before the arrival of the fire service, extinguished by small tools or a chimney fire,
- the share of building fires in respect to the total number of registered fires, can be considered as constant for every year back to 1990,
- the average shares of building categories (industrial building, detached house, undetached house and apartment building) are representative for all years back to 1990.

For the emission calculation for accidental vehicle fires it is assumed that:

- all the different vehicle types leads to similar emissions,
- the share of vehicle fires in relation to the total number of registered vehicles of the respective categories can be counted as constant,
- that only 70 % of the total vehicle mass involved in a fire actually burns.

Data Processing level 1	7.Transparency	DP.1.7.4	Clear reference to dataset at Data Storage level 1

Refer to the Table 7.32 and DS.1.1.1 above.

Data Processing level 1	7.Transparency	DP.1.7.5	A manual log to collect information about recalculations

Recalculation changes in the emission inventories are described in the IIR. The logging of the changes takes place in the yearly model file.

Data Storage level 2	5.Correctness	DS.2.5.1	Documentation of a correct connection between all data types at level 2 to data at level 1

The full documentation for the correct connection exists through the yearly model file, its output and report files made by the CollectER database system.

Data Storage level 2	5.Correctness	DS.2.5.2	Check if a correct data import to level 2 has been made

This check is performed, comparing output and report files made by the CollectER database system, refer to DS.2.5.1.

Source-specific recalculations

The calculation of emissions from accidental fires of both buildings and vehicles has been added the additional data year of 2009. This extra detailed dataset has influenced the activity data for building and vehicle fires for the years 1990-2005. The total number of building fires has with this recalculation increased with 0.69 – 0.70 %.

The activity data for accidental vehicle fires has increased more drastically with the peek of 7.1 % in 1993. This increase is caused by a change in data delivery of the population of the different vehicle types.

Source-specific planned improvements

Estimations of emissions from accidental landfill fires are under investigation.

Source-specific performed improvements

Source-specific QA/QC and verification have been performed.

8 Other and natural emissions

Denmark does not report emissions in the NFR category "Other" (NFR 7). Regarding natural emissions volcanoes do not occur in Denmark and hence is reported as NO (not occurring).

Emissions from forest fires are for most years negligible but have not been estimated. Any other natural emissions to be reported under NFR category 11C have also not been estimated.

9 Reporting spatially distributed emissions on grid

9.1 Background for reporting

Geographically distributed emissions, has been reported in 2007 to the UNECE LRTAP Convention for the years 1990, 1995, 2000 and 2005. Emission data are disaggregated to the standard EMEP grid with a resolution of 50km x 50km. Mandatory reporting are following 14 air pollutants: SO_x, NO_x, NH_3, NMVOC, CO, TSP, PM_{10}, $PM_{2.5}$, Pb, Cd, Hg, DIOX, PAH and HCB. The reporting includes gridded data for sector totals as well as totals for all sectors together. Guidelines for reporting air emissions on grid are given in UN (2003). Gridded emission data are used in integrated European air pollution models, e.g. RAINS/GAINS and EMEP's chemical transport models. Table 8.1 lists the categories (sectors) used for reporting emission data on grid based on the Danish inventories.

Table 8.1 Categories used for reporting gridded emission data according to the guidelines from United Nations.

Categories for Gridding		UN categories used for DK reporting
01	Combustion in Power Plants and Industry	√
02a	Transport above 1000m	√
02b	Transport below 1000m	√
03	Commercial Residential and Other Stationary Combustion	√
04	Fugitive Emissions from Fuels	√
05	Industrial Processes	√
06	Solvents and other product use	√
07	Agriculture	√
08	Waste	√
09	Other	-
	Natural	-

The gridded emission data from the 2007 reporting are available at the EIONET homepage. Further, the methodology is described in a Danish langued report by Jensen et al. (2008).

9.2 Methods and data for disaggregation of emission data

In the present work geographic data was used as proxies positioning the activity, which causes the emission. As an example we used a geographic data set for land cover of forest for distributing emissions from forest machinery.

Based on the theme of forest land cover, fractions of forest in each grid cell were calculated, and the total emission from forest machinery was distributed in harmony with the fractions of forest in each grid cell. A similar methodology was used for distributing emissions from other categories.

An explanation of the applied methodology in greater detail is available in Jensen et al. (2008). A wide range of different geographic data sets has been applied in the mapping procedure. The most essential data are listed in Table 8.2.

Table 8.2 List of different geographic data used in the mapping exercise.

Data owner	Data set	Contents
The National Survey and Cadastre	Topographic map	Geo-referenced basic map layers on administrative units, Land cover, territorial borders, coastline and infrastructure.
National Agency for Enterprise and Construction	Central Dwelling and Building Register (Danish abbreviation BBR)	Geo-referenced information on dwellings and buildings
The Directorate for Food, Fisheries and Agri Business	The Central Husbandry Register (CHR)	Geo-referenced information on stock of livestock at farm level
The Directorate for Food, Fisheries and Agri Business	The General Agricultural Register (GLR)	Geo-referenced information on agricultural fields
National Environmental Research Institute	Large Point Sources (LPS)	Geo-referenced information on power plants and large industrial plants
Danish Forest and Nature Agency	Military training terrain	Geo-referenced information on military training terrains

The disaggregation was as far as possible done at the SNAP level within the different reporting categories listed in Table 7.1. The disaggregation at the highly detailed SNAP level was later aggregated to the reporting categories (sector totals), and these were again further aggregated to national totals for all sectors. It is worth to mention that the composition of the predefined reporting categories for gridded emission data are not fully compatible with the categories used in the NFR-schemes for annual reporting of emission data[11] to UNECE.

9.3 Maps with geographical distributed emission data

It is not possible in this section to present all maps for all reporting years and sectors. Therefore, we choose to show national totals for selected air pollutants from the latest reporting year (2005). The selected air pollutants are: Ammonia (NH_3), sulphur dioxide (SO_2), nitrogen dioxide (NO_2) and small particulate matter ($PM_{2.5}$). Figure 8.1 shows the geographical distributed emissions for these air pollutants. Even from the national distributed totals, spatial patterns from the major sectors are recognisable.

[11] The annual reporting of emission data to UNECE includes all air pollutants except greenhouse gases.

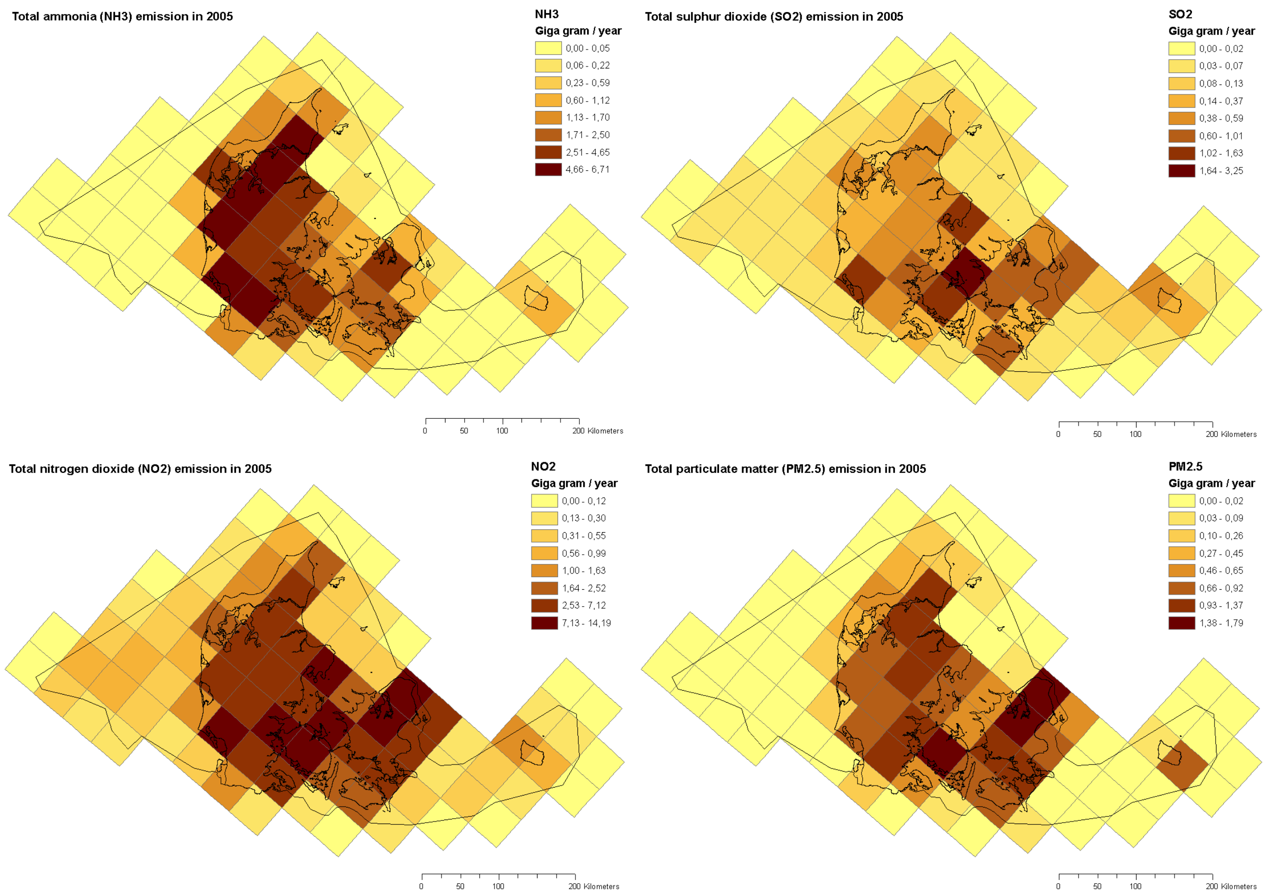

Figure 8.1 Geographical distribution of national emissions of NH_3, SO_2, NO_2 and $PM_{2.5}$ in 2005.

The agricultural sector is the major contributor to the national total NH_3 emission. Emission of NH_3 is mainly related to livestock farming and especially to the handling of manure from the animals. Emissions of NH_3 are therefore related to storage and spreading of manure as well as emissions from stables (Mikkelsen et al., 2006). The geographical pattern of the NH_3 emission is in good agreement with the localisation and concentration of the Danish livestock farming in the northern and western part of Jutland.

The geographical distribution of SO_2 reflects mainly the localisation of large power plants in Denmark, because these are the overall sources of SO_2 emissions. During the 4 reporting years, this pattern has become weaker, due to the implementation of techniques for reduction of sulphur in the outlet smoke from the power plants. Even though the SO_2 emission has decreased dramatically it still produces a distinct pattern reflecting the localisation of large power plants in Denmark.

For NO_2 the pattern is not that distinct as for SO_2, because it reflects a combination of emission contributions from both power plants and industry, commercial and residential plants and as well transport – mainly road transport. This means that the geographic pattern to a certain point reflects the localisation of infrastructure, dwellings and power plants and industry in Denmark.

The distribution of $PM_{2.5}$ is mainly related to road transport and emissions from residential wood use. Therefore the emissions of $PM_{2.5}$ follow the localisation of the Danish road network and the large residential areas with single family houses.

As already mentioned the total SO_2 emission for Denmark has decreased significantly since 1990. The total emission of SO_2 in 2005 corresponds to approx. 12 % of the total SO_2 emission in 1990. The spatially distributed pattern of SO_2 in 1990 is illustrated in Figure 8.2. For making comparisons between the two reporting years – see also Figure 8.1.

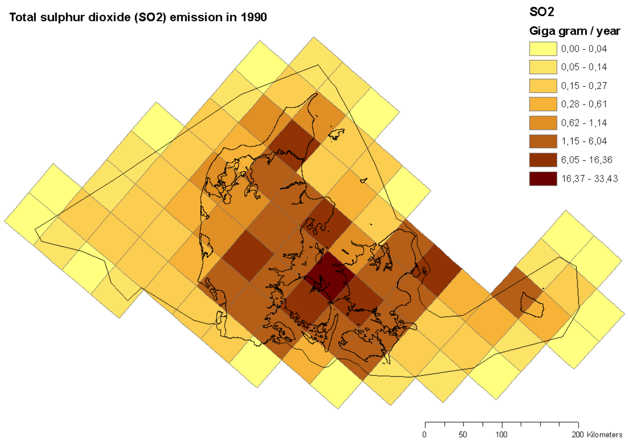

Figure 8.2 Spatial pattern of the total annual SO_2 emission in Denmark in 1990.

9.4 References

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10 Recalculations and Improvements

In general, considerable work is being carried out to improve the inventories. Investigations and research carried out in Denmark and abroad produce new results and findings which are given consideration and, to the extent which is possible, are included as the basis for emission estimates and as data in the inventory databases. Furthermore, the updates of the EMEP/CORINAIR guidebook (Now the EMEP/EEA Guidebook), and the work of the Task Force on Emission Inventories and its expert panels are followed closely in order to be able to incorporate the best scientific information as the basis for the inventories. The further important references in this regard are the IPCC guidelines and IPCC good practice guidance.

The implementation of new results in inventories is made in a way so that improvements, as far as possible, better reflect Danish conditions and circumstances. This is in accordance with good practice. Furthermore, efforts are made to involve as many experts as possible in the reasoning, justification and feasibility of implementation of improvements.

In improving the inventories, care is taken to consider implementation of improvements for the whole time-series of inventories to make it consistent. Such efforts lead to recalculation of previously submitted inventories. This submission includes recalculated inventories for the whole time-series. The reasoning for the recalculations performed is to be found in the sectoral chapters of this report. The text below focuses on recalculations, in general, and further serves as an overview and summary of the relevant text in the sectoral chapters. For sector specific planned improvements please also refer to the relevant sectoral chapters.

10.1 Energy

Improvements and updates of the Danish energy statistics are made regularly by the producer of the statistics, the Danish Energy Agency. In close cooperation with the DEA, these improvements and updates are reflected in the emission inventory for the energy sector. The Danish energy statistics have, for the most part, been aggregated to the SNAP categorisation. This, however, does not include energy statistics for fuel consumption data for specific industries.

The inventories are still being improved through work to increase the number of large point sources, e.g. power plants, included in the databases as individual point sources. Such an inclusion makes it possible to use plant-specific data for emissions, etc, available e.g. in annual environmental reports from the plants in question.

10.1.1 Stationary Combustion

Improvements and recalculations since the 2010 emission inventory submission include:

- The national energy statistics has been updated for the years 1980-2008. The update included both end use and transformation sectors as well as a source category update.
- The petroleum coke purchased abroad and combusted in Danish residential plants is no longer included in the inventory. The border trade was 628 TJ in 2009.
- Emission factors for metals have been updated. All emission factors that are not nationally referenced now refer to the EMEP/EEA Guidebook, 2009 update.

10.1.2 Mobile sources

The following recalculations and improvements of the emission inventories have been made since the emission reporting in 2010.

Road transport

The total mileage per vehicle category from 2005-2008 have been updated based on new data prepared by DTU Transport. More accurate fleet and mileage figures are provided by the latter institution, split into the different vehicle layers of the emission model. An important change is the categorisation of fleet data for heavy duty trucks and buses into the numerous weight classes covered by the COPERT IV model.

The minimum and maximum percentage difference and year of numeric maximum differences (min %, max %, year of max %) for the different emission components are: Particulates (-23.5 %,1.2 %, 2003), NO_x (-10.9 %, 3.5 %, 2008), SO_2 (0 %, - 0.1 %, 2008), NMVOC (-10.7 %, -0.2 %, 2007), CO (-8.5 %, 0.7 %, 2008) and NH_3 (-26.3 %, 14.2 %, 1991).

National sea transport

Fuel consumption by vessels sailing between Denmark and Greenland/Faroe Islands, and between Denmark and the North Sea off shore installations has been added to this category. Previously this fuel consumption was reported under international sea transport. The corresponding minimum and maximum percentage difference and year of numeric maximum differences (min %, max %, year of max %) for the different emission components are: Particulates (15 %, 44 %, 2006), NO_x (13 %, 56 %, 2008), SO_2 (18 %, 131 %, 2008), NMVOC (3 %, 11 %, 2008), CO (3 %, 6 %, 2008) and NH_3 (0 %).

Fisheries

Due to the changes made in national sea transport, and the fuel transferral between national sea transport and fisheries made as an integral part of the Danish inventories, significant fuel consumption and emission changes have been made for the fishery sector accordingly, for 2001 onwards. The corresponding minimum and maximum percentage difference and year of numeric maximum differences (min %, max %, year of max %) are (27 %, 39 %, 2006), for all emission components.

Agriculture

The stock of harvesters have been updated for the years 2001-2008, based on discussions with the Danish Knowledge Centre for Agriculture. For gasoline fuelled ATV's the stock has been updated for 2007 and 2008. The corresponding minimum and maximum percentage difference and year of numeric maximum differences (min %, max %, year of max %) for SO_2, NO_x and Particulates are (0 %, 2 %, 2006), NMVOC (0 %, 8 %, 2008), CO (0 %, 13 %, 2008) and NH_3 (0 %, 5 %, 2008).

Agriculture/forestry/fisheries

The total consequences for agriculture/forestry/fisheries, expressed as minimum and maximum percentage difference and year of numeric maximum differences (min %, max %, year of max %) for the different emission components are: Particulates (3.9 %, 6.5 %, 2006), NO_x (11.9 %, 16.9 %, 2006), SO_2 (18.8 %, 36.7 %, 2006), NMVOC (3.9 %, 10.2 %, 2008), CO (1.8 %, 13.0 %, 2008) and NH_3 (0.2 %, 5.3 %, 2008).

Military

Emission factors derived from the new road transport simulations have caused some emission changes from 1985-2008. The minimum and maximum emission differences (min %, max %) for the different emission components are: Particulates (-24 %, 1 %), NO_x (-7 %, 1 %), SO_2 (0 %), NMVOC (-9 %, 0 %), CO (-5 %, 0 %) and NH_3 (-5 %, 7 %).

Residential

A split in activity codes has been made. In this way the majority of the fuel consumption and emissions previously reported under residential (SNAP code 0809; NFR code 1A4b) are now reported under commercial/institutional (SNAP code 0811; NFR code 1A4a ii).

No changes have been made in the estimated fuel consumption and emissions for Residential and Commercial/institutional as a sum.

Commercial/institutional

A split in activity codes has been made. The majority of the fuel consumption and emissions previously reported under residential (SNAP code 0809; NFR code 1A4b) are now reported under commercial/institutional (SNAP code 0811; NFR code 1A4a ii).

No changes have been made in the estimated fuel consumption and emissions for Residential and Commercial/institutional as a sum.

Industrial non road machinery

The annual working hours for fork lifts in 2008 have been adjusted with a factor of 0.95 due to the decrease in activities caused by the global financial crisis. The total fuel consumption and emission changes in 2008 for industrial non road machinery are approximately -1 %.

Railways

No changes have been made.

Aviation

Very small emission changes between -2 % and 1 % occur for the years 2001-2008, due to inclusion of new aircraft types assigned to the representative aircraft types.

10.1.3 Fugitive emissions

Service stations:

The amounts of gasoline sales used for calculation of fugitive emissions from service stations (SNAP 050503) have been updated according to the Energy Statistics for 2009 1990-2008. The NMVOC emission in 2008 has thereby increased by 6 Mg corresponding to 0.5 %.

Extraction of oil and gas:
Fugitive emissions from extraction are calculated from the standard formula in the EMEP/EEA Guidebook (EMEP/EEA, 2009) based on the number of platforms. In 2009 the number of platforms has been corrected for 2007 and 2008. The NMVOC emission in 2008 has decreased by 20 Mg according to this correction corresponding to 1 %.

Gas distribution
Distribution amounts have been updated for one of three natural gas distribution companies for the years 2006-2008 due to new data availability. The NMVOC emission has decreased by 4 Mg in 2008 due to this corresponding to 10 %.

Flaring in oil and gas extraction
The NMVOC emission in 2008 from flaring in the gas treatment plant has been updated for 2008 according to the environmental report leading to an increase of 2 Mg NMVOC. The increase corresponds to 12 % of the NMVOC emission from flaring in oil and gas extraction including offshore flaring.

10.2 Industrial processes

Recalculations have been done as a consequence of implementation of NFR 2009. Implementation of a more clear and logic distinction between energy and process related emissions are ongoing.

Improvement of emission factors within the sub-sector *Other production* (food and beverage) is ongoing. So far the emission factors for breweries and bakeries have been revised on order to reflect European conditions. The new emission factors are based on the EMEP/EEA guidebook.

10.3 Solvents

Improvements and additions are continuously being implemented due to the comprehensiveness and complexity of the use and application of solvents in industries and households. The main improvements in the 2011 reporting include the following:

- Further improvement of source allocation model, which combines information on Use Categories and NACE Industrial Use Categories from SPIN and use amounts from Statistics DK.
- Implementation of correct 2008 import amounts for xylene, which has been verified by Statistics Denmark.
- Inclusion of use of fireworks in Other Product Use (3D3).

10.4 Agriculture

Compared with the previous NH_3 and PM emissions inventory (submission 2010), some changes and updates have been made. These changes cause an increase in the NH_3 emission (1985 – 2008) and a decrease in the PM emission (2000 – 2008).

The main reason for the increase in NH_3 emission is due to an error in the calculations of NH_3 from sows 1985-2008 and this have led to an increase in the emission from animal manure of 6-11% in the period 1985-2008.

The PM emission mainly decreases because of changes in the calculation of the number of produced swine and poultry and thereby changes in production cycles. For the calculations of the number of produced fattening pigs and weaners slaughter data has been updated. Also the calculation of the number of produced laying hens has been changed, so now the number is based on the amount of eggs produced.

10.5 Waste

The calculation of emissions from accidental fires of both buildings and vehicles has been added the additional data year of 2009. This extra detailed dataset has influenced the activity data for building and vehicle fires for the years 1990-2005. The total number of building fires has with this recalculation increased with 0.69 – 0.70 %.

The activity data for accidental vehicle fires has increased more drastically with the peek of 7.1 % in 1993. This increase is caused by a change in data delivery of the population of the different vehicle types.

Emissions from composting are included for the first time in the inventory.

Annex 1 – Key category analysis

Due to a lack of resources a determination of key categories has not been done.

Annex 2A - Stationary combustion

Annex 2A-1 IPCC/SNAP source correspondence list

Table 2A-1.1 Correspondence list for IPCC source categories 1A1, 1A2 and 1A4 and SNAP (EEA 2007).

SNAP_id	SNAP_name	IPCC source
01	Combustion in energy and transformation industries	
010100	Public power	1A1a
010101	Combustion plants >= 300 MW (boilers)	1A1a
010102	Combustion plants >= 50 and < 300 MW (boilers)	1A1a
010103	Combustion plants < 50 MW (boilers)	1A1a
010104	Gas turbines	1A1a
010105	Stationary engines	1A1a
010200	District heating plants	1A1a
010201	Combustion plants >= 300 MW (boilers)	1A1a
010202	Combustion plants >= 50 and < 300 MW (boilers)	1A1a
010203	Combustion plants < 50 MW (boilers)	1A1a
010204	Gas turbines	1A1a
010205	Stationary engines	1A1a
010300	Petroleum refining plants	1A1b
010301	Combustion plants >= 300 MW (boilers)	1A1b
010302	Combustion plants >= 50 and < 300 MW (boilers)	1A1b
010303	Combustion plants < 50 MW (boilers)	1A1b
010304	Gas turbines	1A1b
010305	Stationary engines	1A1b
010306	Process furnaces	1A1b
010400	Solid fuel transformation plants	1A1c
010401	Combustion plants >= 300 MW (boilers)	1A1c
010402	Combustion plants >= 50 and < 300 MW (boilers)	1A1c
010403	Combustion plants < 50 MW (boilers)	1A1c
010404	Gas turbines	1A1c
010405	Stationary engines	1A1c
010406	Coke oven furnaces	1A1c
010407	Other (coal gasification, liquefaction, ...)	1A1c
010500	Coal mining, oil/gas extraction, pipeline compressors	
010501	Combustion plants >= 300 MW (boilers)	1A1c
010502	Combustion plants >= 50 and < 300 MW (boilers)	1A1c
010503	Combustion plants < 50 MW (boilers)	1A1c
010504	Gas turbines	1A1c
010505	Stationary engines	1A1c
02	Non-industrial combustion plants	
020100	Commercial and institutional plants (t)	1A4a
020101	Combustion plants >= 300 MW (boilers)	1A4a
020102	Combustion plants >= 50 and < 300 MW (boilers)	1A4a
020103	Combustion plants < 50 MW (boilers)	1A4a
020104	Stationary gas turbines	1A4a
020105	Stationary engines	1A4a
020106	Other stationary equipments (n)	1A4a
020200	Residential plants	1A4b
020201	Combustion plants >= 50 MW (boilers)	1A4b
020202	Combustion plants < 50 MW (boilers)	1A4b
020203	Gas turbines	1A4b
020204	Stationary engines	1A4b
020205 [2)]	Other equipments (stoves, fireplaces, cooking,...) [2)]	1A4b
020300	Plants in agriculture, forestry and aquaculture	1A4c
020301	Combustion plants >= 50 MW (boilers)	1A4c
020302	Combustion plants < 50 MW (boilers)	1A4c
020303	Stationary gas turbines	1A4c
020304	Stationary engines	1A4c
020305	Other stationary equipments (n)	1A4c
03	Combustion in manufacturing industry	
030100	Comb. in boilers, gas turbines and stationary	1A2
030101	Combustion plants >= 300 MW (boilers)	1A2
030102	Combustion plants >= 50 and < 300 MW (boilers)	1A2
030103	Combustion plants < 50 MW (boilers)	1A2
030104	Gas turbines	1A2
030105	Stationary engines	1A2
030106	Other stationary equipments (n)	1A2
030200	Process furnaces without contact	
030203	Blast furnace cowpers	1A2a
030204	Plaster furnaces	1A2f
030205	Other furnaces	1A2f
0303	Processes with contact	
030301	Sinter and pelletizing plants	1A2a
030302	Reheating furnaces steel and iron	1A2a
030303	Gray iron foundries	1A2a

SNAP_id	SNAP_name	IPCC source
Continued		
030304	Primary lead production	1A2b
030305	Primary zinc production	1A2b
030306	Primary copper production	1A2b
030307	Secondary lead production	1A2b
030308	Secondary zinc production	1A2b
030309	Secondary copper production	1A2b
030310	Secondary aluminium production	1A2b
030311	Cement (f)	1A2f
030312	Lime (includ. iron and steel and paper pulp industr.)(f)	1A2f
030313	Asphalt concrete plants	1A2f
030314	Flat glass (f)	1A2f
030315	Container glass (f)	1A2f
030316	Glass wool (except binding) (f)	1A2f
030317	Other glass (f)	1A2f
030318	Mineral wool (except binding)	1A2f
030319	Bricks and tiles	1A2f
030320	Fine ceramic materials	1A2f
030321	Paper-mill industry (drying processes)	1A2d
030322	Alumina production	1A2b
030323	Magnesium production (dolomite treatment)	1A2b
030324	Nickel production (thermal process)	1A2b
030325	Enamel production	1A2f
030326	Other	1A2f
08 1)	Other mobile sources and machinery	
0804 1)	Maritime activities	
080403 1)	National fishing	1A4c
0806 1)	Agriculture	1A4c
0807 1)	Forestry	1A4c
0808 1)	Industry	1A2f
0809 1)	Household and gardening	1A4b

1) Not stationary combustion. Included in a NFR sector that also includes stationary combustion plants

2) Stoves, fireplaces and cooking is included in the sector 0202 or 020202 in the Danish inventory.

Annex 2A-2   Fuel rate

Table 2A-2.1   Fuel consumption rate of stationary combustion plants 2009, PJ.

fuel_type	fuel_gr_abbr	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
BIOMASS	BIO OIL								1.97	1.86	1.30
	BIO PROD GAS										
	BIOGAS	0.18	0.19	0.20	0.21	0.25	0.29	0.35	0.34	0.35	0.64
	STRAW	4.84	6.65	7.42	8.32	9.42	9.89	10.27	10.83	11.26	11.66
	WOOD	11.33	14.00	14.98	15.00	15.11	15.01	17.03	17.97	17.63	17.60
WASTE	MUNICIP. WASTES	10.64	11.26	11.88	12.57	13.11	13.83	14.37	14.35	14.47	15.13
GAS	NATURAL GAS	5.04	5.50	5.66	6.28	10.28	30.40	48.50	62.19	67.42	71.72
LIQUID	GAS OIL	147.20	121.18	107.79	99.56	93.89	109.92	102.70	101.13	83.42	71.24
	KEROSENE	3.93	3.57	3.61	3.55	3.26	4.61	3.89	3.00	1.95	1.77
	LPG	6.38	5.59	5.60	5.64	5.92	5.03	4.87	4.38	3.57	2.94
	NAPHTA							0.10			
	ORIMULSION										
	PETROLEUM COKE	1.14	2.63	6.10	7.23	7.19	8.63	9.75	8.20	5.90	4.55
	REFINERY GAS	11.03	11.67	10.58	11.86	12.75	11.52	13.17	13.25	13.62	14.63
	RESIDUAL OIL	177.04	137.46	116.74	95.90	87.80	84.06	73.47	54.66	43.81	37.57
SOLID	BROWN COAL BRI.	0.38	0.50	0.82	0.71	0.62	0.81	0.46	0.35	0.20	0.13
	COAL	245.69	195.56	238.41	232.98	247.43	301.62	306.00	300.37	280.93	231.28
	COKE OVEN COKE	3.54	2.82	2.95	2.54	1.70	1.96	1.59	1.52	1.25	1.03
Total		628.36	518.57	532.75	502.35	508.74	597.58	606.49	594.51	547.64	483.18

Continued

fuel_type	fuel_gr_abbr	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
BIOMASS	BIO OIL	0.74	0.74	0.74	0.80	0.25	0.25	0.06	0.01	0.01	0.03
	BIO PROD GAS					0.08	0.02	0.03	0.04	0.04	0.05
	BIOGAS	0.75	0.75	0.75	0.75	1.28	1.75	1.99	2.39	2.64	2.61
	STRAW	12.48	13.31	13.88	13.37	12.66	12.97	12.94	13.17	13.90	13.67
	WOOD	18.25	20.04	21.03	22.22	21.86	21.82	23.36	23.42	22.95	24.38
WASTE	MUNICIP. WASTES	15.50	16.74	17.80	19.41	20.31	22.91	24.95	26.77	26.59	29.14
GAS	NATURAL GAS	76.10	86.11	90.48	102.48	114.60	132.71	156.26	164.50	178.72	187.95
LIQUID	GAS OIL	61.44	64.99	56.09	62.02	53.92	53.69	58.01	51.06	48.41	47.49
	KEROSENE	5.09	0.94	0.78	0.77	0.65	0.58	0.54	0.44	0.42	0.26
	LPG	2.60	2.55	2.32	2.56	2.60	2.74	2.98	2.49	2.54	2.21
	NAPHTA										
	ORIMULSION						19.91	36.77	40.49	32.58	34.19
	PETROLEUM COKE	4.46	4.40	4.31	5.68	7.55	5.27	5.88	6.02	5.30	6.78
	REFINERY GAS	14.17	14.54	14.87	15.41	16.36	20.84	21.44	16.91	15.23	15.72
	RESIDUAL OIL	31.39	37.52	37.78	32.09	45.50	32.28	37.04	25.85	29.26	22.97
SOLID	BROWN COAL BRI.	0.12	0.17	0.10	0.13	0.09	0.07	0.06	0.05	0.05	0.04
	COAL	253.44	344.30	286.84	300.80	323.40	270.35	371.91	276.28	234.28	196.47
	COKE OVEN COKE	1.28	1.45	1.18	1.15	1.23	1.27	1.23	1.25	1.35	1.42
Total		497.80	608.57	548.94	579.64	622.33	599.44	755.43	651.14	614.27	585.38

Continued

fuel_type	fuel_gr_abbr	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
BIOMASS	BIO OIL	0.05	0.19	0.13	0.42	0.65	0.76	1.13	1.21	1.84	1.66
	BIO PROD GAS	0.05	0.06	0.06	0.07	0.08	0.08	0.09	0.09	0.08	0.25
	BIOGAS	2.87	3.02	3.33	3.54	3.71	3.83	3.92	3.91	3.93	4.17
	STRAW	12.22	13.70	15.65	16.88	17.94	18.49	18.54	18.76	15.84	17.34
	WOOD	27.53	30.91	31.69	39.06	43.97	49.80	52.12	60.35	63.21	63.94
WASTE	MUNICIP. WASTES	30.39	32.70	35.12	36.60	37.27	37.79	38.43	39.75	40.94	38.62
GAS	NATURAL GAS	186.13	193.84	193.62	195.94	195.08	187.41	191.08	170.98	172.12	165.19
LIQUID	GAS OIL	41.25	43.63	38.60	38.83	35.76	31.65	26.52	21.53	20.71	24.19
	KEROSENE	0.17	0.29	0.26	0.34	0.21	0.28	0.22	0.12	0.12	0.11
	LPG	1.99	1.70	1.50	1.66	1.76	1.84	1.97	1.66	1.53	1.39
	NAPHTA										
	ORIMULSION	34.15	30.24	23.85	1.92	0.02					
	PETROLEUM COKE	6.79	7.81	7.78	7.96	8.38	8.08	8.46	9.16	6.92	5.92
	REFINERY GAS	15.56	15.76	15.20	16.55	15.89	15.35	16.12	15.92	14.78	15.42
	RESIDUAL OIL	18.11	20.36	25.43	27.35	23.33	20.76	24.72	18.42	14.29	13.72
SOLID	BROWN COAL BRI.	0.03	0.03	0.02	0.00					0.01	0.01
	COAL	164.71	174.31	174.65	238.97	182.50	154.01	231.97	194.13	170.74	168.00
	COKE OVEN COKE	1.19	1.11	1.07	1.00	1.14	0.98	1.01	1.12	1.04	0.75
Total		**543.18**	**569.65**	**567.96**	**627.11**	**567.69**	**531.11**	**616.29**	**557.11**	**528.09**	**520.68**

Table 2A-2.2 Detailed fuel consumption data for stationary combustion plants, PJ. 1980 – 2009.

fuel_type	fuel_gr_abbr	NFR	nfr_name	snap_id	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
BIOMASS	BIOGAS	1A1	Electricity and heat production	010100	0.05	0.05	0.05	0.06	0.08	0.09	0,10	0,10	0,12	0,16
				010200						0.01	0,04	0,04	0,03	0,03
		1A2	Industry	030100	0.01	0.01	0.01	0.01	0.02	0.02	0,02	0,02	0,03	0,28
		1A4	Commercial/ Institutional	020100	0.12	0.13	0.14	0.14	0.15	0.17	0,18	0,18	0,17	0,16
	BIO OIL	1A1	Electricity and heat production	010200						0.07	0,09	0,06		0,06
	STRAW	1A1	Electricity and heat production	010100	0.29	0.29	0.30	0.55	1.00	1.44	1,74	2,26	2,68	3,07
				010200	2.73	3.81	4.27	4.66	5.05	5.03	5,07	5,11	5,15	5,12
		1A4	Residential	020200	1.82	2.54	2.85	3.11	3.37	3.35	3,38	3,40	3,43	3,41
			Agriculture/ Forestry	020300							1,29	1,70	2,03	2,76
	WOOD	1A1	Electricity and heat production	010200	3.71	4.25	4.42	4.78	5.03	5.28	5,56	5,48	5,58	5,70
		1A2	Industry	030100							0,16	0,16	0,16	0,16
		1A4	Commercial/ Institutional	020100	7.62	9.75	10.55	10.22	9.88	9.63	9,92	10,55	9,78	8,89
			Residential	020200					0.20	0.10	0,09	0,07	0,07	0,09
			Agriculture/ Forestry	020300								1,97	1,86	1,30
WASTE	MUNICIP. WASTES	1A1	Electricity and heat production	010200	6.77	7.17	7.55	7.99	8.34	8.81	9,15	9,15	9,09	9,47
		1A2	Industry	030100	0.04	0.04	0.05	0.05	0.05	0.04	0,04	0,03	0,16	0,20
		1A4	Commercial/ Institutional	020100	0.41	0.43	0.45	0.48	0.50	0.53	0,55	0,55	0,55	0,58
	FOSSIL WASTE	1A1	Electricity and heat production	010200	3.21	3.40	3.59	3.80	3.96	4.18	4,34	4,34	4,32	4,50
		1A2	Industry	030100	0.02	0.02	0.02	0.02	0.02	0.02	0,02	0,01	0,08	0,10
		1A4	Commercial/ Institutional	020100	0.19	0.20	0.22	0.23	0.24	0.25	0,26	0,26	0,26	0,28
GAS	NATURAL GAS	1A1	Electricity and heat production	010100						3.18	5,56	3,51	5,96	6,51
				010200				0.30	1.65	6.08	12,32	15,04	13,82	11,29
			Other energy industries	010504	0.02	0.81	1.27	1.57	2.49	4.15	5,21	7,39	8,81	9,13
		1A2	Industry	030100	0.41	0.43	0.39	0.35	0.77	5.04	8,98	14,82	17,19	21,89
			Industry	030106					0.20	0.15	0,00	0,35	0,27	0,23
		1A4	Commercial/ Institutional	020100	0.37	0.34	0.32	0.34	0.37	3.29	3,67	5,02	5,34	5,26
			Residential	020200	4.24	3.92	3.69	3.72	4.80	8.27	11,81	14,76	14,55	15,52
			Agriculture/ Forestry	020300					0.02	0.25	0,95	1,31	1,50	1,90
LIQUID	GAS OIL	1A1	Electricity and heat production	010100	0.25	0.35	0.30	0.38	0.33	0.12	0,23	0,42	0,40	0,32
				010200	0.29	0.30	0.39	0.33	1.26	0.89	0,73	0,74	0,71	2,95
			Petroleum refining	010306							0,00	0,00		
		1A2	Industry	030100	6.11	2.87	1.07	0.78	3.08	3.57	2,88	2,20	0,86	0,88
		1A4	Commercial/ Institutional	020100	24.69	21.73	18.30	17.88	18.13	18.64	17,96	18,06	13,82	12,18
			Residential	020200	113.25	94.41	87.07	79.68	69.41	84.84	79,36	78,46	67,10	54,29
			Agriculture/ Forestry	020300	2.61	1.53	0.67	0.51	1.68	1.86	1,54	1,25	0,53	0,63
	KEROSENE	1A2	Industry	030100	0.17	0.18	0.17	0.18	0.14	0.44	0,27	0,19	0,10	0,06
		1A4	Commercial/ Institutional	020100	1.15	1.01	1.00	0.98	0.94	1.44	0,99	0,69	0,59	0,46
			Residential	020200	2.34	2.04	2.03	2.08	1.99	2.49	2,45	1,98	1,18	1,21
			Agriculture/ Forestry	020300	0.27	0.34	0.42	0.31	0.19	0.25	0,17	0,15	0,07	0,03
	LPG	1A1	Electricity and heat production	010200	0.00	0.00	0.15	0.14	0.14	0.06	0,02	0,01	0,01	0,01
		1A2	Industry	030100	3.66	2.96	2.72	2.77	2.35	1.97	1,99	2,12	1,94	1,69
		1A4	Commercial/ Institutional	020100	0.94	0.85	0.94	0.90	1.38	1.16	1,01	0,21	0,17	0,12
			Residential	020200	1.16	1.19	1.34	1.42	1.99	1.77	1,80	1,79	1,24	0,84
			Agriculture/ Forestry	020300	0.62	0.59	0.45	0.40	0.07	0.06	0,05	0,24	0,21	0,27
	NAPHTA	1A1	Electricity and heat production	010100							0,10			
	PETROLEUM COKE	1A1	Electricity and heat production	010200								0,17	0,06	
		1A2	Industry	030100	1.14	2.63	5.66	6.99	6.80	0.42	1,50	0,45	0,05	

fuel_type	fuel_gr_abbr	NFR	nfr_name	snap_id	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
				030311						6.77	6,82	5,46	3,92	3,82
		1A4	Commercial/ Institutional	020100			0.10	0.06	0.08	0.18	0,04	0,30	0,27	0,05
			Residential	020200			0.34	0.18	0.26	0.83	0,70	1,11	0,89	0,51
			Agriculture/ Forestry	020300				0.01	0.04	0.44	0,69	0,72	0,70	0,16
	REFINERY GAS	1A1	Petroleum refining	010300							0,07	0,14	0,21	0,33
				010306	10.93	11.56	10.47	11.73	12.61	11.39	12,96	12,95	13,22	14,09
		1A2	Industry	030100	0.10	0.11	0.11	0.13	0.14	0.13	0,14	0,16	0,19	0,21
	RESIDUAL OIL	1A1	Electricity and heat production	010100	47.68	24.96	18.02	8.52	6.89	13.35	14,29	10,46	12,96	10,78
				010200	49.00	43.68	40.82	34.72	29.18	25.10	15,67	11,53	5,43	3,04
			Petroleum refining	010306	3.30	3.59	2.53	2.50	2.49	2.82	2,74	2,18	1,61	1,65
		1A2	Industry	030100	49.95	39.97	34.93	32.97	31.83	29.16	28,66	20,61	16,44	15,87
				030311						0.38	1,33	2,12	2,65	2,63
		1A4	Commercial/ Institutional	020100	12.48	10.47	10.33	8.30	9.10	7.74	5,61	4,21	2,57	1,53
			Residential	020200	4.85	4.68	4.89	3.53	4.24	2.96	2,54	1,30	0,46	0,37
			Agriculture/ Forestry	020300	9.78	10.12	5.21	5.35	4.08	2.55	2,63	2,24	1,69	1,70
SOLID	BROWN COAL BRI.	1A2	Industry	030100	0.00	0.02	0.01	0.03	0.02	0.08	0,04	0,04	0,01	
		1A4	Commercial/ Institutional	020100									0,00	0,00
			Residential	020200	0.38	0.48	0.81	0.66	0.60	0.60	0,28	0,25	0,15	0,09
			Agriculture/ Forestry	020300				0.01	0.00	0.13	0,14	0,06	0,04	0,04
	COAL	1A1	Electricity and heat production	010100	226.19	177.69	221.81	216.54	220.63	271.29	276,47	272,14	253,76	206,80
				010200	0.10	1.70	2.58	5.22	8.52	12.09	11,34	9,34	8,49	6,80
		1A2	Industry	030100	17.65	13.26	11.44	8.01	13.50	9.84	8,97	10,25	10,36	9,11
				030106	0.37	0.41	0.46	0.37						
				030311						2.76	3,79	4,16	4,19	5,48
		1A4	Commercial/ Institutional	020100							0,01	0,03	0,17	0,02
			Residential	020200	1.12	1.48	0.93	0.99	1.31	1.00	0,90	0,31	0,30	0,44
			Agriculture/ Forestry	020300	0.26	1.01	1.20	1.84	3.48	4.64	4,52	4,13	3,67	2,64
	COKE OVEN COKE	1A2	Industry	030100	2.47	1.53	1.34	1.49	1.06	1.31	1,12	1,09	1,06	0,91
		1A4	Residential	020200	1.07	1.29	1.60	1.05	0.64	0.65	0,47	0,43	0,20	0,12
Grand Total					**628.36**	**518.57**	**532.75**	**502.35**	**508.74**	**597.58**	**606.49**	**594.51**	**547.64**	**483.18**

Continued

fuel_type	fuel_gr_abbr	NFR	nfr_name	snap_id	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
BIOMASS	BIOGAS	1A1	Electricity and heat production	010100	0.24	0.24								
				010101					0.02	0.00		0.02		
				010102					0.01		0.09	0.04	0.05	0.03
				010104					0.00	0.02				
				010105			0.27	0.27	0.49	0.58	0.65	0.82	0.98	1.06
				010200	0.03	0.03								
				010203					0.21	0.25	0.25	0.25	0.25	0.22
		1A2	Industry	030100	0.49	0.49	0.49	0.49	0.01	0.13	0.10	0.12	0.07	0.03
				030103					0.01	0.02	0.02	0.02	0.02	0.02
		1A4	Commercial/ Institutional	020100					0.11	0.17	0.17	0.27	0.23	0.29
				020103						0.00	0.01	0.04	0.07	0.07
				020105					0.41	0.57	0.54	0.77	0.90	0.81
			Agriculture/ Forestry	020300					0.00	0.00	0.13	0.03	0.03	0.03
				020304					0.01	0.02	0.02	0.02	0.03	0.05
	STRAW	1A1	Electricity and heat production	010100	0.48	0.99	1.49	1.64						
				010101					0.10	0.08	0.22	0.74	1.01	1.34
				010102					0.61	1.13	1.50	1.31	1.25	1.31

fuel_type	fuel_gr_abbr	NFR	nfr_name	snap_id	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
				010103					0.72	0.99	1.32	1.14	1.46	1.34
				010200	3.52	3.84	3.92	3.81						
				010203					3.87	3.97	3.83	3.49	3.88	3.92
		1A2	Industry	030103						0.00				
				030105									0.00	0.00
		1A4	Residential	020200	5.09	5.09	5.09	4.75	4.41	4.08	3.63	3.89	3.77	3.44
			Agriculture/ Forestry	020300	3.39	3.39	3.39	3.17	2.94	2.72	2.42	2.59	2.03	1.80
				020302					0.01	0.01	0.01	0.01	0.50	0.51
	WOOD	1A1	Electricity and heat production	010100			0.17	0.52						
				010101					0.04				0.26	
				010102					1.74	1.60	1.60	1.57	1.95	2.86
				010103					0.05	0.04	0.03	0.06	0.06	0.34
				010104						0.00				
				010200	3.22	3.65	4.10	3.75						
				010203					3.32	3.48	3.89	4.06	4.14	4.04
		1A2	Industry	030100	5.78	5.69	5.75	5.82	4.46	4.23	4.10	4.17	4.27	4.25
				030102									0.00	0.00
				030103					0.41	0.37	0.53	0.43	0.35	0.37
		1A4	Commercial/ Institutional	020100	0.20	0.20	0.20	0.20	0.22	0.27	0.45	0.47	0.49	0.64
				020105									0.00	0.00
			Residential	020200	8.95	10.41	10.72	11.86	11.56	11.76	12.67	12.57	11.13	11.62
			Agriculture/ Forestry	020300	0.09	0.09	0.09	0.07	0.07	0.07	0.09	0.10	0.23	0.23
				020302									0.06	0.03
	BIO PROD GAS	1A1	Electricity and heat production	010105					0.08	0.02	0.03	0.04	0.04	0.04
		1A4	Agriculture/ Forestry	020304								0.00	0.00	0.01
	BIO OIL	1A1	Electricity and heat production	010200	0.74	0.74	0.74	0.80						
				010203					0.25	0.25	0.06	0.01	0.01	0.03
WASTE	MUNICIP. WASTES	1A1	Electricity and heat production	010100		0.88	1.30	2.52						
				010101									0.76	0.75
				010102					3.20	2.67	3.72	4.54	4.76	8.54
				010103					2.62	3.20	3.54	3.30	2.78	0.67
				010104					0.37	0.54	1.14	1.10	0.91	0.91
				010200	9.20	8.23	7.18	6.21						
				010202						1.98	2.73	2.73	2.72	
				010203					5.85	4.71	2.79	3.35	3.27	5.38
		1A2	Industry	030100	0.69	1.55	2.33	2.83	0.02	0.02	0.02	0.01	0.02	0.02
		1A4	Commercial/ Institutional	020100	0.62	0.69	0.69	0.69	0.75	0.77	0.72	0.69	0.42	0.87
				020103					0.02	0.02	0.01	0.00	0.01	0.00
			Agriculture/ Forestry	020302									0.00	0.00
P_WASTE	FOSSIL WASTE	1A1	Electricity and heat production	010100		0.42	0.71	1.47						
				010101									0.53	0.53
				010102					1.87	1.73	2.61	3.18	3.34	5.98
				010103					1.53	2.07	2.48	2.31	1.95	0.47
				010104					0.21	0.35	0.80	0.77	0.64	0.64
				010200	4.37	3.91	3.93	3.63						
				010202						1.28	1.91	1.92	1.90	
				010203					3.42	3.05	1.96	2.35	2.29	3.77
		1A2	Industry	030100	0.33	0.74	1.28	1.65	0.01	0.01	0.01	0.01	0.01	0.01
		1A4	Commercial/ Institutional	020100	0.29	0.33	0.38	0.41	0.44	0.50	0.50	0.49	0.29	0.61
				020103					0.01	0.01	0.00	0.00	0.00	0.00

fuel_type	fuel_gr_abbr	NFR	nfr_name	snap_id	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
GAS	NATURAL GAS	1A1	Electricity and heat production	010100			0.80	3.21						
				010101	4.01	4.39	3.28	4.42	6.45	7.81	9.48	8.44	17.50	17.27
				010102					2.01	2.85	4.08	8.14	9.30	6.45
				010103					0.02	0.05				
				010104	2.51	3.95	5.67	7.52	7.59	8.23	13.94	15.81	12.76	21.45
				010105	0.09	0.18	0.25	0.41	8.59	16.78	21.93	23.46	26.39	26.61
				010200	10.92	13.13	12.35	11.42						
				010202					0.26	0.38	0.38	0.47	0.54	0.20
				010203					9.39	7.95	6.40	4.01	3.14	2.74
			Other energy industries	010504	9.18	9.44	11.05	11.24	12.26	12.91	15.24	19.87	22.05	23.97
		1A2	Industry	030100	22.78	24.34	25.15	27.18	29.24	29.66	28.82	29.18	28.66	31.02
				030102					0.71	2.66	2.46	2.97	2.96	3.10
				030103					0.77	0.81	1.07	0.98	1.09	0.90
				030104	0.51	0.61	0.66	0.73	0.76	0.91	2.15	3.04	4.77	6.14
				030105					0.02	0.19	0.88	0.97	1.17	1.17
				030106	0.14	0.03	0.05	0.07	0.06	0.03	0.02	0.01	0.05	0.11
				030315								0.92	0.90	1.01
				030318						0.62	0.59	0.62	0.67	0.69
		1A4	Commercial/ Institutional	020100	6.38	6.93	7.38	8.91	7.34	8.44	11.25	9.11	8.66	7.53
				020103					0.00	0.00	0.00	0.00	0.20	0.01
				020104						0.00		0.00		
				020105					0.58	0.71	0.79	0.97	1.04	1.08
			Residential	020200	17.36	20.43	21.44	24.90	24.74	26.95	30.41	28.36	29.14	28.98
				020202					0.05	0.01	0.05	0.04	0.03	0.04
				020204					0.96	1.04	1.41	1.46	1.53	1.52
			Agriculture/ Forestry	020300	2.22	2.68	2.39	2.46	2.49	2.56	2.67	2.64	2.48	2.24
				020304					0.28	1.16	2.22	3.03	3.71	3.72
LIQUID	GAS OIL	1A1	Electricity and heat production	010100	0.30	0.47	0.70	0.29						
				010101					0.01	0.05	0.04	0.09	0.11	0.26
				010102					0.01	0.01	0.03	0.03	0.03	0.05
				010103						0.00	0.04	0.03	0.01	0.03
				010104		0.02	0.02	0.03	0.04	0.08	0.05	0.03	0.14	0.03
				010105					0.12	0.14	0.10	0.10	0.12	0.11
				010200	1.94	0.81	0.74	0.95						
				010202					0.15	0.20	0.15	0.07	0.12	0.05
				010203					0.99	0.68	1.40	1.18	1.06	0.67
			Petroleum refining	010306		0.04	0.04	0.03	0.05	0.03	0.02	0.09		
		1A2	Industry	030100	0.54	1.37	1.43	0.95	0.81	1.46	2.25	1.90	1.80	2.48
				030102					0.00	0.00	0.00	0.00	0.00	0.00
				030103					0.00	0.00	0.01	0.00	0.00	0.00
				030104								0.00	0.00	0.01
				030105					0.00				0.00	0.00
				030315								0.00	0.00	0.00
		1A4	Commercial/ Institutional	020100	11.79	10.62	9.06	9.01	7.16	6.56	6.62	6.09	5.44	5.78
				020102					0.19		0.00		0.00	
				020103					0.00		0.06	0.06	0.06	0.04
				020105					0.00	0.02	0.00	0.00	0.00	0.00
			Residential	020200	46.46	50.64	42.91	49.97	43.68	43.29	45.30	39.60	37.85	35.68
			Agriculture/ Forestry	020300	0.41	1.01	1.18	0.79	0.71	1.18	1.94	1.80	1.68	2.29
				020302								0.00		

fuel_type	fuel_gr_abbr	NFR	nfr_name	snap_id	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
				020304							0.00	0.00		0.01
	KEROSENE	1A2	Industry	030100	0.07	0.05	0.04	0.04	0.03	0.02	0.03	0.03	0.02	0.01
		1A4	Commercial/ Institutional	020100	0.57	0.21	0.21	0.19	0.15	0.12	0.10	0.10	0.13	0.12
			Residential	020200	4.40	0.66	0.51	0.52	0.44	0.41	0.38	0.29	0.25	0.12
			Agriculture/ Forestry	020300	0.04	0.03	0.03	0.03	0.03	0.02	0.02	0.03	0.02	0.01
	LPG	1A1	Electricity and heat production	010100		0.00	0.00	0.00						
				010200	0.01	0.01	0.01							
				010203					0.00	0.00				0.00
			Petroleum refining	010306			0.00		0.01	0.02	0.02	0.02		
		1A2	Industry	030100	1.58	1.69	1.59	1.45	1.56	1.74	1.92	1.60	1.62	1.36
		1A4	Commercial/ Institutional	020100	0.08	0.08	0.08	0.12	0.13	0.13	0.14	0.13	0.12	0.11
				020105										0.00
			Residential	020200	0.67	0.52	0.44	0.86	0.79	0.73	0.77	0.64	0.68	0.66
			Agriculture/ Forestry	020300	0.26	0.25	0.19	0.12	0.12	0.13	0.14	0.11	0.13	0.09
	ORIMULSION	1A1	Electricity and heat production	010101						19.91	36.77	40.49	32.58	34.19
	PETROLEUM COKE	1A1	Electricity and heat production	010100				1.24						
				010102					3.18	0.92				
		1A2	Industry	030100	0.30		0.06	0.12		0.10	0.11	0.03	0.03	0.04
				030311	2.50	2.99	3.23	3.23	3.47	3.71	4.97	5.23	4.77	6.40
		1A4	Commercial/ Institutional	020100	0.06	0.10	0.09	0.10	0.09	0.07	0.09	0.10	0.07	0.05
			Residential	020200	0.76	0.70	0.46	0.49	0.40	0.23	0.43	0.34	0.22	0.20
			Agriculture/ Forestry	020300	0.84	0.61	0.47	0.50	0.41	0.24	0.29	0.32	0.20	0.09
	REFINERY GAS	1A1	Electricity and heat production	010203							0.03	0.04		
			Petroleum refining	010300	0.46	0.93	1.53	2.08						
				010304					2.36	2.29	2.67	2.28	2.48	2.65
				010306	13.52	13.49	13.24	13.21	14.00	18.55	18.70	14.54	12.71	13.07
		1A2	Industry	030100	0.19	0.13	0.10	0.11			0.03	0.05	0.03	
	RESIDUAL OIL	1A1	Electricity and heat production	010100	0.78	0.37	1.75	0.75						
				010101	6.51	9.63	8.26	7.78	21.50	8.49	11.61	5.15	8.87	6.00
				010102	0.70	0.44	0.45	0.66	0.76	2.53	4.57	2.63	2.78	1.58
				010103					0.21	0.36	0.04	0.20	0.16	
				010104										0.01
				010105					0.01	0.00	0.00	0.00	0.01	0.00
				010200	2.01	2.24	1.14	0.88						
				010202					0.24	0.46	0.52	0.41	0.23	0.28
				010203					1.19	1.29	1.66	1.33	1.54	1.43
			Petroleum refining	010306	1.31	2.04	3.57	3.49	3.34	2.33	2.24	1.62	1.11	1.09
		1A2	Industry	030100	15.80	18.27	17.83	13.80	11.86	9.48	9.88	8.49	8.39	7.95
				030102					0.79	0.85	0.77	0.68	0.55	0.58
				030103					0.15	0.22	0.10	0.14	0.07	0.24
				030104								0.05		
				030311	1.76	2.15	2.37	2.40	2.62	2.84	1.77	1.86	2.54	0.89
		1A4	Commercial/ Institutional	020100	1.07	0.87	0.60	0.52	0.72	0.68	0.72	0.73	0.38	0.45
				020103					0.09	0.08				
			Residential	020200	0.22	0.22	0.17	0.13	0.10	0.06	0.07	0.05	0.04	0.05
			Agriculture/ Forestry	020300	1.22	1.30	1.63	1.69	1.94	2.62	3.07	2.49	2.56	2.39
				020302									0.00	0.00
				020304									0.01	0.01
SOLID	BROWN COAL BRI.	1A2	Industry	030100	0.00	0.01	0.00	0.02	0.00	0.00	0.00	0.00		
		1A4	Commercial/ Institutional	020100	0.00	0.00		0.01	0.00	0.00	0.00	0.00		

fuel_type	fuel_gr_abbr	NFR	nfr_name	snap_id	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
			Residential	020200	0.05	0.07	0.04	0.08	0.08	0.06	0.05	0.05	0.04	0.04
			Agriculture/ Forestry	020300	0.06	0.09	0.05	0.02	0.01	0.01	0.01	0.00	0.00	
	COAL	1A1	Electricity and heat production	010100	8.52	12.89	10.18	8.22						
				010101	207.92	294.72	241.79	256.32	284.66	233.17	333.57	244.26	206.22	172.04
				010102	13.98	11.03	13.21	15.41	18.91	19.37	22.59	17.06	14.23	12.84
				010103					0.49	0.37	0.06			
				010104					0.27	0.27	0.30	0.07		
				010105					0.02					
				010200	6.02	6.64	5.17	3.58						
				010202					1.08	0.68				
				010203					1.38	0.95	0.65	0.15	0.09	0.04
		1A2	Industry	030100	8.85	8.98	6.75	7.70	5.87	4.63	4.24	4.14	4.40	3.52
				030102					0.47	1.05	1.45	1.47	1.41	1.41
				030103					0.34	0.39	0.41	0.55	0.27	0.19
				030311	5.02	6.05	6.58	6.60	6.91	7.22	7.07	7.21	6.63	5.64
		1A4	Commercial/ Institutional	020100	0.09	0.01	0.10	0.08	0.09	0.07	0.04	0.04	0.00	
			Residential	020200	0.59	1.13	0.87	0.79	0.62	0.38	0.09	0.09	0.13	0.08
			Agriculture/ Forestry	020300	2.46	2.85	2.20	2.11	2.29	1.80	1.45	1.24	0.90	0.71
	COKE OVEN COKE	1A2	Industry	030100	1.17	1.35	1.08	1.07	1.16	0.29	0.30	0.30	0.32	0.38
				030318						0.94	0.89	0.93	1.01	1.03
		1A4	Residential	020200	0.11	0.10	0.10	0.08	0.06	0.05	0.04	0.03	0.02	0.01
Grand Total					497.80	608.57	548.94	579.64	622.33	599.44	755.43	651.14	614.27	585.38

Continued

fuel_type	fuel_gr_abbr	NFR	nfr_name	snap_id	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
BIOMASS	BIOGAS	1A1	Electricity and heat production	010102	0.03	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.01	0.01
				010105	1.07	1.15	1.27	1.34	1.38	1.45	1.45	1.57	1.58	1.69
				010203	0.30	0.28	0.25	0.26	0.14	0.09	0.12	0.15	0.16	0.13
		1A2	Industry	030100	0.02	0.01	0.01	0.04	0.04	0.11	0.12	0.12	0.09	0.08
				030102	0.02	0.02	0.02	0.04	0.05	0.05	0.04	0.03	0.05	0.06
				030103	0.02	0.06	0.07	0.06	0.06	0.01	0.01	0.01	0.05	0.06
				030105		0.02	0.06	0.08	0.09	0.25	0.22	0.22	0.23	0.25
		1A4	Commercial/ Institutional	020100	0.31	0.35	0.43	0.32	0.44	0.44	0.47	0.37	0.36	0.31
				020103	0.09	0.08	0.07	0.09	0.11	0.11	0.14	0.10	0.11	0.11
				020105	0.87	0.83	0.82	0.79	0.79	0.76	0.59	0.58	0.56	0.62
			Agriculture/ Forestry	020300	0.08	0.08	0.10	0.13	0.17	0.08	0.33	0.28	0.27	0.34
				020304	0.08	0.11	0.20	0.37	0.42	0.46	0.41	0.47	0.46	0.51
	STRAW	1A1	Electricity and heat production	010101	1.12	1.59	2.64	3.16	3.66	3.33	3.69	3.59	2.42	2.82
				010102	1.33	1.26	1.17	1.29	2.06	2.04	1.70	1.87	1.74	1.89
				010103	0.73	2.09	1.94	2.07	2.11	2.13	2.06	2.14	2.13	2.16
				010104		0.10	1.22	1.71	1.86	2.45	2.54	2.51	0.82	1.52
				010203	3.84	3.81	3.83	3.81	3.40	3.69	3.69	3.79	3.89	4.07
		1A2	Industry	030105	0.00	0.00								
		1A4	Residential	020200	3.11	2.90	2.90	2.90	2.90	2.90	2.90	2.90	2.90	2.90
			Agriculture/ Forestry	020300	1.59	1.46	1.48	1.48	1.48	1.48	1.43	1.49	1.46	1.47
				020302	0.50	0.48	0.47	0.47	0.47	0.47	0.52	0.46	0.48	0.50
	WOOD	1A1	Electricity and heat production	010101		0.00	0.07	0.31	0.23	0.17	0.29	0.17	0.26	0.52
				010102	2.73	2.52	3.19	5.36	5.43	6.62	6.49	6.29	5.80	7.11
				010103	0.44	0.53	0.64	0.60	0.67	0.57	0.51	0.56	0.56	0.66
				010104			0.12	1.58	4.49	4.48	2.61	3.77	5.96	6.26
				010203	3.90	4.49	4.96	5.62	6.15	6.55	7.02	7.07	7.86	8.59

fuel_type	fuel_gr_abbr	NFR	nfr_name	snap_id	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
		1A2	Industry	030100	4.45	4.60	3.31	3.53	3.43	3.67	4.26	4.35	5.48	4.51
				030102	0.00	0.00					0.01	1.06	1.18	1.21
				030103	0.39	0.39	0.40	0.28	0.40	0.34	0.44	0.39	0.45	0.48
		1A4	Commercial/ Institutional	020100	0.78	0.67	0.67	0.68	0.68	0.82	0.95	1.01	1.07	1.06
				020105		0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
			Residential	020200	14.62	17.48	18.07	20.86	22.27	26.40	29.42	35.51	34.45	33.38
				020202						0.00	0.00	0.00	0.00	0.00
				020204									0.00	0.00
			Agriculture/ Forestry	020300	0.17	0.15	0.15	0.11	0.10	0.09	0.08	0.08	0.08	0.08
				020302	0.06	0.10	0.13	0.13	0.12	0.09	0.03	0.09	0.06	0.07
	BIO PROD GAS	1A1	Electricity and heat production	010105	0.05	0.06	0.06	0.07	0.08	0.08	0.09	0.09	0.08	0.25
		1A2	Industry	030105								0.00	0.00	0.00
		1A4	Agriculture/ Forestry	020304	0.00	0.00								
	BIO OIL	1A1	Electricity and heat production	010101				0.10				0.01	0.01	
				010105					0.00			0.00	0.00	0.00
				010202				0.01	0.00	0.02	0.02	0.05	0.40	0.19
				010203	0.05	0.19	0.07	0.30	0.64	0.74	1.10	1.14	1.39	1.43
		1A2	Industry	030103			0.06							
				030105			0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		1A4	Commercial/ Institutional	020105								0.00		
			Residential	020200								0.00	0.04	0.04
			Agriculture/ Forestry	020304	0.00	0.00	0.00							
WASTE	MUNICIP. WASTES	1A1	Electricity and heat production	010101		0.11	0.52	0.08					0.02	0.03
				010102	7.09	7.66	8.17	8.30	9.77	11.33	11.71	11.93	12.31	12.18
				010103	5.30	5.28	5.42	5.37	5.36	5.16	5.62	5.56	5.66	5.16
				010104	1.30	1.45	1.54	1.75	1.71	1.52	1.81	1.95	1.95	1.91
				010203	3.78	3.88	3.89	4.36	3.81	2.55	2.25	2.79	2.92	2.38
		1A2	Industry	030102					0.00	0.00			0.02	
				030311	0.32	0.85	1.09	0.86	1.17	1.17	0.89	0.97	1.15	1.03
		1A4	Commercial/ Institutional	020100	0.07			0.77	0.06	0.39	0.21	0.15		
				020103	0.01	0.01	0.01	0.04	0.04	0.10	0.11	0.03	0.04	0.03
P_WASTE	FOSSIL WASTE	1A1	Electricity and heat production	010101		0.08	0.37	0.06					0.01	0.02
				010102	4.97	5.37	5.73	5.81	6.84	7.94	8.21	8.36	8.63	8.54
				010103	3.71	3.70	3.80	3.76	3.75	3.61	3.94	3.89	3.97	3.61
				010104	0.91	1.01	1.08	1.22	1.20	1.06	1.27	1.37	1.37	1.34
				010203	2.65	2.72	2.73	3.05	2.67	1.79	1.58	1.95	2.05	1.67
		1A2	Industry	030102					0.00	0.00			0.02	
				030311	0.22	0.59	0.76	0.60	0.82	0.82	0.62	0.68	0.81	0.72
		1A4	Commercial/ Institutional	020100	0.05			0.54	0.04	0.28	0.15	0.11		
				020103	0.01	0.01	0.01	0.03	0.03	0.07	0.08	0.02	0.03	0.02
GAS	NATURAL GAS	1A1	Electricity and heat production	010101	18.44	18.19	16.52	17.88	17.30	17.24	18.96	13.89	10.91	13.38
				010102	6.54	6.37	5.52	3.94	3.34	2.96	2.60	0.94	3.82	2.73
				010103	0.05	0.03	0.02	0.04	0.04	0.01	0.05	0.06	0.06	0.05
				010104	22.81	24.87	30.04	29.66	30.53	25.50	32.05	26.22	27.83	24.59
				010105	25.51	27.85	27.59	26.74	26.92	24.03	21.47	17.10	18.30	15.43
				010202	0.14	0.08	0.21	0.21	0.28	0.22	0.06	0.23	0.38	2.10
				010203	2.32	2.94	2.36	3.23	2.72	4.42	4.57	6.12	6.03	6.91
			Other energy industries	010504	25.36	24.76	26.56	26.57	27.42	28.11	28.72	28.48	28.33	26.93
		1A2	Industry	030100	28.53	30.89	28.91	27.88	26.40	26.65	26.54	27.08	27.27	25.74
				030102	2.69	2.87	1.19	2.27	2.30	2.20	2.29	1.57	1.50	0.81

fuel_type	fuel_gr_abbr	NFR	nfr_name	snap_id	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
				030103	0.68	0.18	0.46	0.59	0.60	0.57	0.58	0.62	0.52	0.56
				030104	6.42	6.19	6.72	6.48	6.81	5.88	4.64	4.47	3.82	3.33
				030105	1.57	1.66	1.57	1.56	1.59	1.34	1.02	0.53	0.59	0.63
				030106	0.06	0.06	0.03	0.02	0.03	0.01	0.01	0.02	0.12	0.08
				030315	1.10	1.09	1.02	0.95	0.91	0.87	0.83	0.83	0.87	0.72
				030318	0.63	0.59	0.52	0.55	0.61	0.56	0.56	0.63	0.57	0.41
		1A4	Commercial/ Institutional	020100	7.23	7.32	7.62	9.22	9.20	9.74	10.76	10.10	9.73	9.21
				020103	0.16	0.19	0.17	0.01	0.09	0.01	0.08	0.02	0.05	0.03
				020104	0.00	0.01	0.01	0.01	0.00	0.00	0.00	0.00		
				020105	1.11	1.14	1.17	1.14	1.10	1.02	1.03	0.92	0.88	0.85
			Residential	020200	27.57	29.26	28.08	30.02	29.86	29.52	28.59	26.57	26.52	26.84
				020202	0.06	0.08	0.03	0.07	0.07	0.03	0.06	0.07	0.10	0.10
				020204	1.40	1.41	1.36	1.38	1.42	1.41	1.44	1.31	1.20	1.15
			Agriculture/ Forestry	020300	2.38	2.69	2.54	2.32	2.26	2.25	2.24	1.87	1.66	1.71
				020304	3.34	3.12	3.39	3.20	3.30	2.85	1.92	1.33	1.06	0.90
LIQUID	GAS OIL	1A1	Electricity and heat production	010101	0.05	0.08	0.09	0.96	0.21	0.18	0.45	0.52	0.92	2.29
				010102	0.11	0.10	0.09	0.03	0.05	0.03	0.04	0.06	0.04	0.08
				010103	0.05	0.02	0.03	0.03	0.02	0.02	0.01	0.02	0.02	0.02
				010104	0.07	0.04	0.03	0.03	0.07	0.09	0.08	0.05	0.04	0.06
				010105	0.08	0.10	0.09	0.09	0.11	0.08	0.07	0.15	0.14	0.09
				010202	0.54	0.94	0.24	0.35	0.49	0.26	0.24	0.36	0.31	0.51
				010203	0.61	0.54	0.44	0.05	0.61	0.46	0.37	0.33	0.72	0.95
				010204				1.04						
			Petroleum refining	010306				0.00	0.01	0.00	0.01	0.01	0.00	0.01
		1A2	Industry	030100	2.18	2.99	2.34	2.61	2.47	1.58	0.52	0.00	0.00	0.00
				030102				0.00	0.00	0.00	0.01	0.01	0.02	0.00
				030103	0.08	0.01	0.00	0.00	0.00	0.01	0.00	0.00	0.00	
				030104	0.00		0.00			0.00	0.00	0.00	0.00	0.00
				030105	0.00	0.00							0.00	0.00
				030315	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00
		1A4	Commercial/ Institutional	020100	4.96	4.69	4.04	4.30	4.41	3.75	3.03	2.61	2.80	2.78
				020103	0.07	0.05	0.04	0.03	0.02	0.05	0.03	0.02	0.03	0.06
				020105	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Residential	020200	30.28	31.51	29.00	27.03	25.29	23.86	21.20	17.38	15.61	17.28
				020204									0.01	0.02
			Agriculture/ Forestry	020300	2.15	2.55	2.15	2.25	1.97	1.22	0.45			
				020302	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
				020304	0.01	0.01	0.02	0.02	0.01	0.03	0.02	0.02	0.03	0.02
	KEROSENE	1A2	Industry	030100	0.01	0.03	0.07	0.05	0.02	0.01	0.02	0.01	0.02	0.01
		1A4	Commercial/ Institutional	020100	0.06	0.08	0.07	0.07	0.08	0.10	0.06	0.02	0.01	0.02
			Residential	020200	0.09	0.16	0.11	0.21	0.11	0.16	0.14	0.09	0.09	0.07
			Agriculture/ Forestry	020300	0.01	0.02	0.01	0.01	0.01	0.01	0.01	0.00	0.00	0.00
	LPG	1A1	Electricity and heat production	010101							0.00		0.00	0.00
				010102									0.00	0.00
				010202						0.00	0.00	0.00		
				010203	0.00					0.00		0.00	0.00	0.00
		1A2	Industry	030100	1.02	0.76	0.68	0.73	0.75	0.74	0.77	0.49	0.45	0.39
		1A4	Commercial/ Institutional	020100	0.12	0.12	0.14	0.17	0.21	0.25	0.27	0.27	0.27	0.27
				020105						0.00	0.00	0.00	0.00	0.00
			Residential	020200	0.76	0.74	0.63	0.70	0.75	0.80	0.88	0.88	0.78	0.70

fuel_type	fuel_gr_abbr	NFR	nfr_name	snap_id	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
			Agriculture/ Forestry	020300	0.09	0.08	0.06	0.06	0.05	0.05	0.05	0.03	0.03	0.04
	ORIMULSION	1A1	Electricity and heat production	010101	34.15	30.24	23.85	1.92	0.02					
	PETROLEUM COKE	1A1	Electricity and heat production	010102					0.01	0.00				0.03
		1A2	Industry	030100	0.29	0.13	0.22	0.23	0.18	0.16	0.16			
				030311	6.47	7.66	7.54	7.71	8.19	7.80	8.28	9.11	6.84	5.89
		1A4	Commercial/ Institutional	020100	0.01	0.01	0.01	0.01		0.07	0.01	0.04	0.06	0.00
			Residential	020200	0.01	0.01	0.01	0.01		0.06	0.01	0.01	0.02	
			Agriculture/ Forestry	020300	0.01	0.00	0.00	0.00						
	REFINERY GAS	1A1	Petroleum refining	010304	2.40	2.45	2.46	2.67	2.44	2.00	2.25	2.31	1.83	1.94
				010306	13.16	13.31	12.74	13.88	13.45	13.35	13.87	13.61	12.95	13.48
	RESIDUAL OIL	1A1	Electricity and heat production	010101	3.44	3.51	3.75	5.76	4.60	4.33	3.34	5.44	2.81	3.62
				010102	0.66	2.31	1.25	1.66	1.33	1.46	1.79	0.26	0.91	1.86
				010103	0.27	0.09	0.13	0.10	0.18	0.20	0.11	0.60	0.23	0.08
				010104		1.72	6.62	9.32	7.39	6.34	8.40	4.50	4.47	2.88
				010105	0.02	0.00	0.00	0.01	0.00	0.02	0.02	0.00	0.01	0.01
				010202										0.01
				010203	1.11	1.17	1.04	0.69	0.34	0.53	0.45		0.11	0.32
			Petroleum refining	010306	1.32	1.44	1.36	0.91	1.07	0.69	0.62	0.77	0.89	0.73
		1A2	Industry	030100	7.43	6.90	7.89	5.54	5.02	3.66	6.06	3.45	0.66	0.22
				030102	0.63	0.57	0.46	0.92	0.92	1.06	0.82	0.61	1.90	1.97
				030103	0.21	0.31	0.35	0.73	0.77	0.84	0.79	0.81	1.01	1.10
				030105		0.00	0.00	0.00	0.00	0.01	0.00		0.00	
				030311	0.86	0.50	0.59	0.59	0.82	0.69	0.98	1.06	0.51	0.25
		1A4	Commercial/ Institutional	020100	0.34	0.17	0.48	0.17	0.11	0.12	0.25	0.23	0.10	0.03
			Residential	020200	0.04	0.03	0.15	0.05	0.04	0.05	0.20	0.01	0.01	0.01
			Agriculture/ Forestry	020300	1.78	1.64	1.37	0.91	0.72	0.76	0.90	0.64	0.64	0.60
				020302				0.01	0.01	0.01	0.02	0.03	0.03	0.02
				020304	0.00	0.00	0.00	0.00						
SOLID	BROWN COAL BRI.	1A4	Residential	020200	0.03	0.03	0.02	0.00					0.01	0.01
	COAL	1A1	Electricity and heat production	010101	143.84	156.22	158.32	223.55	167.93	140.02	218.36	180.90	159.44	161.87
				010102	9.30	7.74	7.98	6.43	4.51	4.05	3.29	3.05	2.81	1.99
				010104										0.02
				010203	0.04	0.03	0.02	0.03	0.02	0.05		0.06	0.01	
		1A2	Industry	030100	3.23	3.12	2.01	2.72	3.25	2.58	2.52	2.66	1.60	0.14
				030102	1.06	1.00	1.00	1.57	1.50	1.50	1.23	1.16	1.22	1.21
				030103	0.43	0.44	0.12	0.10	0.09	0.10	0.20	0.21	0.25	0.32
				030311	5.71	4.52	4.35	3.37	3.75	3.92	4.36	4.03	3.54	1.14
		1A4	Commercial/ Institutional	020100					0.00					
			Residential	020200	0.01	0.01	0.02	0.00	0.00	0.01	0.00	0.01	0.01	0.01
			Agriculture/ Forestry	020300	1.08	1.23	0.86	1.20	1.44	1.79	2.00	2.05	1.86	1.31
				020304					0.00	0.00				0.00
	COKE OVEN COKE	1A2	Industry	030100	0.24	0.22	0.28	0.28	0.30	0.24	0.25	0.21	0.15	0.02
				030102									0.06	0.06
				030103								0.04	0.05	0.06
				030318	0.94	0.88	0.79	0.69	0.81	0.74	0.76	0.88	0.78	0.61
		1A4	Residential	020200	0.01	0.00	0.00	0.03	0.03	0.00	0.00	0.00	0.00	0.00
Grand Total					**543.18**	**569.65**	**567.96**	**627.11**	**567.69**	**531.11**	**616.29**	**557.11**	**528.09**	**520.68**

Annex 2A-3 Lower Calorific Value (LCV) of fuels

(see table next page)

Table 56 Time-series for calorific values of fuels (DEA 2009b).

		1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Crude Oil, Average	GJ pr tonne	42.40	42.40	42.40	42.70	42.70	42.70	42.70	43.00	43.00	43.00
Crude Oil, Golf	GJ pr tonne	41.80	41.80	41.80	41.80	41.80	41.80	41.80	41.80	41.80	41.80
Crude Oil, North Sea	GJ pr tonne	42.70	42.70	42.70	42.70	42.70	42.70	42.70	43.00	43.00	43.00
Refinery Feedstocks	GJ pr tonne	41.60	41.60	41.60	41.60	41.60	41.60	41.60	42.70	42.70	42.70
Refinery Gas	GJ pr tonne	52.00	52.00	52.00	52.00	52.00	52.00	52.00	52.00	52.00	52.00
LPG	GJ pr tonne	46.00	46.00	46.00	46.00	46.00	46.00	46.00	46.00	46.00	46.00
Naphtha (LVN)	GJ pr tonne	44.50	44.50	44.50	44.50	44.50	44.50	44.50	44.50	44.50	44.50
Motor Gasoline	GJ pr tonne	43.80	43.80	43.80	43.80	43.80	43.80	43.80	43.80	43.80	43.80
Aviation Gasoline	GJ pr tonne	43.80	43.80	43.80	43.80	43.80	43.80	43.80	43.80	43.80	43.80
JP4	GJ pr tonne	43.80	43.80	43.80	43.80	43.80	43.80	43.80	43.80	43.80	43.80
Other Kerosene	GJ pr tonne	43.50	43.50	43.50	43.50	43.50	43.50	43.50	43.50	43.50	43.50
JP1	GJ pr tonne	43.50	43.50	43.50	43.50	43.50	43.50	43.50	43.50	43.50	43.50
Gas/Diesel Oil	GJ pr tonne	42.70	42.70	42.70	42.70	42.70	42.70	42.70	42.70	42.70	42.70
Fuel Oil	GJ pr tonne	40.40	40.40	40.40	40.40	40.40	40.40	40.70	40.65	40.65	40.65
Orimulsion	GJ pr tonne	27.60	27.60	27.60	27.60	27.60	28.13	28.02	27.72	27.84	27.58
Petroleum Coke	GJ pr tonne	31.40	31.40	31.40	31.40	31.40	31.40	31.40	31.40	31.40	31.40
Waste Oil	GJ pr tonne	41.90	41.90	41.90	41.90	41.90	41.90	41.90	41.90	41.90	41.90
White Spirit	GJ pr tonne	43.50	43.50	43.50	43.50	43.50	43.50	43.50	43.50	43.50	43.50
Bitumen	GJ pr tonne	39.80	39.80	39.80	39.80	39.80	39.80	39.80	39.80	39.80	39.80
Lubricants	GJ pr tonne	41.90	41.90	41.90	41.90	41.90	41.90	41.90	41.90	41.90	41.90
Natural Gas	GJ pr 1000 Nm^3	39.00	39.00	39.00	39.30	39.30	39.30	39.30	39.60	39.90	40.00
Town Gas	GJ pr 1000 m^3							17.00	17.00	17.00	17.00
Electricity Plant Coal	GJ pr tonne	25.30	25.40	25.80	25.20	24.50	24.50	24.70	24.96	25.00	25.00
Other Hard Coal	GJ pr tonne	26.10	26.50	26.50	26.50	26.50	26.50	26.50	26.50	26.50	26.50
Coke	GJ pr tonne	31.80	29.30	29.30	29.30	29.30	29.30	29.30	29.30	29.30	29.30
Brown Coal Briquettes	GJ pr tonne	18.30	18.30	18.30	18.30	18.30	18.30	18.30	18.30	18.30	18.30
Straw	GJ pr tonne	14.50	14.50	14.50	14.50	14.50	14.50	14.50	14.50	14.50	14.50
Wood Chips	GJ pr Cubic metre	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80
Wood Chips	GJ pr m^3	9.30	9.30	9.30	9.30	9.30	9.30	9.30	9.30	9.30	9.30
Firewood, Hardwood	GJ pr m^3	10.40	10.40	10.40	10.40	10.40	10.40	10.40	10.40	10.40	10.40
Firewood, Conifer	GJ pr tonne	7.60	7.60	7.60	7.60	7.60	7.60	7.60	7.60	7.60	7.60
Wood Pellets	GJ pr tonne	17.50	17.50	17.50	17.50	17.50	17.50	17.50	17.50	17.50	17.50
Wood Waste	GJ pr Cubic metre	14.70	14.70	14.70	14.70	14.70	14.70	14.70	14.70	14.70	14.70
Wood Waste	GJ pr 1000 m^3	3.20	3.20	3.20	3.20	3.20	3.20	3.20	3.20	3.20	3.20
Biogas	GJ pr tonne								23.00	23.00	23.00
Wastes	GJ pr tonne	8.20	8.20	9.00	9.40	9.40	10.00	10.50	10.50	10.50	10.50
Bioethanol	GJ pr tonne	26.70	26.70	26.70	26.70	26.70	26.70	26.70	26.70	26.70	26.70
Liquid Biofuels	GJ pr tonne	37.60	37.60	37.60	37.60	37.60	37.60	37.60	37.60	37.60	37.60
Bio Oil	GJ pr tonne	37.20	37.20	37.20	37.20	37.20	37.20	37.20	37.20	37.20	37.20

Continued		2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Crude Oil, Average	GJ pr tonne	43.00	43.00	43.00	43.00	43.00	43.00	43.00	43.00	43.00	43.00
Crude Oil, Golf	GJ pr tonne	41.80	41.80	41.80	41.80	41.80	41.80	41.80	41.80	41.80	41.80
Crude Oil, North Sea	GJ pr tonne	43.00	43.00	43.00	43.00	43.00	43.00	43.00	43.00	43.00	43.00
Refinery Feedstocks	GJ pr tonne	42.70	42.70	42.70	42.70	42.70	42.70	42.70	42.70	42.70	42.70
Refinery Gas	GJ pr tonne	52.00	52.00	52.00	52.00	52.00	52.00	52.00	52.00	52.00	52.00
LPG	GJ pr tonne	46.00	46.00	46.00	46.00	46.00	46.00	46.00	46.00	46.00	46.00
Naphtha (LVN)	GJ pr tonne	44.50	44.50	44.50	44.50	44.50	44.50	44.50	44.50	44.50	44.50
Motor Gasoline	GJ pr tonne	43.80	43.80	43.80	43.80	43.80	43.80	43.80	43.80	43.80	43.80
Aviation Gasoline	GJ pr tonne	43.80	43.80	43.80	43.80	43.80	43.80	43.80	43.80	43.80	43.80
JP4	GJ pr tonne	43.80	43.80	43.80	43.80	43.80	43.80	43.80	43.80	43.80	43.80
Other Kerosene	GJ pr tonne	43.50	43.50	43.50	43.50	43.50	43.50	43.50	43.50	43.50	43.50
JP1	GJ pr tonne	43.50	43.50	43.50	43.50	43.50	43.50	43.50	43.50	43.50	43.50
Gas/Diesel Oil	GJ pr tonne	42.70	42.70	42.70	42.70	42.70	42.70	42.70	42.70	42.70	42.70
Fuel Oil	GJ pr tonne	40.65	40.65	40.65	40.65	40.65	40.65	40.65	40.65	40.65	40.65
Orimulsion	GJ pr tonne	27.62	27.64	27.71	27.65	27.65	27.65	27.65	27.65	27.65	27.65
Petroleum Coke	GJ pr tonne	31.40	31.40	31.40	31.40	31.40	31.40	31.40	31.40	31.40	31.40
Waste Oil	GJ pr tonne	41.90	41.90	41.90	41.90	41.90	41.90	41.90	41.90	41.90	41.90
White Spirit	GJ pr tonne	43.50	43.50	43.50	43.50	43.50	43.50	43.50	43.50	43.50	43.50
Bitumen	GJ pr tonne	39.80	39.80	39.80	39.80	39.80	39.80	39.80	39.80	39.80	39.80
Lubricants	GJ pr tonne	41.90	41.90	41.90	41.90	41.90	41.90	41.90	41.90	41.90	41.90
Natural Gas	GJ pr 1000 Nm^3	40.15	39.99	40.06	39.94	39.77	39.67	39.54	39.59	39.48	39.46
Town Gas	GJ pr 1000 m^3	17.01	16.88	17.39	16.88	17.58	17.51	17.20	17.14	15.50	21.29
Electricity Plant Coal	GJ pr tonne	24.80	24.90	25.15	24.73	24.60	24.40	24.80	24.40	24.30	24.60
Other Hard Coal	GJ pr tonne	26.50	26.50	26.50	26.50	26.50	26.50	26.50	26.50	26.50	26.50
Coke	GJ pr tonne	29.30	29.30	29.30	29.30	29.30	29.30	29.30	29.30	29.30	29.30
Brown Coal Briquettes	GJ pr tonne	18.30	18.30	18.30	18.30	18.30	18.30	18.30	18.30	18.30	18.30
Straw	GJ pr tonne	14.50	14.50	14.50	14.50	14.50	14.50	14.50	14.50	14.50	14.50
Wood Chips	GJ pr Cubic metre	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80
Wood Chips	GJ pr m^3	9.30	9.30	9.30	9.30	9.30	9.30	9.30	9.30	9.30	9.30
Firewood, Hardwood	GJ pr m^3	10.40	10.40	10.40	10.40	10.40	10.40	10.40	10.40	10.40	10.40
Firewood, Conifer	GJ pr tonne	7.60	7.60	7.60	7.60	7.60	7.60	7.60	7.60	7.60	7.60
Wood Pellets	GJ pr tonne	17.50	17.50	17.50	17.50	17.50	17.50	17.50	17.50	17.50	17.50
Wood Waste	GJ pr Cubic metre	14.70	14.70	14.70	14.70	14.70	14.70	14.70	14.70	14.70	14.70
Wood Waste	GJ pr 1000 m^3	3.20	3.20	3.20	3.20	3.20	3.20	3.20	3.20	3.20	3.20
Biogas	GJ pr tonne	23.00	23.00	23.00	23.00	23.00	23.00	23.00	23.00	23.00	23.00
Wastes	GJ pr tonne	10.50	10.50	10.50	10.50	10.50	10.50	10.50	10.50	10.50	10.50
Bioethanol	GJ pr tonne	26.70	26.70	26.70	26.70	26.70	26.70	26.70	26.70	26.70	26.70
Liquid Biofuels	GJ pr tonne	37.60	37.60	37.60	37.60	37.60	37.60	37.60	37.60	37.50	37.50
Bio Oil	GJ pr tonne	37.20	37.20	37.20	37.20	37.20	37.20	37.20	37.20	37.20	37.20

Table 2A-3.2 Fuel category correspondence list, DEA, NERI and Climate Convention reportings (IPCC).

Danish Energy Agency	NERI Emission database	IPCC fuel category
Other Hard Coal	Coal	Solid
Coke	Coke oven coke	Solid
Electricity Plant Coal	Coal	Solid
Brown Coal Briquettes	Brown coal briq.	Solid
Orimulsion	Orimulsion	Liquid
Petroleum Coke	Petroleum coke	Liquid
Fuel Oil	Residual oil	Liquid
Waste Oil	Residual oil	Liquid
Gas/Diesel Oil	Gas oil	Liquid
Other Kerosene	Kerosene	Liquid
LPG	LPG	Liquid
Refinery Gas	Refinery gas	Liquid
Town Gas	Natural gas	Gas
Natural Gas	Natural gas	Gas
Straw	Straw	Biomass
Wood Waste	Wood and simil.	Biomass
Wood Pellets	Wood and simil.	Biomass
Wood Chips	Wood and simil.	Biomass
Firewood, Hardwood & Conifer	Wood and simil.	Biomass
Waste Combustion (biomass)	Municip. wastes	Biomass
Bio Oil	Bio oil	Biomass
Biogas	Biogas	Biomass
Biogas, other	Biogas	Biomass
Biogas, landfill	Biogas	Biomass
Biogas, sewage sludge	Biogas	Biomass
(Wood applied in gas engines)	Biomass producer gas	Biomass
Waste Combustion (fossil)	Fossil waste	Other fuel

Annex 2A-4 Emission factors

Table 2A-4.1 SO_2, NO_x, NMVOC and CO emission factors and references 2009.

					SO_2		NO_x		NMVOC		CO	
Fuel type	**Fuel**	**NFR**	**NFR_name**	**SNAP**	**g/GJ**	*Ref.*	**g/GJ**	*Ref.*	**g/GJ**	*Ref.*	**g/GJ**	*Ref.*
BIO-MASS	WOOD	1A1a	Electricity and heat production	010102	1.9	*12*	81	*12*	5.1	*12*	90	*12*
				010103	1.9	*12*	81	*12*	5.1	*12*	90	*12*
				010104	1.9	*12*	81	*12*	5.1	*12*	90	*12*
				010203	25	*22, 21*	90	*22, 21, 4*	7.3	*13*	240	*4*
		1A2	Industry	030100	25	*22, 21*	90	*22, 21, 4*	10	*13*	240	*4*
				030102	25	*22, 21*	90	*22, 21, 4*	10	*13*	240	*4*
				030103	25	*22, 21*	90	*22, 21, 4*	10	*13*	240	*4*
		1A4a	Commercial/ Institutional	020100	25	*22, 21*	90	*22, 21, 4*	146	*13*	240	*4*
				020105	25	*22, 21*	90	*22, 21, 4*	146	*13*	240	*4*
		1A4b i	Residential	020200	25	*22, 21*	120	*22*	437	*39*	3165	*39*
				020202	25	*22, 21*	120	*22*	437	*39*	3165	*39*
				020205	25	*22, 21*	120	*22*	437	*39*	3165	*39*
		1A4c i	Agriculture/ Forestry	020300	25	*22, 21*	90	*22, 21, 4*	146	*13*	240	*4*
	STRAW	1A1a	Electricity and heat production	010101	49	*12*	125	*12*	0.78	*12*	67	*12*
				010102	49	*12*	125	*12*	0.78	*12*	67	*12*
				010103	49	*12*	125	*12*	0.78	*12*	67	*12*
				010104	49	*12*	125	*12*	0.78	*12*	67	*12*
				010203	130	*5*	90	*4, 28*	7.3	*13*	325	*4, 5*
		1A4b i	Residential	020200	130	*5*	90	*4, 28*	400	*13*	4000	*1, 6, 7*
		1A4c i	Agriculture/ Forestry	020300	130	*5*	90	*4, 28*	146	*13*	4000	*1, 6, 7*
	BIO OIL	1A1a	Electricity and heat production	010105	1	*37*	700	*15*	37	*13*	15	*15*
				010202	1	*37*	65	*15*	0.8	*13*	15	*15*
				010203	1	*37*	65	*15*	0.8	*13*	15	*15*
		1A2	Industry	030105	1	*37*	700	*15*	37	*13*	100	*15*
		1A4b i	Residential	020200	1	*37*	65	*15*	15	*13*	100	*15*
	BIOGAS	1A1a	Electricity and heat production	010102	25	*26*	28	*4*	2	*16*	36	*4*
				010105	19.2	*31*	202	*12*	10	*12*	310	*12*
				010203	25	*26*	28	*4*	2	*16*	36	*4*
		1A2	Industry	030100	25	*26*	28	*4*	2	*16*	36	*4*
				030102	25	*26*	59	*4*	2	*16*	36	*4*
				030103	25	*26*	59	*4*	2	*16*	36	*4*
				030105	19.2	*31*	202	*12*	10	*12*	310	*12*
		1A4a	Commercial/ Institutional	020100	25	*26*	28	*4*	2	*16*	36	*4*
				020103	25	*26*	28	*4*	2	*16*	36	*4*
				020105	19.2	*31*	202	*12*	10	*12*	310	*12*
		1A4c i	Agriculture/ Forestry	020300	25	*26*	28	*4*	2	*16*	36	*4*
				020304	19.2	*31*	202	*12*	10	*12*	310	*12*
	BIO PROD GAS	1A1a	Electricity and heat production	010105	1.9	*12*	173	*12*	2	*12*	586	*12*
		1A2	Industry	030105	1.9	*12*	173	*12*	2	*12*	586	*12*
WASTE	MUNICIP. WASTES	1A1a	Electricity and heat production	010101	8.3	*12*	102	*12*	0.56	*12*	3.9	*12*
				010102	8.3	*12*	102	*12*	0.56	*12*	3.9	*12*
				010103	8.3	*12*	102	*12*	0.56	*12*	3.9	*12*
				010203	15	*34*	164	*9*	2	*13*	10	*9*
		1A4a	Commercial/ Institutional	020103	15	*34*	164	*9*	2	*13*	10	*9*
GAS	NATURAL GAS	1A1a	Electricity and heat production	010101	0.3	*17*	97	*9*	2	*14*	15	*3*
				010102	0.3	*17*	97	*9*	2	*14*	15	*3*
				010103	0.3	*17*	42	*9*	2	*14*	28	*4*
				010104	0.3	*17*	48	*12*	1.6	*12*	4.8	*12*
				010105	0.3	*17*	135	*12*	92	*12*	58	*12*
				010202	0.3	*17*	42	*36*	2	*14*	28	*4*
				010203	0.3	*17*	42	*36*	2	*14*	28	*4*
		1A1c	Other energy industries	010504	0.3	*17*	250	*1, 8, 32*	1.4	*31*	6.2	*31*
		1A2	Industry	030100	0.3	*17*	42	*36*	2	*14*	28	*4*
				030103	0.3	*17*	42	*36*	2	*14*	28	*4*
				030104	0.3	*17*	48	*12*	1.6	*12*	4.8	*12*
				030105	0.3	*17*	135	*12*	92	*12*	58	*12*
				030106	0.3	*17*	42	*36*	2	*14*	28	*4*
		1A4a	Commercial/ Institutional	020100	0.3	*17*	30	*1,4,11*	2	*14*	28	*4*
				020103	0.3	*17*	30	*1,4,11*	2	*14*	28	*4*
				020105	0.3	*17*	135	*12*	92	*12*	58	*12*
		1A4b i	Residential	020200	0.3	*17*	30	*1,4,11*	4	*11*	20	*11*
				020202	0.3	*17*	30	*1,4,11*	4	*11*	20	*11*
				020204	0.3	*17*	135	*12*	92	*12*	58	*12*
		1A4c i	Agriculture/ Forestry	020300	0.3	*17*	30	*1,4,11*	2	*14*	28	*4*
				020304	0.3	*17*	135	*12*	92	*12*	58	*12*
LIQUID	PETROLEUM COKE	1A4a	Commercial/ Institutional	020100	605	*20*	50	*1*	88.8	*13*	1000	*1*
	RESIDUAL OIL	1A1a	Electricity and heat production	010101	119	*18*	1347	*18*	2.3	*13*	15	*3*
				010102	119	*18*	1347	*18*	0.8	*12*	2.8	*12*
				010103	119	*18*	1347	*18*	0.8	*12*	2.8	*12*
				010104	119	*18*	1347	*18*	2.3	*13*	15	*3*

					SO_2		NO_x		NMVOC		CO	
Fuel type	Fuel	NFR	NFR_name	SNAP	g/GJ	*Ref.*	g/GJ	*Ref.*	g/GJ	*Ref.*	g/GJ	*Ref.*
				010105	119	*18*	1347	*18*	2.3	*13*	15	*3*
				010202	344	*25,10, 24*	142	*4*	2.3	*13*	30	*1*
				010203	344	*25,10, 24*	142	*4*	2.3	*13*	30	*1*
		1A1b	Petroleum refining	010306	537	*33*	142	*4*	2.3	*13*	30	*1*
		1A2	Industry	030100	344	*25,10, 24*	130	*28*	0.8	*12*	2.8	*12*
				030102	344	*25,10, 24*	136	*12*	0.8	*12*	2.8	*12*
				030103	344	*25,10, 24*	136	*12*	0.8	*12*	2.8	*12*
		1A4a	Commercial/ Institutional	020100	344	*25,10, 24*	142	*4*	5	*13*	30	*1*
		1A4b i	Residential	020200	344	*25,10, 24*	142	*4*	15	*13*	30	*1*
		1A4c i	Agriculture/ Forestry	020300	344	*25,10, 24*	142	*4*	5	*13*	30	*1*
				020302	344	*25,10, 24*	142	*4*	5	*13*	30	*1*
	GAS OIL	1A1a	Electricity and heat production	010101	23	*27*	249	*18*	0.8	*13*	15	*3*
				010102	23	*27*	249	*18*	0.8	*13*	15	*3*
				010103	23	*27*	65	*28*	0.8	*13*	15	*3*
				010104	23	*27*	350	*9*	0.2	*13*	15	*3*
				010105	23	*27*	942	*12*	37	*13*	130	*12*
				010202	23	*27*	65	*28*	0.8	*13*	30	*1*
				010203	23	*27*	65	*28*	0.8	*13*	30	*1*
		1A1b	Petroleum refining	010306	23	*27*	65	*28*	0.8	*13*	30	*1*
		1A2	Industry	030100	23	*27*	65	*28*	10	*13*	30	*1*
				030102	23	*27*	65	*28*	5	*13*	30	*1*
				030104	23	*27*	350	*9*	0.2	*13*	15	*3*
				030105	23	*27*	942	*12*	37	*13*	130	*12*
		1A4a	Commercial/ Institutional	020100	23	*27*	52	*4*	5	*13*	30	*1*
				020103	23	*27*	52	*4*	5	*13*	30	*1*
				020105	23	*27*	942	*12*	37	*13*	130	*12*
		1A4b i	Residential	020200	23	*27*	52	*4*	15	*13*	43	*1*
				020204	23	*27*	942	*12*	37	*13*	130	*12*
	KEROSENE	1A2	Industry	030100	5	*30*	50	*1*	10	*13*	20	*1*
		1A4a	Commercial/ Institutional	020100	5	*30*	50	*1*	5	*13*	20	*1*
		1A4b i	Residential	020200	5	*30*	50	*1*	15	*13*	20	*1*
		1A4c i	Agriculture/ Forestry	020300	5	*30*	50	*1*	5	*13*	20	*1*
	LPG	1A1a	Electricity and heat production	010102	0.13	*23*	96	*32*	0.8	*13*	25	*1*
				010203	0.13	*23*	96	*32*	0.8	*13*	25	*1*
		1A2	Industry	030100	0.13	*23*	96	*32*	5	*13*	25	*1*
		1A4a	Commercial/ Institutional	020100	0.13	*23*	71	*32*	5	*13*	25	*1*
				020105	0.13	*23*	71	*32*	5	*13*	25	*1*
		1A4b i	Residential	020200	0.13	*23*	47	*32*	10	*13*	25	*1*
		1A4c i	Agriculture/ Forestry	020300	0.13	*23*	71	*32*	5	*13*	25	*1*
	REFINERY GAS	1A1b	Petroleum refining	010304	1	*2*	170	*9*	1.4	*35*	6.2	*35*
				010306	1	*2*	80	*40*	1.4	*35*	6.2	*35*
SOLID	COAL	1A1a	Electricity and heat production	010101	14	*18*	39	*18*	1.2	*13*	10	*3*
				010102	14	*18*	39	*18*	1.2	*13*	10	*3*
		1A2	Industry	030100	574	*19*	95	*4*	10	*13*	10	*3*
		1A4b i	Residential	020200	574	*19*	95	*4*	484	*13*	2000	*32*
		1A4c i	Agriculture/ Forestry	020300	574	*19*	95	*4*	88.8	*13*	931	*13*
				020304	574	*19*	95	*4*	88.8	*13*	931	*13*
	BROWN COAL BRI.	1A4b i	Residential	020200	574	*19*	95	*4*	484	*13*	2000	*29*
	COKE OVEN COKE	1A2	Industry	030100	574	*19*	95	*4*	10	*13*	10	*29*
		1A4b i	Residential	020200	574	*19*	95	*4*	484	*13*	2000	*29*

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Table 2A-4.2a SO_2, NO_x, NMVOC and CO emission factors time-series, g pr GJ for the years 1990 to 1999.

pollutant	fuel_type	fuel	nfr	nfr_name	snap	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
SO2	WASTE	MUNICIP. WASTES	1A1a	Electricity and heat production	010100		116	95	73						
					010102					52	30	29	28	26	25
					010103					52	30	29	28	26	25
					010104					52	30	29	28	26	25
					010200	138	131	124	117						
					010203					110	103	95	88	81	74
			1A2	Industry	030100	138	131	124	117	110	103	95	88	81	74
					030102										
			1A4a	Commercial/ Institutional	020100	138	131	124	117	110	103	95	88	81	74
					020103					110	103	95	88	81	74
	LIQUID	GAS OIL	1A1a	Electricity and heat production	010101					94	23	23	23	23	23
					010102					94	23	23	23	23	23
					010104		94	94	94	94	23	23	23	23	23
					010105					94	23	23	23	23	23
					010202					94	23	23	23	23	23
					010203					94	23	23	23	23	23
			1A1b	Petroleum refining	010306		94	94	94	94	23	23	23		
			1A2	Industry	030100	94	94	94	94	94	23	23	23	23	23
					030102					94	23	23	23	23	23
					030103					94	23	23	23	23	23
					030105					94				94	94
			1A4a	Commercial/ Institutional	020100	94	94	94	94	94	23	23	23	23	23
					020102					94		23		23	
					020103					94		23	23	23	23
					020105					94	23	23	23	23	23
			1A4b i	Residential	020200	94	94	94	94	94	23	23	23	23	23
			1A4c i	Agriculture/ Forestry	020300	94	94	94	94	94	23	23	23	23	23
		ORIMULSION	1A1a	Electricity and heat production	010101						149	147	149	149	
		PETROLEUM COKE	1A2	Industry	030100	787		787	787		787	787	787	787	787
			1A4a	Commercial/ Institutional	020100	787	787	787	787	787	787	787	787	787	787
			1A4b i	Residential	020200	787	787	787	787	787	787	787	787	787	787
			1A4c i	Agriculture/ Forestry	020300	787	787	787	787	787	787	787	787	787	787
		REFINERY GAS	1A1b	Petroleum refining	010306	190	190	190	190			1	1	1	1
		RESIDUAL OIL	1A1a	Electricity and heat production	010100	446	470	490	475						
					010101						351	408	344	369	369
					010102	446	470	490	475	543	351	408	344	369	369
					010103					543	351	408	344	369	
					010104										369
					010105					543	351	408	344	369	369
					010202					495	495	495	344	344	344
					010203					495	495	495	344	344	344
			1A1b	Petroleum refining	010306	643	38	222	389				537	537	537
			1A2	Industry	030100	495	495	495	495	495	495	495	344	344	344
					030102					495	495	495	344	344	344
					030103					495	495	495	344	344	344
			1A4a	Commercial/ Institutional	020100	495	495	495	495	495	495	495	344	344	344
			1A4b i	Residential	020200	495	495	495	495	495	495	495	344	344	344
			1A4c i	Agriculture/ Forestry	020300	495	495	495	495	495	495	495	344	344	344

pollutant	fuel_type	fuel	nfr	nfr_name	snap	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
	SOLID	COAL	1A1a	Electricity and heat production	010100	506	571	454	386						
					010101	506	571	454	386	343	312	420	215	263	193
					010102	506	571	454	386	343	312	420	215	263	193
					010103					343	312	420			
					010104					343	312	420	215		
NOX	BIOMASS	BIOGAS	1A1a	Electricity and heat production	010105			681	665	650	635	616	597	578	559
			1A2	Industry	030103					28	28	28	28	28	28
					030105										
			1A4a	Commercial/ Institutional	020105					650	635	616	597	578	559
			1A4c i	Agriculture/ Forestry	020304					650	635	616	597	578	559
		WOOD	1A1a	Electricity and heat production	010203					130	130	130	130	130	90
			1A2	Industry	030100	130	130	130	130	130	130	130	130	130	90
					030102									130	90
					030103					130	130	130	130	130	90
			1A4a	Commercial/ Institutional	020100	130	130	130	130	130	130	130	130	130	90
					020105									130	90
			1A4c i	Agriculture/ Forestry	020300	130	130	130	130	130	130	130	130	130	90
		BIO OIL	1A1a	Electricity and heat production	010200	100	95	90	85						
					010203					80	75	70	65	65	65
	WASTE	MUNICIP. WASTES	1A1a	Electricity and heat production	010102					134	134	134	134	134	129
					010103					134	134	134	134	134	129
					010104					134	134	134	134	134	129
	GAS	NATURAL GAS	1A1a	Electricity and heat production	010101					115	115		115		
					010102					115	115			115	115
					010104	161	157	153	149	145	141	138	134	131	127
					010105	276	241	235	214	199	194	193	170	167	167
			1A2	Industry	030104	161				145	141	138	134	131	127
					030105					199	194	193	170	167	167
			1A4a	Commercial/ Institutional	020104						141		134		
					020105					199	194	193	170	167	167
			1A4b i	Residential	020204					199	194	193	170	167	167
			1A4c i	Agriculture/ Forestry	020304					199	194	193	170	167	167
	LIQUID	GAS OIL	1A1a	Electricity and heat production	010103						75	65	65	65	65
					010105					1247	1196	1145	1094	1044	993
					010200	100	95	90	85						
					010202					80	75	70	65	65	65
					010203					80	75	70	65	65	65
			1A1b	Petroleum refining	010306		95	90	85	80	75	70	65		
			1A2	Industry	030100	100	95	90	85	80	75	70	65	65	65
					030102					75	75	70	65	65	65
					030103					80	75	70	65	65	65
					030105					1247				1247	1247
			1A4a	Commercial/ Institutional	020105					1247	1196	1145	1094	1044	993
			1A4c i	Agriculture/ Forestry	020304							1145	1094		
		ORIMULSION	1A1a	Electricity and heat production	010101						138	139	138	138	
		PETROLEUM COKE	1A2	Industry	030100	200		200	200		200	200	200	200	200
		REFINERY GAS	1A1b	Petroleum refining	010306	100	100	100	100			80	80	80	80
		RESIDUAL OIL	1A1a	Electricity and heat production	010100	342	384	294	289						
					010101						239	250	200	177	152

pollutant	fuel_type	fuel	nfr	nfr_name	snap	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
					010102	342	384	294	289	267	239	250	200	177	152
					010103					267	239	250	200	177	
					010104										152
					010105					267	239	250	200	177	152
	SOLID	BROWN COAL BRI.	1A4b i	Residential	020200	200	200	200	200	200	200	200	200	200	200
		COAL	1A1a	Electricity and heat production	010100	342	384	294	289						
					010101	342	384	294	289	267	239	250	200	177	152
					010102	342	384	294	289	267	239	250	200	177	152
					010103					267	239	250			
					010104					267	239	250	200		
					010203					200	200	200	200	200	200
			1A2	Industry	030100	200	200	200	200	200	200	200	200	200	200
					030103					200	200	200	200	200	200
			1A4a	Commercial/ Institutional	020100	200	200	200	200	200	200	200	200	200	
			1A4b i	Residential	020200	200	200	200	200	200	200	200	200	200	200
			1A4c i	Agriculture/ Forestry	020300	200	200	200	200	200	200	200	200	200	200
		COKE OVEN COKE	1A2	Industry	030100	200	200	200	200	200	200	200	200	200	200
			1A4b i	Residential	020200	200	200	200	200	200	200	200	200	200	200
NMVOC	BIOMASS	BIOGAS	1A1a	Electricity and heat production	010105			14	14	14	14	14	14	14	14
			1A2	Industry	030105										
			1A4a	Commercial/ Institutional	020105					14	14	14	14	14	14
			1A4c i	Agriculture/ Forestry	020304					14	14	14	14	14	14
		STRAW	1A4b i	Residential	020200	925	872.5	820	767	715	663	610	558	505	453
		WOOD	1A2	Industry	030100	146	132	119	105	92	78	64	51	37	24
					030103					92	78	64	51	37	24
			1A4b i	Residential	020200	650	650	650	650	650	650	650	650	650	650
					020202										
					020204										
	WASTE	MUNICIP. WASTES	1A1a	Electricity and heat production	010102					0.98	0.98	0.98	0.98	0.98	0.98
					010103					0.98	0.98	0.98	0.98	0.98	0.98
					010104					0.98	0.98	0.98	0.98	0.98	0.98
	GAS	NATURAL GAS	1A1a	Electricity and heat production	010104	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4
					010105	60	69	81	127	140	142	138	124	122	122
			1A2	Industry	030104	1.4				1.4	1.4	1.4	1.4	1.4	1.4
					030105					140	142	138	124	122	122
			1A4a	Commercial/ Institutional	020104						1.4		1.4		
					020105					140	142	138	124	122	122
			1A4b i	Residential	020204					140	142	138	124	122	122
			1A4c i	Agriculture/ Forestry	020304					140	142	138	124	122	122
	LIQUID	REFINERY GAS	1A1b	Petroleum refining	010306	4	4	4	4			1.4	1.4	1.4	1.4
CO	BIOMASS	BIOGAS	1A1a	Electricity and heat production	010105			239	243	248	252	256	260	265	269
			1A2	Industry	030105										
			1A4a	Commercial/ Institutional	020105					248	252	256	260	265	269
			1A4c i	Agriculture/ Forestry	020304					248	252	256	260	265	269
		STRAW	1A1a	Electricity and heat production	010200	600	554	508	463						
					010203					417	371	325	325	325	325
			1A2	Industry	030105									371	371
			1A4b i	Residential	020200	8500	8500	8500	8500	8500	7500	6500	5500	4500	4000

pollutant	fuel_type	fuel	nfr	nfr_name	snap	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
			1A4c i	Agriculture/ Forestry	020300	8500	8500	8500	8500	8500	7500	6500	5500	4500	4000
		WOOD	1A1a	Electricity and heat production	010200	400	373	347	320						
					010203					293	267	240	240	240	240
			1A2	Industry	030100	400	373	347	320	293	267	240	240	240	240
					030103					293	267	240	240	240	240
			1A4a	Commercial/ Institutional	020100	400	373	347	320	293	267	240	240	240	240
			1A4b i	Residential	020200	4146	4146	4146	4146	4146	4146	4146	4146	4146	4146
					020202										
					020204										
			1A4c i	Agriculture/ Forestry	020300	400	373	347	320	293	267	240	240	240	240
		BIO OIL	1A2	Industry	030105										
			1A4b i	Residential	020200										
	WASTE	MUNICIP. WASTES	1A1a	Electricity and heat production	010102					7.4	7.4	7.4	7.4	7.4	7.4
					010103					7.4	7.4	7.4	7.4	7.4	7.4
					010104					7.4	7.4	7.4	7.4	7.4	7.4
					010200	100	85	70	55						
					010203					40	25	10	10	10	10
			1A2	Industry	030100	100	85	70	55	40	25	10	10	10	10
			1A4a	Commercial/ Institutional	020100	100	85	70	55	40	25	10	10	10	10
					020103					40	25	10	10	10	10
	GAS	NATURAL GAS	1A1a	Electricity and heat production	010104	6.2	6.2	6.2	6.2	6.2	6.2	6.2	6.2	6.2	6.2
					010105	189	211	212	227	226	222	221	182	182	182
			1A2	Industry	030104	6.2				6.2	6.2	6.2	6.2	6.2	6.2
					030105					226	222	221	182	182	182
			1A4a	Commercial/ Institutional	020104						6.2		6.2		
					020105					226	222	221	182	182	182
			1A4b i	Residential	020204					226	222	221	182	182	182
			1A4c i	Agriculture/ Forestry	020304					226	222	221	182	182	182
	LIQUID	REFINERY GAS	1A1b	Petroleum refining	010306	15	15	15	15			6.2	6.2	6.2	6.2

Table 2A-4.2b SO_2, NO_x, NMVOC and CO emission factors time-series, g pr GJ for the years 2000 to 2009.

pollutant	fuel_type	fuel	nfr	nfr_name	snap	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
SO2	WASTE	MUNICIP. WASTES	1A1a	Electricity and heat production	010100										
					010102	24	24	24	24	19	14	8.3	8.3	8.3	8.3
					010103	24	24	24	24	19	14	8.3	8.3	8.3	8.3
					010104	24			24			8.3			
					010200										
					010203	67	60	52	45	37	30	22	15	15	15
			1A2	Industry	030100										
					030102					37	30			15	
			1A4a	Commercial/ Institutional	020100	67			45	37	30	22	15		
					020103	67	60	52	45	37	30	22	15	15	15
	LIQUID	GAS OIL	1A1a	Electricity and heat production	010101	23	23	23	23	23	23	23	23	23	23
					010102	23	23	23	23	23	23	23	23	23	23
					010104	23	23	23	23	23	23	23	23	23	23
					010105	23	23	23	23	23	23	23	23	23	23
					010202	23	23	23	23	23	23	23	23	23	23
					010203	23	23	23	23	23	23	23	23	23	23

pollutant	fuel_type	fuel	nfr	nfr_name	snap	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
			1A1b	Petroleum refining	010306				23	23	23	23	23	23	23
			1A2	Industry	030100	23	23	23	23	23	23	23	23	23	23
					030102				23	23	23	23	23	23	23
					030103	23	23	23	23	23	23	23	23	23	
					030105	23	23							23	23
			1A4a	Commercial/ Institutional	020100	23	23	23	23	23	23	23	23	23	23
					020102										
					020103	23	23	23	23	23	23	23	23	23	23
					020105	23	23	23	23	23	23	23	23	23	23
			1A4b i	Residential	020200	23	23	23	23	23	23	23	23	23	23
			1A4c i	Agriculture/ Forestry	020300	23	23	23	23	23	23	23			
		ORIMULSION	1A1a	Electricity and heat production	010101		10	12	12	12					
		PETROLEUM COKE	1A2	Industry	030100	787	605	605	605	605	605	605			
			1A4a	Commercial/ Institutional	020100	787	605	605	605		605	605	605	605	605
			1A4b i	Residential	020200	787	605	605	605		605	605	605	605	
			1A4c i	Agriculture/ Forestry	020300	787	605	605	605						
		REFINERY GAS	1A1b	Petroleum refining	010306	1	1	1	1	1	1	1	1	1	1
		RESIDUAL OIL	1A1a	Electricity and heat production	010100										
					010101	403	315	290	334	349	283	308	206	82	119
					010102	403	315	290	334	349	283	308	206	82	119
					010103	403	315	290	334	349				82	119
					010104		315	290	334	349	283	308	206	82	119
					010105	403	315	290	334	349	283	308	206	82	119
					010202										344
					010203	344	344	344	344	344	344	344		344	344
			1A1b	Petroleum refining	010306	537	537	537	537	537	537	537	537	537	537
			1A2	Industry	030100	344	344	344	344	344	344	344	344	344	344
					030102	344	344	344	344	344	344	344	344	344	344
					030103	344	344	344						344	344
			1A4a	Commercial/ Institutional	020100	344	344	344	344	344	344	344	344	344	344
			1A4b i	Residential	020200	344	344	344	344	344	344	344	344	344	344
			1A4c i	Agriculture/ Forestry	020300	344	344	344	344	344	344	344	344	344	344
	SOLID	COAL	1A1a	Electricity and heat production	010100										
					010101	64	47	45	61	42	41	37	40	26	14
					010102	64	47	45	61	42	41	37	40	26	14
					010103										
					010104										
NOX	BIOMASS	BIOGAS	1A1a	Electricity and heat production	010105	540	484	427	371	315	259	202	202	202	202
			1A2	Industry	030103	28	28	28			28	28	28	59	59
					030105		484	427	371	315	259	202	202	202	202
			1A4a	Commercial/ Institutional	020105	540	484	427	371	315	259	202	202	202	202
			1A4c i	Agriculture/ Forestry	020304	540	484	427	371	315	259	202	202	202	202
		WOOD	1A1a	Electricity and heat production	010203	90	90	90	90	90	90	90	90	90	90
			1A2	Industry	030100	90	90	90	90	90	90	90	90	90	90
					030102	90	90					90	90	90	90
					030103	90	90	90	90	90	90	90	90	90	90
			1A4a	Commercial/ Institutional	020100	90	90	90	90	90	90	90	90	90	90
					020105		90	90		90	90	90	90	90	90
			1A4c i	Agriculture/ Forestry	020300	90	90	90	90	90	90	90	90	90	90

pollutant	fuel_type	fuel	nfr	nfr_name	snap	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
		BIO OIL	1A1a	Electricity and heat production	010200										
					010203	65	65	65	65	65	65	65	65	65	65
	WASTE	MUNICIP. WASTES	1A1a	Electricity and heat production	010102	124	124	124	124	117	110	102	102	102	102
					010103	124	124	124	124	117	110	102	102	102	102
					010104	124			124			102			
	GAS	NATURAL GAS	1A1a	Electricity and heat production	010101		115	115	115	97	97	97	97	97	97
					010102	115	115	115	115	97	97	97	97	97	97
					010104	124	119	113	108	103	98	73	48	48	48
					010105	168	163	158	153	148	143	139	135	135	135
			1A2	Industry	030104	124	119	113	108	103	98	73	48	48	48
					030105	168	163	158	153	148	143	139	135	135	135
			1A4a	Commercial/ Institutional	020104	124	119	113	108	103	98	73	48		
					020105	168	163	158	153	148	143	139	135	135	135
			1A4b i	Residential	020204	168	163	158	153	148	143	139	135	135	135
			1A4c i	Agriculture/ Forestry	020304	168	163	158	153	148	143	139	135	135	135
	LIQUID	GAS OIL	1A1a	Electricity and heat production	010103		65	65	65	65	65	65	65	65	65
					010105	942	942	942	942	942	942	942	942	942	942
					010200										
					010202	65	65	65	65	65	65	65	65	65	65
					010203	65	65	65	65	65	65	65	65	65	65
			1A1b	Petroleum refining	010306				65	65	65	65	65	65	65
			1A2	Industry	030100	65	65	65	65	65	65	65	65	65	65
					030102				65	65	65	65	65	65	65
					030103	65	65	65	65	65	65	65	65	65	
					030105	942	942							942	942
			1A4a	Commercial/ Institutional	020105	942	942	942	942	942	942	942	942	942	942
			1A4c i	Agriculture/ Forestry	020304	942	942	942	942		942	942	942		
		ORIMULSION	1A1a	Electricity and heat production	010101		88	86	86	86					
		PETROLEUM COKE	1A2	Industry	030100	95	95	95	95	95	95	95			
		REFINERY GAS	1A1b	Petroleum refining	010306	80	80	80	80	80	80	80	80	80	80
		RESIDUAL OIL	1A1a	Electricity and heat production	010100										
					010101	129	122	130	144	131	127	109	98	1717	1347
					010102	129	122	130	144	131	127	109	98	1717	1347
					010103	129	122	130	144	131				1717	1347
					010104		122	130	144	131	127	109	98	1717	1347
					010105	129	122	130	144	131	127	109	98	1717	1347
	SOLID	BROWN COAL BRI.	1A4b i	Residential	020200	95	95	95	95					95	95
		COAL	1A1a	Electricity and heat production	010100										
					010101	129	122	130	144	131	127	109	98	59	39
					010102	129	122	130	144	131	127	109	98	59	39
					010103										
					010104										
					010203	95	95	95	95	95	95		95	95	
			1A2	Industry	030100	95	95	95	95	95	95	95	95	95	95
					030103	95	95	95	95	95	95				
			1A4a	Commercial/ Institutional	020100					95					
			1A4b i	Residential	020200	95	95	95	95	95	95	95	95	95	95
			1A4c i	Agriculture/ Forestry	020300	95	95	95	95	95	95	95	95	95	95
		COKE OVEN COKE	1A2	Industry	030100	95	95	95	95	95	95	95	95	95	95

pollutant	fuel_type	fuel	nfr	nfr_name	snap	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
			1A4b i	Residential	020200	95	95	95	95	95	95	95	95	95	95
NMVOC	BIOMASS	BIOGAS	1A1a	Electricity and heat production	010105	14	13	13	12	11	10	10	10	10	10
			1A2	Industry	030105		13	13	12	11	10	10	10	10	10
			1A4a	Commercial/ Institutional	020105	14	13	13	12	11	10	10	10	10	10
			1A4c i	Agriculture/ Forestry	020304	14	13	13	12	11	10	10	10	10	10
		STRAW	1A4b i	Residential	020200	400	400	400	400	400	400	400	400	400	400
		WOOD	1A2	Industry	030100	10	10	10	10	10	10	10	10	10	10
					030103	10	10	10	10	10	10	10	10	10	10
			1A4b i	Residential	020200	650	582	557	554	550	528	508	508	472	437
					020202						528	508	508	472	437
					020204									472	437
	WASTE	MUNICIP. WASTES	1A1a	Electricity and heat production	010102	0.98	0.98	0.98	0.98	0.84	0.7	0.56	0.56	0.56	0.56
					010103	0.98	0.98	0.98	0.98	0.84	0.7	0.56	0.56	0.56	0.56
					010104	0.98			0.98			0.56			
	GAS	NATURAL GAS	1A1a	Electricity and heat production	010104	1.4	1.4	1.5	1.5	1.6	1.6	1.6	1.6	1.6	1.6
					010105	121	114	108	101	95	88	90	92	92	92
			1A2	Industry	030104	1.4	1.4	1.5	1.5	1.6	1.6	1.6	1.6	1.6	1.6
					030105	121	114	108	101	95	88	90	92	92	92
			1A4a	Commercial/ Institutional	020104	1.4	1.4	1.5	1.5	1.6	1.6	1.6	1.6		
					020105	121	114	108	101	95	88	90	92	92	92
			1A4b i	Residential	020204	121	114	108	101	95	88	90	92	92	92
			1A4c i	Agriculture/ Forestry	020304	121	114	108	101	95	88	90	92	92	92
	LIQUID	REFINERY GAS	1A1b	Petroleum refining	010306	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4
CO	BIOMASS	BIOGAS	1A1a	Electricity and heat production	010105	273	279	285	292	298	304	310	310	310	310
			1A2	Industry	030105		279	285	292	298	304	310	310	310	310
			1A4a	Commercial/ Institutional	020105	273	279	285	292	298	304	310	310	310	310
			1A4c i	Agriculture/ Forestry	020304	273	279	285	292	298	304	310	310	310	310
		STRAW	1A1a	Electricity and heat production	010200										
					010203	325	325	325	325	325	325	325	325	325	325
			1A2	Industry	030105	325	325								
			1A4b i	Residential	020200	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000
			1A4c i	Agriculture/ Forestry	020300	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000
		WOOD	1A1a	Electricity and heat production	010200										
					010203	240	240	240	240	240	240	240	240	240	240
			1A2	Industry	030100	240	240	240	240	240	240	240	240	240	240
					030103	240	240	240	240	240	240	240	240	240	240
			1A4a	Commercial/ Institutional	020100	240	240	240	240	240	240	240	240	240	240
			1A4b i	Residential	020200	4146	3779	3656	3659	3657	3546	3436	3491	3326	3165
					020202						3546	3436	3491	3326	3165
					020204									3326	3165
			1A4c i	Agriculture/ Forestry	020300	240	240	240	240	240	240	240	240	240	240
		BIO OIL	1A2	Industry	030105			100	100	15	100	100	100	100	100
			1A4b i	Residential	020200								15	100	100
	WASTE	MUNICIP. WASTES	1A1a	Electricity and heat production	010102	8	8	8	8	6.6	5.3	3.9	3.9	3.9	3.9
					010103	8	8	8	8	6.6	5.3	3.9	3.9	3.9	3.9
					010104	8			8			3.9			
					010200										
					010203	10	10	10	10	10	10	10	10	10	10

pollutant	fuel_type	fuel	nfr	nfr_name	snap	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
			1A2	Industry	030100										
			1A4a	Commercial/ Institutional	020100	10			10	10	10	10	10		
					020103	10	10	10	10	10	10	10	10	10	10
	GAS	NATURAL GAS	1A1a	Electricity and heat production	010104	6.2	6.2	6.2	6.2	6.2	6.2	5.5	4.8	4.8	4.8
					010105	183	163	142	122	101	81	70	58	58	58
			1A2	Industry	030104	6.2	6.2	6.2	6.2	6.2	6.2	5.5	4.8	4.8	4.8
					030105	183	163	142	122	101	81	70	58	58	58
			1A4a	Commercial/ Institutional	020104	6.2	6.2	6.2	6.2	6.2	6.2	5.5	4.8		
					020105	183	163	142	122	101	81	70	58	58	58
			1A4b i	Residential	020204	183	163	142	122	101	81	70	58	58	58
			1A4c i	Agriculture/ Forestry	020304	183	163	142	122	101	81	70	58	58	58
	LIQUID	REFINERY GAS	1A1b	Petroleum refining	010306	6.2	6.2	6.2	6.2	6.2	6.2	6.2	6.2	6.2	6.2

Table 2A-4.3 PM emission factors and references, 2009.

					TSP		PM_{10}		$PM_{2.5}$	
fuel_type	**fuel_gr_abbr**	**NFR**	**nfr_name**	**snap**	**g pr GJ**	***Ref.***	**g pr GJ**	***Ref.***	**g pr GJ**	***Ref.***
BIOMASS	WOOD	1A1a	Electricity and heat production	010102	10	*18*	1.94	*3*	1.23	*3*
				010103	10	*18*	1.94	*3*	1.23	*3*
				010104	10	*18*	1.94	*3*	1.23	*3*
				010203	19	*1*	13	*2*	10	*2*
		1A2	Industry	030100	19	*1*	13	*2*	10	*2*
				030102	19	*1*	13	*2*	10	*2*
				030103	19	*1*	13	*2*	10	*2*
		1A4a	Commercial/ Institutional	020100	143	*1*	143	*9*	135	*9*
				020105	143	*1*	143	*9*	135	*9*
		1A4b i	Residential	020200	532	*17*	506	*17*	497	*17*
				020202	532	*17*	506	*17*	497	*17*
				020204	532	*17*	506	*17*	497	*17*
		1A4c i	Agriculture/ Forestry	020300	143	*1*	143	*9*	135	*9*
	STRAW	1A1a	Electricity and heat production	010101	2.3	*18*	0.133	*3*	0.102	*3*
				010102	2.3	*18*	0.133	*3*	0.102	*3*
				010103	2.3	*18*	0.133	*3*	0.102	*3*
				010104	2.3	*18*	0.133	*3*	0.102	*3*
				010203	21	*1*	15	*2*	12	*2*
		1A4b i	Residential	020200	234	*4*	222	*5*	211	*5*
		1A4c i	Agriculture/ Forestry	020300	234	*4*	222	*5*	211	*5*
	BIO OIL	1A1a	Electricity and heat production	010105	5	*15*	5	*15*	5	*15*
				010202	5	*15*	5	*15*	5	*15*
				010203	5	*15*	5	*15*	5	*15*
		1A2	Industry	030105	5	*15*	5	*15*	5	*15*
		1A4b i	Residential	020200	5	*15*	5	*15*	5	*15*
	BIOGAS	1A1a	Electricity and heat production	010102	1.5	*6*	1.5	*7*	1.5	*7*
				010105	2.63	*3*	0.451	*3*	0.206	*3*
				010203	1.5	*6*	1.5	*7*	1.5	*7*
		1A2	Industry	030100	1.5	*6*	1.5	*7*	1.5	*7*
				030102	1.5	*6*	1.5	*7*	1.5	*7*
				030103	1.5	*6*	1.5	*7*	1.5	*7*
				030105	2.63	*3*	0.451	*3*	0.206	*3*
		1A4a	Commercial/ Institutional	020100	1.5	*6*	1.5	*7*	1.5	*7*
				020103	1.5	*6*	1.5	*7*	1.5	*7*
				020105	2.63	*3*	0.451	*3*	0.206	*3*
		1A4c i	Agriculture/ Forestry	020300	1.5	*6*	1.5	*7*	1.5	*7*
				020304	2.63	*3*	0.451	*3*	0.206	*3*
	BIO PROD GAS	1A1a	Electricity and heat production	010105	2.63	*19*	0.451	*19*	0.206	*19*
		1A2	Industry	030105	2.63	*19*	0.451	*19*	0.206	*19*
WASTE	MUNICIP. WASTES	1A1a	Electricity and heat production	010101	0.29	*18*	1.126[1]	*3*	1.084[1]	*3*
				010102	0.29	*18*	0.29	*3*	0.29	*3*
				010103	0.29	*18*	0.29	*3*	0.29	*3*
				010203	4.2	*20*	0.29[2]	*11*	0.29[2]	*11*
		1A4a	Commercial/ Institutional	020103	4.2	*20*	3.2	*11*	2.1	*11*
GAS	NATURAL GAS	1A1a	Electricity and heat production	010101	0.1	*9*	0.1	*9*	0.1	*9*
				010102	0.1	*9*	0.1	*9*	0.1	*9*
				010103	0.1	*9*	0.1	*9*	0.1	*9*
				010104	0.1	*3*	0.061	*3*	0.051	*3*
				010105	0.76	*3*	0.189	*3*	0.161	*3*
				010202	0.1	*9*	0.1	*9*	0.1	*9*
				010203	0.1	*9*	0.1	*9*	0.1	*9*
		1A1c	Other energy industries	010504	0.1	*3*	0.061	*3*	0.051	*3*
		1A2	Industry	030100	0.1	*9*	0.1	*9*	0.1	*9*
				030103	0.1	*9*	0.1	*9*	0.1	*9*
				030104	0.1	*3*	0.061	*3*	0.051	*3*
				030105	0.76	*3*	0.189	*3*	0.161	*3*
				030106	0.1	*9*	0.1	*9*	0.1	*9*
		1A4a	Commercial/ Institutional	020100	0.1	*9*	0.1	*9*	0.1	*9*
				020103	0.1	*9*	0.1	*9*	0.1	*9*
				020105	0.76	*3*	0.189	*3*	0.161	*3*
		1A4b i	Residential	020200	0.1	*9*	0.1	*9*	0.1	*9*
				020202	0.1	*9*	0.1	*9*	0.1	*9*
				020204	0.76	*3*	0.189	*3*	0.161	*3*
		1A4c i	Agriculture/ Forestry	020300	0.1	*9*	0.1	*9*	0.1	*9*
				020304	0.76	*3*	0.189	*3*	0.161	*3*
LIQUID	PETROLEUM COKE	1A4a	Commercial/ Institutional	020100	100	*9*	60	*9*	30	*9*

[1] The emission factor is higher than the TSP emission factor and will be corrected in the next inventory.
[2] Error. Should be in agreement with reference no 11.

fuel_type	fuel_gr_abbr	NFR	nfr_name	snap	TSP g pr GJ	TSP *Ref.*	PM_{10} g pr GJ	PM_{10} *Ref.*	$PM_{2.5}$ g pr GJ	$PM_{2.5}$ *Ref.*
	RESIDUAL OIL	1A1a	Electricity and heat production	010101	3	*9*	3	*9*	2.5	*9*
				010102	9.5	*18*	9.5	*13*	7.9	*13*
				010103	9.5	*18*	9.5	*13*	7.9	*13*
				010104	3	*9*	3	*9*	2.5	*9*
				010105	3	*9*	3	*9*	2.5	*9*
				010202	3	*9*	3	*9*	2.5	*9*
				010203	3	*9*	3	*9*	2.5	*9*
		1A1b	Petroleum refining	010306	50	*9*	40	*9*	35	*9*
		1A2	Industry	030100	9.5	*18*	7.1	*13*	4.8	*13*
				030102	9.5	*18*	7.1	*13*	4.8	*13*
				030103	9.5	*18*	7.1	*13*	4.8	*13*
		1A4a	Commercial/ Institutional	020100	14	*6*	10.5	*13*	7	*13*
		1A4b i	Residential	020200	14	*6*	10.5	*13*	7	*13*
		1A4c i	Agriculture/ Forestry	020300	14	*6*	10.5	*13*	7	*13*
				020302	14	*6*	10.5	*13*	7	*13*
	GAS OIL	1A1a	Electricity and heat production	010101	5	*9*	5	*9*	5	*9*
				010102	5	*9*	5	*9*	5	*9*
				010103	5	*9*	5	*9*	5	*9*
				010104	5	*9*	5	*9*	5	*9*
				010105	5	*9*	5	*9*	5	*9*
				010202	5	*9*	5	*9*	5	*9*
				010203	5	*9*	5	*9*	5	*9*
		1A1b	Petroleum refining	010306	5	*9*	5	*9*	5	*9*
		1A2	Industry	030100	5	*9*	5	*9*	5	*9*
				030102	5	*9*	5	*9*	5	*9*
				030104	5	*9*	5	*9*	5	*9*
				030105	5	*9*	5	*9*	5	*9*
		1A4a	Commercial/ Institutional	020100	5	*9*	5	*9*	5	*9*
				020103	5	*9*	5	*9*	5	*9*
				020105	5	*9*	5	*9*	5	*9*
		1A4b i	Residential	020200	5	*9*	5	*9*	5	*9*
				020204	5	*9*	5	*9*	5	*9*
	KEROSENE	1A2	Industry	030100	5	*9*	5	*9*	5	*9*
		1A4a	Commercial/ Institutional	020100	5	*9*	5	*9*	5	*9*
		1A4b i	Residential	020200	5	*9*	5	*9*	5	*9*
		1A4c i	Agriculture/ Forestry	020300	5	*9*	5	*9*	5	*9*
	LPG	1A1a	Electricity and heat production	010102	0.2	*9*	0.2	*9*	0.2	*9*
				010203	0.2	*9*	0.2	*9*	0.2	*9*
		1A2	Industry	030100	0.2	*9*	0.2	*9*	0.2	*9*
		1A4a	Commercial/ Institutional	020100	0.2	*9*	0.2	*9*	0.2	*9*
				020105	0.2	*9*	0.2	*9*	0.2	*9*
		1A4b i	Residential	020200	0.2	*9*	0.2	*9*	0.2	*9*
		1A4c i	Agriculture/ Forestry	020300	0.2	*9*	0.2	*9*	0.2	*9*
	REFINERY GAS	1A1b	Petroleum refining	010304	5	*9*	5	*9*	5	*9*
				010306	5	*9*	5	*9*	5	*9*
SOLID	COAL	1A1a	Electricity and heat production	010101	3	*12*	2.6	*12*	2.1	*12*
				010102	3	*12*	2.6	*12*	2.1	*12*
		1A2	Industry	030100	17	*6*	12	*14*	7	*14*
		1A4b i	Residential	020200	17	*6*	12	*14*	7	*14*
		1A4c i	Agriculture/ Forestry	020300	17	*6*	12	*14*	7	*14*
				020304	17	*6*	12	*14*	7	*14*
	BROWN COAL BRI	1A4b i	Residential	020200	17	*16*	12	*16*	7	*16*
	COKE OVEN COKE	1A2	Industry	030100	17	*16*	12	*16*	7	*16*
		1A4b i	Residential	020200	17	*16*	12	*16*	7	*16*

1. Danish legislation, Miljøstyrelsen 2001. Luftvejledningen, Begrænsning af luftforurening fra virksomheder, Vejledning fra Miljøstyrelsen nr 2 2001.
2. Particulate size distribution for wood and straw combustion in power plants refers to the TNO CEPMEIP emission factor database 2001 (wood). Available on the internet at: http://www.air.sk/tno/cepmeip/ (05-02-2011).
3. Nielsen, M. & Illerup, J.B: 2003. Emissionsfaktorer og emissionsopgørelse for decentral kraftvarme. Eltra PSO projekt 3141. Kortlægning af emissioner fra decentrale kraftvarmeværker. Delrapport 6. Danmarks Miljøundersøgelser. 116 s. – Faglig rapport fra DMU nr. 442.(In Danish, whith an english summary). Available on the Internet at : http://www.dmu.dk/1_viden/2_Publikationer/3_fagrapporter/rapporter/FR442.pdf (05-02-2011).
4. German, L., 2003. The Danish Technological Institute, Personal communication, rough estimate.
5. Particulate size distribution for wood and straw combustion in residential plants refers to the TNO CEPMEIP emission factor database 2001 (wood). Available on the internet at: http://www.air.sk/tno/cepmeip/ (05-02-2011).
6. Danish legislation. Miljøstyrelsen 1990, Bekendtgørelse 689, 15/10/1990, Bekendtgørelse om begrænsning af emissioner af svovldioxid, kvælstofoxider og støv fra store fyringsanlæg. (and Bekendtgørelse 518/1995).
7. All TSP emission is assumed to be <2,5µm (NERI assumption).
8. -
9. The TNO CEPMEIP emission factor database 2001. Available on the internet at: http://www.air.sk/tno/cepmeip/ (05-02-2011).
10. -
11. Particulate size distribution is unknown. The PM_{10} fraction is assumed to equal 85 % of TSP and the $PM_{2.5}$ fraction is assumed to equal 70 % of TSP (NERI assumption).
12. Livbjerg, H. Thellefsen, M. Sander, B. Simonsen, P., Lund, C., Poulsen, K.& Fogh, C.L., 2001. Feltstudier af Forbrændingsaerosoler, EFP -98 Projekt, Aerosollaboratoriet DTU, FLS Miljø, Forskningscenter Risø, Elsam, Energi E2 (in Danish).
13. Particulate size distribution for residual oil combustion refers to the TNO CEPMEIP emission factor database 2001. Available on the internet at: http://www.air.sk/tno/cepmeip/ (05-02-2011).
14. Particulate size distribution for coal combustion refers to the TNO CEPMEIP emission factor database 2001. Available on the internet at: http://www.air.sk/tno/cepmeip/ (05-02-2011).
15. Assuming same emission factors as for gas oil (NERI assumption).
16. Same emission factor as for coal is assumed (NERI assumption).
17. Illerup, J. B., Henriksen, T. C., Lundhede, T., Breugel C. v., Jensen, N. Z. (2007) "Brændeovne og små kedler - partikelemissioner og reduktionstiltag". Miljøprojekt nr. 1164 2007. Miljøstyrelsen. Available on the internet at: http://www2.mst.dk/common/Udgivramme/Frame.asp?http://www2.mst.dk/Udgiv/publikationer/2007/978-87-7052-451-3/html/default.htm (25-02-2011)
18. Nielsen, M., Nielsen, O.K. & Thomsen, M. 2010c: Emissionskortlægning for decentral kraftvarme, Energinet.dk miljøprojekt nr. 07/1882. Delrapport 5. Emissionsfaktorer og emissionsopgørelse for decentral kraftvarme, 2006. National Environmental Research Institute, University of Aarhus.
19. Same emission factor as for biogas assumed (NERI assumption)
20. The emission factor have been estimated by NERI based on plant specific data from MSW incineration plants, district heating, 2008.

Table 2A-4.4a PM emission factors, time-series for the years 1990 to 1999

pollutant	fuel	fuel_gr_abbr	nfr	nfr_name	snap	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
TSP	BIOMASS	WOOD	1A4b i	Residential	020200	807	807	807	807	807	807	807	807	807	807
					020202										
					020204										
	WASTE	MUNICIP. WASTES	1A1a	Electricity and heat production	010102					2.02	2.02	2.02	2.02	2.02	2.02
					010103					2.02	2.02	2.02	2.02	2.02	2.02
					010104					2.02	2.02	2.02	2.02	2.02	2.02
					010203					6	6	6	6	6	6
			1A2	Industry	030102										
			1A4a	Commercial/ Institutional	020100	6	6	6	6	6	6	6	6	6	6
					020103					6	6	6	6	6	6
PM10	BIOMASS	WOOD	1A4b i	Residential	020200										
					020202										
					020204										
	WASTE	MUNICIP. WASTES	1A1a	Electricity and heat production	010102									1.126	
					010103					1.126	1.126				
					010104					1.126	1.126	1.126	1.126	1.126	1.126
					010203					5	5	5	5		
			1A2	Industry	030102										
			1A4a	Commercial/ Institutional	020100										
					020103					5	5	5	5	5	
PM2,5	BIOMASS	WOOD	1A4b i	Residential	020200										
					020202										
					020204										
	WASTE	MUNICIP. WASTES	1A1a	Electricity and heat production	010102									1.084	
					010103					1.084	1.084				
					010104					1.084	1.084	1.084	1.084	1.084	1.084
					010203					4	4	4	4		
			1A2	Industry	030102										
			1A4a	Commercial/ Institutional	020100										
					020103					4	4	4	4	4	

Table 2A-4.4b PM emission factors, time-series for the years 2000 to 2009

pollutant	fuel	fuel_gr_abbr	nfr	nfr_name	snap	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
TSP	BIOMASS	WOOD	1A4b i	Residential	020200	760	681	651	647	641	614	592	600	565	532
					020202						614	592	600	565	532
					020204									565	532
	WASTE	MUNICIP. WASTES	1A1a	Electricity and heat production	010102	2.02	2.02	2.02	2.02	1.44	0.87	0.29	0.29	0.29	0.29
					010103	2.02	2.02	2.02	2.02	1.44	0.87	0.29	0.29	0.29	0.29
					010104	2.02			2.02			0.29			
					010203	6	5.7	5.5	5.2	5	4.7	4.5	4.2	4.2	4.2
			1A2	Industry	030102					5	4.7			4.2	
			1A4a	Commercial/ Institutional	020100	6			5.2	5	4.7	4.5	4.2		
					020103	6	5.7	5.5	5.2	5	4.7	4.5	4.2	4.2	4.2
PM10	BIOMASS	WOOD	1A4b i	Residential	020200	723	648	620	615	610	585	564	571	538	506
					020202						585	564	571	538	506
					020204									538	506
	WASTE	MUNICIP. WASTES	1A1a	Electricity and heat production	010102	1.126	1.126	1.126	1.126	1.126	0.87	0.29	0.29	0.29	0.29
					010103	1.126	1.126	1.126	1.126	1.126	0.87	0.29	0.29	0.29	0.29
					010104	1.126			1.126			0.29			
					010203	4.6	4.4	4.2	4	3.8	3.6	3.4	0.29	0.29	0.29
			1A2	Industry	030102					3.8	3.6			3.2	
			1A4a	Commercial/ Institutional	020100	4.6			4	3.8	3.6	3.4	3.2		
					020103	4.6	4.4	4.2	4	3.8	3.6	3.4	3.2	3.2	3.2
PM2,5	BIOMASS	WOOD	1A4b i	Residential	020200	708	635	607	603	598	573	553	560	528	497
					020202						573	553	560	528	497
					020204									528	497
	WASTE	MUNICIP. WASTES	1A1a	Electricity and heat production	010102	1.084	1.084	1.084	1.084	1.084	0.87	0.29	0.29	0.29	0.29
					010103	1.084	1.084	1.084	1.084	1.084	0.87	0.29	0.29	0.29	0.29
					010104	1.084			1.084			0.29			
					010203	3	2.9	2.7	2.6	2.5	2.4	2.2	0.29	0.29	0.29
			1A2	Industry	030102					2.5	2.4			2.1	
			1A4a	Commercial/ Institutional	020100	3			2.6	2.5	2.4	2.2	2.1		
					020103	3	2.9	2.7	2.6	2.5	2.4	2.2	2.1	2.1	2.1

Table 2A-4.5 HM emission factors (mg per GJ) and references 2009.

fuel_type	fuel_gr_abbr	nfr	nfr_name	snap	As	Cd	Cr	Cu	Hg	Ni	Pb	Se	Zn	Refer-ence
					mg/GJ	mg/GJ	mg/GJ	mg/GJ	mg/GJ	mg/GJ	mg/GJ	mg/GJ	mg/GJ	
BIOMASS	WOOD	-	All non-residential	all	1.4	0.27	2.34	2.6	0.4	2.34	3.62	0.5	2.3	2 and 4
		1A4b i	Residential	all	0.5	1	2	8	0.4	2	40	0.5	100	2
	STRAW	1A1a	Electricity and heat production	all	1.4	0.32	1.6	1.7	0.31	1.7	6.2	0.5	0.41	2 and 4
		1A4b i	Residential	020200	1	1.4	2.9	8.6	0.5	4.4	40	0.5	130	2
		1A4c i	Agriculture/ Forestry	020300	1	1.4	2.9	8.6	0.5	4.4	40	0.5	130	2
	BIO OIL	-	All non-residential	engines	0.055	0.011	0.2	0.3	0.11	0.013	0.15	0.22	58	5
		-	All non-residential	boilers	0.002	0.001	0.2	0.13	0.12	0.005	0.012	0.002	0.42	5
		1A4b i	Residential	020200	0.002	0.001	0.2	0.13	0.12	0.005	0.012	0.002	0.42	5
	BIOGAS	-	All	all	0.04	0.002	0.18	0.31	0.12	0.23	0.005	0.21	3.95	4
	BIO PROD GAS	-	All	all	0.12	0.009	0.029	0.045	0.54	0.014	0.022	0.18	0.058	4
WASTE	MUNICIP. WASTES	-	All	all	0.59	0.44	1.56	1.3	1.79	2.06	5.52	1.11	2.33	4
GAS	NATURAL GAS	-	Engines (reciprocating)	all	0.05	0.003	0.05	0.01	0.1	0.05	0.04	0.01	2.9	4
		-	All other	010102	0.119	0.00025	0.00076	0.000076	0.1	0.00051	0.0015	0.01	0.0015	7 and 2
LIQUID	PETROLEUM COKE	1A4a	Commercial/ Institutional	020100	4	1.8	13.5	17.5	7.9	13	134	1.8	200	2
	RESIDUAL OIL	1A1a	Electricity and heat production	all	2.1	0.53	2.6	2.4	0.21	362	2.6	1.2	7.4	1
		All other	All other	all	4.3	1.3	2.7	5.7	0.4	362	4.9	2.2	94	2
	GAS OIL	-	Engines (reciprocating)	all	0.055	0.011	0.2	0.3	0.11	0.013	0.15	0.22	58	4
		-	All other	all	0.002	0.001	0.2	0.13	0.12	0.005	0.012	0.002	0.42	3
	KEROSENE	All	All	all	0.002	0.001	0.2	0.13	0.12	0.005	0.012	0.002	0.42	5
	LPG	-	Engines	all	0.055	0.011	0.2	0.3	0.11	0.013	0.15	0.22	58	6
		-	All other	all	0.002	0.001	0.2	0.13	0.12	0.005	0.012	0.002	0.42	2
	REFINERY GAS	1A1b	Petroleum refining	all	1.8	1.4	1.4	2.7	1.4	1.4	4.1	6.8	1.8	2
SOLID	COAL	1A1a	Electricity and heat production	all	0.51	0.07	0.86	0.48	1.3	0.97	0.62	5.9	1.9	1
		All other	All other	All	4	1.8	13.5	17.5	7.9	13	134	25	200	2
	BROWN COAL BRI.	1A4b i	Residential	020200	2.5	1.5	11.2	22.3	5.1	12.7	130	1	220	2
	COKE OVEN COKE	1A2	Industry	030100	4	1.8	13.5	17.5	7.9	13	134	1.8	200	2
		1A4b i	Residential	020200	2.5	1.5	11.2	22.3	5.1	12.7	130	1	220	2

1) Implied emission factor 2008 estimated by NEIR based on plant specific emission data for power plants.
2) EMEP/EEA Emission inventory Guidebook, 2009 update (EEA 2009).
3) CONCAWE (Denier van der Gon & Kuenen, 2009).
4) Nielsen et al. 2010.
5) Assumed equal to gas oil. NERI assumption.
6) Assumed equal to natural gas fuelled engines.
7) Gruijthuijsen (2001)

Table 2A-4.7a HM emission factors time-series for municipal waste, mg pr GJ for the years 1990 to 1999.

pol_abbr	fuel_type	fuel_gr_abbr	nfr_id_EA	nfr_name	snap_id	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
As	SOLID	COAL	1A1a	Electricity and heat production	010100	3.3	2.8	2.4	1.9						
					010101	3.3	2.8	2.4	1.9	1.4	0.93	0.9	0.87	0.83	0.8
					010102	3.3	2.8	2.4	1.9	1.4	0.93	0.9	0.87	0.83	0.8
					010103					1.4	0.93	0.9			
					010104					1.4	0.93	0.9	0.87		
					010200	3.3	2.8	2.4	1.9						
					010202					1.4	0.93				
					010203					1.4	0.93	0.9	0.87	0.83	0.8
	WASTE	MUNICIP. WASTES	1A1a	Electricity and heat production	010102					7.8	7.8	7.6	7.4	7.2	7
					010103					7.8	7.8	7.6	7.4	7.2	7
					010104					7.8	7.8	7.6	7.4	7.2	7
					010203					7.8	7.8	7.7	7.6	7.4	7.3
			1A2	Industry	030100	7.8	7.8	7.8	7.8	7.8	7.8	7.7	7.6	7.4	7.3
					030102										
			1A4a	Commercial/ Institutional	020100	7.8	7.8	7.8	7.8	7.8	7.8	7.7	7.6	7.4	7.3
					020103					7.8	7.8	7.7	7.6	7.4	7.3
Cd	SOLID	COAL	1A1a	Electricity and heat production	010100	1.1	0.9	0.71	0.51						
					010101	1.1	0.9	0.71	0.51	0.32	0.12	0.11	0.1	0.09	0.08
					010102	1.1	0.9	0.71	0.51	0.32	0.12	0.11	0.1	0.09	0.08
					010103					0.32	0.12	0.11			
					010104					0.32	0.12	0.11	0.1		
					010200	1.1	0.9	0.71	0.51						
					010202					0.32	0.12				
					010203					0.32	0.12	0.11	0.1	0.09	0.08
	WASTE	MUNICIP. WASTES	1A1a	Electricity and heat production	010100		27	22	18						
					010102					14	9.2	8.3	7.4	6.6	5.7
					010103					14	9.2	8.3	7.4	6.6	5.7
					010104					14	9.2	8.3	7.4	6.6	5.7
					010200	31	27	22	18						
					010203					14	9.2	8.7	8.1	7.6	7
			1A2	Industry	030100	31	27	22	18	14	9.2	8.7	8.1	7.6	7
					030102										
			1A4a	Commercial/ Institutional	020100	31	27	22	18	14	9.2	8.7	8.1	7.6	7
					020103					14	9.2	8.7	8.1	7.6	7
Cr	SOLID	COAL	1A1a	Electricity and heat production	010100	8	7.3	6.7	6						
					010101	8	7.3	6.7	6	5.4	4.7	4.1	3.5	2.9	2.3
					010102	8	7.3	6.7	6	5.4	4.7	4.1	3.5	2.9	2.3
					010103					5.4	4.7	4.1			
					010104					5.4	4.7	4.1	3.5		
					010200	8	7.3	6.7	6						
					010202					5.4	4.7				
					010203					5.4	4.7	4.1	3.5	2.9	2.3
	WASTE	MUNICIP. WASTES	1A1a	Electricity and heat production	010100		155	125	94						
					010102					64	33	27	21	15	8.6
					010103					64	33	27	21	15	8.6

pol_abbr	fuel_type	fuel_gr_abbr	nfr_id_EA	nfr_name	snap_id	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
					010104					64	33	27	21	15	8.6
					010200	186	155	125	94						
					010203					64	33	29	25	22	18
			1A2	Industry	030100	186	155	125	94	64	33	29	25	22	18
					030102										
			1A4a	Commercial/ Institutional	020100	186	155	125	94	64	33	29	25	22	18
					020103					64	33	29	25	22	18
Cu	SOLID	COAL	1A1a	Electricity and heat production	010100	4.4	4.2	4	3.7						
					010101	4.4	4.2	4	3.7	3.5	3.3	2.8	2.4	1.9	1.5
					010102	4.4	4.2	4	3.7	3.5	3.3	2.8	2.4	1.9	1.5
					010103					3.5	3.3	2.8			
					010104					3.5	3.3	2.8	2.4		
					010200	4.4	4.2	4	3.7						
					010202					3.5	3.3				
					010203					3.5	3.3	2.8	2.4	1.9	1.5
	WASTE	MUNICIP. WASTES	1A1a	Electricity and heat production	010100		105	87	68						
					010102					50	32	28	23	19	14
					010103					50	32	28	23	19	14
					010104					50	32	28	23	19	14
					010200	123	105	87	68						
					010203					50	32	29	27	24	21
			1A2	Industry	030100	123	105	87	68	50	32	29	27	24	21
					030102										
			1A4a	Commercial/ Institutional	020100	123	105	87	68	50	32	29	27	24	21
					020103					50	32	29	27	24	21
Hg	SOLID	COAL	1A1a	Electricity and heat production	010100	2.2	2.1	2	2						
					010101	2.2	2.1	2	2	1.9	1.8	1.7	1.6	1.5	1.4
					010102	2.2	2.1	2	2	1.9	1.8	1.7	1.6	1.5	1.4
					010103					1.9	1.8	1.7			
					010104					1.9	1.8	1.7	1.6		
					010200	2.2	2.1	2	2						
					010202					1.9	1.8				
					010203					1.9	1.8	1.7	1.6	1.5	1.4
	WASTE	MUNICIP. WASTES	1A1a	Electricity and heat production	010100		117	103	88						
					010102					74	59	49	38	28	18
					010103					74	59	49	38	28	18
					010104					74	59	49	38	28	18
					010200	132	117	103	88						
					010203					74	59	53	46	40	33
			1A2	Industry	030100	132	117	103	88	74	59	53	46	40	33
					030102										
			1A4a	Commercial/ Institutional	020100	132	117	103	88	74	59	53	46	40	33
					020103					74	59	53	46	40	33
Ni	SOLID	COAL	1A1a	Electricity and heat production	010101	6.8	6.8	6.8	6.8	6.8	6.8	6.3	5.8	5.4	4.9
					010102	6.8	6.8	6.8	6.8	6.8	6.8	6.3	5.8	5.4	4.9
					010103					6.8	6.8	6.3			
					010104					6.8	6.8	6.3	5.8		

pol_abbr	fuel_type	fuel_gr_abbr	nfr_id_EA	nfr_name	snap_id	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
					010203					6.8	6.8	6.3	5.8	5.4	4.9
	WASTE	MUNICIP. WASTES	1A1a	Electricity and heat production	010100		165	137	110						
					010102					82	55	45	35	25	15
					010103					82	55	45	35	25	15
					010104					82	55	45	35	25	15
					010200	192	165	137	110						
					010203					82	55	49	42	36	30
			1A2	Industry	030100	192	165	137	110	82	55	49	42	36	30
					030102										
			1A4a	Commercial/ Institutional	020100	192	165	137	110	82	55	49	42	36	30
					020103					82	55	49	42	36	30
Pb	SOLID	COAL	1A1a	Electricity and heat production	010101	6	6	6	6	6	6	5.1	4.2	3.4	2.5
					010102	6	6	6	6	6	6	5.1	4.2	3.4	2.5
					010103					6	6	5.1			
					010104					6	6	5.1	4.2		
					010203					6	6	5.1	4.2	3.4	2.5
	WASTE	MUNICIP. WASTES	1A1a	Electricity and heat production	010100		606	489	372						
					010102					255	138	135	132	129	126
					010103					255	138	135	132	129	126
					010104					255	138	135	132	129	126
					010200	723	606	489	372						
					010203					255	138	136	134	132	131
			1A2	Industry	030100	723	606	489	372	255	138	136	134	132	131
					030102										
			1A4a	Commercial/ Institutional	020100	723	606	489	372	255	138	136	134	132	131
					020103					255	138	136	134	132	131
Se	SOLID	COAL	1A1a	Electricity and heat production	010100	13	12.6	12.2	11.8						
					010101	13	12.6	12.2	11.8	11.4	11	10	9	7.9	6.9
					010102	13	12.6	12.2	11.8	11.4	11	10	9	7.9	6.9
					010103					11.4	11	10			
					010104					11.4	11	10	9		
					010200	13	12.6	12.2	11.8						
					010202					11.4	11				
					010203					11.4	11	10	9	7.9	6.9
	WASTE	MUNICIP. WASTES	1A1a	Electricity and heat production	010102					25	25	25	25	25	25
					010103					25	25	25	25	25	25
					010104					25	25	25	25	25	25
					010203					25	25	25	25	25	25
			1A2	Industry	030102										
			1A4a	Commercial/ Institutional	020100	25	25	25	25	25	25	25	25	25	25
					020103					25	25	25	25	25	25
Zn	SOLID	COAL	1A1a	Electricity and heat production	010100	19	18	17	16						
					010101	19	18	17	16	14	13	12	11	10	8.9
					010102	19	18	17	16	14	13	12	11	10	8.9
					010103					14	13	12			
					010104					14	13	12	11		
					010200	19	18	17	16						

pol_abbr	fuel_type	fuel_gr_abbr	nfr_id_EA	nfr_name	snap_id	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
					010202					14	13				
					010203					14	13	12	11	10	8.9
	WASTE	MUNICIP. WASTES	1A1a	Electricity and heat production	010100		716	627	538						
					010102					449	360	298	237	175	114
					010103					449	360	298	237	175	114
					010104					449	360	298	237	175	114
					010200	805	716	627	538						
					010203					449	360	322	283	245	206
			1A2	Industry	030100	805	716	627	538	449	360	322	283	245	206
					030102										
			1A4a	Commercial/ Institutional	020100	805	716	627	538	449	360	322	283	245	206
					020103					449	360	322	283	245	206

Table 2A-4.7b HM emission factors time-series for municipal waste, mg pr GJ for the years 2000 to 2009.

pol_abbr	fuel_type	fuel_gr_abbr	nfr_id_EA	nfr_name	snap_id	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
As	SOLID	COAL	1A1a	Electricity and heat production	010100										
					010101	0.77	0.72	0.67	0.63	0.58	0.53	0.523	0.517	0.51	0.51
					010102	0.77	0.72	0.67	0.63	0.58	0.53	0.523	0.517	0.51	0.51
					010103										
					010104										
					010200										
					010202										
					010203	0.77	0.72	0.67	0.63	0.58	0.53		0.517	0.51	
	WASTE	MUNICIP. WASTES	1A1a	Electricity and heat production	010102	6.8	6.8	6.8	6.8	4.7	2.7	0.59	0.59	0.59	0.59
					010103	6.8	6.8	6.8	6.8	4.7	2.7	0.59	0.59	0.59	0.59
					010104	6.8			6.8			0.59			
					010203	7.2	7.1	6.9	6.8	4.7	2.7	0.59	0.59	0.59	0.59
			1A2	Industry	030100										
					030102					4.7	2.7			0.59	
			1A4a	Commercial/ Institutional	020100	7.2			6.8	4.7	2.7	0.59	0.59		
					020103	7.2	7.1	6.9	6.8	4.7	2.7	0.59	0.59	0.59	0.59
Cd	SOLID	COAL	1A1a	Electricity and heat production	010100										
					010101	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07
					010102	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07
					010103										
					010104										
					010200										
					010202										
					010203	0.07	0.07	0.07	0.07	0.07	0.07		0.07	0.07	
	WASTE	MUNICIP. WASTES	1A1a	Electricity and heat production	010100										
					010102	4.8	4.8	4.8	4.8	3.3	1.9	0.44	0.44	0.44	0.44
					010103	4.8	4.8	4.8	4.8	3.3	1.9	0.44	0.44	0.44	0.44
					010104	4.8			4.8			0.44			
					010200										
					010203	6.5	5.9	5.4	4.8	3.3	1.9	0.44	0.44	0.44	0.44
			1A2	Industry	030100										
					030102					3.3	1.9			0.44	
			1A4a	Commercial/ Institutional	020100	6.5			4.8	3.3	1.9	0.44	0.44		
					020103	6.5	5.9	5.4	4.8	3.3	1.9	0.44	0.44	0.44	0.44
Cr	SOLID	COAL	1A1a	Electricity and heat production	010100										
					010101	1.7	1.6	1.4	1.3	1.1	1	0.95	0.91	0.86	0.86
					010102	1.7	1.6	1.4	1.3	1.1	1	0.95	0.91	0.86	0.86
					010103										
					010104										
					010200										
					010202										
					010203	1.7	1.6	1.4	1.3	1.1	1		0.91	0.86	
	WASTE	MUNICIP. WASTES	1A1a	Electricity and heat production	010100										
					010102	2.5	2.5	2.5	2.5	2.2	1.9	1.56	1.56	1.56	1.56
					010103	2.5	2.5	2.5	2.5	2.2	1.9	1.56	1.56	1.56	1.56

pol_abbr	fuel_type	fuel_gr_abbr	nfr_id_EA	nfr_name	snap_id	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
					010104	2.5			2.5			1.56			
					010200										
					010203	14	10	6.3	2.5	2.2	1.9	1.56	1.56	1.56	1.56
			1A2	Industry	030100										
					030102					2.2	1.9			1.56	
			1A4a	Commercial/ Institutional	020100	14			2.5	2.2	1.9	1.56	1.56		
					020103	14	10	6.3	2.5	2.2	1.9	1.56	1.56	1.56	1.56
Cu	SOLID	COAL	1A1a	Electricity and heat production	010100										
					010101	1	0.92	0.84	0.76	0.68	0.6	0.56	0.52	0.48	0.48
					010102	1	0.92	0.84	0.76	0.68	0.6	0.56	0.52	0.48	0.48
					010103										
					010104										
					010200										
					010202										
					010203	1	0.92	0.84	0.76	0.68	0.6		0.52	0.48	
	WASTE	MUNICIP. WASTES	1A1a	Electricity and heat production	010100										
					010102	10.1	10.1	10.1	10.1	7.2	4.2	1.3	1.3	1.3	1.3
					010103	10.1	10.1	10.1	10.1	7.2	4.2	1.3	1.3	1.3	1.3
					010104	10.1			10.1			1.3			
					010200										
					010203	18	16	13	10.1	7.2	4.2	1.3	1.3	1.3	1.3
			1A2	Industry	030100										
					030102					7.2	4.2			1.3	
			1A4a	Commercial/ Institutional	020100	18			10.1	7.2	4.2	1.3	1.3		
					020103	18	16	13	10.1	7.2	4.2	1.3	1.3	1.3	1.3
Hg	SOLID	COAL	1A1a	Electricity and heat production	010100										
					010101	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3
					010102	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3
					010103										
					010104										
					010200										
					010202										
					010203	1.3	1.3	1.3	1.3	1.3	1.3		1.3	1.3	
	WASTE	MUNICIP. WASTES	1A1a	Electricity and heat production	010100										
					010102	7.4	7.4	7.4	7.4	5.5	3.7	1.79	1.79	1.79	1.79
					010103	7.4	7.4	7.4	7.4	5.5	3.7	1.79	1.79	1.79	1.79
					010104	7.4			7.4			1.79			
					010200										
					010203	27	20	14	7.4	5.5	3.7	1.79	1.79	1.79	1.79
			1A2	Industry	030100										
					030102					5.5	3.7			1.79	
			1A4a	Commercial/ Institutional	020100	27			7.4	5.5	3.7	1.79	1.79		
					020103	27	20	14	7.4	5.5	3.7	1.79	1.79	1.79	1.79
Ni	SOLID	COAL	1A1a	Electricity and heat production	010101	4.4	3.8	3.2	2.5	1.9	1.3	1.2	1.1	0.97	0.97
					010102	4.4	3.8	3.2	2.5	1.9	1.3	1.2	1.1	0.97	0.97
					010103										
					010104										

pol_abbr	fuel_type	fuel_gr_abbr	nfr_id_EA	nfr_name	snap_id	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
					010203	4.4	3.8	3.2	2.5	1.9	1.3		1.1	0.97	
	WASTE	MUNICIP. WASTES	1A1a	Electricity and heat production	010100										
					010102	4.8	4.8	4.8	4.8	3.9	3	2.06	2.06	2.06	2.06
					010103	4.8	4.8	4.8	4.8	3.9	3	2.06	2.06	2.06	2.06
					010104	4.8			4.8			2.06			
					010200										
					010203	24	17	11	4.8	3.9	3	2.06	2.06	2.06	2.06
			1A2	Industry	030100										
					030102					3.9	3			2.06	
			1A4a	Commercial/ Institutional	020100	24			4.8	3.9	3	2.06	2.06		
					020103	24	17	11	4.8	3.9	3	2.06	2.06	2.06	2.06
Pb	SOLID	COAL	1A1a	Electricity and heat production	010101	1.6	1.5	1.4	1.2	1.1	1	0.87	0.75	0.62	0.62
					010102	1.6	1.5	1.4	1.2	1.1	1	0.87	0.75	0.62	0.62
					010103										
					010104										
					010203	1.6	1.5	1.4	1.2	1.1	1		0.75	0.62	
	WASTE	MUNICIP. WASTES	1A1a	Electricity and heat production	010100										
					010102	123	123	123	123	84	45	5.52	5.52	5.52	5.52
					010103	123	123	123	123	84	45	5.52	5.52	5.52	5.52
					010104	123			123			5.52			
					010200										
					010203	129	127	125	123	84	45	5.52	5.52	5.52	5.52
			1A2	Industry	030100										
					030102					84	45			5.52	
			1A4a	Commercial/ Institutional	020100	129			123	84	45	5.52	5.52		
					020103	129	127	125	123	84	45	5.52	5.52	5.52	5.52
Se	SOLID	COAL	1A1a	Electricity and heat production	010100										
					010101	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.9
					010102	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.9
					010103										
					010104										
					010200										
					010202										
					010203	5.9	5.9	5.9	5.9	5.9	5.9		5.9	5.9	
	WASTE	MUNICIP. WASTES	1A1a	Electricity and heat production	010102	25	25	25	25	17	9.1	1.11	1.11	1.11	1.11
					010103	25	25	25	25	17	9.1	1.11	1.11	1.11	1.11
					010104	25			25			1.11			
					010203	25	25	25	25	17	9.1	1.11	1.11	1.11	1.11
			1A2	Industry	030102					17	9.1			1.11	
			1A4a	Commercial/ Institutional	020100	25			25	17	9.1	1.11	1.11		
					020103	25	25	25	25	17	9.1	1.11	1.11	1.11	1.11
Zn	SOLID	COAL	1A1a	Electricity and heat production	010100										
					010101	7.7	6.6	5.5	4.4	3.2	2.1	2.03	1.97	1.9	1.9
					010102	7.7	6.6	5.5	4.4	3.2	2.1	2.03	1.97	1.9	1.9
					010103										
					010104										
					010200										

pol_abbr	fuel_type	fuel_gr_abbr	nfr_id_EA	nfr_name	snap_id	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
					010202										
					010203	7.7	6.6	5.5	4.4	3.2	2.1		1.97	1.9	
	WASTE	MUNICIP. WASTES	1A1a	Electricity and heat production	010100										
					010102	52	52	52	52	35	19	2.33	2.33	2.33	2.33
					010103	52	52	52	52	35	19	2.33	2.33	2.33	2.33
					010104	52			52			2.33			
					010200										
					010203	168	129	91	52	35	19	2.33	2.33	2.33	2.33
			1A2	Industry	030100										
					030102					35	19			2.33	
			1A4a	Commercial/ Institutional	020100	168			52	35	19	2.33	2.33		
					020103	168	129	91	52	35	19	2.33	2.33	2.33	2.33

Table 2A-4.8 PAH emission factors 2009.

fuel_type	fuel_gr_abbr	nfr_id_EA	nfr_name	snap_id	Benzo(a)-pyrene µg per GJ	Ref.	Benzo(b)-flouran-thene µg per GJ	Ref.	Benzo(k)-flouran-thene µg per GJ	Ref.	Indeno-(1,2,3-c,d)-pyrene µg per GJ	Ref.
BIOMASS	WOOD	1A1a	Electricity and heat production	010102	11	7	15	7	5	7	0.8	7
				010103	11	7	15	7	5	7	0.8	7
				010104	11	7	15	7	5	7	0.8	7
				010203	6.46	4	1292.52	4	1292.52	4	11.56	4
		1A2	Industry	030100	6.46	4	1292.52	4	1292.52	4	11.56	4
				030102	6.46	4	1292.52	4	1292.52	4	11.56	4
				030103	6.46	4	1292.52	4	1292.52	4	11.56	4
		1A4a	Commercial/ Institutional	020100	168707	4	221769	4	73469	4	119728	4
				020105	6.46	4	1292.52	4	1292.52	4	11.56	4
		1A4b i	Residential	020200	113604	10	115922	10	66530	10	76403	10
				020202	113604	10	115922	10	66530	10	76403	10
				020204	113604	10	115922	10	66530	10	76403	10
		1A4c i	Agriculture/ Forestry	020300	168707	4	221769	4	73469	4	119728	4
	STRAW	1A1a	Electricity and heat production	010101	0.5	7	0.5	7	0.5	7	0.5	7
				010102	0.5	7	0.5	7	0.5	7	0.5	7
				010103	0.5	7	0.5	7	0.5	7	0.5	7
				010104	0.5	7	0.5	7	0.5	7	0.5	7
				010203	1529	2	3452	2	1400	2	1029	2
		1A4b i	Residential	020200	12956	2	12828	2	6912	2	4222	2
		1A4c i	Agriculture/ Forestry	020300	12956	2	12828	2	6912	2	4222	2
	BIO OIL	1A1a	Electricity and heat production	010105	109.6	3	475.41	3	93.21	3	177.28	3
				010202	109.6	3	475.41	3	93.21	3	177.28	3
				010203	109.6	3	475.41	3	93.21	3	177.28	3
		1A2	Industry	030105	80	3	42	3	66	3	160	3
		1A4b i	Residential	020200	80	3	42	3	66	3	160	3
	BIOGAS	1A1a	Electricity and heat production	010105	1.3	7	1.2	7	1.2	7	0.6	7
		1A2	Industry	030105	1.3	7	1.2	7	1.2	7	0.6	7
		1A4a	Commercial/ Institutional	020105	1.3	7	1.2	7	1.2	7	0.6	7
		1A4c i	Agriculture/ Forestry	020304	1.3	7	1.2	7	1.2	7	0.6	7
	BIO PROD GAS	1A1a	Electricity and heat production	010105	2	7	2	7	2	7	2	7
		1A2	Industry	030105	2	7	2	7	2	7	2	7
WASTE	MUNICIP. WASTES	1A1a	Electricity and heat production	010101	0.8	7	1.7	7	0.9	7	1.1	7
				010102	0.8	7	1.7	7	0.9	7	1.1	7
				010103	0.8	7	1.7	7	0.9	7	1.1	7
				010203	0.8	7	1.7	7	0.9	7	1.1	7
		1A2	Industry	030102	0.8	7	1.7	7	0.9	7	1.1	7
		1A4a	Commercial/ Institutional	020103	0.8	7	1.7	7	0.9	7	1.1	7
GAS	NATURAL GAS	1A1a	Electricity and heat production	010104	1	8	1	8	2	8	3	8
				010105	1.2	7	9	7	1.7	7	1.8	7
		1A1c	Other energy industries	010504	1	8	1	8	2	8	3	8
		1A2	Industry	030104	1	8	1	8	2	8	3	8

					Benzo(a)-pyrene		Benzo(b)-flouran-thene		Benzo(k)-flouran-thene		Indeno-(1,2,3-c,d)-pyrene	
				030105	1.2	7	9	7	1.7	7	1.8	7
		1A4a	Commercial/ Institutional	020105	1.2	7	9	7	1.7	7	1.8	7
		1A4b i	Residential	020202	0.133	6	0.663	6	0.265	6	2.653	6
				020204	1.2	7	9	7	1.7	7	1.8	7
		1A4c i	Agriculture/ Forestry	020304	1	8	1	8	2	8	3	8
LIQUID	PETROLEUM COKE	1A4a	Commercial/ Institutional	020100	3184	5	9554	5	-	-	-	-
	RESIDUAL OIL	1A1a	Electricity and heat production	010101	109.6	4	475.41	4	93.21	4	177.28	4
				010102	109.6	4	475.41	4	93.21	4	177.28	4
				010103	109.6	4	475.41	4	93.21	4	177.28	4
				010104	109.6	4	475.41	4	93.21	4	177.28	4
				010105	109.6	4	475.41	4	93.21	4	177.28	4
				010202	109.6	4	475.41	4	93.21	4	177.28	4
				010203	109.6	4	475.41	4	93.21	4	177.28	4
		1A1b	Petroleum refining	010306	109.6	4	475.41	4	93.21	4	177.28	4
		1A2	Industry	030100	80	4	42	4	66	4	160	4
				030102	80	4	42	4	66	4	160	4
				030103	80	4	42	4	66	4	160	4
		1A4a	Commercial/ Institutional	020100	80	4	42	4	66	4	160	4
		1A4b i	Residential	020200	80	4	42	4	66	4	160	4
		1A4c i	Agriculture/ Forestry	020300	80	4	42	4	66	4	160	4
				020302	80	4	42	4	66	4	160	4
	GAS OIL	1A1a	Electricity and heat production	010101	109.6	4	475.41	4	93.21	4	177.28	4
				010102	109.6	4	475.41	4	93.21	4	177.28	4
				010103	109.6	4	475.41	4	93.21	4	177.28	4
				010104	109.6	4	475.41	4	93.21	4	177.28	4
				010105	1.9	7	15	7	1.7	7	1.5	7
				010202	109.6	4	475.41	4	93.21	4	177.28	4
				010203	109.6	4	475.41	4	93.21	4	177.28	4
		1A1b	Petroleum refining	010306	109.6	4	475.41	4	93.21	4	177.28	4
		1A2	Industry	030100	80	4	42	4	66	4	160	4
				030102	80	4	42	4	66	4	160	4
				030104	80	4	42	4	66	4	160	4
				030105	1.9	7	15	7	1.7	7	1.5	7
		1A4a	Commercial/ Institutional	020100	80	4	42	4	66	4	160	4
				020103	80	4	42	4	66	4	160	4
				020105	1.9	7	15	7	1.7	7	1.5	7
		1A4b i	Residential	020200	80	4	42	4	66	4	160	4
				020204	1.9	7	15	7	1.7	7	1.5	7
SOLID	COAL	1A1a	Electricity and heat production	010101	0.14	4	0.29	4	0.29	4	0.28	4
				010102	0.14	4	0.29	4	0.29	4	0.28	4
		1A2	Industry	030100	23	4	929	4	929	4	698	4
		1A4b i	Residential	020200	59524	4	63492	4	1984	4	119048	4
		1A4c i	Agriculture/ Forestry	020300	59524	4	63492	4	1984	4	119048	4

					Benzo(a)-pyrene		Benzo(b)-flouran-thene		Benzo(k)-flouran-thene		Indeno-(1,2,3-c,d)-pyrene	
				020304	59524	4	63492	4	1984	4	119048	4
	BROWN COAL BRI	1A4b i	Residential	020200	59524	4 (9)	63492	4 (9)	1984	4 (9)	119048	4 (9)
	COKE OVEN COKE	1A2	Industry	030100	23	4 (9)	929	4 (9)	929	4 (9)	698	4 (9)
		1A4b i	Residential	020200	59524	4 (9)	63492	4 (9)	1984	4 (9)	119048	4 (9)

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2. Same emission factors as for gas oil is assumed (NERI assumption).
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8. Same emission factor as for coal is assumed (NERI assumption).
9. Aggregated emission factor based on the technology distribution in the sector and guidebook (EEA 2009) emission factors. Technology distribution based on: (Illerup, J. B., Henriksen, T. C., Lundhede, T., Breugel C. v., Jensen, N. Z. (2009) "Brændeovne og små kedler - partikelemissioner og reduktionstiltag". Miljøprojekt nr. 1164 2009. Miljøstyrelsen. Available on the Internet at: http://www2.mst.dk/common/Udgivramme/Frame.asp?http://www2.mst.dk/Udgiv/publikationer/2007/978-87-7052-451-3/html/default.htm (2011-02-07)

Table 2A-4.9a PAH emission factors time-series, µg pr GJ for the years 1990 to 1999.

pollutant	fuel_type	fuel	nfr	nfr_name	snap_id	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Benzo(a)pyrene	BIOMASS	BIOGAS	1A1a	Electricity and heat production	010105			1	1	1	1	1	1	1	1
			1A2	Industry	030105										
			1A4a	Commercial/ Institutional	020105					1	1	1	1	1	1
			1A4c i	Agriculture/ Forestry	020304					1	1	1	1	1	1
		WOOD	1A4a	Commercial/ Institutional	020105									168707	168707
			1A4b i	Residential	020200	158978	158978	158978	158978	158978	158978	158978	158978	158978	158978
					020202										
					020204										
		BIO OIL	1A2	Industry	030105										
			1A4b i	Residential	020200										
	GAS	NATURAL GAS	1A1a	Electricity and heat production	010105	3	3	3	3	3	3	3	3	3	3
			1A2	Industry	030105					3	3	3	3	3	3
			1A4a	Commercial/ Institutional	020105					3	3	3	3	3	3
			1A4b i	Residential	020204					3	3		3	3	3
			1A4c i	Agriculture/ Forestry	020304					3	3	3	3	3	3
	WASTE	MUNICIP. WASTES	1A1a	Electricity and heat production	010102					0.8	0.8	0.8	0.8	0.8	0.8
					010103					0.8	0.8	0.8	0.8	0.8	0.8
					010104					0.8	0.8	0.8	0.8	0.8	0.8
					010203					0.8	0.8	0.8	0.8	0.8	0.8
			1A2	Industry	030102										
			1A4a	Commercial/ Institutional	020100	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
					020103					0.8	0.8	0.8	0.8	0.8	0.8
Benzo(b)flouranthene	BIOMASS	BIOGAS	1A1a	Electricity and heat production	010105			1	1	1	1	1	1	1	1
			1A2	Industry	030105										
			1A4a	Commercial/ Institutional	020105					1	1	1	1	1	1
			1A4c i	Agriculture/ Forestry	020304					1	1	1	1	1	1
		WOOD	1A4a	Commercial/ Institutional	020105									221769	221769
			1A4b i	Residential	020200	169294	169294	169294	169294	169294	169294	169294	169294	169294	169294
					020202										
					020204										
		BIO OIL	1A2	Industry	030105										
			1A4b i	Residential	020200										
	GAS	NATURAL GAS	1A1a	Electricity and heat production	010105	42	42	42	42	42	42	42	42	42	42
			1A2	Industry	030105					42	42	42	42	42	42
			1A4a	Commercial/ Institutional	020105					42	42	42	42	42	42
			1A4b i	Residential	020204					42	42		42	42	42
			1A4c i	Agriculture/ Forestry	020304					42	42	42	42	42	42
Benzo(k)flouranthene	BIOMASS	BIOGAS	1A1a	Electricity and heat production	010105			0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
			1A2	Industry	030105										
			1A4a	Commercial/ Institutional	020105					0.4	0.4	0.4	0.4	0.4	0.4
			1A4c i	Agriculture/ Forestry	020304					0.4	0.4	0.4	0.4	0.4	0.4
		WOOD	1A4a	Commercial/ Institutional	020105									73469	73469
			1A4b i	Residential	020200	98916	98916	98916	98916	98916	98916	98916	98916	98916	98916
					020202										

pollutant	fuel_type	fuel	nfr	nfr_name	snap_id	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
					020204										
		BIO OIL	1A2	Industry	030105										
			1A4b i	Residential	020200										
	GAS	NATURAL GAS	1A1a	Electricity and heat production	010105	24	24	24	24	24	24	24	24	24	24
			1A2	Industry	030105					24	24	24	24	24	24
			1A4a	Commercial/ Institutional	020105					24	24	24	24	24	24
			1A4b i	Residential	020204					24	24		24	24	24
			1A4c i	Agriculture/ Forestry	020304					24	24	24	24	24	24
	WASTE	MUNICIP. WASTES	1A1a	Electricity and heat production	010102					0.8	0.8	0.8	0.8	0.8	0.8
					010103					0.8	0.8	0.8	0.8	0.8	0.8
					010104					0.8	0.8	0.8	0.8	0.8	0.8
					010203					0.8	0.8	0.8	0.8	0.8	0.8
			1A2	Industry	030102										
			1A4a	Commercial/ Institutional	020100	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
					020103					0.8	0.8	0.8	0.8	0.8	0.8
Indeno(1,2,3-c,d)pyrene	BIOMASS	BIOGAS	1A1a	Electricity and heat production	010105			1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1
			1A2	Industry	030105										
			1A4a	Commercial/ Institutional	020105					1.1	1.1	1.1	1.1	1.1	1.1
			1A4c i	Agriculture/ Forestry	020304					1.1	1.1	1.1	1.1	1.1	1.1
		WOOD	1A4a	Commercial/ Institutional	020105									119728	119728
			1A4b i	Residential	020200	110462	110462	110462	110462	110462	110462	110462	110462	110462	110462
					020202										
					020204										
		BIO OIL	1A2	Industry	030105										
			1A4b i	Residential	020200										
	GAS	NATURAL GAS	1A1a	Electricity and heat production	010105	6	6	6	6	6	6	6	6	6	6
			1A2	Industry	030105					6	6	6	6	6	6
			1A4a	Commercial/ Institutional	020105					6	6	6	6	6	6
			1A4b i	Residential	020204					6	6		6	6	6
			1A4c i	Agriculture/ Forestry	020304					6	6	6	6	6	6
	WASTE	MUNICIP. WASTES	1A1a	Electricity and heat production	010102					0.9	0.9	0.9	0.9	0.9	0.9
					010103					0.9	0.9	0.9	0.9	0.9	0.9
					010104					0.9	0.9	0.9	0.9	0.9	0.9
					010203					0.9	0.9	0.9	0.9	0.9	0.9
			1A2	Industry	030102										
			1A4a	Commercial/ Institutional	020100	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
					020103					0.9	0.9	0.9	0.9	0.9	0.9

Table 2A-4.9b PAH emission factors time-series, µg pr GJ for the years 2000 to 2009.

pollutant	fuel_type	fuel	nfr	nfr_name	snap_id	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Benzo(a)pyrene	BIOMASS	BIOGAS	1A1a	Electricity and heat production	010105	1	1.1	1.1	1.2	1.2	1.3	1.3	1.3	1.3	1.3
			1A2	Industry	030105		1.1	1.1	1.2	1.2	1.3	1.3	1.3	1.3	1.3
			1A4a	Commercial/ Institutional	020105	1	1.1	1.1	1.2	1.2	1.3	1.3	1.3	1.3	1.3
			1A4c i	Agriculture/ Forestry	020304	1	1.1	1.1	1.2	1.2	1.3	1.3	1.3	1.3	1.3
		WOOD	1A4a	Commercial/ Institutional	020105		168707	168707		168707	168707	168707	168707	6.46	6.46
			1A4b i	Residential	020200	158978	143819	138366	137886	137246	132394	127943	128724	121082	113604
					020202						132394	127943	128724	121082	113604
					020204									121082	113604
		BIO OIL	1A2	Industry	030105			80	80	109.6	80	80	80	80	80
			1A4b i	Residential	020200								109.6	80	80
	GAS	NATURAL GAS	1A1a	Electricity and heat production	010105	3	2.7	2.5	2.2	2	1.7	1.5	1.2	1.2	1.2
			1A2	Industry	030105	3	2.7	2.5	2.2	2	1.7	1.5	1.2	1.2	1.2
			1A4a	Commercial/ Institutional	020105	3	2.7	2.5	2.2	2	1.7	1.5	1.2	1.2	1.2
			1A4b i	Residential	020204	3	2.7	2.5	2.2	2	1.7	1.5	1.2	1.2	1.2
			1A4c i	Agriculture/ Forestry	020304	3	2.7	2.5	2.2	2	1.7	1.5	1.2	1.2	1.2
	WASTE	MUNICIP. WASTES	1A1a	Electricity and heat production	010102	0.9	0.9	0.9	0.9	0.9	0.8	0.8	0.8	0.8	0.8
					010103	0.9	0.9	0.9	0.9	0.9	0.8	0.8	0.8	0.8	0.8
					010104	0.9			0.9			0.8			
					010203	0.9	0.9	0.9	0.9	0.9	0.8	0.8	0.8	0.8	0.8
			1A2	Industry	030102					0.9	0.8			0.8	
			1A4a	Commercial/ Institutional	020100	0.9			0.9	0.9	0.8	0.8	0.8		
					020103	0.9	0.9	0.9	0.9	0.9	0.8	0.8	0.8	0.8	0.8
Benzo(b)flouranthene	BIOMASS	BIOGAS	1A1a	Electricity and heat production	010105	1	1	1.1	1.1	1.1	1.2	1.2	1.2	1.2	1.2
			1A2	Industry	030105		1	1.1	1.1	1.1	1.2	1.2	1.2	1.2	1.2
			1A4a	Commercial/ Institutional	020105	1	1	1.1	1.1	1.1	1.2	1.2	1.2	1.2	1.2
			1A4c i	Agriculture/ Forestry	020304	1	1	1.1	1.1	1.1	1.2	1.2	1.2	1.2	1.2
		WOOD	1A4a	Commercial/ Institutional	020105		221769	221769		221769	221769	221769	221769	1292.52	1292.52
			1A4b i	Residential	020200	169294	152421	145960	144786	143466	137800	133097	133116	124423	115922
					020202						137800	133097	133116	124423	115922
					020204									124423	115922
		BIO OIL	1A2	Industry	030105			42	42	475.41	42	42	42	42	42
			1A4b i	Residential	020200								475.41	42	42
	GAS	NATURAL GAS	1A1a	Electricity and heat production	010105	42	37	33	28	23	18	14	9	9	9
			1A2	Industry	030105	42	37	33	28	23	18	14	9	9	9
			1A4a	Commercial/ Institutional	020105	42	37	33	28	23	18	14	9	9	9
			1A4b i	Residential	020204	42	37	33	28	23	18	14	9	9	9
			1A4c i	Agriculture/ Forestry	020304	42	37	33	28	23	18	14	9	9	9
Benzo(k)flouranthene	BIOMASS	BIOGAS	1A1a	Electricity and heat production	010105	0.4	0.5	0.7	0.8	0.9	1	1.2	1.2	1.2	1.2
			1A2	Industry	030105		0.5	0.7	0.8	0.9	1	1.2	1.2	1.2	1.2
			1A4a	Commercial/ Institutional	020105	0.4	0.5	0.7	0.8	0.9	1	1.2	1.2	1.2	1.2
			1A4c i	Agriculture/ Forestry	020304	0.4	0.5	0.7	0.8	0.9	1	1.2	1.2	1.2	1.2
		WOOD	1A4a	Commercial/ Institutional	020105		73469	73469		73469	73469	73469	73469	1292.52	1292.52
			1A4b i	Residential	020200	98916	89076	85286	84566	83767	80458	77736	77311	71858	66530
					020202						80458	77736	77311	71858	66530

pollutant	fuel_type	fuel	nfr	nfr_name	snap_id	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
					020204									71858	66530
		BIO OIL	1A2	Industry	030105			66	66	93.21	66	66	66	66	66
			1A4b i	Residential	020200								93.21	66	66
	GAS	NATURAL GAS	1A1a	Electricity and heat production	010105	24	21	18	14	11	8	5	1.7	1.7	1.7
			1A2	Industry	030105	24	21	18	14	11	8	5	1.7	1.7	1.7
			1A4a	Commercial/ Institutional	020105	24	21	18	14	11	8	5	1.7	1.7	1.7
			1A4b i	Residential	020204	24	21	18	14	11	8	5	1.7	1.7	1.7
			1A4c i	Agriculture/ Forestry	020304	24	21	18	14	11	8	5	1.7	1.7	1.7
	WASTE	MUNICIP. WASTES	1A1a	Electricity and heat production	010102	0.8	0.8	0.8	0.8	0.8	0.9	0.9	0.9	0.9	0.9
					010103	0.8	0.8	0.8	0.8	0.8	0.9	0.9	0.9	0.9	0.9
					010104	0.8			0.8			0.9			
					010203	0.8	0.8	0.8	0.8	0.8	0.9	0.9	0.9	0.9	0.9
			1A2	Industry	030102					0.8	0.9			0.9	
			1A4a	Commercial/ Institutional	020100	0.8			0.8	0.8	0.9	0.9	0.9		
					020103	0.8	0.8	0.8	0.8	0.8	0.9	0.9	0.9	0.9	0.9
Indeno(1,2,3-c,d)pyrene	BIOMASS	BIOGAS	1A1a	Electricity and heat production	010105	1.1	1	0.9	0.9	0.8	0.7	0.6	0.6	0.6	0.6
			1A2	Industry	030105		1	0.9	0.9	0.8	0.7	0.6	0.6	0.6	0.6
			1A4a	Commercial/ Institutional	020105	1.1	1	0.9	0.9	0.8	0.7	0.6	0.6	0.6	0.6
			1A4c i	Agriculture/ Forestry	020304	1.1	1	0.9	0.9	0.8	0.7	0.6	0.6	0.6	0.6
		WOOD	1A4a	Commercial/ Institutional	020105		119728	119728		119728	119728	119728	119728	11.56	11.56
			1A4b i	Residential	020200	110462	99570	95544	95023	94398	90846	87681	87784	82030	76403
					020202						90846	87681	87784	82030	76403
					020204									82030	76403
		BIO OIL	1A2	Industry	030105			160	160	177.28	160	160	160	160	160
			1A4b i	Residential	020200								177.28	160	160
	GAS	NATURAL GAS	1A1a	Electricity and heat production	010105	6	5.4	4.8	4.2	3.6	3	2.4	1.8	1.8	1.8
			1A2	Industry	030105	6	5.4	4.8	4.2	3.6	3	2.4	1.8	1.8	1.8
			1A4a	Commercial/ Institutional	020105	6	5.4	4.8	4.2	3.6	3	2.4	1.8	1.8	1.8
			1A4b i	Residential	020204	6	5.4	4.8	4.2	3.6	3	2.4	1.8	1.8	1.8
			1A4c i	Agriculture/ Forestry	020304	6	5.4	4.8	4.2	3.6	3	2.4	1.8	1.8	1.8
	WASTE	MUNICIP. WASTES	1A1a	Electricity and heat production	010102	0.9	0.9	0.9	0.9	1	1	1.1	1.1	1.1	1.1
					010103	0.9	0.9	0.9	0.9	1	1	1.1	1.1	1.1	1.1
					010104	0.9			0.9			1.1			
					010203	0.9	0.9	0.9	0.9	1	1	1.1	1.1	1.1	1.1
			1A2	Industry	030102					1	1			1.1	
			1A4a	Commercial/ Institutional	020100	0.9			0.9	1	1	1.1	1.1		
					020103	0.9	0.9	0.9	0.9	1	1	1.1	1.1	1.1	1.1

Table 2A-4.10 Dioxin and HCB emission factors 2009.

fuel_type	fuel	nfr	nfr_name	snap_id	HCB, ng pr GJ	Dioxin, ng pr GJ
BIOMASS	WOOD	1A1a	Electricity and heat production	010102	4000	14
				010103	4000	14
				010104	4000	14
				010203	4000	1
		1A2	Industry	030100	4000	1
				030102	4000	1
				030103	4000	1
		1A4a	Commercial/ Institutional	020100	4000	400
				020105	4000	400
		1A4b i	Residential	020200	4000	400
				020202	4000	400
				020204	4000	400
		1A4c i	Agriculture/ Forestry	020300	4000	400
	STRAW	1A1a	Electricity and heat production	010101	113	19
				010102	113	19
				010103	113	19
				010104	113	19
				010203	113	22
		1A4b i	Residential	020200	113	500
		1A4c i	Agriculture/ Forestry	020300	113	400
	BIO OIL	1A1a	Electricity and heat production	010105		0.882
				010202		0.882
				010203		0.882
		1A2	Industry	030105		0.882
		1A4b i	Residential	020200		10
	BIOGAS	1A1a	Electricity and heat production	010102		0.025
				010105	190	0.96
				010203		0.025
		1A2	Industry	030100		0.025
				030102		0.025
				030103		0.025
				030105	190	0.96
		1A4a	Commercial/ Institutional	020100		2
				020103		2
				020105	190	0.96
		1A4c i	Agriculture/ Forestry	020300		2
				020304	190	0.96
	BIO PROD GAS	1A1a	Electricity and heat production	010105		1.7
		1A2	Industry	030105		1.7
WASTE	MUNICIP. WASTES	1A1a	Electricity and heat production	010101	4300	5
				010102	4300	5
				010103	4300	5
				010203	4300	5
		1A4a	Commercial/ Institutional	020103	4300	5
GAS	NATURAL GAS	1A1a	Electricity and heat production	010101		0.025
				010102		0.025
				010103		0.025
				010104		0.025
				010105		0.57
				010202		0.025
				010203		0.025
		1A1c	Other energy industries	010504		0.025
		1A2	Industry	030100		0.025
				030103		0.025
				030104		0.025
				030105		0.57
				030106		0.025
		1A4a	Commercial/ Institutional	020100		2
				020103		2
				020105		0.57
		1A4b i	Residential	020200		2
				020202		2
				020204		0.57
		1A4c i	Agriculture/ Forestry	020300		2
				020304		0.57
LIQUID	PETROLEUM COKE	1A4a	Commercial/ Institutional	020100		300
	RESIDUAL OIL	1A1a	Electricity and heat production	010101		0.882
				010102		0.882

fuel_type	fuel	nfr	nfr_name	snap_id	HCB, ng pr GJ	Dioxin, ng pr GJ
				010103		0.882
				010104		0.882
				010105		0.882
				010202		0.882
				010203		0.882
		1A1b	Petroleum refining	010306		0.882
		1A2	Industry	030100		0.882
				030102		0.882
				030103		0.882
		1A4a	Commercial/ Institutional	020100		10
		1A4b i	Residential	020200		10
		1A4c i	Agriculture/ Forestry	020300		10
				020302		10
	GAS OIL	1A1a	Electricity and heat production	010101		0.882
				010102		0.882
				010103		0.882
				010104		0.882
				010105	220	0.99
				010202		0.882
				010203		0.882
		1A1b	Petroleum refining	010306		0.882
		1A2	Industry	030100		0.882
				030102		0.882
				030104		0.882
				030105	220	0.99
		1A4a	Commercial/ Institutional	020100		10
				020103		10
				020105	220	0.99
		1A4b i	Residential	020200		10
				020204		0.99
	KEROSENE	1A2	Industry	030100		0.882
		1A4a	Commercial/ Institutional	020100		10
		1A4b i	Residential	020200		10
		1A4c i	Agriculture/ Forestry	020300		10
	LPG	1A1a	Electricity and heat production	010102		0.025
				010203		0.025
		1A2	Industry	030100		0.025
		1A4a	Commercial/ Institutional	020100		2
				020105		2
		1A4b i	Residential	020200		2
		1A4c i	Agriculture/ Forestry	020300		2
	REFINERY GAS	1A1b	Petroleum refining	010304		0.025
				010306		0.025
SOLID	COAL	1A1a	Electricity and heat production	010101	640	1.32
				010102	640	1.32
		1A2	Industry	030100	640	1.32
		1A4b i	Residential	020200	640	800
		1A4c i	Agriculture/ Forestry	020300	640	300
				020304	640	300
	BROWN COAL BRI.	1A4b i	Residential	020200		800
	COKE OVEN COKE	1A2	Industry	030100		1.32
		1A4b i	Residential	020200		800

Table 2A-4.11a Dioxin and HCB emission factor time-series for the years 1990 to 1999.

pol_abbr	fuel_type	fuel	nfr	nfr_name	snap_id	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
DIOXIN	BIOMASS	WOOD	1A4b i	Residential	020200	547	547	547	547	547	547	547	547	547	547
					020202										
					020204										
		BIO OIL	1A4b i	Residential	020200										
	WASTE	MUNICIP. WASTES	1A1a	Electricity and heat production	010100		1746	1396	1047						
					010102					907	767	628	488	348	253
					010103					907	767	628	488	348	253
					010104					907	767	628	488	348	253
					010200	2095	1746	1396	1047						
					010203					907	767	628	488	348	348
			1A2	Industry	030100	2095	1746	1396	1047	907	767	628	488	348	348
					030102										
			1A4a	Commercial/ Institutional	020100	2095	1746	1396	1047	907	767	628	488	348	348
					020103					907	767	628	488	348	348
HCB	BIOMASS	BIO PROD GAS	1A1a	Electricity and heat production	010105					82000	70000	57000	45000	32000	4000
	WASTE	MUNICIP. WASTES	1A1a	Electricity and heat production	010100		158000	127000	95000						
					010102					82000	70000	57000	45000	32000	23000
					010103					82000	70000	57000	45000	32000	23000
					010104					82000	70000	57000	45000	32000	23000
					010200	190000	158000	127000	95000						
					010203					82000	70000	57000	45000	32000	23000
			1A2	Industry	030100	190000	158000	127000	95000	82000	70000	57000	45000	32000	23000
					030102										
			1A4a	Commercial/ Institutional	020100	190000	158000	127000	95000	82000	70000	57000	45000	32000	23000
					020103					82000	70000	57000	45000	32000	23000

Table 2A-4.11b Dioxin and HCB emission factor time-series for the years 2000 to 2009.

pol_abbr	fuel_type	fuel	nfr	nfr_name	snap_id	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
DIOXIN	BIOMASS	WOOD	1A4b i	Residential	020200	547	494	476	475	474	457	441	448	423	400
					020202						457	441	448	423	400
					020204									423	400
		BIO OIL	1A4b i	Residential	020200								0.882	10	10
	WASTE	MUNICIP. WASTES	1A1a	Electricity and heat production	010100										
					010102	157	157	157	157	81	5	5	5	5	5
					010103	157	157	157	157	81	5	5	5	5	5
					010104	157			157			5			
					010200										
					010203	348	348	348	348	177	5	5	5	5	5
			1A2	Industry	030100										
					030102					177	5			5	
			1A4a	Commercial/ Institutional	020100	348			348	177	5	5	5		
					020103	348	348	348	348	177	5	5	5	5	5
HCB	BIOMASS	BIO PROD GAS	1A1a	Electricity and heat production	010105	4000	4000	4000	4000	6000	4300	4300	4300		
	WASTE	MUNICIP. WASTES	1A1a	Electricity and heat production	010100										
					010102	14000	12000	10000	8000	6000	4300	4300	4300	4300	4300
					010103	14000	12000	10000	8000	6000	4300	4300	4300	4300	4300
					010104	14000			8000			4300			
					010200										
					010203	14000	12000	10000	8000	6000	4300	4300	4300	4300	4300
			1A2	Industry	030100										
					030102					6000	4300			4300	
			1A4a	Commercial/ Institutional	020100	14000			8000	6000	4300	4300	4300		
					020103	14000	12000	10000	8000	6000	4300	4300	4300	4300	4300

Table 2A-4.12 NH_3 emission factors 2009.

Fuel gr	Fuel	NFR		SNAP	NH_3 g/GJ
BIOMASS	WOOD	1A4b i	Residential	020200	5
				020202	5
				020204	5
	STRAW	1A4b i	Residential	020200	3.8
WASTE	MUNICIP. WASTES	1A1a	Electricity and heat production	010101	0.29
				010102	0.29
				010103	0.29
SOLID	COAL	1A4b i	Residential	020200	3.8
	BROWN COAL BRI.	1A4b i	Residential	020200	3.8
	COKE OVEN COKE	1A4b i	Residential	020200	3.8

Annex 2A-5 Implied emission factors for municipal waste incineration plants and power plants combustion coal

Table 74 Implied emission factors for municipal waste incineration plants 2009.

Pollutant	Implied Emission factor	Unit
SO_2	8.6	g pr GJ
NO_x	110	g pr GJ
TSP	2.6	g pr GJ
As	0.55	mg pr GJ
Cd	0.37	mg pr GJ
Cr	1.74	mg pr GJ
Cu	1.51	mg pr GJ
Hg	1.50	mg pr GJ
Ni	3.16	mg pr GJ
Pb	5.60	mg pr GJ
Se	1.11	mg pr GJ
Zn	2.36	mg pr GJ

Table 75 Implied emission factors for power plants combusting coal, 2009.

Pollutant	Implied Emission factor	Unit
SO_2	13	g pr GJ
NO_x	38	g pr GJ
TSP	2.5	g pr GJ
PM_{10}	2.1	g pr GJ
$PM_{2.5}$	1.7	g pr GJ
As	0.19	mg pr GJ
Cd	0.05	mg pr GJ
Cr	0.46	mg pr GJ
Cu	0.28	mg pr GJ
Hg	0.97	mg pr GJ
Ni	0.54	mg pr GJ
Pb	0.31	mg pr GJ
Se	4.7	mg pr GJ
Zn	1.2	mg pr GJ

Annex 2A-6 Large point sources

Table 2A-6.1 Large point sources, fuel consumption in 2009 (1A1, 1A2 and 1A4). *(for detaljeret?)*

Source id	Source category name	lps name	part id	fuel	Fuel rate, TJ
1A1a	Electricity and heat production	Amagervaerket	01	COAL	1205
				WOOD	146
				STRAW	166
				RESIDUAL OIL	1162
			02	WOOD	315
				STRAW	417
				RESIDUAL OIL	25
			03	COAL	15576
				RESIDUAL OIL	108
		Svanemoellevaerket	07	GAS OIL	25
				NATURAL GAS	3134
		H.C.Oerstedsvaerket	03	RESIDUAL OIL	93
				GAS OIL	92
				NATURAL GAS	586
			07	RESIDUAL OIL	1283
				NATURAL GAS	2035
			08	NATURAL GAS	2581
		Kyndbyvaerket	21	GAS OIL	355
			22	GAS OIL	425
			26	GAS OIL	32
			41	GAS OIL	1
			51	GAS OIL	14
			52	GAS OIL	15
		Stigsnaesvaerket	02	COAL	1566
				RESIDUAL OIL	676
			03	RESIDUAL OIL	144
				GAS OIL	6
		Asnaesvaerket	01	GAS OIL	18
			02	COAL	3995
				RESIDUAL OIL	64
			05	COAL	21461
				RESIDUAL OIL	420
		Avedoerevaerket	01	COAL	12019
				RESIDUAL OIL	221
				GAS OIL	10
			02	COAL	18
				WOOD	6251
				STRAW	1517
				RESIDUAL OIL	2885
				NATURAL GAS	6948
		Fynsvaerket	03	COAL	876
				RESIDUAL OIL	51
			04	STRAW	503
			07	COAL	19943
				RESIDUAL OIL	94
		Studstrupvaerket	03	COAL	13889
				STRAW	466
				RESIDUAL OIL	177
			04	COAL	13840
				STRAW	819
				RESIDUAL OIL	141
		Nordjyllandsvaerket	02	COAL	1447
				RESIDUAL OIL	36
			03	COAL	24059
				RESIDUAL OIL	64
		Skaerbaekvaerket	03	GAS OIL	1404
				NATURAL GAS	12791
		Enstedvaerket	03	COAL	18123
				RESIDUAL OIL	88
			04	WOOD	373
				STRAW	1374
				GAS OIL	9
		Esbjergvaerket	03	COAL	13868
				MUNICIP. WASTES	45
				RESIDUAL OIL	227
				LPG	0
		Oestkraft	05	RESIDUAL OIL	18

			06	COAL	637
				WOOD	51
				RESIDUAL OIL	117
		Horsens Kraftvarmevaerk	01	MUNICIP. WASTES	1055
			02	NATURAL GAS	802
		Herningvaerket	01	WOOD	2680
				RESIDUAL OIL	368
				NATURAL GAS	611
		I/S Vestforbraending	01	MUNICIP. WASTES	2316
				GAS OIL	15
			02	MUNICIP. WASTES	252
				NATURAL GAS	5
			03	MUNICIP. WASTES	3099
				NATURAL GAS	5
		Amagerforbraending	01	MUNICIP. WASTES	4386
		Energi Randers Produktion	01	COAL	883
				PETROLEUM COKE	30
				WOOD	2317
				BIOGAS	13
			02	GAS OIL	7
				BIO OIL	113
		Grenaa Kraftvarmevaerk	01	COAL	472
				STRAW	574
				RESIDUAL OIL	38
				GAS OIL	6
		Hilleroed Kraftvarmevaerk	01	NATURAL GAS	2428
		Helsingoer Kraftvarmevaerk	01	NATURAL GAS	1131
			02	NATURAL GAS	47
		Kolding Forbraendingsanlaeg	01	WOOD	8
				MUNICIP. WASTES	687
			05	WOOD	7
				MUNICIP. WASTES	578
		Maabjergvaerket	02	WOOD	471
				MUNICIP. WASTES	1698
				STRAW	396
				NATURAL GAS	65
		Soenderborg Kraftvarmevaerk	01	WOOD	8
				MUNICIP. WASTES	710
			02	NATURAL GAS	951
		I/S Kara Affaldsforbraendingsanlaeg	01	WOOD	34
				MUNICIP. WASTES	1818
				NATURAL GAS	9
		Viborg Kraftvarme	01	NATURAL GAS	1760
		I/S Nordforbraending	01	WOOD	418
				MUNICIP. WASTES	1039
		Affaldscenter aarhus - Forbraend-sanlaegget	01	MUNICIP. WASTES	2290
		I/S Reno Nord	01	MUNICIP. WASTES	1899
				GAS OIL	6
		Silkeborg Kraftvarmevaerk	01	NATURAL GAS	3447
		Fasan+Naestved Kraftvarmevaerk	01	MUNICIP. WASTES	1064
		AVV Forbraendingsanlaeg	01	MUNICIP. WASTES	802
		Affaldsforbraendingsanlaeg I/S REFA	01	MUNICIP. WASTES	1213
		Svendborg Kraftvarmevaerk	01	WOOD	10
				MUNICIP. WASTES	470
				NATURAL GAS	6
		Kommunekemi	01	MUNICIP. WASTES	584
				RESIDUAL OIL	26
				GAS OIL	8
			02	MUNICIP. WASTES	550
				RESIDUAL OIL	32
				GAS OIL	11
			03	MUNICIP. WASTES	516
				RESIDUAL OIL	23
				GAS OIL	4
		I/S Faelles Forbraending	01	MUNICIP. WASTES	276
		I/S Reno Syd	01	MUNICIP. WASTES	599
		I/S Kraftvarmevaerk Thisted	01	WOOD	16
				MUNICIP. WASTES	537
				STRAW	15
		Knudmosevaerket	01	WOOD	6
				MUNICIP. WASTES	509
				NATURAL GAS	34
		Affaldplus I/S Slagelse Forbr.+Slagelse KVV	01	MUNICIP. WASTES	210

			02	MUNICIP. WASTES	44
				STRAW	25
		Haderslev Kraftvarmevaerk	01	MUNICIP. WASTES	616
				NATURAL GAS	7
		Frederiskhavn Affaldskraftvarmevaerk	01	MUNICIP. WASTES	414
				GAS OIL	2
		Vejen Kraftvarmevaerk	01	MUNICIP. WASTES	393
		Bofa I/S	01	MUNICIP. WASTES	208
		DTU	01	NATURAL GAS	1183
		Naestved Kraftvarmevaerk	01	NATURAL GAS	172
		Hjoerring Varmeforsyning	01	NATURAL GAS	48
			02	WOOD	385
		L90 Affaldsforbraending	01	MUNICIP. WASTES	2202
				GAS OIL	11
		Hammel Fjernvarme	01	MUNICIP. WASTES	316
				BIO OIL	8
		Koege Kraftvarmevaerk	07	WOOD	1241
				RESIDUAL OIL	8
		Skagen Forbraendingen	01	MUNICIP. WASTES	125
		Odense Kraftvarmevaerk	01	MUNICIP. WASTES	2872
				GAS OIL	41
1A1b	Petroleum refining	Statoil Raffinaderi	01	GAS OIL	3
				REFINERY GAS	8783
		Shell Raffinaderi	01	RESIDUAL OIL	726
				REFINERY GAS	4300
			05	REFINERY GAS	1936
1A1c	Other energy industries	Nybro Gasbehandlingsanlaeg	01	NATURAL GAS	393
1A2	Industry	Danisco Grindsted	01	COAL	439
				RESIDUAL OIL	9
				NATURAL GAS	37
		DanSteel	01	NATURAL GAS	687
		Dalum Papir	01	WOOD	1180
				NATURAL GAS	87
		Aalborg Portland	01	COAL	1144
				PETROLEUM COKE	5888
				MUNICIP. WASTES	1745
				RESIDUAL OIL	252
		Maricogen	01	NATURAL GAS	228
		Rockwool A/S Vamdrup	01	COKE OVEN COKE	315
				NATURAL GAS	210
		Rockwool A/S Doense	01	COKE OVEN COKE	298
				NATURAL GAS	199
		Rexam Glass Holmegaard A/S	01	GAS OIL	1
				NATURAL GAS	717
		Haldor Topsoee	02	GAS OIL	2
				NATURAL GAS	509
				LPG	0
		Danisco Sugar Nakskov	02	COAL	767
				COKE OVEN COKE	62
				RESIDUAL OIL	695
				GAS OIL	4
				BIOGAS	62
		Danisco Sugar Nykoebing	02	COAL	315
				COKE OVEN COKE	57
				RESIDUAL OIL	1097
				BIOGAS	56
		Cheminova	02	GAS OIL	0
				NATURAL GAS	1133
		AarhusKarlshamn Denmark A/S	01	WOOD	27
				RESIDUAL OIL	1267
				GAS OIL	0
1A4a	Commercial/ Institutional	Rensningsanlaegget Lynetten	01	MUNICIP. WASTES	52
				GAS OIL	17
				BIOGAS	107
1A4c i	Agriculture/ Forestry	Masnedoevaerket	12	WOOD	74
				STRAW	498
				GAS OIL	3
			31	GAS OIL	21
Grand Total					309744

Table 2A-6.2 Large point sources, plant specific emissions (IPCC 1A1, 1A2 and 1A4)[1].

LPS id	LPS name	NFR	SNAP	SO_2	NO_x	NMVOC	CO	NH_3	TSP	PM_{10} [2]	$PM_{2.5}$ [2]	As	Cd	Cr	Cu	Hg	Ni	Pb	Se	Zn	Dioxin
001	Amagervaerket	1A1a	010101	x	x				x	x	x	x	x	x	x	x	x	x	x	x	
002	Svanemoellevaerket	1A1a	010104	x	x																
003	H.C.Oerstedsvaerket	1A1a	010101	x	x	x	x		x	x	x	x	x	x	x	x	x	x	x	x	
			010104	x	x																
004	Kyndbyvaerket	1A1a	010101	x	x	x	x		x	x	x	x	x	x	x	x	x	x	x	x	
			010104																		
			010105	x	x																
005	Masnedoevaerket	1A1a	010102	x	x				x	x	x										
			010104	x	x																
007	Stigsnaesvaerket	1A1a	010101	x	x				x	x	x	x	x	x	x	x	x	x	x	x	
008	Asnaesvaerket	1A1a	010101	x	x				x	x	x	x	x	x	x	x	x	x	x	x	
009	Statoil Raffinaderi	1A1b	010306	x	x																
010	Avedoerevaerket	1A1a	010101	x	x	x	x		x	x	x	x	x	x	x	x	x	x	x	x	
			010104	x	x	x	x		x	x	x	x	x	x	x	x	x	x	x	x	
011	Fynsvaerket+Odense kraftvarmevaerk	1A1a	010101	x	x				x	x	x	x	x	x	x	x	x	x	x	x	
			010102	x	x		x		x	x	x	x	x	x	x	x	x	x			x
012	Studstrupvaerket	1A1a	010101	x	x				x	x	x	x	x	x	x	x	x	x	x	x	
014	Nordjyllandsvaerket	1A1a	010101	x	x				x	x	x	x	x	x	x	x	x	x	x	x	
017	Shell Raffinaderi	1A1b	010304	x	x																
			010306	x	x																
018	Skaerbaekvaerket	1A1a	010101	x	x		x		x	x	x	x	x	x	x	x	x	x	x	x	
019	Enstedvaerket	1A1a	010101	x	x		x		x	x	x	x	x	x	x	x	x	x	x	x	
020	Esbjergvaerket	1A1a	010101	x	x		x		x	x	x	x	x	x	x	x	x	x	x	x	
022	Oestkraft	1A1a	010102	x	x		x														
023	Danisco Grindsted	1A2f	030102	x	x																
024	Nybro Gasbehandlingsanlaeg	1A1c	010502		x																
025	Horsens Kraftvarmevaerk	1A1a	010102	x	x		x		x	x	x	x	x	x	x	x	x	x			x
			010104		x																
026	Herningvaerket	1A1a	010102	x	x		x		x	x	x	x	x	x	x	x	x	x	x	x	
027	I/S Vestforbraending	1A1a	010102	x	x				x	x	x	x	x	x	x	x	x	x			x
028	Amagerforbraending	1A1a	010102	x	x		x		x	x	x		x			x		x			x
029	Energi Randers Produktion	1A1a	010102	x	x				x	x	x										
030	Grenaa Kraftvarmevaerk	1A1a	010102	x	x		x		x	x	x	x	x	x	x	x	x	x		x	
031	Hilleroed Kraftvarmevaerk	1A1a	010104	x	x																
032	Helsingoer Kraftvarmevaerk	1A1a	010104	x	x																
			010105																		
034	Dalum Papir	1A2f	030102		x																
036	Kolding Forbraendingsanlaeg	1A1a	010103	x	x	x	x		x	x	x					x					x
			010203	x	x	x	x		x	x	x					x					x
037	Maabjergvaerket	1A1a	010102	x	x	x	x		x	x	x	x	x	x	x	x	x	x			x
038	Soenderborg Kraftvarmevaerk	1A1a	010102	x	x		x		x	x	x	x	x	x	x	x	x	x			x
			010104		x																
039	I/S Kara Affaldsforbraendingsanlaeg	1A1a	010102	x			x		x	x	x					x					x
040	Viborg Kraftvarme	1A1a	010104		x																
042	I/S Nordforbraending	1A1a	010102	x	x		x		x	x	x										x
045	Aalborg Portland	1A2f	030311	x	x		x		x	x	x										
046	Affaldscenter aarhus - Forbraendsanlaegget	1A1a	010102	x	x	x			x	x	x										
047	I/S Reno Nord	1A1a	010103	x	x		x														
048	Silkeborg Kraftvarmevaerk	1A1a	010104		x																

Continued

049	Rensningsanlaegget Lynetten	1A4a	020103	x					x	x	x	x	x	x	x	x	x	x			x
050	Fasan+Naestved Kraftvarmevaerk	1A1a	010203	x	x		x		x	x	x					x					x
051	AVV Forbraendingsanlaeg	1A1a	010103	x	x		x		x	x	x					x					x
052	Affaldsforbraendingsanlaeg I/S REFA	1A1a	010103	x	x		x					x	x	x	x	x	x	x			x
053	Svendborg Kraftvarmevaerk	1A1a	010102	x	x	x	x		x	x	x							x			x
054	Kommunekemi	1A1a	010102	x	x		x		x	x	x					x					x
055	I/S Faelles Forbraending	1A1a	010203				x		x	x	x					x					x
058	I/S Reno Syd	1A1a	010103	x			x		x	x	x					x					x
059	I/S Kraftvarmevaerk Thisted	1A1a	010103	x	x		x		x	x	x										x
060	Knudmosevaerket	1A1a	010103	x	x		x		x	x	x					x					x
061	Kavo I/S Energien+Slagelse Kraftvarmevaerk	1A1a	010103	x	x		x		x	x	x					x					x
065	Haderslev Kraftvarmevaerk	1A1a	010103	x	x		x		x	x	x	x	x	x	x	x	x	x			x
066	Frederiskhavn Affaldskraftvarmevaerk	1A1a	010103	x	x		x		x	x	x	x	x	x	x	x	x	x			x
067	Vejen Kraftvarmevaerk	1A1a	010103	x	x	x	x		x	x	x	x	x	x	x	x	x	x			x
068	Bofa I/S	1A1a	010203	x	x		x		x	x	x					x		x			x
069	DTU	1A1a	010104	x	x																
070	Naestved Kraftvarmevaerk	1A1a	010104		x		x														
071	Maricogen	1A2f	030104	x	x																
072	Hjoerring Varmeforsyning	1A1a	010104		x		x														
076	Rockwool A/S Vamdrup	1A2f	030318	x		x	x	x	x	x	x										x
077	Rockwool A/S Doense	1A2f	030318	x		x	x	x	x	x	x										x
078	Rexam Glass Holmegaard A/S	1A2f	030315		x		x		x	x	x							x	x	x	
080	Saint-Gobain Isover A/S	1A2f	030316					x	x	x	x										
081	Haldor Topsoee		030100						x	x	x										
082	Danisco Sugar Nakskov	1A2f	030102	x					x	x	x										
083	Danisco Sugar Nykoebing	1A2f	030102	x					x	x	x										
085	L90 Affaldsforbraending	1A1a	010102	x	x		x		x	x	x					x					
086	Hammel Fjernvarme	1A1a	010203	x	x		x		x	x	x					x					x
087	Koege Kraftvarmevaerk	1A1a	010102	x	x	x	x		x	x	x										
088	Skagen Forbraendingen	1A1a	010203	x		x			x	x	x							x			x
089	AarhusKarlshamn Denmark A/S	1A2f	030102	x	x				x	x	x										
Grand Total				**8903**	**26951**	**95**	**12015**	**374**	**1068**	**870**	**641**	**108**	**28**	**169**	**115**	**329**	**649**	**242**	**930**	**400**	**596**
Share of total emission from stationary combustion, %				**60%**	**20%**	**0.1%**	**3%**	**0.5%**	**3%**	**3%**	**3%**	**36%**	**14%**	**22%**	**0.2%**	**64%**	**13%**	**2%**	**66%**	**1%**	**2%**

1) Emissions of the pollutants marked with “x” are plant specific. Emission of other pollutants is estimated based on emission factors. The total shown *in this table* only includes plant specific data.
2) Based on particle size distribution.

Annex 2A-7 Uncertainty estimates 2009

Table 2A-7.1 Uncertainty estimation.

SNAP	Gas	Base year emission	Year t emission	Activity data uncertainty	Emission factor uncertainty	Combined uncertainty	Combined uncertainty as % of total national emissions in year t	Type A sensitivity	Type B sensitivity	Uncertainty in trend in national emissions introduced by emission factor uncertainty	Uncertainty in trend in national emissions introduced by activity data uncertainty	Uncertainty introduced into the trend in total national emissions
		Input data	Input data	Input data	Input data							
		Mg SO2	Mg SO2	%	%	%	%	%	%	%	%	%
01	SO_2	129466	4939	2	10	10.198	4.676	-0.025	0.031	-0.248	0.089	0.263
02	SO_2	11481	2985	2	20	20.100	5.570	0.014	0.019	0.279	0.054	0.285
03	SO_2	16296	2847	2	10	10.198	2.695	0.011	0.018	0.110	0.051	0.121
Total	SO_2	157242	10771				60.163					0.165
Total uncertainties					Overall uncertainty in the year (%):		7.757			Trend uncertainty (%):		0.406

SNAP	Gas	Base year emission	Year t emission	Activity data uncertainty	Emission factor uncertainty	Combined uncertainty	Combined uncertainty as % of total national emissions in year t	Type A sensitivity	Type B sensitivity	Uncertainty in trend in national emissions introduced by emission factor uncertainty	Uncertainty in trend in national emissions introduced by activity data uncertainty	Uncertainty introduced into the trend in total national emissions
		Input data	Input data	Input data	Input data							
		Mg NOx	Mg NOx	%	%	%	%	%	%	%	%	%
01	NO_x	94393	28092	2	20	20.100	13.266	-0.059	0.2444	-1.184	0.691	1.371
02	NO_x	7271	7706	2	50	50.040	9.060	0.044	0.0670	2.180	0.190	2.188
03	NO_x	13277	6764	2	20	20.100	3.194	0.016	0.0589	0.321	0.166	0.362
Total	NO_x	114941	42563				268.281					6.798
Total uncertainties					Overall uncertainty in the year (%):		16.379			Trend uncertainty (%):		2.607

SNAP	Gas	Base year emission	Year t emission	Activity data uncertainty	Emission factor uncertainty	Combined uncertainty	Combined uncertainty as % of total national emissions in year t	Type A sensitivity	Type B sensitivity	Uncertainty in trend in national emissions introduced by emission factor uncertainty	Uncertainty in trend in national emissions introduced by activity data uncertainty	Uncertainty introduced into the trend in total national emissions
		Input data	Input data	Input data	Input data							
		Mg NMVOC	Mg NMVOC	%	%	%	%	%	%	%	%	%
01	NMVOC	495	1977	2	50	50.040	5.143	0.090	0.1348	4.523	0.381	4.539
02	NMVOC	13043	16964	2	50	50.040	44.129	-0.009	1.1564	-0.472	3.271	3.305
03	NMVOC	1131	295	2	50	50.040	0.768	-0.081	0.0201	-4.046	0.057	4.046
Total	NMVOC	14669	19236				1974.413					47.897
Total uncertainties					Overall uncertainty in the year (%):		44.434			Trend uncertainty (%):		6.921

Continued

SNAP	Gas	Base year emission	Year t emission	Activity data uncertainty	Emission factor uncertainty	Combined uncertainty	Combined uncertainty as % of total	Type A sensitivity	Type B sensitivity	Uncertainty in trend in national emissions intro-	Uncertainty in trend in national emissions intro-	Uncertainty introduced into the trend in total

							national emissions in year t			duced by emission factor uncertainty	duced by activity data uncertainty	national emissions
		Input data	Input data	Input data	Input data							
		Mg CO	Mg CO	%	%	%	%	%	%	%	%	%
01	CO	8123	9372	2	20	20.100	1.284	0.007	0.066	0.136	0.187	0.231
02	CO	118073	127012	2	50	50.040	43.320	0.034	0.896	1.682	2.534	3.042
03	CO	15560	10330	2	20	20.100	1.415	-0.041	0.073	-0.814	0.206	0.840
Total	CO	141756	146714				1880.293					10.011
Total uncertainties					Overall uncertainty in the year (%):		43.362			Trend uncertainty (%):		3.164

SNAP	Gas	Base year emission	Year t emission	Activity data uncertainty	Emission factor uncertainty	Combined uncertainty	Combined uncertainty as % of total national emissions in year t	Type A sensitivity	Type B sensitivity	Uncertainty in trend in national emissions introduced by emission factor uncertainty	Uncertainty in trend in national emissions introduced by activity data uncertainty	Uncertainty introduced into the trend in total national emissions
		Input data	Input data	Input data	Input data							
		Mg NH3	Mg NH3	%	%	%	%	%	%	%	%	%
01	NH_3	0	9	2	1000	1000.002	17.795	0.016	0.016	16.363	0.046	16.363
02	NH_3	67	178	2	1000	1000.002	348.176	0.209	0.320	209.225	0.906	209.227
03	NH_3	489	324	2	1000	1000.002	634.031	-0.224	0.583	-223.871	1.649	223.877
Total	NH_3	556	511				523538.345					94164.618
Total uncertainties					Overall uncertainty in the year (%):		723.559			Trend uncertainty (%):		306.863

SNAP	Gas	Base year emission (year 2000)	Year t emission	Activity data uncertainty	Emission factor uncertainty	Combined uncertainty	Combined uncertainty as % of total national emissions in year t	Type A sensitivity	Type B sensitivity	Uncertainty in trend in national emissions introduced by emission factor uncertainty	Uncertainty in trend in national emissions introduced by activity data uncertainty	Uncertainty introduced into the trend in total national emissions
		Input data	Input data	Input data	Input data							
		Mg TSP	Mg TSP	%	%	%	%	%	%	%	%	%
01	TSP	1167	1019	2	50	50.040	2.473	-0.040	0.068	-2.005	0.194	2.014
02	TSP	12630	19093	2	500	500.004	463.212	0.107	1.282	53.585	3.627	53.707
03	TSP	1090	498	2	50	50.040	1.209	-0.068	0.033	-3.395	0.095	3.396
Total	TSP	14888	20610				214572.997					2900.078
Total uncertainties					Overall uncertainty in the year (%):		463.220			Trend uncertainty (%):		58.852

Continued

SNAP	Gas	Base year emission (year 2000)	Year t emission	Activity data uncertainty	Emission factor uncertainty	Combined uncertainty	Combined uncertainty as % of total national emissions in year t	Type A sensitivity	Type B sensitivity	Uncertainty in trend in national emissions introduced by emission factor uncertainty	Uncertainty in trend in national emissions introduced by activity data uncertainty	Uncertainty introduced into the trend in total national emissions
		Input data	Input data	Input data	Input data							

		Mg PM10	Mg PM10	%	%	%	%	%	%	%	%	%
01	PM_{10}	947	716	2	50	50.040	1.863	-0.044	0.052	-2.209	0.147	2.214
02	PM_{10}	12006	18159	2	500	500.004	472.058	0.099	1.320	49.313	3.734	49.454
03	PM_{10}	800	359	2	50	50.040	0.934	-0.055	0.026	-2.762	0.074	2.763
Total	PM_{10}	13754	19234				222843.095					2458.207
Total uncertainties					Overall uncertainty in the year (%):		472.063			Trend uncertainty (%):		49.580

SNAP	Gas	Base year emission (year 2000)	Year t emission	Activity data uncertainty	Emission factor uncertainty	Combined uncertainty	Combined uncertainty as % of total national emissions in year t	Type A sensitivity	Type B sensitivity	Uncertainty in trend in national emissions introduced by emission factor uncertainty	Uncertainty in trend in national emissions introduced by activity data uncertainty	Uncertainty introduced into the trend in total national emissions
		Input data	Input data	Input data	Input data							
		Mg PM2.5	Mg PM2.5	%	%	%	%	%	%	%	%	%
01	$PM_{2.5}$	809	600	2	50	50.040	1.612	-0.043	0.046	-2.153	0.131	2.157
02	$PM_{2.5}$	11709	17792	2	500	500.004	477.646	0.077	1.370	38.258	3.874	38.454
03	$PM_{2.5}$	471	233	2	50	50.040	0.625	-0.034	0.018	-1.706	0.051	1.706
Total	$PM_{2.5}$	12989	18625				228148.930					1486.248
Total uncertainties					Overall uncertainty in the year (%):		477.649			Trend uncertainty (%):		38.552

SNAP	Gas	Base year emission	Year t emission	Activity data uncertainty	Emission factor uncertainty	Combined uncertainty	Combined uncertainty as % of total national emissions in year t	Type A sensitivity	Type B sensitivity	Uncertainty in trend in national emissions introduced by emission factor uncertainty	Uncertainty in trend in national emissions introduced by activity data uncertainty	Uncertainty introduced into the trend in total national emissions
		Input data	Input data	Input data	Input data							
		kg As	kg As	%	%	%	%	%	%	%	%	%
01	As	951	123	2	100	100.020	51.451	-0.052	0.101	-5.236	0.287	5.244
02	As	53	37	2	1000	1000.002	152.577	0.021	0.030	21.423	0.085	21.424
03	As	211	80	2	100	100.020	33.308	0.031	0.066	3.128	0.185	3.133
Total	As	1216	239				27036.507					496.284
Total uncertainties					Overall uncertainty in the year (%) :		164.128			Trend uncertainty (%):		22.277

Continued

SNAP		Base year emission	Year t emission	Activity data uncertainty	Emission factor uncertainty	Combined uncertainty	Combined uncertainty as % of total national emissions in year t	Type A sensitivity	Type B sensitivity	Uncertainty in trend in national emissions introduced by emission factor uncertainty	Uncertainty in trend in national emissions introduced by activity data uncertainty	Uncertainty introduced into the trend in total national emissions
		Input data	Input data	Input data	Input data							
		kg Cd	kg Cd	%	%	%	%	%	%	%	%	%
01	Cd	709	54	2	100	100.020	43.552	-0.049	0.060	-4.935	0.171	4.938
02	Cd	61	43	2	1000	1000.002	349.267	0.039	0.048	38.933	0.137	38.933
03	Cd	123	27	2	100	100.020	21.534	0.011	0.030	1.077	0.085	1.080
Total	Cd	894	124				124348.077					1541.360
Total uncertainties					Overall uncertainty in the year (%):		352.630			Trend uncertainty (%):		39.260

SNAP		Base year emission	Year t emission	Activity data uncertainty	Emission factor uncertainty	Combined uncertainty	Combined uncertainty as % of total national emissions in year t	Type A sensitivity	Type B sensitivity	Uncertainty in trend in national emissions introduced by emission factor uncertainty	Uncertainty in trend in national emissions introduced by activity data uncertainty	Uncertainty introduced into the trend in total national emissions
		Input data	Input data	Input data	Input data							
		kg Cr	kg Cr	%	%	%	%	%	%	%	%	%
01	Cr	4479	221	2	100	100.020	50.362	-0.022	0.039	-2.172	0.110	2.175
02	Cr	298	108	2	1000	1000.002	245.983	0.015	0.019	14.900	0.054	14.900
03	Cr	909	110	2	100	100.020	25.055	0.007	0.019	0.697	0.055	0.700
Total	Cr	5686	438				63671.673					227.219
Total uncertainties					Overall uncertainty in the year (%):		252.332			Trend uncertainty (%):		15.074

SNAP		Base year emission	Year t emission	Activity data uncertainty	Emission factor uncertainty	Combined uncertainty	Combined uncertainty as % of total national emissions in year t	Type A sensitivity	Type B sensitivity	Uncertainty in trend in national emissions introduced by emission factor uncertainty	Uncertainty in trend in national emissions introduced by activity data uncertainty	Uncertainty introduced into the trend in total national emissions
		Input data	Input data	Input data	Input data							
		kg Cu	kg Cu	%	%	%	%	%	%	%	%	%
01	Cu	2794	203	2	100	100.020	31.878	-0.075	0.055	-7.481	0.155	7.483
02	Cu	373	339	2	1000	1000.002	533.372	0.074	0.092	74.427	0.260	74.427
03	Cu	528	94	2	100	100.020	14.794	0.001	0.025	0.087	0.072	0.113
Total	Cu	3694	636				285720.897					5595.403
Total uncertainties					Overall uncertainty in the year (%):		534.529			Trend uncertainty (%):		74.802

Continued

SNAP		Base year emission	Year t emission	Activity data uncertainty	Emission factor uncertainty	Combined uncertainty	Combined uncertainty as % of total national emissions in year t	Type A sensitivity	Type B sensitivity	Uncertainty in trend in national emissions introduced by emission factor uncertainty	Uncertainty in trend in national emissions introduced by activity data uncertainty	Uncertainty introduced into the trend in total national emissions
		Input data	Input data	Input data	Input data							
		kg Hg	kg Hg	%	%	%	%	%	%	%	%	%
01	Hg	2339	261	2	100	100.020	61.972	-0.030	0.092	-2.954	0.259	2.965
02	Hg	177	35	2	1000	1000.002	82.198	0.003	0.012	2.966	0.034	2.966
03	Hg	333	126	2	100	100.020	29.827	0.027	0.044	2.678	0.125	2.681
Total	Hg	2849	421				11486.610					24.775
Total uncertainties					Overall uncertainty in the year (%):		107.176			Trend uncertainty (%):		4.977

SNAP		Base year emission	Year t emission	Activity data uncertainty	Emission factor uncertainty	Combined uncertainty	Combined uncertainty as % of total national emissions in year t	Type A sensitivity	Type B sensitivity	Uncertainty in trend in national emissions introduced by emission factor uncertainty	Uncertainty in trend in national emissions introduced by activity data uncertainty	Uncertainty introduced into the trend in total national emissions
		Input data	Input data	Input data	Input data							
		kg Ni	kg Ni	%	%	%	%	%	%	%	%	%
01	Ni	8342	1213	2	100	100.020	42.213	-0.017	0.075	-1.714	0.213	1.727
02	Ni	1206	349	2	1000	1000.002	121.418	0.008	0.022	8.299	0.061	8.299
03	Ni	6542	1312	2	100	100.020	45.663	0.009	0.082	0.889	0.231	0.918
Total	Ni	16090	2875				18609.444					72.699
Total uncertainties					Overall uncertainty in the year (%):		136.416			Trend uncertainty (%):		8.526

SNAP		Base year emission	Year t emission	Activity data uncertainty	Emission factor uncertainty	Combined uncertainty	Combined uncertainty as % of total national emissions in year t	Type A sensitivity	Type B sensitivity	Uncertainty in trend in national emissions introduced by emission factor uncertainty	Uncertainty in trend in national emissions introduced by activity data uncertainty	Uncertainty introduced into the trend in total national emissions
		Input data	Input data	Input data	Input data							
		kg Pb	kg Pb	%	%	%	%	%	%	%	%	%
01	Pb	11354	417	2	100	100.020	15.113	-0.078	0.024	-7.760	0.067	7.761
02	Pb	2040	1701	2	1000	1000.002	615.752	0.079	0.097	78.545	0.274	78.545
03	Pb	4149	644	2	100	100.020	23.320	-0.001	0.037	-0.053	0.104	0.116
Total	Pb	17543	2762				379922.814					6229.625
Total uncertainties					Overall uncertainty in the year (%):		616.379			Trend uncertainty (%):		78.928

Continued

SNAP		Base year emission	Year t emission	Activity data uncertainty	Emission factor uncertainty	Combined uncertainty	Combined uncertainty as % of total national emissions in year t	Type A sensitivity	Type B sensitivity	Uncertainty in trend in national emissions introduced by emission factor uncertainty	Uncertainty in trend in national emissions introduced by activity data uncertainty	Uncertainty introduced into the trend in total national emissions
		Input data	Input data	Input data	Input data							
		kg Se	kg Se	%	%	%	%	%	%	%	%	%
01	Se	3527	987	2	100	100.020	75.742	0.006	0.206	0.561	0.583	0.809
02	Se	119	55	2	1000	1000.002	42.396	0.005	0.012	4.796	0.033	4.797
03	Se	1143	261	2	100	100.020	20.038	-0.010	0.055	-1.042	0.154	1.053
Total	Se	4788	1304				7935.783					24.770
Total uncertainties					Overall uncertainty in the year (%):		89.083			Trend uncertainty (%):		4.977

SNAP		Base year emission	Year t emission	Activity data uncertainty	Emission factor uncertainty	Combined uncertainty	Combined uncertainty as % of total national emissions in year t	Type sensitivity	Type B sensitivity	Uncertainty in trend in national emissions introduced by emission factor uncertainty	Uncertainty in trend in national emissions introduced by activity data uncertainty	Uncertainty introduced into the trend in total national emissions
		Input data	Input data	Input data	Input data							
		kg Zn	kg Zn	%	%	%	%	%	%	%	%	%
01	Zn	15648	589	2	100	100.020	9.932	-0.126	0.024	-12.628	0.067	12.629
02	Zn	4018	4268	2	1000	1000.002	719.152	0.133	0.172	133.049	0.486	133.050
03	Zn	5146	1077	2	100	100.020	18.159	-0.006	0.043	-0.617	0.123	0.629
Total	Zn	24812	5934				517608.549					17862.164
Total uncertainties					Overall uncertainty in the year (%):		719.450			Trend uncertainty (%):		133.649

SNAP		Base year emission	Year t emission	Activity data uncertainty	Emission factor uncertainty	Combined uncertainty	Combined uncertainty as % of total national emissions in year t	Type A sensitivity	Type B sensitivity	Uncertainty in trend in national emissions introduced by emission factor uncertainty	Uncertainty in trend in national emissions introduced by activity data uncertainty	Uncertainty introduced into the trend in total national emissions
		Input data	Input data	Input data	Input data							
		g Dioxin	g Dioxin	%	%	%	%	%	%	%	%	%
01	Dioxin	29	1	2	500	500.004	34.657	-0.203	0.026	-101.306	0.074	101.306
02	Dioxin	14	17	2	1000	1000.002	925.659	0.239	0.350	238.897	0.989	238.899
03	Dioxin	5	0	2	1000	1000.002	5.031	-0.036	0.002	-35.711	0.005	35.711
Total	Dioxin	47	18				858070.305					68610.895
Total uncertainties					Overall uncertainty in the year (%):		926.321			Trend uncertainty (%):		261.937

Continued

SNAP		Base year emission	Year t emission	Activity data uncertainty	Emission factor uncertainty	Combined uncertainty	Combined uncertainty as % of total national emissions in year t	Type A sensitivity	Type B sensitivity	Uncertainty in trend in national emissions introduced by emission factor uncertainty	Uncertainty in trend in national emissions introduced by activity data uncertainty	Uncertainty introduced into the trend in total national emissions
		Input data	Input data	Input data	Input data							
		kg Benzo(b)	kg Benzo(b)	%	%	%	%	%	%	%	%	%
01	Benzo(b)	23	33	2	100	100.020	0.759	-0.009	0.017	-0.892	0.047	0.893
02	Benzo(b)	1921	4265	2	1000	1000.002	976.682	0.028	2.140	28.008	6.054	28.655
03	Benzo(b)	49	69	2	100	100.020	1.574	-0.019	0.034	-1.935	0.098	1.938
Total	Benzo(b)	1993	4367				953910.931					825.672
Total uncertainties					Overall uncertainty in the year (%):		976.684			Trend uncertainty (%):		28.735

SNAP		Base year emission	Year t emission	Activity data uncertainty	Emission factor uncertainty	Combined uncertainty	Combined uncertainty as % of total national emissions in year t	Type A sensitivity	Type B sensitivity	Uncertainty in trend in national emissions introduced by emission factor uncertainty	Uncertainty in trend in national emissions introduced by activity data uncertainty	Uncertainty introduced into the trend in total national emissions
		Input data	Input data	Input data	Input data							
		kg Benzo(k)	kg Benzo(k)	%	%	%	%	%	%	%	%	%
01	Benzo(k)	11	19	2	100	100.020	0.781	-0.006	0.018	-0.615	0.052	0.617
02	Benzo(k)	976	2339	2	1000	1000.002	987.319	0.047	2.317	46.906	6.553	47.361
03	Benzo(k)	23	12	2	100	100.020	0.488	-0.041	0.011	-4.120	0.032	4.120
Total	Benzo(k)	1010	2369				974800.416					2260.434
Total uncertainties					Overall uncertainty in the year (%):		987.320			Trend uncertainty (%):		47.544

SNAP		Base year emission	Year t emission	Activity data uncertainty	Emission factor uncertainty	Combined uncertainty	Combined uncertainty as % of total national emissions in year t	Type A sensitivity	Type B sensitivity	Uncertainty in trend in national emissions introduced by emission factor uncertainty	Uncertainty in trend in national emissions introduced by activity data uncertainty	Uncertainty introduced into the trend in total national emissions
		Input data	Input data	Input data	Input data							
		kg Benzo(a)	kg Benzo(a)	%	%	%	%	%	%	%	%	%
01	Benzo(a)	7	8	2	100	100.020	0.200	-0.004	0.005	-0.431	0.013	0.431
02	Benzo(a)	1792	4123	2	1000	1000.002	993.355	0.007	2.278	7.211	6.443	9.670
03	Benzo(a)	11	19	2	100	100.020	0.464	-0.003	0.011	-0.297	0.030	0.299
Total	Benzo(a)	1810	4151				986754.848					93.785
Total uncertainties					Overall uncertainty in the year (%):		993.355			Trend uncertainty (%):		9.684

Continued

SNAP		Base year emission	Year t emission	Activity data uncertainty	Emission factor uncertainty	Combined uncertainty	Combined uncertainty as % of total national emissions in year t	Type A sensitivity	Type B sensitivity	Uncertainty in trend in national emissions introduced by emission factor uncertainty	Uncertainty in trend in national emissions introduced by activity data uncertainty	Uncertainty introduced into the trend in total national emissions
		Input data	Input data	Input data	Input data							
		kg Indeno	kg Indeno	%	%	%	%	%	%	%	%	%
01	Indeno	6	7	2	100	100.020	0.252	-0.003	0.005	-0.333	0.014	0.334
02	Indeno	1469	2868	2	1000	1000.002	996.400	0.019	1.927	18.548	5.450	19.332
03	Indeno	13	3	2	100	100.020	0.109	-0.015	0.002	-1.540	0.006	1.540
Total	Indeno	1489	2879				992812.457					376.200
Total uncertainties					Overall uncertainty in the year (%):		996.400			Trend uncertainty (%):		19.396

SNAP		Base year emission	Year t emission	Activity data uncertainty	Emission factor uncertainty	Combined uncertainty	Combined uncertainty as % of total national emissions in year t	Type A sensitivity	Type B sensitivity	Uncertainty in trend in national emissions introduced by emission factor uncertainty	Uncertainty in trend in national emissions introduced by activity data uncertainty	Uncertainty introduced into the trend in total national emissions
		Input data	Input data	Input data	Input data							
		kg HCB	kg HCB	%	%	%	%	%	%	%	%	%
01	HCB	2.74	0.36	2	1000	1000.002	679.247	-0.030	0.113	-30.139	0.320	30.140
02	HCB	0.21	0.14	2	1000	1000.002	264.151	0.033	0.044	32.997	0.125	32.997
03	HCB	0.23	0.03	2	1000	1000.002	56.604	-0.003	0.009	-2.619	0.027	2.619
Total	HCB	3.18	0.53				534356.000					2004.121
Total uncertainties					Overall uncertainty in the year (%):		730.997			Trend uncertainty (%):		44.767

Annex 2A-8 Emission inventory 2009 based on SNAP sectors

Table 104 Emission inventory 2009 based on SNAP sectors.

SNAP	SO_2 [Mg]	NO_X [Mg]	NMVOC [Mg]	CH_4 [Mg]	CO [Mg]	CO_2 [1)] [Gg]	N_2O [Mg]	NH_3 [Mg]	TSP [Mg]	PM_{10} [Mg]	$PM_{2,5}$ [Mg]	As [kg]	Cd [kg]	Cr [kg]	Cu [kg]	Hg [kg]	Ni [kg]	Pb [kg]	Se [kg]	Zn [kg]	HCB [kg]	Dioxin [g]	Benzo(b) [kg]	Benzo(k) [kg]	Benzo(a) [kg]	Indeno [kg]
Total, SNAP 01-03	**10771**	**42563**	**19236**	**18103**	**146714**	**42706**	**632**	**511**	**20610**	**19234**	**18625**	**239**	**124**	**438**	**636**	**421**	**2875**	**2762**	**1304**	**5934**	**1**	**18**	**4367**	**2369**	**4151**	**2879**
1	4939	28092	1977	8866	9372	30571	364	9	1019	716	600	123	54	221	203	261	1213	417	987	589	0	1	33	19	8	7
10100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10101	2366	7683	236	155	1953	16710	136	0	429	348	286	32	8	80	48	161	130	53	760	203	0	0	3	1	1	1
10102	920	3697	55	35	724	3740	44	5	140	48	40	21	12	57	51	36	568	138	58	163	0	1	1	0	0	0
10103	181	1347	10	6	223	1282	14	3	12	5	4	10	5	20	18	15	63	67	11	23	0	0	0	0	0	0
10104	160	2282	81	72	847	2783	37	1	35	10	8	4	1	5	4	12	7	14	39	11	0	0	2	0	0	1
10105	43	2576	1441	8164	1580	1061	13	0	17	4	3	1	0	1	1	2	6	1	1	57	0	0	0	0	0	0
10200	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10201	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10202	16	135	5	1	77	172	0	0	4	4	4	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0
10203	905	2075	111	384	3674	2349	57	1	265	188	150	21	5	34	35	11	151	79	11	35	0	0	26	17	7	5
10204	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10205	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10300	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10301	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10302	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10303	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10304	5	298	0	3	12	110	2	0	10	10	10	3	3	3	5	3	3	8	13	3	0	0	0	0	0	0
10305	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10306	336	1312	1	0	106	823	2	0	104	96	93	27	20	21	41	19	282	59	93	93	0	0	0	0	0	0
10400	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10401	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10402	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10403	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10404	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10405	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10406	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10407	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10500	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10501	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10502	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10503	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10504	8	6686	38	46	176	1542	59	0	3	2	1	3	0	0	0	3	0	0	0	0	0	0	0	0	0	0
10505	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10506	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	2985	7706	16964	8581	127012	8246	204	178	19093	18159	17792	37	43	108	339	35	349	1701	55	4268	0	17	4265	2339	4123	2868
20100	112	550	190	49	616	884	27	0	168	168	159	3	0	3	3	2	14	4	1	8	0	0	236	78	180	128
20101	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20102	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20103	5	20	1	2	7	21	0	0	1	1	1	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0
20104	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20105	12	242	85	678	242	100	1	0	2	1	0	0	0	0	0	0	0	0	0	5	0	0	0	0	0	0
20106	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20200	1635	6014	16137	6166	118626	6557	159	178	18530	17627	17295	23	38	79	295	20	85	1455	19	3730	0	15	3909	2242	3833	2568
20201	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20202	0	3	2	1	11	6	0	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20203	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20204	1	175	107	555	70	67	1	0	1	0	0	0	0	0	0	0	0	0	0	5	0	0	0	0	0	0

Continued

20205	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20300	1161	412	349	460	7188	456	12	0	386	359	334	10	5	24	39	12	240	238	35	511	0	1	119	18	110	172
20301	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20302	47	60	6	15	41	60	2	0	1	1	0	1	0	1	1	0	10	3	0	3	0	0	0	0	0	0
20303	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20304	11	230	88	654	212	95	1	0	2	1	0	0	0	0	0	0	0	0	0	6	0	0	0	0	0	0
20305	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	2847	6764	295	656	10330	3889	64	324	498	359	233	80	27	110	94	126	1312	644	261	1077	0	0	69	12	19	3
30100	287	1570	101	107	1817	1983	22	0	93	65	50	11	2	13	16	6	91	38	6	63	0	0	6	6	0	0
30101	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30102	933	509	28	35	343	450	17	0	78	57	39	15	5	25	37	11	733	184	35	442	0	0	3	3	0	1
30103	370	254	11	13	140	206	8	0	45	33	23	7	2	8	13	3	403	50	11	168	0	0	1	1	0	0
30104	1	137	9	6	13	189	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30105	5	136	61	412	114	57	1	0	1	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0
30106	0	3	0	0	2	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30200	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30203	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30204	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30205	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30300	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30301	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30302	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30303	0	0	0	0	0	0	0	0	68	21	3	10	5	38	0	0	44	246	171	171	0	0	0	0	0	0
30304	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30305	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30306	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30307	0	0	0	0	0	0	0	0	2	1	1	0	0	0	1	0	0	9	0	0	0	0	0	0	0	0
30308	0	0	0	0	0	0	0	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30309	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30310	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30311	877	3881	76	76	1244	869	12	0	69	62	28	33	12	17	17	100	33	17	12	83	0	0	58	1	19	1
30312	0	0	0	0	0	0	0	0	18	9	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30313	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30314	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30315	0	155	1	1	31	41	0	0	1	1	1	0	0	0	0	0	0	18	25	25	0	0	0	0	0	0
30316	0	43	0	0	0	0	0	152	33	30	23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30317	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30318	374	75	8	7	6625	89	1	172	88	79	62	3	1	8	11	5	8	82	1	123	0	0	1	1	0	0
30319	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30320	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30321	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30322	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30323	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30324	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30325	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30326	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

1) Including CO_2 emission from biomass.

Annex 2A-9 Description of the Danish energy statistics

This description of the Danish energy statistics has been prepared by Denmark's National Environmental Research Institute (NERI) in cooperation with the Danish Energy Agency (DEA) as background information to the Danish National Inventory Report (NIR).

The Danish energy statistics system

DEA is responsible for the Danish energy balance. Main contributors to the energy statistics outside DEA are Statistics Denmark and Danish Energy Association (before Association of Danish Energy Companies). The statistics is performed using an integrated statistical system building on an Access database and Excel spreadsheets.

The DEA follows the recommendations of the International Energy Agency as well as Eurostat.

The national energy statistics is updated annually and all revisions are immediately included in the published statistics, which can be found on the DEA homepage[3]. It is an easy task to check for breaks in a series because the statistics is 100% time-series oriented.

The national energy statistics does not include Greenland and Faroe Islands.

For historical reasons, DEA receive monthly information from the Danish oil companies regarding Danish deliveries of oil products to Greenland and Faroe Islands. However, the monthly (MOS) and annual (AOS) reporting of oil statistics to Eurostat and IEA exclude Greenland and Faroe Islands. For all other energy products, the Danish figures are also excluding Greenland and Faroe Islands.

Reporting to the Danish Energy Agency

The Danish Energy Agency receives monthly statistics for the following fuel groups:

- Crude oil and oil products.
  - Monthly data from 46 oil companies, the main purpose is monitoring oil stocks according to the oil preparedness system.
- Natural gas.
  - Fuel/flare from platforms in the North Sea.
  - Natural gas balance from the regulator Energinet.dk (National monopoly).
- Coal and coke.
  - Power plants (94 %).
  - Industry companies (4 %).
  - Coal and coke traders (2 %).
- Electricity.

[3] http://www.ens.dk/EN-US/INFO/FACTSANDFIGURES/ENERGY_STATISTICS_AND_INDICATORS/ANNUAL%20STATISTICS/Sider/Forside.aspx

- Monthly reporting by e-mail from the regulator Energinet.dk (National monopoly).
  The statistics covers:
  - Production by type of producer.
  - Own use of electricity.
  - Import and export by country.
  - Domestic supply (consumption + distribution loss).
- Town gas (quarterly) from two town gas producers.

- The large central power plants also report monthly consumption of biomass.

Annual data includes renewable energy including waste. The DEA conducts a biannual survey on wood pellets and wood fuel. Statistics Denmark conducts biannual surveys on the energy consumption in the service and industrial sectors. Statistics Denmark prepares annual surveys on forest (wood fuel) & straw.

Other annual data sources include:

- DEA.
  - Survey on production of electricity and heat and fuels used.
  - Survey on end use of oil.
  - Survey on end use of natural gas.
  - Survey on end use of coal and coke.
- National Environmental Research Institute (NERI), Aarhus University.
  - Energy consumption for domestic air transport.
- Danish Energy Association (Association of Danish Energy companies).
  - Survey on electricity consumption.
- Ministry of Taxation.
  - Border trade.
- Centre for Biomass Technology.
  - Annual estimates of final consumption of straw and wood chips.

Annual revisions

In general, DEA follows the same procedures as in the Danish national account. This means that normally only figures for the last two years are revised.

Aggregating the energy statistics on SNAP level

The sectors used in the official energy statistics have been mapped to SNAP categories, used in the Danish emission database. NERI aggregates the official energy statistics to SNAP level based on a source correspondence table.

In cooperation between DEA and NERI, a fuel correspondence table has been developed mapping the fuels used by the DEA in the official energy statistics with the fuel codes used in the Danish national emission database. The fuel correspondence table between fuel categories used by the DEA, NERI and IPCC is presented in Annex 2A-3.

The mapping between the energy statistics and the SNAP and fuel codes used by NERI can be seen in the table below.

Table 105 Correspondence between the Danish national energy statistics and the SNAP nomenclature (only stationary combustion part shown).

Unit: TJ		End-use			Transformation 1980-1993
	SNAP	Fuel *(in Danish)*	Fuel-code	SNAP	Fuel-code
Foreign Trade					
- *Border Trade*					
- - Motor Gasoline					
- - Gas-/Diesel Oil					
- - Petroleum Coke	0202	Petrokoks	110A		
Vessels in Foreign Trade					
- *International Marine Bunkers*					
- - Gas-/Diesel Oil					
- - Fuel Oil					
- - Lubricants					
Energy Sector					
Extraction and Gasification					
- *Extraction*					
- - Natural Gas	010504	Naturgas	301A		
- *Gasification*					
- - Biogas, Landfill	091006	Biogas	309A		
- - Biogas, Other	091006	Biogas	309A		
Refineries					
- Own Use					
- - Refinery Gas	010306	Raffinaderigas	308A		
- - LPG	010306	LPG	303A		
- - Gas-/Diesel Oil	010306	Gas & Dieselolie	204A		
- - Fuel Oil	010306	Fuelolie & Spildolie	203A		
Transformation Sector					
Large-scale Power Units					
- *Fuels Used for Power Production*					
- - Gas-/Diesel Oil				0101	204A
- - Fuel Oil				0101	203A
- - Electricity Plant Coal				0101	102A
- - Straw				0101	117A
Large-Scale CHP Units					
- *Fuels Used for Power Production*					
- - Refinery Gas				0103	308A
- - LPG				0101	303A
- - Naphtha (LVN)				0101	210A
- - Gas-/Diesel Oil				0101	204A
- - Fuel Oil				0101	203A
- - Petroleum Coke				0101	110A
- - Orimulsion				0101	225A
- - Natural Gas				0101	301A
- - Electricity Plant Coal				0101	102A
- - Straw				0101	117A
- - Wood Chips				0101	111A
- - Wood Pellets				0101	111A
- - Wood Waste				0101	111A
- - Biogas, Landfill				0101	309A
- - Biogas, Others				0101	309A
- - Waste, Non-renewable				0101	114A
- - Wastes, Renewable				0101	114A
- *Fuels Used for Heat Production*					
- - Refinery Gas				0103	308A
- - LPG				0101	303A
- - Naphtha (LVN)				0101	210A
- - Gas-/Diesel Oil				0101	204A
- - Fuel Oil				0101	203A
- - Petroleum Coke				0101	110A
- - Orimulsion				0101	225A
- - Natural Gas				0101	301A
- - Electricity Plant Coal				0101	102A
- - Straw				0101	117A
- - Wood Chips				0101	111A
- - Wood Pellets				0101	111A
- - Wood Waste				0101	111A
- - Biogas, Landfill				0101	309A
- - Biogas, Other				0101	309A
- - Waste, Non-renewable				0101	114A
- - Wastes, Renewable				0101	114A
Small-Scale CHP Units					

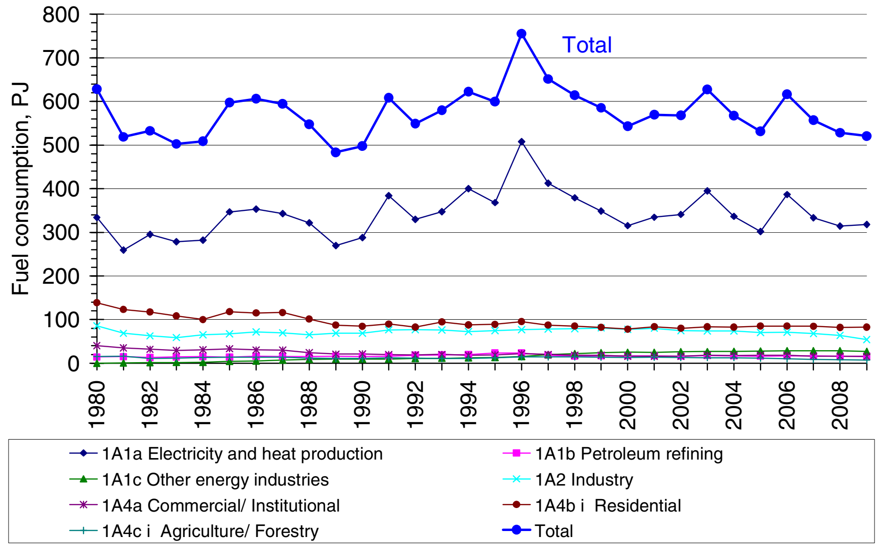
Unit: TJ	SNAP	End-use Fuel *(in Danish)*	Fuel-code	Transformation SNAP	1980-1993 Fuel-code
- *Fuels Used for Power Production*					
- - Gas-/Diesel Oil				0101	204A
- - Fuel Oil				0101	203A
- - Natural Gas				0101	301A
- - Hard Coal				0101	102A
- - Straw				0101	117A
- - Wood Chips				0101	111A
- - Wood Pellets				0101	111A
- - Wood Waste				0101	111A
- - Biogas, Landfill				0101	309A
- - Biogas, Other				0101	309A
- - Waste, Non-renewable				0101	114A
- - Wastes, Renewable				0101	114A
- *Fuels Used for Heat Production*					
- - Gas-/Diesel Oil				0101	204A
- - Fuel Oil				0101	203A
- - Natural Gas				0101	301A
- - Coal				0101	102A
- - Straw				0101	117A
- - Wood Chips				0101	111A
- - Wood Pellets				0101	111A
- - Wood Waste				0101	111A
- - Biogas, Landfill				0101	309A
- - Biogas, Other				0101	309A
- - Waste, Non-renewable				0101	114A
- - Wastes, Renewable				0101	114A
District Heating Units					
- *Fuels Used for Heat Production*					
- - Refinery Gas				0103	308A
- - LPG				0102	303A
- - Gas-/Diesel Oil				0102	204A
- - Fuel Oil				0102	203A
- - Waste Oil				0102	203A
- - Petroleum Coke				0102	110A
- - Natural Gas				0102	301A
- - Electricity Plant Coal				0102	102A
- - Coal				0102	102A
- - Straw				0102	117A
- - Wood Chips				0102	111A
- - Wood Pellets				0102	111A
- - Wood Waste				0102	111A
- - Biogas, Landfill				0102	309A
- - Biogas, Sludge				0102	309A
- - Biogas, Other				0102	309A
- - Waste, Non-renewable				0102	114A
- - Wastes, Renewable				0102	114A
- - Fish Oil				0102	215A
Autoproducers, Electricity Only					
- Fuels Used for Power Production					
- - Natural Gas				0301	301A
- - Biogas, Landfill				0301	309A
- - Biogas, Sewage Sludge				0301	309A
- - Biogas, Other				0301	309A
Autoproducers, CHP Units					
- *Fuels Used for Power Production*					
- - Refinery Gas				0103	308A
- - Gas-/Diesel Oil				0301	204A
- - Fuel Oil				0301	203A
- - Waste Oil				0301	203A
- - Natural Gas				0301	301A
- - Coal				0301	102A
- - Straw				0301	117A
- - Wood Chips				0301	111A
- - Wood Pellets				0301	111A
- - Wood Waste				0301	111A
- - Biogas, Landfill				0301	309A
- - Biogas, Sludge				0301	309A
- - Biogas, Other				0301	309A
- - Fish Oil				0301	215A
- - Waste, Non-renewable				0301	114A
- - Wastes, Renewable				0301	114A
- *Fuels Used for Heat Production*					
- - Refinery Gas				0103	308A
- - Gas-/Diesel Oil				0301	204A
- - Fuel Oil				0301	203A

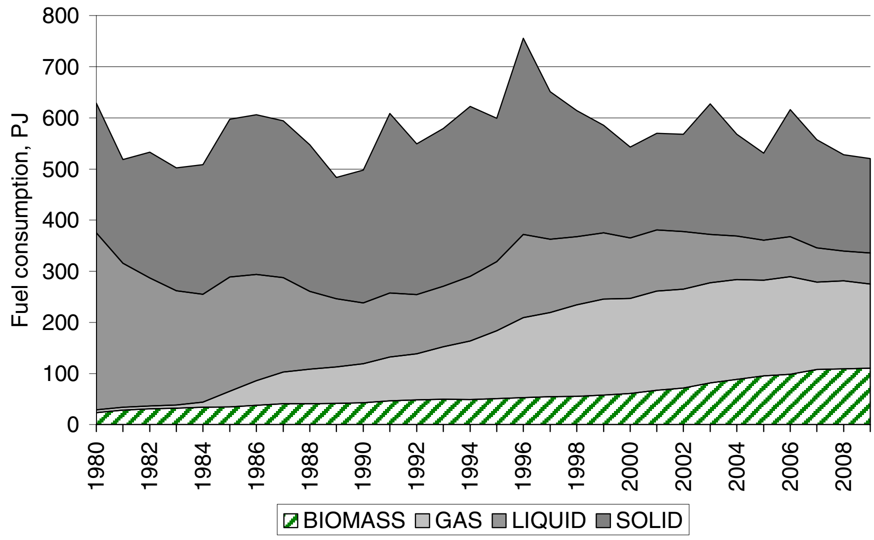
Unit: TJ		End-use		Transformation	
					1980-1993
	SNAP	Fuel *(in Danish)*	Fuel-code	SNAP	Fuel-code
- - Waste Oil				0301	203A
- - Natural Gas				0301	301A
- - Coal				0301	102A
- - Wood Chips				0301	111A
- - Wood Waste				0301	111A
- - Biogas, Landfill				0301	309A
- - Biogas, Sludge				0301	309A
- - Biogas, Other				0301	309A
- - Waste, Non-renewable				0301	114A
- - Wastes, Renewable				0301	114A
Autoproducers, Heat Only					
- *Fuels Used for Heat Production*					
- - Gas-/Diesel Oil				0301	204A
- - Fuel Oil				0301	203A
- - Waste Oil				0301	203A
- - Natural Gas				0301	301A
- - Straw				0301	117A
- - Wood Chips				0301	111A
- - Wood Chips				0301	111A
- - Wood Waste				0301	111A
- - Biogas, Landfill				0301	309A
- - Biogas, Sludge				0301	309A
- - Biogas, Other				0301	309A
- - Waste, Non-renewable				0102	114A
- - Wastes, Renewable				0102	114A
Town Gas Units	030106	Naturgas	301A		
- Fuels Used for Production of District Heating	030106	Kul (-83) / Gasolie (84-)	102A / 204A		
Transport sector					
Military Transport					
- Aviation Gasoline					
- Motor Gasoline					
- JP4					
- JP1					
- Gas-/Diesel Oil					
Road					
- LPG					
- Motor Gasoline					
- Other Kerosene	0202	Petroleum	206A		
- Gas-/Diesel Oil					
- Fuel Oil					
Rail					
- Motor Gasoline					
- Other Kerosene					
- Gas-/Diesel Oil					
- Electricity					
Domestic Sea Transport					
- LPG					
- Other Kerosene					
- Gas-/Diesel Oil					
- Fuel Oil					
Air Transport, Domestic					
- LPG					
- Aviation Gasoline					
- Motor Gasoline					
- Other Kerosene	0201	Petroleum	206A		
- JP1					
Air Transport, International					
- Aviation Gasoline					
- JP1					
Agriculture and Forestry					
- LPG					
- Motor Gasoline					
- Other Kerosene	0203	Petroleum	206A		
- Gas-/Diesel Oil					
- Fuel Oil	0203	Fuelolie & Spildolie	203A		
- Petroleum Coke	0203	Petrokoks	110A		
- Natural Gas	0203	Naturgas	301A		
- Coal	0203	Kul	102A		
- Brown Coal Briquettes	0203	Brunkul	106A		
- Straw	0203	Halm	117A		
- Wood Chips	0203	Træ	111A		
- Wood Waste	0203	Træ	111A		
- Biogas, Other	0203	Biogas	309A		
Horticulture					

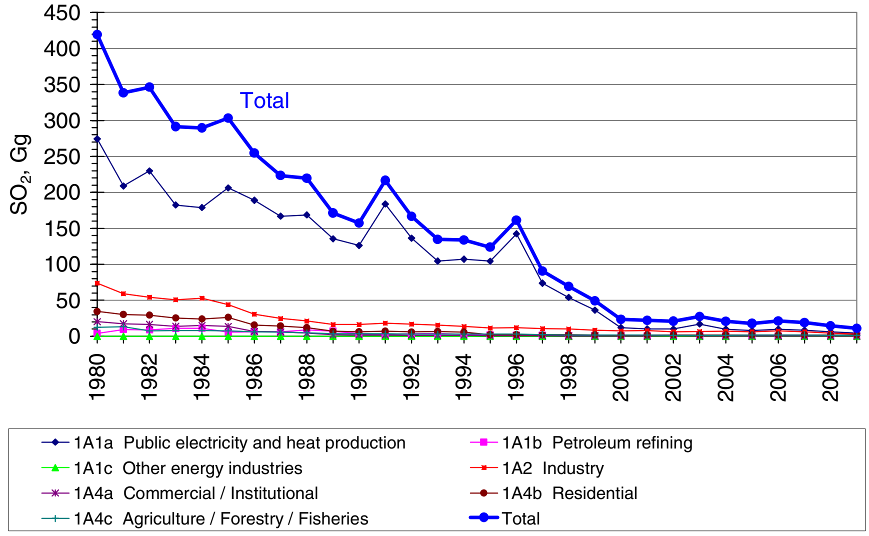
Unit: TJ		End-use			Transformation 1980-1993
	SNAP	Fuel *(in Danish)*	Fuel-code	SNAP	Fuel-code
- LPG					
- Motor Gasoline					
- Gas-/Diesel Oil					
- Fuel Oil	0203	Fuelolie & Spildolie	203A		
- Petroleum Coke	0203	Petrokoks	110A		
- Natural Gas	0203	Naturgas	301A		
- Coal	0203	Kul	102A		
- Wood Waste	0203	Træ	111A		
Fishing					
- LPG					
- Motor Gasoline					
- Other Kerosene					
- Gas-/Diesel Oil					
- Fuel Oil					
Manufacturing Industry					
- Refinery Gas	0301	Raffinaderigas	308A		
- LPG					
- Naphtha (LVN)					
- Motor Gasoline					
- Other Kerosene	0301	Petroleum	206A		
- Gas-/Diesel Oil					
- Fuel Oil	0301	Fuelolie & Spildolie	203A		
- Waste Oil	0301	Fuelolie & Spildolie	203A		
- Petroleum Coke	0301	Petrokoks	110A		
- Natural Gas	0301	Naturgas	301A		
- Coal	0301	Kul	102A		
- Coke	0301	Koks	107A		
- Brown Coal Briquettes	0301	Brunkul	106A		
- Wood Pellets	0301	Træ	111A		
- Wood Waste	0301	Træ	111A		
- Biogas, Landfill	0301	Biogas	309A		
- Biogas, Other	0301	Biogas	309A		
- Wastes, Non-renewable	0301	Affald	114A		
- Wastes, Renewable	0301	Affald	114A		
- Town Gas	0301	Naturgas	301A		
Construction					
- LPG	0301	LPG	303A		
- Motor Gasoline					
- Other Kerosene	0301	Petroleum	206A		
- Gas-/Diesel Oil					
- Fuel Oil	0301	Fuelolie & Spildolie	203A		
- Natural Gas	0301	Naturgas	301A		
Wholesale					
- LPG	0201	LPG	303A		
- Motor Gasoline	0201	Petroleum	206A		
- Other Kerosene	0201	Gas & Dieselolie	204A		
- Gas-/Diesel Oil	0201	Fuelolie & Spildolie	203A		
- Petroleum Coke	0201	Petrokoks	110A		
- Natural Gas	0201	Naturgas	301A		
- Wood Waste	0201	Træ	111A		
Retail Trade					
- LPG	0201	LPG	303A		
- Other Kerosene	0201	Petroleum	206A		
- Gas-/Diesel Oil	0201	Gas & Dieselolie	204A		
- Fuel Oil	0201	Fuelolie & Spildolie	203A		
- Petroleum Coke	0201	Petrokoks	110A		
- Natural Gas	0201	Naturgas	301A		
Private Service					
- LPG	0201	LPG	303A		
- Other Kerosene	0201	Petroleum	206A		
- Gas-/Diesel Oil	0201	Gas & Dieselolie	204A		
- Fuel Oil	0201	Fuelolie & Spildolie	203A		
- Waste Oil	0201	Fuelolie & Spildolie	203A		
- Petroleum Coke	0201	Petrokoks	110A		
- Natural Gas	0201	Naturgas	301A		
- Wood Chips	0201	Træ	111A		
- Wood Waste	0201	Træ	111A		
- Biogas, Landfill	0201	Biogas	309A		
- Biogas, Sludge	0201	Biogas	309A		
- Biogas, Other	0201	Biogas	309A		
- Wastes, Non-renewable	0201	Affald	114A		
- Wastes, Renewable	0201	Affald	114A		
- Town Gas	0201	Naturgas	301A		
Public Service					
- LPG	0201	LPG	303A		

Unit: TJ		End-use		Transformation 1980-1993	
	SNAP	**Fuel *(in Danish)***	**Fuel-code**	**SNAP**	**Fuel-code**
- Other Kerosene	0201	Petroleum	206A		
- Gas-/Diesel Oil	0201	Gas & Dieselolie	204A		
- Fuel Oil	0201	Fuelolie & Spildolie	203A		
- Petroleum Coke	0201	Petrokoks	110A		
- Natural Gas	0201	Naturgas	301A		
- Coal	0201	Kul	102A		
- Brown Coal Briquettes	0201	Brunkul	106A		
- Wood Chips	0201	Træ	111A		
- Wood Pellets	0201	Træ	111A		
- Town Gas	0201	Naturgas	301A		
Single Family Houses					
- LPG	0202	LPG	303A		
- Motor Gasoline					
- Other Kerosene	0202	Petroleum	206A		
- Gas-/Diesel Oil	0202	Gas & Dieselolie	204A		
- Fuel Oil	0202	Fuelolie & Spildolie	203A		
- Petroleum Coke	0202	Petrokoks	110A		
- Natural Gas	0202	Naturgas	301A		
- Coal	0202	Kul	102A		
- Coke	0202	koks	107A		
- Brown Coal Briquettes	0202	Brunkul	106A		
- Straw	0202	Halm	117A		
- Firewood	0202	Træ	111A		
- Wood Chips	0202	Træ	111A		
- Wood Pellets	0202	Træ	111A		
- Town Gas	0202	Naturgas	301A		
Multi-family Houses					
- LPG	0202	LPG	303A		
- Other Kerosene	0202	Petroleum	206A		
- Gas-/Diesel Oil	0202	Gas & Dieselolie	204A		
- Fuel Oil	0202	Fuelolie & Spildolie	203A		
- Petroleum Coke	0202	Petrokoks	110A		
- Natural Gas	0202	Naturgas	301A		
- Coal	0202	Kul	102A		
- Coke	0202	Koks	107A		
- Brown Coal Briquettes	0202	Brunkul	106A		
- Town Gas	0202	Naturgas	301A		

Annex 2A-10 Time-series 1980-2009







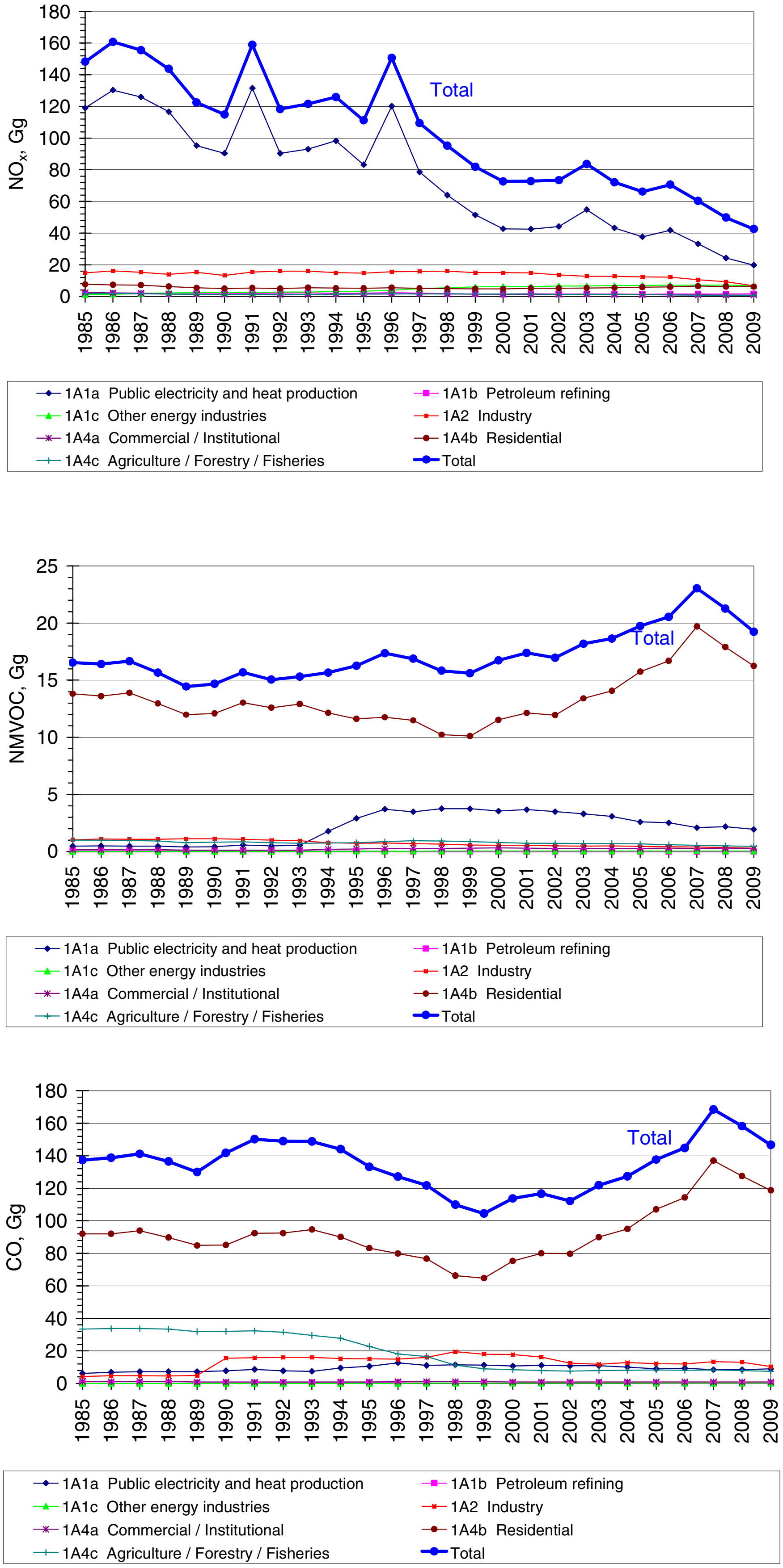


Figure 2A-10.1 Time-series for fuel consumption and emissions, 1980/1985 - 2009.

Annex 2A-11 QA/QC for stationary combustion

The elaboration of a formal QA/QC plan started in 2004. A first version is available from Sørensen et al. (2005). This quality manual describes the concepts of quality work and definitions of sufficient quality, critical control points and a list of Point for Measuring. The work on expanding the QC will be ongoing in future years.

Documentation concerning verification of the Danish emission inventories has been published by Fauser et al. (2007). The reference approach for the energy sector is shown is shown in chapter 16.1.

The sector reports for stationary combustion has been reviewed by external Danish experts in 2009, 2006 and 2004 (Nielsen et al. 2009; Nielsen et al. 2007; Nielsen et al. 2005).

Data storage, level 1

Table 6.1 List of external data sources.

Dataset	Description	AD or Emf.	Reference	Contact(s)	Data agreement/ Comment
Energiproducenttællingen.xls	Data set for all electricity and heat producing plants.	Activity data	The Danish Energy Agency (DEA)	Peter Dal	Data agreement in place
Gas consumption for gas engines and gas turbines 1990-1994		Activity data	DEA	Peter Dal	No data agreement. Historical data
Basic data (Grunddata.xls)	Data set used for IPCC reference approach	Activity data	DEA	Peter Dal	Not necessary. Published as part of national energy statistics
Energy statistics	The Danish energy statistics on SNAP level	Activity data	DEA	Peter Dal	Data agreement in place
SO_2 & NO_x data, plants>25 MW_e		Emissions	DEA	Rasmus Sørensen	No data agreement in place
Emission factors	Emission factors refer to a large number of sources	Emission factors	See chapter regarding emission factors		
HM and PM from public power plants	Emissions from the two large power plant operators in DK DONG Energy and Vattenfall	Emissions	Dong Energy Vattenfall	Marina Snowman Møller, Heidi Demant	No formal data agreement in place
Environmental reports	Emissions from plants defined as large point sources	Emissions	Various plants		No data agreement necessary. Plants are obligated by law.
EU ETS data	Plant specific CO_2 emission factors	Emission factors	DEA	Dorte Maimann Helen Falster	Plants are obligated by law. The availability of detailed information is part of a future data agreement with DEA.

Data Storage level 1	1. Accuracy	DS.1.1.1	General level of uncertainty for every dataset including the reasoning for the specific values

Since the DEA are responsible for the official Danish energy statistics as well as reporting to the IEA, NERI regards the data as being complete and in accordance with the official Danish energy statistics and IEA reporting. The uncertainties connected with estimating fuel consumption do not, therefore, influence the accordance between IEA data, the energy statistics and the dataset on SNAP level utilised by NERI. For the remaining datasets, it is assumed that the level of uncertainty is relatively low. For further comments regarding uncertainties, see Chapter 15.

Data Storage level 1	1. Accuracy	DS.1.1.2	Quantification of the uncertainty level of every single data value including the reasoning for the specific values.

The uncertainty for external data is not quantified. The uncertainties of activity data and emission factors are quantified see main report.

Data Storage level 1	2.Comparability	DS.1.2.1	Comparability of the data values with similar data from other countries, which are comparable with Denmark, and evaluation of discrepancy.

On the external data the comparability has not been checked. However, at CRF level a project has been carried out comparing the Danish inventories with those of other countries (Fauser et al. 2007).

Data Storage level 1	3.Completeness	DS.1.3.1	Documentation showing that all possible national data sources are included by setting up the reasoning for the selection of datasets.

See the above Table 61 for an overview of external datasets.

Danish Energy Authority

Statistic on fuel consumption from district heating and power plants

A spreadsheet from DEA is listing fuel consumption of all plants included as large point sources in the emission inventory. The statistic on fuel consumption from district heating and power plants is regarded as complete and with no significant uncertainty since the plants are bound by law to report their fuel consumption and other information.

Gas consumption for gas engines and gas turbines 1990-1994

For the years 1990-1994 DEA has estimated consumption of natural gas and biogas in gas engines and gas turbines. NERI assesses that the estimation by the DEA are the best available data.

Basic data

A spreadsheet from DEA is used for the CO_2 emission calculation in accordance with the IPCC reference approach. It is published annually on DEA's webpage; therefore, a formal data delivery agreement is not deemed necessary.

Energy statistics on SNAP level

The data agreement have been renewed in 2011. NERI aggregates fuel consumption statistics to SNAP level based on a correspondence table developed in co-operation with DEA. Both traded and non-traded fuels are included in the Danish energy statistics. Thus, for example, estimation of the annual consumption of non-traded wood is included.

Emissions from non-energy use of fuels have been included in other source categories of the Danish inventory. The non-energy use of fuels is, however, included in the reference approach for Climate Convention reporting.

SO_2 and NO_x emission data from electricity producing plants > 25MWe
Plants larger than 25 MW_e are obligated to report emission data for SO_2 and NO_x to the DEA annually. Data are on block level and classified. The data on plant level are part of the plants annually environmental reports. NERI's QC of the data consists of a comparison with data from previous years and with data from the plants' annual environmental reports.

Emission factors from a wide range of sources
For specific references, see the chapter regarding emission factors.

Data for emission of heavy metals and particles from central power plants, DONG Energy and Vattenfall

The two major Danish power plant operators assess heavy metal emissions from their plants using model calculations based on fuel data and type of flue gas cleaning. NERI's QC of the data consists of a comparison with data from previous years and with data from the plants' annual environmental reports.

Annual environmental reports from plants defined as large point sources
A large number of plants are obligated by law to report annual environmental data including emission data. NERI compares the data with those from previous years and large discrepancies are checked.

EU ETS data
EU ETS data are information on fuel consumption, heating values, carbon content of fuel, oxidation factor and CO_2 emissions. NERI receives the verified reports for all plants which utilises a detailed estimation methodology. NERI's QC of the received data consists of comparing to calculation using standard emission factors as well as comparing reported values with those for previous years.

Data Storage level 1	4.Consistency	DS.1.4.1	The origin of external data has to be preserved whenever possible without explicit arguments (referring to other PM's)

It is ensured that all external data are archived at NERI. Subsequent data processing takes place in other spreadsheets or databases. The datasets are archived annually in order to ensure that the basic data for a given report are always available in their original form.

Data Storage level 1	6.Robustness	DS.1.6.1	Explicit agreements between the external institution of data delivery and NERI about the condition of delivery

For stationary combustion a data delivery agreement is made with the DEA. NERI and DEA have renewed the data delivery agreement 2011. Most of the other external data sources are available due to legislatory requirements. See Table 61.

Data Storage level 1	7.Transparency	DS.1.7.1	Summary of each dataset including the reasoning for selecting the specific dataset

See DS 1.3.1

Data Storage level 1	7.Transparency	DS.1.7.3	References for citation for any external data set have to be available for any single number in any dataset.

See Table 61 for general references. Much documentation already exists. However, some of the information used is classified and therefore not publicly available.

Data Storage level 1	7.Transparency	DS.1.7.4	Listing of external contacts for every dataset

See Table 61.

Data processing, level 1

Data Processing level 1	1. Accuracy	DP.1.1.1	Uncertainty assessment for every data source as input to Data Storage level 2 in relation to type of variability. (Distribution as: normal, log normal or other type of variability)

The uncertainty assessment of activity data and emission factors are discussed in the chapter concerning uncertainties.

Data Processing level 1	1. Accuracy	DP.1.1.2	Uncertainty assessment for every data source as input to Data Storage level 2 in relation to scale of variability (size of variation intervals)

The uncertainty assessment of activity data and emission factors are discussed in the chapter concerning uncertainties.

Data Processing level 1	1. Accuracy	DP.1.1.3	Evaluation of the methodological approach using international guidelines

The methodological approach is consistent with international guidelines. Tier 2 or tier 3 methodologies are used.

Data Processing level 1	1. Accuracy	DP.1.1.4	Verification of calculation results using guideline values

Calculated emission factors are compared with guideline emission factors to ensure that they are within reason.

Data Processing level 1	2.Comparability	DP.1.2.1	The inventory calculation has to follow the international guidelines suggested by UNFCCC and IPCC.

The calculations follow the principle in international guidelines.

Data Processing level 1	3.Completeness	DP.1.3.1	Assessment of the most important quantitative knowledge which is lacking.

Regarding the distribution of energy consumption for industrial sources (CRF sector 1A2), a more detailed and frequently updated data material would be preferred. There is ongoing work to increase the accuracy and completeness of this IPCC source category. It is not assessed that this has any influence on the overall emission level of greenhouse gases.

Data Processing level 1	3.Completeness	DP.1.3.2	Assessment of the most important cases where accessibility to critical data sources that could improve quantitative knowledge is missing.

There is no missing accessibility to critical data sources.

Data Processing level 1	4.Consistency	DP.1.4.1	In order to keep consistency at a higher level, an explicit description of the activities needs to accompany any change in the calculation procedure.

A change in calculation procedure would entail that an updated description would be elaborated.

Data Processing level 1	5.Correctness	DP.1.5.1	Show at least once, by independent calculation, the correctness of every data manipulation.

During data processing it is checked that calculations are done correctly. This is to a wide degree documented in the data processing spreadsheets.

Data Processing level 1	5.Correctness	DP.1.5.2	Verification of calculation results using time-series

Time-series for activity data on SNAP level and sectoral level (see main report) are used to identify possible errors in the calculation procedure. Time-series for emission factors and fuel consumption are also scrutinized.

Data Processing level 1	5.Correctness	DP.1.5.3	Verification of calculation results using other measures

The IPCC reference approach validates the fuel consumption rates and CO_2 emissions of fuel combustion. Fuel consumption rates and CO_2 emissions differ by less than 2.0 % (1990-2009). The reference approach is further discussed in the main report.

Data Processing level 1	5.Correctness	DP.1.5.4	Show one-to-one correctness between external data sources and the databases at Data Storage level 2.

There is a direct line between the external datasets, the calculation process and the input data used to Data Storage level 2. During the calculation process numerous controls are conducted to ensure correctness, e.g. sum checks of the various stages in the calculation procedure.

Data Processing level 1	7.Transparency	DP.1.7.1	The calculation principle and equations used must be described.
Data Processing level 1	7.Transparency	DP.1.7.2	The theoretical reasoning for all methods must be described.
Data Processing level 1	7.Transparency	DP.1.7.3	Explicit listing of assumptions behind all methods

Where appropriate, this is included in the present report with annexes.

Data Processing level 1	7.Transparency	DP.1.7.4	Clear reference to dataset at Data Storage level 1

There is a clear line between the external data and the data processing.

Data Processing level 1	7.Transparency	DP.1.7.5	A manual log to collect information about recalculations

At present, a manual log table is not in place at this level. However, this feature will be implemented in the future. A manual log table is incorporated in the national emission database, Data Storage level 2.

Data storage, level 2

Data Storage level 2	5.Correctness	DS.2.5.1	Documentation of a correct connection between all data types at level 2 to data at level 1

To ensure a correct connection between data on level 2 and data on level 1, different controls are in place, e.g. control of sums and random tests.

Data Storage level 2	5.Correctness	DS.2.5.2	Check if a correct data import to level 2 has been made.

Data import is checked by use of sum control and random testing. The same procedure is applied every year in order to minimise the risk of data import errors.

Other QC procedures

The emission from each large point source is compared with the emission reported the previous year.

Some automated checks have been prepared for the emission databases:

- Check of units for fuel rate, emission factors and plant-specific emissions.
- Check of emission factors for large point sources. Emission factors for pollutants that are not plant-specific should be the same as those defined for area sources.
- Additional checks on database consistency.
- Most emission factor references are included in this report (Chapter 3.2 and Appendix 2A-4).
- Annual environmental reports are kept for subsequent control of plant-specific emission data.
- QC checks of the country-specific emission factors have not been performed, but most factors are based on input from companies that have implemented some QA/QC work. The major power plant owner/operator in Denmark, DONG Energy has obtained the ISO 14001 certification for an environmental management system. The Danish Gas Technology Centre and Force Technology both run accredited laboratories for emission measurements.

Annex 2B - Transport

List of content

Annex 2B-1: Fleet data 1985-2009 for road transport (No. vehicles)

Sector	Subsector	Tech 2	FYear	LYear	1985	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Passenger Cars	Gasoline <1,4 l	PRE ECE	0	1969	75564	16627	13368	10706	8571	7246	6992	6618	6159	5646	5194
Passenger Cars	Gasoline <1,4 l	ECE 15/00-01	1970	1978	404441	179963	156167	134583	102209	66638	55669	43359	30440	19722	12950
Passenger Cars	Gasoline <1,4 l	ECE 15/02	1979	1980	97500	87416	63723	53008	61799	45282	38690	30726	21910	14275	8539
Passenger Cars	Gasoline <1,4 l	ECE 15/03	1981	1985	152241	318622	330062	307289	254029	235152	221928	204914	179982	150784	119474
Passenger Cars	Gasoline <1,4 l	ECE 15/04	1986	1990		165103	178393	209260	261580	258381	253651	249450	243072	232062	220895
Passenger Cars	Gasoline <1,4 l	Euro I	1991	1996			28375	60724	96923	141546	180780	219477	218990	216002	214711
Passenger Cars	Gasoline <1,4 l	Euro II	1997	2000									39547	74071	107025
Passenger Cars	Gasoline <1,4 l	Euro III	2001	2005											
Passenger Cars	Gasoline <1,4 l	Euro IV	2006	2010											
Passenger Cars	Gasoline 1,4 - 2,0 l	PRE ECE	0	1969	90872	28856	23474	19524	15744	13167	12527	11642	10624	9570	8659
Passenger Cars	Gasoline 1,4 - 2,0 l	ECE 15/00-01	1970	1978	344505	171158	152919	137410	110812	76213	63961	50125	35583	23605	15800
Passenger Cars	Gasoline 1,4 - 2,0 l	ECE 15/02	1979	1980	87587	74393	54644	44813	52998	40866	35395	28785	21181	14516	9144
Passenger Cars	Gasoline 1,4 - 2,0 l	ECE 15/03	1981	1985	210664	276842	281144	261222	218176	205239	196225	184150	165329	142253	115689
Passenger Cars	Gasoline 1,4 - 2,0 l	ECE 15/04	1986	1990		221807	211098	215194	242499	240697	238039	236139	232642	225250	217019
Passenger Cars	Gasoline 1,4 - 2,0 l	Euro I	1991	1996			51521	101611	148509	235536	319571	414973	413070	407030	404816
Passenger Cars	Gasoline 1,4 - 2,0 l	Euro II	1997	2000									105322	217501	303709
Passenger Cars	Gasoline 1,4 - 2,0 l	Euro III	2001	2005											
Passenger Cars	Gasoline 1,4 - 2,0 l	Euro IV	2006	2010											
Passenger Cars	Gasoline >2,0 l	PRE ECE	0	1969	3246	1388	1186	1033	897	911	945	971	986	987	989
Passenger Cars	Gasoline >2,0 l	ECE 15/00-01	1970	1978	3113	3661	3581	3373	3096	2800	2589	2352	2039	1657	1381
Passenger Cars	Gasoline >2,0 l	ECE 15/02	1979	1980	1078	564	531	687	859	865	865	846	773	702	599
Passenger Cars	Gasoline >2,0 l	ECE 15/03	1981	1985	4087	2263	2037	1700	1575	1659	1801	1950	2055	2081	2018
Passenger Cars	Gasoline >2,0 l	ECE 15/04	1986	1990		4323	3630	3161	2668	2810	3052	3331	3638	3874	4089
Passenger Cars	Gasoline >2,0 l	Euro I	1991	1996			1263	2350	3350	5384	7888	10682	11000	11250	11334
Passenger Cars	Gasoline >2,0 l	Euro II	1997	2000									3980	8667	14011
Passenger Cars	Gasoline >2,0 l	Euro III	2001	2005											
Passenger Cars	Gasoline >2,0 l	Euro IV	2006	2010											
Passenger Cars	Diesel <2,0 l	Conventional	0	1990	69406	71018	70198	69500	68720	65169	62762	59117	54631	50590	48238
Passenger Cars	Diesel <2,0 l	Euro I	1991	1996			979	2163	3799	6613	9919	13122	13689	14318	15305
Passenger Cars	Diesel <2,0 l	Euro II	1997	2000									3064	8535	18568
Passenger Cars	Diesel <2,0 l	Euro III	2001	2005											
Passenger Cars	Diesel <2,0 l	Euro IV	2006	2010											
Passenger Cars	Diesel >2,0 l	Conventional	0	1990	14055	14871	13888	13012	12136	11757	11413	10708	10043	9269	8435
Passenger Cars	Diesel >2,0 l	Euro I	1991	1996			1017	1988	3035	4323	5638	7401	7600	7595	7716

Continued

Sector	Subsector	Tech 2	FYear	LYear	1985	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Passenger Cars	Diesel >2,0 l	Euro II	1997	2000									2079	5072	9087
Passenger Cars	Diesel >2,0 l	Euro III	2001	2005											
Passenger Cars	Diesel >2,0 l	Euro IV	2006	2010											
Passenger Cars	LPG cars	Conventional	0	1990	1136	1163	1166	1173	1184	734	495	310	171	96	56
Passenger Cars	LPG cars	Euro I	1991	1996				1	4	4	3	1	1	1	3
Passenger Cars	LPG cars	Euro II	1997	2000											
Passenger Cars	LPG cars	Euro III	2001	2005											
Passenger Cars	LPG cars	Euro IV	2006	2010											
Passenger Cars	2-Stroke	Conventional	0	9999	4823	5417	4804	4308	3747	3029	2443	1824	1248	761	400
Passenger Cars	Electric cars	Conventional	0	9999	130	133	133	134	136	155	163	187	230	292	298
Light Duty Vehicles	Gasoline <3,5t	Conventional	0	1994	34172	44442	45625	46865	48934	49865	46712	42710	37987	34274	30224
Light Duty Vehicles	Gasoline <3,5t	Euro I	1995	1998							3773	7509	12025	17550	17352
Light Duty Vehicles	Gasoline <3,5t	Euro II	1999	2001											5272
Light Duty Vehicles	Gasoline <3,5t	Euro III	2002	2006											
Light Duty Vehicles	Gasoline <3,5t	Euro IV	2007	2011											
Light Duty Vehicles	Diesel <3,5t	Conventional	0	1994	113019	146986	150898	154999	161842	169142	160228	148520	133718	120795	105967
Light Duty Vehicles	Diesel <3,5t	Euro I	1995	1998							16899	35370	56836	76717	75753
Light Duty Vehicles	Diesel <3,5t	Euro II	1999	2001											24555
Light Duty Vehicles	Diesel <3,5t	Euro III	2002	2006											
Light Duty Vehicles	Diesel <3,5t	Euro IV	2007	2011											
Light Duty Vehicles	LPG <3,5t	Conventional	0	1994	684	889	913	938	979	632	462	295	196	125	90
Light Duty Vehicles	LPG <3,5t	Euro I	1995	1998										1	1
Light Duty Vehicles	LPG <3,5t	Euro II	1999	2001											
Light Duty Vehicles	LPG <3,5t	Euro III	2002	2006											
Light Duty Vehicles	LPG <3,5t	Euro IV	2007	2011											
Light Duty Vehicles	Electric <3,5t	Conventional	0	9999	3	4	4	4	4	3	2	2	1	1	1
Heavy Duty Vehicles	Gasoline >3,5t	Conventional	0	9999	621	530	510	497	503	455	412	365	326	336	318
Heavy Duty Vehicles	Diesel RT 3,5 - 7,5t	Conventional	0	1993	8686	7049	6675	6430	6419	6194	5738	5137	4646	4156	3518
Heavy Duty Vehicles	Diesel RT 3,5 - 7,5t	Euro I	1994	1996					66	376	711	976	973	967	906
Heavy Duty Vehicles	Diesel RT 3,5 - 7,5t	Euro II	1997	2001								89	521	1236	1782
Heavy Duty Vehicles	Diesel RT 3,5 - 7,5t	Euro III	2002	2006											
Heavy Duty Vehicles	Diesel RT 3,5 - 7,5t	Euro IV	2007	2009											
Heavy Duty Vehicles	Diesel RT 3,5 - 7,5t	Euro V	2010	2014											
Heavy Duty Vehicles	Diesel RT 7,5 - 12t	Conventional	0	1993	7266	5897	5584	5379	5375	5316	5373	5207	4854	4491	4116
Heavy Duty Vehicles	Diesel RT 7,5 - 12t	Euro I	1994	1996					51	298	671	968	1002	1081	1102
Heavy Duty Vehicles	Diesel RT 7,5 - 12t	Euro II	1997	2001								94	429	798	1200

Continued

Sector	Subsector	Tech 2	FYear	LYear	1985	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Heavy Duty Vehicles	Diesel RT 7,5 - 12t	Euro III	2002	2006											
Heavy Duty Vehicles	Diesel RT 7,5 - 12t	Euro IV	2007	2009											
Heavy Duty Vehicles	Diesel RT 7,5 - 12t	Euro V	2010	2014											
Heavy Duty Vehicles	Diesel RT 12 - 14 t	Conventional	0	1993	4984	4519	4461	4388	4454	3991	3248	2731	2360	1984	1623
Heavy Duty Vehicles	Diesel RT 12 - 14 t	Euro I	1994	1996					37	156	234	285	283	286	289
Heavy Duty Vehicles	Diesel RT 12 - 14 t	Euro II	1997	2001								21	126	216	262
Heavy Duty Vehicles	Diesel RT 12 - 14 t	Euro III	2002	2006											
Heavy Duty Vehicles	Diesel RT 12 - 14 t	Euro IV	2007	2009											
Heavy Duty Vehicles	Diesel RT 12 - 14 t	Euro V	2010	2014											
Heavy Duty Vehicles	Diesel RT 14 - 20t	Conventional	0	1993	5171	4689	4628	4552	4601	4348	4047	3669	3316	2924	2537
Heavy Duty Vehicles	Diesel RT 14 - 20t	Euro I	1994	1996					58	334	708	1001	1007	985	963
Heavy Duty Vehicles	Diesel RT 14 - 20t	Euro II	1997	2001								98	535	937	1371
Heavy Duty Vehicles	Diesel RT 14 - 20t	Euro III	2002	2006											
Heavy Duty Vehicles	Diesel RT 14 - 20t	Euro IV	2007	2009											
Heavy Duty Vehicles	Diesel RT 14 - 20t	Euro V	2010	2014											
Heavy Duty Vehicles	Diesel RT 20 - 26t	Conventional	0	1993	4307	5179	5237	5326	5315	5031	4565	4059	3536	3067	2596
Heavy Duty Vehicles	Diesel RT 20 - 26t	Euro I	1994	1996					67	469	1003	1452	1442	1400	1322
Heavy Duty Vehicles	Diesel RT 20 - 26t	Euro II	1997	2001								152	748	1330	1898
Heavy Duty Vehicles	Diesel RT 20 - 26t	Euro III	2002	2006											
Heavy Duty Vehicles	Diesel RT 20 - 26t	Euro IV	2007	2009											
Heavy Duty Vehicles	Diesel RT 20 - 26t	Euro V	2010	2014											
Heavy Duty Vehicles	Diesel RT 26 - 28t	Conventional	0	1993	7	8	8	9	9	7	6	6	6	6	6
Heavy Duty Vehicles	Diesel RT 26 - 28t	Euro I	1994	1996							0	1	1	1	1
Heavy Duty Vehicles	Diesel RT 26 - 28t	Euro II	1997	2001								0	1	2	3
Heavy Duty Vehicles	Diesel RT 26 - 28t	Euro III	2002	2006											
Heavy Duty Vehicles	Diesel RT 26 - 28t	Euro IV	2007	2009											
Heavy Duty Vehicles	Diesel RT 26 - 28t	Euro V	2010	2014											
Heavy Duty Vehicles	Diesel RT 28 - 32t	Conventional	0	1993	271	326	329	335	327	326	329	321	300	262	231
Heavy Duty Vehicles	Diesel RT 28 - 32t	Euro I	1994	1996					11	62	152	239	246	252	253
Heavy Duty Vehicles	Diesel RT 28 - 32t	Euro II	1997	2001								28	147	289	455
Heavy Duty Vehicles	Diesel RT 28 - 32t	Euro III	2002	2006											
Heavy Duty Vehicles	Diesel RT 28 - 32t	Euro IV	2007	2009											
Heavy Duty Vehicles	Diesel RT 28 - 32t	Euro V	2010	2014											
Heavy Duty Vehicles	Diesel RT >32t	Conventional	0	1993	0	0	0	0	0	0	1	0	0	1	1
Heavy Duty Vehicles	Diesel RT >32t	Euro I	1994	1996							0	1	1	1	1
Heavy Duty Vehicles	Diesel RT >32t	Euro II	1997	2001								0	1	0	0

Continued

Sector	Subsector	Tech 2	FYear	LYear	1985	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Heavy Duty Vehicles	Diesel RT >32t	Euro III	2002	2006											
Heavy Duty Vehicles	Diesel RT >32t	Euro IV	2007	2009											
Heavy Duty Vehicles	Diesel RT >32t	Euro V	2010	2014											
Heavy Duty Vehicles	Diesel TT/AT 28 - 34t	Conventional	0	1993	5617	5132	5080	5011	5065	4783	4448	4025	3645	3208	2772
Heavy Duty Vehicles	Diesel TT/AT 28 - 34t	Euro I	1994	1996					63	356	759	1069	1076	1051	1028
Heavy Duty Vehicles	Diesel TT/AT 28 - 34t	Euro II	1997	2001								104	570	1000	1467
Heavy Duty Vehicles	Diesel TT/AT 28 - 34t	Euro III	2002	2006											
Heavy Duty Vehicles	Diesel TT/AT 28 - 34t	Euro IV	2007	2009											
Heavy Duty Vehicles	Diesel TT/AT 28 - 34t	Euro V	2010	2014											
Heavy Duty Vehicles	Diesel TT/AT 34 - 40t	Conventional	0	1993	8359	10252	10740	11202	11174	10480	8917	7262	5877	4730	3842
Heavy Duty Vehicles	Diesel TT/AT 34 - 40t	Euro I	1994	1996					204	1616	3609	4958	4683	4110	3555
Heavy Duty Vehicles	Diesel TT/AT 34 - 40t	Euro II	1997	2001								495	2223	4240	5939
Heavy Duty Vehicles	Diesel TT/AT 34 - 40t	Euro III	2002	2006											
Heavy Duty Vehicles	Diesel TT/AT 34 - 40t	Euro IV	2007	2009											
Heavy Duty Vehicles	Diesel TT/AT 34 - 40t	Euro V	2010	2014											
Heavy Duty Vehicles	Diesel TT/AT 40 - 50t	Conventional	0	1993	1672	2083	2242	2382	2379	2398	2257	2045	1799	1469	1240
Heavy Duty Vehicles	Diesel TT/AT 40 - 50t	Euro I	1994	1996					49	333	888	1316	1327	1314	1305
Heavy Duty Vehicles	Diesel TT/AT 40 - 50t	Euro II	1997	2001								143	778	1564	2540
Heavy Duty Vehicles	Diesel TT/AT 40 - 50t	Euro III	2002	2006											
Heavy Duty Vehicles	Diesel TT/AT 40 - 50t	Euro IV	2007	2009											
Heavy Duty Vehicles	Diesel TT/AT 40 - 50t	Euro V	2010	2014											
Heavy Duty Vehicles	Diesel TT/AT 50 - 60t	Euro I	1994	1996								1	1	1	1
Heavy Duty Vehicles	Diesel TT/AT 50 - 60t	Euro II	1997	2001										1	1
Heavy Duty Vehicles	Diesel TT/AT 50 - 60t	Euro IV	2007	2009											
Heavy Duty Vehicles	Diesel TT/AT >60t	Euro V	2010	2014											
Buses	Gasoline Urban Buses	Conventional	0	9999	8	8	9	11	14	11	11	16	17	17	15
Buses	Diesel Urban Buses <15t	Conventional	0	1993	347	352	433	488	639	558	494	411	335	281	250
Buses	Diesel Urban Buses <15t	Euro I	1994	1996						49	81	122	130	132	124
Buses	Diesel Urban Buses <15t	Euro II	1997	2001									103	295	438
Buses	Diesel Urban Buses <15t	Euro III	2002	2006											
Buses	Diesel Urban Buses <15t	Euro IV	2007	2009											
Buses	Diesel Urban Buses 15 - 18t	Conventional	0	1993	2083	2109	2597	2928	3833	3475	3205	2861	2691	2353	2012
Buses	Diesel Urban Buses 15 - 18t	Euro I	1994	1996						397	632	985	989	891	891
Buses	Diesel Urban Buses 15 - 18t	Euro II	1997	2001									183	568	817

Continued

Sector	Subsector	Tech 2	FYear	LYear	1985	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Buses	Diesel Urban Buses 15 - 18t	Euro III	2002	2006											
Buses	Diesel Urban Buses 15 - 18t	Euro IV	2007	2009											
Buses	Diesel Urban Buses >18t	Conventional	0	1993	5	5	6	7	9	8	6	7	6	3	2
Buses	Diesel Urban Buses >18t	Euro I	1994	1996						1	1	3	3	3	2
Buses	Diesel Urban Buses >18t	Euro II	1997	2001										6	20
Buses	Diesel Urban Buses >18t	Euro III	2002	2006											
Buses	Diesel Urban Buses >18t	Euro IV	2007	2009											
Buses	Gasoline Coaches	Conventional	0	9999	931	942	1161	1309	1508	1762	1775	1786	1791	1808	1810
Buses	Diesel Coaches <15t	Conventional	0	1993	3710	3756	4627	5215	6010	5926	5739	5506	5208	4941	4629
Buses	Diesel Coaches <15t	Euro I	1994	1996						420	682	1113	1103	1091	1056
Buses	Diesel Coaches <15t	Euro II	1997	2001									370	695	1039
Buses	Diesel Coaches <15t	Euro III	2002	2006											
Buses	Diesel Coaches <15t	Euro IV	2007	2009											
Buses	Diesel Coaches 15 - 18t	Conventional	0	1993	804	814	1003	1131	1303	1389	1393	1342	1253	1241	1184
Buses	Diesel Coaches 15 - 18t	Euro I	1994	1996						35	89	153	162	163	159
Buses	Diesel Coaches 15 - 18t	Euro II	1997	2001									44	77	119
Buses	Diesel Coaches 15 - 18t	Euro III	2002	2006											
Buses	Diesel Coaches 15 - 18t	Euro IV	2007	2009											
Buses	Diesel Coaches >18t	Conventional	0	1993	122	123	152	171	197	210	221	211	193	193	206
Buses	Diesel Coaches >18t	Euro I	1994	1996						20	42	78	84	82	81
Buses	Diesel Coaches >18t	Euro II	1997	2001									25	54	99
Buses	Diesel Coaches >18t	Euro III	2002	2006											
Buses	Diesel Coaches >18t	Euro IV	2007	2009											
Mopeds	<50 cm³	Conventional	0	1999	151000	120000	118000	113000	109000	105000	114167	123333	132500	141667	150833
Mopeds	<50 cm³	Euro I	2000	2003											
Mopeds	<50 cm³	Euro II	2004	9999											
Motorcycles	2-stroke >50 cm³	Conventional	0	1999	6209	6617	6804	6904	7111	7406	7672	8214	8980	9598	10385
Motorcycles	4-stroke <250 cm³	Conventional	0	1999	7037	7499	7712	7824	8059	8394	8695	9310	10177	10878	11769
Motorcycles	4-stroke <250 cm³	Euro I	2000	2003											
Motorcycles	4-stroke <250 cm³	Euro II	2004	2006											
Motorcycles	4-stroke <250 cm³	Euro III	2007	9999											
Motorcycles	4-stroke 250 - 750 cm³	Conventional	0	1999	19352	20622	21207	21516	22162	23083	23911	25602	27986	29914	32365
Motorcycles	4-stroke 250 - 750 cm³	Euro I	2000	2003											
Motorcycles	4-stroke 250 - 750 cm³	Euro II	2004	2006											
Motorcycles	4-stroke 250 - 750 cm³	Euro III	2007	9999											

Continued															
Sector	Subsector	Tech 2	FYear	LYear	1985	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Motorcycles	4-stroke >750 cm³	Conventional	0	1999	8796	9374	9639	9780	10074	10492	10869	11637	12721	13597	14712
Motorcycles	4-stroke >750 cm³	Euro I	2000	2003											
Motorcycles	4-stroke >750 cm³	Euro II	2004	2006											
Motorcycles	4-stroke >750 cm³	Euro III	2007	9999											

Sector	Subsector	Tech 2	FYear	LYear	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Passenger Cars	Gasoline <1,4 l	PRE ECE	0	1969	5194	4994	4949	4963	5045	5223	5417	5720	6082	6467	6725
Passenger Cars	Gasoline <1,4 l	ECE 15/00-01	1970	1978	12950	9402	7791	6441	5527	4770	4352	4074	4103	4094	4147
Passenger Cars	Gasoline <1,4 l	ECE 15/02	1979	1980	8539	5582	4146	3061	2228	1672	1270	1027	857	728	634
Passenger Cars	Gasoline <1,4 l	ECE 15/03	1981	1985	119474	95486	78149	62695	47507	35638	25239	18617	13047	9408	6534
Passenger Cars	Gasoline <1,4 l	ECE 15/04	1986	1990	220895	203911	188827	166452	145685	119764	96438	73966	56842	40817	29940
Passenger Cars	Gasoline <1,4 l	Euro I	1991	1996	214711	212883	211037	207661	203273	197813	189161	177736	161965	144902	127481
Passenger Cars	Gasoline <1,4 l	Euro II	1997	2000	107025	132974	131683	130255	129818	128942	127649	126013	122908	119230	116047
Passenger Cars	Gasoline <1,4 l	Euro III	2001	2005			20508	43702	64814	94621	136765	135422	134549	133140	132632
Passenger Cars	Gasoline <1,4 l	Euro IV	2006	2010								46184	87915	132696	172453
Passenger Cars	Gasoline 1,4 - 2,0 l	PRE ECE	0	1969	8659	8291	8215	8200	8321	8638	9068	9589	10256	10936	11399
Passenger Cars	Gasoline 1,4 - 2,0 l	ECE 15/00-01	1970	1978	15800	11566	9555	7938	6866	5944	5373	5149	5260	5419	5580
Passenger Cars	Gasoline 1,4 - 2,0 l	ECE 15/02	1979	1980	9144	6258	4775	3690	2780	2170	1670	1386	1183	1020	895
Passenger Cars	Gasoline 1,4 - 2,0 l	ECE 15/03	1981	1985	115689	94495	78552	64108	49671	37838	27501	20744	15212	11502	8468
Passenger Cars	Gasoline 1,4 - 2,0 l	ECE 15/04	1986	1990	217019	203364	190772	171667	153308	129613	107638	85474	67960	51210	39584
Passenger Cars	Gasoline 1,4 - 2,0 l	Euro I	1991	1996	404816	402938	402008	397847	391775	383212	370014	348949	317429	286209	256600
Passenger Cars	Gasoline 1,4 - 2,0 l	Euro II	1997	2000	303709	363267	359633	355644	355739	352843	349396	344681	334040	320023	310538
Passenger Cars	Gasoline 1,4 - 2,0 l	Euro III	2001	2005			51628	107387	148845	196878	250957	248647	251018	247684	246743
Passenger Cars	Gasoline 1,4 - 2,0 l	Euro IV	2006	2010								55169	101832	129710	145252
Passenger Cars	Gasoline >2,0 l	PRE ECE	0	1969	989	1024	1079	1128	1237	1391	1600	2060	2628	3224	3589
Passenger Cars	Gasoline >2,0 l	ECE 15/00-01	1970	1978	1381	1181	1034	936	859	830	841	1031	1314	1735	2009
Passenger Cars	Gasoline >2,0 l	ECE 15/02	1979	1980	599	520	479	444	399	369	318	311	330	319	297
Passenger Cars	Gasoline >2,0 l	ECE 15/03	1981	1985	2018	1904	1798	1696	1572	1431	1299	1182	1129	1031	935
Passenger Cars	Gasoline >2,0 l	ECE 15/04	1986	1990	4089	4161	4188	4196	4099	3992	3847	3772	3641	3404	3151
Passenger Cars	Gasoline >2,0 l	Euro I	1991	1996	11334	11470	11572	11776	11983	12425	12702	13039	13204	12844	12336
Passenger Cars	Gasoline >2,0 l	Euro II	1997	2000	14011	18867	18776	18757	18984	19326	19848	20510	21171	20918	20652
Passenger Cars	Gasoline >2,0 l	Euro III	2001	2005			4628	9892	14692	21393	29899	30850	32713	33204	33810
Passenger Cars	Gasoline >2,0 l	Euro IV	2006	2010								7690	14232	17902	19391
Passenger Cars	Diesel <2,0 l	Conventional	0	1990	48238	46384	44480	41523	38006	34340	30089	26006	22027	17996	14360

Continued															
Sector	Subsector	Tech 2	FYear	LYear	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Passenger Cars	Diesel <2,0 l	Euro I	1991	1996	15305	16471	17245	18106	19220	20895	21616	21549	20568	19152	17776
Passenger Cars	Diesel <2,0 l	Euro II	1997	2000	18568	30074	30082	30026	30342	30592	30774	31125	33912	32640	32025
Passenger Cars	Diesel <2,0 l	Euro III	2001	2005			12723	30100	46644	70013	100191	102310	119573	119892	121697
Passenger Cars	Diesel <2,0 l	Euro IV	2006	2010								35637	97621	163452	211200
Passenger Cars	Diesel >2,0 l	Conventional	0	1990	8435	7728	7120	6345	5723	5039	4460	3895	3402	2906	2515
Passenger Cars	Diesel >2,0 l	Euro I	1991	1996	7716	7698	7640	7463	7353	7287	7147	6943	6586	6016	5573
Passenger Cars	Diesel >2,0 l	Euro II	1997	2000	9087	13139	13250	13151	13303	13569	13890	13944	14951	14421	14008
Passenger Cars	Diesel >2,0 l	Euro III	2001	2005			3892	8650	12988	18896	25773	26255	31305	31519	32057
Passenger Cars	Diesel >2,0 l	Euro IV	2006	2010								7152	18381	24262	30134
Passenger Cars	LPG cars	Conventional	0	1990	56	30	24	17	11	10	10	10	7	8	7
Passenger Cars	LPG cars	Euro I	1991	1996	3	2	2	3	2	4	4	3	2	2	2
Passenger Cars	LPG cars	Euro II	1997	2000				1	2	1	1	1			1
Passenger Cars	LPG cars	Euro III	2001	2005									1	2	4
Passenger Cars	LPG cars	Euro IV	2006	2010											1
Passenger Cars	2-Stroke	Conventional	0	9999	400	300	200	150	100	50					
Passenger Cars	Electric cars	Conventional	0	9999	298	322	301	280	250	211	183	183	188	191	273
Light Duty Vehicles	Gasoline <3,5t	Conventional	0	1994	30224	27140	23832	21083	18787	16405	14063	11895	9932	7990	6333
Light Duty Vehicles	Gasoline <3,5t	Euro I	1995	1998	17352	17103	16862	16703	16454	16011	15464	14728	13331	12214	11199
Light Duty Vehicles	Gasoline <3,5t	Euro II	1999	2001	5272	9655	14319	14153	14012	13791	13616	13420	10302	9608	8984
Light Duty Vehicles	Gasoline <3,5t	Euro III	2002	2006				3784	8014	13934	20623	26271	18997	18312	17579
Light Duty Vehicles	Gasoline <3,5t	Euro IV	2007	2011									3184	3811	4024
Light Duty Vehicles	Diesel <3,5t	Conventional	0	1994	105967	94102	80466	67925	56940	46624	37412	29736	24088	18849	14736
Light Duty Vehicles	Diesel <3,5t	Euro I	1995	1998	75753	74373	72684	71182	69081	66775	63284	58501	52343	46832	41793
Light Duty Vehicles	Diesel <3,5t	Euro II	1999	2001	24555	49951	74831	73532	72069	70326	68384	65625	55257	49899	45253
Light Duty Vehicles	Diesel <3,5t	Euro III	2002	2006				27192	54236	92157	139815	194261	167940	158600	150016
Light Duty Vehicles	Diesel <3,5t	Euro IV	2007	2011									47073	72419	83205
Light Duty Vehicles	LPG <3,5t	Conventional	0	1994	90	60	36	27	21	14	10	9	7	5	4
Light Duty Vehicles	LPG <3,5t	Euro I	1995	1998	1	1	1								
Light Duty Vehicles	LPG <3,5t	Euro II	1999	2001		1				1	3	3	2	2	3
Light Duty Vehicles	LPG <3,5t	Euro III	2002	2006								5	7	7	8
Light Duty Vehicles	LPG <3,5t	Euro IV	2007	2011									1	3	4
Light Duty Vehicles	Electric <3,5t	Conventional	0	9999	1	1								1	7
Heavy Duty Vehicles	Gasoline >3,5t	Conventional	0	9999	318	307	295	291	283	268	287	296	328	324	340
Heavy Duty Vehicles	Diesel RT 3,5 - 7,5t	Conventional	0	1993	3518	3011	2552	2088	1709	1430	1244	1075	937	793	653
Heavy Duty Vehicles	Diesel RT 3,5 - 7,5t	Euro I	1994	1996	906	834	769	715	656	594	492	437	360	290	234
Heavy Duty Vehicles	Diesel RT 3,5 - 7,5t	Euro II	1997	2001	1782	2136	2254	2161	2078	2003	1901	1722	1504	1386	1189

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Sector	Subsector	Tech 2	FYear	LYear	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Heavy Duty Vehicles	Diesel RT 3,5 - 7,5t	Euro III	2002	2006			166	460	755	1049	1437	1677	1662	1576	1448
Heavy Duty Vehicles	Diesel RT 3,5 - 7,5t	Euro IV	2007	2009								53	364	758	911
Heavy Duty Vehicles	Diesel RT 3,5 - 7,5t	Euro V	2010	2014									2	5	27
Heavy Duty Vehicles	Diesel RT 7,5 - 12t	Conventional	0	1993	4116	3782	3406	3069	2766	2503	2241	2077	1899	1682	1418
Heavy Duty Vehicles	Diesel RT 7,5 - 12t	Euro I	1994	1996	1102	1099	1070	1040	985	948	885	827	747	666	544
Heavy Duty Vehicles	Diesel RT 7,5 - 12t	Euro II	1997	2001	1200	1575	1783	1840	1884	1858	1838	1706	1587	1525	1359
Heavy Duty Vehicles	Diesel RT 7,5 - 12t	Euro III	2002	2006			155	443	713	1061	1501	1936	1996	1908	1784
Heavy Duty Vehicles	Diesel RT 7,5 - 12t	Euro IV	2007	2009			2	2	2	2	3	93	427	823	890
Heavy Duty Vehicles	Diesel RT 7,5 - 12t	Euro V	2010	2014					1	1	1	2	42	180	345
Heavy Duty Vehicles	Diesel RT 12 - 14 t	Conventional	0	1993	1623	1368	1094	896	734	612	500	435	367	295	224
Heavy Duty Vehicles	Diesel RT 12 - 14 t	Euro I	1994	1996	289	278	274	248	203	174	152	138	113	99	85
Heavy Duty Vehicles	Diesel RT 12 - 14 t	Euro II	1997	2001	262	298	312	291	285	278	273	267	239	203	159
Heavy Duty Vehicles	Diesel RT 12 - 14 t	Euro III	2002	2006			10	32	46	58	82	99	108	107	103
Heavy Duty Vehicles	Diesel RT 12 - 14 t	Euro IV	2007	2009						1	1	2	25	49	63
Heavy Duty Vehicles	Diesel RT 12 - 14 t	Euro V	2010	2014										8	11
Heavy Duty Vehicles	Diesel RT 14 - 20t	Conventional	0	1993	2537	2143	1897	1382	1158	1003	884	895	724	531	427
Heavy Duty Vehicles	Diesel RT 14 - 20t	Euro I	1994	1996	963	905	983	787	701	638	562	574	461	334	246
Heavy Duty Vehicles	Diesel RT 14 - 20t	Euro II	1997	2001	1371	1642	1926	1653	1586	1587	1564	1711	1454	1187	942
Heavy Duty Vehicles	Diesel RT 14 - 20t	Euro III	2002	2006			194	389	665	919	1245	1740	1655	1464	1326
Heavy Duty Vehicles	Diesel RT 14 - 20t	Euro IV	2007	2009			4	4	6	7	14	101	457	697	747
Heavy Duty Vehicles	Diesel RT 14 - 20t	Euro V	2010	2014							3	21	106	255	414
Heavy Duty Vehicles	Diesel RT 20 - 26t	Conventional	0	1993	2596	2097	1769	1231	984	797	655	623	463	306	217
Heavy Duty Vehicles	Diesel RT 20 - 26t	Euro I	1994	1996	1322	1204	1206	935	815	728	643	654	515	361	271
Heavy Duty Vehicles	Diesel RT 20 - 26t	Euro II	1997	2001	1898	2179	2589	2176	2053	1970	1846	1969	1668	1353	1074
Heavy Duty Vehicles	Diesel RT 20 - 26t	Euro III	2002	2006			197	487	803	1143	1583	2273	2160	1903	1747
Heavy Duty Vehicles	Diesel RT 20 - 26t	Euro IV	2007	2009			3	3	3	3	26	126	593	907	985
Heavy Duty Vehicles	Diesel RT 20 - 26t	Euro V	2010	2014							7	24	124	292	490
Heavy Duty Vehicles	Diesel RT 26 - 28t	Conventional	0	1993	6	4	4	4	4	4	4	4	4	3	2
Heavy Duty Vehicles	Diesel RT 26 - 28t	Euro I	1994	1996	1	1	2	1	1	1	0	1	1	1	0
Heavy Duty Vehicles	Diesel RT 26 - 28t	Euro II	1997	2001	3	3	3	2	2	2	2	2	2	1	1
Heavy Duty Vehicles	Diesel RT 26 - 28t	Euro III	2002	2006					0	2	2	3	3	3	3
Heavy Duty Vehicles	Diesel RT 26 - 28t	Euro IV	2007	2009									3	3	1
Heavy Duty Vehicles	Diesel RT 26 - 28t	Euro V	2010	2014									1	1	1
Heavy Duty Vehicles	Diesel RT 28 - 32t	Conventional	0	1993	231	185	139	93	70	50	42	36	22	12	9
Heavy Duty Vehicles	Diesel RT 28 - 32t	Euro I	1994	1996	253	239	241	190	157	134	114	95	68	41	27
Heavy Duty Vehicles	Diesel RT 28 - 32t	Euro II	1997	2001	455	618	792	670	641	637	639	702	590	504	383

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Sector	Subsector	Tech 2	FYear	LYear	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Heavy Duty Vehicles	Diesel RT 28 - 32t	Euro III	2002	2006			82	193	341	509	747	1189	1157	1025	932
Heavy Duty Vehicles	Diesel RT 28 - 32t	Euro IV	2007	2009				0	1	1	21	86	400	606	661
Heavy Duty Vehicles	Diesel RT 28 - 32t	Euro V	2010	2014								10	69	157	254
Heavy Duty Vehicles	Diesel RT >32t	Conventional	0	1993	1	2	2	1	2	2	2	1	1	1	
Heavy Duty Vehicles	Diesel RT >32t	Euro I	1994	1996	1	0	1	1	1	1	1	1	1	1	1
Heavy Duty Vehicles	Diesel RT >32t	Euro II	1997	2001	0	1	1	0							
Heavy Duty Vehicles	Diesel RT >32t	Euro III	2002	2006			1	1	2	1	2	3	3	3	3
Heavy Duty Vehicles	Diesel RT >32t	Euro IV	2007	2009									1	1	1
Heavy Duty Vehicles	Diesel RT >32t	Euro V	2010	2014											1
Heavy Duty Vehicles	Diesel TT/AT 28 - 34t	Conventional	0	1993	2772	2481	1887	1804	1515	1250	1033	756	655	548	442
Heavy Duty Vehicles	Diesel TT/AT 28 - 34t	Euro I	1994	1996	1028	1025	954	1006	898	781	648	475	407	337	248
Heavy Duty Vehicles	Diesel TT/AT 28 - 34t	Euro II	1997	2001	1467	1862	1872	2119	2035	1942	1802	1407	1275	1190	944
Heavy Duty Vehicles	Diesel TT/AT 28 - 34t	Euro III	2002	2006			188	497	852	1123	1432	1434	1454	1468	1329
Heavy Duty Vehicles	Diesel TT/AT 28 - 34t	Euro IV	2007	2009			3	6	8	8	15	83	402	701	751
Heavy Duty Vehicles	Diesel TT/AT 28 - 34t	Euro V	2010	2014							3	17	93	256	415
Heavy Duty Vehicles	Diesel TT/AT 34 - 40t	Conventional	0	1993	3842	3173	2250	1980	1585	1255	973	705	576	453	328
Heavy Duty Vehicles	Diesel TT/AT 34 - 40t	Euro I	1994	1996	3555	2884	2100	1834	1472	1214	979	713	596	466	346
Heavy Duty Vehicles	Diesel TT/AT 34 - 40t	Euro II	1997	2001	5939	7098	7055	6586	5636	4638	3653	2744	2272	1947	1478
Heavy Duty Vehicles	Diesel TT/AT 34 - 40t	Euro III	2002	2006			1009	2342	3625	4439	5378	5558	4873	4142	3372
Heavy Duty Vehicles	Diesel TT/AT 34 - 40t	Euro IV	2007	2009			4	7	6	10	76	213	992	1630	1718
Heavy Duty Vehicles	Diesel TT/AT 34 - 40t	Euro V	2010	2014			1	1	1		27	151	672	1159	1543
Heavy Duty Vehicles	Diesel TT/AT 40 - 50t	Conventional	0	1993	1240	1029	708	549	388	287	219	170	123	94	67
Heavy Duty Vehicles	Diesel TT/AT 40 - 50t	Euro I	1994	1996	1305	1215	1060	967	781	616	482	352	286	177	115
Heavy Duty Vehicles	Diesel TT/AT 40 - 50t	Euro II	1997	2001	2540	3548	4062	4016	3731	3293	2841	2248	1798	1422	961
Heavy Duty Vehicles	Diesel TT/AT 40 - 50t	Euro III	2002	2006			552	1706	3011	4472	6217	7584	7031	5987	4774
Heavy Duty Vehicles	Diesel TT/AT 40 - 50t	Euro IV	2007	2009			1	5	6	6	82	328	2117	3548	3677
Heavy Duty Vehicles	Diesel TT/AT 40 - 50t	Euro V	2010	2014			1	2	2	2	1	68	722	1421	1894
Heavy Duty Vehicles	Diesel TT/AT 50 - 60t	Euro I	1994	1996	1	1	1	1	1	1	1				
Heavy Duty Vehicles	Diesel TT/AT 50 - 60t	Euro II	1997	2001	1	1	1	1	1	1	1	1	1	1	1
Heavy Duty Vehicles	Diesel TT/AT 50 - 60t	Euro IV	2007	2009									1	1	1
Heavy Duty Vehicles	Diesel TT/AT >60t	Euro V	2010	2014										1	3
Buses	Gasoline Urban Buses	Conventional	0	9999	15	11	9	7	1	2	2	2	4	7	9
Buses	Diesel Urban Buses <15t	Conventional	0	1993	250	200	183	154	123	101	80	68	56	49	33
Buses	Diesel Urban Buses <15t	Euro I	1994	1996	124	118	118	96	106	88	84	75	57	53	28
Buses	Diesel Urban Buses <15t	Euro II	1997	2001	438	525	542	553	569	535	545	494	427	367	221
Buses	Diesel Urban Buses <15t	Euro III	2002	2006				56	155	248	378	461	438	433	416

Continued															
Sector	Subsector	Tech 2	FYear	LYear	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Buses	Diesel Urban Buses <15t	Euro IV	2007	2009									119	261	433
Buses	Diesel Urban Buses 15 - 18t	Conventional	0	1993	2012	1701	1506	1175	1030	880	758	621	538	451	329
Buses	Diesel Urban Buses 15 - 18t	Euro I	1994	1996	891	845	810	749	691	620	561	476	399	338	296
Buses	Diesel Urban Buses 15 - 18t	Euro II	1997	2001	817	1049	1165	1156	1136	1066	1061	1032	1002	919	851
Buses	Diesel Urban Buses 15 - 18t	Euro III	2002	2006				288	456	596	733	991	992	989	962
Buses	Diesel Urban Buses 15 - 18t	Euro IV	2007	2009									107	327	624
Buses	Diesel Urban Buses >18t	Conventional	0	1993	2	37	47	45	25	24	23	16	7	6	5
Buses	Diesel Urban Buses >18t	Euro I	1994	1996	2	28	44	52	51	42	44	44	23	6	4
Buses	Diesel Urban Buses >18t	Euro II	1997	2001	20	106	220	225	224	218	217	215	213	161	147
Buses	Diesel Urban Buses >18t	Euro III	2002	2006				135	228	337	388	448	439	414	398
Buses	Diesel Urban Buses >18t	Euro IV	2007	2009									124	247	338
Buses	Gasoline Coaches	Conventional	0	9999	1810	1796	1788	1763	1722	1663	1586	1521	1422	1306	1186
Buses	Diesel Coaches <15t	Conventional	0	1993	4629	4340	3989	3649	3360	3029	2726	2438	2162	1928	1661
Buses	Diesel Coaches <15t	Euro I	1994	1996	1056	1079	1053	1031	982	956	920	873	814	732	664
Buses	Diesel Coaches <15t	Euro II	1997	2001	1039	1347	1658	1694	1740	1908	2023	2144	2144	2078	2010
Buses	Diesel Coaches <15t	Euro III	2002	2006				253	482	751	1052	1351	1423	1439	1463
Buses	Diesel Coaches <15t	Euro IV	2007	2009									227	478	790
Buses	Diesel Coaches 15 - 18t	Conventional	0	1993	1184	1133	1061	1013	957	914	847	758	682	598	520
Buses	Diesel Coaches 15 - 18t	Euro I	1994	1996	159	148	161	173	176	176	184	177	177	176	184
Buses	Diesel Coaches 15 - 18t	Euro II	1997	2001	119	173	208	221	220	230	240	238	236	226	245
Buses	Diesel Coaches 15 - 18t	Euro III	2002	2006				19	46	61	71	90	81	99	106
Buses	Diesel Coaches 15 - 18t	Euro IV	2007	2009									11	38	69
Buses	Diesel Coaches >18t	Conventional	0	1993	206	192	177	157	142	138	121	92	77	56	49
Buses	Diesel Coaches >18t	Euro I	1994	1996	81	78	76	79	74	70	65	60	56	49	46
Buses	Diesel Coaches >18t	Euro II	1997	2001	99	145	190	196	201	192	192	202	199	173	164
Buses	Diesel Coaches >18t	Euro III	2002	2006				32	92	152	230	293	302	312	321
Buses	Diesel Coaches >18t	Euro IV	2007	2009									55	114	180
Mopeds	<50 cm³	Conventional	0	1999	150833	143607	136249	128209	120305	112262	103829	94855	86621	78814	71067
Mopeds	<50 cm³	Euro I	2000	2003		16393	28751	42791	48695	46069	43455	40746	37826	35231	32572
Mopeds	<50 cm³	Euro II	2004	9999						10669	21715	33399	44553	50954	56361
Motorcycles	2-stroke >50 cm³	Conventional	0	1999	10385	11054	11367	11582	11850	12326	13158	14241	15400	15790	15474
Motorcycles	4-stroke <250 cm³	Conventional	0	1999	11769	11909	12331	12662	13098	13716	14486	15411	16311	16873	17111
Motorcycles	4-stroke <250 cm³	Euro I	2000	2003		619	1074	1568	2088	2087	2144	2240	2373	2462	2488

Continued

Sector	Subsector	Tech 2	FYear	LYear	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Motorcycles	4-stroke <250 cm³	Euro II	2004	2006						694	1791	3236	3221	3196	3132
Motorcycles	4-stroke <250 cm³	Euro III	2007	9999									1798	3021	3649
Motorcycles	4-stroke 250 - 750 cm³	Conventional	0	1999	32365	32749	33910	34821	36019	37720	39837	42380	44855	46402	47054
Motorcycles	4-stroke 250 - 750 cm³	Euro I	2000	2003		1703	2953	4311	5742	5739	5897	6159	6527	6769	6843
Motorcycles	4-stroke 250 - 750 cm³	Euro II	2004	2006						1910	4925	8898	8857	8788	8614
Motorcycles	4-stroke 250 - 750 cm³	Euro III	2007	9999									4945	8307	10034
Motorcycles	4-stroke >750 cm³	Conventional	0	1999	14712	14886	15414	15828	16372	17146	18108	19264	20388	21092	21388
Motorcycles	4-stroke >750 cm³	Euro I	2000	2003		774	1342	1960	2610	2609	2681	2800	2967	3077	3110
Motorcycles	4-stroke >750 cm³	Euro II	2004	2006						868	2239	4045	4026	3995	3915
Motorcycles	4-stroke >750 cm³	Euro III	2007	9999									2248	3776	4561

Annex 2B-2: Mileage data 1985-2008 for road transport (km)

Sector	Subsector	Tech 2	FYear	LYear	1985	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Passenger Cars	Gasoline <1,4 l	PRE ECE	0	1969	6907	5043	5026	4950	4679	4510	4050	3625	3339	3054	2747
Passenger Cars	Gasoline <1,4 l	ECE 15/00-01	1970	1978	11968	9137	9327	9478	9117	8947	8066	7255	6696	6094	5471
Passenger Cars	Gasoline <1,4 l	ECE 15/02	1979	1980	15850	12204	12142	11974	11354	11114	10033	9045	8392	7711	7039
Passenger Cars	Gasoline <1,4 l	ECE 15/03	1981	1985	18179	15219	15478	15584	14975	14720	13316	12044	11235	10415	9514
Passenger Cars	Gasoline <1,4 l	ECE 15/04	1986	1990		19323	21341	20854	19640	19212	17350	15653	14556	13449	12243
Passenger Cars	Gasoline <1,4 l	Euro I	1991	1996			13096	20237	22145	22169	22091	21178	21989	20253	18402
Passenger Cars	Gasoline <1,4 l	Euro II	1997	2000									13680	19685	20308
Passenger Cars	Gasoline <1,4 l	Euro III	2001	2005											
Passenger Cars	Gasoline <1,4 l	Euro IV	2006	2010											
Passenger Cars	Gasoline 1,4 - 2,0 l	PRE ECE	0	1969	8172	6123	6124	6108	5833	5622	5042	4506	4142	3783	3396
Passenger Cars	Gasoline 1,4 - 2,0 l	ECE 15/00-01	1970	1978	14483	10984	11174	11359	10900	10716	9667	8703	8046	7336	6599
Passenger Cars	Gasoline 1,4 - 2,0 l	ECE 15/02	1979	1980	19318	14872	14796	14633	13850	13560	12245	11045	10250	9423	8597
Passenger Cars	Gasoline 1,4 - 2,0 l	ECE 15/03	1981	1985	21865	18617	18862	18978	18232	17905	16193	14643	13653	12640	11528
Passenger Cars	Gasoline 1,4 - 2,0 l	ECE 15/04	1986	1990		23276	26553	25869	24262	23731	21429	19332	17974	16600	15108
Passenger Cars	Gasoline 1,4 - 2,0 l	Euro I	1991	1996			16068	24258	26466	26596	26680	25610	27384	25212	22891
Passenger Cars	Gasoline 1,4 - 2,0 l	Euro II	1997	2000									16692	23292	25175
Passenger Cars	Gasoline 1,4 - 2,0 l	Euro III	2001	2005											
Passenger Cars	Gasoline 1,4 - 2,0 l	Euro IV	2006	2010											
Passenger Cars	Gasoline >2,0 l	PRE ECE	0	1969	9819	7341	7282	7174	6790	6622	5947	5324	4906	4494	4048
Passenger Cars	Gasoline >2,0 l	ECE 15/00-01	1970	1978	16756	12973	13275	13434	13043	12744	11488	10349	9573	8824	7995
Passenger Cars	Gasoline >2,0 l	ECE 15/02	1979	1980	24176	18448	18271	18062	17294	16929	15298	13790	12813	11805	10719
Passenger Cars	Gasoline >2,0 l	ECE 15/03	1981	1985	27345	23861	23772	23416	22198	21735	19605	17677	16447	15178	13812
Passenger Cars	Gasoline >2,0 l	ECE 15/04	1986	1990		28892	34037	33006	30993	30349	27364	24628	22878	21130	19226
Passenger Cars	Gasoline >2,0 l	Euro I	1991	1996			20267	30098	32800	33759	32656	31714	33886	31144	28248
Passenger Cars	Gasoline >2,0 l	Euro II	1997	2000									20682	28448	29808
Passenger Cars	Gasoline >2,0 l	Euro III	2001	2005											
Passenger Cars	Gasoline >2,0 l	Euro IV	2006	2010											
Passenger Cars	Diesel <2,0 l	Conventional	0	1990	29011	34689	35526	33499	32324	33027	30452	28522	26903	24831	22984
Passenger Cars	Diesel <2,0 l	Euro I	1991	1996			58705	75310	68926	59883	55674	53640	53892	45454	39745
Passenger Cars	Diesel <2,0 l	Euro II	1997	2000									36205	45397	43665
Passenger Cars	Diesel <2,0 l	Euro III	2001	2005											
Passenger Cars	Diesel <2,0 l	Euro IV	2006	2010											
Passenger Cars	Diesel >2,0 l	Conventional	0	1990	41740	47927	47979	41188	36786	36554	33125	30707	28615	26354	24470
Passenger Cars	Diesel >2,0 l	Euro I	1991	1996			66364	88552	85830	86568	81054	74707	73714	56528	45889

Continued

Sector	Subsector	Tech 2	FYear	LYear	1985	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Passenger Cars	Diesel >2,0 l	Euro II	1997	2000									57092	75623	69126
Passenger Cars	Diesel >2,0 l	Euro III	2001	2005											
Passenger Cars	Diesel >2,0 l	Euro IV	2006	2010											
Passenger Cars	LPG cars	Conventional	0	1990	19464	20345	21568	22731	23108	22963	20947	19087	17931	16544	15320
Passenger Cars	LPG cars	Euro I	1991	1996				50914	46268	45030	44086	39075	36267	33419	34913
Passenger Cars	LPG cars	Euro II	1997	2000											
Passenger Cars	LPG cars	Euro III	2001	2005											
Passenger Cars	LPG cars	Euro IV	2006	2010											
Passenger Cars	2-Stroke	Conventional	0	9999	17848	15403	15367	15207	14524	14218	12830	11561	10731	9888	8983
Passenger Cars	Electric cars	Conventional	0	9999	11674	12362	13128	13863	14135	17181	16301	14937	14412	13477	13754
Light Duty Vehicles	Gasoline <3,5t	Conventional	0	1994	17906	16929	17341	18014	18128	18991	18769	17601	16819	16116	15223
Light Duty Vehicles	Gasoline <3,5t	Euro I	1995	1998							15012	20957	21784	21913	24279
Light Duty Vehicles	Gasoline <3,5t	Euro II	1999	2001											14138
Light Duty Vehicles	Gasoline <3,5t	Euro III	2002	2006											
Light Duty Vehicles	Gasoline <3,5t	Euro IV	2007	2011											
Light Duty Vehicles	Diesel <3,5t	Conventional	0	1994	26193	28584	28610	27369	26659	27465	27145	25694	24311	22747	21465
Light Duty Vehicles	Diesel <3,5t	Euro I	1995	1998							21254	29902	31637	32234	34863
Light Duty Vehicles	Diesel <3,5t	Euro II	1999	2001											20419
Light Duty Vehicles	Diesel <3,5t	Euro III	2002	2006											
Light Duty Vehicles	Diesel <3,5t	Euro IV	2007	2011											
Light Duty Vehicles	LPG <3,5t	Conventional	0	1994	16938	16004	16392	17027	17134	17053	15936	15341	14676	13975	13056
Light Duty Vehicles	LPG <3,5t	Euro I	1995	1998										18616	34065
Light Duty Vehicles	LPG <3,5t	Euro II	1999	2001											
Light Duty Vehicles	LPG <3,5t	Euro III	2002	2006											
Light Duty Vehicles	LPG <3,5t	Euro IV	2007	2011											
Light Duty Vehicles	Electric <3,5t	Conventional	0	9999	8358	7906	8099	8414	8467	8721	6946	6326	8444	7860	7192
Heavy Duty Vehicles	Gasoline >3,5t	Conventional	0	9999	21185	19218	20687	21192	19552	18714	18826	17889	16872	15945	16019
Heavy Duty Vehicles	Diesel RT 3,5 - 7,5t	Conventional	0	1993	28489	27516	29674	26423	22217	21568	23078	21294	19711	18515	16946
Heavy Duty Vehicles	Diesel RT 3,5 - 7,5t	Euro I	1994	1996					18543	21249	30004	31328	33438	31008	28133
Heavy Duty Vehicles	Diesel RT 3,5 - 7,5t	Euro II	1997	2001								19896	22230	26001	28933
Heavy Duty Vehicles	Diesel RT 3,5 - 7,5t	Euro III	2002	2006											
Heavy Duty Vehicles	Diesel RT 3,5 - 7,5t	Euro IV	2007	2009											
Heavy Duty Vehicles	Diesel RT 3,5 - 7,5t	Euro V	2010	2014											
Heavy Duty Vehicles	Diesel RT 7,5 - 12t	Conventional	0	1993	31961	30806	33214	29580	24874	24239	26079	24008	22252	20992	19211
Heavy Duty Vehicles	Diesel RT 7,5 - 12t	Euro I	1994	1996					21299	24364	33019	35847	38609	35795	32401
Heavy Duty Vehicles	Diesel RT 7,5 - 12t	Euro II	1997	2001								22851	26526	32326	32922

Continued															
Sector	Subsector	Tech 2	FYear	LYear	1985	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Heavy Duty Vehicles	Diesel RT 7,5 - 12t	Euro III	2002	2006											
Heavy Duty Vehicles	Diesel RT 7,5 - 12t	Euro IV	2007	2009											
Heavy Duty Vehicles	Diesel RT 7,5 - 12t	Euro V	2010	2014											
Heavy Duty Vehicles	Diesel RT 12 - 14 t	Conventional	0	1993	25877	28475	30802	29330	24928	27370	27560	22693	21569	21360	23180
Heavy Duty Vehicles	Diesel RT 12 - 14 t	Euro I	1994	1996					20135	27131	37510	34109	36256	35361	37717
Heavy Duty Vehicles	Diesel RT 12 - 14 t	Euro II	1997	2001								21162	24109	33196	42058
Heavy Duty Vehicles	Diesel RT 12 - 14 t	Euro III	2002	2006											
Heavy Duty Vehicles	Diesel RT 12 - 14 t	Euro IV	2007	2009											
Heavy Duty Vehicles	Diesel RT 12 - 14 t	Euro V	2010	2014											
Heavy Duty Vehicles	Diesel RT 14 - 20t	Conventional	0	1993	43123	47463	51343	48889	41597	46256	46862	38626	36833	36540	39384
Heavy Duty Vehicles	Diesel RT 14 - 20t	Euro I	1994	1996					32702	42814	55395	53902	59953	58503	62305
Heavy Duty Vehicles	Diesel RT 14 - 20t	Euro II	1997	2001								34370	39917	53206	62992
Heavy Duty Vehicles	Diesel RT 14 - 20t	Euro III	2002	2006											
Heavy Duty Vehicles	Diesel RT 14 - 20t	Euro IV	2007	2009											
Heavy Duty Vehicles	Diesel RT 14 - 20t	Euro V	2010	2014											
Heavy Duty Vehicles	Diesel RT 20 - 26t	Conventional	0	1993	68020	74853	70503	74452	71279	70963	69361	67502	59893	59066	52034
Heavy Duty Vehicles	Diesel RT 20 - 26t	Euro I	1994	1996					54333	61972	79388	90107	94480	92004	80208
Heavy Duty Vehicles	Diesel RT 20 - 26t	Euro II	1997	2001								58025	63576	82755	81264
Heavy Duty Vehicles	Diesel RT 20 - 26t	Euro III	2002	2006											
Heavy Duty Vehicles	Diesel RT 20 - 26t	Euro IV	2007	2009											
Heavy Duty Vehicles	Diesel RT 20 - 26t	Euro V	2010	2014											
Heavy Duty Vehicles	Diesel RT 26 - 28t	Conventional	0	1993	69652	76490	72488	76202	73014	75843	73940	73891	64235	62130	53609
Heavy Duty Vehicles	Diesel RT 26 - 28t	Euro I	1994	1996							104447	80548	100483	96533	83881
Heavy Duty Vehicles	Diesel RT 26 - 28t	Euro II	1997	2001								60568	72633	74350	84741
Heavy Duty Vehicles	Diesel RT 26 - 28t	Euro III	2002	2006											
Heavy Duty Vehicles	Diesel RT 26 - 28t	Euro IV	2007	2009											
Heavy Duty Vehicles	Diesel RT 26 - 28t	Euro V	2010	2014											
Heavy Duty Vehicles	Diesel RT 28 - 32t	Conventional	0	1993	77080	84647	80218	84328	81593	83975	80793	77637	68838	68165	60141
Heavy Duty Vehicles	Diesel RT 28 - 32t	Euro I	1994	1996					58007	67906	80845	92147	98676	95441	82968
Heavy Duty Vehicles	Diesel RT 28 - 32t	Euro II	1997	2001								60568	65681	83341	81390
Heavy Duty Vehicles	Diesel RT 28 - 32t	Euro III	2002	2006											
Heavy Duty Vehicles	Diesel RT 28 - 32t	Euro IV	2007	2009											
Heavy Duty Vehicles	Diesel RT 28 - 32t	Euro V	2010	2014											
Heavy Duty Vehicles	Diesel RT >32t	Conventional	0	1993	56514	62062	58815	61828	59241	56136	74920	50562	43948	70726	61456
Heavy Duty Vehicles	Diesel RT >32t	Euro I	1994	1996							59737	90679	102604	99241	80050
Heavy Duty Vehicles	Diesel RT >32t	Euro II	1997	2001								60568	72981	101839	54129

Continued

Sector	Subsector	Tech 2	FYear	LYear	1985	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Heavy Duty Vehicles	Diesel RT >32t	Euro III	2002	2006											
Heavy Duty Vehicles	Diesel RT >32t	Euro IV	2007	2009											
Heavy Duty Vehicles	Diesel RT >32t	Euro V	2010	2014											
Heavy Duty Vehicles	Diesel TT/AT 28 - 34t	Conventional	0	1993	56367	62687	68231	64989	56316	62646	63493	52517	50375	49967	53295
Heavy Duty Vehicles	Diesel TT/AT 28 - 34t	Euro I	1994	1996					44090	57832	75090	72818	81104	79511	84078
Heavy Duty Vehicles	Diesel TT/AT 28 - 34t	Euro II	1997	2001								46341	53919	72247	84966
Heavy Duty Vehicles	Diesel TT/AT 28 - 34t	Euro III	2002	2006											
Heavy Duty Vehicles	Diesel TT/AT 28 - 34t	Euro IV	2007	2009											
Heavy Duty Vehicles	Diesel TT/AT 28 - 34t	Euro V	2010	2014											
Heavy Duty Vehicles	Diesel TT/AT 34 - 40t	Conventional	0	1993	90452	96878	92986	89230	90636	94470	88445	89361	83697	79698	72073
Heavy Duty Vehicles	Diesel TT/AT 34 - 40t	Euro I	1994	1996					63260	73977	87341	107949	124745	114681	107365
Heavy Duty Vehicles	Diesel TT/AT 34 - 40t	Euro II	1997	2001								69102	84745	99437	107874
Heavy Duty Vehicles	Diesel TT/AT 34 - 40t	Euro III	2002	2006											
Heavy Duty Vehicles	Diesel TT/AT 34 - 40t	Euro IV	2007	2009											
Heavy Duty Vehicles	Diesel TT/AT 34 - 40t	Euro V	2010	2014											
Heavy Duty Vehicles	Diesel TT/AT 40 - 50t	Conventional	0	1993	179307	183696	178227	163726	167408	170494	149580	140464	131102	116618	104431
Heavy Duty Vehicles	Diesel TT/AT 40 - 50t	Euro I	1994	1996					122670	140305	150612	173364	191900	167697	148315
Heavy Duty Vehicles	Diesel TT/AT 40 - 50t	Euro II	1997	2001								112336	126762	144731	144062
Heavy Duty Vehicles	Diesel TT/AT 40 - 50t	Euro III	2002	2006											
Heavy Duty Vehicles	Diesel TT/AT 40 - 50t	Euro IV	2007	2009											
Heavy Duty Vehicles	Diesel TT/AT 40 - 50t	Euro V	2010	2014											
Heavy Duty Vehicles	Diesel TT/AT 50 - 60t	Euro I	1994	1996								200011	188890	160987	146272
Heavy Duty Vehicles	Diesel TT/AT 50 - 60t	Euro II	1997	2001										98475	178948
Heavy Duty Vehicles	Diesel TT/AT 50 - 60t	Euro IV	2007	2009											
Heavy Duty Vehicles	Diesel TT/AT >60t	Euro V	2010	2014											
Buses	Gasoline Urban Buses	Conventional	0	9999	28159	27652	22943	21032	16607	24925	22599	18797	20979	20295	17881
Buses	Diesel Urban Buses <15t	Conventional	0	1993	160776	181917	147471	124484	95132	103097	95437	90536	84863	81528	72794
Buses	Diesel Urban Buses <15t	Euro I	1994	1996						81399	121211	123538	135479	127203	112832
Buses	Diesel Urban Buses <15t	Euro II	1997	2001									77522	102227	114891
Buses	Diesel Urban Buses <15t	Euro III	2002	2006											
Buses	Diesel Urban Buses <15t	Euro IV	2007	2009											
Buses	Diesel Urban Buses 15 - 18t	Conventional	0	1993	153193	173553	140699	118773	90772	98878	91592	88390	82130	78165	71412
Buses	Diesel Urban Buses 15 - 18t	Euro I	1994	1996						81399	121740	118929	135400	127434	112378
Buses	Diesel Urban Buses 15 - 18t	Euro II	1997	2001									77522	99858	115558

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Sector	Subsector	Tech 2	FYear	LYear	1985	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Buses	Diesel Urban Buses 15 - 18t	Euro III	2002	2006											
Buses	Diesel Urban Buses 15 - 18t	Euro IV	2007	2009											
Buses	Diesel Urban Buses >18t	Conventional	0	1993	195753	221769	179787	151771	115990	127646	112591	102807	101414	83892	65303
Buses	Diesel Urban Buses >18t	Euro I	1994	1996						81399	147469	98792	138888	129877	119572
Buses	Diesel Urban Buses >18t	Euro II	1997	2001										77532	92231
Buses	Diesel Urban Buses >18t	Euro III	2002	2006											
Buses	Diesel Urban Buses >18t	Euro IV	2007	2009											
Buses	Gasoline Coaches	Conventional	0	9999	17020	17278	14388	13247	12255	13317	16473	18291	17701	17003	15971
Buses	Diesel Coaches <15t	Conventional	0	1993	28681	33618	27356	23196	20774	21886	25445	29138	28175	26656	25368
Buses	Diesel Coaches <15t	Euro I	1994	1996						15520	29058	34127	40990	38089	35548
Buses	Diesel Coaches <15t	Euro II	1997	2001									23371	33700	35523
Buses	Diesel Coaches <15t	Euro III	2002	2006											
Buses	Diesel Coaches <15t	Euro IV	2007	2009											
Buses	Diesel Coaches 15 - 18t	Conventional	0	1993	38594	45259	36830	31230	27970	26208	31086	36029	34942	33063	31667
Buses	Diesel Coaches 15 - 18t	Euro I	1994	1996						25531	43047	56568	67683	62822	58714
Buses	Diesel Coaches 15 - 18t	Euro II	1997	2001									38448	57217	58225
Buses	Diesel Coaches 15 - 18t	Euro III	2002	2006											
Buses	Diesel Coaches 15 - 18t	Euro IV	2007	2009											
Buses	Diesel Coaches >18t	Conventional	0	1993	82792	97099	79016	67004	60009	58557	67805	78201	74964	70678	65934
Buses	Diesel Coaches >18t	Euro I	1994	1996						40618	68552	88070	108218	100521	93954
Buses	Diesel Coaches >18t	Euro II	1997	2001									61166	84308	87891
Buses	Diesel Coaches >18t	Euro III	2002	2006											
Buses	Diesel Coaches >18t	Euro IV	2007	2009											
Mopeds	<50 cm^3	Conventional	0	1999	2335	2213	2312	2430	2498	2549	2499	2463	2487	2510	2137
Mopeds	<50 cm^3	Euro I	2000	2003											
Mopeds	<50 cm^3	Euro II	2004	9999											
Motorcycles	2-stroke >50 cm^3	Conventional	0	1999	6703	6564	6578	6930	7126	7258	7214	6820	6522	6313	5944
Motorcycles	4-stroke <250 cm^3	Conventional	0	1999	6703	6564	6578	6930	7126	7258	7214	6820	6522	6313	5944
Motorcycles	4-stroke <250 cm^3	Euro I	2000	2003											
Motorcycles	4-stroke <250 cm^3	Euro II	2004	2006											
Motorcycles	4-stroke <250 cm^3	Euro III	2007	9999											
Motorcycles	4-stroke 250 - 750 cm^3	Conventional	0	1999	6703	6564	6578	6930	7126	7258	7214	6820	6522	6313	5944
Motorcycles	4-stroke 250 - 750 cm^3	Euro I	2000	2003											
Motorcycles	4-stroke 250 - 750 cm^3	Euro II	2004	2006											
Motorcycles	4-stroke 250 - 750 cm^3	Euro III	2007	9999											

Continued

Sector	Subsector	Tech 2	FYear	LYear	1985	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Motorcycles	4-stroke >750 cm³	Conventional	0	1999	6703	6564	6578	6930	7126	7258	7214	6820	6522	6313	5944
Motorcycles	4-stroke >750 cm³	Euro I	2000	2003											
Motorcycles	4-stroke >750 cm³	Euro II	2004	2006											
Motorcycles	4-stroke >750 cm³	Euro III	2007	9999											

Sector	Subsector	Tech 2	FYear	LYear	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Passenger Cars	Gasoline <1,4 l	PRE ECE	0	1969	2747	2508	2308	2206	2090	1973	1771	1613	1507	1381	1253
Passenger Cars	Gasoline <1,4 l	ECE 15/00-01	1970	1978	5471	4961	4521	4262	3989	3700	3271	2921	2690	2426	2183
Passenger Cars	Gasoline <1,4 l	ECE 15/02	1979	1980	7039	6473	5981	5707	5425	5104	4580	4151	3879	3548	3224
Passenger Cars	Gasoline <1,4 l	ECE 15/03	1981	1985	9514	8803	8151	7828	7420	7006	6266	5693	5302	4867	4412
Passenger Cars	Gasoline <1,4 l	ECE 15/04	1986	1990	12243	11311	10483	10099	9625	9146	8245	7523	7051	6484	5908
Passenger Cars	Gasoline <1,4 l	Euro I	1991	1996	18402	16935	15653	15004	14254	13464	12103	11030	10353	9538	8728
Passenger Cars	Gasoline <1,4 l	Euro II	1997	2000	20308	20524	21381	20475	19421	18335	16437	14932	13949	12779	11605
Passenger Cars	Gasoline <1,4 l	Euro III	2001	2005			12721	18243	20383	20163	19063	20966	19575	17930	16273
Passenger Cars	Gasoline <1,4 l	Euro IV	2006	2010								12435	18035	18618	18574
Passenger Cars	Gasoline 1,4 - 2,0 l	PRE ECE	0	1969	3396	3096	2846	2719	2575	2432	2185	1990	1864	1710	1553
Passenger Cars	Gasoline 1,4 - 2,0 l	ECE 15/00-01	1970	1978	6599	5998	5479	5176	4851	4509	3979	3550	3262	2933	2639
Passenger Cars	Gasoline 1,4 - 2,0 l	ECE 15/02	1979	1980	8597	7909	7310	6985	6640	6254	5612	5091	4758	4352	3956
Passenger Cars	Gasoline 1,4 - 2,0 l	ECE 15/03	1981	1985	11528	10654	9858	9466	8972	8472	7578	6885	6412	5876	5323
Passenger Cars	Gasoline 1,4 - 2,0 l	ECE 15/04	1986	1990	15108	13948	12926	12450	11866	11269	10156	9257	8665	7951	7233
Passenger Cars	Gasoline 1,4 - 2,0 l	Euro I	1991	1996	22891	21062	19466	18653	17711	16726	15025	13684	12828	11798	10774
Passenger Cars	Gasoline 1,4 - 2,0 l	Euro II	1997	2000	25175	25429	26034	24922	23634	22309	20002	18171	16964	15545	14120
Passenger Cars	Gasoline 1,4 - 2,0 l	Euro III	2001	2005			15584	22459	25515	25407	24109	25057	23273	21331	19381
Passenger Cars	Gasoline 1,4 - 2,0 l	Euro IV	2006	2010								15234	22188	23974	23613
Passenger Cars	Gasoline >2,0 l	PRE ECE	0	1969	4048	3681	3393	3255	3096	2941	2666	2458	2321	2141	1949
Passenger Cars	Gasoline >2,0 l	ECE 15/00-01	1970	1978	7995	7349	6808	6488	6122	5767	5072	4423	3968	3538	3174
Passenger Cars	Gasoline >2,0 l	ECE 15/02	1979	1980	10719	9886	9151	8763	8332	7851	7024	6366	5925	5410	4915
Passenger Cars	Gasoline >2,0 l	ECE 15/03	1981	1985	13812	12722	11770	11280	10707	10116	9072	8230	7676	7014	6360
Passenger Cars	Gasoline >2,0 l	ECE 15/04	1986	1990	19226	17731	16405	15739	14961	14156	12721	11574	10816	9916	9015
Passenger Cars	Gasoline >2,0 l	Euro I	1991	1996	28248	25969	23960	22908	21710	20509	18405	16728	15615	14301	12991
Passenger Cars	Gasoline >2,0 l	Euro II	1997	2000	29808	30484	32802	31384	29749	28083	25183	22869	21222	19458	17674
Passenger Cars	Gasoline >2,0 l	Euro III	2001	2005			19295	27607	30706	30611	29412	31355	28981	26568	24157
Passenger Cars	Gasoline >2,0 l	Euro IV	2006	2010								18820	27581	29879	29664

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Sector	Subsector	Tech 2	FYear	LYear	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Passenger Cars	Diesel <2,0 l	Conventional	0	1990	22984	20413	18555	17390	17181	16617	14973	13554	12722	11207	9841
Passenger Cars	Diesel <2,0 l	Euro I	1991	1996	39745	34340	30595	28254	27539	26366	23619	21295	19869	17354	15089
Passenger Cars	Diesel <2,0 l	Euro II	1997	2000	43665	42519	46889	42625	41323	39699	35609	32143	29276	25588	22193
Passenger Cars	Diesel <2,0 l	Euro III	2001	2005			27291	36640	42493	43100	41210	44239	39807	34780	30202
Passenger Cars	Diesel <2,0 l	Euro IV	2006	2010								26589	34964	35682	35554
Passenger Cars	Diesel >2,0 l	Conventional	0	1990	24470	21664	19592	18431	18260	17829	16157	14671	13649	11926	10314
Passenger Cars	Diesel >2,0 l	Euro I	1991	1996	45889	38625	34189	31506	30675	29398	26321	23743	22169	19313	16694
Passenger Cars	Diesel >2,0 l	Euro II	1997	2000	69126	62306	62300	50218	44733	41577	36785	32952	29888	26016	22503
Passenger Cars	Diesel >2,0 l	Euro III	2001	2005			41466	56508	61814	58099	53205	53089	42785	35851	30811
Passenger Cars	Diesel >2,0 l	Euro IV	2006	2010								35507	47027	49665	44936
Passenger Cars	LPG cars	Conventional	0	1990	15320	14866	14422	13285	11658	11539	10337	9384	8024	6750	5934
Passenger Cars	LPG cars	Euro I	1991	1996	34913	28799	29589	27081	26832	27566	24709	21526	19252	17628	15994
Passenger Cars	LPG cars	Euro II	1997	2000				31455	33289	27200	24121	21713			18936
Passenger Cars	LPG cars	Euro III	2001	2005									28390	25717	27475
Passenger Cars	LPG cars	Euro IV	2006	2010											23424
Passenger Cars	2-Stroke	Conventional	0	9999	8983	8258	7623	7303	6929	6541					
Passenger Cars	Electric cars	Conventional	0	9999	13754	13359	13003	12725	12090	11361	10275	9463	9006	8918	9285
Light Duty Vehicles	Gasoline <3,5t	Conventional	0	1994	15223	14636	14079	13500	12822	11941	10679	9634	8959	8265	7575
Light Duty Vehicles	Gasoline <3,5t	Euro I	1995	1998	24279	22857	21458	20231	18958	17534	15569	14030	13102	12280	11476
Light Duty Vehicles	Gasoline <3,5t	Euro II	1999	2001	14138	20924	21951	25211	23599	21798	19327	17406	16229	15197	14174
Light Duty Vehicles	Gasoline <3,5t	Euro III	2002	2006				14417	20347	20918	20541	20359	21701	20334	18950
Light Duty Vehicles	Gasoline <3,5t	Euro IV	2007	2011									13013	22320	22316
Light Duty Vehicles	Diesel <3,5t	Conventional	0	1994	21465	19584	18243	16981	16697	15920	14286	12811	11990	10680	9492
Light Duty Vehicles	Diesel <3,5t	Euro I	1995	1998	34863	31247	28518	26174	25416	24038	21412	19209	17984	16041	14268
Light Duty Vehicles	Diesel <3,5t	Euro II	1999	2001	20419	27851	29308	32873	31896	30141	26794	24024	22470	20038	17787
Light Duty Vehicles	Diesel <3,5t	Euro III	2002	2006				18744	27845	28927	28021	27155	30323	27096	24061
Light Duty Vehicles	Diesel <3,5t	Euro IV	2007	2011									17908	26542	27222
Light Duty Vehicles	LPG <3,5t	Conventional	0	1994	13056	12728	12258	11299	10099	8366	6532	6312	5536	4387	4201
Light Duty Vehicles	LPG <3,5t	Euro I	1995	1998	34065	32069	30119								
Light Duty Vehicles	LPG <3,5t	Euro II	1999	2001		18341				30037	25519	23977	22403	20975	18732
Light Duty Vehicles	LPG <3,5t	Euro III	2002	2006								24719	27787	26732	25224
Light Duty Vehicles	LPG <3,5t	Euro IV	2007	2011									16765	26525	30280
Light Duty Vehicles	Electric <3,5t	Conventional	0	9999	7192	6770								9275	8787
Heavy Duty Vehicles	Gasoline >3,5t	Conventional	0	9999	16019	15493	16676	17806	16919	16518	14653	15671	17689	16019	14957
Heavy Duty Vehicles	Diesel RT 3,5 - 7,5t	Conventional	0	1993	16946	16153	16989	15554	15174	15045	11466	10078	9612	7771	6040
Heavy Duty Vehicles	Diesel RT 3,5 - 7,5t	Euro I	1994	1996	28133	26535	27670	25270	24653	24420	18721	16791	16297	13484	10784

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Sector	Subsector	Tech 2	FYear	LYear	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Heavy Duty Vehicles	Diesel RT 3,5 - 7,5t	Euro II	1997	2001	28933	30173	33976	32474	31683	31361	24133	21676	20953	17649	14125
Heavy Duty Vehicles	Diesel RT 3,5 - 7,5t	Euro III	2002	2006			20988	26565	32250	35054	28231	27689	28887	24013	19227
Heavy Duty Vehicles	Diesel RT 3,5 - 7,5t	Euro IV	2007	2009								17575	20478	22672	22594
Heavy Duty Vehicles	Diesel RT 3,5 - 7,5t	Euro V	2010	2014									18145	21620	16183
Heavy Duty Vehicles	Diesel RT 7,5 - 12t	Conventional	0	1993	19211	18423	19271	17738	17318	17223	13049	11550	10970	8863	7110
Heavy Duty Vehicles	Diesel RT 7,5 - 12t	Euro I	1994	1996	32401	30753	31801	29193	28211	28040	21302	19089	18427	15361	12723
Heavy Duty Vehicles	Diesel RT 7,5 - 12t	Euro II	1997	2001	32922	34378	38552	37442	36459	36375	27765	24933	24097	20575	17052
Heavy Duty Vehicles	Diesel RT 7,5 - 12t	Euro III	2002	2006			24498	31333	38240	40030	32128	31075	33068	28004	23326
Heavy Duty Vehicles	Diesel RT 7,5 - 12t	Euro IV	2007	2009			23979	43961	37542	37294	25898	20599	24897	27003	28163
Heavy Duty Vehicles	Diesel RT 7,5 - 12t	Euro V	2010	2014					37206	36959	28085	22668	21305	22281	23758
Heavy Duty Vehicles	Diesel RT 12 - 14 t	Conventional	0	1993	23180	17709	17743	16172	15830	15326	13791	12346	11754	9723	7609
Heavy Duty Vehicles	Diesel RT 12 - 14 t	Euro I	1994	1996	37717	28471	28400	25660	25163	24249	21873	19696	18690	15540	12253
Heavy Duty Vehicles	Diesel RT 12 - 14 t	Euro II	1997	2001	42058	33239	35046	32043	31499	30428	27607	24972	23909	20175	15805
Heavy Duty Vehicles	Diesel RT 12 - 14 t	Euro III	2002	2006			22052	27914	34134	34579	32312	32899	34142	28620	22578
Heavy Duty Vehicles	Diesel RT 12 - 14 t	Euro IV	2007	2009						37505	33839	25324	22896	26712	25936
Heavy Duty Vehicles	Diesel RT 12 - 14 t	Euro V	2010	2014										19230	26178
Heavy Duty Vehicles	Diesel RT 14 - 20t	Conventional	0	1993	39384	29954	29942	27217	26890	25963	23558	21080	19988	16510	12869
Heavy Duty Vehicles	Diesel RT 14 - 20t	Euro I	1994	1996	62305	46987	46696	42342	41766	40384	36436	32750	31223	25877	20380
Heavy Duty Vehicles	Diesel RT 14 - 20t	Euro II	1997	2001	62992	52561	57348	54322	53522	51752	46827	42199	40418	34116	26940
Heavy Duty Vehicles	Diesel RT 14 - 20t	Euro III	2002	2006			36816	47376	54021	58042	55288	53433	56311	47025	37105
Heavy Duty Vehicles	Diesel RT 14 - 20t	Euro IV	2007	2009			35496	55294	56391	62520	47694	38317	41350	47116	44909
Heavy Duty Vehicles	Diesel RT 14 - 20t	Euro V	2010	2014							35955	39286	40909	41332	39078
Heavy Duty Vehicles	Diesel RT 20 - 26t	Conventional	0	1993	52034	48784	42643	39593	39050	37481	33324	29756	28873	23604	18829
Heavy Duty Vehicles	Diesel RT 20 - 26t	Euro I	1994	1996	80208	74190	64232	59346	58498	55750	49488	44263	43129	35448	28621
Heavy Duty Vehicles	Diesel RT 20 - 26t	Euro II	1997	2001	81264	83315	78717	75696	74690	71344	63391	56807	55509	46407	37555
Heavy Duty Vehicles	Diesel RT 20 - 26t	Euro III	2002	2006			50076	63427	76848	79855	74740	72241	79086	65449	53105
Heavy Duty Vehicles	Diesel RT 20 - 26t	Euro IV	2007	2009			48983	84353	88921	79153	51634	56409	57100	64341	62710
Heavy Duty Vehicles	Diesel RT 20 - 26t	Euro V	2010	2014							49022	59839	57144	57196	54311
Heavy Duty Vehicles	Diesel RT 26 - 28t	Conventional	0	1993	53609	50997	43580	41765	39906	37863	34287	29658	28641	23599	18292
Heavy Duty Vehicles	Diesel RT 26 - 28t	Euro I	1994	1996	83881	76507	64409	60665	58979	54944	53762	46227	44643	36492	31114
Heavy Duty Vehicles	Diesel RT 26 - 28t	Euro II	1997	2001	84741	91344	79662	74674	72598	69481	63108	54264	52064	44479	34695
Heavy Duty Vehicles	Diesel RT 26 - 28t	Euro III	2002	2006					52319	64639	86216	83003	80157	65522	53315
Heavy Duty Vehicles	Diesel RT 26 - 28t	Euro IV	2007	2009									48987	71594	67431
Heavy Duty Vehicles	Diesel RT 26 - 28t	Euro V	2010	2014									48987	80087	65166
Heavy Duty Vehicles	Diesel RT 28 - 32t	Conventional	0	1993	60141	55679	48588	45446	43906	42120	38430	33582	31783	26181	20948
Heavy Duty Vehicles	Diesel RT 28 - 32t	Euro I	1994	1996	82968	75768	65876	62280	60792	57511	52159	44818	43114	35113	28729

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Sector	Subsector	Tech 2	FYear	LYear	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Heavy Duty Vehicles	Diesel RT 28 - 32t	Euro II	1997	2001	81390	80921	80349	81290	79404	75568	68757	59408	57589	48115	39423
Heavy Duty Vehicles	Diesel RT 28 - 32t	Euro III	2002	2006			50491	67114	77491	81130	77643	71417	80573	66822	54663
Heavy Duty Vehicles	Diesel RT 28 - 32t	Euro IV	2007	2009				50317	67491	97129	53964	59067	57411	64566	63325
Heavy Duty Vehicles	Diesel RT 28 - 32t	Euro V	2010	2014								47429	54934	57646	55456
Heavy Duty Vehicles	Diesel RT >32t	Conventional	0	1993	61456	56930	52272	49233	29506	28060	25562	20218	19525	15960	
Heavy Duty Vehicles	Diesel RT >32t	Euro I	1994	1996	80050	70560	62408	63010	61258	58122	52791	45392	43836	35833	29157
Heavy Duty Vehicles	Diesel RT >32t	Euro II	1997	2001	54129	68116	90370	87977							
Heavy Duty Vehicles	Diesel RT >32t	Euro III	2002	2006			49949	94093	80937	85041	71024	64141	65351	57129	58102
Heavy Duty Vehicles	Diesel RT >32t	Euro IV	2007	2009									48987	80087	65166
Heavy Duty Vehicles	Diesel RT >32t	Euro V	2010	2014											65166
Heavy Duty Vehicles	Diesel TT/AT 28 - 34t	Conventional	0	1993	53295	38922	32473	29422	29713	30166	27179	26616	26748	24973	16784
Heavy Duty Vehicles	Diesel TT/AT 28 - 34t	Euro I	1994	1996	84078	60543	50244	45450	45881	46687	41913	41040	41616	39171	26799
Heavy Duty Vehicles	Diesel TT/AT 28 - 34t	Euro II	1997	2001	84966	67786	61810	58394	58854	59841	53827	52537	53512	51220	35156
Heavy Duty Vehicles	Diesel TT/AT 28 - 34t	Euro III	2002	2006			39585	50819	59298	67034	63515	66578	74674	70642	48414
Heavy Duty Vehicles	Diesel TT/AT 28 - 34t	Euro IV	2007	2009			38166	59313	61899	72154	54666	47802	54884	70940	58707
Heavy Duty Vehicles	Diesel TT/AT 28 - 34t	Euro V	2010	2014							41211	48818	54042	62039	51085
Heavy Duty Vehicles	Diesel TT/AT 34 - 40t	Conventional	0	1993	72073	64558	48148	43681	44268	44431	40409	40900	41052	40311	28023
Heavy Duty Vehicles	Diesel TT/AT 34 - 40t	Euro I	1994	1996	107365	95799	72582	65656	66419	66426	60475	60901	61035	58983	40743
Heavy Duty Vehicles	Diesel TT/AT 34 - 40t	Euro II	1997	2001	107874	104806	90497	85887	87511	87889	81043	82961	81406	80188	55173
Heavy Duty Vehicles	Diesel TT/AT 34 - 40t	Euro III	2002	2006			60313	75055	89898	98531	98018	113777	123585	123680	85543
Heavy Duty Vehicles	Diesel TT/AT 34 - 40t	Euro IV	2007	2009			54704	82664	104198	82680	70426	83526	85356	118021	98205
Heavy Duty Vehicles	Diesel TT/AT 34 - 40t	Euro V	2010	2014			56776	103364	105168		65024	87663	91138	122131	99175
Heavy Duty Vehicles	Diesel TT/AT 40 - 50t	Conventional	0	1993	104431	101476	114926	102603	94962	85488	75662	67070	59053	48131	46129
Heavy Duty Vehicles	Diesel TT/AT 40 - 50t	Euro I	1994	1996	148315	142311	161568	144626	134519	121881	108658	96350	86720	71181	71682
Heavy Duty Vehicles	Diesel TT/AT 40 - 50t	Euro II	1997	2001	144062	151404	198320	190450	178242	162017	145438	128386	114063	93609	93015
Heavy Duty Vehicles	Diesel TT/AT 40 - 50t	Euro III	2002	2006			126193	152220	171833	171463	166125	162178	165279	138141	140174
Heavy Duty Vehicles	Diesel TT/AT 40 - 50t	Euro IV	2007	2009			123985	140693	195700	197102	111866	121519	111377	130173	161836
Heavy Duty Vehicles	Diesel TT/AT 40 - 50t	Euro V	2010	2014			123985	170490	214023	195058	171983	106655	108526	125989	150541
Heavy Duty Vehicles	Diesel TT/AT 50 - 60t	Euro I	1994	1996	146272	140321	165680	148443	138194	125949	114909				
Heavy Duty Vehicles	Diesel TT/AT 50 - 60t	Euro II	1997	2001	178948	171668	202691	181603	169066	154085	140579	126501	111773	94269	96292
Heavy Duty Vehicles	Diesel TT/AT 50 - 60t	Euro IV	2007	2009									102330	172609	176313
Heavy Duty Vehicles	Diesel TT/AT >60t	Euro V	2010	2014										92304	130083
Buses	Gasoline Urban Buses	Conventional	0	9999	17881	15823	15743	15595	15006	13286	18347	18359	34570	31935	34782
Buses	Diesel Urban Buses <15t	Conventional	0	1993	72794	66146	60826	57543	55307	52192	48496	44291	41096	38348	32610
Buses	Diesel Urban Buses <15t	Euro I	1994	1996	112832	101749	92253	86054	82570	78273	71818	66943	63750	57120	49227
Buses	Diesel Urban Buses <15t	Euro II	1997	2001	114891	113814	110138	107090	103339	98231	89952	84302	80381	71816	63223

Continued

Sector	Subsector	Tech 2	FYear	LYear	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Buses	Diesel Urban Buses <15t	Euro III	2002	2006				67351	90904	107019	104611	106855	115870	103738	88843
Buses	Diesel Urban Buses <15t	Euro IV	2007	2009									70060	92204	92610
Buses	Diesel Urban Buses 15 - 18t	Conventional	0	1993	71412	65164	59597	56622	54814	52082	47901	45699	43693	39704	34659
Buses	Diesel Urban Buses 15 - 18t	Euro I	1994	1996	112378	100729	90853	84448	80724	76708	70404	66159	63196	56534	48811
Buses	Diesel Urban Buses 15 - 18t	Euro II	1997	2001	115558	110687	108855	109189	104975	99787	91374	85628	81892	73730	63603
Buses	Diesel Urban Buses 15 - 18t	Euro III	2002	2006				67351	107300	112453	108690	102169	114521	102938	88672
Buses	Diesel Urban Buses 15 - 18t	Euro IV	2007	2009									70060	86788	88600
Buses	Diesel Urban Buses >18t	Conventional	0	1993	65303	76734	70006	66212	63926	60217	56266	53110	49067	46046	36574
Buses	Diesel Urban Buses >18t	Euro I	1994	1996	119572	97997	89234	85077	81698	77586	71230	66673	65034	53661	45872
Buses	Diesel Urban Buses >18t	Euro II	1997	2001	92231	87827	98878	118634	113907	107934	99049	92507	88522	79220	68713
Buses	Diesel Urban Buses >18t	Euro III	2002	2006				67351	104529	107817	112631	108029	111653	100667	86922
Buses	Diesel Urban Buses >18t	Euro IV	2007	2009									70060	96699	98283
Buses	Gasoline Coaches	Conventional	0	9999	15971	15352	14868	14682	14149	13766	12926	12319	12174	11966	11288
Buses	Diesel Coaches <15t	Conventional	0	1993	25368	23169	21846	20959	20959	20726	19195	18144	17813	16610	14778
Buses	Diesel Coaches <15t	Euro I	1994	1996	35548	32129	29743	28216	27895	27396	25265	23752	23240	21691	19341
Buses	Diesel Coaches <15t	Euro II	1997	2001	35523	35631	35048	36620	36063	35348	32646	30780	30214	28259	25223
Buses	Diesel Coaches <15t	Euro III	2002	2006				22561	35324	38161	38371	38544	42168	39304	35027
Buses	Diesel Coaches <15t	Euro IV	2007	2009									25744	35854	36765
Buses	Diesel Coaches 15 - 18t	Conventional	0	1993	31667	29443	27570	26749	26784	26555	25037	23851	23664	22357	20308
Buses	Diesel Coaches 15 - 18t	Euro I	1994	1996	58714	53172	49088	46384	45870	44966	41451	38812	37965	35286	31526
Buses	Diesel Coaches 15 - 18t	Euro II	1997	2001	58225	57318	58475	60333	59741	58474	53620	50232	49157	45992	40988
Buses	Diesel Coaches 15 - 18t	Euro III	2002	2006				37115	53241	67461	65797	63728	67781	62845	55764
Buses	Diesel Coaches 15 - 18t	Euro IV	2007	2009									42351	53830	59674
Buses	Diesel Coaches >18t	Conventional	0	1993	65934	60505	56275	53918	53742	53378	49253	46460	45915	43254	38132
Buses	Diesel Coaches >18t	Euro I	1994	1996	93954	84867	78697	75015	73828	72136	66165	62616	61049	57094	50839
Buses	Diesel Coaches >18t	Euro II	1997	2001	87891	91117	90487	98678	97645	95875	87814	81921	79821	74718	67123
Buses	Diesel Coaches >18t	Euro III	2002	2006				59047	81754	98907	98849	102820	110819	103359	92172
Buses	Diesel Coaches >18t	Euro IV	2007	2009									67375	97429	102033
Mopeds	<50 cm³	Conventional	0	1999	2137	1942	1555	1584	1593	1579	1563	1571	1604	1624	1619
Mopeds	<50 cm³	Euro I	2000	2003		1942	1555	1584	1593	1579	1563	1571	1604	1624	1619
Mopeds	<50 cm³	Euro II	2004	9999						1579	1563	1571	1604	1624	1619
Motorcycles	2-stroke >50 cm³	Conventional	0	1999	5944	5738	5503	5340	5087	4776	4450	4203	4008	3770	3481
Motorcycles	4-stroke <250 cm³	Conventional	0	1999	5944	5738	5503	5340	5087	4776	4450	4203	4008	3770	3481

Continued

Sector	Subsector	Tech 2	FYear	LYear	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Motorcycles	4-stroke <250 cm³	Euro I	2000	2003		5738	5503	5340	5087	4776	4450	4203	4008	3770	3481
Motorcycles	4-stroke <250 cm³	Euro II	2004	2006						4776	4450	4203	4008	3770	3481
Motorcycles	4-stroke <250 cm³	Euro III	2007	9999									4008	3770	3481
Motorcycles	4-stroke 250 - 750 cm³	Conventional	0	1999	5944	5738	5503	5340	5087	4776	4450	4203	4008	3770	3481
Motorcycles	4-stroke 250 - 750 cm³	Euro I	2000	2003		5738	5503	5340	5087	4776	4450	4203	4008	3770	3481
Motorcycles	4-stroke 250 - 750 cm³	Euro II	2004	2006						4776	4450	4203	4008	3770	3481
Motorcycles	4-stroke 250 - 750 cm³	Euro III	2007	9999									4008	3770	3481
Motorcycles	4-stroke >750 cm³	Conventional	0	1999	5944	5738	5503	5340	5087	4776	4450	4203	4008	3770	3481
Motorcycles	4-stroke >750 cm³	Euro I	2000	2003		5738	5503	5340	5087	4776	4450	4203	4008	3770	3481
Motorcycles	4-stroke >750 cm³	Euro II	2004	2006						4776	4450	4203	4008	3770	3481
Motorcycles	4-stroke >750 cm³	Euro III	2007	9999									4008	3770	3481

Annex 2B-3: EU directive emission limits for road transportation vehicles

Private cars and light duty vehicles I (<1305 kg).

G prkm		EURO 1	EURO 2	EURO 3[1)]	EURO 4	EURO 5	EURO 6
<u>Normal temp.</u>							
CO	Gasoline	2.72	2.2	2.3	1.0	1.0	1.0
	Diesel	2.72	1.0	0.64	0.5	0.5	0.5
HC	Gasoline	-	-	0.20	0.10	0.1	0.1
NMHC	Gasoline	-	-	-	-	0.068	0.068
NO_x	Gasoline	-	-	0.15	0.08	0.06	0.06
	Diesel	-	-	0.5	0.25	0.18	0.08
$HC+NO_x$	Gasoline	0.97	0.5	-	-		-
	Diesel	0.97	0.7/0.9[2)]	0.56	0.30	0.23	0.17
Particulates	Diesel	0.14	0.08/0.10[2)]	0.05	0.025	0.005	0.005
<u>Low temp.</u>							
CO	Gasoline	-	-	-	15	15	15
HC	Gasoline	-	-	-	1.8	1.8	1.8
<u>Evaporation</u>							
HC[3)]	Gasoline	2.0	2.0	2.0	2.0	2.0	2.0

1) Changed test procedure at normal temperatures (40 s warm-up phase omitted) and for evaporation measurements.

2) Less stringent emission limits for direct injection diesel engines.

3) Unit: g/test.

Light duty vehicles II (1305-1760 kg)

G pr km		EURO 1	EURO 2	EURO 3[1)]	EURO 4	EURO 5	EURO 6
<u>Normal temp.</u>							
CO	Gasoline	5.17	4.0	4.17	1.81	1.81	1.81
	Diesel	5.17	1.25	0.80	0.63	0.63	0.63
HC	Gasoline	-	-	0.25	0.13	0.13	0.13
NMHC	Gasoline	-	-	-	-	0.9	0.9
NO_x	Gasoline	-	-	0.18	0.10	0.75	0.75
	Diesel	-	-	0.65	0.33	0.235	0.105
$HC+NO_x$	Gasoline	1.4	0.6	-	-	-	-
	Diesel	1.4	1.0/1.3[2)]	0.72	0.39	0.295	0.195
Particulates	Gasoline					0.005	0.005
	Diesel	0.19	0.12/0.14[2)]	0.07	0.04	0.005	0.005
<u>Low temp.</u>							
CO	Gasoline	-	-	-	24	24	24
HC	Gasoline	-	-		2.7	2.7	2.7
<u>Evaporation</u>							
HC[3)]	Gasoline	2.0	2.0	2.0	2.0	2.0	2.0

1) Changed test procedure at normal temperatures (40 s warm-up phase omitted) and for evaporation measurements.

2) Less stringent emission limits for direct injection diesel engines.

3) Unit: g/test.

Light duty vehicles III (>1760 kg)

G pr km		EURO 1	EURO 2	EURO 3[1)]	EURO 4	EURO 5	EURO 6
Normal temp.							
CO	Gasoline	6.9	5.0	5.22	2.27	2.27	2.27
	Diesel	6.9	1.5	0.95	0.74	0.74	0.74
HC	Gasoline	-	-	0.29	0.16	0.16	0.16
NMHC	Gasoline					0.108	0.108
NO_x	Gasoline	-	-	0.21	0.11	0.082	0.082
	Diesel	-	-	0.78	0.39	0.28	0.125
$HC+NO_x$	Gasoline	1.7	0.7	-	-	-	-
	Diesel	1.7	1.2/1.6[2)]	0.86	0.46	0.35	0.215
Particulates	Gasoline					0.005	0.005
	Diesel	0.25	0.17/0.20[2)]	0.10	0.06	0.005	0.005
Low temp.							
CO	Gasoline	-	-	-	30	30	30
HC	Gasoline	-	-	-	3.2	3.2	3.2
Evaporation							
HC[3)]	Gasoline	2.0	2.0	2.0	2.0	2.0	2.0

1) Changed test procedure at normal temperatures (40 s warm-up phase omitted) and for evaporation measurements.

2) Less stringent emission limits for direct injection diesel engines.

3) Unit: g/test.

Heavy duty diesel vehicles

(g pr kWh)		EURO 1	EURO 2	EURO 3	EURO 4	EURO 5	EEV[2)]
	Test[1)]	1993	1996	2001	2006	2009	2000
CO	ECE/ESC	4.5	4.0	2.1	1.5	1.5	1.5
	ETC	-	-	(5.45)	4.0	4.0	3.0
HC	ECE/ESC	1.1	1.1	0.66	0.46	0.46	0.25
	ETC	-	-	(0.78)	0.55	0.55	0.40
NO_x	ECE/ESC	8.0	7.0	5.0	3.5	2.0	2.0
	ETC	-	-	(5.0)	3.5	2.0	2.0
Particulates[3)]	ECE/ESC	0.36/0.61	0.15/0.25	0.10/0.13	0.02	0.02	0.02
	ETC	-	-	(0.16/0.21)	0.03	0.03	0.02
	ELR	-	-	0.8	0.5	0.5	0.15

1) Test procedure: Euro 1 og Euro 2: ECE (stationary).
Euro 3: ESC (stationary) + ELR (load response).
Euro 4, Euro 5 og EEV: ESC (stationary) + ETC (transient) + ELR (load response).

2) EEV: Emission limits for extra environmental friendly vehicles, used as a basis for economical incitaments (gas fueled vehicles)..

3) For Euro 1, Euro 2 og Euro 3 less stringent emission limits apply for small engines:

Euro 1:	<85 kW
Euro 2:	<0,7 l
Euro 3:	<0,75 l

Annex 2B-4: Basis emission factors (g pr km)

Sector	Subsector	Tech 2	FYear	LYear	FCu	FCr	FCh	COu	COr	COh	PMu	PMr	PMh	NOxu	NOxr	NOxh
Passenger Cars	Gasoline <1,4 l	PRE ECE	0	1969	67,499	55,000	62,743	27,505	19,333	15,520	0,063	0,044	0,041	1,849	2,062	2,023
Passenger Cars	Gasoline <1,4 l	ECE 15/00-01	1970	1978	58,240	44,460	48,600	18,966	14,480	18,620	0,063	0,044	0,041	1,849	2,062	2,023
Passenger Cars	Gasoline <1,4 l	ECE 15/02	1979	1980	53,248	45,170	51,200	15,859	8,200	8,260	0,063	0,044	0,041	1,619	2,102	2,909
Passenger Cars	Gasoline <1,4 l	ECE 15/03	1981	1985	53,248	45,170	51,200	16,752	8,793	7,620	0,042	0,029	0,029	1,680	2,253	3,276
Passenger Cars	Gasoline <1,4 l	ECE 15/04	1986	1990	51,420	43,440	47,700	9,087	4,956	4,292	0,030	0,020	0,020	1,691	2,089	2,662
Passenger Cars	Gasoline <1,4 l	Euro I	1991	1996	47,399	41,954	46,055	1,765	1,372	1,765	0,003	0,002	0,002	0,273	0,281	0,458
Passenger Cars	Gasoline <1,4 l	Euro II	1997	2000	46,486	39,509	44,016	0,659	0,575	0,749	0,003	0,002	0,002	0,154	0,154	0,181
Passenger Cars	Gasoline <1,4 l	Euro III	2001	2005	48,687	42,255	45,323	0,519	0,691	1,148	0,001	0,001	0,001	0,076	0,060	0,052
Passenger Cars	Gasoline <1,4 l	Euro IV	2006	2010	50,038	44,193	48,285	0,195	0,287	0,529	0,001	0,001	0,001	0,054	0,030	0,019
Passenger Cars	Gasoline 1,4 - 2,0 l	PRE ECE	0	1969	79,277	67,000	76,386	27,505	19,333	15,520	0,063	0,044	0,041	2,164	2,683	3,130
Passenger Cars	Gasoline 1,4 - 2,0 l	ECE 15/00-01	1970	1978	67,779	51,090	60,300	18,966	14,480	18,620	0,063	0,044	0,041	2,164	2,683	3,130
Passenger Cars	Gasoline 1,4 - 2,0 l	ECE 15/02	1979	1980	61,731	50,686	59,680	15,859	8,200	8,260	0,063	0,044	0,041	1,831	2,377	3,283
Passenger Cars	Gasoline 1,4 - 2,0 l	ECE 15/03	1981	1985	61,731	50,686	59,680	16,752	8,793	7,620	0,042	0,029	0,029	1,917	2,580	3,472
Passenger Cars	Gasoline 1,4 - 2,0 l	ECE 15/04	1986	1990	61,652	49,112	52,052	9,087	4,956	4,292	0,030	0,020	0,020	2,122	2,757	3,524
Passenger Cars	Gasoline 1,4 - 2,0 l	Euro I	1991	1996	57,521	48,522	51,518	1,765	1,372	1,765	0,003	0,002	0,002	0,273	0,281	0,458
Passenger Cars	Gasoline 1,4 - 2,0 l	Euro II	1997	2000	56,324	47,687	48,786	0,659	0,575	0,749	0,003	0,002	0,002	0,154	0,154	0,181
Passenger Cars	Gasoline 1,4 - 2,0 l	Euro III	2001	2005	58,259	49,897	53,092	0,519	0,691	1,148	0,001	0,001	0,001	0,076	0,060	0,052
Passenger Cars	Gasoline 1,4 - 2,0 l	Euro IV	2006	2010	60,486	52,793	55,293	0,195	0,287	0,529	0,001	0,001	0,001	0,054	0,030	0,019
Passenger Cars	Gasoline >2,0 l	PRE ECE	0	1969	96,536	80,000	88,267	27,505	19,333	15,520	0,063	0,044	0,041	2,860	4,090	5,500
Passenger Cars	Gasoline >2,0 l	ECE 15/00-01	1970	1978	73,798	57,090	66,300	18,966	14,480	18,620	0,063	0,044	0,041	2,860	4,090	5,500
Passenger Cars	Gasoline >2,0 l	ECE 15/02	1979	1980	75,270	63,260	70,700	15,859	8,200	8,260	0,063	0,044	0,041	2,066	2,675	3,680
Passenger Cars	Gasoline >2,0 l	ECE 15/03	1981	1985	75,270	63,260	70,700	16,752	8,793	7,620	0,042	0,029	0,029	2,806	3,441	4,604
Passenger Cars	Gasoline >2,0 l	ECE 15/04	1986	1990	71,055	58,080	69,900	9,087	4,956	4,292	0,030	0,020	0,020	2,293	2,750	3,687
Passenger Cars	Gasoline >2,0 l	Euro I	1991	1996	74,616	61,902	65,020	1,765	1,372	1,765	0,003	0,002	0,002	0,273	0,281	0,458
Passenger Cars	Gasoline >2,0 l	Euro II	1997	2000	76,837	65,226	66,732	0,659	0,575	0,749	0,003	0,002	0,002	0,154	0,154	0,181
Passenger Cars	Gasoline >2,0 l	Euro III	2001	2005	70,798	57,424	56,826	0,519	0,691	1,148	0,001	0,001	0,001	0,076	0,060	0,052
Passenger Cars	Gasoline >2,0 l	Euro IV	2006	2010	86,099	67,877	65,859	0,195	0,287	0,529	0,001	0,001	0,001	0,054	0,030	0,019
Passenger Cars	Diesel <2,0 l	Conventional	0	1990	57,529	41,209	50,089	0,651	0,472	0,384	0,199	0,132	0,170	0,520	0,433	0,528
Passenger Cars	Diesel <2,0 l	Euro I	1991	1996	47,836	42,807	48,388	0,419	0,215	0,208	0,057	0,062	0,107	0,603	0,562	0,663
Passenger Cars	Diesel <2,0 l	Euro II	1997	2000	50,442	44,117	48,779	0,343	0,110	0,035	0,047	0,039	0,050	0,651	0,555	0,665
Passenger Cars	Diesel <2,0 l	Euro III	2001	2005	48,920	43,427	45,585	0,099	0,041	0,012	0,029	0,030	0,045	0,716	0,665	0,750
Passenger Cars	Diesel <2,0 l	Euro IV	2006	2010	48,920	43,427	45,585	0,083	0,034	0,021	0,029	0,024	0,026	0,539	0,424	0,576
Passenger Cars	Diesel >2,0 l	Conventional	0	1990	57,529	41,209	50,089	0,651	0,472	0,384	0,199	0,132	0,170	0,824	0,723	0,861

Continued

Sector	Subsector	Tech 2	FYear	LYear	FCu	FCr	FCh	COu	COr	COh	PMu	PMr	PMh	NOxu	NOxr	NOxh
Passenger Cars	Diesel >2,0 l	Euro I	1991	1996	65,267	58,299	64,360	0,419	0,215	0,208	0,057	0,062	0,107	0,603	0,562	0,663
Passenger Cars	Diesel >2,0 l	Euro II	1997	2000	65,267	58,299	64,360	0,343	0,110	0,035	0,047	0,039	0,050	0,651	0,555	0,665
Passenger Cars	Diesel >2,0 l	Euro III	2001	2005	65,267	58,299	64,360	0,099	0,041	0,012	0,029	0,030	0,045	0,716	0,665	0,750
Passenger Cars	Diesel >2,0 l	Euro IV	2006	2010	65,267	58,299	64,360	0,083	0,034	0,021	0,029	0,024	0,026	0,539	0,424	0,576
Passenger Cars	LPG cars	Conventional	0	1990	59,000	45,000	54,000	2,043	2,373	9,723	0,040	0,030	0,025	2,203	2,584	2,861
Passenger Cars	LPG cars	Euro I	1991	1996	49,145	45,155	54,125	1,310	1,445	3,560	0,040	0,030	0,025	0,340	0,283	0,298
Passenger Cars	LPG cars	Euro III	2001	2005	49,145	45,155	54,125	0,733	0,809	1,993	0,040	0,030	0,025	0,082	0,068	0,071
Light Duty Vehicles	Gasoline <3,5t	Conventional	0	1994	82,270	59,883	56,470	14,925	6,075	7,389	0,040	0,040	0,040	2,671	3,118	3,387
Light Duty Vehicles	Gasoline <3,5t	Euro I	1995	1998	96,450	70,388	66,450	4,187	0,862	1,087	0,003	0,002	0,002	0,427	0,400	0,429
Light Duty Vehicles	Gasoline <3,5t	Euro II	1999	2001	96,450	70,388	66,450	2,554	0,526	0,663	0,003	0,002	0,002	0,145	0,136	0,146
Light Duty Vehicles	Gasoline <3,5t	Euro III	2002	2006	96,450	70,388	66,450	2,177	0,448	0,565	0,001	0,001	0,001	0,090	0,084	0,090
Light Duty Vehicles	Gasoline <3,5t	Euro IV	2007	2011	96,450	70,388	66,450	1,172	0,241	0,304	0,001	0,001	0,001	0,043	0,040	0,043
Light Duty Vehicles	Diesel <3,5t	Conventional	0	1994	76,718	65,934	72,142	1,124	1,009	1,060	0,285	0,303	0,322	1,673	0,843	0,834
Light Duty Vehicles	Diesel <3,5t	Euro I	1995	1998	68,860	58,185	63,660	0,393	0,328	0,423	0,070	0,066	0,090	1,138	0,975	1,022
Light Duty Vehicles	Diesel <3,5t	Euro II	1999	2001	68,860	58,185	63,660	0,393	0,328	0,423	0,070	0,066	0,090	1,138	0,975	1,022
Light Duty Vehicles	Diesel <3,5t	Euro III	2002	2006	68,860	58,185	63,660	0,322	0,269	0,347	0,047	0,044	0,061	0,740	0,634	0,664
Light Duty Vehicles	Diesel <3,5t	Euro IV	2007	2011	68,860	58,185	63,660	0,255	0,213	0,275	0,024	0,023	0,032	0,319	0,273	0,286
Light Duty Vehicles	LPG <3,5t	Conventional	0	1994	88,500	67,500	81,000	3,064	3,559	14,584	0,060	0,045	0,038	3,305	3,876	4,291
Light Duty Vehicles	LPG <3,5t	Euro II	1999	2001	73,718	67,733	81,188	1,336	1,474	3,631	0,060	0,045	0,038	0,183	0,153	0,161
Light Duty Vehicles	LPG <3,5t	Euro III	2002	2006	73,718	67,733	81,188	1,100	1,214	2,990	0,060	0,045	0,038	0,122	0,102	0,107
Light Duty Vehicles	LPG <3,5t	Euro IV	2007	2011	73,718	67,733	81,188	0,668	0,737	1,815	0,060	0,045	0,038	0,066	0,055	0,058
Heavy Duty Vehicles	Gasoline >3,5t	Conventional	0	9999	225,000	150,000	165,000	70,000	55,000	55,000	0,400	0,400	0,400	4,500	7,500	7,500
Heavy Duty Vehicles	Diesel RT 3,5 - 7,5t	Conventional	0	1993	126,126	110,262	121,098	2,122	1,540	1,405	0,379	0,278	0,257	4,427	4,351	4,894
Heavy Duty Vehicles	Diesel RT 3,5 - 7,5t	Euro I	1994	1996	101,649	94,975	107,022	0,701	0,528	0,551	0,146	0,107	0,100	3,084	3,162	3,555
Heavy Duty Vehicles	Diesel RT 3,5 - 7,5t	Euro II	1997	2001	95,904	91,415	103,765	0,581	0,461	0,462	0,062	0,054	0,059	3,288	3,262	3,568
Heavy Duty Vehicles	Diesel RT 3,5 - 7,5t	Euro III	2002	2006	102,401	96,395	107,651	0,695	0,471	0,416	0,067	0,047	0,041	2,573	2,401	2,585
Heavy Duty Vehicles	Diesel RT 3,5 - 7,5t	Euro IV	2007	2009	96,010	90,427	101,100	0,055	0,038	0,034	0,013	0,008	0,007	1,561	1,528	1,686
Heavy Duty Vehicles	Diesel RT 3,5 - 7,5t	Euro V	2010	2014	97,564	91,551	102,095	0,055	0,038	0,034	0,013	0,009	0,007	0,922	0,886	0,978
Heavy Duty Vehicles	Diesel RT 7,5 - 12t	Conventional	0	1993	185,930	153,512	158,158	2,458	1,717	1,564	0,391	0,273	0,248	8,414	7,702	8,114
Heavy Duty Vehicles	Diesel RT 7,5 - 12t	Euro I	1994	1996	159,000	135,529	144,405	1,152	0,821	0,748	0,231	0,161	0,148	4,989	4,616	4,790
Heavy Duty Vehicles	Diesel RT 7,5 - 12t	Euro II	1997	2001	151,797	131,067	140,716	0,950	0,725	0,693	0,100	0,081	0,090	5,284	4,799	4,879
Heavy Duty Vehicles	Diesel RT 7,5 - 12t	Euro III	2002	2006	160,444	137,265	146,295	1,135	0,758	0,675	0,105	0,071	0,064	4,188	3,656	3,585
Heavy Duty Vehicles	Diesel RT 7,5 - 12t	Euro IV	2007	2009	151,058	128,558	136,547	0,085	0,058	0,051	0,020	0,013	0,011	2,544	2,280	2,313
Heavy Duty Vehicles	Diesel RT 7,5 - 12t	Euro V	2010	2014	154,061	130,592	138,157	0,086	0,059	0,051	0,020	0,013	0,011	1,503	1,347	1,330
Heavy Duty Vehicles	Diesel RT 12 - 14 t	Conventional	0	1993	203,004	165,090	167,652	2,673	1,889	1,720	0,421	0,298	0,271	9,438	8,311	8,445

Continued

Sector	Subsector	Tech 2	FYear	LYear	FCu	FCr	FCh	COu	COr	COh	PMu	PMr	PMh	NOxu	NOxr	NOxh
Heavy Duty Vehicles	Diesel RT 12 - 14 t	Euro I	1994	1996	174,591	145,586	151,052	1,284	0,909	0,828	0,251	0,177	0,163	5,642	4,985	4,980
Heavy Duty Vehicles	Diesel RT 12 - 14 t	Euro II	1997	2001	167,307	140,752	146,283	1,060	0,817	0,789	0,109	0,087	0,100	6,009	5,199	5,076
Heavy Duty Vehicles	Diesel RT 12 - 14 t	Euro III	2002	2006	175,726	146,513	151,354	1,243	0,856	0,772	0,109	0,077	0,072	4,913	4,029	3,844
Heavy Duty Vehicles	Diesel RT 12 - 14 t	Euro IV	2007	2009	165,171	137,073	141,023	0,089	0,064	0,056	0,021	0,014	0,012	2,935	2,499	2,421
Heavy Duty Vehicles	Diesel RT 14 - 20t	Conventional	0	1993	263,547	207,773	198,027	3,646	2,498	2,245	0,573	0,394	0,352	12,021	10,076	9,710
Heavy Duty Vehicles	Diesel RT 14 - 20t	Euro I	1994	1996	216,806	173,222	171,436	1,711	1,178	1,060	0,337	0,232	0,205	7,173	5,985	5,769
Heavy Duty Vehicles	Diesel RT 14 - 20t	Euro II	1997	2001	209,134	167,157	166,583	1,370	1,028	0,964	0,137	0,111	0,112	7,724	6,335	6,058
Heavy Duty Vehicles	Diesel RT 14 - 20t	Euro III	2002	2006	219,423	173,810	170,762	1,676	1,132	1,014	0,151	0,105	0,094	6,315	4,989	4,624
Heavy Duty Vehicles	Diesel RT 14 - 20t	Euro IV	2007	2009	204,908	162,692	159,703	0,123	0,084	0,073	0,030	0,020	0,017	3,734	3,017	2,858
Heavy Duty Vehicles	Diesel RT 14 - 20t	Euro V	2010	2014	208,878	165,319	161,803	0,124	0,085	0,074	0,030	0,020	0,017	2,240	1,786	1,681
Heavy Duty Vehicles	Diesel RT 20 - 26t	Conventional	0	1993	323,084	246,656	229,263	2,716	1,857	1,678	0,578	0,407	0,368	13,189	10,579	9,899
Heavy Duty Vehicles	Diesel RT 20 - 26t	Euro I	1994	1996	277,160	214,981	200,286	2,182	1,505	1,348	0,439	0,288	0,253	9,261	7,445	6,985
Heavy Duty Vehicles	Diesel RT 20 - 26t	Euro II	1997	2001	267,310	209,335	196,695	1,756	1,332	1,261	0,183	0,136	0,152	9,856	7,830	7,311
Heavy Duty Vehicles	Diesel RT 20 - 26t	Euro III	2002	2006	278,374	215,339	199,691	2,121	1,437	1,291	0,190	0,126	0,112	7,933	6,202	5,760
Heavy Duty Vehicles	Diesel RT 20 - 26t	Euro IV	2007	2009	259,989	200,877	186,331	0,151	0,104	0,090	0,036	0,023	0,020	4,769	3,800	3,546
Heavy Duty Vehicles	Diesel RT 20 - 26t	Euro V	2010	2014	264,916	203,965	188,898	0,153	0,105	0,090	0,037	0,024	0,020	2,840	2,250	2,096
Heavy Duty Vehicles	Diesel RT 26 - 28t	Conventional	0	1993	342,618	262,077	242,130	2,864	1,958	1,749	0,613	0,431	0,384	13,891	11,154	10,394
Heavy Duty Vehicles	Diesel RT 26 - 28t	Euro I	1994	1996	294,638	228,789	211,847	2,291	1,605	1,437	0,458	0,307	0,269	9,774	7,811	7,278
Heavy Duty Vehicles	Diesel RT 26 - 28t	Euro II	1997	2001	284,537	222,861	206,136	1,809	1,374	1,300	0,195	0,145	0,162	10,281	8,136	7,563
Heavy Duty Vehicles	Diesel RT 26 - 28t	Euro III	2002	2006	296,130	229,353	211,009	2,192	1,514	1,351	0,203	0,136	0,116	8,026	6,265	5,829
Heavy Duty Vehicles	Diesel RT 26 - 28t	Euro IV	2007	2009	276,478	213,564	196,337	0,159	0,108	0,092	0,037	0,024	0,020	4,920	3,903	3,635
Heavy Duty Vehicles	Diesel RT 26 - 28t	Euro V	2010	2014	281,780	216,892	199,043	0,161	0,110	0,092	0,038	0,024	0,020	2,905	2,290	2,133
Heavy Duty Vehicles	Diesel RT 28 - 32t	Conventional	0	1993	378,779	297,138	275,491	3,126	2,153	1,910	0,678	0,479	0,426	15,696	12,868	11,970
Heavy Duty Vehicles	Diesel RT 28 - 32t	Euro I	1994	1996	332,342	263,557	246,501	2,583	1,838	1,652	0,504	0,345	0,306	11,194	9,086	8,470
Heavy Duty Vehicles	Diesel RT 28 - 32t	Euro II	1997	2001	322,660	258,365	241,198	2,081	1,575	1,468	0,226	0,163	0,195	11,628	9,492	8,563
Heavy Duty Vehicles	Diesel RT 28 - 32t	Euro III	2002	2006	333,761	265,033	246,162	2,421	1,680	1,509	0,217	0,148	0,130	9,211	7,293	6,656
Heavy Duty Vehicles	Diesel RT 28 - 32t	Euro IV	2007	2009	312,241	246,686	227,949	0,174	0,120	0,102	0,040	0,026	0,022	5,677	4,590	4,173
Heavy Duty Vehicles	Diesel RT 28 - 32t	Euro V	2010	2014	318,221	250,590	231,247	0,177	0,121	0,103	0,041	0,027	0,022	3,374	2,698	2,413
Heavy Duty Vehicles	Diesel RT >32t	Conventional	0	1993	387,365	294,650	269,739	3,158	2,175	1,966	0,681	0,481	0,432	16,129	12,809	11,740
Heavy Duty Vehicles	Diesel RT >32t	Euro I	1994	1996	338,943	260,541	238,935	2,641	1,856	1,665	0,524	0,349	0,307	11,428	9,055	8,322
Heavy Duty Vehicles	Diesel RT >32t	Euro III	2002	2006	339,496	260,455	237,636	2,493	1,736	1,565	0,221	0,147	0,129	9,538	7,485	6,752
Heavy Duty Vehicles	Diesel RT >32t	Euro IV	2007	2009	316,183	242,176	220,892	0,174	0,119	0,104	0,041	0,026	0,022	5,853	4,616	4,240
Heavy Duty Vehicles	Diesel TT/AT 28 - 34t	Conventional	0	1993	343,555	260,036	236,450	2,738	1,911	1,722	0,596	0,421	0,376	14,461	11,377	9,952
Heavy Duty Vehicles	Diesel TT/AT 28 - 34t	Euro I	1994	1996	306,923	233,697	212,320	2,316	1,677	1,502	0,449	0,309	0,274	10,252	8,006	6,997
Heavy Duty Vehicles	Diesel TT/AT 28 - 34t	Euro II	1997	2001	293,259	225,478	203,953	1,881	1,415	1,312	0,204	0,143	0,174	10,453	8,195	7,100

Continued

Sector	Subsector	Tech 2	FYear	LYear	FCu	FCr	FCh	COu	COr	COh	PMu	PMr	PMh	NOxu	NOxr	NOxh
Heavy Duty Vehicles	Diesel TT/AT 28 - 34t	Euro III	2002	2006	303,355	231,394	209,072	2,169	1,519	1,372	0,188	0,129	0,114	8,434	6,399	5,523
Heavy Duty Vehicles	Diesel TT/AT 28 - 34t	Euro IV	2007	2009	283,113	215,309	194,236	0,149	0,102	0,088	0,035	0,022	0,019	5,190	3,961	3,537
Heavy Duty Vehicles	Diesel TT/AT 28 - 34t	Euro V	2010	2014	288,186	218,561	196,902	0,151	0,103	0,089	0,035	0,023	0,019	3,078	2,321	2,064
Heavy Duty Vehicles	Diesel TT/AT 34 - 40t	Conventional	0	1993	398,891	296,003	264,722	3,217	2,206	1,987	0,697	0,485	0,431	16,667	12,937	11,208
Heavy Duty Vehicles	Diesel TT/AT 34 - 40t	Euro I	1994	1996	350,514	262,234	234,473	2,730	1,918	1,717	0,539	0,357	0,312	11,743	9,110	7,904
Heavy Duty Vehicles	Diesel TT/AT 34 - 40t	Euro II	1997	2001	341,156	257,431	229,531	2,199	1,662	1,554	0,243	0,166	0,202	12,255	9,433	8,176
Heavy Duty Vehicles	Diesel TT/AT 34 - 40t	Euro III	2002	2006	351,246	262,639	233,347	2,553	1,777	1,602	0,225	0,149	0,130	9,759	7,458	6,473
Heavy Duty Vehicles	Diesel TT/AT 34 - 40t	Euro IV	2007	2009	326,747	243,891	216,608	0,173	0,118	0,101	0,041	0,026	0,022	6,018	4,600	4,105
Heavy Duty Vehicles	Diesel TT/AT 34 - 40t	Euro V	2010	2014	332,585	247,612	219,701	0,175	0,119	0,102	0,042	0,026	0,022	3,557	2,700	2,410
Heavy Duty Vehicles	Diesel TT/AT 40 - 50t	Conventional	0	1993	443,142	330,536	294,460	3,472	2,403	2,169	0,760	0,534	0,475	18,739	14,561	12,573
Heavy Duty Vehicles	Diesel TT/AT 40 - 50t	Euro I	1994	1996	389,973	292,874	260,505	2,973	2,170	1,968	0,589	0,398	0,350	13,110	10,164	8,785
Heavy Duty Vehicles	Diesel TT/AT 40 - 50t	Euro II	1997	2001	382,402	288,742	255,439	2,441	1,852	1,732	0,273	0,189	0,227	13,610	10,454	9,009
Heavy Duty Vehicles	Diesel TT/AT 40 - 50t	Euro III	2002	2006	391,940	293,248	258,907	2,782	1,950	1,761	0,242	0,162	0,141	10,808	8,275	7,184
Heavy Duty Vehicles	Diesel TT/AT 40 - 50t	Euro IV	2007	2009	364,496	272,094	239,648	0,185	0,125	0,109	0,043	0,027	0,023	6,735	5,141	4,558
Heavy Duty Vehicles	Diesel TT/AT 40 - 50t	Euro V	2010	2014	371,062	276,236	243,105	0,187	0,127	0,109	0,044	0,028	0,023	3,961	3,000	2,667
Heavy Duty Vehicles	Diesel TT/AT 50 - 60t	Euro II	1997	2001	462,505	347,232	302,541	2,921	2,080	2,298	0,333	0,231	0,275	16,388	12,481	10,660
Heavy Duty Vehicles	Diesel TT/AT 50 - 60t	Euro IV	2007	2009	440,676	327,160	283,955	0,211	0,144	0,124	0,049	0,031	0,026	8,166	6,177	5,397
Buses	Gasoline Urban Buses	Conventional	0	9999	225,000	150,000	165,000	70,000	55,000	55,000	0,400	0,400	0,400	4,500	7,500	7,500
Buses	Diesel Urban Buses <15t	Conventional	0	1993	254,519	199,726	188,313	4,690	3,142	2,705	0,859	0,554	0,466	9,228	7,495	7,107
Buses	Diesel Urban Buses <15t	Euro I	1994	1996	206,542	161,946	154,018	1,668	1,073	0,874	0,300	0,208	0,184	6,771	5,376	5,072
Buses	Diesel Urban Buses <15t	Euro II	1997	2001	197,589	158,105	149,177	1,514	0,934	0,721	0,136	0,100	0,092	7,260	5,708	5,355
Buses	Diesel Urban Buses <15t	Euro III	2002	2006	208,219	166,361	156,952	1,674	1,032	0,742	0,132	0,096	0,086	6,306	4,448	3,682
Buses	Diesel Urban Buses <15t	Euro IV	2007	2009	198,772	156,259	149,123	0,138	0,082	0,065	0,029	0,018	0,015	3,667	2,730	2,374
Buses	Diesel Urban Buses 15 - 18t	Conventional	0	1993	322,706	243,813	223,493	4,844	3,059	2,424	0,767	0,479	0,382	14,829	11,863	11,160
Buses	Diesel Urban Buses 15 - 18t	Euro I	1994	1996	274,847	211,253	194,777	2,323	1,475	1,080	0,416	0,279	0,215	9,029	7,194	6,521
Buses	Diesel Urban Buses 15 - 18t	Euro II	1997	2001	265,398	208,065	194,280	2,048	1,308	0,933	0,191	0,136	0,120	9,648	7,517	6,867
Buses	Diesel Urban Buses 15 - 18t	Euro III	2002	2006	279,078	216,481	199,731	2,267	1,401	1,009	0,180	0,122	0,103	8,172	5,883	5,016
Buses	Diesel Urban Buses 15 - 18t	Euro IV	2007	2009	263,088	203,469	188,046	0,185	0,108	0,083	0,038	0,023	0,018	4,807	3,706	3,107
Buses	Diesel Urban Buses >18t	Conventional	0	1993	402,598	306,217	279,065	6,091	3,927	3,119	0,946	0,604	0,482	19,133	15,142	13,936
Buses	Diesel Urban Buses >18t	Euro I	1994	1996	350,073	270,379	248,470	3,052	1,967	1,451	0,517	0,354	0,277	11,612	9,124	8,459
Buses	Diesel Urban Buses >18t	Euro II	1997	2001	344,223	267,704	244,604	2,788	1,661	1,163	0,258	0,178	0,152	12,066	9,475	8,348
Buses	Diesel Urban Buses >18t	Euro III	2002	2006	355,419	275,841	252,154	2,920	1,768	1,251	0,212	0,144	0,123	10,151	7,587	6,037
Buses	Diesel Urban Buses >18t	Euro IV	2007	2009	333,619	258,536	237,511	0,235	0,133	0,090	0,044	0,026	0,020	6,195	4,750	3,961
Buses	Gasoline Coaches	Conventional	0	9999	225,000	150,000	165,000	70,000	55,000	55,000	0,400	0,400	0,400	4,500	7,500	7,500
Buses	Diesel Coaches <15t	Conventional	0	1993	306,500	221,749	201,709	2,872	1,740	1,434	0,585	0,376	0,317	11,897	9,161	8,705

Continued

Sector	Subsector	Tech 2	FYear	LYear	FCu	FCr	FCh	COu	COr	COh	PMu	PMr	PMh	NOxu	NOxr	NOxh
Buses	Diesel Coaches <15t	Euro I	1994	1996	282,096	204,733	185,736	2,328	1,452	1,199	0,463	0,286	0,231	9,107	6,966	6,519
Buses	Diesel Coaches <15t	Euro II	1997	2001	281,233	205,413	185,701	1,944	1,253	1,089	0,199	0,139	0,121	10,178	7,648	7,097
Buses	Diesel Coaches <15t	Euro III	2002	2006	301,264	220,508	201,327	2,395	1,501	1,252	0,220	0,144	0,119	8,745	6,216	5,621
Buses	Diesel Coaches <15t	Euro IV	2007	2009	285,248	207,955	189,950	0,186	0,116	0,095	0,044	0,027	0,022	5,217	3,799	3,465
Buses	Diesel Coaches 15 - 18t	Conventional	0	1993	306,500	221,749	201,709	2,872	1,740	1,434	0,585	0,376	0,317	11,897	9,161	8,705
Buses	Diesel Coaches 15 - 18t	Euro I	1994	1996	282,096	204,733	185,736	2,328	1,452	1,199	0,463	0,286	0,231	9,107	6,966	6,519
Buses	Diesel Coaches 15 - 18t	Euro II	1997	2001	281,233	205,413	185,701	1,944	1,253	1,089	0,199	0,139	0,121	10,178	7,648	7,097
Buses	Diesel Coaches 15 - 18t	Euro III	2002	2006	301,264	220,508	201,327	2,395	1,501	1,252	0,220	0,144	0,119	8,745	6,216	5,621
Buses	Diesel Coaches 15 - 18t	Euro IV	2007	2009	285,248	207,955	189,950	0,186	0,116	0,095	0,044	0,027	0,022	5,217	3,799	3,465
Buses	Diesel Coaches >18t	Conventional	0	1993	370,182	269,609	246,371	3,258	2,077	1,775	0,676	0,450	0,387	14,875	11,298	10,404
Buses	Diesel Coaches >18t	Euro I	1994	1996	330,019	240,992	219,214	2,651	1,729	1,463	0,514	0,334	0,282	11,189	8,363	7,688
Buses	Diesel Coaches >18t	Euro II	1997	2001	324,611	238,936	217,246	2,228	1,472	1,281	0,227	0,163	0,146	12,100	8,952	8,176
Buses	Diesel Coaches >18t	Euro III	2002	2006	336,072	239,073	214,011	2,661	1,682	1,382	0,238	0,155	0,129	9,785	7,006	6,166
Buses	Diesel Coaches >18t	Euro IV	2007	2009	317,902	225,401	202,042	0,199	0,124	0,103	0,047	0,029	0,024	5,905	4,299	3,767
Mopeds	<50 cm³	Conventional	0	1999	25,000	25,000	0,000	13,800	13,800	0,000	0,188	0,188	0,000	0,020	0,020	0,000
Mopeds	<50 cm³	Euro I	2000	2003	15,000	15,000	0,000	5,600	5,600	0,000	0,076	0,076	0,000	0,020	0,020	0,000
Mopeds	<50 cm³	Euro II	2004	9999	12,080	12,080	0,000	1,300	1,300	0,000	0,038	0,038	0,000	0,260	0,260	0,000
Motorcycles	2-stroke >50 cm³	Conventional	0	1999	27,115	28,317	39,640	15,605	19,285	28,470	0,200	0,200	0,200	0,029	0,030	0,035
Motorcycles	4-stroke <250 cm³	Conventional	0	1999	24,800	27,499	36,055	15,258	17,209	24,960	0,020	0,020	0,020	0,237	0,428	0,655
Motorcycles	4-stroke <250 cm³	Euro I	2000	2003	27,015	30,386	40,330	10,391	14,456	24,910	0,020	0,020	0,020	0,304	0,424	0,567
Motorcycles	4-stroke <250 cm³	Euro II	2004	2006	22,260	25,160	33,756	3,708	5,765	9,135	0,005	0,005	0,005	0,323	0,447	0,598
Motorcycles	4-stroke <250 cm³	Euro III	2007	9999	19,262	20,359	25,932	2,060	3,201	5,092	0,005	0,005	0,005	0,253	0,382	0,612
Motorcycles	4-stroke 250 - 750 cm³	Conventional	0	1999	26,648	23,766	26,620	20,461	19,486	22,990	0,020	0,020	0,020	0,196	0,300	0,548
Motorcycles	4-stroke 250 - 750 cm³	Euro I	2000	2003	37,374	35,472	41,400	10,599	9,003	10,460	0,020	0,020	0,020	0,258	0,400	0,610
Motorcycles	4-stroke 250 - 750 cm³	Euro II	2004	2006	34,197	33,450	41,276	2,230	2,436	6,092	0,005	0,005	0,005	0,257	0,390	0,577
Motorcycles	4-stroke 250 - 750 cm³	Euro III	2007	9999	30,983	30,719	38,129	1,228	1,345	3,357	0,005	0,005	0,005	0,076	0,132	0,265
Motorcycles	4-stroke >750 cm³	Conventional	0	1999	35,731	35,542	43,748	20,461	19,486	22,990	0,020	0,020	0,020	0,019	0,030	0,086
Motorcycles	4-stroke >750 cm³	Euro I	2000	2003	43,101	41,041	47,500	10,599	9,003	10,460	0,020	0,020	0,020	0,125	0,178	0,392
Motorcycles	4-stroke >750 cm³	Euro II	2004	2006	42,110	38,004	41,895	2,230	2,436	6,092	0,005	0,005	0,005	0,143	0,244	0,459
Motorcycles	4-stroke >750 cm³	Euro III	2007	9999	40,343	37,470	43,083	1,228	1,345	3,357	0,005	0,005	0,005	0,104	0,200	0,484

Sector	Subsector	Tech 2	FYear	LYear	CH_4u	CH_4r	CH_4h	N_2Ou	N_2Or	N_2Oh	NH_3u	NH_3r	NH_3h	VOCu	VOCr
Passenger Cars	Gasoline <1,4 l	PRE ECE	0	1969	0,092	0,029	0,026	0,010	0,007	0,007	0,002	0,002	0,002	2,354	1,597
Passenger Cars	Gasoline <1,4 l	ECE 15/00-01	1970	1978	0,092	0,029	0,026	0,010	0,007	0,007	0,002	0,002	0,002	1,862	1,256
Passenger Cars	Gasoline <1,4 l	ECE 15/02	1979	1980	0,092	0,029	0,026	0,010	0,007	0,007	0,002	0,002	0,002	1,849	1,061
Passenger Cars	Gasoline <1,4 l	ECE 15/03	1981	1985	0,092	0,029	0,026	0,010	0,007	0,007	0,002	0,002	0,002	1,849	1,061
Passenger Cars	Gasoline <1,4 l	ECE 15/04	1986	1990	0,092	0,029	0,026	0,010	0,007	0,007	0,002	0,002	0,002	1,480	0,895
Passenger Cars	Gasoline <1,4 l	Euro I	1991	1996	0,026	0,016	0,014	0,024	0,009	0,005	0,070	0,132	0,074	0,177	0,121
Passenger Cars	Gasoline <1,4 l	Euro II	1997	2000	0,017	0,013	0,011	0,012	0,005	0,003	0,163	0,149	0,084	0,071	0,047
Passenger Cars	Gasoline <1,4 l	Euro III	2001	2005	0,003	0,002	0,004	0,001	0,000	0,000	0,002	0,029	0,065	0,015	0,015
Passenger Cars	Gasoline <1,4 l	Euro IV	2006	2010	0,002	0,002	0,000	0,002	0,000	0,000	0,002	0,029	0,065	0,012	0,014
Passenger Cars	Gasoline 1,4 - 2,0 l	PRE ECE	0	1969	0,092	0,029	0,026	0,010	0,007	0,007	0,002	0,002	0,002	2,354	1,597
Passenger Cars	Gasoline 1,4 - 2,0 l	ECE 15/00-01	1970	1978	0,092	0,029	0,026	0,010	0,007	0,007	0,002	0,002	0,002	1,862	1,256
Passenger Cars	Gasoline 1,4 - 2,0 l	ECE 15/02	1979	1980	0,092	0,029	0,026	0,010	0,007	0,007	0,002	0,002	0,002	1,849	1,061
Passenger Cars	Gasoline 1,4 - 2,0 l	ECE 15/03	1981	1985	0,092	0,029	0,026	0,010	0,007	0,007	0,002	0,002	0,002	1,849	1,061
Passenger Cars	Gasoline 1,4 - 2,0 l	ECE 15/04	1986	1990	0,092	0,029	0,026	0,010	0,007	0,007	0,002	0,002	0,002	1,480	0,895
Passenger Cars	Gasoline 1,4 - 2,0 l	Euro I	1991	1996	0,026	0,016	0,014	0,024	0,009	0,005	0,070	0,132	0,074	0,177	0,121
Passenger Cars	Gasoline 1,4 - 2,0 l	Euro II	1997	2000	0,017	0,013	0,011	0,012	0,005	0,003	0,163	0,149	0,084	0,071	0,047
Passenger Cars	Gasoline 1,4 - 2,0 l	Euro III	2001	2005	0,003	0,002	0,004	0,001	0,000	0,000	0,002	0,029	0,065	0,015	0,015
Passenger Cars	Gasoline 1,4 - 2,0 l	Euro IV	2006	2010	0,002	0,002	0,000	0,002	0,000	0,000	0,002	0,029	0,065	0,012	0,014
Passenger Cars	Gasoline >2,0 l	PRE ECE	0	1969	0,092	0,029	0,026	0,010	0,007	0,007	0,002	0,002	0,002	2,354	1,597
Passenger Cars	Gasoline >2,0 l	ECE 15/00-01	1970	1978	0,092	0,029	0,026	0,010	0,007	0,007	0,002	0,002	0,002	1,862	1,256
Passenger Cars	Gasoline >2,0 l	ECE 15/02	1979	1980	0,092	0,029	0,026	0,010	0,007	0,007	0,002	0,002	0,002	1,849	1,061
Passenger Cars	Gasoline >2,0 l	ECE 15/03	1981	1985	0,092	0,029	0,026	0,010	0,007	0,007	0,002	0,002	0,002	1,849	1,061
Passenger Cars	Gasoline >2,0 l	ECE 15/04	1986	1990	0,092	0,029	0,026	0,010	0,007	0,007	0,002	0,002	0,002	1,480	0,895
Passenger Cars	Gasoline >2,0 l	Euro I	1991	1996	0,026	0,016	0,014	0,024	0,009	0,005	0,070	0,132	0,074	0,177	0,121
Passenger Cars	Gasoline >2,0 l	Euro II	1997	2000	0,017	0,013	0,011	0,012	0,005	0,003	0,163	0,149	0,084	0,071	0,047
Passenger Cars	Gasoline >2,0 l	Euro III	2001	2005	0,003	0,002	0,004	0,001	0,000	0,000	0,002	0,030	0,065	0,015	0,015
Passenger Cars	Gasoline >2,0 l	Euro IV	2006	2010	0,002	0,002	0,000	0,002	0,000	0,000	0,002	0,029	0,065	0,012	0,014
Passenger Cars	Diesel <2,0 l	Conventional	0	1990	0,028	0,012	0,008	0,000	0,000	0,000	0,001	0,001	0,001	0,145	0,086
Passenger Cars	Diesel <2,0 l	Euro I	1991	1996	0,011	0,009	0,003	0,002	0,004	0,004	0,001	0,001	0,001	0,053	0,031
Passenger Cars	Diesel <2,0 l	Euro II	1997	2000	0,007	0,003	0,002	0,004	0,006	0,006	0,001	0,001	0,001	0,034	0,021
Passenger Cars	Diesel <2,0 l	Euro III	2001	2005	0,003	0,000	0,000	0,009	0,004	0,004	0,001	0,001	0,001	0,018	0,011
Passenger Cars	Diesel <2,0 l	Euro IV	2006	2010	0,000	0,000	0,000	0,009	0,004	0,004	0,001	0,001	0,001	0,038	0,017
Passenger Cars	Diesel >2,0 l	Conventional	0	1990	0,028	0,012	0,008	0,000	0,000	0,000	0,001	0,001	0,001	0,145	0,086
Passenger Cars	Diesel >2,0 l	Euro I	1991	1996	0,011	0,009	0,003	0,002	0,004	0,004	0,001	0,001	0,001	0,080	0,046
Passenger Cars	Diesel >2,0 l	Euro II	1997	2000	0,007	0,003	0,002	0,004	0,006	0,006	0,001	0,001	0,001	0,098	0,058
Passenger Cars	Diesel >2,0 l	Euro III	2001	2005	0,003	0,000	0,000	0,009	0,004	0,004	0,001	0,001	0,001	0,038	0,017

Continued

Sector	Subsector	Tech 2	FYear	LYear	CH_4u	CH_4r	CH_4h	N_2Ou	N_2Or	N_2Oh	NH_3u	NH_3r	NH_3h	VOCu	VOCr
Passenger Cars	Diesel >2,0 l	Euro IV	2006	2010	0,000	0,000	0,000	0,009	0,004	0,004	0,001	0,001	0,001	0,011	0,006
Passenger Cars	LPG cars	Conventional	0	1990	0,080	0,035	0,025	0,000	0,000	0,000	0,000	0,000	0,000	1,082	0,667
Passenger Cars	LPG cars	Euro I	1991	1996	0,080	0,035	0,025	0,021	0,013	0,008	0,000	0,000	0,000	0,239	0,071
Passenger Cars	LPG cars	Euro III	2001	2005	0,013	0,006	0,004	0,005	0,002	0,001	0,000	0,000	0,000	0,036	0,011
Light Duty Vehicles	Gasoline <3,5t	Conventional	0	1994	0,150	0,040	0,025	0,010	0,007	0,007	0,002	0,002	0,002	1,877	0,729
Light Duty Vehicles	Gasoline <3,5t	Euro I	1995	1998	0,026	0,016	0,014	0,034	0,020	0,010	0,070	0,132	0,074	0,220	0,109
Light Duty Vehicles	Gasoline <3,5t	Euro II	1999	2001	0,017	0,013	0,011	0,023	0,013	0,008	0,163	0,149	0,084	0,053	0,026
Light Duty Vehicles	Gasoline <3,5t	Euro III	2002	2006	0,003	0,002	0,004	0,006	0,001	0,001	0,002	0,029	0,065	0,031	0,015
Light Duty Vehicles	Gasoline <3,5t	Euro IV	2007	2011	0,002	0,002	0,000	0,001	0,000	0,000	0,002	0,029	0,065	0,013	0,007
Light Duty Vehicles	Diesel <3,5t	Conventional	0	1994	0,028	0,012	0,008	0,000	0,000	0,000	0,001	0,001	0,001	0,131	0,106
Light Duty Vehicles	Diesel <3,5t	Euro I	1995	1998	0,011	0,009	0,003	0,002	0,004	0,004	0,001	0,001	0,001	0,131	0,106
Light Duty Vehicles	Diesel <3,5t	Euro II	1999	2001	0,007	0,003	0,002	0,004	0,006	0,006	0,001	0,001	0,001	0,131	0,106
Light Duty Vehicles	Diesel <3,5t	Euro III	2002	2006	0,003	0,000	0,000	0,009	0,004	0,004	0,001	0,001	0,001	0,081	0,065
Light Duty Vehicles	Diesel <3,5t	Euro IV	2007	2011	0,000	0,000	0,000	0,009	0,004	0,004	0,001	0,001	0,001	0,030	0,024
Light Duty Vehicles	LPG <3,5t	Conventional	0	1994	0,120	0,053	0,038	0,000	0,000	0,000	0,000	0,000	0,000	1,623	1,000
Light Duty Vehicles	LPG <3,5t	Euro II	1999	2001	0,029	0,013	0,009	0,020	0,005	0,003	0,000	0,000	0,000	0,075	0,022
Light Duty Vehicles	LPG <3,5t	Euro III	2002	2006	0,019	0,008	0,006	0,008	0,003	0,002	0,000	0,000	0,000	0,054	0,016
Light Duty Vehicles	LPG <3,5t	Euro IV	2007	2011	0,006	0,003	0,002	0,008	0,003	0,002	0,000	0,000	0,000	0,011	0,003
Heavy Duty Vehicles	Gasoline >3,5t	Conventional	0	9999	0,140	0,110	0,070	0,006	0,006	0,006	0,002	0,002	0,002	7,000	5,500
Heavy Duty Vehicles	Diesel RT 3,5 - 7,5t	Conventional	0	1993	0,085	0,023	0,020	0,030	0,030	0,030	0,003	0,003	0,003	1,432	0,865
Heavy Duty Vehicles	Diesel RT 3,5 - 7,5t	Euro I	1994	1996	0,085	0,023	0,020	0,030	0,030	0,030	0,003	0,003	0,003	0,285	0,185
Heavy Duty Vehicles	Diesel RT 3,5 - 7,5t	Euro II	1997	2001	0,054	0,020	0,019	0,030	0,030	0,030	0,003	0,003	0,003	0,184	0,118
Heavy Duty Vehicles	Diesel RT 3,5 - 7,5t	Euro III	2002	2006	0,048	0,021	0,018	0,030	0,030	0,030	0,003	0,003	0,003	0,166	0,105
Heavy Duty Vehicles	Diesel RT 3,5 - 7,5t	Euro IV	2007	2009	0,003	0,002	0,001	0,030	0,030	0,030	0,003	0,003	0,003	0,009	0,005
Heavy Duty Vehicles	Diesel RT 3,5 - 7,5t	Euro V	2010	2014	0,003	0,002	0,001	0,030	0,030	0,030	0,003	0,003	0,003	0,009	0,005
Heavy Duty Vehicles	Diesel RT 7,5 - 12t	Conventional	0	1993	0,085	0,023	0,020	0,030	0,030	0,030	0,003	0,003	0,003	1,054	0,638
Heavy Duty Vehicles	Diesel RT 7,5 - 12t	Euro I	1994	1996	0,085	0,023	0,020	0,030	0,030	0,030	0,003	0,003	0,003	0,440	0,286
Heavy Duty Vehicles	Diesel RT 7,5 - 12t	Euro II	1997	2001	0,054	0,020	0,019	0,030	0,030	0,030	0,003	0,003	0,003	0,284	0,182
Heavy Duty Vehicles	Diesel RT 7,5 - 12t	Euro III	2002	2006	0,048	0,021	0,018	0,030	0,030	0,030	0,003	0,003	0,003	0,257	0,162
Heavy Duty Vehicles	Diesel RT 7,5 - 12t	Euro IV	2007	2009	0,003	0,002	0,001	0,030	0,030	0,030	0,003	0,003	0,003	0,013	0,008
Heavy Duty Vehicles	Diesel RT 7,5 - 12t	Euro V	2010	2014	0,003	0,002	0,001	0,030	0,030	0,030	0,003	0,003	0,003	0,014	0,008
Heavy Duty Vehicles	Diesel RT 12 - 14 t	Conventional	0	1993	0,085	0,023	0,020	0,030	0,030	0,030	0,003	0,003	0,003	1,110	0,702
Heavy Duty Vehicles	Diesel RT 12 - 14 t	Euro I	1994	1996	0,085	0,023	0,020	0,030	0,030	0,030	0,003	0,003	0,003	0,473	0,318
Heavy Duty Vehicles	Diesel RT 12 - 14 t	Euro II	1997	2001	0,054	0,020	0,019	0,030	0,030	0,030	0,003	0,003	0,003	0,302	0,200
Heavy Duty Vehicles	Diesel RT 12 - 14 t	Euro III	2002	2006	0,048	0,021	0,018	0,030	0,030	0,030	0,003	0,003	0,003	0,265	0,175

Continued

Sector	Subsector	Tech 2	FYear	LYear	CH_4u	CH_4r	CH_4h	N_2Ou	N_2Or	N_2Oh	NH_3u	NH_3r	NH_3h	VOCu	VOCr
Heavy Duty Vehicles	Diesel RT 12 - 14 t	Euro IV	2007	2009	0,003	0,002	0,001	0,030	0,030	0,030	0,003	0,003	0,003	0,013	0,009
Heavy Duty Vehicles	Diesel RT 14 - 20t	Conventional	0	1993	0,175	0,080	0,070	0,030	0,030	0,030	0,003	0,003	0,003	1,636	1,050
Heavy Duty Vehicles	Diesel RT 14 - 20t	Euro I	1994	1996	0,175	0,080	0,070	0,030	0,030	0,030	0,003	0,003	0,003	0,674	0,446
Heavy Duty Vehicles	Diesel RT 14 - 20t	Euro II	1997	2001	0,112	0,070	0,065	0,030	0,030	0,030	0,003	0,003	0,003	0,435	0,282
Heavy Duty Vehicles	Diesel RT 14 - 20t	Euro III	2002	2006	0,098	0,074	0,064	0,030	0,030	0,030	0,003	0,003	0,003	0,386	0,251
Heavy Duty Vehicles	Diesel RT 14 - 20t	Euro IV	2007	2009	0,005	0,006	0,004	0,030	0,030	0,030	0,003	0,003	0,003	0,020	0,013
Heavy Duty Vehicles	Diesel RT 14 - 20t	Euro V	2010	2014	0,005	0,006	0,004	0,030	0,030	0,030	0,003	0,003	0,003	0,020	0,013
Heavy Duty Vehicles	Diesel RT 20 - 26t	Conventional	0	1993	0,175	0,080	0,070	0,030	0,030	0,030	0,003	0,003	0,003	0,920	0,566
Heavy Duty Vehicles	Diesel RT 20 - 26t	Euro I	1994	1996	0,175	0,080	0,070	0,030	0,030	0,030	0,003	0,003	0,003	0,819	0,527
Heavy Duty Vehicles	Diesel RT 20 - 26t	Euro II	1997	2001	0,112	0,070	0,065	0,030	0,030	0,030	0,003	0,003	0,003	0,522	0,335
Heavy Duty Vehicles	Diesel RT 20 - 26t	Euro III	2002	2006	0,098	0,074	0,064	0,030	0,030	0,030	0,003	0,003	0,003	0,463	0,293
Heavy Duty Vehicles	Diesel RT 20 - 26t	Euro IV	2007	2009	0,005	0,006	0,004	0,030	0,030	0,030	0,003	0,003	0,003	0,024	0,015
Heavy Duty Vehicles	Diesel RT 20 - 26t	Euro V	2010	2014	0,005	0,006	0,004	0,030	0,030	0,030	0,003	0,003	0,003	0,024	0,015
Heavy Duty Vehicles	Diesel RT 26 - 28t	Conventional	0	1993	0,175	0,080	0,070	0,030	0,030	0,030	0,003	0,003	0,003	0,966	0,601
Heavy Duty Vehicles	Diesel RT 26 - 28t	Euro I	1994	1996	0,175	0,080	0,070	0,030	0,030	0,030	0,003	0,003	0,003	0,842	0,548
Heavy Duty Vehicles	Diesel RT 26 - 28t	Euro II	1997	2001	0,112	0,070	0,065	0,030	0,030	0,030	0,003	0,003	0,003	0,544	0,351
Heavy Duty Vehicles	Diesel RT 26 - 28t	Euro III	2002	2006	0,098	0,074	0,064	0,030	0,030	0,030	0,003	0,003	0,003	0,488	0,313
Heavy Duty Vehicles	Diesel RT 26 - 28t	Euro IV	2007	2009	0,005	0,006	0,004	0,030	0,030	0,030	0,003	0,003	0,003	0,025	0,015
Heavy Duty Vehicles	Diesel RT 26 - 28t	Euro V	2010	2014	0,005	0,006	0,004	0,030	0,030	0,030	0,003	0,003	0,003	0,026	0,016
Heavy Duty Vehicles	Diesel RT 28 - 32t	Conventional	0	1993	0,175	0,080	0,070	0,030	0,030	0,030	0,003	0,003	0,003	0,997	0,612
Heavy Duty Vehicles	Diesel RT 28 - 32t	Euro I	1994	1996	0,175	0,080	0,070	0,030	0,030	0,030	0,003	0,003	0,003	0,889	0,580
Heavy Duty Vehicles	Diesel RT 28 - 32t	Euro II	1997	2001	0,112	0,070	0,065	0,030	0,030	0,030	0,003	0,003	0,003	0,571	0,368
Heavy Duty Vehicles	Diesel RT 28 - 32t	Euro III	2002	2006	0,098	0,074	0,064	0,030	0,030	0,030	0,003	0,003	0,003	0,507	0,325
Heavy Duty Vehicles	Diesel RT 28 - 32t	Euro IV	2007	2009	0,005	0,006	0,004	0,030	0,030	0,030	0,003	0,003	0,003	0,026	0,016
Heavy Duty Vehicles	Diesel RT 28 - 32t	Euro V	2010	2014	0,005	0,006	0,004	0,030	0,030	0,030	0,003	0,003	0,003	0,026	0,016
Heavy Duty Vehicles	Diesel RT >32t	Conventional	0	1993	0,175	0,080	0,070	0,030	0,030	0,030	0,003	0,003	0,003	1,001	0,610
Heavy Duty Vehicles	Diesel RT >32t	Euro I	1994	1996	0,175	0,080	0,070	0,030	0,030	0,030	0,003	0,003	0,003	0,917	0,588
Heavy Duty Vehicles	Diesel RT >32t	Euro III	2002	2006	0,098	0,074	0,064	0,030	0,030	0,030	0,003	0,003	0,003	0,512	0,323
Heavy Duty Vehicles	Diesel RT >32t	Euro IV	2007	2009	0,005	0,006	0,004	0,030	0,030	0,030	0,003	0,003	0,003	0,026	0,016
Heavy Duty Vehicles	Diesel TT/AT 28 - 34t	Conventional	0	1993	0,175	0,080	0,070	0,030	0,030	0,030	0,003	0,003	0,003	0,831	0,528
Heavy Duty Vehicles	Diesel TT/AT 28 - 34t	Euro I	1994	1996	0,175	0,080	0,070	0,030	0,030	0,030	0,003	0,003	0,003	0,769	0,506
Heavy Duty Vehicles	Diesel TT/AT 28 - 34t	Euro II	1997	2001	0,112	0,070	0,065	0,030	0,030	0,030	0,003	0,003	0,003	0,489	0,320
Heavy Duty Vehicles	Diesel TT/AT 28 - 34t	Euro III	2002	2006	0,098	0,074	0,064	0,030	0,030	0,030	0,003	0,003	0,003	0,427	0,279
Heavy Duty Vehicles	Diesel TT/AT 28 - 34t	Euro IV	2007	2009	0,005	0,006	0,004	0,030	0,030	0,030	0,003	0,003	0,003	0,022	0,014
Heavy Duty Vehicles	Diesel TT/AT 28 - 34t	Euro V	2010	2014	0,005	0,006	0,004	0,030	0,030	0,030	0,003	0,003	0,003	0,022	0,014

Continued

Sector	Subsector	Tech 2	FYear	LYear	CH_4u	CH_4r	CH_4h	N_2Ou	N_2Or	N_2Oh	NH_3u	NH_3r	NH_3h	VOCu	VOCr
Heavy Duty Vehicles	Diesel TT/AT 34 - 40t	Conventional	0	1993	0,175	0,080	0,070	0,030	0,030	0,030	0,003	0,003	0,003	0,988	0,608
Heavy Duty Vehicles	Diesel TT/AT 34 - 40t	Euro I	1994	1996	0,175	0,080	0,070	0,030	0,030	0,030	0,003	0,003	0,003	0,914	0,586
Heavy Duty Vehicles	Diesel TT/AT 34 - 40t	Euro II	1997	2001	0,112	0,070	0,065	0,030	0,030	0,030	0,003	0,003	0,003	0,580	0,371
Heavy Duty Vehicles	Diesel TT/AT 34 - 40t	Euro III	2002	2006	0,098	0,074	0,064	0,030	0,030	0,030	0,003	0,003	0,003	0,507	0,322
Heavy Duty Vehicles	Diesel TT/AT 34 - 40t	Euro IV	2007	2009	0,005	0,006	0,004	0,030	0,030	0,030	0,003	0,003	0,003	0,026	0,016
Heavy Duty Vehicles	Diesel TT/AT 34 - 40t	Euro V	2010	2014	0,005	0,006	0,004	0,030	0,030	0,030	0,003	0,003	0,003	0,026	0,016
Heavy Duty Vehicles	Diesel TT/AT 40 - 50t	Conventional	0	1993	0,175	0,080	0,070	0,030	0,030	0,030	0,003	0,003	0,003	1,015	0,628
Heavy Duty Vehicles	Diesel TT/AT 40 - 50t	Euro I	1994	1996	0,175	0,080	0,070	0,030	0,030	0,030	0,003	0,003	0,003	0,955	0,616
Heavy Duty Vehicles	Diesel TT/AT 40 - 50t	Euro II	1997	2001	0,112	0,070	0,065	0,030	0,030	0,030	0,003	0,003	0,003	0,605	0,389
Heavy Duty Vehicles	Diesel TT/AT 40 - 50t	Euro III	2002	2006	0,098	0,074	0,064	0,030	0,030	0,030	0,003	0,003	0,003	0,525	0,336
Heavy Duty Vehicles	Diesel TT/AT 40 - 50t	Euro IV	2007	2009	0,005	0,006	0,004	0,030	0,030	0,030	0,003	0,003	0,003	0,026	0,016
Heavy Duty Vehicles	Diesel TT/AT 40 - 50t	Euro V	2010	2014	0,005	0,006	0,004	0,030	0,030	0,030	0,003	0,003	0,003	0,027	0,017
Heavy Duty Vehicles	Diesel TT/AT 50 - 60t	Euro II	1997	2001	0,112	0,070	0,065	0,030	0,030	0,030	0,003	0,003	0,003	0,685	0,444
Heavy Duty Vehicles	Diesel TT/AT 50 - 60t	Euro IV	2007	2009	0,005	0,006	0,004	0,030	0,030	0,030	0,003	0,003	0,003	0,030	0,018
Buses	Gasoline Urban Buses	Conventional	0	9999	0,140	0,110	0,070	0,006	0,006	0,006	0,002	0,002	0,002	7,000	5,500
Buses	Diesel Urban Buses <15t	Conventional	0	1993	0,175	0,080	0,070	0,030	0,030	0,030	0,003	0,003	0,003	2,990	1,962
Buses	Diesel Urban Buses <15t	Euro I	1994	1996	0,175	0,080	0,070	0,030	0,030	0,030	0,003	0,003	0,003	0,577	0,396
Buses	Diesel Urban Buses <15t	Euro II	1997	2001	0,114	0,052	0,046	0,030	0,030	0,030	0,003	0,003	0,003	0,375	0,255
Buses	Diesel Urban Buses <15t	Euro III	2002	2006	0,103	0,047	0,041	0,030	0,030	0,030	0,003	0,003	0,003	0,334	0,228
Buses	Diesel Urban Buses <15t	Euro IV	2007	2009	0,005	0,002	0,002	0,030	0,030	0,030	0,003	0,003	0,003	0,017	0,011
Buses	Diesel Urban Buses 15 - 18t	Conventional	0	1993	0,175	0,080	0,070	0,030	0,030	0,030	0,003	0,003	0,003	1,830	1,116
Buses	Diesel Urban Buses 15 - 18t	Euro I	1994	1996	0,175	0,080	0,070	0,030	0,030	0,030	0,003	0,003	0,003	0,754	0,488
Buses	Diesel Urban Buses 15 - 18t	Euro II	1997	2001	0,114	0,052	0,046	0,030	0,030	0,030	0,003	0,003	0,003	0,491	0,318
Buses	Diesel Urban Buses 15 - 18t	Euro III	2002	2006	0,103	0,047	0,041	0,030	0,030	0,030	0,003	0,003	0,003	0,437	0,283
Buses	Diesel Urban Buses 15 - 18t	Euro IV	2007	2009	0,005	0,002	0,002	0,030	0,030	0,030	0,003	0,003	0,003	0,023	0,014
Buses	Diesel Urban Buses >18t	Conventional	0	1993	0,175	0,080	0,070	0,030	0,030	0,030	0,003	0,003	0,003	1,907	1,155
Buses	Diesel Urban Buses >18t	Euro I	1994	1996	0,175	0,080	0,070	0,030	0,030	0,030	0,003	0,003	0,003	0,821	0,537
Buses	Diesel Urban Buses >18t	Euro II	1997	2001	0,114	0,052	0,046	0,030	0,030	0,030	0,003	0,003	0,003	0,532	0,347
Buses	Diesel Urban Buses >18t	Euro III	2002	2006	0,103	0,047	0,041	0,030	0,030	0,030	0,003	0,003	0,003	0,468	0,304
Buses	Diesel Urban Buses >18t	Euro IV	2007	2009	0,005	0,002	0,002	0,030	0,030	0,030	0,003	0,003	0,003	0,024	0,015
Buses	Gasoline Coaches	Conventional	0	9999	0,140	0,110	0,070	0,006	0,006	0,006	0,002	0,002	0,002	7,000	5,500
Buses	Diesel Coaches <15t	Conventional	0	1993	0,175	0,080	0,070	0,030	0,030	0,030	0,003	0,003	0,003	1,008	0,577
Buses	Diesel Coaches <15t	Euro I	1994	1996	0,175	0,080	0,070	0,030	0,030	0,030	0,003	0,003	0,003	0,936	0,563
Buses	Diesel Coaches <15t	Euro II	1997	2001	0,114	0,052	0,046	0,030	0,030	0,030	0,003	0,003	0,003	0,623	0,380
Buses	Diesel Coaches <15t	Euro III	2002	2006	0,103	0,047	0,041	0,030	0,030	0,030	0,003	0,003	0,003	0,575	0,354

Continued

Sector	Subsector	Tech 2	FYear	LYear	CH_4u	CH_4r	CH_4h	N_2Ou	N_2Or	N_2Oh	NH_3u	NH_3r	NH_3h	VOCu	VOCr
Buses	Diesel Coaches <15t	Euro IV	2007	2009	0,005	0,002	0,002	0,030	0,030	0,030	0,003	0,003	0,003	0,030	0,018
Buses	Diesel Coaches 15 - 18t	Conventional	0	1993	0,175	0,080	0,070	0,030	0,030	0,030	0,003	0,003	0,003	1,008	0,577
Buses	Diesel Coaches 15 - 18t	Euro I	1994	1996	0,175	0,080	0,070	0,030	0,030	0,030	0,003	0,003	0,003	0,936	0,563
Buses	Diesel Coaches 15 - 18t	Euro II	1997	2001	0,114	0,052	0,046	0,030	0,030	0,030	0,003	0,003	0,003	0,623	0,380
Buses	Diesel Coaches 15 - 18t	Euro III	2002	2006	0,103	0,047	0,041	0,030	0,030	0,030	0,003	0,003	0,003	0,575	0,354
Buses	Diesel Coaches 15 - 18t	Euro IV	2007	2009	0,005	0,002	0,002	0,030	0,030	0,030	0,003	0,003	0,003	0,030	0,018
Buses	Diesel Coaches >18t	Conventional	0	1993	0,175	0,080	0,070	0,030	0,030	0,030	0,003	0,003	0,003	1,104	0,668
Buses	Diesel Coaches >18t	Euro I	1994	1996	0,175	0,080	0,070	0,030	0,030	0,030	0,003	0,003	0,003	1,010	0,638
Buses	Diesel Coaches >18t	Euro II	1997	2001	0,114	0,052	0,046	0,030	0,030	0,030	0,003	0,003	0,003	0,660	0,409
Buses	Diesel Coaches >18t	Euro III	2002	2006	0,103	0,047	0,041	0,030	0,030	0,030	0,003	0,003	0,003	0,603	0,374
Buses	Diesel Coaches >18t	Euro IV	2007	2009	0,005	0,002	0,002	0,030	0,030	0,030	0,003	0,003	0,003	0,031	0,019
Mopeds	<50 cm³	Conventional	0	1999	0,219	0,219	0,000	0,001	0,001	0,001	0,001	0,001	0,001	13,910	13,910
Mopeds	<50 cm³	Euro I	2000	2003	0,044	0,044	0,000	0,001	0,001	0,001	0,001	0,001	0,001	2,730	2,730
Mopeds	<50 cm³	Euro II	2004	9999	0,024	0,024	0,000	0,001	0,001	0,001	0,001	0,001	0,001	1,560	1,560
Motorcycles	2-stroke >50 cm³	Conventional	0	1999	0,150	0,150	0,150	0,002	0,002	0,002	0,002	0,002	0,002	8,393	7,078
Motorcycles	4-stroke <250 cm³	Conventional	0	1999	0,200	0,200	0,200	0,002	0,002	0,002	0,002	0,002	0,002	0,128	0,104
Motorcycles	4-stroke <250 cm³	Euro I	2000	2003	0,142	0,144	0,132	0,002	0,002	0,002	0,002	0,002	0,002	1,242	0,866
Motorcycles	4-stroke <250 cm³	Euro II	2004	2006	0,136	0,092	0,092	0,002	0,002	0,002	0,002	0,002	0,002	1,042	0,843
Motorcycles	4-stroke <250 cm³	Euro III	2007	9999	0,082	0,032	0,028	0,002	0,002	0,002	0,002	0,002	0,002	0,456	0,441
Motorcycles	4-stroke 250 - 750 cm³	Conventional	0	1999	0,200	0,200	0,200	0,002	0,002	0,002	0,002	0,002	0,002	0,545	0,487
Motorcycles	4-stroke 250 - 750 cm³	Euro I	2000	2003	0,148	0,174	0,156	0,002	0,002	0,002	0,002	0,002	0,002	2,390	1,522
Motorcycles	4-stroke 250 - 750 cm³	Euro II	2004	2006	0,156	0,120	0,122	0,002	0,002	0,002	0,002	0,002	0,002	1,326	0,925
Motorcycles	4-stroke 250 - 750 cm³	Euro III	2007	9999	0,094	0,042	0,036	0,002	0,002	0,002	0,002	0,002	0,002	0,598	0,499
Motorcycles	4-stroke >750 cm³	Conventional	0	1999	0,200	0,200	0,200	0,002	0,002	0,002	0,002	0,002	0,002	0,392	0,337
Motorcycles	4-stroke >750 cm³	Euro I	2000	2003	0,092	0,092	0,154	0,002	0,002	0,002	0,002	0,002	0,002	2,495	1,643
Motorcycles	4-stroke >750 cm³	Euro II	2004	2006	0,084	0,062	0,102	0,002	0,002	0,002	0,002	0,002	0,002	1,088	0,674
Motorcycles	4-stroke >750 cm³	Euro III	2007	9999	0,050	0,022	0,030	0,002	0,002	0,002	0,002	0,002	0,002	0,384	0,309

Annex 2B-5: Reduction factors

Sector	Subsector	Tech 2	FYear	LYear	FCuR	FCrR	FChR	COuR	COrR	COhR	PMuR	PMrR	PMhR	NOxuR	NOxrR	NOxhR	VOCuR	VOCrR	VOChR
Passenger Cars	Gasoline <1,4 l	PRE ECE	0	1969	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Passenger Cars	Gasoline <1,4 l	ECE 15/00-01	1970	1978	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Passenger Cars	Gasoline <1,4 l	ECE 15/02	1979	1980	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Passenger Cars	Gasoline <1,4 l	ECE 15/03	1981	1985	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Passenger Cars	Gasoline <1,4 l	ECE 15/04	1986	1990	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Passenger Cars	Gasoline <1,4 l	Euro I	1991	1996	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Passenger Cars	Gasoline <1,4 l	Euro II	1997	2000	1,93	5,83	4,43	62,65	58,10	57,55	0,00	0,00	0,00	43,59	45,20	60,45	60,19	61,27	62,09
Passenger Cars	Gasoline <1,4 l	Euro III	2001	2005	-2,72	-0,72	1,59	70,59	49,62	34,95	60,25	54,57	37,37	72,16	78,49	88,69	91,74	87,53	77,02
Passenger Cars	Gasoline <1,4 l	Euro IV	2006	2010	-5,57	-5,34	-4,84	88,95	79,10	70,06	60,25	54,57	37,37	80,12	89,24	95,86	93,34	88,71	84,51
Passenger Cars	Gasoline 1,4 - 2,0 l	PRE ECE	0	1969	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Passenger Cars	Gasoline 1,4 - 2,0 l	ECE 15/00-01	1970	1978	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Passenger Cars	Gasoline 1,4 - 2,0 l	ECE 15/02	1979	1980	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Passenger Cars	Gasoline 1,4 - 2,0 l	ECE 15/03	1981	1985	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Passenger Cars	Gasoline 1,4 - 2,0 l	ECE 15/04	1986	1990	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Passenger Cars	Gasoline 1,4 - 2,0 l	Euro I	1991	1996	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Passenger Cars	Gasoline 1,4 - 2,0 l	Euro II	1997	2000	2,08	1,72	5,30	62,65	58,10	57,55	0,00	0,00	0,00	43,59	45,20	60,45	60,19	61,27	62,09
Passenger Cars	Gasoline 1,4 - 2,0 l	Euro III	2001	2005	-1,28	-2,83	-3,05	70,59	49,62	34,95	60,25	54,57	37,37	72,16	78,49	88,69	91,74	87,53	77,02
Passenger Cars	Gasoline 1,4 - 2,0 l	Euro IV	2006	2010	-5,15	-8,80	-7,33	88,95	79,10	70,06	60,25	54,57	37,37	80,12	89,24	95,86	93,34	88,71	84,51
Passenger Cars	Gasoline >2,0 l	PRE ECE	0	1969	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Passenger Cars	Gasoline >2,0 l	ECE 15/00-01	1970	1978	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Passenger Cars	Gasoline >2,0 l	ECE 15/02	1979	1980	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Passenger Cars	Gasoline >2,0 l	ECE 15/03	1981	1985	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Passenger Cars	Gasoline >2,0 l	ECE 15/04	1986	1990	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Passenger Cars	Gasoline >2,0 l	Euro I	1991	1996	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Passenger Cars	Gasoline >2,0 l	Euro II	1997	2000	-2,98	-5,37	-2,63	62,65	58,10	57,55	0,00	0,00	0,00	43,59	45,20	60,45	60,19	61,27	62,09
Passenger Cars	Gasoline >2,0 l	Euro III	2001	2005	5,12	7,23	12,60	70,59	49,62	34,95	60,25	54,57	37,37	72,16	78,49	88,69	91,74	87,53	77,02
Passenger Cars	Gasoline >2,0 l	Euro IV	2006	2010	-15,39	-9,65	-1,29	88,95	79,10	70,06	60,25	54,57	37,37	80,12	89,24	95,86	93,34	88,71	84,51
Passenger Cars	Diesel <2,0 l	Conventional	0	1990	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Passenger Cars	Diesel <2,0 l	Euro I	1991	1996	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Passenger Cars	Diesel <2,0 l	Euro II	1997	2000	-5,45	-3,06	-0,81	18,08	48,77	83,05	17,92	36,92	53,22	-7,94	1,18	-0,20	34,81	33,43	41,61
Passenger Cars	Diesel <2,0 l	Euro III	2001	2005	-2,27	-1,45	5,79	76,38	81,12	94,30	48,53	51,90	58,32	-18,71	-18,46	-12,98	65,94	63,35	66,25
Passenger Cars	Diesel <2,0 l	Euro IV	2006	2010	-2,27	-1,45	5,79	80,09	84,22	89,72	49,02	60,57	75,83	10,60	24,53	13,19	27,61	44,26	51,85
Passenger Cars	Diesel >2,0 l	Conventional	0	1990	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Passenger Cars	Diesel >2,0 l	Euro I	1991	1996	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00

Continued																				
Sector	Subsector	Tech 2	FYear	LYear	FCuR	FCrR	FChR	COuR	COrR	COhR	PMuR	PMrR	PMhR	NOxuR	NOxrR	NOxhR	VOCuR	VOCrR	VOChR
Passenger Cars	Diesel >2,0 l	Euro II	1997	2000	0,00	0,00	0,00	18,08	48,77	83,05	17,92	36,92	53,22	-7,94	1,18	-0,20	-22,14	-25,38	-11,51
Passenger Cars	Diesel >2,0 l	Euro III	2001	2005	0,00	0,00	0,00	76,38	81,12	94,30	48,53	51,90	58,32	-18,71	-18,46	-12,98	52,23	62,67	63,93
Passenger Cars	Diesel >2,0 l	Euro IV	2006	2010	0,00	0,00	0,00	80,09	84,22	89,72	49,02	60,57	75,83	10,60	24,53	13,19	86,39	86,10	83,20
Passenger Cars	LPG cars	Conventional	0	1990	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Passenger Cars	LPG cars	Euro I	1991	1996	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Passenger Cars	LPG cars	Euro II	1997	2000	0,00	0,00	0,00	32,00	32,00	32,00	0,00	0,00	0,00	64,00	64,00	64,00	79,00	79,00	79,00
Passenger Cars	LPG cars	Euro III	2001	2005	0,00	0,00	0,00	44,00	44,00	44,00	0,00	0,00	0,00	76,00	76,00	76,00	85,00	85,00	85,00
Passenger Cars	LPG cars	Euro IV	2006	2010	0,00	0,00	0,00	66,00	66,00	66,00	0,00	0,00	0,00	87,00	87,00	87,00	97,00	97,00	97,00
Passenger Cars	Electric cars	Conventional	0	9999	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Light Duty Vehicles	Gasoline <3,5t	Conventional	0	1994	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Light Duty Vehicles	Gasoline <3,5t	Euro I	1995	1998	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Light Duty Vehicles	Gasoline <3,5t	Euro II	1999	2001	0,00	0,00	0,00	39,00	39,00	39,00	0,00	0,00	0,00	66,00	66,00	66,00	76,00	76,00	76,00
Light Duty Vehicles	Gasoline <3,5t	Euro III	2002	2006	0,00	0,00	0,00	48,00	48,00	48,00	60,25	54,57	37,37	79,00	79,00	79,00	86,00	86,00	86,00
Light Duty Vehicles	Gasoline <3,5t	Euro IV	2007	2011	0,00	0,00	0,00	72,00	72,00	72,00	60,25	54,57	37,37	90,00	90,00	90,00	94,00	94,00	94,00
Light Duty Vehicles	Diesel <3,5t	Conventional	0	1994	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Light Duty Vehicles	Diesel <3,5t	Euro I	1995	1998	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Light Duty Vehicles	Diesel <3,5t	Euro II	1999	2001	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Light Duty Vehicles	Diesel <3,5t	Euro III	2002	2006	0,00	0,00	0,00	18,00	18,00	18,00	33,00	33,00	33,00	35,00	35,00	35,00	38,00	38,00	38,00
Light Duty Vehicles	Diesel <3,5t	Euro IV	2007	2011	0,00	0,00	0,00	35,00	35,00	35,00	65,00	65,00	65,00	72,00	72,00	72,00	77,00	77,00	77,00
Light Duty Vehicles	LPG <3,5t	Conventional	0	1994	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Light Duty Vehicles	LPG <3,5t	Euro II	1999	2001	0,00	0,00	0,00	32,00	32,00	32,00	0,00	0,00	0,00	64,00	64,00	64,00	79,00	79,00	79,00
Light Duty Vehicles	LPG <3,5t	Euro III	2002	2006	0,00	0,00	0,00	44,00	44,00	44,00	0,00	0,00	0,00	76,00	76,00	76,00	85,00	85,00	85,00
Light Duty Vehicles	LPG <3,5t	Euro IV	2007	2011	0,00	0,00	0,00	66,00	66,00	66,00	0,00	0,00	0,00	87,00	87,00	87,00	97,00	97,00	97,00
Light Duty Vehicles	Electric <3,5t	Conventional	0	9999	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Heavy Duty Veh.	Gasoline >3,5t	Conventional	0	9999	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Heavy Duty Veh.	Diesel RT 3,5 - 7,5t	Conventional	0	1993	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Heavy Duty Veh.	Diesel RT 3,5 - 7,5t	Euro I	1994	1996	19,41	13,86	11,62	66,97	65,69	60,81	61,51	61,35	61,09	30,34	27,31	27,37	80,08	78,62	76,18
Heavy Duty Veh.	Diesel RT 3,5 - 7,5t	Euro II	1997	2001	23,96	17,09	14,31	72,63	70,07	67,15	83,57	80,45	77,17	25,72	25,03	27,10	87,19	86,41	85,11
Heavy Duty Veh.	Diesel RT 3,5 - 7,5t	Euro III	2002	2006	18,81	12,58	11,10	67,25	69,42	70,43	82,21	83,12	84,01	41,88	44,80	47,19	88,42	87,82	87,33
Heavy Duty Veh.	Diesel RT 3,5 - 7,5t	Euro IV	2007	2009	23,88	17,99	16,51	97,42	97,51	97,57	96,62	96,96	97,24	64,74	64,88	65,56	99,40	99,41	99,42
Heavy Duty Veh.	Diesel RT 3,5 - 7,5t	Euro V	2010	2014	22,65	16,97	15,69	97,40	97,51	97,58	96,59	96,94	97,22	79,18	79,63	80,02	99,39	99,41	99,42
Heavy Duty Veh.	Diesel RT 7,5 - 12t	Conventional	0	1993	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Heavy Duty Veh.	Diesel RT 7,5 - 12t	Euro I	1994	1996	14,48	11,71	8,70	53,11	52,21	52,16	40,93	41,10	40,30	40,70	40,06	40,97	58,27	55,23	52,06
Heavy Duty Veh.	Diesel RT 7,5 - 12t	Euro II	1997	2001	18,36	14,62	11,03	61,36	57,79	55,70	74,55	70,47	63,66	37,20	37,70	39,86	73,01	71,48	69,76
Heavy Duty Veh.	Diesel RT 7,5 - 12t	Euro III	2002	2006	13,71	10,58	7,50	53,80	55,89	56,85	73,09	73,84	74,02	50,22	52,54	55,81	75,61	74,61	73,20
Heavy Duty Veh.	Diesel RT 7,5 - 12t	Euro IV	2007	2009	18,76	16,26	13,66	96,53	96,60	96,76	94,95	95,23	95,52	69,76	70,40	71,49	98,75	98,76	98,73

Continued

Sector	Subsector	Tech 2	FYear	LYear	FCuR	FCrR	FChR	COuR	COrR	COhR	PMuR	PMrR	PMhR	NOxuR	NOxrR	NOxhR	VOCuR	VOCrR	VOChR
Heavy Duty Veh.	Diesel RT 7,5 - 12t	Euro V	2010	2014	17,14	14,93	12,65	96,48	96,57	96,72	94,86	95,15	95,45	82,13	82,51	83,61	98,72	98,74	98,70
Heavy Duty Veh.	Diesel RT 12 - 14 t	Conventional	0	1993	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Heavy Duty Veh.	Diesel RT 12 - 14 t	Euro I	1994	1996	14,00	11,81	9,90	51,98	51,86	51,84	40,50	40,59	40,00	40,22	40,02	41,03	57,38	54,76	53,17
Heavy Duty Veh.	Diesel RT 12 - 14 t	Euro II	1997	2001	17,58	14,74	12,75	60,35	56,72	54,16	74,17	70,73	63,07	36,33	37,45	39,89	72,77	71,56	70,80
Heavy Duty Veh.	Diesel RT 12 - 14 t	Euro III	2002	2006	13,44	11,25	9,72	53,50	54,67	55,12	74,18	74,13	73,49	47,95	51,53	54,48	76,11	75,05	74,06
Heavy Duty Veh.	Diesel RT 12 - 14 t	Euro IV	2007	2009	18,64	16,97	15,88	96,66	96,63	96,74	94,95	95,22	95,47	68,91	69,93	71,33	98,79	98,78	98,76
Heavy Duty Veh.	Diesel RT 12 - 14 t	Euro V	2010	2014	17,12	15,74	14,94	96,62	96,60	96,71	94,87	95,16	95,41	81,37	82,27	83,21	98,76	98,76	98,73
Heavy Duty Veh.	Diesel RT 14 - 20t	Conventional	0	1993	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Heavy Duty Veh.	Diesel RT 14 - 20t	Euro I	1994	1996	17,74	16,63	13,43	53,07	52,85	52,78	41,21	41,16	41,68	40,33	40,60	40,59	58,81	57,49	56,82
Heavy Duty Veh.	Diesel RT 14 - 20t	Euro II	1997	2001	20,65	19,55	15,88	62,41	58,84	57,06	76,03	71,76	68,05	35,74	37,13	37,61	73,41	73,11	72,71
Heavy Duty Veh.	Diesel RT 14 - 20t	Euro III	2002	2006	16,74	16,35	13,77	54,04	54,70	54,84	73,64	73,46	73,44	47,46	50,49	52,38	76,41	76,07	75,61
Heavy Duty Veh.	Diesel RT 14 - 20t	Euro IV	2007	2009	22,25	21,70	19,35	96,63	96,62	96,74	94,79	95,05	95,27	68,94	70,06	70,56	98,79	98,81	98,79
Heavy Duty Veh.	Diesel RT 14 - 20t	Euro V	2010	2014	20,74	20,43	18,29	96,59	96,59	96,70	94,72	94,99	95,22	81,36	82,28	82,69	98,76	98,78	98,77
Heavy Duty Veh.	Diesel RT 20 - 26t	Conventional	0	1993	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Heavy Duty Veh.	Diesel RT 20 - 26t	Euro I	1994	1996	14,21	12,84	12,64	19,63	18,94	19,66	24,10	29,41	31,30	29,79	29,62	29,43	11,04	7,01	3,05
Heavy Duty Veh.	Diesel RT 20 - 26t	Euro II	1997	2001	17,26	15,13	14,21	35,33	28,28	24,87	68,32	66,55	58,73	25,27	25,98	26,14	43,30	40,88	39,78
Heavy Duty Veh.	Diesel RT 20 - 26t	Euro III	2002	2006	13,84	12,70	12,90	21,91	22,62	23,06	67,20	69,00	69,67	39,86	41,37	41,81	49,68	48,23	45,89
Heavy Duty Veh.	Diesel RT 20 - 26t	Euro IV	2007	2009	19,53	18,56	18,73	94,44	94,41	94,66	93,69	94,28	94,61	63,84	64,08	64,18	97,42	97,43	97,34
Heavy Duty Veh.	Diesel RT 20 - 26t	Euro V	2010	2014	18,00	17,31	17,61	94,37	94,36	94,61	93,59	94,21	94,55	78,46	78,73	78,82	97,37	97,38	97,29
Heavy Duty Veh.	Diesel RT 26 - 28t	Conventional	0	1993	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Heavy Duty Veh.	Diesel RT 26 - 28t	Euro I	1994	1996	14,00	12,70	12,51	20,01	18,01	17,86	25,27	28,77	29,97	29,64	29,98	29,98	12,80	8,80	3,69
Heavy Duty Veh.	Diesel RT 26 - 28t	Euro II	1997	2001	16,95	14,96	14,87	36,85	29,81	25,67	68,28	66,29	57,85	25,99	27,06	27,24	43,65	41,57	40,08
Heavy Duty Veh.	Diesel RT 26 - 28t	Euro III	2002	2006	13,57	12,49	12,85	23,47	22,67	22,77	66,93	68,50	69,78	42,22	43,83	43,92	49,46	47,97	46,83
Heavy Duty Veh.	Diesel RT 26 - 28t	Euro IV	2007	2009	19,30	18,51	18,91	94,45	94,46	94,77	93,92	94,40	94,74	64,58	65,01	65,03	97,41	97,42	97,34
Heavy Duty Veh.	Diesel RT 26 - 28t	Euro V	2010	2014	17,76	17,24	17,79	94,38	94,41	94,73	93,83	94,33	94,68	79,09	79,47	79,48	97,35	97,37	97,29
Heavy Duty Veh.	Diesel RT 28 - 32t	Conventional	0	1993	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Heavy Duty Veh.	Diesel RT 28 - 32t	Euro I	1994	1996	12,26	11,30	10,52	17,38	14,65	13,49	25,71	28,05	28,20	28,68	29,39	29,24	10,80	5,19	2,39
Heavy Duty Veh.	Diesel RT 28 - 32t	Euro II	1997	2001	14,82	13,05	12,45	33,44	26,86	23,15	66,69	65,89	54,27	25,92	26,23	28,46	42,77	39,78	39,27
Heavy Duty Veh.	Diesel RT 28 - 32t	Euro III	2002	2006	11,88	10,80	10,65	22,56	21,95	20,96	68,08	69,19	69,50	41,32	43,32	44,39	49,15	46,82	45,76
Heavy Duty Veh.	Diesel RT 28 - 32t	Euro IV	2007	2009	17,57	16,98	17,26	94,42	94,43	94,66	94,07	94,53	94,85	63,83	64,33	65,14	97,41	97,39	97,33
Heavy Duty Veh.	Diesel RT 28 - 32t	Euro V	2010	2014	15,99	15,67	16,06	94,34	94,36	94,59	93,97	94,44	94,77	78,50	79,03	79,84	97,35	97,34	97,27
Heavy Duty Veh.	Diesel RT >32t	Euro I	1994	1996	12,50	11,58	11,42	16,36	14,69	15,31	23,16	27,51	29,07	29,15	29,31	29,12	8,38	3,49	0,77
Heavy Duty Veh.	Diesel RT >32t	Euro III	2002	2006	12,36	11,61	11,90	21,04	20,21	20,42	67,54	69,42	70,25	40,86	41,56	42,49	48,85	46,96	45,25
Heavy Duty Veh.	Diesel RT >32t	Euro IV	2007	2009	18,38	17,81	18,11	94,49	94,55	94,72	93,96	94,54	94,85	63,71	63,97	63,88	97,41	97,39	97,33
Heavy Duty Veh.	Diesel RT >32t	Euro V	2010	2014	16,89	16,56	16,96	94,41	94,49	94,68	93,86	94,46	94,79	78,48	78,77	78,75	97,35	97,33	97,28
Heavy Duty Veh.	Diesel TT/AT 28 - 34t	Conventional	0	1993	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00

Continued

Sector	Subsector	Tech 2	FYear	LYear	FCuR	FCrR	FChR	COuR	COrR	COhR	PMuR	PMrR	PMhR	NOxuR	NOxrR	NOxhR	VOCuR	VOCrR	VOChR
Heavy Duty Veh.	Diesel TT/AT 28 - 34t	Euro I	1994	1996	10,66	10,13	10,20	15,43	12,25	12,77	24,63	26,46	27,12	29,11	29,63	29,69	7,38	4,00	3,37
Heavy Duty Veh.	Diesel TT/AT 28 - 34t	Euro II	1997	2001	14,64	13,29	13,74	31,30	25,94	23,81	65,67	65,99	53,62	27,71	27,97	28,65	41,09	39,33	40,65
Heavy Duty Veh.	Diesel TT/AT 28 - 34t	Euro III	2002	2006	11,70	11,01	11,58	20,78	20,50	20,31	68,41	69,33	69,54	41,68	43,76	44,51	48,57	47,10	46,10
Heavy Duty Veh.	Diesel TT/AT 28 - 34t	Euro IV	2007	2009	17,59	17,20	17,85	94,57	94,65	94,91	94,14	94,65	94,97	64,11	65,18	64,46	97,40	97,39	97,34
Heavy Duty Veh.	Diesel TT/AT 28 - 34t	Euro V	2010	2014	16,12	15,95	16,73	94,50	94,59	94,86	94,05	94,58	94,90	78,71	79,60	79,26	97,35	97,34	97,29
Heavy Duty Veh.	Diesel TT/AT 34 - 40t	Conventional	0	1993	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Heavy Duty Veh.	Diesel TT/AT 34 - 40t	Euro I	1994	1996	12,13	11,41	11,43	15,15	13,05	13,59	22,77	26,35	27,63	29,55	29,58	29,47	7,47	3,64	2,14
Heavy Duty Veh.	Diesel TT/AT 34 - 40t	Euro II	1997	2001	14,47	13,03	13,29	31,64	24,64	21,80	65,15	65,77	53,15	26,47	27,08	27,05	41,31	38,92	40,06
Heavy Duty Veh.	Diesel TT/AT 34 - 40t	Euro III	2002	2006	11,94	11,27	11,85	20,63	19,44	19,37	67,76	69,22	69,88	41,45	42,35	42,24	48,65	47,10	45,84
Heavy Duty Veh.	Diesel TT/AT 34 - 40t	Euro IV	2007	2009	18,09	17,61	18,18	94,63	94,66	94,93	94,11	94,66	94,93	63,89	64,44	63,38	97,40	97,39	97,33
Heavy Duty Veh.	Diesel TT/AT 34 - 40t	Euro V	2010	2014	16,62	16,35	17,01	94,55	94,60	94,89	94,01	94,58	94,86	78,66	79,13	78,50	97,35	97,34	97,27
Heavy Duty Veh.	Diesel TT/AT 40 - 50t	Conventional	0	1993	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Heavy Duty Veh.	Diesel TT/AT 40 - 50t	Euro I	1994	1996	12,00	11,39	11,53	14,38	9,70	9,28	22,52	25,41	26,29	30,04	30,19	30,13	5,93	1,77	1,82
Heavy Duty Veh.	Diesel TT/AT 40 - 50t	Euro II	1997	2001	13,71	12,64	13,25	29,69	22,96	20,14	64,07	64,68	52,14	27,37	28,20	28,34	40,39	37,95	40,18
Heavy Duty Veh.	Diesel TT/AT 40 - 50t	Euro III	2002	2006	11,55	11,28	12,07	19,87	18,88	18,81	68,17	69,70	70,31	42,32	43,17	42,86	48,25	46,50	47,44
Heavy Duty Veh.	Diesel TT/AT 40 - 50t	Euro IV	2007	2009	17,75	17,68	18,61	94,68	94,79	94,99	94,32	94,90	95,15	64,06	64,69	63,75	97,40	97,39	97,36
Heavy Duty Veh.	Diesel TT/AT 40 - 50t	Euro V	2010	2014	16,27	16,43	17,44	94,61	94,70	94,98	94,22	94,82	95,08	78,86	79,40	78,79	97,34	97,34	97,30
Heavy Duty Veh.	Diesel TT/AT 50 - 60t	Euro II	1997	2001	14,04	13,10	13,89	28,00	26,76	9,91	63,10	63,63	50,92	28,81	29,51	29,11	39,38	37,01	39,90
Heavy Duty Veh.	Diesel TT/AT 50 - 60t	Euro IV	2007	2009	18,10	18,12	19,18	94,79	94,92	95,16	94,58	95,14	95,36	64,53	65,11	64,11	97,39	97,39	97,37
Heavy Duty Veh.	Diesel TT/AT >60t	Euro V	2010	2014	16,40	16,64	17,80	94,72	94,86	95,10	94,49	95,06	95,28	79,29	79,80	79,09	97,34	97,34	97,32
Buses	Gasoline Urban Buses	Conventional	0	9999	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Buses	Diesel Urban Buses <15t	Conventional	0	1993	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Buses	Diesel Urban Buses <15t	Euro I	1994	1996	18,85	18,92	18,21	64,43	65,86	67,68	65,05	62,49	60,57	26,62	28,27	28,63	80,71	79,83	79,24
Buses	Diesel Urban Buses <15t	Euro II	1997	2001	22,37	20,84	20,78	67,71	70,27	73,36	84,13	81,90	80,25	21,33	23,84	24,64	87,45	87,01	86,66
Buses	Diesel Urban Buses <15t	Euro III	2002	2006	18,19	16,71	16,65	64,31	67,16	72,55	84,65	82,77	81,54	31,66	40,65	48,19	88,82	88,36	88,06
Buses	Diesel Urban Buses <15t	Euro IV	2007	2009	21,90	21,76	20,81	97,06	97,41	97,61	96,60	96,75	96,78	60,26	63,58	66,60	99,42	99,42	99,42
Buses	Diesel Urban Buses 15 - 18t	Conventional	0	1993	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Buses	Diesel Urban Buses 15 - 18t	Euro I	1994	1996	14,83	13,35	12,85	52,04	51,79	55,42	45,74	41,81	43,69	39,11	39,36	41,56	58,81	56,29	54,39
Buses	Diesel Urban Buses 15 - 18t	Euro II	1997	2001	17,76	14,66	13,07	57,73	57,23	61,50	75,04	71,66	68,52	34,94	36,64	38,47	73,19	71,52	69,69
Buses	Diesel Urban Buses 15 - 18t	Euro III	2002	2006	13,52	11,21	10,63	53,21	54,20	58,38	76,57	74,49	72,92	44,89	50,41	55,05	76,10	74,64	73,35
Buses	Diesel Urban Buses 15 - 18t	Euro IV	2007	2009	18,47	16,55	15,86	96,18	96,48	96,59	95,01	95,23	95,20	67,58	68,76	72,16	98,77	98,75	98,71
Buses	Diesel Urban Buses >18t	Conventional	0	1993	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Buses	Diesel Urban Buses >18t	Euro I	1994	1996	13,05	11,70	10,96	49,89	49,90	53,47	45,37	41,48	42,64	39,31	39,74	39,30	56,95	53,47	50,97
Buses	Diesel Urban Buses >18t	Euro II	1997	2001	14,50	12,58	12,35	54,22	57,70	62,71	72,77	70,48	68,51	36,94	37,43	40,10	72,09	69,98	67,95

Continued

Sector	Subsector	Tech 2	FYear	LYear	FCuR	FCrR	FChR	COuR	COrR	COhR	PMuR	PMrR	PMhR	NOxuR	NOxrR	NOxhR	VOCuR	VOCrR	VOChR
Buses	Diesel Urban Buses >18t	Euro III	2002	2006	11,72	9,92	9,64	52,06	54,97	59,90	77,63	76,08	74,56	46,95	49,89	56,68	75,47	73,72	72,30
Buses	Diesel Urban Buses >18t	Euro IV	2007	2009	17,13	15,57	14,89	96,15	96,61	97,12	95,36	95,74	95,80	67,62	68,63	71,57	98,74	98,72	98,68
Buses	Gasoline Coaches	Conventional	0	9999	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Buses	Diesel Coaches <15t	Conventional	0	1993	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Buses	Diesel Coaches <15t	Euro I	1994	1996	7,96	7,67	7,92	18,93	16,53	16,34	20,89	23,78	27,11	23,46	23,96	25,12	7,21	2,52	-4,41
Buses	Diesel Coaches <15t	Euro II	1997	2001	8,24	7,37	7,94	32,32	27,97	24,04	65,98	63,06	61,68	14,45	16,52	18,47	38,19	34,08	31,34
Buses	Diesel Coaches <15t	Euro III	2002	2006	1,71	0,56	0,19	16,59	13,73	12,65	62,34	61,58	62,41	26,50	32,15	35,43	42,96	38,70	31,67
Buses	Diesel Coaches <15t	Euro IV	2007	2009	6,93	6,22	5,83	93,52	93,34	93,37	92,49	92,91	92,91	56,15	58,53	60,19	97,02	96,87	96,57
Buses	Diesel Coaches 15 - 18t	Conventional	0	1993	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Buses	Diesel Coaches 15 - 18t	Euro I	1994	1996	7,96	7,67	7,92	18,93	16,53	16,34	20,89	23,78	27,11	23,46	23,96	25,12	7,21	2,52	-4,41
Buses	Diesel Coaches 15 - 18t	Euro II	1997	2001	8,24	7,37	7,94	32,32	27,97	24,04	65,98	63,06	61,68	14,45	16,52	18,47	38,19	34,08	31,34
Buses	Diesel Coaches 15 - 18t	Euro III	2002	2006	1,71	0,56	0,19	16,59	13,73	12,65	62,34	61,58	62,41	26,50	32,15	35,43	42,96	38,70	31,67
Buses	Diesel Coaches 15 - 18t	Euro IV	2007	2009	6,93	6,22	5,83	93,52	93,34	93,37	92,49	92,91	92,91	56,15	58,53	60,19	97,02	96,87	96,57
Buses	Diesel Coaches >18t	Conventional	0	1993	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Buses	Diesel Coaches >18t	Euro I	1994	1996	10,85	10,61	11,02	18,66	16,77	17,56	23,95	25,83	27,25	24,78	25,97	26,10	8,54	4,54	2,08
Buses	Diesel Coaches >18t	Euro II	1997	2001	12,31	11,38	11,82	31,63	29,13	27,82	66,43	63,73	62,36	18,65	20,76	21,41	40,27	38,73	37,32
Buses	Diesel Coaches >18t	Euro III	2002	2006	9,21	11,33	13,13	18,34	19,05	22,13	64,85	65,53	66,70	34,22	37,99	40,74	45,39	43,98	42,31
Buses	Diesel Coaches >18t	Euro IV	2007	2009	14,12	16,40	17,99	93,89	94,02	94,22	93,08	93,60	93,92	60,31	61,95	63,79	97,17	97,16	97,11
Mopeds	<50 cm^3	Conventional	0	1999	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Mopeds	<50 cm^3	Euro I	2000	2003	40,00	40,00	0,00	59,42	59,42	0,00	59,84	59,84	0,00	0,00	0,00	0,00	80,37	80,37	0,00
Mopeds	<50 cm^3	Euro II	2004	9999	51,68	51,68	0,00	90,58	90,58	0,00	80,00	80,00	0,00	-1.200,00	-1.200,00	0,00	88,79	88,79	0,00
Motorcycles	2-stroke >50 cm^3	Conventional	0	1999	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Motorcycles	4-stroke <250 cm^3	Conventional	0	1999	8,20	9,50	10,60	0,00	0,00	0,00	0,00	0,00	0,00	22,10	-0,90	-15,50	89,70	88,00	85,90
Motorcycles	4-stroke <250 cm^3	Euro I	2000	2003	0,00	0,00	0,00	31,90	16,00	0,20	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Motorcycles	4-stroke <250 cm^3	Euro II	2004	2006	17,60	17,20	16,30	75,70	66,50	63,40	75,00	75,00	75,00	-6,10	-5,40	-5,50	16,10	2,60	1,10
Motorcycles	4-stroke <250 cm^3	Euro III	2007	9999	28,70	33,00	35,70	86,50	81,40	79,60	75,00	75,00	75,00	16,90	9,90	-7,90	63,30	49,10	47,60
Motorcycles	4-stroke 250 - 750 cm^3	Conventional	0	1999	28,70	33,00	35,70	0,00	0,00	0,00	0,00	0,00	0,00	24,10	24,90	10,10	77,20	68,00	66,50
Motorcycles	4-stroke 250 - 750 cm^3	Euro I	2000	2003	0,00	0,00	0,00	48,20	53,80	54,50	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Motorcycles	4-stroke 250 - 750 cm^3	Euro II	2004	2006	8,50	5,70	0,30	89,10	87,50	73,50	75,00	75,00	75,00	0,20	2,50	5,40	44,50	39,20	23,30
Motorcycles	4-stroke 250 - 750 cm^3	Euro III	2007	9999	17,10	13,40	7,90	94,00	93,10	85,40	75,00	75,00	75,00	70,40	67,00	56,50	75,00	67,20	43,00
Motorcycles	4-stroke >750 cm^3	Conventional	0	1999	17,10	13,40	7,90	0,00	0,00	0,00	0,00	0,00	0,00	85,00	83,20	78,10	84,30	79,50	64,20
Motorcycles	4-stroke >750 cm^3	Euro I	2000	2003	0,00	0,00	0,00	48,20	53,80	54,50	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Motorcycles	4-stroke >750 cm^3	Euro II	2004	2006	2,30	7,40	11,80	89,10	87,50	73,50	75,00	75,00	75,00	-14,20	-37,30	-17,00	56,40	59,00	57,80
Motorcycles	4-stroke >750 cm^3	Euro III	2007	9999	6,40	8,70	9,30	94,00	93,10	85,40	75,00	75,00	75,00	16,90	-12,40	-23,50	84,60	81,20	73,20

Annex 2B-6: Fuel consumption factors (MJ/km) and emission factors (g/km)

Sector	ForecastYear	FCu (MJ)	FCr (MJ)	FCh (MJ)	CO_2u	CO_2r	CO_2h	CH_4u	CH_4r	CH_4h	N_2Ou	N_2Or	N_2Oh	SO_2u	SO_2r	SO_2h	NO_xu	NO_xr	NO_xh
Passenger Cars	1985	3,393	2,112	2,438	248	154	178	0,149	0,027	0,024	0,009	0,006	0,006	0,079	0,048	0,058	1,898	2,194	2,706
Passenger Cars	1986	3,340	2,099	2,419	244	153	177	0,148	0,027	0,024	0,009	0,006	0,006	0,053	0,032	0,038	1,867	2,183	2,747
Passenger Cars	1987	3,317	2,087	2,393	242	153	175	0,148	0,027	0,024	0,009	0,006	0,006	0,052	0,032	0,038	1,865	2,192	2,797
Passenger Cars	1988	3,241	2,078	2,373	237	152	173	0,147	0,027	0,024	0,009	0,006	0,006	0,051	0,031	0,038	1,846	2,203	2,840
Passenger Cars	1989	3,203	2,070	2,356	234	151	172	0,145	0,027	0,024	0,009	0,006	0,006	0,037	0,023	0,028	1,835	2,205	2,862
Passenger Cars	1990	3,184	2,063	2,341	233	151	171	0,145	0,027	0,024	0,009	0,006	0,006	0,037	0,023	0,028	1,836	2,212	2,882
Passenger Cars	1991	3,196	2,058	2,326	234	150	170	0,142	0,027	0,023	0,009	0,006	0,006	0,037	0,023	0,027	1,787	2,126	2,777
Passenger Cars	1992	3,153	2,054	2,307	230	150	169	0,133	0,026	0,023	0,010	0,006	0,006	0,025	0,016	0,018	1,678	1,967	2,575
Passenger Cars	1993	3,155	2,047	2,283	231	150	167	0,126	0,025	0,022	0,011	0,006	0,005	0,013	0,008	0,010	1,596	1,819	2,387
Passenger Cars	1994	3,113	2,045	2,269	228	149	166	0,113	0,024	0,021	0,012	0,007	0,005	0,013	0,009	0,010	1,469	1,630	2,157
Passenger Cars	1995	3,110	2,046	2,259	227	150	165	0,103	0,022	0,020	0,012	0,007	0,005	0,013	0,009	0,010	1,364	1,454	1,940
Passenger Cars	1996	3,135	2,049	2,251	229	150	165	0,094	0,021	0,019	0,013	0,007	0,005	0,013	0,009	0,010	1,280	1,300	1,751
Passenger Cars	1997	3,084	2,050	2,238	225	150	164	0,084	0,020	0,017	0,014	0,007	0,005	0,013	0,008	0,010	1,175	1,151	1,562
Passenger Cars	1998	3,079	2,050	2,221	225	150	162	0,076	0,019	0,016	0,013	0,007	0,005	0,013	0,009	0,010	1,076	1,007	1,371
Passenger Cars	1999	3,058	2,050	2,209	224	150	161	0,069	0,018	0,015	0,013	0,006	0,004	0,010	0,007	0,008	0,988	0,883	1,202
Passenger Cars	2000	3,040	2,050	2,201	222	150	161	0,063	0,017	0,014	0,013	0,006	0,004	0,007	0,005	0,005	0,927	0,795	1,079
Passenger Cars	2001	3,066	2,053	2,199	224	150	161	0,059	0,015	0,013	0,013	0,006	0,004	0,007	0,005	0,005	0,885	0,733	0,990
Passenger Cars	2002	3,039	2,058	2,200	222	150	161	0,053	0,014	0,012	0,012	0,006	0,004	0,007	0,005	0,005	0,831	0,670	0,899
Passenger Cars	2003	3,044	2,061	2,200	223	151	161	0,047	0,012	0,011	0,012	0,005	0,003	0,007	0,005	0,005	0,781	0,610	0,811
Passenger Cars	2004	2,993	2,063	2,199	219	151	161	0,041	0,011	0,010	0,011	0,005	0,003	0,007	0,005	0,005	0,725	0,552	0,726
Passenger Cars	2005	3,019	2,064	2,198	221	151	161	0,037	0,009	0,009	0,011	0,005	0,003	0,001	0,001	0,001	0,676	0,496	0,644
Passenger Cars	2006	2,998	2,067	2,198	219	151	161	0,031	0,008	0,007	0,010	0,004	0,003	0,001	0,001	0,001	0,619	0,441	0,567
Passenger Cars	2007	2,975	2,073	2,201	217	152	161	0,026	0,007	0,006	0,010	0,004	0,003	0,001	0,001	0,001	0,573	0,398	0,509
Passenger Cars	2008	2,977	2,071	2,196	218	152	161	0,022	0,006	0,005	0,009	0,003	0,003	0,001	0,001	0,001	0,539	0,364	0,465
Passenger Cars	2009	2,955	2,065	2,190	216	151	160	0,020	0,005	0,004	0,009	0,003	0,003	0,001	0,001	0,001	0,515	0,342	0,437
Light Duty Vehicles	1985	4,031	2,783	2,979	297	205	220	0,052	0,017	0,011	0,002	0,001	0,001	0,758	0,546	0,597	2,086	1,241	1,281
Light Duty Vehicles	1986	4,010	2,785	2,985	296	206	220	0,050	0,017	0,011	0,002	0,001	0,001	0,460	0,332	0,363	2,067	1,217	1,254
Light Duty Vehicles	1987	4,022	2,785	2,985	297	206	220	0,050	0,017	0,011	0,002	0,001	0,001	0,461	0,332	0,363	2,073	1,218	1,255
Light Duty Vehicles	1988	3,967	2,785	2,985	293	206	220	0,050	0,017	0,011	0,002	0,001	0,001	0,455	0,332	0,363	2,039	1,216	1,253
Light Duty Vehicles	1989	3,944	2,787	2,989	291	206	221	0,049	0,016	0,011	0,002	0,001	0,001	0,305	0,224	0,244	2,021	1,200	1,235
Light Duty Vehicles	1990	3,939	2,787	2,990	291	206	221	0,048	0,016	0,011	0,002	0,001	0,001	0,305	0,224	0,245	2,016	1,196	1,230
Light Duty Vehicles	1991	3,977	2,787	2,989	293	206	221	0,049	0,016	0,011	0,002	0,001	0,001	0,307	0,223	0,244	2,041	1,203	1,238
Light Duty Vehicles	1992	3,966	2,784	2,982	293	206	220	0,051	0,017	0,011	0,002	0,001	0,001	0,197	0,144	0,157	2,040	1,229	1,267
Light Duty Vehicles	1993	4,006	2,784	2,979	296	205	220	0,051	0,017	0,011	0,002	0,001	0,001	0,077	0,056	0,061	2,065	1,239	1,279

Continued

Sector	ForecastYear	FCu (MJ)	FCr (MJ)	FCh (MJ)	CO_2u	CO_2r	CO_2h	CH_4u	CH_4r	CH_4h	N_2Ou	N_2Or	N_2Oh	SO_2u	SO_2r	SO_2h	NO_xu	NO_xr	NO_xh
Light Duty Vehicles	1994	3,981	2,783	2,979	294	205	220	0,051	0,017	0,011	0,002	0,001	0,001	0,077	0,056	0,061	2,049	1,233	1,272
Light Duty Vehicles	1995	3,976	2,768	2,962	293	204	219	0,049	0,016	0,010	0,002	0,001	0,001	0,077	0,055	0,061	1,993	1,202	1,241
Light Duty Vehicles	1996	3,978	2,737	2,931	294	202	216	0,044	0,015	0,009	0,003	0,002	0,002	0,077	0,055	0,060	1,900	1,150	1,189
Light Duty Vehicles	1997	3,894	2,707	2,899	287	200	214	0,039	0,014	0,009	0,003	0,003	0,002	0,076	0,055	0,060	1,763	1,107	1,147
Light Duty Vehicles	1998	3,873	2,682	2,870	286	198	212	0,036	0,014	0,008	0,004	0,003	0,003	0,075	0,054	0,059	1,669	1,073	1,114
Light Duty Vehicles	1999	3,834	2,659	2,845	283	196	210	0,032	0,012	0,007	0,005	0,004	0,003	0,042	0,030	0,032	1,575	1,040	1,082
Light Duty Vehicles	2000	3,803	2,640	2,823	281	195	208	0,028	0,011	0,006	0,006	0,005	0,004	0,009	0,006	0,007	1,499	1,018	1,061
Light Duty Vehicles	2001	3,820	2,623	2,804	282	194	207	0,025	0,010	0,006	0,006	0,005	0,004	0,009	0,006	0,007	1,453	0,997	1,041
Light Duty Vehicles	2002	3,778	2,609	2,789	279	193	206	0,022	0,009	0,005	0,007	0,005	0,005	0,009	0,006	0,007	1,357	0,955	0,998
Light Duty Vehicles	2003	3,767	2,594	2,777	278	192	205	0,019	0,007	0,004	0,008	0,005	0,005	0,009	0,006	0,006	1,264	0,896	0,938
Light Duty Vehicles	2004	3,699	2,581	2,766	273	191	204	0,016	0,006	0,003	0,009	0,005	0,004	0,009	0,006	0,006	1,149	0,837	0,876
Light Duty Vehicles	2005	3,723	2,571	2,757	275	190	204	0,013	0,004	0,003	0,010	0,005	0,004	0,002	0,001	0,001	1,073	0,779	0,817
Light Duty Vehicles	2006	3,693	2,561	2,749	273	189	203	0,011	0,003	0,002	0,011	0,005	0,004	0,002	0,001	0,001	0,996	0,732	0,768
Light Duty Vehicles	2007	3,648	2,547	2,744	269	188	203	0,009	0,003	0,002	0,011	0,004	0,004	0,002	0,001	0,001	0,918	0,680	0,713
Light Duty Vehicles	2008	3,664	2,543	2,741	271	188	202	0,008	0,002	0,001	0,011	0,004	0,004	0,002	0,001	0,001	0,833	0,614	0,644
Light Duty Vehicles	2009	3,658	2,541	2,739	270	187	202	0,007	0,002	0,001	0,012	0,004	0,004	0,002	0,001	0,001	0,782	0,577	0,606
Heavy Duty Vehicles	1985	13,634	10,397	9,631	1009	769	713	0,153	0,066	0,058	0,030	0,030	0,030	3,181	2,427	2,247	13,431	10,825	9,874
Heavy Duty Vehicles	1986	13,736	10,467	9,685	1016	775	717	0,154	0,067	0,059	0,030	0,030	0,030	1,924	1,467	1,356	13,531	10,890	9,921
Heavy Duty Vehicles	1987	13,819	10,523	9,729	1023	779	720	0,155	0,067	0,059	0,030	0,030	0,030	1,936	1,475	1,363	13,610	10,943	9,958
Heavy Duty Vehicles	1988	13,987	10,639	9,818	1035	787	726	0,156	0,068	0,060	0,030	0,030	0,030	1,960	1,491	1,375	13,779	11,058	10,038
Heavy Duty Vehicles	1989	14,045	10,679	9,848	1039	790	729	0,157	0,069	0,060	0,030	0,030	0,030	1,312	0,998	0,920	13,837	11,096	10,065
Heavy Duty Vehicles	1990	14,344	10,882	10,005	1061	805	740	0,159	0,070	0,061	0,030	0,030	0,030	1,340	1,017	0,935	14,122	11,288	10,197
Heavy Duty Vehicles	1991	14,327	10,871	9,996	1060	804	740	0,159	0,070	0,061	0,030	0,030	0,030	1,339	1,016	0,934	14,114	11,284	10,193
Heavy Duty Vehicles	1992	14,488	10,980	10,081	1072	813	746	0,160	0,071	0,062	0,030	0,030	0,030	0,880	0,667	0,612	14,264	11,385	10,266
Heavy Duty Vehicles	1993	14,732	11,145	10,206	1090	825	755	0,162	0,072	0,063	0,030	0,030	0,030	0,344	0,261	0,238	14,463	11,513	10,344
Heavy Duty Vehicles	1994	14,697	11,120	10,174	1088	823	753	0,163	0,072	0,063	0,030	0,030	0,030	0,344	0,260	0,238	14,231	11,315	10,152
Heavy Duty Vehicles	1995	14,348	10,880	9,965	1062	805	737	0,162	0,072	0,063	0,030	0,030	0,030	0,335	0,254	0,233	13,495	10,741	9,653
Heavy Duty Vehicles	1996	14,310	10,850	9,915	1059	803	734	0,163	0,073	0,064	0,030	0,030	0,030	0,335	0,254	0,232	13,020	10,335	9,260
Heavy Duty Vehicles	1997	14,147	10,740	9,804	1047	795	725	0,157	0,072	0,064	0,030	0,030	0,030	0,331	0,251	0,229	12,584	9,967	8,911
Heavy Duty Vehicles	1998	13,896	10,576	9,654	1028	783	714	0,147	0,071	0,063	0,030	0,030	0,030	0,325	0,247	0,226	12,200	9,650	8,623
Heavy Duty Vehicles	1999	13,741	10,476	9,556	1017	775	707	0,139	0,070	0,063	0,030	0,030	0,030	0,177	0,135	0,123	11,930	9,417	8,398
Heavy Duty Vehicles	2000	13,777	10,509	9,567	1019	778	708	0,132	0,069	0,062	0,030	0,030	0,030	0,032	0,025	0,022	11,851	9,330	8,298
Heavy Duty Vehicles	2001	13,743	10,500	9,555	1017	777	707	0,124	0,068	0,062	0,030	0,030	0,030	0,032	0,025	0,022	11,571	9,101	8,093
Heavy Duty Vehicles	2002	13,921	10,615	9,630	1030	786	713	0,119	0,068	0,061	0,030	0,030	0,030	0,033	0,025	0,023	11,328	8,880	7,870
Heavy Duty Vehicles	2003	13,997	10,661	9,656	1036	789	715	0,113	0,068	0,061	0,030	0,030	0,030	0,033	0,025	0,023	10,954	8,567	7,585
Heavy Duty Vehicles	2004	14,023	10,673	9,661	1038	790	715	0,109	0,068	0,061	0,030	0,030	0,030	0,033	0,025	0,023	10,603	8,280	7,331

Continued

Sector	ForecastYear	FCu (MJ)	FCr (MJ)	FCh (MJ)	CO_2u	CO_2r	CO_2h	CH_4u	CH_4r	CH_4h	N_2Ou	N_2Or	N_2Oh	SO_2u	SO_2r	SO_2h	NO_xu	NO_xr	NO_xh
Heavy Duty Vehicles	2005	14,262	10,833	9,778	1055	802	724	0,106	0,069	0,061	0,030	0,030	0,030	0,007	0,005	0,005	10,387	8,085	7,143
Heavy Duty Vehicles	2006	14,296	10,850	9,789	1058	803	724	0,101	0,068	0,060	0,030	0,030	0,030	0,007	0,005	0,005	10,023	7,791	6,887
Heavy Duty Vehicles	2007	14,234	10,793	9,729	1053	799	720	0,087	0,060	0,052	0,030	0,030	0,030	0,007	0,005	0,005	9,295	7,219	6,389
Heavy Duty Vehicles	2008	13,948	10,554	9,492	1032	781	702	0,068	0,047	0,041	0,029	0,029	0,029	0,007	0,005	0,004	8,204	6,360	5,635
Heavy Duty Vehicles	2009	14,105	10,657	9,565	1042	787	707	0,054	0,039	0,033	0,030	0,030	0,030	0,007	0,005	0,004	7,569	5,860	5,201
Buses	1985	13,264	9,858	8,936	981	729	661	0,174	0,081	0,070	0,029	0,029	0,029	3,057	2,258	2,006	13,431	10,515	9,565
Buses	1986	13,269	9,864	8,940	982	730	661	0,174	0,081	0,070	0,030	0,029	0,029	1,837	1,358	1,208	13,439	10,517	9,567
Buses	1987	13,271	9,868	8,944	982	730	662	0,174	0,081	0,070	0,030	0,029	0,029	1,838	1,359	1,209	13,449	10,527	9,578
Buses	1988	13,273	9,875	8,951	982	731	662	0,174	0,081	0,070	0,030	0,029	0,029	1,839	1,360	1,211	13,466	10,544	9,595
Buses	1989	13,276	9,879	8,954	982	731	662	0,174	0,081	0,070	0,030	0,029	0,029	1,227	0,908	0,809	13,472	10,545	9,596
Buses	1990	13,273	9,868	8,943	982	730	661	0,174	0,081	0,070	0,030	0,029	0,029	1,226	0,907	0,807	13,445	10,516	9,567
Buses	1991	13,271	9,865	8,941	982	730	661	0,174	0,081	0,070	0,030	0,029	0,029	1,226	0,906	0,806	13,440	10,513	9,563
Buses	1992	13,265	9,856	8,933	981	729	661	0,174	0,081	0,070	0,029	0,029	0,029	0,795	0,588	0,522	13,424	10,503	9,554
Buses	1993	13,261	9,847	8,925	981	728	660	0,174	0,081	0,070	0,029	0,029	0,029	0,306	0,226	0,201	13,404	10,486	9,536
Buses	1994	13,126	9,751	8,853	971	721	655	0,174	0,081	0,070	0,029	0,029	0,029	0,302	0,223	0,198	13,029	10,223	9,321
Buses	1995	12,931	9,598	8,738	957	710	646	0,174	0,081	0,070	0,029	0,029	0,028	0,296	0,218	0,194	12,431	9,774	8,956
Buses	1996	12,777	9,483	8,650	945	701	640	0,174	0,081	0,070	0,029	0,029	0,028	0,292	0,215	0,192	11,939	9,404	8,658
Buses	1997	12,600	9,381	8,576	932	694	634	0,171	0,080	0,069	0,029	0,029	0,028	0,288	0,213	0,191	11,571	9,132	8,436
Buses	1998	12,327	9,238	8,488	912	683	628	0,163	0,077	0,067	0,029	0,029	0,028	0,282	0,210	0,189	11,183	8,856	8,239
Buses	1999	12,079	9,113	8,414	894	674	622	0,156	0,074	0,064	0,029	0,029	0,029	0,152	0,114	0,104	10,801	8,585	8,046
Buses	2000	11,977	9,065	8,377	886	671	619	0,150	0,071	0,062	0,029	0,029	0,029	0,028	0,021	0,020	10,591	8,421	7,908
Buses	2001	11,964	9,064	8,366	885	670	619	0,146	0,069	0,061	0,029	0,029	0,029	0,028	0,021	0,020	10,484	8,328	7,815
Buses	2002	11,964	9,076	8,369	885	671	619	0,141	0,067	0,059	0,029	0,029	0,029	0,028	0,021	0,020	10,229	8,110	7,618
Buses	2003	11,970	9,098	8,386	886	673	620	0,135	0,064	0,057	0,029	0,029	0,029	0,028	0,021	0,020	9,956	7,855	7,377
Buses	2004	12,009	9,128	8,404	888	675	622	0,131	0,062	0,055	0,029	0,029	0,029	0,028	0,021	0,020	9,765	7,662	7,179
Buses	2005	11,991	9,131	8,409	887	675	622	0,127	0,060	0,053	0,029	0,029	0,029	0,006	0,004	0,004	9,563	7,464	6,975
Buses	2006	12,002	9,147	8,422	888	677	623	0,123	0,058	0,052	0,030	0,029	0,029	0,006	0,004	0,004	9,385	7,282	6,787
Buses	2007	12,013	9,157	8,428	889	677	623	0,115	0,055	0,049	0,030	0,029	0,029	0,006	0,004	0,004	9,085	7,030	6,546
Buses	2008	11,954	9,117	8,399	884	674	621	0,102	0,049	0,044	0,030	0,029	0,029	0,006	0,004	0,004	8,554	6,633	6,196
Buses	2009	11,919	9,091	8,379	881	672	619	0,086	0,042	0,039	0,030	0,029	0,029	0,006	0,004	0,004	7,998	6,219	5,827
Mopeds	1985	1,095	1,095		80	80		0,219	0,219		0,001	0,001		0,003	0,003		0,020	0,020	
Mopeds	1986	1,095	1,095		80	80		0,219	0,219		0,001	0,001		0,003	0,003		0,020	0,020	
Mopeds	1987	1,095	1,095		80	80		0,219	0,219		0,001	0,001		0,003	0,003		0,020	0,020	
Mopeds	1988	1,095	1,095		80	80		0,219	0,219		0,001	0,001		0,003	0,003		0,020	0,020	
Mopeds	1989	1,095	1,095		80	80		0,219	0,219		0,001	0,001		0,003	0,003		0,020	0,020	
Mopeds	1990	1,095	1,095		80	80		0,219	0,219		0,001	0,001		0,003	0,003		0,020	0,020	

Continued

Sector	ForecastYear	FCu (MJ)	FCr (MJ)	FCh (MJ)	CO_2u	CO_2r	CO_2h	CH_4u	CH_4r	CH_4h	N_2Ou	N_2Or	N_2Oh	SO_2u	SO_2r	SO_2h	NO_xu	NO_xr	NO_xh
Mopeds	1991	1,095	1,095		80	80		0,219	0,219		0,001	0,001		0,003	0,003		0,020	0,020	
Mopeds	1992	1,095	1,095		80	80		0,219	0,219		0,001	0,001		0,003	0,003		0,020	0,020	
Mopeds	1993	1,095	1,095		80	80		0,219	0,219		0,001	0,001		0,003	0,003		0,020	0,020	
Mopeds	1994	1,095	1,095		80	80		0,219	0,219		0,001	0,001		0,003	0,003		0,020	0,020	
Mopeds	1995	1,095	1,095		80	80		0,219	0,219		0,001	0,001		0,003	0,003		0,020	0,020	
Mopeds	1996	1,095	1,095		80	80		0,219	0,219		0,001	0,001		0,003	0,003		0,020	0,020	
Mopeds	1997	1,095	1,095		80	80		0,219	0,219		0,001	0,001		0,003	0,003		0,020	0,020	
Mopeds	1998	1,095	1,095		80	80		0,219	0,219		0,001	0,001		0,003	0,003		0,020	0,020	
Mopeds	1999	1,095	1,095		80	80		0,219	0,219		0,001	0,001		0,003	0,003		0,020	0,020	
Mopeds	2000	1,050	1,050		77	77		0,201	0,201		0,001	0,001		0,002	0,002		0,020	0,020	
Mopeds	2001	1,019	1,019		74	74		0,188	0,188		0,001	0,001		0,002	0,002		0,020	0,020	
Mopeds	2002	0,985	0,985		72	72		0,175	0,175		0,001	0,001		0,002	0,002		0,020	0,020	
Mopeds	2003	0,969	0,969		71	71		0,169	0,169		0,001	0,001		0,002	0,002		0,020	0,020	
Mopeds	2004	0,940	0,940		69	69		0,159	0,159		0,001	0,001		0,002	0,002		0,035	0,035	
Mopeds	2005	0,910	0,910		66	66		0,149	0,149		0,001	0,001		0,000	0,000		0,051	0,051	
Mopeds	2006	0,876	0,876		64	64		0,138	0,138		0,001	0,001		0,000	0,000		0,067	0,067	
Mopeds	2007	0,848	0,848		62	62		0,128	0,128		0,001	0,001		0,000	0,000		0,083	0,083	
Mopeds	2008	0,827	0,827		60	60		0,121	0,121		0,001	0,001		0,000	0,000		0,094	0,094	
Mopeds	2009	0,806	0,806		59	59		0,115	0,115		0,001	0,001		0,000	0,000		0,105	0,105	
Motorcycles	1985	1,241	1,208	1,481	91	88	108	0,193	0,193	0,193	0,002	0,002	0,002	0,003	0,003	0,003	0,140	0,224	0,391
Motorcycles	1986	1,241	1,208	1,481	91	88	108	0,193	0,193	0,193	0,002	0,002	0,002	0,003	0,003	0,003	0,140	0,224	0,391
Motorcycles	1987	1,241	1,208	1,481	91	88	108	0,193	0,193	0,193	0,002	0,002	0,002	0,003	0,003	0,003	0,140	0,224	0,391
Motorcycles	1988	1,241	1,208	1,481	91	88	108	0,193	0,193	0,193	0,002	0,002	0,002	0,003	0,003	0,003	0,140	0,224	0,391
Motorcycles	1989	1,241	1,208	1,481	91	88	108	0,193	0,193	0,193	0,002	0,002	0,002	0,003	0,003	0,003	0,140	0,224	0,391
Motorcycles	1990	1,241	1,208	1,481	91	88	108	0,193	0,193	0,193	0,002	0,002	0,002	0,003	0,003	0,003	0,140	0,224	0,391
Motorcycles	1991	1,241	1,208	1,481	91	88	108	0,193	0,193	0,193	0,002	0,002	0,002	0,003	0,003	0,003	0,140	0,224	0,391
Motorcycles	1992	1,241	1,208	1,481	91	88	108	0,193	0,193	0,193	0,002	0,002	0,002	0,003	0,003	0,003	0,140	0,224	0,391
Motorcycles	1993	1,241	1,208	1,481	91	88	108	0,193	0,193	0,193	0,002	0,002	0,002	0,003	0,003	0,003	0,140	0,224	0,391
Motorcycles	1994	1,241	1,208	1,481	91	88	108	0,193	0,193	0,193	0,002	0,002	0,002	0,003	0,003	0,003	0,140	0,224	0,391
Motorcycles	1995	1,241	1,208	1,481	91	88	108	0,193	0,193	0,193	0,002	0,002	0,002	0,003	0,003	0,003	0,140	0,224	0,391
Motorcycles	1996	1,241	1,208	1,481	91	88	108	0,193	0,193	0,193	0,002	0,002	0,002	0,003	0,003	0,003	0,140	0,224	0,391
Motorcycles	1997	1,241	1,208	1,481	91	88	108	0,193	0,193	0,193	0,002	0,002	0,002	0,003	0,003	0,003	0,140	0,224	0,391
Motorcycles	1998	1,241	1,208	1,481	91	88	108	0,193	0,193	0,193	0,002	0,002	0,002	0,003	0,003	0,003	0,140	0,224	0,391
Motorcycles	1999	1,241	1,208	1,481	91	88	108	0,193	0,193	0,193	0,002	0,002	0,002	0,003	0,003	0,003	0,140	0,224	0,391
Motorcycles	2000	1,256	1,224	1,499	92	89	109	0,190	0,190	0,190	0,002	0,002	0,002	0,003	0,003	0,003	0,143	0,228	0,395
Motorcycles	2001	1,266	1,233	1,509	92	90	110	0,188	0,189	0,189	0,002	0,002	0,002	0,003	0,003	0,003	0,146	0,231	0,400

Continued

Sector	ForecastYear	FCu (MJ)	FCr (MJ)	FCh (MJ)	CO_2u	CO_2r	CO_2h	CH_4u	CH_4r	CH_4h	N_2Ou	N_2Or	N_2Oh	SO_2u	SO_2r	SO_2h	NO_xu	NO_xr	NO_xh
Motorcycles	2002	1,276	1,243	1,519	93	91	111	0,187	0,188	0,188	0,002	0,002	0,002	0,003	0,003	0,003	0,148	0,235	0,404
Motorcycles	2003	1,285	1,251	1,528	94	91	112	0,185	0,187	0,187	0,002	0,002	0,002	0,003	0,003	0,003	0,151	0,238	0,409
Motorcycles	2004	1,290	1,257	1,534	94	92	112	0,184	0,184	0,185	0,002	0,002	0,002	0,003	0,003	0,004	0,154	0,243	0,413
Motorcycles	2005	1,299	1,265	1,545	95	92	113	0,181	0,180	0,181	0,002	0,002	0,002	0,001	0,001	0,001	0,158	0,248	0,419
Motorcycles	2006	1,306	1,273	1,554	95	93	113	0,179	0,175	0,177	0,002	0,002	0,002	0,001	0,001	0,001	0,162	0,254	0,426
Motorcycles	2007	1,310	1,277	1,559	95	93	113	0,172	0,166	0,168	0,002	0,002	0,002	0,001	0,001	0,001	0,158	0,249	0,421
Motorcycles	2008	1,311	1,278	1,560	95	93	114	0,169	0,161	0,163	0,002	0,002	0,002	0,001	0,001	0,001	0,157	0,247	0,420
Motorcycles	2009	1,312	1,279	1,560	95	93	114	0,167	0,159	0,160	0,002	0,002	0,002	0,001	0,001	0,001	0,156	0,246	0,420

Sector	ForecastYear	NMVOCu (exh)	NMVOCr (exh)	NMVOCh (exh)	NMVOCu (tot)	NMVOCr (tot)	NMVOCh (tot)	COu	COr	COh	NH_3u	NH_3r	NH_3h	TSPu	TSPr	TSPh
Passenger Cars	1985	3,272	1,058	0,933	5,400	1,437	0,988	39,845	10,662	11,775	0,002	0,002	0,002	0,092	0,049	0,051
Passenger Cars	1986	3,171	1,024	0,902	5,304	1,402	0,956	37,281	9,808	10,609	0,002	0,002	0,002	0,092	0,048	0,051
Passenger Cars	1987	3,144	0,994	0,869	5,265	1,368	0,922	35,687	9,007	9,533	0,002	0,002	0,002	0,089	0,046	0,049
Passenger Cars	1988	2,908	0,967	0,839	5,113	1,355	0,894	31,789	8,379	8,629	0,002	0,002	0,002	0,083	0,044	0,047
Passenger Cars	1989	2,783	0,940	0,809	5,015	1,331	0,865	29,625	7,840	7,854	0,002	0,002	0,002	0,081	0,043	0,046
Passenger Cars	1990	2,720	0,920	0,787	4,948	1,310	0,842	28,383	7,452	7,324	0,002	0,002	0,002	0,078	0,042	0,045
Passenger Cars	1991	2,728	0,873	0,744	4,826	1,238	0,795	28,260	6,968	6,776	0,004	0,007	0,005	0,076	0,039	0,043
Passenger Cars	1992	2,535	0,801	0,681	4,496	1,142	0,729	25,718	6,357	6,186	0,008	0,017	0,010	0,066	0,035	0,038
Passenger Cars	1993	2,490	0,728	0,614	4,222	1,028	0,655	24,623	5,638	5,477	0,011	0,027	0,016	0,062	0,032	0,035
Passenger Cars	1994	2,256	0,641	0,539	3,822	0,911	0,576	21,742	4,948	4,787	0,016	0,039	0,022	0,055	0,028	0,032
Passenger Cars	1995	2,153	0,565	0,476	3,508	0,798	0,508	20,505	4,449	4,364	0,021	0,051	0,029	0,050	0,025	0,029
Passenger Cars	1996	2,134	0,498	0,420	3,267	0,692	0,446	20,113	4,013	4,000	0,025	0,061	0,035	0,046	0,022	0,026
Passenger Cars	1997	1,858	0,432	0,364	2,859	0,603	0,387	17,215	3,564	3,615	0,032	0,072	0,041	0,038	0,019	0,023
Passenger Cars	1998	1,699	0,367	0,310	2,507	0,505	0,328	15,747	3,108	3,207	0,041	0,083	0,047	0,033	0,017	0,020
Passenger Cars	1999	1,477	0,311	0,262	2,167	0,428	0,278	13,568	2,709	2,853	0,049	0,091	0,051	0,030	0,015	0,018
Passenger Cars	2000	1,347	0,271	0,228	1,802	0,348	0,239	12,361	2,431	2,612	0,055	0,097	0,054	0,027	0,014	0,017
Passenger Cars	2001	1,303	0,241	0,203	1,691	0,306	0,212	12,113	2,237	2,454	0,055	0,096	0,056	0,027	0,013	0,016
Passenger Cars	2002	1,142	0,211	0,179	1,479	0,267	0,186	10,704	2,046	2,304	0,052	0,091	0,056	0,024	0,012	0,015
Passenger Cars	2003	1,050	0,181	0,154	1,325	0,226	0,161	10,023	1,839	2,122	0,049	0,086	0,055	0,024	0,012	0,015
Passenger Cars	2004	0,872	0,152	0,131	1,096	0,189	0,136	8,396	1,633	1,935	0,046	0,080	0,055	0,022	0,012	0,015
Passenger Cars	2005	0,830	0,124	0,108	1,017	0,155	0,112	8,333	1,424	1,735	0,040	0,073	0,054	0,023	0,011	0,016
Passenger Cars	2006	0,699	0,100	0,088	0,852	0,125	0,092	7,134	1,217	1,522	0,036	0,066	0,052	0,022	0,011	0,015
Passenger Cars	2007	0,576	0,079	0,070	0,688	0,097	0,073	5,867	0,994	1,269	0,030	0,057	0,048	0,023	0,012	0,015
Passenger Cars	2008	0,523	0,064	0,058	0,610	0,079	0,060	5,383	0,846	1,102	0,026	0,051	0,046	0,024	0,012	0,015

Continued

Sector	ForecastYear	NMVOCu (exh)	NMVOCr (exh)	NMVOCh (exh)	NMVOCu (tot)	NMVOCr (tot)	NMVOCh (tot)	COu	COr	COh	NH_3u	NH_3r	NH_3h	TSPu	TSPr	TSPh
Passenger Cars	2009	0,463	0,055	0,050	0,538	0,067	0,052	4,774	0,739	0,979	0,023	0,046	0,044	0,025	0,012	0,015
Light Duty Vehicles	1985	0,805	0,198	0,151	1,148	0,254	0,162	7,613	1,882	2,184	0,001	0,001	0,001	0,480	0,258	0,273
Light Duty Vehicles	1986	0,759	0,192	0,148	1,085	0,245	0,158	7,146	1,830	2,117	0,001	0,001	0,001	0,475	0,260	0,276
Light Duty Vehicles	1987	0,769	0,192	0,148	1,094	0,245	0,158	7,243	1,832	2,119	0,001	0,001	0,001	0,482	0,260	0,276
Light Duty Vehicles	1988	0,719	0,191	0,147	1,056	0,246	0,158	6,786	1,827	2,114	0,001	0,001	0,001	0,445	0,260	0,276
Light Duty Vehicles	1989	0,681	0,187	0,145	1,010	0,240	0,155	6,423	1,792	2,068	0,001	0,001	0,001	0,435	0,262	0,278
Light Duty Vehicles	1990	0,673	0,186	0,144	0,998	0,238	0,155	6,341	1,784	2,057	0,001	0,001	0,001	0,433	0,263	0,278
Light Duty Vehicles	1991	0,712	0,188	0,145	1,039	0,240	0,156	6,702	1,799	2,077	0,001	0,001	0,001	0,455	0,262	0,277
Light Duty Vehicles	1992	0,729	0,195	0,149	1,086	0,252	0,160	6,911	1,855	2,150	0,001	0,001	0,001	0,436	0,259	0,274
Light Duty Vehicles	1993	0,775	0,197	0,151	1,127	0,253	0,161	7,346	1,878	2,179	0,001	0,001	0,001	0,457	0,258	0,273
Light Duty Vehicles	1994	0,749	0,196	0,150	1,113	0,253	0,161	7,125	1,870	2,156	0,001	0,001	0,001	0,444	0,258	0,274
Light Duty Vehicles	1995	0,729	0,187	0,145	1,063	0,240	0,155	6,882	1,752	2,017	0,002	0,002	0,002	0,429	0,244	0,260
Light Duty Vehicles	1996	0,701	0,172	0,136	0,975	0,215	0,144	6,524	1,541	1,777	0,002	0,005	0,003	0,408	0,217	0,234
Light Duty Vehicles	1997	0,612	0,159	0,129	0,851	0,197	0,136	5,639	1,349	1,564	0,003	0,007	0,004	0,336	0,190	0,207
Light Duty Vehicles	1998	0,581	0,149	0,123	0,777	0,180	0,129	5,369	1,199	1,399	0,004	0,009	0,006	0,295	0,165	0,184
Light Duty Vehicles	1999	0,527	0,139	0,118	0,692	0,165	0,122	4,827	1,056	1,243	0,006	0,011	0,007	0,254	0,144	0,162
Light Duty Vehicles	2000	0,488	0,133	0,113	0,599	0,150	0,117	4,509	0,955	1,135	0,007	0,013	0,008	0,219	0,125	0,144
Light Duty Vehicles	2001	0,480	0,126	0,109	0,571	0,140	0,112	4,405	0,861	1,033	0,008	0,015	0,009	0,205	0,110	0,129
Light Duty Vehicles	2002	0,428	0,118	0,103	0,506	0,130	0,106	3,981	0,780	0,944	0,009	0,015	0,009	0,173	0,096	0,115
Light Duty Vehicles	2003	0,390	0,108	0,096	0,452	0,118	0,098	3,626	0,692	0,844	0,008	0,013	0,009	0,156	0,084	0,102
Light Duty Vehicles	2004	0,323	0,098	0,088	0,372	0,106	0,090	3,015	0,605	0,745	0,007	0,012	0,009	0,128	0,073	0,091
Light Duty Vehicles	2005	0,304	0,089	0,081	0,344	0,095	0,082	2,850	0,527	0,654	0,006	0,010	0,009	0,120	0,063	0,081
Light Duty Vehicles	2006	0,267	0,082	0,075	0,298	0,087	0,076	2,461	0,464	0,581	0,005	0,009	0,008	0,106	0,056	0,073
Light Duty Vehicles	2007	0,233	0,075	0,069	0,257	0,079	0,070	2,040	0,420	0,527	0,004	0,008	0,007	0,096	0,052	0,068
Light Duty Vehicles	2008	0,215	0,067	0,062	0,235	0,070	0,062	1,923	0,384	0,485	0,004	0,007	0,007	0,090	0,046	0,061
Light Duty Vehicles	2009	0,200	0,062	0,058	0,217	0,065	0,058	1,824	0,365	0,461	0,004	0,007	0,007	0,084	0,043	0,057
Heavy Duty Vehicles	1985	0,954	0,626	0,494	0,954	0,626	0,494	3,309	2,325	2,128	0,003	0,003	0,003	0,592	0,416	0,373
Heavy Duty Vehicles	1986	0,946	0,620	0,490	0,946	0,620	0,490	3,278	2,299	2,101	0,003	0,003	0,003	0,595	0,418	0,374
Heavy Duty Vehicles	1987	0,943	0,618	0,489	0,943	0,618	0,489	3,275	2,296	2,098	0,003	0,003	0,003	0,598	0,420	0,376
Heavy Duty Vehicles	1988	0,935	0,613	0,485	0,935	0,613	0,485	3,271	2,290	2,090	0,003	0,003	0,003	0,603	0,423	0,379
Heavy Duty Vehicles	1989	0,931	0,610	0,484	0,931	0,610	0,484	3,254	2,276	2,076	0,003	0,003	0,003	0,604	0,424	0,380
Heavy Duty Vehicles	1990	0,918	0,602	0,477	0,918	0,602	0,477	3,253	2,272	2,070	0,003	0,003	0,003	0,613	0,430	0,385
Heavy Duty Vehicles	1991	0,920	0,604	0,479	0,920	0,604	0,479	3,259	2,277	2,075	0,003	0,003	0,003	0,613	0,430	0,385
Heavy Duty Vehicles	1992	0,913	0,599	0,475	0,913	0,599	0,475	3,275	2,287	2,084	0,003	0,003	0,003	0,618	0,433	0,387
Heavy Duty Vehicles	1993	0,901	0,591	0,470	0,901	0,591	0,470	3,279	2,289	2,085	0,003	0,003	0,003	0,624	0,437	0,391
Heavy Duty Vehicles	1994	0,882	0,581	0,463	0,882	0,581	0,463	3,198	2,232	2,029	0,003	0,003	0,003	0,615	0,430	0,384

Continued

Sector	ForecastYear	NMVOCu (exh)	NMVOCr (exh)	NMVOCh (exh)	NMVOCu (tot)	NMVOCr (tot)	NMVOCh (tot)	COu	COr	COh	NH_3u	NH_3r	NH_3h	TSPu	TSPr	TSPh
Heavy Duty Vehicles	1995	0,856	0,568	0,453	0,856	0,568	0,453	3,079	2,155	1,958	0,003	0,003	0,003	0,590	0,410	0,365
Heavy Duty Vehicles	1996	0,815	0,543	0,435	0,815	0,543	0,435	2,962	2,080	1,888	0,003	0,003	0,003	0,566	0,391	0,349
Heavy Duty Vehicles	1997	0,761	0,509	0,406	0,761	0,509	0,406	2,816	1,994	1,814	0,003	0,003	0,003	0,519	0,358	0,324
Heavy Duty Vehicles	1998	0,697	0,465	0,370	0,697	0,465	0,370	2,663	1,907	1,744	0,003	0,003	0,003	0,457	0,316	0,295
Heavy Duty Vehicles	1999	0,642	0,428	0,338	0,642	0,428	0,338	2,535	1,834	1,685	0,003	0,003	0,003	0,405	0,280	0,270
Heavy Duty Vehicles	2000	0,599	0,398	0,313	0,599	0,398	0,313	2,454	1,793	1,655	0,003	0,003	0,003	0,367	0,254	0,253
Heavy Duty Vehicles	2001	0,559	0,370	0,289	0,559	0,370	0,289	2,393	1,760	1,630	0,003	0,003	0,003	0,326	0,227	0,231
Heavy Duty Vehicles	2002	0,528	0,347	0,271	0,528	0,347	0,271	2,407	1,764	1,631	0,003	0,003	0,003	0,304	0,210	0,215
Heavy Duty Vehicles	2003	0,498	0,324	0,254	0,498	0,324	0,254	2,406	1,750	1,613	0,003	0,003	0,003	0,283	0,195	0,196
Heavy Duty Vehicles	2004	0,475	0,306	0,241	0,475	0,306	0,241	2,407	1,738	1,596	0,003	0,003	0,003	0,267	0,183	0,181
Heavy Duty Vehicles	2005	0,455	0,290	0,229	0,455	0,290	0,229	2,436	1,746	1,599	0,003	0,003	0,003	0,254	0,173	0,168
Heavy Duty Vehicles	2006	0,432	0,273	0,216	0,432	0,273	0,216	2,410	1,717	1,568	0,003	0,003	0,003	0,239	0,163	0,154
Heavy Duty Vehicles	2007	0,375	0,237	0,187	0,375	0,237	0,187	2,148	1,527	1,394	0,003	0,003	0,003	0,209	0,142	0,133
Heavy Duty Vehicles	2008	0,291	0,183	0,145	0,291	0,183	0,145	1,702	1,208	1,102	0,003	0,003	0,003	0,167	0,113	0,105
Heavy Duty Vehicles	2009	0,237	0,149	0,117	0,237	0,149	0,117	1,432	1,017	0,928	0,003	0,003	0,003	0,140	0,095	0,087
Buses	1985	1,742	1,101	0,777	1,742	1,101	0,777	5,846	4,395	4,713	0,003	0,003	0,003	0,736	0,454	0,360
Buses	1986	1,733	1,090	0,766	1,733	1,090	0,766	5,756	4,284	4,537	0,003	0,003	0,003	0,736	0,454	0,359
Buses	1987	1,735	1,092	0,768	1,735	1,092	0,768	5,743	4,269	4,520	0,003	0,003	0,003	0,737	0,455	0,360
Buses	1988	1,737	1,092	0,770	1,737	1,092	0,770	5,711	4,232	4,471	0,003	0,003	0,003	0,738	0,455	0,360
Buses	1989	1,732	1,086	0,763	1,732	1,086	0,763	5,653	4,161	4,356	0,003	0,003	0,003	0,738	0,455	0,360
Buses	1990	1,725	1,080	0,756	1,725	1,080	0,756	5,679	4,189	4,385	0,003	0,003	0,003	0,736	0,454	0,359
Buses	1991	1,727	1,083	0,759	1,727	1,083	0,759	5,710	4,226	4,441	0,003	0,003	0,003	0,735	0,454	0,359
Buses	1992	1,736	1,094	0,770	1,736	1,094	0,770	5,819	4,359	4,648	0,003	0,003	0,003	0,735	0,453	0,359
Buses	1993	1,737	1,097	0,772	1,737	1,097	0,772	5,888	4,439	4,763	0,003	0,003	0,003	0,733	0,453	0,359
Buses	1994	1,671	1,080	0,774	1,671	1,080	0,774	5,978	4,659	5,183	0,003	0,003	0,003	0,706	0,439	0,350
Buses	1995	1,549	1,023	0,738	1,549	1,023	0,738	6,012	4,815	5,421	0,003	0,003	0,003	0,663	0,416	0,336
Buses	1996	1,431	0,960	0,697	1,431	0,960	0,697	5,894	4,760	5,326	0,003	0,003	0,003	0,626	0,397	0,323
Buses	1997	1,322	0,901	0,663	1,322	0,901	0,663	5,620	4,566	5,132	0,003	0,003	0,003	0,586	0,375	0,307
Buses	1998	1,200	0,837	0,628	1,200	0,837	0,628	5,322	4,379	4,979	0,003	0,003	0,003	0,528	0,344	0,288
Buses	1999	1,076	0,768	0,588	1,076	0,768	0,588	4,971	4,130	4,739	0,003	0,003	0,003	0,472	0,314	0,268
Buses	2000	0,986	0,720	0,561	0,986	0,720	0,561	4,770	4,003	4,635	0,003	0,003	0,003	0,431	0,290	0,252
Buses	2001	0,930	0,690	0,543	0,930	0,690	0,543	4,653	3,925	4,566	0,003	0,003	0,003	0,403	0,274	0,240
Buses	2002	0,854	0,648	0,519	0,854	0,648	0,519	4,496	3,812	4,455	0,003	0,003	0,003	0,367	0,254	0,226
Buses	2003	0,776	0,596	0,485	0,776	0,596	0,485	4,214	3,544	4,125	0,003	0,003	0,003	0,337	0,236	0,212
Buses	2004	0,725	0,560	0,458	0,725	0,560	0,458	4,050	3,367	3,868	0,003	0,003	0,003	0,315	0,222	0,200
Buses	2005	0,672	0,522	0,431	0,672	0,522	0,431	3,848	3,165	3,603	0,003	0,003	0,003	0,294	0,208	0,188

Continued

Sector	ForecastYear	NMVOCu (exh)	NMVOCr (exh)	NMVOCh (exh)	NMVOCu (tot)	NMVOCr (tot)	NMVOCh (tot)	COu	COr	COh	NH_3u	NH_3r	NH_3h	TSPu	TSPr	TSPh
Buses	2006	0,628	0,490	0,408	0,628	0,490	0,408	3,686	3,000	3,380	0,003	0,003	0,003	0,275	0,195	0,177
Buses	2007	0,576	0,452	0,378	0,576	0,452	0,378	3,445	2,788	3,122	0,003	0,003	0,003	0,252	0,180	0,165
Buses	2008	0,512	0,408	0,345	0,512	0,408	0,345	3,129	2,560	2,895	0,003	0,003	0,003	0,223	0,161	0,149
Buses	2009	0,439	0,356	0,305	0,439	0,356	0,305	2,759	2,282	2,604	0,003	0,003	0,003	0,192	0,140	0,131
Mopeds	1985	13,691	13,691		14,110	13,838		13,800	13,800		0,001	0,001		0,188	0,188	
Mopeds	1986	13,691	13,691		14,118	13,841		13,800	13,800		0,001	0,001		0,188	0,188	
Mopeds	1987	13,691	13,691		14,114	13,840		13,800	13,800		0,001	0,001		0,188	0,188	
Mopeds	1988	13,691	13,691		14,143	13,850		13,800	13,800		0,001	0,001		0,188	0,188	
Mopeds	1989	13,691	13,691		14,161	13,856		13,800	13,800		0,001	0,001		0,188	0,188	
Mopeds	1990	13,691	13,691		14,151	13,853		13,800	13,800		0,001	0,001		0,188	0,188	
Mopeds	1991	13,691	13,691		14,131	13,846		13,800	13,800		0,001	0,001		0,188	0,188	
Mopeds	1992	13,691	13,691		14,135	13,847		13,800	13,800		0,001	0,001		0,188	0,188	
Mopeds	1993	13,691	13,691		14,106	13,837		13,800	13,800		0,001	0,001		0,188	0,188	
Mopeds	1994	13,691	13,691		14,124	13,843		13,800	13,800		0,001	0,001		0,188	0,188	
Mopeds	1995	13,691	13,691		14,125	13,844		13,800	13,800		0,001	0,001		0,188	0,188	
Mopeds	1996	13,691	13,691		14,108	13,838		13,800	13,800		0,001	0,001		0,188	0,188	
Mopeds	1997	13,691	13,691		14,131	13,846		13,800	13,800		0,001	0,001		0,188	0,188	
Mopeds	1998	13,691	13,691		14,111	13,839		13,800	13,800		0,001	0,001		0,188	0,188	
Mopeds	1999	13,691	13,691		14,157	13,855		13,800	13,800		0,001	0,001		0,188	0,188	
Mopeds	2000	12,563	12,563		12,947	12,699		12,960	12,960		0,001	0,001		0,176	0,176	
Mopeds	2001	11,773	11,773		12,189	11,920		12,371	12,371		0,001	0,001		0,168	0,168	
Mopeds	2002	10,937	10,937		11,364	11,087		11,748	11,748		0,001	0,001		0,160	0,160	
Mopeds	2003	10,520	10,520		10,942	10,669		11,437	11,437		0,001	0,001		0,156	0,156	
Mopeds	2004	9,924	9,924		10,346	10,072		10,776	10,776		0,001	0,001		0,148	0,148	
Mopeds	2005	9,299	9,299		9,757	9,460		10,085	10,085		0,001	0,001		0,140	0,140	
Mopeds	2006	8,636	8,636		9,108	8,802		9,353	9,353		0,001	0,001		0,131	0,131	
Mopeds	2007	8,023	8,023		8,481	8,185		8,669	8,669		0,001	0,001		0,123	0,123	
Mopeds	2008	7,588	7,588		8,032	7,744		8,189	8,189		0,001	0,001		0,118	0,118	
Mopeds	2009	7,169	7,169		7,620	7,328		7,727	7,727		0,001	0,001		0,112	0,112	
Motorcycles	1985	1,426	1,186	1,588	2,214	1,409	1,625	18,848	19,069	24,147	0,002	0,002	0,002	0,047	0,047	0,047
Motorcycles	1986	1,426	1,186	1,588	2,223	1,410	1,625	18,848	19,069	24,147	0,002	0,002	0,002	0,047	0,047	0,047
Motorcycles	1987	1,426	1,186	1,588	2,219	1,409	1,625	18,848	19,069	24,147	0,002	0,002	0,002	0,047	0,047	0,047
Motorcycles	1988	1,426	1,186	1,588	2,255	1,418	1,626	18,848	19,069	24,147	0,002	0,002	0,002	0,047	0,047	0,047
Motorcycles	1989	1,426	1,186	1,588	2,276	1,423	1,627	18,848	19,069	24,147	0,002	0,002	0,002	0,047	0,047	0,047
Motorcycles	1990	1,426	1,186	1,588	2,271	1,421	1,626	18,848	19,069	24,147	0,002	0,002	0,002	0,047	0,047	0,047
Motorcycles	1991	1,426	1,186	1,588	2,257	1,416	1,625	18,848	19,069	24,147	0,002	0,002	0,002	0,047	0,047	0,047

Continued																
Sector	ForecastYear	NMVOCu (exh)	NMVOCr (exh)	NMVOCh (exh)	NMVOCu (tot)	NMVOCr (tot)	NMVOCh (tot)	COu	COr	COh	NH_3u	NH_3r	NH_3h	TSPu	TSPr	TSPh
Motorcycles	1992	1,426	1,186	1,588	2,267	1,418	1,626	18,848	19,069	24,147	0,002	0,002	0,002	0,047	0,047	0,047
Motorcycles	1993	1,426	1,186	1,588	2,230	1,407	1,624	18,848	19,069	24,147	0,002	0,002	0,002	0,047	0,047	0,047
Motorcycles	1994	1,426	1,186	1,588	2,261	1,415	1,625	18,848	19,069	24,147	0,002	0,002	0,002	0,047	0,047	0,047
Motorcycles	1995	1,426	1,186	1,588	2,260	1,414	1,624	18,848	19,069	24,147	0,002	0,002	0,002	0,047	0,047	0,047
Motorcycles	1996	1,426	1,186	1,588	2,241	1,408	1,623	18,848	19,069	24,147	0,002	0,002	0,002	0,047	0,047	0,047
Motorcycles	1997	1,426	1,186	1,588	2,288	1,420	1,625	18,848	19,069	24,147	0,002	0,002	0,002	0,047	0,047	0,047
Motorcycles	1998	1,426	1,186	1,588	2,266	1,413	1,624	18,848	19,069	24,147	0,002	0,002	0,002	0,047	0,047	0,047
Motorcycles	1999	1,426	1,186	1,588	2,307	1,424	1,625	18,848	19,069	24,147	0,002	0,002	0,002	0,047	0,047	0,047
Motorcycles	2000	1,503	1,232	1,624	2,206	1,421	1,654	18,476	18,693	23,725	0,002	0,002	0,002	0,047	0,047	0,047
Motorcycles	2001	1,511	1,228	1,600	2,211	1,415	1,629	18,260	18,455	23,434	0,002	0,002	0,002	0,046	0,046	0,046
Motorcycles	2002	1,519	1,223	1,575	2,245	1,415	1,604	18,047	18,219	23,145	0,002	0,002	0,002	0,045	0,045	0,045
Motorcycles	2003	1,524	1,216	1,548	2,252	1,409	1,578	17,851	18,002	22,877	0,002	0,002	0,002	0,044	0,044	0,044
Motorcycles	2004	1,498	1,193	1,513	2,247	1,391	1,543	17,330	17,497	22,330	0,002	0,002	0,002	0,043	0,043	0,043
Motorcycles	2005	1,485	1,178	1,484	2,297	1,392	1,517	16,604	16,797	21,579	0,002	0,002	0,002	0,041	0,041	0,041
Motorcycles	2006	1,475	1,165	1,458	2,324	1,389	1,492	15,823	16,046	20,773	0,002	0,002	0,002	0,040	0,040	0,040
Motorcycles	2007	1,424	1,132	1,420	2,270	1,354	1,453	14,954	15,190	19,752	0,002	0,002	0,002	0,038	0,038	0,038
Motorcycles	2008	1,380	1,099	1,379	2,226	1,320	1,412	14,464	14,697	19,156	0,002	0,002	0,002	0,037	0,037	0,037
Motorcycles	2009	1,337	1,065	1,334	2,214	1,293	1,368	14,245	14,467	18,862	0,002	0,002	0,002	0,035	0,035	0,035

Annex 2B-7: Fuel use (GJ) and emissions (tonnes) per vehicle category and as totals

Sector	Year	FC (PJ)	SO_2	NO_x	NMVOC	CH_4	CO	CO_2	N_2O	NH_3	TSP
Passenger Cars	1985	65,0	1508	53603	69206	1754	530786	4751	171	47	1607
Passenger Cars	1986	65,7	1023	54585	69215	1778	503246	4802	174	48	1628
Passenger Cars	1987	65,9	1022	55484	68908	1801	478767	4816	176	48	1591
Passenger Cars	1988	66,7	1038	57155	68897	1829	442145	4875	181	49	1538
Passenger Cars	1989	66,1	757	57141	67362	1812	410530	4830	180	49	1493
Passenger Cars	1990	70,1	807	61178	70678	1929	417142	5124	191	52	1546
Passenger Cars	1991	74,6	845	62884	72550	2003	432366	5449	209	165	1565
Passenger Cars	1992	77,9	602	61679	70903	1986	414613	5696	231	398	1465
Passenger Cars	1993	79,9	336	59268	67558	1939	398524	5841	248	618	1389
Passenger Cars	1994	82,8	351	56047	63335	1846	366009	6052	272	930	1297
Passenger Cars	1995	83,5	351	51255	57878	1707	343722	6105	288	1221	1173
Passenger Cars	1996	84,3	353	46997	53196	1585	331558	6164	302	1479	1071
Passenger Cars	1997	86,5	358	43630	47964	1485	296261	6320	314	1844	943
Passenger Cars	1998	88,2	367	39680	42451	1388	273409	6446	312	2225	835
Passenger Cars	1999	88,7	295	35727	36805	1277	238592	6482	306	2509	758
Passenger Cars	2000	88,2	202	32541	30399	1180	215971	6446	299	2686	693
Passenger Cars	2001	87,6	201	30071	27775	1085	206059	6408	286	2661	660
Passenger Cars	2002	89,0	204	28252	24615	991	186833	6506	276	2602	617
Passenger Cars	2003	91,1	209	26582	22297	909	177375	6667	267	2520	623
Passenger Cars	2004	92,3	212	24708	18839	814	154178	6755	258	2425	609
Passenger Cars	2005	91,8	42	22264	16826	710	146534	6718	239	2209	608
Passenger Cars	2006	92,9	43	20280	14179	615	127412	6793	226	2041	600
Passenger Cars	2007	99,7	46	19871	12214	542	112559	7291	230	1909	657
Passenger Cars	2008	100,2	46	18485	10691	465	101896	7330	222	1727	645
Passenger Cars	2009	97,7	45	17122	9149	399	88173	7146	211	1552	596
Light Duty Vehicles	1985	11,7	2259	5572	2036	103	14397	864	5	4	1221
Light Duty Vehicles	1986	13,5	1582	6330	2226	115	15730	994	5	5	1408
Light Duty Vehicles	1987	14,1	1659	6645	2344	121	16625	1043	5	5	1485
Light Duty Vehicles	1988	14,5	1707	6805	2361	125	16412	1072	6	5	1475
Light Duty Vehicles	1989	15,0	1190	6983	2356	127	16299	1110	6	5	1520
Light Duty Vehicles	1990	16,1	1273	7434	2485	135	17209	1185	6	6	1620
Light Duty Vehicles	1991	16,6	1313	7730	2639	140	18442	1226	6	6	1709
Light Duty Vehicles	1992	16,5	839	7779	2741	143	18920	1218	7	6	1657
Light Duty Vehicles	1993	17,0	334	8035	2881	148	20220	1251	7	6	1729
Light Duty Vehicles	1994	18,1	358	8569	3059	158	21197	1339	7	7	1830
Light Duty Vehicles	1995	18,2	360	8409	2936	152	20406	1345	9	12	1764

Continued

Sector	Year	FC (PJ)	SO_2	NO_x	NMVOC	CH_4	CO	CO_2	N_2O	NH_3	TSP
Light Duty Vehicles	1996	18,5	369	8226	2741	142	19330	1369	13	21	1663
Light Duty Vehicles	1997	18,8	374	8004	2492	133	17236	1386	17	31	1453
Light Duty Vehicles	1998	19,3	382	7941	2356	127	16611	1423	21	43	1318
Light Duty Vehicles	1999	19,8	218	7867	2192	117	15349	1458	26	55	1180
Light Duty Vehicles	2000	20,1	47	7812	1978	108	14581	1487	31	68	1053
Light Duty Vehicles	2001	20,7	48	7844	1932	99	14331	1528	36	79	984
Light Duty Vehicles	2002	21,2	49	7679	1791	89	13353	1567	40	84	873
Light Duty Vehicles	2003	22,9	53	7787	1742	82	13091	1691	46	82	844
Light Duty Vehicles	2004	24,6	57	7798	1602	73	11969	1814	52	80	775
Light Duty Vehicles	2005	26,1	12	7724	1561	62	11742	1929	57	75	745
Light Duty Vehicles	2006	28,1	13	7826	1491	54	11042	2078	63	72	716
Light Duty Vehicles	2007	27,5	13	7125	1289	44	9218	2028	62	58	636
Light Duty Vehicles	2008	26,6	12	6235	1124	36	8332	1964	61	53	553
Light Duty Vehicles	2009	24,0	11	5307	941	29	7144	1774	56	47	459
Heavy Duty Vehicles	1985	27,6	6447	28197	1675	213	6312	2044	76	8	1123
Heavy Duty Vehicles	1986	31,0	4345	31644	1852	239	6962	2296	84	8	1259
Heavy Duty Vehicles	1987	30,5	4272	31092	1803	235	6799	2257	83	8	1236
Heavy Duty Vehicles	1988	30,1	4216	30661	1746	232	6618	2226	81	8	1215
Heavy Duty Vehicles	1989	31,3	2928	31935	1804	241	6826	2319	84	8	1265
Heavy Duty Vehicles	1990	32,5	3036	33038	1808	249	6932	2403	85	9	1305
Heavy Duty Vehicles	1991	33,1	3095	33706	1851	254	7089	2450	87	9	1331
Heavy Duty Vehicles	1992	32,5	1976	33074	1786	250	6926	2407	85	8	1303
Heavy Duty Vehicles	1993	31,7	741	32133	1694	243	6660	2347	81	8	1264
Heavy Duty Vehicles	1994	33,9	793	33846	1782	262	6957	2509	87	9	1333
Heavy Duty Vehicles	1995	34,1	797	33034	1787	268	6896	2523	90	9	1308
Heavy Duty Vehicles	1996	35,0	818	32691	1757	278	6838	2586	92	9	1286
Heavy Duty Vehicles	1997	35,5	831	32385	1687	280	6720	2628	95	10	1214
Heavy Duty Vehicles	1998	36,0	842	32287	1587	278	6604	2663	98	10	1112
Heavy Duty Vehicles	1999	37,2	479	32931	1523	283	6627	2754	102	10	1040
Heavy Duty Vehicles	2000	36,1	85	31586	1370	266	6263	2673	99	10	922
Heavy Duty Vehicles	2001	36,6	86	31271	1291	262	6232	2709	101	10	840
Heavy Duty Vehicles	2002	36,5	86	30123	1197	254	6170	2703	99	10	770
Heavy Duty Vehicles	2003	38,5	90	30478	1178	263	6425	2845	104	10	746
Heavy Duty Vehicles	2004	39,6	93	30339	1150	267	6575	2933	107	11	712
Heavy Duty Vehicles	2005	40,0	19	29462	1087	264	6577	2959	107	11	667
Heavy Duty Vehicles	2006	42,0	20	29754	1076	270	6779	3105	112	11	653

Continued											
Sector	Year	FC (PJ)	SO_2	NO_x	NMVOC	CH_4	CO	CO_2	N_2O	NH_3	TSP
Heavy Duty Vehicles	2007	43,8	21	28945	978	248	6331	3240	118	12	598
Heavy Duty Vehicles	2008	41,1	19	24479	725	186	4805	3039	111	11	451
Heavy Duty Vehicles	2009	35,6	17	19404	507	130	3476	2633	96	10	324
Buses	1985	6,1	1405	6351	736	67	2756	453	16	2	310
Buses	1986	6,6	910	6850	788	72	2908	488	17	2	334
Buses	1987	6,5	892	6718	773	70	2842	479	17	2	328
Buses	1988	6,5	895	6740	775	70	2826	480	17	2	329
Buses	1989	6,6	610	6889	788	72	2847	490	17	2	336
Buses	1990	7,1	649	7321	835	76	3050	522	18	2	357
Buses	1991	7,1	649	7318	836	76	3073	522	18	2	357
Buses	1992	6,7	402	6979	803	73	3011	498	17	2	340
Buses	1993	6,8	156	7042	813	74	3091	503	18	2	343
Buses	1994	7,3	166	7391	851	79	3452	536	19	2	357
Buses	1995	7,6	172	7469	840	83	3733	559	20	2	355
Buses	1996	7,9	180	7647	830	88	3915	587	21	2	357
Buses	1997	7,9	179	7451	776	87	3763	582	21	2	338
Buses	1998	7,7	175	7187	710	83	3577	569	21	2	306
Buses	1999	7,5	94	6889	638	79	3328	554	21	2	274
Buses	2000	7,2	17	6551	574	73	3117	534	20	2	244
Buses	2001	7,0	16	6305	531	69	2969	519	20	2	213
Buses	2002	7,0	16	6108	490	66	2862	516	20	2	195
Buses	2003	7,3	17	6217	471	67	2797	541	21	2	182
Buses	2004	7,4	17	6165	447	66	2706	551	21	2	173
Buses	2005	7,4	3	5961	412	63	2529	545	21	2	156
Buses	2006	7,4	3	5832	387	61	2406	546	21	2	147
Buses	2007	7,5	4	5761	363	58	2289	558	22	2	138
Buses	2008	7,3	3	5242	315	50	2021	536	21	2	118
Buses	2009	6,9	3	4659	259	41	1704	507	20	2	97
Mopeds	1985	0,4	1	7	4936	77	4865	28	0	0	66
Mopeds	1986	0,3	1	6	4431	69	4365	25	0	0	59
Mopeds	1987	0,3	1	6	4100	64	4040	23	0	0	55
Mopeds	1988	0,3	1	6	3860	60	3798	22	0	0	52
Mopeds	1989	0,3	1	5	3665	57	3603	21	0	0	49
Mopeds	1990	0,3	1	5	3727	58	3665	21	0	0	50
Mopeds	1991	0,3	1	5	3825	60	3766	22	0	0	51
Mopeds	1992	0,3	1	5	3849	60	3789	22	0	0	52

Continued											
Sector	Year	FC (PJ)	SO_2	NO_x	NMVOC	CH_4	CO	CO_2	N_2O	NH_3	TSP
Mopeds	1993	0,3	1	5	3811	60	3757	22	0	0	51
Mopeds	1994	0,3	1	5	3751	59	3694	21	0	0	50
Mopeds	1995	0,3	1	6	3997	62	3936	23	0	0	54
Mopeds	1996	0,3	1	6	4252	67	4191	24	0	0	57
Mopeds	1997	0,4	1	7	4619	72	4548	26	0	0	62
Mopeds	1998	0,4	1	7	4978	78	4906	28	0	0	67
Mopeds	1999	0,4	1	6	4525	71	4449	26	0	0	61
Mopeds	2000	0,3	1	6	3992	62	4027	24	0	0	55
Mopeds	2001	0,3	1	5	3099	48	3173	19	0	0	43
Mopeds	2002	0,3	1	5	3049	47	3183	19	0	0	43
Mopeds	2003	0,3	1	5	2916	45	3079	19	0	0	42
Mopeds	2004	0,3	1	9	2732	42	2876	18	0	0	39
Mopeds	2005	0,2	0	13	2546	39	2664	18	0	0	37
Mopeds	2006	0,2	0	18	2385	37	2482	17	0	0	35
Mopeds	2007	0,2	0	23	2266	35	2349	17	0	0	33
Mopeds	2008	0,2	0	25	2121	33	2194	16	0	0	31
Mopeds	2009	0,2	0	27	1944	30	2002	15	0	0	29
Motorcycles	1985	0,3	1	57	508	53	5441	26	1	1	13
Motorcycles	1986	0,3	1	57	509	53	5443	26	1	1	13
Motorcycles	1987	0,3	1	55	495	52	5305	25	1	1	13
Motorcycles	1988	0,3	1	56	507	53	5374	25	1	1	13
Motorcycles	1989	0,3	1	55	502	52	5296	25	1	1	13
Motorcycles	1990	0,4	1	60	538	56	5684	27	1	1	14
Motorcycles	1991	0,4	1	61	552	57	5859	27	1	1	14
Motorcycles	1992	0,4	1	66	591	61	6263	29	1	1	15
Motorcycles	1993	0,4	1	70	618	65	6635	31	1	1	16
Motorcycles	1994	0,5	1	74	662	69	7041	33	1	1	17
Motorcycles	1995	0,5	1	76	681	71	7250	34	1	1	17
Motorcycles	1996	0,5	1	77	685	72	7341	34	1	1	18
Motorcycles	1997	0,5	1	81	726	75	7676	36	1	1	18
Motorcycles	1998	0,5	1	84	746	78	7943	37	1	1	19
Motorcycles	1999	0,5	1	85	769	79	8093	38	1	1	19
Motorcycles	2000	0,5	1	89	771	80	8157	39	1	1	20
Motorcycles	2001	0,6	1	93	785	81	8222	41	1	1	20
Motorcycles	2002	0,6	1	97	808	83	8321	42	1	1	20
Motorcycles	2003	0,6	1	99	815	83	8316	43	1	1	20

Continued

Sector	Year	FC (PJ)	SO_2	NO_x	NMVOC	CH_4	CO	CO_2	N_2O	NH_3	TSP
Motorcycles	2004	0,6	1	102	820	83	8200	43	1	1	19
Motorcycles	2005	0,6	0	108	858	85	8147	45	1	1	19
Motorcycles	2006	0,7	0	118	917	88	8291	48	1	1	20
Motorcycles	2007	0,7	0	125	962	91	8450	52	1	1	20
Motorcycles	2008	0,7	0	125	948	89	8247	53	1	1	20
Motorcycles	2009	0,7	0	118	887	84	7700	50	1	1	18
Total	1985	111,2	11621	93787	79097	2267	564556	8166	268	61	4341
Total	1986	117,5	7862	99472	79021	2327	538653	8631	281	63	4701
Total	1987	117,7	7847	100001	78423	2343	514377	8643	281	64	4708
Total	1988	118,4	7857	101422	78147	2368	477172	8700	284	65	4623
Total	1989	119,7	5488	103009	76478	2361	445400	8795	287	65	4676
Total	1990	126,3	5767	109035	80071	2503	453681	9282	302	69	4891
Total	1991	132,0	5903	111706	82252	2590	470593	9697	321	183	5026
Total	1992	134,4	3820	109581	80674	2574	453523	9870	341	415	4831
Total	1993	136,1	1569	106554	77375	2528	438888	9995	355	635	4791
Total	1994	142,9	1669	105932	73439	2472	408350	10491	386	948	4883
Total	1995	144,2	1682	100249	68119	2344	385944	10588	408	1245	4670
Total	1996	146,6	1721	95644	63461	2231	373173	10766	429	1512	4452
Total	1997	149,5	1744	91557	58265	2132	336203	10978	448	1887	4027
Total	1998	152,0	1768	87186	52828	2032	313050	11167	453	2281	3656
Total	1999	154,0	1088	83506	46451	1905	276439	11312	457	2578	3331
Total	2000	152,5	352	78585	39084	1770	252115	11203	451	2767	2986
Total	2001	152,8	353	75589	35413	1645	240986	11223	443	2753	2760
Total	2002	154,5	357	72264	31951	1531	220720	11352	437	2699	2520
Total	2003	160,6	371	71168	29419	1449	211083	11806	440	2616	2457
Total	2004	164,8	381	69121	25590	1345	186503	12115	440	2518	2328
Total	2005	166,1	77	65533	23290	1224	178194	12214	425	2298	2233
Total	2006	171,3	79	63829	20433	1125	158413	12587	424	2127	2170
Total	2007	179,5	83	61849	18073	1018	141197	13187	433	1982	2083
Total	2008	176,0	81	54591	15924	859	127495	12938	417	1794	1818
Total	2009	165,1	76	46637	13685	712	110199	12125	384	1612	1523

Annex 2B-8: COPERT IV:DEA statistics fuel use ratios and mileage adjustment factors

Sales			1985	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Fuel ratio	Gasoline	DEA:COPERT IV	1,04	0,98	1,03	1,08	1,11	1,13	1,11	1,09	1,10	1,11	1,09	1,11	1,11	1,14	1,14	1,13	1,12	1,13	1,15	1,15	1,16
	Diesel	DEA:COPERT IV	1,07	1,17	1,20	1,16	1,15	1,23	1,22	1,23	1,24	1,24	1,23	1,18	1,16	1,15	1,19	1,21	1,20	1,20	1,23	1,18	1,12
Consumption																							
Fuel ratio	Gasoline	DEA:COPERT IV	1,08	1,08	1,07	1,08	1,09	1,10	1,10	1,10	1,11	1,12	1,14	1,17	1,16	1,17	1,17	1,16	1,14	1,14	1,15	1,15	1,18
	Diesel	DEA:COPERT IV	1,00	1,07	1,14	1,11	1,10	1,13	1,11	1,12	1,13	1,12	1,12	1,10	1,08	1,06	1,07	1,08	1,08	1,09	1,10	1,06	1,02

Annex 2B-9: Basis fuel consumption and emission factors, deterioration factors, transient factors and specific operational data for non road working machinery and equipment, and recreational craft

Basis factors for diesel fuelled non road machinery.

Engine size [P=kW]	Emission Level	NO_x	VOC	CO	N_2O [g pr kWh]	NH_3	TSP	Fuel
P<19	<1981	12.0	5.0	7	0.035	0.002	2.8	300
P<19	1981-1990	11.5	3.8	6	0.035	0.002	2.3	285
P<19	1991-Stage I	11.2	2.5	5	0.035	0.002	1.6	270
P<19	Stage I	11.2	2.5	5	0.035	0.002	1.6	270
P<19	Stage II	11.2	2.5	5	0.035	0.002	1.6	270
P<19	Stage IIIA	11.2	2.5	5	0.035	0.002	1.6	270
P<19	Stage IIIB	11.2	2.5	5	0.035	0.002	1.6	270
P<19	Stage IV	11.2	2.5	5	0.035	0.002	1.6	270
19<=P<37	<1981	18.0	2.5	6.5	0.035	0.002	2	300
19<=P<37	1981-1990	18.0	2.2	5.5	0.035	0.002	1.4	281
19<=P<37	1991-Stage I	9.8	1.8	4.5	0.035	0.002	1.4	262
19<=P<37	Stage I	9.8	1.8	4.5	0.035	0.002	1.4	262
19<=P<37	Stage II	6.5	0.6	2.2	0.035	0.002	0.4	262
19<=P<37	Stage IIIA	6.2	0.6	2.2	0.035	0.002	0.4	262
19<=P<37	Stage IIIB	6.2	0.6	2.2	0.035	0.002	0.4	262
19<=P<37	Stage IV	6.2	0.6	2.2	0.035	0.002	0.4	262
37<=P<56	<1981	7.7	2.4	6	0.035	0.002	1.8	290
37<=P<56	1981-1990	8.6	2.0	5.3	0.035	0.002	1.2	275
37<=P<56	1991-Stage I	11.5	1.5	4.5	0.035	0.002	0.8	260
37<=P<56	Stage I	7.7	0.6	2.2	0.035	0.002	0.4	260
37<=P<56	Stage II	5.5	0.4	2.2	0.035	0.002	0.2	260
37<=P<56	Stage IIIA	3.9	0.4	2.2	0.035	0.002	0.2	260
37<=P<56	Stage IIIB	3.9	0.4	2.2	0.035	0.002	0.0225	260
37<=P<56	Stage IV	3.9	0.4	2.2	0.035	0.002	0.0225	260
56<=P<75	<1981	7.7	2.0	5	0.035	0.002	1.4	290
56<=P<75	1981-1990	8.6	1.6	4.3	0.035	0.002	1	275
56<=P<75	1991-Stage I	11.5	1.2	3.5	0.035	0.002	0.4	260
56<=P<75	Stage I	7.7	0.4	1.5	0.035	0.002	0.2	260
56<=P<75	Stage II	5.5	0.3	1.5	0.035	0.002	0.2	260
56<=P<75	Stage IIIA	4.0	0.3	1.5	0.035	0.002	0.2	260
56<=P<75	Stage IIIB	3.0	0.2	1.5	0.035	0.002	0.0225	260
56<=P<75	Stage IV	0.4	0.2	1.5	0.035	0.002	0.0225	260
75<=P<130	<1981	10.5	2.0	5	0.035	0.002	1.4	280
75<=P<130	1981-1990	11.8	1.6	4.3	0.035	0.002	1	268
75<=P<130	1991-Stage I	13.3	1.2	3.5	0.035	0.002	0.4	255
75<=P<130	Stage I	8.1	0.4	1.5	0.035	0.002	0.2	255
75<=P<130	Stage II	5.2	0.3	1.5	0.035	0.002	0.2	255
75<=P<130	Stage IIIA	3.4	0.3	1.5	0.035	0.002	0.2	255
75<=P<130	Stage IIIB	3.0	0.2	1.5	0.035	0.002	0.0225	255
75<=P<130	Stage IV	0.4	0.2	1.5	0.035	0.002	0.0225	255
130<=P<560	<1981	17.8	1.5	2.5	0.035	0.002	0.9	270
130<=P<560	1981-1990	12.4	1.0	2.5	0.035	0.002	0.8	260
130<=P<560	1991-Stage I	11.2	0.5	2.5	0.035	0.002	0.4	250
130<=P<560	Stage I	7.6	0.3	1.5	0.035	0.002	0.2	250
130<=P<560	Stage II	5.2	0.3	1.5	0.035	0.002	0.1	250
130<=P<560	Stage IIIA	3.4	0.3	1.5	0.035	0.002	0.1	250
130<=P<560	Stage IIIB	3.0	0.2	1.5	0.035	0.002	0.0225	250
130<=P<560	Stage IV	0.4	0.2	1.5	0.035	0.002	0.0225	250

Basis factors for 4-stroke gasoline non road machinery.

Engine	Size code	Size classe [S=ccm]	Emission Level	NO_x	VOC	CO	N_2O [g pr kWh]	NH_3	TSP	Fuel
4-stroke	SH2	20<=S<50	<1981	2.4	33	198	0.002	0.03	0.08	496
4-stroke	SH2	20<=S<50	1981-1990	3.5	27.5	165	0.002	0.03	0.08	474
4-stroke	SH2	20<=S<50	1991-Stage I	4.7	22	132	0.002	0.03	0.08	451
4-stroke	SH2	20<=S<50	Stage I	4.7	22	132	0.002	0.03	0.08	406
4-stroke	SH2	20<=S<50	Stage II	4.7	22	132	0.002	0.03	0.08	406
4-stroke	SH3	S>=50	<1981	2.4	33	198	0.002	0.03	0.08	496
4-stroke	SH3	S>=50	1981-1990	3.5	27.5	165	0.002	0.03	0.08	474
4-stroke	SH3	S>=50	1991-Stage I	4.7	22	132	0.002	0.03	0.08	451
4-stroke	SH3	S>=50	Stage I	4.7	22	132	0.002	0.03	0.08	406
4-stroke	SH3	S>=50	Stage II	4.7	22	132	0.002	0.03	0.08	406
4-stroke	SN1	S<66	<1981	1.2	26.9	822	0.002	0.03	0.08	603
4-stroke	SN1	S<66	1981-1990	1.8	22.5	685	0.002	0.03	0.08	603
4-stroke	SN1	S<66	1991-Stage I	2.4	18	548	0.002	0.03	0.08	603
4-stroke	SN1	S<66	Stage I	4.3	16.1	411	0.002	0.03	0.08	475
4-stroke	SN1	S<66	Stage II	4.3	16.1	411	0.002	0.03	0.08	475
4-stroke	SN2	66<=S<100	<1981	2.3	10.5	822	0.002	0.03	0.08	627
4-stroke	SN2	66<=S<100	1981-1990	3.5	8.7	685	0.002	0.03	0.08	599
4-stroke	SN2	66<=S<100	1991-Stage I	4.7	7	548	0.002	0.03	0.08	570
4-stroke	SN2	66<=S<100	Stage I	4.7	7	467	0.002	0.03	0.08	450
4-stroke	SN2	66<=S<100	Stage II	4.7	7	467	0.002	0.03	0.08	450
4-stroke	SN3	100<=S<225	<1981	2.6	19.1	525	0.002	0.03	0.08	601
4-stroke	SN3	100<=S<225	1981-1990	3.8	15.9	438	0.002	0.03	0.08	573
4-stroke	SN3	100<=S<225	1991-Stage I	5.1	12.7	350	0.002	0.03	0.08	546
4-stroke	SN3	100<=S<225	Stage I	5.1	11.6	350	0.002	0.03	0.08	546
4-stroke	SN3	100<=S<225	Stage II	5.1	9.4	350	0.002	0.03	0.08	546
4-stroke	SN4	S>=225	<1981	1.3	11.1	657	0.002	0.03	0.08	539
4-stroke	SN4	S>=225	1981-1990	2	9.3	548	0.002	0.03	0.08	514
4-stroke	SN4	S>=225	1991-Stage I	2.6	7.4	438	0.002	0.03	0.08	490
4-stroke	SN4	S>=225	Stage I	2.6	7.4	438	0.002	0.03	0.08	490
4-stroke	SN4	S>=225	Stage II	2.6	7.4	438	0.002	0.03	0.08	490

Basis factors for 2-stroke gasoline non road machinery.

Engine	Size code	Size classe [ccm]	Emission Level	NO_x	VOC	CO	N_2O [g pr kWh]	NH_3	TSP	Fuel
2-stroke	SH2	20<=S<50	<1981	1	305	695	0.002	0.01	7	882
2-stroke	SH2	20<=S<50	1981-1990	1	300	579	0.002	0.01	5.3	809
2-stroke	SH2	20<=S<50	1991-Stage I	1.1	203	463	0.002	0.01	3.5	735
2-stroke	SH2	20<=S<50	Stage I	1.5	188	379	0.002	0.01	3.5	720
2-stroke	SH2	20<=S<50	Stage II	1.5	44	379	0.002	0.01	3.5	500
2-stroke	SH3	S>=50	<1981	1.1	189	510	0.002	0.01	3.6	665
2-stroke	SH3	S>=50	1981-1990	1.1	158	425	0.002	0.01	2.7	609
2-stroke	SH3	S>=50	1991-Stage I	1.2	126	340	0.002	0.01	1.8	554
2-stroke	SH3	S>=50	Stage I	2	126	340	0.002	0.01	1.8	529
2-stroke	SH3	S>=50	Stage II	1.2	64	340	0.002	0.01	1.8	500
2-stroke	SN1	S<66	<1981	0.5	155	418	0.002	0.01	2.6	652
2-stroke	SN1	S<66	1981-1990	0.5	155	418	0.002	0.01	2.6	652
2-stroke	SN1	S<66	1991-Stage I	0.5	155	418	0.002	0.01	2.6	652
2-stroke	SN1	S<66	Stage I	0.5	155	418	0.002	0.01	2.6	652
2-stroke	SN1	S<66	Stage II	0.5	155	418	0.002	0.01	2.6	652
2-stroke	SN2	66<=S<100	<1981	0.5	155	418	0.002	0.01	2.6	652
2-stroke	SN2	66<=S<100	1981-1990	0.5	155	418	0.002	0.01	2.6	652
2-stroke	SN2	66<=S<100	1991-Stage I	0.5	155	418	0.002	0.01	2.6	652
2-stroke	SN2	66<=S<100	Stage I	0.5	155	418	0.002	0.01	2.6	652
2-stroke	SN2	66<=S<100	Stage II	0.5	155	418	0.002	0.01	2.6	652
2-stroke	SN3	100<=S<225	<1981	0.5	155	418	0.002	0.01	2.6	652
2-stroke	SN3	100<=S<225	1981-1990	0.5	155	418	0.002	0.01	2.6	652
2-stroke	SN3	100<=S<225	1991-Stage I	0.5	155	418	0.002	0.01	2.6	652
2-stroke	SN3	100<=S<225	Stage I	0.5	155	418	0.002	0.01	2.6	652
2-stroke	SN3	100<=S<225	Stage II	0.5	155	418	0.002	0.01	2.6	652
2-stroke	SN4	S>=225	<1981	0.5	155	418	0.002	0.01	2.6	652
2-stroke	SN4	S>=225	1981-1990	0.5	155	418	0.002	0.01	2.6	652
2-stroke	SN4	S>=225	1991-Stage I	0.5	155	418	0.002	0.01	2.6	652
2-stroke	SN4	S>=225	Stage I	0.5	155	418	0.002	0.01	2.6	652
2-stroke	SN4	S>=225	Stage II	0.5	155	418	0.002	0.01	2.6	652

Fuel consumption and emission factors LPG fork lifts.

NO_x [g pr kWh]	VOC [g pr kWh]	CO [g pr kWh]	NH_3 [g pr kWh]	N_2O [g pr kWh]	TSP [g pr kWh]	FC [g pr kWh]
19	2.2	1.5	0.003	0.05	0.07	311

Fuel consumption and emission factors for All Terrain Vehicles (ATV's).

ATV type	NO_x [g pr GJ]	VOC [g pr GJ]	CO [g pr GJ]	NH_3 [g pr GJ]	N_2O [g pr GJ]	TSP [g pr GJ]	Fuel [kg pr hour]
Professional	108	1077	16306	2	2	32	1.125
Private	128	1527	22043	2	2	39	0.75

Fuel consumption and emission factors for recreational craft.

Fuel type	Vessel type	Engine	Engine type	Direktiv	Engine size	CO	VOC	N_2O	NH_3	NO_x	TSP	Fuel
					[kW]	[g pr kWh]						
Gasoline	Other boats (< 20 ft)	Out board	2-stroke	2003/44	8	202.5	45.9	0.01	0.002	2	10	791
Gasoline	Other boats (< 20 ft)	Out board	2-stroke	Konv.	8	427	257.0	0.01	0.002	2	10	791
Gasoline	Other boats (< 20 ft)	Out board	4-stroke	2003/44	8	202.5	24.0	0.03	0.002	7	0.08	426
Gasoline	Other boats (< 20 ft)	Out board	4-stroke	Konv.	8	520	24.0	0.03	0.002	7	0.08	426
Gasoline	Yawls and cabin boats	Out board	2-stroke	2003/44	20	162	36.5	0.01	0.002	3	10	791
Gasoline	Yawls and cabin boats	Out board	2-stroke	Konv.	20	374	172.0	0.01	0.002	3	10	791
Gasoline	Yawls and cabin boats	Out board	4-stroke	2003/44	20	162	14.0	0.03	0.002	10	0.08	426
Gasoline	Yawls and cabin boats	Out board	4-stroke	Konv.	20	390	14.0	0.03	0.002	10	0.08	426
Gasoline	Sailing boats (< 26 ft)	Out board	2-stroke	2003/44	10	189	43.0	0.01	0.002	2	10	791
Gasoline	Sailing boats (< 26 ft)	Out board	2-stroke	Konv.	10	427	257.0	0.01	0.002	2	10	791
Gasoline	Sailing boats (< 26 ft)	Out board	4-stroke	2003/44	10	189	24.0	0.03	0.002	7	0.08	426
Gasoline	Sailing boats (< 26 ft)	Out board	4-stroke	Konv.	10	520	24.0	0.03	0.002	7	0.08	426
Gasoline	Speed boats	In board	4-stroke	2003/44	90	141	10.0	0.03	0.002	12	0.08	426
Gasoline	Speed boats	In board	4-stroke	Konv.	90	346	10.0	0.03	0.002	12	0.08	426
Gasoline	Speed boats	Out board	2-stroke	2003/44	50	145.8	31.8	0.01	0.002	3	10	791
Gasoline	Speed boats	Out board	2-stroke	Konv.	50	374	172.0	0.01	0.002	3	10	791
Gasoline	Speed boats	Out board	4-stroke	2003/44	50	145.8	14.0	0.03	0.002	10	0.08	426
Gasoline	Speed boats	Out board	4-stroke	Konv.	50	390	14.0	0.03	0.002	10	0.08	426
Gasoline	Water scooters	Built in	2-stroke	2003/44	45	147	32.2	0.01	0.002	3	10	791
Gasoline	Water scooters	Built in	2-stroke	Konv.	45	374	172.0	0.01	0.002	3	10	791
Gasoline	Water scooters	Built in	4-stroke	2003/44	45	147	14.0	0.03	0.002	10	0.08	426
Gasoline	Water scooters	Built in	4-stroke	Konv.	45	390	14.0	0.03	0.002	10	0.08	426
Diesel	Motor boats (27-34 ft)	In board		2003/44	150	5	1.7	0.035	0.002	8.6	1	275
Diesel	Motor boats (27-34 ft)	In board		Konv.	150	5.3	2.0	0.035	0.002	8.6	1.2	275
Diesel	Motor boats (> 34 ft)	In board		2003/44	250	5	1.6	0.035	0.002	8.6	1	275
Diesel	Motor boats (> 34 ft)	In board		Konv.	250	5.3	2.0	0.035	0.002	8.6	1.2	275
Diesel	Motor boats (< 27 ft)	In board		2003/44	40	5	1.8	0.035	0.002	9.8	1	281
Diesel	Motor boats (< 27 ft)	In board		Konv.	40	5.5	2.2	0.035	0.002	18	1.4	281
Diesel	Motor sailors	In board		2003/44	30	5	1.9	0.035	0.002	9.8	1	281
Diesel	Motor sailors	In board		Konv.	30	5.5	2.2	0.035	0.002	18	1.4	281
Diesel	Sailing boats (> 26 ft)	In board		2003/44	30	5	1.9	0.035	0.002	9.8	1	281
Diesel	Sailing boats (> 26 ft)	In board		Konv.	30	5.5	2.2	0.035	0.002	18	1.4	281

CH_4 shares of VOC for diesel, gasoline and LPG.

Fuel type	CH_4 share of VOC
Diesel	0.016
Gasoline 4-stroke	0.1
Gasoline 2-stroke	0.009
LPG	0.05

Deterioration factors for diesel machinery.

Emission Level	NO_x	VOC	CO	TSP
<1981	0.024	0.047	0.185	0.473
1981-1990	0.024	0.047	0.185	0.473
1991-Stage I	0.024	0.047	0.185	0.473
Stage I	0.024	0.036	0.101	0.473
Stage II	0.009	0.034	0.101	0.473
Stage IIIA	0.008	0.027	0.151	0.473
Stage IIIB	0.008	0.027	0.151	0.473
Stage IV	0.008	0.027	0.151	0.473

Deterioration factors for gasoline 2-stroke machinery.

Engine	Size code	Size classe	Emission Level	NO_x	VOC	CO	TSP
2-stroke	SH2	20<=S<50	<1981	0	0.2	0.2	0
2-stroke	SH2	20<=S<50	1981-1990	0	0.2	0.2	0
2-stroke	SH2	20<=S<50	1991-Stage I	0	0.2	0.2	0
2-stroke	SH2	20<=S<50	Stage I	0	0.29	0.24	0
2-stroke	SH2	20<=S<50	Stage II	0	0.29	0.24	0
2-stroke	SH3	S>=50	<1981	-0.031	0.2	0.2	0
2-stroke	SH3	S>=50	1981-1990	-0.031	0.2	0.2	0
2-stroke	SH3	S>=50	1991-Stage I	-0.031	0.2	0.2	0
2-stroke	SH3	S>=50	Stage I	0	0.266	0.231	0
2-stroke	SH3	S>=50	Stage II	0	0.266	0.231	0
2-stroke	SN1	S<66	<1981	-0.6	0.201	0.9	1.1
2-stroke	SN1	S<66	1981-1990	-0.6	0.201	0.9	1.1
2-stroke	SN1	S<66	1991-Stage I	-0.6	0.201	0.9	1.1
2-stroke	SN1	S<66	Stage I	-0.33	0.266	1.109	5.103
2-stroke	SN1	S<66	Stage II	-0.33	0	1.109	5.103
2-stroke	SN2	66<=S<100	<1981	-0.6	0.201	0.9	1.1
2-stroke	SN2	66<=S<100	1981-1990	-0.6	0.201	0.9	1.1
2-stroke	SN2	66<=S<100	1991-Stage I	-0.6	0.201	0.9	1.1
2-stroke	SN2	66<=S<100	Stage I	-0.33	0.266	1.109	5.103
2-stroke	SN2	66<=S<100	Stage II	-0.33	0	1.109	5.103
2-stroke	SN3	100<=S<225	<1981	-0.6	0.201	0.9	1.1
2-stroke	SN3	100<=S<225	1981-1990	-0.6	0.201	0.9	1.1
2-stroke	SN3	100<=S<225	1991-Stage I	-0.6	0.201	0.9	1.1
2-stroke	SN3	100<=S<225	Stage I	-0.33	0.266	1.109	5.103
2-stroke	SN3	100<=S<225	Stage II	-0.33	0	1.109	5.103
2-stroke	SN4	S>=225	<1981	-0.6	0.201	0.9	1.1
2-stroke	SN4	S>=225	1981-1990	-0.6	0.201	0.9	1.1
2-stroke	SN4	S>=225	1991-Stage I	-0.6	0.201	0.9	1.1
2-stroke	SN4	S>=225	Stage I	-0.274	0	0.887	1.935
2-stroke	SN4	S>=225	Stage II	-0.274	0	0.887	1.935

Deterioration factors for gasoline 4-stroke machinery.

Engine	Size code	Size classe	Emission Level	NO_x	VOC	CO	TSP
4-stroke	SN1	S<66	<1981	-0.6	1.1	0.9	1.1
4-stroke	SN1	S<66	1981-1990	-0.6	1.1	0.9	1.1
4-stroke	SN1	S<66	1991-Stage I	-0.6	1.1	0.9	1.1
4-stroke	SN1	S<66	Stage I	-0.3	1.753	1.051	1.753
4-stroke	SN1	S<66	Stage II	-0.3	1.753	1.051	1.753
4-stroke	SN2	66<=S<100	<1981	-0.6	1.1	0.9	1.1
4-stroke	SN2	66<=S<100	1981-1990	-0.6	1.1	0.9	1.1
4-stroke	SN2	66<=S<100	1991-Stage I	-0.6	1.1	0.9	1.1
4-stroke	SN2	66<=S<100	Stage I	-0.3	1.753	1.051	1.753
4-stroke	SN2	66<=S<100	Stage II	-0.3	1.753	1.051	1.753
4-stroke	SN3	100<=S<225	<1981	-0.6	1.1	0.9	1.1
4-stroke	SN3	100<=S<225	1981-1990	-0.6	1.1	0.9	1.1
4-stroke	SN3	100<=S<225	1991-Stage I	-0.6	1.1	0.9	1.1
4-stroke	SN3	100<=S<225	Stage I	-0.3	1.753	1.051	1.753
4-stroke	SN3	100<=S<225	Stage II	-0.3	1.753	1.051	1.753
4-stroke	SN4	S>=225	<1981	-0.6	1.1	0.9	1.1
4-stroke	SN4	S>=225	1981-1990	-0.6	1.1	0.9	1.1
4-stroke	SN4	S>=225	1991-Stage I	-0.6	1.1	0.9	1.1
4-stroke	SN4	S>=225	Stage I	-0.599	1.095	1.307	1.095
4-stroke	SN4	S>=225	Stage II	-0.599	1.095	1.307	1.095
4-stroke	SH2	20<=S<50	<1981	0	0	0	0
4-stroke	SH2	20<=S<50	1981-1990	0	0	0	0
4-stroke	SH2	20<=S<50	1991-Stage I	0	0	0	0
4-stroke	SH2	20<=S<50	Stage I	0	0	0	0
4-stroke	SH2	20<=S<50	Stage II	0	0	0	0
4-stroke	SH3	S>=50	<1981	0	0	0	0
4-stroke	SH3	S>=50	1981-1990	0	0	0	0
4-stroke	SH3	S>=50	1991-Stage I	0	0	0	0
4-stroke	SH3	S>=50	Stage I	0	0	0	0
4-stroke	SH3	S>=50	Stage II	0	0	0	0

Transient factors for diesel machinery.

Emission Level	Load	NO_x	VOC	CO	TSP	Fuel
<1981	High	0.95	1.05	1.53	1.23	1.01
1981-1990	High	0.95	1.05	1.53	1.23	1.01
1991-Stage I	High	0.95	1.05	1.53	1.23	1.01
Stage I	High	0.95	1.05	1.53	1.23	1.01
Stage II	High	0.95	1.05	1.53	1.23	1.01
Stage IIIA	High	0.95	1.05	1.53	1.23	1.01
Stage IIIB	High	1	1	1	1	1
Stage IV	High	1	1	1	1	1
<1981	Low	1.1	2.29	2.57	1.97	1.18
1981-1990	Low	1.1	2.29	2.57	1.97	1.18
1991-Stage I	Low	1.1	2.29	2.57	1.97	1.18
Stage I	Low	1.1	2.29	2.57	1.97	1.18
Stage II	Low	1.1	2.29	2.57	1.97	1.18
Stage IIIA	Low	1.1	2.29	2.57	1.97	1.18
Stage IIIB	Low	1	1	1	1	1
Stage IV	Low	1	1	1	1	1

Annual working hours, load factors and lifetimes for agricultural tractors.

Tractor type	Annual working hours	Load factor	Lifetime (yrs)
Diesel	500 (0-7 years) 500-100 (7-16 years) 100 (>16 years)	0.5	30
Gasoline (certified)	100	0.4	37
Gasoline (non certified)	50	0.4	37

Annual working hours, load factors and lifetimes for harvesters.

Annual working hours	Load factor	Lifetime (yrs)
250-100 (linear decrease 0-24 years)	0.8	25

Annual working hours, load factors and lifetime for machine pool machinery.

Tractor type	Hours pr yr	Load factor	Lifetime (yrs)
Tractors	750	0.5	7
Harvesters	100	0.8	11
Self-propelled vehicles	500	0.75	6

Operational data for other machinery types in agriculture.

Machinery type	Fuel type	Load factor	Lifetime (yrs)	Hours	Size (kW)
ATV private	Gasoline	-	6	250	-
ATV professional	Gasoline	-	8	400	-
Bedding machines	Gasoline	0.3	10	50	3
Fodder trucks	Gasoline	0.4	10	200	8
Other (gasoline)	Gasoline	0.4	10	50	5
Scrapers	Gasoline	0.3	10	50	3
Self-propelled vehicles	Diesel	0.75	15	150	60
Sweepers	Gasoline	0.3	10	50	3

Annual working hours, load factors and lifetimes for forestry machinery.

Machinery type	Hours	Load factors	Lifetime
Chippers	1200	0.5	6
Tractors (other)	100 (1990) 400 (2004)	0.5	15
Tractors (silvicultural)	800	0.5	6
Harvesters	1200	0.5	8
Forwarders	1200	0.5	8
Chain saws (forestry)	800	0.4	3

Annual working hours, load factors and lifetime for fork lifts.

Hours pr yr	Load factor	Lifetime (yrs)
1200 (>=50 kW and <=10 years old) 650 (>=50 kW and >10 years old) 650 (<50 kW)	0.27	20

Operational data for construction machinery.

Machinery type	Load factor	Lifetime	Hours	Size
Track type dozers	0.5	10	1100	140
Track type loaders	0.5	10	1100	100 (1990) 150 (2004)
Wheel loaders (0-5 tonnes)	0.5	10	1200	20
Wheel loaders (> 5,1 tonnes)	0.5	10	1200	120
Wheel type excavators	0.6	10	1200	100
Track type excavators (0-5 ton-	0.6	10	1100	20
Track type excavators (>5,1	0.6	10	1100	120
Excavators/Loaders	0.45	10	700	50
Dump trucks	0.4	10	900 (1990) 1200 (2004)	60 (1990) 180 (2004)
Mini loaders	0.5	14	700	30
Telescopic loaders	0.5	14	1000	35

Stock and operational data for other machinery types in industry.

Sector	Fuel type	Machinery type	Size (kW)	No	Load Factor	Hours
Construction machinery	Diesel	Tampers/Land rollers	30	2800	0.45	600
Construction machinery	Diesel	Generators (diesel)	45	5000	0.5	200
Construction machinery	Diesel	Kompressors (diesel)	45	5000	0.5	500
Construction machinery	Diesel	Pumps (diesel)	75	1000	0.5	5
Construction machinery	Diesel	Asphalt pavers	80	300	0.35	700
Construction machinery	Diesel	Motor graders	100	100	0.4	700
Construction machinery	Diesel	Refuse compressors	160	100	0.25	1300
Construction machinery	Gasoline	Generators (gasoline)	2.5	11000	0.4	80
Construction machinery	Gasoline	Pumps (gasoline)	4	10000	0.4	300
Construction machinery	Gasoline	Kompressors (gasoline)	4	500	0.35	15
Industry	Diesel	Refrigerating units (distribution)	8	3000	0.5	1250
Industry	Diesel	Refrigerating units (long distance)	15	3500	0.5	200
Industry	Diesel	Tractors (transport, industry)	50	3000	0.4	500
Airport GSE and other	Diesel	Airport GSE and other (light duty)	100	500	0.5	400
Airport GSE and other	Diesel	Airport GSE and other (medium duty)	125	350	0.5	300
Airport GSE and other	Diesel	Airport GSE and other (Heavy duty)	175	650	0.5	200
Building and construction	Diesel	Vibratory plates	6	3500	0.6	300
Building and construction	Diesel	Aereal lifts (diesel)	30	150	0.4	400
Building and construction	Diesel	Sweepers (diesel)	30	200	0.4	300
Building and construction	Diesel	High pressure cleaners (diesel)	30	50	0.8	500
Building and construction	Gasoline	Rammers	2.5	3000	0.4	80
Building and construction	Gasoline	Drills	3	100	0.4	10
Building and construction	Gasoline	Vibratory plates (gasoline)	4	2500	0.5	200
Building and construction	Gasoline	Cutters	4	800	0.5	50
Building and construction	Gasoline	Other (gasoline)	5	1000	0.5	40
Building and construction	Gasoline	High pressure cleaners (gasoline)	5	500	0.6	200
Building and construction	Gasoline	Sweepers (gasoline)	10	500	0.4	150
Building and construction	Gasoline	Slicers	10	100	0.7	150
Building and construction	Gasoline	Aereal lifts (gasoline)	20	50	0.4	400

Operational data for the most important types of household and gardening machinery.

Machinery type	Engine	Size (kW)	Hours	Load factor	Lifetime (yrs)
Chain saws (private)	2-stroke	2	5	0.3	10
Chain saws (professional)	2-stroke	3	270	0.4	3
Cultivators (private-large)	4-stroke	3.7	5	0.6	5
Cultivators (private-small)	4-stroke	1	5	0.6	15
Cultivators (professional)	4-stroke	7	360	0.6	8
Hedge cutters (private)	2-stroke	0.9	10	0.5	10
Hedge cutters (professional)	2-stroke	2	300	0.5	4
Lawn movers (private)	4-stroke	2.5 (2000) 3.5 (2004)	25	0.4	8
Lawn movers (professional)	4-stroke	2.5 (2000) 3.5 (2004)	250	0.4	4
Riders (private)	4-stroke	11	50	0.5	12
Riders (professional)	4-stroke	13	330	0.5	5
Shrub clearers (private)	2-stroke	1	15	0.6	10
Shrub clearers (professional)	2-stroke	2	300	0.6	4
Trimmers (private)	2-stroke	0.9	20	0.5	10
Trimmers (professional)	2-stroke	0.9	200	0.5	4

Stock and operational data for other machines in household and gardening.

Machinery type	Engine	No.	Size (kW)	Hours	Load factor	Lifetime (yrs)
Chippers	2-stroke	200	10	100	0.7	10
Garden shredders	2-stroke	500	3	20	0.7	10
Other (gasoline)	2-stroke	200	2	20	0.5	10
Suction machines	2-stroke	300	4	80	0.5	10
Wood cutters	4-stroke	100	4	15	0.5	10

Operational data for recreational craft.

Fuel type	Vessel type	Engine type	Stroke	Hours	Lifetime	Load factor
Gasoline	Other boats (<20 ft)	Out board engine	2-stroke	30	10	0.5
Gasoline	Other boats (<20 ft)	Out board engine	4-stroke	30	10	0.5
Gasoline	Yawls and cabin boats	Out board engine	2-stroke	50	10	0.5
Gasoline	Yawls and cabin boats	Out board engine	4-stroke	50	10	0.5
Gasoline	Sailing boats (<26ft)	Out board engine	2-stroke	5	10	0.5
Gasoline	Sailing boats (<26ft)	Out board engine	4-stroke	5	10	0.5
Gasoline	Speed boats	In board engine	4-stroke	75	10	0.5
Gasoline	Speed boats	Out board engine	2-stroke	50	10	0.5
Gasoline	Speed boats	Out board engine	4-stroke	50	10	0.5
Gasoline	Water scooters	Built in	2-stroke	10	10	0.5
Gasoline	Water scooters	Built in	4-stroke	10	10	0.5
Diesel	Motor boats (27-34 ft)	In board engine		150	15	0.5
Diesel	Motor boats (>34 ft)	In board engine		100	15	0.5
Diesel	Motor boats (<27 ft)	In board engine		75	15	0.5
Diesel	Motor sailors	In board engine		75	15	0.5
Diesel	Sailing boats (<26ft)	In board engine		25	15	0.5

Annex 2B-10: Stock data for non-road working machinery and equipment

Stock data for diesel tractors 1985-2009.

Size (kW)	Emission Level	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
37	<1981	3882	3792	3542	3543	3403	3234	3106	2922	2861	2610	2605	2273	2193	1918	1796
37	1981-1990	635	731	760	835	855	879	889	883	915	887	945	883	918	869	888
37	1991-Stage I							25	107	153	201	278	354	445	496	554
37	Stage I															
37	Stage II															
37	Stage IIIA															
45	<1981	25988	25387	23709	23718	22781	21650	20796	19563	19154	17475	17441	15219	14684	12840	12025
45	1981-1990	5740	6808	7263	8075	8476	8770	8867	8805	9128	8848	9419	8807	9151	8668	8856
45	1991-Stage I							203	202	209	203	216	202	210	199	203
49	1991-Stage I								154	281	485	602	618	702	749	765
52	1991-Stage I															247
52	Stage I															
52	Stage II															
52	Stage IIIA															
56	1991-Stage I								201	338	428	747	943	1181	1280	1307
60	<1981	54651	53387	49857	49877	47907	45529	43732	41140	40278	36747	36676	32004	30879	27001	25287
60	1981-1990	11751	14613	15795	17797	19395	20542	20770	20624	21380	20725	22063	20628	21434	20304	20744
60	1991-Stage I							863	857	888	861	917	857	891	844	862
63	1991-Stage I								468	855	1325	2014	2384	2837	3011	3076
67	1991-Stage I															671
67	Stage I															
67	Stage II															
67	Stage IIIA															
71	1991-Stage I								411	715	1179	1949	2507	3344	3594	3672
78	<1981	14558	14221	13281	13286	12761	12128	11649	10959	10729	9789	9770	8525	8226	7192	6736
78	1981-1990	4592	6152	7196	8559	10026	11323	11448	11368	11785	11424	12162	11371	11815	11192	11434
78	1991-Stage I							1233	1503	1713	1945	2429	2561	2946	2994	3287
78	Stage I															
78	Stage II															
78	Stage IIIA															
86	1991-Stage I								108	193	333	589	880	1364	1532	1718
86	Stage I															

Continued																
Size (kW)	Emission Level	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
86	Stage II															
86	Stage IIIA															
93	1991-Stage I															149
93	Stage I															
93	Stage II															
93	Stage IIIA															
97	1991-Stage I								71	175	443	962	1556	2327	2638	2695
101	<1981	4659	4551	4250	4252	4084	3881	3728	3507	3433	3132	3126	2728	2632	2302	2156
101	1981-1990	1158	1434	1618	1921	2156	2377	2403	2387	2474	2398	2553	2387	2480	2350	2400
101	1991-Stage I							266	264	274	266	283	264	275	260	696
101	Stage I															
101	Stage II															
101	Stage IIIA															
112	1991-Stage I								63	114	166	252	422	690	790	978
112	Stage I															
112	Stage II															
112	Stage IIIA															
127	1991-Stage I								12	36	81	193	279	408	457	590
127	Stage I															
127	Stage II															
127	Stage IIIA															
131	<1981	798	780	728	728	700	665	639	601	588	537	536	467	451	394	369
131	1981-1990	288	421	500	651	753	887	897	890	923	895	952	890	925	876	895
131	1991-Stage I							97	97	100	97	103	97	100	95	97
157	1981-1990		2	3	6	11	15	15	15	16	15	16	15	16	15	15
157	1991-Stage I							9	23	39	102	232	357	545	648	784
157	Stage I															
157	Stage II															
157	Stage IIIA															
186	1991-Stage I															23
186	Stage I															
186	Stage II															
186	Stage IIIA															

Continued											
Size (kW)	Emission Level	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
37	<1981	1601	1449	1298	1148	993	833	664	504	342	176
37	1981-1990	871	876	882	892	900	906	903	914	930	959
37	1991-Stage I	568	572	576	582	587	592	590	597	607	626
37	Stage I		33	56	83	84	84	84	85	86	89
37	Stage II					23	53	162	324	330	340
37	Stage IIIA									109	205
45	<1981	10715	9700	8690	7685	6646	5577	4447	3376	2290	1180
45	1981-1990	8681	8731	8800	8894	8974	9037	9006	9116	9274	9563
45	1991-Stage I	199	200	202	204	206	207	207	209	213	219
49	1991-Stage I	750	754	760	768	775	780	778	787	801	826
52	1991-Stage I	358	360	363	367	370	373	372	376	383	395
52	Stage I		132	242	377	381	383	382	387	393	406
52	Stage II					68	147	241	347	353	364
52	Stage IIIA									86	133
56	1991-Stage I	1281	1289	1299	1313	1325	1334	1329	1346	1369	1412
60	<1981	22533	20397	18273	16162	13976	11729	9351	7099	4815	2482
60	1981-1990	20333	20451	20612	20834	21019	21167	21096	21353	21723	22401
60	1991-Stage I	845	850	856	866	873	879	876	887	903	931
63	1991-Stage I	3015	3033	3057	3090	3117	3139	3128	3167	3221	3322
67	1991-Stage I	1343	1351	1361	1376	1388	1398	1393	1410	1435	1479
67	Stage I		533	835	1113	1123	1131	1127	1141	1161	1197
67	Stage II					375	729	1144	1524	1550	1599
67	Stage IIIA									303	472
71	1991-Stage I	3600	3620	3649	3688	3721	3747	3735	3780	3846	3966
78	<1981	6002	5433	4868	4305	3723	3124	2491	1891	1283	661
78	1981-1990	11208	11273	11361	11484	11586	11668	11628	11770	11974	12348
78	1991-Stage I	3436	3727	3756	3797	3830	3857	3844	3891	3959	4082
78	Stage I			325	329	332	334	333	337	343	354
78	Stage II				227	310	400	463	469	477	492
78	Stage IIIA								63	121	147
86	1991-Stage I	1876	2023	2039	2061	2079	2094	2087	2112	2149	2216
86	Stage I			134	136	137	138	137	139	142	146
86	Stage II				91	343	530	760	769	783	807
86	Stage IIIA								226	434	529
93	1991-Stage I	245	325	327	331	334	336	335	339	345	356

Continued											
Size (kW)	Emission Level	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
93	Stage I			114	115	116	117	116	118	120	123
93	Stage II				107	186	313	512	518	527	544
93	Stage IIIA								264	470	574
97	1991-Stage I	2642	2657	2678	2707	2731	2750	2741	2774	2822	2911
101	<1981	1921	1739	1558	1378	1191	1000	797	605	410	212
101	1981-1990	2353	2367	2385	2411	2432	2449	2441	2471	2514	2592
101	1991-Stage I	1116	1567	1579	1596	1611	1622	1616	1636	1664	1716
101	Stage I			232	234	236	238	237	240	244	252
101	Stage II				136	357	635	776	785	799	824
101	Stage IIIA								188	336	410
112	1991-Stage I	1265	1626	1639	1656	1671	1683	1677	1698	1727	1781
112	Stage I			465	470	474	478	476	482	490	505
112	Stage II				337	732	1170	1763	1785	1815	1872
112	Stage IIIA								378	663	823
127	1991-Stage I	707	847	854	863	871	877	874	884	900	928
127	Stage I			152	154	155	156	156	158	161	166
127	Stage II				78	268	453	591	599	609	628
127	Stage IIIA								292	675	880
131	<1981	329	298	267	236	204	171	137	104	70	36
131	1981-1990	878	883	890	899	907	914	911	922	938	967
131	1991-Stage I	95	96	96	97	98	99	99	100	102	105
157	1981-1990	15	15	15	15	16	16	16	16	16	17
157	1991-Stage I	900	905	912	922	930	937	934	945	961	991
157	Stage I		89	89	90	91	92	91	92	94	97
157	Stage II			149	415	695	1089	1085	1098	1117	1152
157	Stage IIIA							623	1453	2140	2586
186	1991-Stage I	53	54	54	55	55	56	55	56	57	59
186	Stage I		47	48	48	49	49	49	49	50	52
186	Stage II			68	207	320	481	480	486	494	509
186	Stage IIIA							272	685	1103	1427

Stock data for gasoline tractors 1985-2005.

Size (kW)	Emission Level	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Certified	<1981	13176	12541	11906	11270	10635	10000	9053	8148	7285	6465	5687	4951	4258	3607	2998
Non certified	<1981	26352	25082	23811	22541	21270	20000	19042	18041	16998	15913	14785	13616	12403	11149	9852

Size (kW)	Emission Level	2000	2001	2002	2003	2004	2005
Certified	<1981	2432	1908	1427	987	591	236
Non certified	<1981	8512	7131	5707	4240	2732	1180

Stock data for harvesters 1985-2009.

Size Group	Emission Level	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
0<S<=50	<1981	26601	24394	22599	22144	19842	18915	17241	15607	14575	12673	10700	9491	6966	5446	3589
0<S<=50	1981-1990	519	534	550	582	566	591	594	601	635	636	633	683	641	686	672
50<S<=60	<1981	2703	2648	2634	2785	2711	2828	2847	2876	3040	3044	3029	3271	3068	2930	2235
50<S<=60	1981-1990	853	1102	1164	1275	1258	1333	1341	1355	1432	1434	1427	1541	1446	1548	1516
50<S<=60	1991-Stage I							8	8	8	8	8	9	9	9	9
60<S<=70	<1981	1786	1750	1741	1841	1792	1869	1881	1901	2009	2012	2002	2162	2028	2171	2127
60<S<=70	1981-1990	1138	1679	1943	2237	2213	2348	2363	2388	2524	2527	2515	2716	2547	2727	2671
60<S<=70	1991-Stage I							8	16	18	21	22	24	23	24	24
70<S<=80	<1981	929	910	905	958	932	972	979	989	1045	1046	1041	1125	1055	1129	1106
70<S<=80	1981-1990	383	699	1026	1165	1318	1493	1502	1518	1604	1606	1598	1726	1619	1733	1698
70<S<=80	1991-Stage I							72	77	83	86	87	96	91	98	96
70<S<=80	Stage I															1
80<S<=90	<1981	323	317	315	333	324	338	340	344	363	364	362	391	367	393	385
80<S<=90	1981-1990	383	562	645	967	1107	1466	1475	1491	1575	1577	1570	1695	1590	1702	1667
80<S<=90	1991-Stage I							61	158	181	200	200	217	207	222	217
80<S<=90	Stage I															1
90<S<=100	1981-1990	89	175	235	387	515	670	674	681	720	721	717	775	726	778	762
90<S<=100	1991-Stage I							180	257	320	329	351	382	367	393	385
90<S<=100	Stage I															1
100<S<=120	1981-1990		54	106	219	334	589	592	599	633	634	630	681	639	684	670
100<S<=120	1991-Stage I							129	253	316	375	440	567	586	673	660
100<S<=120	Stage I															2
120<S<=140	1981-1990				4	69	183	184	186	197	197	196	212	199	213	208
120<S<=140	1991-Stage I							70	148	189	215	319	484	626	804	860

Continued																
Size Group	Emission Level	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
120<S<=140	Stage I															21
120<S<=140	Stage II															
120<S<=140	Stage IIIA															
140<S<=160	1991-Stage I								8	36	69	112	271	354	554	632
140<S<=160	Stage II															
140<S<=160	Stage IIIA															
160<S<=180	1991-Stage I											26	69	200	374	440
160<S<=180	Stage II															
160<S<=180	Stage IIIA															
180<S<=200	1991-Stage I												20	67	117	193
180<S<=200	Stage II															
180<S<=200	Stage IIIA															
200<S<=220	1991-Stage I														45	92
200<S<=220	Stage II															
200<S<=220	Stage IIIA															
220<S<=240	1991-Stage I															3
220<S<=240	Stage II															
220<S<=240	Stage IIIA															
240<S<=260	1991-Stage I															3
240<S<=260	Stage II															
240<S<=260	Stage IIIA															
260<S<=280	1991-Stage I															14
260<S<=280	Stage II															
260<S<=280	Stage IIIA															
280<S<=300	1991-Stage I															
280<S<=300	Stage II															
280<S<=300	Stage IIIA															
300<S<=320	Stage II															
300<S<=320	Stage IIIA															

Continued											
Size Group	Emission Level	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
0<S<=50	<1981	2873	1854	1272	750	267					
0<S<=50	1981-1990	715	758	776	812	877	908	774	625	445	264
50<S<=60	<1981	1999	1570	1257	892	389					
50<S<=60	1981-1990	1612	1711	1751	1831	1979	2048	1844	1635	1326	1020
50<S<=60	1991-Stage I	10	10	10	11	12	12	12	12	12	12
60<S<=70	<1981	2073	1648	1337	976	480					
60<S<=70	1981-1990	2841	3014	3085	3226	3486	3608	3323	3043	2642	2253
60<S<=70	1991-Stage I	25	27	27	29	31	32	32	32	32	33
70<S<=80	<1981	1176	1248	1102	731	215					
70<S<=80	1981-1990	1806	1916	1961	2051	2216	2293	2151	2030	1926	1836
70<S<=80	1991-Stage I	102	109	111	116	126	130	130	129	130	133
70<S<=80	Stage I	1	1	1	1	1	1	1	1	1	1
80<S<=90	<1981	409	434	444	465	215					
80<S<=90	1981-1990	1773	1881	1926	2014	2176	2252	2110	1989	1885	1794
80<S<=90	1991-Stage I	231	245	251	263	284	294	292	290	293	299
80<S<=90	Stage I	1	1	1	1	1	1	1	1	1	1
90<S<=100	1981-1990	810	860	880	920	994	1029	1024	1017	980	951
90<S<=100	1991-Stage I	410	435	445	465	503	520	518	514	520	530
90<S<=100	Stage I	1	1	1	1	1	1	1	1	1	1
100<S<=120	1981-1990	712	756	773	809	874	904	900	894	903	921
100<S<=120	1991-Stage I	702	744	762	797	861	891	887	881	890	907
100<S<=120	Stage I	2	2	2	3	3	3	3	3	3	3
120<S<=140	1981-1990	222	235	241	252	272	282	280	278	281	287
120<S<=140	1991-Stage I	918	977	1000	1046	1130	1170	1164	1156	1168	1191
120<S<=140	Stage I	26	31	32	33	36	37	37	37	37	38
120<S<=140	Stage II					3	4	4	4	4	4
120<S<=140	Stage IIIA							1	1	1	4
140<S<=160	1991-Stage I	715	795	814	851	920	952	947	940	950	969
140<S<=160	Stage II			23	40	53	62	61	61	61	63
140<S<=160	Stage IIIA							5	8	12	16
160<S<=180	1991-Stage I	533	602	616	644	696	720	717	712	720	734
160<S<=180	Stage II			45	80	101	116	115	114	116	118
160<S<=180	Stage IIIA							9	14	20	24
180<S<=200	1991-Stage I	249	300	307	321	347	359	358	355	359	366

Continued											
Size Group	Emission Level	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
180<S<=200	Stage II			68	103	127	142	142	141	142	145
180<S<=200	Stage IIIA							9	14	20	24
200<S<=220	1991-Stage I	142	187	192	200	217	224	223	221	224	228
200<S<=220	Stage II			45	80	101	116	115	114	116	118
200<S<=220	Stage IIIA							9	14	20	24
220<S<=240	1991-Stage I	48	151	154	161	174	180	180	178	180	184
220<S<=240	Stage II			80	129	180	238	237	235	238	242
220<S<=240	Stage IIIA							61	122	194	251
240<S<=260	1991-Stage I	71	142	145	152	164	169	169	167	169	173
240<S<=260	Stage II			80	143	220	319	318	315	319	325
240<S<=260	Stage IIIA							113	231	369	477
260<S<=280	1991-Stage I	61	131	134	140	151	156	156	154	156	159
260<S<=280	Stage II			80	143	220	319	318	315	319	325
260<S<=280	Stage IIIA							113	231	369	477
280<S<=300	1991-Stage I		33	34	36	38	40	40	39	40	40
280<S<=300	Stage II			80	143	220	319	318	315	319	325
280<S<=300	Stage IIIA							113	231	369	477
300<S<=320	Stage II				29	65	113	112	111	113	115
300<S<=320	Stage IIIA							56	115	184	239

Stock data for fork lifts 1985-2009.

FuelCode	Size (kW)	Emission Level	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
205B	35	<1981	387	361	336	311	285	260	234	209	183	158	133	107	84	58	30
205B	35	1981-1990	120	162	202	239	270	297	297	297	297	297	297	297	297	297	297
205B	35	1991-Stage I							26	49	65	93	131	168	218	247	275
205B	35	Stage II															
205B	35	Stage IIIA															
205B	45	<1981	1612	1506	1400	1294	1188	1082	976	870	764	658	552	446	349	243	126
205B	45	1981-1990	499	674	839	994	1122	1233	1233	1233	1233	1233	1233	1233	1233	1233	1233
205B	45	1991-Stage I							108	203	270	386	544	699	905	1063	1063
205B	45	Stage I															151
205B	45	Stage II															
205B	45	Stage IIIA															
205B	50	<1981	2173	2031	1888	1745	1602	1459	1316	1174	1031	888	745	602	471	328	170
205B	50	1981-1990	673	909	1131	1340	1512	1662	1662	1662	1662	1662	1662	1662	1662	1662	1662
205B	50	1991-Stage I							145	273	363	519	732	940	1217	1469	1469
205B	50	Stage I															240
205B	50	Stage II															
205B	50	Stage IIIA															
205B	75	<1981	497	465	432	399	367	334	301	269	236	203	170	138	108	75	39
205B	75	1981-1990	154	208	259	307	347	382	382	382	382	382	382	382	382	382	382
205B	75	1991-Stage I							33	63	84	120	169	217	281	354	354
205B	75	Stage I															70
205B	75	Stage II															
205B	75	Stage IIIA															
205B	120	<1981	111	103	96	89	81	74	67	60	52	45	38	31	24	17	9
205B	120	1981-1990	34	46	57	68	77	85	85	85	85	85	85	85	85	85	85
205B	120	1991-Stage I							7	14	19	27	38	49	63	97	97
205B	120	Stage I															32
205B	120	Stage II															
205B	120	Stage IIIA															
3030	33		5420	5427	5390	5323	5265	5215	5156	5068	4947	4863	4835	4792	4732	4765	4712
3030	40		4917	4923	4889	4828	4775	4730	4676	4596	4486	4410	4384	4344	4289	4295	4223
3030	50		2149	2151	2137	2110	2087	2067	2044	2008	1960	1926	1915	1897	1874	1926	1941
3030	78		97	97	96	95	94	93	92	91	89	88	88	87	86	90	92
3030	120															1	2

Continued

FuelCode	Size (kW)	Emission Level	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
205B	35	<1981										
205B	35	1981-1990	297	277	249	232	198	177	135	95	58	27
205B	35	1991-Stage I	304	304	304	304	304	304	304	304	304	304
205B	35	Stage II		23	53	75	89	117	152	152	152	152
205B	35	Stage IIIA								41	76	92
205B	45	<1981										
205B	45	1981-1990	1233	1151	1036	964	820	734	559	394	239	111
205B	45	1991-Stage I	1063	1063	1063	1063	1063	1063	1063	1063	1063	1063
205B	45	Stage I	303	422	524	664	664	664	664	664	664	664
205B	45	Stage II					104	232	452	612	612	612
205B	45	Stage IIIA									126	181
205B	50	<1981										
205B	50	1981-1990	1662	1551	1396	1299	1105	989	753	531	322	150
205B	50	1991-Stage I	1469	1469	1469	1469	1469	1469	1469	1469	1469	1469
205B	50	Stage I	461	682	897	1135	1135	1135	1135	1135	1135	1135
205B	50	Stage II					187	447	818	1134	1134	1134
205B	50	Stage IIIA									181	275
205B	75	<1981										
205B	75	1981-1990	382	357	321	299	255	228	174	123	75	35
205B	75	1991-Stage I	354	354	354	354	354	354	354	354	354	354
205B	75	Stage I	162	234	311	311	311	311	311	311	311	311
205B	75	Stage II				58	129	208	326	326	326	326
205B	75	Stage IIIA								142	213	252
205B	120	<1981										
205B	120	1981-1990	85	80	72	67	57	51	39	28	17	8
205B	120	1991-Stage I	97	97	97	97	97	97	97	97	97	97
205B	120	Stage I	71	89	118	118	118	118	118	118	118	118
205B	120	Stage II				16	38	58	112	112	112	112
205B	120	Stage IIIA								58	70	76
3030	33		4718	4677	4655	4595	4494	4345	4220	4154	4043	3941
3030	40		4218	4214	4244	4224	4166	4116	4048	4005	3951	3878
3030	50		1897	1938	2003	2020	2018	2029	2061	2136	2198	2192
3030	78		88	95	98	99	104	104	114	123	147	149
3030	120		2	2	3	3	3	3	3	3	3	3

Stock data for construction machinery 1985-2009.

EquipmentName (Eng)	Emission Level	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Track type dozers	<1981	125	100	75	50	25										
Track type dozers	1981-1990	125	150	175	200	225	250	221	193	166	139	114	89	66	43	21
Track type dozers	1991-Stage I							25	48	71	93	114	134	153	172	189
Track type dozers	Stage II															
Track type dozers	Stage IIIA															
Track type loaders	<1981	50	40	30	20	10										
Track type loaders	1981-1990	50	60	70	80	90	100	89	79	68	58	48	38	28	19	9
Track type loaders	1991-Stage I							10	20	29	39	48	57	66	75	83
Track type loaders	Stage II															
Track type loaders	Stage IIIA															
Wheel loaders (0-5 tonnes)	1981-1990							186	331	434	496	517	496	434	331	186
Wheel loaders (0-5 tonnes)	1991-Stage I							21	83	186	331	517	744	1013	1323	1674
Wheel loaders (0-5 tonnes)	Stage II															
Wheel loaders (0-5 tonnes)	Stage IIIA															
Wheel loaders (> 5,1 tonnes)	<1981	1250	1000	750	500	250										
Wheel loaders (> 5,1 tonnes)	1981-1990	1250	1500	1750	2000	2250	2500	2228	1960	1698	1441	1188	941	698	460	228
Wheel loaders (> 5,1 tonnes)	1991-Stage I							248	490	728	960	1188	1411	1629	1841	1822
Wheel loaders (> 5,1 tonnes)	Stage I															228
Wheel loaders (> 5,1 tonnes)	Stage II															
Wheel loaders (> 5,1 tonnes)	Stage IIIA															
Wheel type excavators	<1981	500	400	300	200	100										
Wheel type excavators	1981-1990	500	600	700	800	900	1000	862	732	611	498	394	298	211	132	62
Wheel type excavators	1991-Stage I							96	183	262	332	394	447	491	528	493
Wheel type excavators	Stage I															62
Wheel type excavators	Stage II															
Wheel type excavators	Stage IIIA															
Track type excavators (0-5 tonnes)	1981-1990							459	816	1071	1224	1275	1224	1071	816	459
Track type excavators (0-5 tonnes)	1991-Stage I							51	204	459	816	1275	1837	2500	3265	4132
Track type excavators (0-5 tonnes)	Stage II															
Track type excavators (0-5 tonnes)	Stage IIIA															
Track type excavators (>5,1 tonnes)	<1981	1000	800	600	400	200										
Track type excavators (>5,1 tonnes)	1981-1990	1000	1200	1400	1600	1800	2000	1798	1596	1394	1194	993	794	594	396	198
Track type excavators (>5,1 tonnes)	1991-Stage I							200	399	598	796	993	1190	1387	1583	1581
Track type excavators (>5,1 tonnes)	Stage I															198
Track type excavators (>5,1 tonnes)	Stage II															

Continued																
EquipmentName (Eng)	Emission Level	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Track type excavators (>5,1 tonnes)	Stage IIIA															
Excavators/Loaders	<1981	2100	1680	1260	840	420										
Excavators/Loaders	1981-1990	2100	2520	2940	3360	3780	4200	3807	3408	3003	2592	2175	1752	1323	888	447
Excavators/Loaders	1991-Stage I							423	852	1287	1728	2175	2628	3087	3552	3575
Excavators/Loaders	Stage I															447
Excavators/Loaders	Stage II															
Excavators/Loaders	Stage IIIA															
Dump trucks	<1981	250	200	150	100	50										
Dump trucks	1981-1990	250	300	350	400	450	500	489	469	441	404	358	304	241	169	89
Dump trucks	1991-Stage I							54	117	189	269	358	455	561	676	711
Dump trucks	Stage I															89
Dump trucks	Stage II															
Dump trucks	Stage IIIA															
Mini loaders	<1981	1800	1600	1400	1200	1000	800	635	447	235						
Mini loaders	1981-1990	1000	1200	1400	1600	1800	2000	2118	2237	2355	2473	2332	2168	1980	1768	1532
Mini loaders	1991-Stage I							212	447	706	989	1296	1626	1980	2357	2758
Mini loaders	Stage II															
Mini loaders	Stage IIIA															
Telescopic loaders	1981-1990											149	265	348	398	414
Telescopic loaders	1991-Stage I											83	199	348	530	746
Telescopic loaders	Stage II															
Telescopic loaders	Stage IIIA															

Continued											
EquipmentName (Eng)	Emission Level	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Track type dozers	<1981										
Track type dozers	1981-1990										
Track type dozers	1991-Stage I	206	201	177	154	132	128	125	116	95	59
Track type dozers	Stage II			20	38	56	86	100	116	126	119
Track type dozers	Stage IIIA							25	58	95	119
Track type loaders	<1981										
Track type loaders	1981-1990										
Track type loaders	1991-Stage I	91	91	81	71	62	61	71	68	55	38
Track type loaders	Stage II			9	18	26	40	56	68	73	76
Track type loaders	Stage IIIA							14	34	55	76
Wheel loaders (0-5 tonnes)	1981-1990										

Continued											
EquipmentName (Eng)	Emission Level	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Wheel loaders (0-5 tonnes)	1991-Stage I	2067	2046	1984	1881	1736	1444	1269	1045	726	353
Wheel loaders (0-5 tonnes)	Stage II		227	496	806	1158	1444	1903	2090	2177	2117
Wheel loaders (0-5 tonnes)	Stage IIIA								348	726	1058
Wheel loaders (> 5,1 tonnes)	<1981										
Wheel loaders (> 5,1 tonnes)	1981-1990										
Wheel loaders (> 5,1 tonnes)	1991-Stage I	1802	1559	1322	1089	861	677	485	273		
Wheel loaders (> 5,1 tonnes)	Stage I	450	668	881	871	861	902	969	1092	1174	854
Wheel loaders (> 5,1 tonnes)	Stage II				218	431	677	969	1092	1174	1138
Wheel loaders (> 5,1 tonnes)	Stage IIIA								273	587	854
Wheel type excavators	<1981										
Wheel type excavators	1981-1990										
Wheel type excavators	1991-Stage I	459	372	293	223	162	118	74	38		
Wheel type excavators	Stage I	115	160	196	179	162	157	148	152	146	103
Wheel type excavators	Stage II				45	81	118	148	152	146	138
Wheel type excavators	Stage IIIA								38	73	103
Track type excavators (0-5 tonnes)	1981-1990										
Track type excavators (0-5 tonnes)	1991-Stage I	5101	5050	4897	4642	4285	3889	3599	3027	2073	995
Track type excavators (0-5 tonnes)	Stage II		561	1224	1990	2857	3889	5399	6054	6220	5968
Track type excavators (0-5 tonnes)	Stage IIIA								1009	2073	2984
Track type excavators (>5,1 tonnes)	<1981										
Track type excavators (>5,1 tonnes)	1981-1990										
Track type excavators (>5,1 tonnes)	1991-Stage I	1579	1380	1181	983	785	683	536	313		
Track type excavators (>5,1 tonnes)	Stage I	395	591	787	786	785	910	1073	1251	1338	980
Track type excavators (>5,1 tonnes)	Stage II				197	393	683	1073	1251	1338	1307
Track type excavators (>5,1 tonnes)	Stage IIIA								313	669	980
Excavators/Loaders	<1981										
Excavators/Loaders	1981-1990										
Excavators/Loaders	1991-Stage I	3599	3170	2735	2295	1848	1370	938	481		
Excavators/Loaders	Stage I	900	1359	1824	2295	2310	2283	2344	2403	2314	1688
Excavators/Loaders	Stage II					462	913	1406	1922	1851	1688
Excavators/Loaders	Stage IIIA									463	844
Dump trucks	<1981										
Dump trucks	1981-1990										
Dump trucks	1991-Stage I	745	682	611	530	442	385	301	176		
Dump trucks	Stage I	186	292	407	530	552	642	752	880	943	739

Continued											
EquipmentName (Eng)	Emission Level	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Dump trucks	Stage II					110	257	451	704	754	739
Dump trucks	Stage IIIA									189	369
Mini loaders	<1981										
Mini loaders	1981-1990	1273	990	684	354						
Mini loaders	1991-Stage I	3183	3301	3419	3537	3656	2756	2294	1077	715	498
Mini loaders	Stage II		330	684	1061	1462	1531	1720	923	715	597
Mini loaders	Stage IIIA								154	238	299
Telescopic loaders	1981-1990	398	348	265	149						
Telescopic loaders	1991-Stage I	994	1160	1326	1491	1657	1740	1837	1846	1687	1343
Telescopic loaders	Stage II		116	265	447	663	966	1378	1582	1687	1612
Telescopic loaders	Stage IIIA								264	562	806

Stock data for machine pools 1985-2009.

EquipmentName (Eng)	Emission Level	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Tractors (machine pools)	<1981	1236	627													
Tractors (machine pools)	1981-1990	3091	3763	4575	4515	4370	4100	3643	2808	2368	1786	1214	604			
Tractors (machine pools)	1991-Stage I							607	1123	1776	2382	3035	3624	4324	4210	4336
Tractors (machine pools)	Stage I															
Tractors (machine pools)	Stage II															
Tractors (machine pools)	Stage IIIA															
Harvesters (machine pools)	<1981	969	776	661	472	287	139									
Harvesters (machine pools)	1981-1990	807	932	1157	1257	1294	1385	1385	1197	927	794	712	512	421	282	162
Harvesters (machine pools)	1991-Stage I							139	266	348	454	593	615	737	751	729
Harvesters (machine pools)	Stage II															
Harvesters (machine pools)	Stage IIIA															
Self-propelled vehicles (machine pools)	1981-1990									72	61	38				
Self-propelled vehicles (machine pools)	1991-Stage I									72	122	190	263	278	277	295
Self-propelled vehicles (machine pools)	Stage II															
Self-propelled vehicles (machine pools)	Stage IIIA															

Continued

EquipmentName (Eng)	Emission Level	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Tractors (machine pools)	<1981										
Tractors (machine pools)	1981-1990										
Tractors (machine pools)	1991-Stage I	3956	4069	3323	2566	2066	1421	927	487		
Tractors (machine pools)	Stage I			554	513	517	474	464	487	487	
Tractors (machine pools)	Stage II				513	1033	1421	1855	1946	1946	1946
Tractors (machine pools)	Stage IIIA								487	973	1460
Harvesters (machine pools)	<1981										
Harvesters (machine pools)	1981-1990	78									
Harvesters (machine pools)	1991-Stage I	778	779	651	531	472	300	257	211	169	127
Harvesters (machine pools)	Stage II			65	118	177	171	172	169	169	169
Harvesters (machine pools)	Stage IIIA							43	85	127	169
Self-propelled vehicles (machine pools)	1981-1990										
Self-propelled vehicles (machine pools)	1991-Stage I	289	314	237	203	153	99	49			
Self-propelled vehicles (machine pools)	Stage II			47	102	153	199	194	189	142	94
Self-propelled vehicles (machine pools)	Stage IIIA							49	94	142	189

Stock data for household and gardening 1985-2009.

SNAP	EquipmentName (Eng)	Emission Level	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
0809	Lawn movers (private)	<1981	253125	168750	84375												
0809	Lawn movers (private)	1981-1990	421875	506250	590625	675000	675000	675000	590625	506250	421875	337500	253125	168750	84375		
0809	Lawn movers (private)	1991-Stage I							84375	168750	253125	337500	421875	506250	590625	675000	675000
0809	Lawn movers (private)	Stage I															
0809	Lawn movers (private)	Stage II															
0809	Cultivators (private-large)	<1981	73333	66000	58667	51333	44000	36667	29333	22000	14667	7333					
0809	Cultivators (private-large)	1981-1990	36667	44000	51333	58667	66000	73333	73333	73333	73333	73333	73333	66000	58667	51333	44000
0809	Cultivators (private-large)	1991-Stage I							7333	14667	22000	29333	36667	44000	51333	58667	66000
0809	Cultivators (private-large)	Stage II															
0809	Cultivators (private-small)	1981-1990	10000	10000	10000	10000	10000	10000	8000	6000	4000	2000					
0809	Cultivators (private-small)	1991-Stage I							2000	4000	6000	8000	10000	10000	10000	10000	10000
0809	Cultivators (private-small)	Stage II															
0809	Chain saws (private)	<1981	125000	100000	75000	50000	25000										
0809	Chain saws (private)	1981-1990	125000	150000	175000	200000	225000	250000	227250	204000	180250	156000	131250	106000	80250	54000	27250
0809	Chain saws (private)	1991-Stage I							25250	51000	77250	104000	131250	159000	187250	216000	245250
0809	Chain saws (private)	Stage I															
0809	Chain saws (private)	Stage II															
0809	Riders (private)	<1981	40950	35100	29250	23400	17550	11700	5880								
0809	Riders (private)	1981-1990	29250	35100	40950	46800	52650	58500	58796	59388	54248	49167	44056	38828	33392	27660	21544
0809	Riders (private)	1991-Stage I							5880	11878	18083	24583	31469	38828	46748	55320	64631
0809	Riders (private)	Stage I															
0809	Riders (private)	Stage II															
0809	Shrub clearers (private)	<1981	24000	19200	14400	9600	4800										
0809	Shrub clearers (private)	1981-1990	24000	28800	33600	38400	43200	48000	47520	46080	43680	40320	36000	30720	24480	17280	9120
0809	Shrub clearers (private)	1991-Stage I							5280	11520	18720	26880	36000	46080	57120	69120	82080
0809	Shrub clearers (private)	Stage I															
0809	Shrub clearers (private)	Stage II															
0809	Hedge cutters (private)	<1981	6850	5480	4110	2740	1370										
0809	Hedge cutters (private)	1981-1990	6850	8220	9590	10960	12330	13700	15237	16128	16373	15972	14925	13232	10893	7908	4277
0809	Hedge cutters (private)	1991-Stage I							1693	4032	7017	10648	14925	19848	25417	31632	38493
0809	Hedge cutters (private)	Stage I															
0809	Hedge cutters (private)	Stage II															
0809	Trimmers (private)	<1981	25500	20400	15300	10200	5100										
0809	Trimmers (private)	1981-1990	25500	30600	35700	40800	45900	51000	48086	44686	40800	36429	31571	26229	20400	14086	7286
0809	Trimmers (private)	1991-Stage I							5343	11171	17486	24286	31571	39343	47600	56343	65571

Continued																	
SNAP	EquipmentName (Eng)	Emission Level	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
0809	Trimmers (private)	Stage I															
0809	Trimmers (private)	Stage II															
0811	Lawn movers (professional)	1981-1990	25000	25000	25000	25000	25000	25000	18750	12500	6250						
0811	Lawn movers (professional)	1991-Stage I							6250	12500	18750	25000	25000	25000	25000	25000	25000
0811	Lawn movers (professional)	Stage I															
0811	Lawn movers (professional)	Stage II															
0811	Cultivators (professional)	<1981	3750	2500	1250												
0811	Cultivators (professional)	1981-1990	6250	7500	8750	10000	10000	10000	8750	7500	6250	5000	3750	2500	1250		
0811	Cultivators (professional)	1991-Stage I							1250	2500	3750	5000	6250	7500	8750	10000	10000
0811	Cultivators (professional)	Stage I															
0811	Cultivators (professional)	Stage II															
0811	Chain saws (professional)	1981-1990	10000	10000	10000	10000	10000	10000	7333	4000							
0811	Chain saws (professional)	1991-Stage I							3667	8000	13000	14000	15000	16000	17000	18000	19000
0811	Chain saws (professional)	Stage I															
0811	Chain saws (professional)	Stage II															
0811	Riders (professional)	1981-1990	4800	4800	4800	4800	4800	4800	3878	2966	2035	1056					
0811	Riders (professional)	1991-Stage I							970	1978	3053	4224	5520	5760	6000	6240	6480
0811	Riders (professional)	Stage I															
0811	Riders (professional)	Stage II															
0811	Shrub clearers (professional)	1981-1990	2000	2000	2000	2000	2000	2000	1650	1200	650						
0811	Shrub clearers (professional)	1991-Stage I							550	1200	1950	2800	3000	3200	3400	3600	3800
0811	Shrub clearers (professional)	Stage I															
0811	Shrub clearers (professional)	Stage II															
0811	Hedge cutters (professional)	1981-1990	1300	1300	1300	1300	1300	1300	1178	920	528						
0811	Hedge cutters (professional)	1991-Stage I							393	920	1583	2380	2650	2920	3190	3460	3730
0811	Hedge cutters (professional)	Stage I															
0811	Hedge cutters (professional)	Stage II															
0811	Trimmers (professional)	1981-1990	9000	9000	9000	9000	9000	9000	7071	4929	2571						
0811	Trimmers (professional)	1991-Stage I							2357	4929	7714	10714	11143	11571	12000	12429	12857
0811	Trimmers (professional)	Stage I															
0811	Trimmers (professional)	Stage II															

Continued												
SNAP	EquipmentName (Eng)	Emission Level	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
0809	Lawn movers (private)	<1981										
0809	Lawn movers (private)	1981-1990										

Continued

SNAP	EquipmentName (Eng)	Emission Level	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
0809	Lawn movers (private)	1991-Stage I	675000	675000	675000	675000	675000	595000	513750	428125	342500	256875
0809	Lawn movers (private)	Stage I						85000	171250	256875	256875	256875
0809	Lawn movers (private)	Stage II									85625	171250
0809	Cultivators (private-large)	<1981										
0809	Cultivators (private-large)	1981-1990	36667	29333	22000	14667	7333					
0809	Cultivators (private-large)	1991-Stage I	73333	80667	88000	95333	102667	102667	95333	88000	80667	73333
0809	Cultivators (private-large)	Stage II						7333	14667	22000	29333	36667
0809	Cultivators (private-small)	1981-1990										
0809	Cultivators (private-small)	1991-Stage I	10000	10000	10000	10000	10000	8000	6000	4000	2000	
0809	Cultivators (private-small)	Stage II						2000	4000	6000	8000	10000
0809	Chain saws (private)	<1981										
0809	Chain saws (private)	1981-1990										
0809	Chain saws (private)	1991-Stage I	275000	280750	286500	292250	298000	268200	238400	208600	178800	149000
0809	Chain saws (private)	Stage I						29800	59600	89400	89400	89400
0809	Chain saws (private)	Stage II									29800	59600
0809	Riders (private)	<1981										
0809	Riders (private)	1981-1990	14954	7910								
0809	Riders (private)	1991-Stage I	74771	87015	101775	109920	119360	117741	114313	107663	99047	86666
0809	Riders (private)	Stage I						10704	22863	23925	24762	24762
0809	Riders (private)	Stage II								11963	24762	37143
0809	Shrub clearers (private)	<1981										
0809	Shrub clearers (private)	1981-1990										
0809	Shrub clearers (private)	1991-Stage I	96000	107000	118000	129000	140000	126000	112000	98000	84000	70000
0809	Shrub clearers (private)	Stage I						14000	28000	42000	42000	42000
0809	Shrub clearers (private)	Stage II									14000	28000
0809	Hedge cutters (private)	<1981										
0809	Hedge cutters (private)	1981-1990										
0809	Hedge cutters (private)	1991-Stage I	46000	52900	59800	66700	73600	66240	58880	51520	44160	36800
0809	Hedge cutters (private)	Stage I						7360	14720	22080	22080	22080
0809	Hedge cutters (private)	Stage II									7360	14720
0809	Trimmers (private)	<1981										
0809	Trimmers (private)	1981-1990										
0809	Trimmers (private)	1991-Stage I	75286	77714	80143	82571	85000	76500	68000	59500	51000	42500
0809	Trimmers (private)	Stage I						8500	17000	25500	25500	25500
0809	Trimmers (private)	Stage II									8500	17000

Continued

SNAP	EquipmentName (Eng)	Emission Level	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
0811	Lawn movers (professional)	1981-1990										
0811	Lawn movers (professional)	1991-Stage I	25000	25000	25000	25000	25000	18750	12500	6250		
0811	Lawn movers (professional)	Stage I						6250	12500	18750	18750	12500
0811	Lawn movers (professional)	Stage II									6250	12500
0811	Cultivators (professional)	<1981										
0811	Cultivators (professional)	1981-1990										
0811	Cultivators (professional)	1991-Stage I	10000	10000	10000	10000	10000	8750	7500	6250	5000	3750
0811	Cultivators (professional)	Stage I						1250	2500	3750	3750	3750
0811	Cultivators (professional)	Stage II									1250	2500
0811	Chain saws (professional)	1981-1990										
0811	Chain saws (professional)	1991-Stage I	20000	27500	35000	42500	50000	33333	16667			
0811	Chain saws (professional)	Stage I						16667	33333	50000	50000	33333
0811	Chain saws (professional)	Stage II										16667
0811	Riders (professional)	1981-1990										
0811	Riders (professional)	1991-Stage I	6720	7802	9726	12492	16100	15728	13398	9444	4800	
0811	Riders (professional)	Stage I						3932	8932	9444	9600	9600
0811	Riders (professional)	Stage II								4722	9600	14400
0811	Shrub clearers (professional)	1981-1990										
0811	Shrub clearers (professional)	1991-Stage I	4000	5500	7000	8500	10000	7500	5000	2500		
0811	Shrub clearers (professional)	Stage I						2500	5000	7500	7500	5000
0811	Shrub clearers (professional)	Stage II									2500	5000
0811	Hedge cutters (professional)	1981-1990										
0811	Hedge cutters (professional)	1991-Stage I	4000	4600	5200	5800	6400	4800	3200	1600		
0811	Hedge cutters (professional)	Stage I						1600	3200	4800	4800	3200
0811	Hedge cutters (professional)	Stage II									1600	3200
0811	Trimmers (professional)	1981-1990										
0811	Trimmers (professional)	1991-Stage I	13286	13714	14143	14571	15000	11250	7500	3750		
0811	Trimmers (professional)	Stage I						3750	7500	11250	11250	7500
0811	Trimmers (professional)	Stage II									3750	7500

Stock data for small boats and pleasure crafts 1985-2009.

Brændstof	Motortakt	Boat type	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Diesel		Motor boats (27-34 ft)	1550	1550	1719	1889	2058	2228	2397	2567	2736	2906	3075	3244	3414	3583	3753
Diesel		Motor boats (> 34 ft)	450	450	503	556	608	661	714	767	819	872	925	978	1031	1083	1136
Diesel		Motor boats <(27 ft)	3000	3000	3000	3000	3000	3000	3000	3000	3000	3000	3000	3000	3000	3000	3000
Diesel		Motor sailors	3500	3500	3583	3667	3750	3833	3917	4000	4083	4167	4250	4333	4417	4500	4583
Diesel		Sailing boats (> 26 ft)	7500	7500	7917	8333	8750	9167	9583	10000	10417	10833	11250	11667	12083	12500	12917
Benzin	2-takt	Other boats (< 20 ft)	4000	4000	4056	4111	4167	4222	4278	4333	4389	4444	4500	4556	4565	4527	4439
Benzin	2-takt	Yawls and cabin boats	4000	4000	4056	4111	4167	4222	4278	4333	4389	4444	4500	4556	4565	4527	4439
Benzin	2-takt	Sailing boats (< 26 ft)	19000	19000	18778	18556	18333	18111	17889	17667	17444	17222	17000	16778	16390	15843	15144
Benzin	2-takt	Speed boats	3000	3000	3000	3000	3000	3000	3000	3000	3000	3000	3000	3000	2970	2910	2820
Benzin	2-takt	Water scooters	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	990	970	940
Benzin	4-takt	Other boats (< 20 ft)													46	140	283
Benzin	4-takt	Yawls and cabin boats													46	140	283
Benzin	4-takt	Sailing boats (< 26 ft)													166	490	967
Benzin	4-takt	Speed boats	3000	3000	3000	3000	3000	3000	3000	3000	3000	3000	3000	3000	3000	3000	3000
Benzin	4-takt	Speed boats													30	90	180
Benzin	4-takt	Water scooters													10	30	60

Continued

Brændstof	Motortakt	Boat type	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Diesel		Motor boats (27-34 ft)	3922	4092	4261	4431	4600	4600	4600	4600	4600	4600
Diesel		Motor boats (> 34 ft)	1189	1242	1294	1347	1400	1400	1400	1400	1400	1400
Diesel		Motor boats <(27 ft)	3000	3000	3000	3000	3000	3000	3000	3000	3000	3000
Diesel		Motor sailors	4667	4750	4833	4917	5000	5000	5000	5000	5000	5000
Diesel		Sailing boats (> 26 ft)	13333	13750	14167	14583	15000	15000	15000	15000	15000	15000
Benzin	2-takt	Other boats (< 20 ft)	4300	4108	3862	3560	3200	2750	2250	1800	1400	1050
Benzin	2-takt	Yawls and cabin boats	4300	4108	3862	3560	3200	2750	2250	1800	1400	1050
Benzin	2-takt	Sailing boats (< 26 ft)	14300	13317	12201	10960	9600	8250	6750	5400	4200	3150
Benzin	2-takt	Speed boats	2700	2550	2370	2160	1920	1650	1350	1080	840	630
Benzin	2-takt	Water scooters	900	850	790	720	640	550	450	360	280	210
Benzin	4-takt	Other boats (< 20 ft)	478	725	1027	1384	1800	2250	2750	3200	3600	3950
Benzin	4-takt	Yawls and cabin boats	478	725	1027	1384	1800	2250	2750	3200	3600	3950
Benzin	4-takt	Sailing boats (< 26 ft)	1589	2350	3243	4262	5400	6750	8250	9600	10800	11850
Benzin	4-takt	Speed boats	3000	3000	3000	3000	3000	3000	3000	3000	3000	3000
Benzin	4-takt	Speed boats	300	450	630	840	1080	1350	1650	1920	2160	2370
Benzin	4-takt	Water scooters	100	150	210	280	360	450	550	640	720	790

Engine sizes (kW) for recreational craft 1985-2009.

Motor type	Boat type	1985	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004-2009
2-takt	Other boats (< 20 ft)	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8
2-takt	Yawls and cabin boats	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20
2-takt	Sailing boats (< 26 ft)	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
2-takt	Speed boats	25	31	32	33	35	36	38	39	40	42	43	44	46	47	49	50
2-takt	Water scooters	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45
4-takt	Other boats (< 20 ft)									8	8	8	8	8	8	8	8
4-takt	Yawls and cabin boats									20	20	20	20	20	20	20	20
4-takt	Sailing boats (< 26 ft)									10	10	10	10	10	10	10	10
4-takt	Speed boats (in board eng.)	45	55	58	60	63	65	68	70	73	75	78	80	83	85	88	90
4-takt	Speed boats (out board eng.)									40	42	43	44	46	47	49	50
4-takt	Water scooters									45	45	45	45	45	45	45	45
Diesel	Motor boats (27-34 ft)	70	88	92	97	101	106	110	114	119	123	128	132	137	141	146	150
Diesel	Motor boats (> 34 ft)	120	149	156	163	171	178	185	192	199	207	214	221	228	236	243	250
Diesel	Motor boats <(27 ft)	20	24	26	27	28	29	30	31	32	33	34	36	37	38	39	40
Diesel	Motor sailors	20	22	23	23	24	24	25	26	26	27	27	28	28	29	29	30
Diesel	Sailing boats (> 26 ft)	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30

Annex 3B-11: Traffic data and different technical and operational data for Danish domestic ferries

Annual traffic data for ferries (no. of round trips) for Danish domestic ferries.

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Korsør-Nyborg, DSB	9305	9167	9237	8959	8813	8789	8746	3258	0	0
Korsør-Nyborg, Vognmandsruten	7512	7363	7468	7496	7502	7828	7917	8302	3576	0
Halsskov-Knudshoved	10601	10582	11701	11767	12420	12970	13539	13612	5732	0
Kalundborg-Juelsminde	0	1326	1733	1542	1541	1508	856	0	0	0
Kalundborg-Århus	1907	2400	3162	2921	2913	3540	4962	4888	4483	1454
Sjællands Odde-Ebeltoft	3908	3978	4008	3988	4325	4569	5712	8153	7851	7720
Sjællands Odde-Århus	0	0	0	0	0	0	0	0	0	2339
Hundested-Grenaa	1026	1025	1032	1030	718	602	67	0	0	0
København-Rønne	558	545	484	412	427	426	437	465	458	506
Køge-Rønne	0	0	0	0	0	0	0	0	0	0
Kalundborg-Samsø	873	873	860	881	826	811	813	823	824	850
Tårs-Spodsbjerg	7656	8835	9488	9535	9402	9562	9000	9129	7052	6442
Hanstholm-Torshavn	0	14	15	0	0	0	0	0	0	48
Esbjerg-Torshavn	9	9	9	15	14	13	0	0	0	0
Local ferries	176891	179850	181834	178419	202445	209129	182750	197489	200027	202054
Continued	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Korsør-Nyborg, DSB	0	0	0	0	0	0	0	0	0	0
Korsør-Nyborg, Vognmandsruten	0	0	0	0	0	0	0	0	0	0
Halsskov-Knudshoved	0	0	0	0	0	0	0	0	0	0
Kalundborg-Juelsminde	0	0	0	0	0	0	0	0	0	0
Kalundborg-Århus	1870	1804	2037	1800	1750	1725	1724	1695	1694	1668
Sjællands Odde-Ebeltoft	4775	4226	3597	3191	2906	2889	2690	2670	2577	2454
Sjællands Odde-Århus	1799	1817	1825	2359	2863	2795	2853	2810	2814	2810
Hundested-Grenaa	0	0	0	0	0	0	0	0	0	0
København-Rønne	491	430	413	397	293	0	0	0	0	0
Køge-Rønne	0	0	0	0	154	488	436	399	428	407
Kalundborg-Samsø	828	817	833	831	841	867	862	887	921	969
Tårs-Spodsbjerg	6477	6498	6468	6516	6497	6494	6460	6493	6504	6474
Hanstholm-Torshavn	67	94	85	50	59	51	51	48	52	27
Esbjerg-Torshavn	0	0	0	0	0	0	0	0	0	35
Local ferries	201833	200130	208396	208501	206297	205564	203413	205260	210089	209082

Ferry data: Service, name, engine year, main engine MCR (kW), engine type, specific fuel consumption (sfc), aux. engine (kW).

Ferry service	Ferry name	Engine year	Main engine MCR (kW)	Engine type	Sfc (g/kWh)	Fuel type	Aux engine (kW)
Esbjerg-Torshavn	Gamle Norrøna	1973	11768	Medium speed (4-stroke)	239	Diesel	2354
Esbjerg-Torshavn	Nye Norrøna	2003	21600	Medium speed (4-stroke)	190	Fuel	4320
Halsskov-Knudshoved	ARVEPRINS KNUD	1963	8238	Slow speed (2-stroke)	220	Fuel	1666
Halsskov-Knudshoved	DRONNING MARGRETHE II	1973	8826	Medium speed (4-stroke)	230	Diesel	1692
Halsskov-Knudshoved	HEIMDAL	1983	8309	Medium speed (4-stroke)	220	Diesel	740
Halsskov-Knudshoved	KNUDSHOVED	1961	6400	Slow speed (2-stroke)	220	Fuel	1840
Halsskov-Knudshoved	KONG FREDERIK IX	1954	6767	Slow speed (2-stroke)	225	Fuel	1426
Halsskov-Knudshoved	KRAKA	1982	8309	Medium speed (4-stroke)	220	Diesel	740
Halsskov-Knudshoved	LODBROG	1982	8309	Medium speed (4-stroke)	220	Diesel	740
Halsskov-Knudshoved	PRINSESSE ANNE-MARIE	1960	8238	Slow speed (2-stroke)	220	Fuel	1360
Halsskov-Knudshoved	PRINSESSE ELISABETH	1964	8238	Slow speed (2-stroke)	220	Fuel	1360
Halsskov-Knudshoved	ROMSØ	1973	8826	Medium speed (4-stroke)	230	Diesel	1728
Halsskov-Knudshoved	SPROGØ	1962	6400	Slow speed (2-stroke)	220	Fuel	1840
Hanstholm-Torshavn	Gamle Norrøna	1973	11768	Medium speed (4-stroke)	239	Diesel	2354
Hanstholm-Torshavn	Nye Norrøna	2003	21600	Medium speed (4-stroke)	190	Fuel	4320
Hundested-Grenaa	DJURSLAND	1974	9856	Medium speed (4-stroke)	230	Diesel	900
Hundested-Grenaa	KATTEGAT	1995	23200	High speed (4-stroke)	205	Diesel	1223
Hundested-Grenaa	KONG FREDERIK IX	1954	6767	Slow speed (2-stroke)	235	Fuel	1375
Hundested-Grenaa	PRINSESSE ANNE-MARIE	1960	8238	Slow speed (2-stroke)	220	Fuel	1360
Kalundborg-Juelsminde	Mercandia I	1989	2950	High speed (4-stroke)	220	Diesel	0
Kalundborg-Juelsminde	Mercandia II	1989	2950	High speed (4-stroke)	220	Diesel	0
Kalundborg-Juelsminde	Mercandia III	1989	2950	High speed (4-stroke)	220	Diesel	0
Kalundborg-Juelsminde	Mercandia IV	1989	2950	High speed (4-stroke)	220	Diesel	0
Kalundborg-Samsø	HOLGER DANSKE	1976	2354	High speed (4-stroke)	225	Diesel	600
Kalundborg-Samsø	KALUNDBORG	1952	3825	Slow speed (2-stroke)	235	Fuel	570
Kalundborg-Samsø	KYHOLM	1998	2940	High speed (4-stroke)	195	Diesel	864
Kalundborg-Samsø	VESBORG	1995	1770	High speed (4-stroke)	200	Diesel	494
Kalundborg-Århus	ASK	1984	8826	Medium speed (4-stroke)	215	Diesel	2220
Kalundborg-Århus	ASK	1984	8826	Medium speed (4-stroke)	215	Diesel	3000
Kalundborg-Århus	ASK	1984	9840	Medium speed (4-stroke)	215	Diesel	3000
Kalundborg-Århus	CAT-LINK I	1995	17280	High speed (4-stroke)	205	Diesel	1160
Kalundborg-Århus	CAT-LINK II	1995	17280	High speed (4-stroke)	205	Diesel	1160
Kalundborg-Århus	CAT-LINK III	1995	22000	High speed (4-stroke)	205	Diesel	800
Kalundborg-Århus	CAT-LINK IV	1998	28320	High speed (4-stroke)	205	Diesel	920
Kalundborg-Århus	CAT-LINK V	1998	28320	High speed (4-stroke)	205	Diesel	920

Continued

Ferry service	Ferry name	Engine year	Main engine MCR (kW)	Engine type	Sfc (g/kWh)	Fuel type	Aux engine (kW)
Kalundborg-Århus	KATTEGAT SYD	1979	7650	Medium speed (4-stroke)	225	Diesel	1366
Kalundborg-Århus	KNUDSHOVED	1961	6400	Slow speed (2-stroke)	220	Fuel	1840
Kalundborg-Århus	KONG FREDERIK IX	1954	6767	Slow speed (2-stroke)	225	Fuel	1426
Kalundborg-Århus	KRAKA	1982	8309	Medium speed (4-stroke)	220	Diesel	740
Kalundborg-Århus	MAREN MOLS	1996	11700	Slow speed (2-stroke)	180	Diesel	2530
Kalundborg-Århus	METTE MOLS	1996	11700	Slow speed (2-stroke)	180	Diesel	2530
Kalundborg-Århus	NIELS KLIM	1986	12474	Slow speed (2-stroke)	215	Fuel	4440
Kalundborg-Århus	PEDER PAARS	1985	12474	Slow speed (2-stroke)	215	Fuel	4440
Kalundborg-Århus	PRINSESSE ELISABETH	1964	8238	Slow speed (2-stroke)	220	Fuel	1360
Kalundborg-Århus	ROSTOCK LINK	1975	8385	Medium speed (4-stroke)	230	Diesel	2500
Kalundborg-Århus	SØLØVEN/SØBJØRNEN	1992	4000	High speed (4-stroke)	210	Diesel	272
Kalundborg-Århus	URD	1981	8826	Medium speed (4-stroke)	215	Diesel	2220
Kalundborg-Århus	URD	1981	8826	Medium speed (4-stroke)	215	Diesel	3000
Kalundborg-Århus	URD	1981	9840	Medium speed (4-stroke)	215	Diesel	3000
Korsør-Nyborg, DSB	ASA-THOR	1965	6472	Slow speed (2-stroke)	220	Fuel	1305
Korsør-Nyborg, DSB	DRONNING INGRID	1980	18720	Medium speed (4-stroke)	220	Diesel	2932
Korsør-Nyborg, DSB	DRONNING MARGRETHE II	1973	8826	Medium speed (4-stroke)	230	Diesel	1692
Korsør-Nyborg, DSB	KONG FREDERIK IX	1954	6767	Slow speed (2-stroke)	225	Fuel	1426
Korsør-Nyborg, DSB	KRONPRINS FREDERIK	1981	18720	Medium speed (4-stroke)	220	Diesel	2932
Korsør-Nyborg, DSB	PRINS JOACHIM	1980	18720	Medium speed (4-stroke)	220	Diesel	2932
Korsør-Nyborg, DSB	SPROGØ/KNUDSHOVED	1962	6400	Slow speed (2-stroke)	220	Fuel	1840
Korsør-Nyborg, Vognmandsruten	Superflex Alfa	1989	2950	High speed (4-stroke)	220	Diesel	0
Korsør-Nyborg, Vognmandsruten	Superflex Bravo	1989	2950	High speed (4-stroke)	220	Diesel	0
Korsør-Nyborg, Vognmandsruten	Superflex Charlie	1988	2950	High speed (4-stroke)	220	Diesel	0
København-Rønne	JENS KOFOED	1979	12950	Medium speed (4-stroke)	233	Fuel	2889
København-Rønne	JENS KOFOED	2009	12950	Medium speed (4-stroke)	190	Fuel	2889
København-Rønne	POVL ANKER	1979	12950	Medium speed (4-stroke)	233	Fuel	2889
København-Rønne	POVL ANKER	2009	12950	Medium speed (4-stroke)	190	Fuel	2889
Køge-Rønne	DUEODDE	2005	8640	Medium speed (4-stroke)	190	Fuel	1545
Køge-Rønne	HAMMERODDE	2005	8640	Medium speed (4-stroke)	190	Fuel	1545
Køge-Rønne	JENS KOFOED	1979	12950	Medium speed (4-stroke)	233	Fuel	2889
Køge-Rønne	POVL ANKER	1979	12950	Medium speed (4-stroke)	233	Fuel	2889
Køge-Rønne	POVL ANKER	2009	12950	Medium speed (4-stroke)	190	Fuel	2889
Sjællands Odde-Ebeltoft	MAI MOLS	1996	24800	Gas turbine	240	Diesel	752
Sjællands Odde-Ebeltoft	MAREN MOLS	1975	12062	Medium speed (4-stroke)	230	Fuel	1986

Continued

Ferry service	Ferry name	Engine year	Main engine MCR (kW)	Engine type	Sfc (g/kWh)	Fuel type	Aux engine (kW)
Sjællands Odde-Ebeltoft	MAREN MOLS 2	1996	11700	Slow speed (2-stroke)	180	Diesel	2530
Sjællands Odde-Ebeltoft	METTE MOLS	1975	12062	Medium speed (4-stroke)	230	Fuel	1986
Sjællands Odde-Ebeltoft	METTE MOLS 2	1996	11700	Slow speed (2-stroke)	180	Diesel	2530
Sjællands Odde-Ebeltoft	MIE MOLS	1971	5884	Medium speed (4-stroke)	230	Diesel	
Sjællands Odde-Ebeltoft	MIE MOLS 2	1996	24800	Gas turbine	240	Diesel	752
Sjællands Odde-Århus	MADS MOLS	1998	28320	High speed (4-stroke)	205	Diesel	920
Sjællands Odde-Århus	MAI MOLS	1996	24800	Gas turbine	240	Diesel	752
Sjællands Odde-Århus	MAX MOLS	1998	28320	High speed (4-stroke)	205	Diesel	920
Sjællands Odde-Århus	MIE MOLS	1996	24800	Gas turbine	240	Diesel	752
Tårs-Spodsbjerg	FRIGG SYDFYEN	1984	1300	Medium speed (4-stroke)	220	Diesel	780
Tårs-Spodsbjerg	ODIN SYDFYEN	1982	1180	Medium speed (4-stroke)	220	Diesel	780
Tårs-Spodsbjerg	SPODSBJERG	1972	1530	Medium speed (4-stroke)	225	Diesel	300
Tårs-Spodsbjerg	SPODSBJERG	2006	1545	Medium speed (4-stroke)	190	Diesel	300
Tårs-Spodsbjerg	THOR SYDFYEN	1978	1176	Medium speed (4-stroke)	225	Diesel	300
Tårs-Spodsbjerg	THOR SYDFYEN	2008	1176	Medium speed (4-stroke)	190	Diesel	300
Sjællands Odde-Århus	MIE MOLS	1996	24800	Gas turbine	240	Diesel	752
Tårs-Spodsbjerg	FRIGG SYDFYEN	1984	1300	Medium speed (4-stroke)	220	Diesel	780
Tårs-Spodsbjerg	ODIN SYDFYEN	1982	1180	Medium speed (4-stroke)	220	Diesel	780
Tårs-Spodsbjerg	SPODSBJERG	1972	1530	Medium speed (4-stroke)	225	Diesel	300
Tårs-Spodsbjerg	SPODSBJERG	2006	1545	Medium speed (4-stroke)	190	Diesel	300
Tårs-Spodsbjerg	THOR SYDFYEN	1978	1176	Medium speed (4-stroke)	225	Diesel	300
Tårs-Spodsbjerg	THOR SYDFYEN	2008	1176	Medium speed (4-stroke)	190	Diesel	300

Ferry data: Sailing time (single trip).

Ferry service	Ferry name	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Esbjerg-Torshavn	Gamle Norrøna	1860	1860	1860	1860	1860	1860	1860	1860	1860	1860	1860	1860	1860							
Esbjerg-Torshavn	Nye Norrøna														1860	1860	1860	1860	1860	1860	1860
Halsskov-Knudshoved	ARVEPRINS KNUD	60	60	60	60	60	60	60	60	60											
Halsskov-Knudshoved	DRONNING MARGRETHE II	60	60	60	60	60	60	60	60	60											
Halsskov-Knudshoved	HEIMDAL	60	60	60	60	60	60	60	60	60											
Halsskov-Knudshoved	KNUDSHOVED	60	60	60	60	60	60	60	60	60											
Halsskov-Knudshoved	KONG FREDERIK IX	60	60	60	60	60	60	60	60	60											
Halsskov-Knudshoved	KRAKA	60	60	60	60	60	60	60	60	60											
Halsskov-Knudshoved	LODBROG	60	60	60	60	60	60	60	60	60											
Halsskov-Knudshoved	PRINSESSE ANNE-MARIE	60	60	60	60	60	60	60	60	60											
Halsskov-Knudshoved	PRINSESSE ELISABETH	60	60	60	60	60	60	60	60	60											
Halsskov-Knudshoved	ROMSØ	60	60	60	60	60	60	60	60	60											
Halsskov-Knudshoved	SPROGØ	60	60	60	60	60	60	60	60	60											
Hanstholm-Torshavn	Gamle Norrøna	1740	1740	1740	1740	1740	1740	1740	1740	1740	1740	1740	1740	1740							
Hanstholm-Torshavn	Nye Norrøna														1740	1740	1740	1740	1740	1740	1740
Hundested-Grenaa	DJURSLAND	160	160	160	160	160															
Hundested-Grenaa	KATTEGAT						90	90													
Hundested-Grenaa	KONG FREDERIK IX					170															
Hundested-Grenaa	PRINSESSE ANNE-MARIE					165															
Kalundborg-Juelsminde	Mercandia I	160	160	160	160	160	160	160													
Kalundborg-Juelsminde	Mercandia II	160	160	160	160	160	160	160													
Kalundborg-Juelsminde	Mercandia III	160	160	160	160	160	160	160													
Kalundborg-Juelsminde	Mercandia IV	160	160	160	160	160	160	160													
Kalundborg-Samsø	HOLGER DANSKE			120	120	120	120	120	120	120											
Kalundborg-Samsø	KALUNDBORG	120	120	120																	
Kalundborg-Samsø	KYHOLM									110	110	110	110	110	110	110	110	110	110	110	110
Kalundborg-Samsø	VESBORG									120											
Kalundborg-Århus	ASK		195	195	195	195	195	195	195	195	195										
Kalundborg-Århus	CAT-LINK I						80	85	90	95											
Kalundborg-Århus	CAT-LINK II						80	85	90	95											
Kalundborg-Århus	CAT-LINK III							85	90	95											
Kalundborg-Århus	CAT-LINK IV									80	80										
Kalundborg-Århus	CAT-LINK V									80	80										
Kalundborg-Århus	KATTEGAT SYD										195										
Kalundborg-Århus	KNUDSHOVED		190																		
Kalundborg-Århus	KONG FREDERIK IX		190	190	190	190	190	190													

Continued

Ferry service	Ferry name	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Kalundborg-Århus	KRAKA									195											
Kalundborg-Århus	MAREN MOLS											160	160	155	155	155	155	165	165	165	165
Kalundborg-Århus	METTE MOLS											160	160	155	155	155	155	165	165	165	165
Kalundborg-Århus	NIELS KLIM	185	185																		
Kalundborg-Århus	PEDER PAARS	185	185																		
Kalundborg-Århus	PRINSESSE ELISABETH		185																		
Kalundborg-Århus	ROSTOCK LINK										195										
Kalundborg-Århus	SØLØVEN/SØBJØRNEN		90	90	90	90	90	90													
Kalundborg-Århus	URD		195	195	195	195	195	195	195	195	195										
Korsør-Nyborg, DSB	ASA-THOR	65	65	65	65	65	65	65	65												
Korsør-Nyborg, DSB	DRONNING INGRID	65	65	65	65	65	65	65	65												
Korsør-Nyborg, DSB	DRONNING MARGRETHE II	65	65	65	65	65	65	65	65												
Korsør-Nyborg, DSB	KONG FREDERIK IX	75	75	75	75	75	75	75	75												
Korsør-Nyborg, DSB	KRONPRINS FREDERIK	65	65	65	65	65	65	65	65												
Korsør-Nyborg, DSB	PRINS JOACHIM	65	65	65	65	65	65	65	65												
Korsør-Nyborg, DSB	SPROGØ/KNUDSHOVED	75	75	75	75	75	75	75	75												
Korsør-Nyborg, Vognmandsruten	Superflex Alfa	70	70	70	70	70	70	70	70	70											
Korsør-Nyborg, Vognmandsruten	Superflex Bravo	70	70	70	70	70	70	70	70	70											
Korsør-Nyborg, Vognmandsruten	Superflex Charlie	70	70	70	70	70	70	70	70	70											
København-Rønne	JENS KOFOED	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420
København-Rønne	POVL ANKER	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420
Køge-Rønne	DUEODDE																375	375	375	375	375
Køge-Rønne	HAMMERODDE																375	375	375	375	375
Køge-Rønne	JENS KOFOED															375	375				
Køge-Rønne	POVL ANKER															375	375	375	375	375	375
Sjællands Odde-Ebeltoft	MAI MOLS							45	45	45	45	45	45	45	45	45	45	50	50	50	50
Sjællands Odde-Ebeltoft	MAREN MOLS	100	100	100	100	100	100	100													
Sjællands Odde-Ebeltoft	MAREN MOLS 2							100	100	100	95										
Sjællands Odde-Ebeltoft	METTE MOLS	100	100	100	100	100	100	100													
Sjællands Odde-Ebeltoft	METTE MOLS 2							100	100	100	95										
Sjællands Odde-Ebeltoft	MIE MOLS	105	105	105	105	105	105	105													
Sjællands Odde-Ebeltoft	MIE MOLS 2							45	45	45	45	45	45	45	45	45	45	50	50	50	50
Sjællands Odde-Århus	MADS MOLS										60	65	65	65	65	65	65	70	70	70	70
Sjællands Odde-Århus	MAI MOLS													65	65	65	65	68	68	68	68
Sjællands Odde-Århus	MAX MOLS										60	65	65	65	65	65	65	70	70	70	70
Sjællands Odde-Århus	MIE MOLS													65	65	65	65	68	68	68	68

Continued

Ferry service	Ferry name	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Tårs-Spodsbjerg	FRIGG SYDFYEN	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45
Tårs-Spodsbjerg	ODIN SYDFYEN	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45
Tårs-Spodsbjerg	SPODSBJERG	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45
Tårs-Spodsbjerg	THOR SYDFYEN	45	45	45	45	45	17	45	45	45	45	45	45	45	45	45	45	45	45	45	45

Ferry data: Load factor (% MCR).

Ferry service	Ferry name	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Esbjerg-Torshavn	Gamle Norrøna	90	90	90	90	90	90	90	90	90	90	90	90	90							
Esbjerg-Torshavn	Nye Norrøna														90	90	90	90	90	90	90
Halsskov-Knudshoved	ARVEPRINS KNUD	85	85	85	85	85	85	85	85	85											
Halsskov-Knudshoved	DRONNING MARGRETHE II	85	85	85	85	85	85	85	85	85											
Halsskov-Knudshoved	HEIMDAL	85	85	85	85	85	85	85	85	85											
Halsskov-Knudshoved	KNUDSHOVED	85	85	85	85	85	85	85	85	85											
Halsskov-Knudshoved	KONG FREDERIK IX	85	85	85	85	85	85	85	85	85											
Halsskov-Knudshoved	KRAKA	85	85	85	85	85	85	85	85	85											
Halsskov-Knudshoved	LODBROG	85	85	85	85	85	85	85	85	85											
Halsskov-Knudshoved	PRINSESSE ANNE-MARIE	85	85	85	85	85	85	85	85	85											
Halsskov-Knudshoved	PRINSESSE ELISABETH	85	85	85	85	85	85	85	85	85											
Halsskov-Knudshoved	ROMSØ	85	85	85	85	85	85	85	85	85											
Halsskov-Knudshoved	SPROGØ	85	85	85	85	85	85	85	85	85											
Hanstholm-Torshavn	Gamle Norrøna	90	90	90	90	90	90	90	90	90	90	90	90	90							
Hanstholm-Torshavn	Nye Norrøna														90	90	90	90	90	90	90
Hundested-Grenaa	DJURSLAND	80	80	80	80	80															
Hundested-Grenaa	KATTEGAT						85	85													
Hundested-Grenaa	KONG FREDERIK IX					65															
Hundested-Grenaa	PRINSESSE ANNE-MARIE					85															
Kalundborg-Juelsminde	Mercandia I	75	75	75	75	75	75	75													
Kalundborg-Juelsminde	Mercandia II	70	70	70	70	70	70	70													
Kalundborg-Juelsminde	Mercandia III	70	70	70	70	70	70	70													
Kalundborg-Juelsminde	Mercandia IV	70	70	70	70	70	70	70													
Kalundborg-Samsø	HOLGER DANSKE			85	85	85	85	85	85	85											
Kalundborg-Samsø	KALUNDBORG	80	80	80																	
Kalundborg-Samsø	KYHOLM									85	85	85	85	85	85	85	85	85	85	85	85

Continued

Ferry service	Ferry name	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Kalundborg-Samsø	VESBORG									95											
Kalundborg-Århus	ASK		85	85	85	80	80	80	80	80	80										
Kalundborg-Århus	CAT-LINK I						95	90	90	85											
Kalundborg-Århus	CAT-LINK II						95	90	90	85											
Kalundborg-Århus	CAT-LINK III							95	95	90											
Kalundborg-Århus	CAT-LINK IV									95	95										
Kalundborg-Århus	CAT-LINK V									95	95										
Kalundborg-Århus	KATTEGAT SYD										85										
Kalundborg-Århus	KNUDSHOVED		85																		
Kalundborg-Århus	KONG FREDERIK IX		85	85	85	85	85	85													
Kalundborg-Århus	KRAKA									85											
Kalundborg-Århus	MAREN MOLS											85	85	85	85	85	85	82	80	80	80
Kalundborg-Århus	METTE MOLS											85	85	85	85	85	85	82	80	80	80
Kalundborg-Århus	NIELS KLIM	85	85																		
Kalundborg-Århus	PEDER PAARS	85	85																		
Kalundborg-Århus	PRINSESSE ELISABETH		80																		
Kalundborg-Århus	ROSTOCK LINK										80										
Kalundborg-Århus	SØLØVEN/SØBJØRNEN		90	90	90	90	90	90													
Kalundborg-Århus	URD		85	85	85	85	85	85	85	80	80										
Korsør-Nyborg, DSB	ASA-THOR	85	85	85	85	85	85	85	85												
Korsør-Nyborg, DSB	DRONNING INGRID	60	60	60	60	60	60	60	60												
Korsør-Nyborg, DSB	DRONNING MARGRETHE II	85	85	85	85	85	85	85	85												
Korsør-Nyborg, DSB	KONG FREDERIK IX	70	70	70	70	70	70	70	70												
Korsør-Nyborg, DSB	KRONPRINS FREDERIK	60	60	60	60	60	60	60	60												
Korsør-Nyborg, DSB	PRINS JOACHIM	60	60	60	60	60	60	60	60												
Korsør-Nyborg, DSB	SPROGØ/KNUDSHOVED	70	70	70	70	70	70	70	70												
Korsør-Nyborg, Vognmandsruten	Superflex Alfa	70	70	70	70	70	70	70	70	70											
Korsør-Nyborg, Vognmandsruten	Superflex Bravo	70	70	70	70	70	70	70	70	70											
Korsør-Nyborg, Vognmandsruten	Superflex Charlie	70	70	70	70	70	70	70	70	70											
København-Rønne	JENS KOFOED	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31
København-Rønne	POVL ANKER	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31
Køge-Rønne	DUEODDE																69	65	65	65	65
Køge-Rønne	HAMMERODDE																69	65	66	66	66

Continued																					
Ferry service	Ferry name	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Køge-Rønne	JENS KOFOED															31	31				
Køge-Rønne	POVL ANKER															31	31	45	49	49	49
Sjællands Odde-Ebeltoft	MAI MOLS							80	80	80	80	80	80	80	80	80	80	79	78	78	78
Sjællands Odde-Ebeltoft	MAREN MOLS	75	75	75	75	75	75	75													
Sjællands Odde-Ebeltoft	MAREN MOLS 2							80	80	80	85										
Sjællands Odde-Ebeltoft	METTE MOLS	75	75	75	75	75	75	75													
Sjællands Odde-Ebeltoft	METTE MOLS 2							80	80	80	85										
Sjællands Odde-Ebeltoft	MIE MOLS	85	85	85	85	85	85	85													
Sjællands Odde-Ebeltoft	MIE MOLS 2							80	80	80	80	80	80	80	80	80	80	79	78	78	78
Sjællands Odde-Århus	MADS MOLS										90	85	85	85	85	85	85	67	67	67	67
Sjællands Odde-Århus	MAI MOLS													75	75	75	75	69	69	69	69
Sjællands Odde-Århus	MAX MOLS										90	85	85	85	85	85	85	67	67	67	67
Sjællands Odde-Århus	MIE MOLS													75	75	75	75	69	69	69	69
Tårs-Spodsbjerg	FRIGG SYDFYEN	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80
Tårs-Spodsbjerg	ODIN SYDFYEN	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80
Tårs-Spodsbjerg	SPODSBJERG	75	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80
Tårs-Spodsbjerg	THOR SYDFYEN	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80

Ferry data: Round trip shares (%).

Ferry service	Ferry name	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Esbjerg-Torshavn	Gamle Norrøna	100	100	100	100	100	100	100	100	100	100	100	100	100							
Esbjerg-Torshavn	Nye Norrøna														100	100	100	100	100	100	100
Halsskov-Knudshoved	ARVEPRINS KNUD	21	20	20	20	21	19	19	18	20											
Halsskov-Knudshoved	DRONNING MARGRETHE II	2	0	0	0	0	0	0	0	0											
Halsskov-Knudshoved	HEIMDAL	23	24	22	24	23	21	21	19	22											
Halsskov-Knudshoved	KNUDSHOVED	0	0	0	0	0	0	2	5	0											
Halsskov-Knudshoved	KONG FREDERIK IX	0	0	0	0	0	0	0	0	0											
Halsskov-Knudshoved	KRAKA	24	25	23	23	21	20	20	20	21											
Halsskov-Knudshoved	LODBROG	0	0	0	0	0	0	0	7	14											
Halsskov-Knudshoved	PRINSESSE ANNE-MARIE	0	0	0	0	0	6	2	0	0											
Halsskov-Knudshoved	PRINSESSE ELISABETH	0	0	0	3	0	0	0	0	0											
Halsskov-Knudshoved	ROMSØ	21	22	21	16	20	19	21	21	23											
Halsskov-Knudshoved	SPROGØ	9	9	15	14	15	15	14	11	1											
Hanstholm-Torshavn	Gamle Norrøna	100	100	100	100	100	100	100	100	100	100	100	100	100							

Continued

Ferry service	Ferry name	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Hanstholm-Torshavn	Nye Norrøna														100	100	100	100	100	100	100
Hundested-Grenaa	DJURSLAND	100	100	100	100	50															
Hundested-Grenaa	KATTEGAT						100	100													
Hundested-Grenaa	KONG FREDERIK IX					5															
Hundested-Grenaa	PRINSESSE ANNE-MARIE					45															
Kalundborg-Juelsminde	Mercandia I	25	25	25	25	25	25	25													
Kalundborg-Juelsminde	Mercandia II	25	25	25	25	25	25	25													
Kalundborg-Juelsminde	Mercandia III	25	25	25	25	25	25	25													
Kalundborg-Juelsminde	Mercandia IV	25	25	25	25	25	25	25													
Kalundborg-Samsø	HOLGER DANSKE			95	100	100	100	100	100	92											
Kalundborg-Samsø	KALUNDBORG	100	100	5																	
Kalundborg-Samsø	KYHOLM									6	100	100	100	100	100	100	100	100	100	100	100
Kalundborg-Samsø	VESBORG									2											
Kalundborg-Århus	ASK		16	32	26	33	27	18	11	12	2										
Kalundborg-Århus	CAT-LINK I						17	25	28	11											
Kalundborg-Århus	CAT-LINK II						1	23	28	8											
Kalundborg-Århus	CAT-LINK III							8	24	19											
Kalundborg-Århus	CAT-LINK IV									23	26										
Kalundborg-Århus	CAT-LINK V									15	26										
Kalundborg-Århus	KATTEGAT SYD										2										
Kalundborg-Århus	KNUDSHOVED		4																		
Kalundborg-Århus	KONG FREDERIK IX		4	0	7	0	0	2													
Kalundborg-Århus	KRAKA									2											
Kalundborg-Århus	MAREN MOLS											50	50	50	50	50	50	50	50	50	50
Kalundborg-Århus	METTE MOLS											50	50	50	50	50	50	50	50	50	50
Kalundborg-Århus	NIELS KLIM	50	20																		
Kalundborg-Århus	PEDER PAARS	50	16																		
Kalundborg-Århus	PRINSESSE ELISABETH		4																		
Kalundborg-Århus	ROSTOCK LINK										22										
Kalundborg-Århus	SØLØVEN/SØBJØRNEN		21	36	34	34	28	5													
Kalundborg-Århus	URD		16	32	33	33	27	18	11	9	22										
Korsør-Nyborg, DSB	ASA-THOR	13	13	13	11	9	9	9	6												
Korsør-Nyborg, DSB	DRONNING INGRID	26	28	26	28	28	29	28	31												
Korsør-Nyborg, DSB	DRONNING MARGRETHE II	3	0	3	1	3	1	2	0												
Korsør-Nyborg, DSB	KONG FREDERIK IX	0	0	0	0	3	4	1	0												
Korsør-Nyborg, DSB	KRONPRINS FREDERIK	27	28	27	29	28	29	29	32												

Continued

Ferry service	Ferry name	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Korsør-Nyborg, DSB	PRINS JOACHIM	25	27	25	27	27	27	27	28												
Korsør-Nyborg, DSB	SPROGØ/KNUDSHOVED	6	4	5	4	1	1	4	3												
Korsør-Nyborg, Vognmandsruten	Superflex Alfa	33	33	33	33	33	33	33	33	33											
Korsør-Nyborg, Vognmandsruten	Superflex Bravo	33	33	33	33	33	33	33	33	33											
Korsør-Nyborg, Vognmandsruten	Superflex Charlie	34	34	34	34	34	34	34	34	34											
København-Rønne	JENS KOFOED	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50
København-Rønne	POVL ANKER	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50
Køge-Rønne	DUEODDE																25	49	47	47	47
Køge-Rønne	HAMMERODDE																35	49	53	53	53
Køge-Rønne	JENS KOFOED															50	20				
Køge-Rønne	POVL ANKER															50	20	3	1	1	1
Sjællands Odde-Ebeltoft	MAI MOLS							21	35	35	35	50	50	50	50	50	50	50	50	50	50
Sjællands Odde-Ebeltoft	MAREN MOLS	40	40	40	40	40	40	15													
Sjællands Odde-Ebeltoft	MAREN MOLS 2							18	15	15	15										
Sjællands Odde-Ebeltoft	METTE MOLS	40	40	40	40	40	40	17													
Sjællands Odde-Ebeltoft	METTE MOLS 2							15	15	15	15										
Sjællands Odde-Ebeltoft	MIE MOLS	20	20	20	20	20	20	5													
Sjællands Odde-Ebeltoft	MIE MOLS 2							9	35	35	35	50	50	50	50	50	50	50	50	50	50
Sjællands Odde-Århus	MADS MOLS										50	95	90	95	60	60	35	30	31	31	31
Sjællands Odde-Århus	MAI MOLS													1	10	15	15	20	19	19	19
Sjællands Odde-Århus	MAX MOLS										50	5	10	3	20	10	35	30	31	31	31
Sjællands Odde-Århus	MIE MOLS													1	10	15	15	20	19	19	19
Tårs-Spodsbjerg	FRIGG SYDFYEN	41	40	39	38	36	36	36	32	33	45	45	45	45	45	45	45	45	45	45	45
Tårs-Spodsbjerg	ODIN SYDFYEN	41	40	39	38	36	36	36	32	33	45	45	45	45	45	45	45	45	45	45	45
Tårs-Spodsbjerg	SPODSBJERG	4	2	8	8	9	8	8	19	20	10	10	10	10	10	10	10	10	10	10	10
Tårs-Spodsbjerg	THOR SYDFYEN	14	18	14	16	19	20	20	17	14	0	0	0	0	0	0	0	0	0	0	0

Annex 2B-12 Fuel consumption and emission factors, engine specific (NO_x, CO, VOC (NMVOC and CH_4)), and fuel type specific (S-%, SO_2, PM) for ship engines

Specific fuel consumption and NO_x emission factors (g pr kWh) per engine year for diesel ship engines.

Year	High speed 4-stroke sfc (g pr kWh)	Medium speed 4-stroke sfc (g pr kWh)	Slow speed 2-stroke sfc (g pr kWh)	High speed 4-stroke NO_X (g pr kWh)	Medium speed 4-stroke NO_X (g pr kWh)	Slow speed 2-stroke NO_X (g pr kWh)
1949	265.5	255.5	235.5	7.3	8.0	14.5
1950	265.0	255.0	235.0	7.3	8.0	14.5
1951	264.5	254.5	234.5	7.3	8.0	14.5
1952	264.0	254.0	234.0	7.3	8.0	14.5
1953	263.5	253.5	233.5	7.3	8.0	14.5
1954	263.0	253.0	233.0	7.3	8.0	14.5
1955	262.4	252.4	232.4	7.3	8.0	14.5
1956	261.9	251.9	231.9	7.4	8.1	14.6
1957	261.3	251.3	231.3	7.5	8.2	14.7
1958	260.7	250.7	230.7	7.6	8.3	14.8
1959	260.1	250.1	230.1	7.7	8.4	14.9
1960	259.5	249.5	229.5	7.8	8.5	15.0
1961	258.9	248.9	228.9	7.9	8.6	15.1
1962	258.2	248.2	228.2	8.0	8.7	15.1
1963	257.6	247.6	227.6	8.1	8.8	15.2
1964	256.9	246.9	226.9	8.2	8.9	15.3
1965	256.1	246.1	226.1	8.3	9.0	15.4
1966	255.4	245.4	225.4	8.3	9.1	15.5
1967	254.6	244.6	224.6	8.4	9.2	15.6
1968	253.8	243.8	223.8	8.5	9.3	15.7
1969	253.0	243.0	223.0	8.6	9.4	15.8
1970	252.1	242.1	222.1	8.7	9.5	15.9
1971	251.2	241.2	221.2	8.8	9.6	16.0
1972	250.3	240.3	220.3	8.9	9.7	16.1
1973	249.3	239.3	219.3	9.0	9.8	16.2
1974	248.3	238.3	218.3	9.1	9.9	16.3
1975	247.3	237.3	217.3	9.2	10.0	16.4
1976	246.2	236.2	216.2	9.3	10.1	16.4
1977	245.0	235.0	215.0	9.3	10.2	16.5
1978	243.8	233.8	213.8	9.4	10.3	16.6

Continued

Year	High speed 4-stroke sfc (g pr kWh)	Medium speed 4-stroke sfc (g pr kWh)	Slow speed 2-stroke sfc (g pr kWh)	High speed 4-stroke NO_X (g pr kWh)	Medium speed 4-stroke NO_X (g pr kWh)	Slow speed 2-stroke NO_X (g pr kWh)
1979	242.6	232.6	212.6	9.5	10.4	16.7
1980	241.3	231.3	211.3	9.6	10.5	16.8
1981	239.9	229.9	209.9	9.7	10.6	16.9
1982	238.5	228.5	208.5	9.8	10.7	17.0
1983	237.0	227.0	207.0	9.9	10.8	17.4
1984	235.5	225.5	205.5	10.0	10.9	17.8
1985	233.9	223.9	203.9	10.1	11.0	18.2
1986	232.2	222.2	202.2	10.2	11.1	18.6
1987	230.5	220.5	200.5	10.3	11.3	19.0
1988	228.6	218.6	198.6	10.5	11.4	19.3
1989	226.7	216.7	196.7	10.6	11.6	19.5
1990	224.8	214.8	194.8	10.7	11.7	19.8
1991	222.7	212.7	192.7	10.9	11.9	20.0
1992	220.5	210.5	190.5	11.0	12.0	19.8
1993	218.3	208.3	188.3	11.1	12.1	19.6
1994	216.0	206.0	186.0	11.3	12.3	19.4
1995	213.6	203.6	183.6	11.4	12.4	19.3
1996	211.0	201.0	181.0	11.5	12.6	19.1
1997	208.4	198.4	178.4	11.7	12.7	18.9
1998	205.7	195.7	175.7	11.8	12.9	18.7
1999	202.9	192.9	172.9	11.9	13.0	18.5
2000	199.9	189.9	169.9	11.0	12.0	16.0

CO and VOC emission factors (g/kg fuel) for ship engines

Year	High speed 4-stroke CO	Medium speed 4-stroke CO	Slow speed 2-stroke CO	High speed 4-stroke VOC	Medium speed 4-stroke VOC	Slow speed 2-stroke VOC
1949	6.03	6.26	6.79	1.88	1.96	2.12
1950	6.04	6.27	6.81	1.89	1.96	2.13
1951	6.05	6.29	6.82	1.89	1.96	2.13
1952	6.06	6.30	6.84	1.89	1.97	2.14
1953	6.07	6.31	6.85	1.90	1.97	2.14
1954	6.08	6.33	6.87	1.90	1.98	2.15
1955	6.10	6.34	6.88	1.91	1.98	2.15
1956	6.11	6.35	6.90	1.91	1.99	2.16
1957	6.12	6.37	6.92	1.91	1.99	2.16
1958	6.14	6.38	6.93	1.92	1.99	2.17
1959	6.15	6.40	6.95	1.92	2.00	2.17
1960	6.17	6.41	6.97	1.93	2.00	2.18
1961	6.18	6.43	6.99	1.93	2.01	2.18
1962	6.20	6.45	7.01	1.94	2.01	2.19
1963	6.21	6.46	7.03	1.94	2.02	2.20
1964	6.23	6.48	7.05	1.95	2.03	2.20
1965	6.25	6.50	7.08	1.95	2.03	2.21
1966	6.26	6.52	7.10	1.96	2.04	2.22
1967	6.28	6.54	7.12	1.96	2.04	2.23
1968	6.30	6.56	7.15	1.97	2.05	2.23
1969	6.32	6.58	7.17	1.98	2.06	2.24
1970	6.35	6.61	7.20	1.98	2.06	2.25
1971	6.37	6.63	7.23	1.99	2.07	2.26
1972	6.39	6.66	7.26	2.00	2.08	2.27
1973	6.42	6.69	7.29	2.01	2.09	2.28
1974	6.44	6.71	7.33	2.01	2.10	2.29
1975	6.47	6.74	7.36	2.02	2.11	2.30
1976	6.50	6.77	7.40	2.03	2.12	2.31
1977	6.53	6.81	7.44	2.04	2.13	2.33
1978	6.56	6.84	7.48	2.05	2.14	2.34
1979	6.60	6.88	7.53	2.06	2.15	2.35
1980	6.63	6.92	7.57	2.07	2.16	2.37
1981	6.67	6.96	7.62	2.08	2.17	2.38
1982	6.71	7.00	7.67	2.10	2.19	2.40

Continued

Year	High speed 4-stroke CO	Medium speed 4-stroke CO	Slow speed 2-stroke CO	High speed 4-stroke VOC	Medium speed 4-stroke VOC	Slow speed 2-stroke VOC
1983	6.75	7.05	7.73	2.11	2.20	2.42
1984	6.79	7.10	7.79	2.12	2.22	2.43
1985	6.84	7.15	7.85	2.14	2.23	2.45
1986	6.89	7.20	7.91	2.15	2.25	2.47
1987	6.94	7.26	7.98	2.17	2.27	2.49
1988	7.00	7.32	8.05	2.19	2.29	2.52
1989	7.06	7.38	8.13	2.21	2.31	2.54
1990	7.12	7.45	8.22	2.22	2.33	2.57
1991	7.18	7.52	8.30	2.25	2.35	2.59
1992	7.25	7.60	8.40	2.27	2.37	2.62
1993	7.33	7.68	8.50	2.29	2.40	2.66
1994	7.41	7.77	8.60	2.31	2.43	2.69
1995	7.49	7.86	8.72	2.34	2.46	2.72
1996	7.58	7.96	8.84	2.37	2.49	2.76
1997	7.68	8.06	8.97	2.40	2.52	2.80
1998	7.78	8.18	9.11	2.43	2.56	2.85
1999	7.89	8.30	9.26	2.46	2.59	2.89
2000	8.00	8.43	9.42	2.50	2.63	2.94

NMVOC and CH_4 emission factors (g/kg fuel) for ship engines.

Year	High speed 4-stroke NMVOC	Medium speed 4-stroke NMVOC	Slow speed 2-stroke NMVOC	High speed 4-stroke CH_4	Medium speed 4-stroke CH_4	Slow speed 2-stroke CH_4
1949	1.83	1.90	2.06	0.06	0.06	0.06
1950	1.83	1.90	2.06	0.06	0.06	0.06
1951	1.83	1.91	2.07	0.06	0.06	0.06
1952	1.84	1.91	2.07	0.06	0.06	0.06
1953	1.84	1.91	2.08	0.06	0.06	0.06
1954	1.84	1.92	2.08	0.06	0.06	0.06
1955	1.85	1.92	2.09	0.06	0.06	0.06
1956	1.85	1.93	2.09	0.06	0.06	0.06
1957	1.86	1.93	2.10	0.06	0.06	0.06
1958	1.86	1.93	2.10	0.06	0.06	0.07
1959	1.86	1.94	2.11	0.06	0.06	0.07
1960	1.87	1.94	2.11	0.06	0.06	0.07
1961	1.87	1.95	2.12	0.06	0.06	0.07
1962	1.88	1.95	2.13	0.06	0.06	0.07
1963	1.88	1.96	2.13	0.06	0.06	0.07
1964	1.89	1.96	2.14	0.06	0.06	0.07
1965	1.89	1.97	2.14	0.06	0.06	0.07
1966	1.90	1.98	2.15	0.06	0.06	0.07
1967	1.90	1.98	2.16	0.06	0.06	0.07
1968	1.91	1.99	2.17	0.06	0.06	0.07
1969	1.92	2.00	2.17	0.06	0.06	0.07
1970	1.92	2.00	2.18	0.06	0.06	0.07
1971	1.93	2.01	2.19	0.06	0.06	0.07
1972	1.94	2.02	2.20	0.06	0.06	0.07
1973	1.95	2.03	2.21	0.06	0.06	0.07
1974	1.95	2.04	2.22	0.06	0.06	0.07
1975	1.96	2.04	2.23	0.06	0.06	0.07
1976	1.97	2.05	2.24	0.06	0.06	0.07
1977	1.98	2.06	2.26	0.06	0.06	0.07
1978	1.99	2.07	2.27	0.06	0.06	0.07
1979	2.00	2.09	2.28	0.06	0.06	0.07
1980	2.01	2.10	2.30	0.06	0.06	0.07
1981	2.02	2.11	2.31	0.06	0.07	0.07

Continued						
Year	High speed 4-stroke NMVOC	Medium speed 4-stroke NMVOC	Slow speed 2-stroke NMVOC	High speed 4-stroke CH_4	Medium speed 4-stroke CH_4	Slow speed 2-stroke CH_4
1982	2.03	2.12	2.33	0.06	0.07	0.07
1983	2.05	2.14	2.34	0.06	0.07	0.07
1984	2.06	2.15	2.36	0.06	0.07	0.07
1985	2.07	2.17	2.38	0.06	0.07	0.07
1986	2.09	2.18	2.40	0.06	0.07	0.07
1987	2.10	2.20	2.42	0.07	0.07	0.07
1988	2.12	2.22	2.44	0.07	0.07	0.08
1989	2.14	2.24	2.47	0.07	0.07	0.08
1990	2.16	2.26	2.49	0.07	0.07	0.08
1991	2.18	2.28	2.52	0.07	0.07	0.08
1992	2.20	2.30	2.55	0.07	0.07	0.08
1993	2.22	2.33	2.58	0.07	0.07	0.08
1994	2.25	2.35	2.61	0.07	0.07	0.08
1995	2.27	2.38	2.64	0.07	0.07	0.08
1996	2.30	2.41	2.68	0.07	0.07	0.08
1997	2.33	2.44	2.72	0.07	0.08	0.08
1998	2.36	2.48	2.76	0.07	0.08	0.09
1999	2.39	2.51	2.81	0.07	0.08	0.09
2000	2.43	2.55	2.85	0.08	0.08	0.09

S-%, SO_2 and PM emission factors (g/kg fuel and g/GJ) per fuel type for diesel ship engines.

Fuel type	SNAPCode	Year	S %	SO_2 (g/kg)	TSP (g/kg)	PM_{10} (g/kg)	$PM_{2,5}$ (g/kg)	SO_2 (g/GJ)	TSP (g/GJ)	PM_{10} (g/GJ)	$PM_{2,5}$ (g/GJ)
Fuel	National sea	1990	2,64	52,8	6,1	6,0	6,0	1291,0	149,2	147,8	147,0
Fuel	National sea	1991	2,35	47,0	4,9	4,9	4,8	1149,1	120,2	119,0	118,4
Fuel	National sea	1992	1,80	36,0	3,3	3,2	3,2	880,2	79,8	79,0	78,6
Fuel	National sea	1993	2,39	47,8	5,1	5,0	5,0	1168,7	123,9	122,6	122,0
Fuel	National sea	1994	2,62	52,4	6,0	6,0	5,9	1281,2	147,0	145,6	144,8
Fuel	National sea	1995	2,95	59,0	7,7	7,6	7,6	1442,5	188,0	186,1	185,2
Fuel	National sea	1996	2,57	51,4	5,8	5,7	5,7	1256,7	141,7	140,2	139,5
Fuel	National sea	1997	2,74	54,8	6,6	6,5	6,5	1339,9	160,8	159,2	158,4
Fuel	National sea	1998	1,97	39,4	3,7	3,7	3,6	963,3	90,6	89,7	89,2
Fuel	National sea	1999	1,97	39,4	3,7	3,7	3,6	963,3	90,6	89,7	89,2
Fuel	National sea	2000	1,81	36,2	3,3	3,3	3,2	885,1	80,4	79,6	79,2
Fuel	National sea	2001	1,70	34,0	3,0	3,0	3,0	831,3	74,1	73,4	73,0
Fuel	National sea	2002	1,51	30,2	2,6	2,6	2,6	738,4	64,3	63,7	63,3
Fuel	National sea	2003	1,62	32,4	2,9	2,8	2,8	792,2	69,8	69,1	68,8
Fuel	National sea	2004	1,98	39,6	3,7	3,7	3,7	968,2	91,3	90,4	89,9
Fuel	National sea	2005	2,00	40,0	3,8	3,8	3,7	978,0	92,6	91,7	91,3
Fuel	National sea	2006	1,94	38,8	3,6	3,6	3,6	948,7	88,6	87,7	87,3
Fuel	National sea	2007	1,20	24,0	2,1	2,1	2,1	586,8	51,0	50,5	50,3
Fuel	National sea	2008	1,20	24,0	2,1	2,1	2,1	586,8	51,0	50,5	50,3
Fuel	National sea	2009	1,20	24,0	2,1	2,1	2,1	586,8	51,0	50,5	50,3
Fuel	International sea	1990	2,96	59,2	7,7	7,7	7,6	1447,4	189,4	187,5	186,6
Fuel	International sea	1991	2,89	57,8	7,4	7,3	7,2	1413,2	179,8	178,0	177,1
Fuel	International sea	1992	2,88	57,6	7,3	7,2	7,2	1408,3	178,5	176,7	175,8
Fuel	International sea	1993	3,20	64,0	9,3	9,2	9,1	1564,8	226,5	224,2	223,1
Fuel	International sea	1994	3,03	60,6	8,2	8,1	8,0	1481,7	199,6	197,6	196,6
Fuel	International sea	1995	3,30	66,0	10,0	9,9	9,8	1613,7	244,0	241,6	240,4
Fuel	International sea	1996	3,42	68,4	10,9	10,8	10,8	1672,4	266,9	264,2	262,9
Fuel	International sea	1997	3,45	69,0	11,2	11,0	11,0	1687,0	272,9	270,2	268,8
Fuel	International sea	1998	3,42	68,4	10,9	10,8	10,8	1672,4	266,9	264,2	262,9
Fuel	International sea	1999	3,45	69,0	11,2	11,0	11,0	1687,0	272,9	270,2	268,8
Fuel	International sea	2000	3,36	67,2	10,4	10,3	10,3	1643,0	255,2	252,6	251,4
Fuel	International sea	2001	3,42	68,4	10,9	10,8	10,8	1672,4	266,9	264,2	262,9
Fuel	International sea	2002	3,44	68,8	11,1	11,0	10,9	1682,2	270,9	268,2	266,8
Fuel	International sea	2003	3,11	62,2	8,7	8,6	8,5	1520,8	211,8	209,7	208,6
Fuel	International sea	2004	3,20	64,0	9,3	9,2	9,1	1564,8	226,5	224,2	223,1
Fuel	International sea	2005	3,50	70,0	11,6	11,5	11,4	1711,5	283,2	280,4	279,0

Continued											
Fuel type	SNAPCode	Year	S %	SO_2 (g/kg)	TSP (g/kg)	PM_{10} (g/kg)	$PM_{2,5}$ (g/kg)	SO_2 (g/GJ)	TSP (g/GJ)	PM_{10} (g/GJ)	$PM_{2,5}$ (g/GJ)
Fuel	International sea	2006	3,35	67,0	10,4	10,3	10,2	1638,1	253,3	250,8	249,5
Fuel	International sea	2007	1,50	30,0	2,6	2,6	2,6	733,5	63,8	63,2	62,9
Fuel	International sea	2008	1,50	30,0	2,6	2,6	2,6	733,5	63,8	63,2	62,9
Fuel	International sea	2009	1,50	30,0	2,6	2,6	2,6	733,5	63,8	63,2	62,9
Fuel	International sea	1990	0,20	4,0	1,0	1,0	1,0	93,7	23,2	23,0	22,9
Diesel	-	1991	0,20	4,0	1,0	1,0	1,0	93,7	23,2	23,0	22,9
Diesel	-	1992	0,20	4,0	1,0	1,0	1,0	93,7	23,2	23,0	22,9
Diesel	-	1993	0,20	4,0	1,0	1,0	1,0	93,7	23,2	23,0	22,9
Diesel	-	1994	0,20	4,0	1,0	1,0	1,0	93,7	23,2	23,0	22,9
Diesel	-	1995	0,20	4,0	1,0	1,0	1,0	93,7	23,2	23,0	22,9
Diesel	-	1996	0,20	4,0	1,0	1,0	1,0	93,7	23,2	23,0	22,9
Diesel	-	1997	0,20	4,0	1,0	1,0	1,0	93,7	23,2	23,0	22,9
Diesel	-	1998	0,20	4,0	1,0	1,0	1,0	93,7	23,2	23,0	22,9
Diesel	-	1999	0,20	4,0	1,0	1,0	1,0	93,7	23,2	23,0	22,9
Diesel	-	2000	0,20	4,0	1,0	1,0	1,0	93,7	23,2	23,0	22,9
Diesel	-	2001	0,20	4,0	1,0	1,0	1,0	93,7	23,2	23,0	22,9
Diesel	-	2002	0,20	4,0	1,0	1,0	1,0	93,7	23,2	23,0	22,9
Diesel	-	2003	0,20	4,0	1,0	1,0	1,0	93,7	23,2	23,0	22,9
Diesel	-	2004	0,20	4,0	1,0	1,0	1,0	93,7	23,2	23,0	22,9
Diesel	-	2005	0,20	4,0	1,0	1,0	1,0	93,7	23,2	23,0	22,9
Diesel	-	2006	0,20	4,0	1,0	1,0	1,0	93,7	23,2	23,0	22,9
Diesel	-	2007	0,20	4,0	1,0	1,0	1,0	93,7	23,2	23,0	22,9
Diesel	-	2008	0,10	2,0	0,9	0,9	0,9	46,8	21,5	21,3	21,2
Diesel	-	2009	0,10	2,0	0,9	0,9	0,9	46,8	21,5	21,3	21,2

Annex 2B-13: Fuel sales figures from DEA, and further processed fuel consumption data suited for the Danish inventory

Enhed: TJ	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Agriculture and forestry, DEA statistics															
- LPG	88	84	354	311	457	438	412	359	234	205	204	212	184	219	162
- gasoline	425	184	315	317	304	274	251	240	208	166	161	191	70	61	56
- gas/diesel oil	9 199	9 634	9 498	9 520	10 605	10 528	10 700	11 028	11 423	11 494	11 585	13 088	13 875	13 310	13 909
Gartneri, DEA statistics															
- LPG	8	5	47	47	53	50	47	39	26	23	23	22	20	24	17
- gasoline	10	3	6	6	11	10	10	12	23	18	18	19	7	6	6
- gas/diesel oil	1 705	1 270	1 405	1 383	1 231	1 409	1 687	1 887	1 205	963	1 138	487	356	341	347
Fishery, DEA statistics															
- LPG	-	-	34	29	50	42	34	30	12	18	16	36	5	1	16
- gasoline	-	1	2	2	9	9	10	8	7	7	8	7	6	6	60
- kerosene	7	2	9	5	12	26	9	5	4	3	4	3	3	2	0
- gas/diesel oil	9 152	10 248	8 390	9 499	10 038	10 422	10 809	10 868	8 843	8 796	8 277	8 750	8 748	9 186	9 282
- fuel oil	27	5	82	68	251	285	113	231	146	8	19	219	260	27	-
Manufacturing industry, DEA statistics															
- LPG	2 860	2 839	2 688	2 553	2 080	2 032	2 076	1 827	1 858	2 029	2 234	2 404	2 106	2 017	1 917
- gasoline	262	273	453	326	136	177	161	158	145	138	110	86	82	137	80
- gas/diesel oil	15 576	15 441	14 743	13 346	12 670	12 259	12 934	11 901	11 323	10 154	10 401	10 184	8 921	8 720	8 852
- fuel oil	29 465	29 451	21 518	19 056	16 741	15 989	17 133	16 694	14 600	15 438	14 000	12 632	11 009	10 943	8 704
Building and construction, DEA statistics															
- LPG	305	343	500	451	575	500	573	708	579	522	501	509	471	575	422
- gasoline	19	85	52	48	36	34	26	24	20	23	25	34	27	23	27
- gas/diesel oil	5 313	4 962	4 378	4 220	3 945	3 548	3 797	3 839	3 871	4 145	5 317	5 572	6 079	5 947	6 556
Housing, DEA statistics															
- gasoline	1 006	1 046	1 073	1 114	1 128	1 131	1 146	1 158	1 168	1 194	1 233	1 258	1 299	1 317	1 357
- gas/dieselolie	74 257	69 392	68 349	59 832	46 935	41 152	45 219	38 406	45 029	39 770	40 004	41 836	36 491	34 902	32 936
Etageboliger															
- gas/dieselolie	10 584	9 968	10 112	7 266	7 350	5 311	5 420	4 507	4 938	3 909	3 284	3 460	3 105	2 948	2 739
Road transport, DEA statistics															
- gasoline	66 037	68 670	70 502	73 151	74 152	74 326	75 290	76 084	76 697	78 425	80 998	82 656	85 341	86 520	89 129
- gas/diesel oil	45 609	49 738	49 626	49 686	51 854	54 746	58 427	57 511	56 796	58 755	58 561	59 851	60 528	61 072	63 619
- bioethanol	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Continued	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Road transport, DEA statistics															
- biodiesel	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Non-road, DEA statistics															
- LPG	2 955	2 929	3 089	2 911	2 590	2 520	2 535	2 224	2 118	2 257	2 461	2 638	2 310	2 260	2 097
- gasoline	1 722	1 590	1 898	1 810	1 616	1 626	1 595	1 592	1 563	1 540	1 547	1 589	1 485	1 545	1 526
- gas/diesel oil	31 793	31 307	30 025	28 469	28 451	27 744	29 118	28 655	27 822	26 755	28 441	29 331	29 231	28 319	29 665
Non-road, NERI model															
- LPG	1232	1233	1225	1209	1196	1185	1172	1151	1124	1105	1099	1088	1075	1086	1077
- gasoline	2998	2950	2903	2856	2813	2770	2702	2641	2587	2550	2521	2499	2479	2463	2456
- gas/diesel oil	26357	26895	26577	27075	26940	26800	26734	26046	26073	25235	25798	25139	25536	24844	24885
Recreational craft, NERI model															
- gasoline	270	270	279	289	299	309	319	329	339	348	358	368	377	385	391
- gas/diesel oil	219	219	247	277	309	343	378	415	454	495	537	581	628	676	726
Non-road, added 0202															
- gas/diesel oil	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non-road, added 0203 and 0301															
- gas/diesel oil	5436	4412	3448	1395	1510	944	2384	2609	1748	1521	2642	4192	3695	3475	4780
- LPG	1724	1696	1864	1701	1393	1335	1363	1073	994	1152	1362	1549	1235	1175	1020
Non-road, added 0203															
- gas/diesel oil	1864	1537	1252	534	628	406	1014	1176	794	708	1182	1940	1799	1675	2297
- LPG	56	52	242	209	274	259	247	192	122	116	125	137	109	126	87
Non-road, added 0301															
- gas/diesel oil	3572	2875	2196	860	882	538	1370	1433	955	813	1460	2252	1896	1800	2483
- LPG	1668	1644	1622	1492	1119	1076	1116	881	872	1036	1237	1412	1126	1048	933
Non-road, added road transport															
- gasoline	-1276	-1360	-1005	-1046	-1197	-1145	-1107	-1049	-1023	-1010	-975	-909	-994	-918	-931
Fisheries, added national sea transport															
- fuel oil	27	5	82	68	251	285	113	231	146	8	19	219	260	27	0
Fisheries, consumed by recreational craft															
- gasoline	0	1	2	2	9	9	10	8	7	7	8	7	6	6	60
National sea transport, input NERI model															
- LPG	3	1	3	-	2	2	2	3	16	1	2	1	2	3	1
- kerosene	5	-	5	3	1	0	2	1	1	1	1	1	0	1	0
- gas/diesel oil	3 074	3 045	3 032	3 230	2 669	2 782	3 313	3 501	4 971	5 035	6 049	6 764	5 899	4 113	3 409

Continued	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
National sea transport, input NERI model															
- fuel oil	2 541	3 424	3 922	2 795	4 228	3 845	4 429	3 646	2 797	2 160	1 592	1 379	1 210	1 367	1 435
Fisheries, input NERI model															
- LPG	-	-	34	29	50	42	34	30	12	18	16	36	5	1	16
- gasoline	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
- kerosene	7	2	9	5	12	26	9	5	4	3	4	3	3	2	0
- gas/diesel oil	8 932	10 029	8 143	9 222	9 729	10 080	10 431	10 453	8 389	8 301	7 740	8 169	8 120	8 510	8 556
International sea transport, input NERI model															
- gas/diesel oil	7 171	7 867	8 547	9 743	10 514	11 633	12 590	16 881	19 114	24 123	26 743	27 231	25 325	31 243	26 085
- fuel oil	10 123	12 236	20 883	27 532	27 667	28 543	23 470	20 998	36 988	39 024	39 509	35 739	32 427	26 952	28 526
National sea transport, output NERI model															
- gas/diesel oil	5285	5285	5285	5285	5285	5285	6015	6920	6673	6618	7028	8465	8967	7333	6201
- fuel oil	4571	4571	4571	4571	4571	4571	3926	3202	3201	3362	3382	2826	2052	1590	1455
- kerosene	5	0	5	3	1	0	2	1	1	1	1	1	0	1	0
- LPG	3	1	3	0	2	2	2	3	16	1	2	1	2	3	1
Fisheries, output NERI model															
- gas/diesel oil	7064	8131	6233	7509	7455	7920	8170	7482	7075	7097	7134	6744	5328	5566	6375
- kerosene	7	2	9	5	12	26	9	5	4	3	4	3	3	2	0
- LPG	0	0	34	29	50	42	34	30	12	18	16	36	5	1	16
International sea transport, output NERI model															
- gas/diesel oil	6828	7524	8204	9400	10171	11289	12149	16433	18726	23742	26370	26955	25049	30967	25474
- fuel oil	9394	11507	20155	26804	26938	27815	22742	20269	36259	38296	38780	35010	31698	26223	27797
National sea transport, added 0301															
- fuel oil	-2 030	-1 147	- 649	-1 776	- 343	- 726	504	445	- 404	-1 201	-1 789	-1 447	- 842	- 223	- 20
Road transport, NERI excl. traded fuels															
- gasoline	64 492	67 041	69 220	71 819	72 664	72 882	73 874	74 714	75 342	77 074	79 674	81 385	83 976	85 223	87 867
- gas/diesel oil	45 609	49 738	49 626	49 686	51 854	54 746	58 427	57 511	56 796	58 755	58 561	59 851	60 528	61 072	63 619
- bioethanol	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
- biodiesel	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Road transport, input NERI model incl. traded fuels															
- gasoline	62 077	62 442	62 716	63 442	62 546	66 279	70 589	74 320	76 459	79 209	80 101	80 958	83 089	84 832	84 506
- gas/diesel oil	49 016	54 939	54 827	54 887	57 055	59 947	61 296	59 950	59 522	63 561	64 013	65 590	66 374	67 206	69 501
- bioethanol	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Continued	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Road transport, input NERI model incl. traded fuels															
- biodiesel	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Continued										
Enhed: TJ	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Agriculture and forestry, DEA statistics										
- LPG	179	190	159	153	138	121	116	110	104	114
- gasoline	38	39	28	42	51	52	20	21	20	31
- gas/diesel oil	13 689	13 437	13 706	13 463	12 934	12 464	13 047	12 481	13 698	14 389
Gartneri, DEA statistics										
- LPG	19	20	17	16	14	12	12	11	10	11
- gasoline	4	4	3	5	6	6	2	2	2	3
- gas/diesel oil	698	581	529	556	488	407	391	418	444	466
Fishery, DEA statistics										
- LPG	13	19	21	20	18	20	20	18	12	12
- gasoline	67	3	3	0	0	0	1	1	1	1
- kerosene	25	1	1	1	1	1	0	0	0	-
- gas/diesel oil	9 347	8 908	8 888	8 428	7 337	7 340	7 362	6 854	6 258	6 075
- fuel oil	-	-	4	84	35	126	86	13	14	17
Manufacturing industry, DEA statistics										
- LPG	1 819	1 526	1 405	1 472	1 488	1 478	1 482	1 216	1 178	1 029
- gasoline	97	69	42	26	30	21	32	16	15	97
- gas/diesel oil	8 635	10 099	9 155	9 964	10 515	10 022	9 132	8 170	7 448	6 665
- fuel oil	8 221	7 395	7 818	6 916	6 940	6 055	8 527	6 422	5 177	4 067
Building and construction, DEA statistics										
- LPG	165	179	236	226	228	224	248	222	172	85
- gasoline	33	24	26	27	27	27	27	28	26	20
- gas/diesel oil	5 950	6 356	6 226	6 226	6 227	6 338	6 187	6 410	6 339	5 429
Housing, DEA statistics										
- gasoline	1 355	1 317	1 313	1 303	1 288	1 250	1 216	1 193	1 135	1 092
- gas/dieselolie	27 929	28 996	26 967	24 932	22 863	21 712	19 572	18 012	16 585	15 762
Etageboliger										
- gas/dieselolie	2 346	2 511	2 031	2 095	2 427	2 151	1 625	1 411	1 610	1 658
Road transport, DEA statistics										
- gasoline	88 975	86 474	86 247	85 611	84 629	82 118	79 822	78 325	74 545	71 689
- gas/diesel oil	64 282	66 254	66 814	70 875	75 422	79 476	86 223	93 111	93 447	88 069

Continued	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
- bioethanol	-	-	-	-	-	-	151	252	210	204
- biodiesel	-	-	-	-	-	-	-	-	10	139
Non-road, DEA statistics										
- LPG	2 018	1 736	1 581	1 641	1 640	1 612	1 610	1 337	1 292	1 155
- gasoline	1 525	1 453	1 412	1 404	1 402	1 356	1 296	1 259	1 199	1 242
- gas/diesel oil	28 972	30 473	29 616	30 209	30 164	29 232	28 757	27 479	27 928	26 948
Non-road, NERI model										
- LPG	1071	1073	1084	1079	1065	1049	1038	1040	986	817
- gasoline	2458	2622	2833	3090	3391	3604	3807	3923	3975	3942
- gas/diesel oil	24630	24923	25117	25334	25704	26393	27762	29522	30515	27089
Recreational craft, NERI model										
- gasoline	396	400	403	404	404	393	382	371	361	353
- gas/diesel oil	777	831	886	944	1002	1002	1002	1002	1002	1002
Non-road, added 0202										
- gas/diesel oil	0	0	0	0	0	0	0	-2043	-2587	-141
Non-road, added 0203 and 0301										
- gas/diesel oil	4342	5550	4500	4875	4460	2838	995	0	0	0
- LPG	947	662	497	563	575	562	572	298	306	338
Non-road, added 0203										
- gas/diesel oil	2156	2553	2163	2262	1985	1250	465	0	0	0
- LPG	93	80	55	58	53	46	46	27	27	37
Non-road, added 0301										
- gas/diesel oil	2186	2997	2337	2612	2476	1589	530	0	0	0
- LPG	854	582	442	505	522	516	526	271	279	301
Non-road, added road transport										
- gasoline	-932	-1169	-1421	-1686	-1990	-2248	-2511	-2663	-2776	-2700
Fisheries, added national sea transport										
- fuel oil	0	0	4	84	35	126	86	13	14	17
Fisheries, consumed by recreational craft										
- gasoline	67	3	3	0	0	0	1	1	1	1
National sea transport, input NERI model										
- LPG	0	-	-	0	0	0	0	0	-	-
- kerosene	1	1	1	1	1	1	0	-	-	-
- gas/diesel oil	5 348	5 608	5 855	6 009	5 259	6 646	5 986	5 233	6 954	6 489
- fuel oil	1 509	1 513	2 068	1 907	1 704	1 506	1 367	1 110	1 174	1 634

Continued	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Fisheries, input NERI model										
- LPG	13	19	21	20	18	20	20	18	12	12
- gasoline	-	-	-	-	-	-	-	-	-	-
- kerosene	25	1	1	1	1	1	0	0	0	-
- gas/diesel oil	8 570	8 077	8 001	7 484	6 335	6 338	6 360	5 852	5 256	5 073
International sea transport, input NERI model										
- gas/diesel oil	20 892	19 022	19 505	18 549	14 357	11 630	10 829	9 124	11 218	10 433
- fuel oil	33 165	25 924	17 547	20 462	17 298	20 591	31 565	35 243	27 164	11 091
National sea transport, output NERI model										
- gas/diesel oil	5258	5233	5061	4475	4591	4559	4427	4435	4393	4315
- fuel oil	1444	1400	1387	1862	1853	1859	2026	2005	2142	2289
- kerosene	1	1	1	1	1	1	0	0	0	0
- LPG	0	0	0	0	0	0	0	0	0	0
Fisheries, output NERI model										
- gas/diesel oil	7422	9384	9664	9294	7286	8725	8166	6966	8106	7517
- kerosene	25	1	1	1	1	1	0	0	0	0
- LPG	13	19	21	20	18	20	20	18	12	12
International sea transport, output NERI model										
- gas/diesel oil	22129	18090	18636	18273	14074	11330	10583	8809	10928	10164
- fuel oil	32437	25195	16818	19247	16118	19411	30172	33848	25650	9416
National sea transport, added 0301										
- fuel oil	65	113	681	45	- 148	- 353	- 659	- 895	- 968	- 655
Road transport, NERI excl. traded fuels										
- gasoline	87 713	84 907	84 426	83 521	82 235	79 477	76 930	75 292	71 409	68 637
- gas/diesel oil	64 282	66 254	66 814	70 875	75 422	79 476	86 223	93 111	93 447	88 069
- bioethanol	-	-	-	-	-	-	151	252	210	204
- biodiesel	-	-	-	-	-	-	-	-	10	139
Road transport, input NERI model incl. traded fuels										
- gasoline	83 312	81 852	81 963	81 878	80 593	77 835	76 109	75 292	71 409	67 815
- gas/diesel oil	69 196	70 916	72 552	78 766	84 209	88 264	95 010	103 871	103 490	97 036
- bioethanol	-	-	-	-	-	-	151	252	210	204
- biodiesel	-	-	-	-	-	-	-	-	10	139

Annex 2B-14: Emission factors and total emissions in CollectER format

1990 emission factors for CO_2, CH_4, N_2O, SO_2, NO_x; NMVOC, NH_3 and TSP.

Year	SNAP ID	Category		Fuel type	SO_2	NO_x	NMVOC	CH_4	CO	CO_2	N_2O	NH_3	TSP
					g pr GJ	g pr GJ	g pr GJ	g pr GJ	g pr GJ	g pr GJ	g pr GJ	g pr GJ	g pr GJ
1990	070101	Passenger cars	Highway	Diesel	93,68	281,80	25,07	3,74	179,70	74,00	0,00	0,47	79,48
1990	070101	Passenger cars	Highway	Gasoline	2,28	1341,85	372,77	10,99	3471,98	73,00	2,75	0,85	12,32
1990	070101	Passenger cars	Highway	LPG	0,00	1151,70	187,09	10,06	3914,25	65,00	0,00	0,00	10,06
1990	070102	Passenger cars	Rural	Diesel	93,68	282,97	42,09	6,82	268,08	74,00	0,00	0,57	75,13
1990	070102	Passenger cars	Rural	Gasoline	2,28	1157,33	489,92	13,86	3975,56	73,00	3,09	0,95	14,22
1990	070102	Passenger cars	Rural	LPG	0,00	1248,46	305,18	16,91	1146,38	65,00	0,00	0,00	14,49
1990	070103	Passenger cars	Urban	Diesel	93,68	228,36	83,84	8,41	317,11	74,00	0,00	0,35	122,24
1990	070103	Passenger cars	Urban	Gasoline	2,28	616,49	943,13	49,98	9909,86	73,00	3,10	0,62	13,42
1990	070103	Passenger cars	Urban	LPG	0,00	620,57	439,16	23,63	1315,38	65,00	0,00	0,00	11,82
1990	070201	Light duty vehicles	Highway	Diesel	93,68	270,67	30,19	2,60	344,14	74,00	0,00	0,32	104,48
1990	070201	Light duty vehicles	Highway	Gasoline	2,28	1369,26	170,29	10,11	2987,40	73,00	2,63	0,81	16,17
1990	070201	Light duty vehicles	Highway	LPG	0,00	1151,70	187,09	10,06	3914,25	65,00	0,00	0,00	10,06
1990	070202	Light duty vehicles	Rural	Diesel	93,68	299,25	33,22	4,26	358,42	74,00	0,00	0,36	107,73
1990	070202	Light duty vehicles	Rural	Gasoline	2,28	1188,86	262,59	15,25	2316,18	73,00	2,48	0,76	15,25
1990	070202	Light duty vehicles	Rural	LPG	0,00	1248,46	305,18	16,91	1146,38	65,00	0,00	0,00	14,49
1990	070203	Light duty vehicles	Urban	Diesel	93,68	487,30	55,86	6,31	411,00	74,00	0,00	0,26	131,44
1990	070203	Light duty vehicles	Urban	Gasoline	2,28	626,69	712,66	40,57	7326,15	73,00	2,22	0,44	8,90
1990	070203	Light duty vehicles	Urban	LPG	0,00	620,31	439,26	23,62	1316,15	65,00	0,00	0,00	11,81
1990	070301	Heavy duty vehicles	Highway	Diesel	93,68	1022,46	48,05	6,21	189,51	74,00	3,02	0,30	38,50
1990	070301	Heavy duty vehicles	Highway	Gasoline	2,28	1037,78	474,61	9,69	7610,35	73,00	0,83	0,28	55,35
1990	070302	Heavy duty vehicles	Rural	Diesel	93,68	1041,19	59,99	6,66	202,57	74,00	2,79	0,28	40,44
1990	070302	Heavy duty vehicles	Rural	Gasoline	2,28	1141,55	820,40	16,74	8371,39	73,00	0,91	0,30	60,88
1990	070303	Heavy duty vehicles	Urban	Diesel	93,68	995,93	79,54	11,66	245,07	74,00	2,14	0,21	46,48
1990	070303	Heavy duty vehicles	Urban	Gasoline	2,28	456,62	696,09	14,21	7102,99	73,00	0,61	0,20	40,59
1990	070400	Mopeds	Urban	Gasoline	2,28	18,26	12503,20	200,00	12602,74	73,00	0,91	0,91	171,69
1990	070501	Motorcycles	Highway	Gasoline	2,28	264,11	1072,19	129,96	16302,60	73,00	1,35	1,35	31,73
1990	070502	Motorcycles	Rural	Gasoline	2,28	185,41	981,69	159,32	15782,07	73,00	1,66	1,66	38,90
1990	070503	Motorcycles	Urban	Gasoline	2,28	112,92	1149,21	155,11	15187,59	73,00	1,61	1,61	37,87
1990	080100	Military		AvGas	22,83	859,00	1242,60	21,90	6972,00	73,00	2,00	1,60	10,00
1990	080100	Military		Diesel	93,68	785,58	58,23	7,33	258,20	74,00	1,72	0,30	65,61
1990	080100	Military		Gasoline	2,28	932,90	1154,80	31,10	6608,56	73,00	2,99	0,78	14,43

Continued	SNAP ID	Category	Fuel type	SO_2	NO_x	NMVOC	CH_4	CO	CO_2	N_2O	NH_3	TSP
				g pr GJ	g pr GJ	g pr GJ	g pr GJ	g pr GJ	g pr GJ	g pr GJ	g pr GJ	g pr GJ
1990	080100	Military	Jet fuel	22,99	250,57	24,94	2,65	229,89	72,00	2,30	0,00	1,16
1990	080200	Railways	Diesel	93,68	1225,13	79,94	3,07	223,21	74,00	2,04	0,20	50,26
1990	080200	Railways	Kerosene	5,00	50,00	3,00	7,00	20,00	72,00	2,00	0,00	121,95
1990	080300	Inland waterways	Diesel	93,68	983,64	171,79	2,79	453,65	74,00	2,96	0,17	106,93
1990	080300	Inland waterways	Gasoline	2,28	291,33	3606,55	50,38	13853,27	73,00	0,78	0,08	182,44
1990	080402	National sea traffic	Diesel	93,68	1104,18	50,57	1,56	166,83	74,00	4,68	0,00	23,21
1990	080402	National sea traffic	Kerosene	2,30	50,00	3,00	7,00	20,00	72,00	0,00	0,00	5,00
1990	080402	National sea traffic	LPG	0,00	1249,00	384,94	20,26	443,00	65,00	0,00	0,00	0,20
1990	080402	National sea traffic	Residual oil	1290,95	1615,26	53,44	1,65	176,29	78,00	4,89	0,00	149,25
1990	080403	Fishing	Diesel	93,68	1052,12	49,13	1,52	162,08	74,00	4,68	0,00	23,21
1990	080403	Fishing	Kerosene	2,30	50,00	3,00	7,00	20,00	72,00	0,00	0,00	5,00
1990	080403	Fishing	LPG	0,00	1249,00	384,94	20,26	443,00	65,00	0,00	0,00	0,20
1990	080404	International sea traffic	Diesel	93,68	1208,60	49,46	1,53	163,17	74,00	4,68	0,00	23,21
1990	080404	International sea traffic	Residual oil	1447,43	1689,57	53,98	1,67	178,09	78,00	4,89	0,00	189,43
1990	080501	Air traffic, Dom. < 3000 ft.	AvGas	22,83	859,00	1242,60	21,90	6972,00	73,00	2,00	1,60	10,00
1990	080501	Air traffic, Dom. < 3000 ft.	Jet fuel	22,99	314,51	14,93	1,59	90,41	72,00	5,70	0,00	1,16
1990	080502	Air traffic, Int. < 3000 ft.	AvGas	22,83	859,00	1242,60	21,90	6972,00	73,00	2,00	1,60	10,00
1990	080502	Air traffic, Int. < 3000 ft.	Jet fuel	22,99	309,25	16,47	1,75	168,98	72,00	7,10	0,00	1,16
1990	080503	Air traffic, Dom. > 3000 ft.	Jet fuel	22,99	330,11	12,36	1,31	90,75	72,00	2,30	0,00	1,16
1990	080504	Air traffic, Int. > 3000 ft.	Jet fuel	22,99	244,20	6,48	0,69	54,10	72,00	2,30	0,00	1,16
1990	080600	Agriculture	Diesel	93,68	758,87	156,85	2,55	635,53	74,00	2,93	0,17	144,45
1990	080600	Agriculture	Gasoline	2,28	31,60	949,55	88,42	47524,17	73,00	1,28	0,09	6,56
1990	080700	Forestry	Diesel	93,68	857,48	156,47	2,54	645,65	74,00	2,97	0,17	149,05
1990	080700	Forestry	Gasoline	2,28	40,39	7206,91	60,42	18057,40	73,00	0,37	0,07	101,22
1990	080800	Industry	Diesel	93,68	933,58	178,23	2,90	655,80	74,00	2,94	0,17	154,50
1990	080800	Industry	Gasoline	2,28	136,27	1610,77	120,61	14797,46	73,00	1,33	0,09	12,40
1990	080800	Industry	LPG	0,00	1328,11	146,09	7,69	104,85	65,00	3,50	0,21	4,89
1990	080900	Household and gardening	Gasoline	2,28	63,98	3366,01	95,22	32901,19	73,00	1,15	0,08	20,75
1990	081100	Commercial and institutional	Gasoline	2,28	68,83	2280,66	97,87	29887,31	73,00	1,09	0,08	24,00
1990	080501	Air traffic, Dom. < 3000 ft.	AvGas	22,83	859,00	1242,60	21,90	6972,00	73,00	2,00	1,60	10,00
1990	080501	Air traffic, Dom. < 3000 ft.	Jet fuel	22,99	283,87	20,73	2,20	129,70	72,00	4,58	0,00	1,16
1990	080502	Air traffic, Int. < 3000 ft.	AvGas	22,83	859,00	1242,60	21,90	6972,00	73,00	2,00	1,60	10,00
1990	080502	Air traffic, Int. < 3000 ft.	Jet fuel	22,99	324,87	34,25	3,64	157,15	72,00	3,79	0,00	1,16
1990	080503	Air traffic, Dom. > 3000 ft.	Jet fuel	22,99	314,86	11,78	1,25	84,05	72,00	2,30	0,00	1,16
1990	080504	Air traffic, Int. > 3000 ft.	Jet fuel	22,99	290,20	10,08	1,07	37,65	72,00	2,30	0,00	1,16

2009 emission factors for CO_2, CH_4, N_2O, SO_2, NO_x; NMVOC, NH_3 and TSP.

Year	SNAP ID	Category		Fuel type	SO_2	NO_x	NMVOC	CH_4	CO	CO_2	N_2O	NH_3	TSP
					g pr GJ	g pr GJ	g pr GJ	g pr GJ	g pr GJ	g pr GJ	g pr GJ	g pr GJ	g pr GJ
2009	070101	Passenger cars	Highway	Diesel	0,47	303,26	5,80	0,14	13,23	73,89	1,95	0,48	15,44
2009	070101	Passenger cars	Highway	Gasoline	0,45	142,30	32,30	2,97	685,83	72,78	0,72	30,88	0,90
2009	070101	Passenger cars	Highway	LPG	0,00	247,65	39,76	4,31	1443,35	65,00	0,76	0,00	10,05
2009	070102	Passenger cars	Rural	Diesel	0,47	259,62	8,38	0,28	25,61	73,89	2,08	0,51	12,65
2009	070102	Passenger cars	Rural	Gasoline	0,45	114,22	36,32	3,52	538,53	72,78	1,35	34,47	0,85
2009	070102	Passenger cars	Rural	LPG	0,00	270,21	59,92	7,23	562,88	65,00	1,58	0,00	14,45
2009	070103	Passenger cars	Urban	Diesel	0,47	258,88	23,86	0,76	65,93	73,89	4,55	0,38	19,84
2009	070103	Passenger cars	Urban	Gasoline	0,45	132,47	221,92	9,48	2378,17	72,78	2,43	11,46	0,92
2009	070103	Passenger cars	Urban	LPG	0,00	162,36	123,43	11,53	816,28	65,00	3,20	0,00	13,44
2009	070201	Light duty vehicles	Highway	Diesel	0,47	227,43	21,27	0,22	129,50	73,89	1,52	0,37	21,83
2009	070201	Light duty vehicles	Highway	Gasoline	0,45	160,23	18,87	2,74	543,60	72,78	1,49	22,77	1,39
2009	070201	Light duty vehicles	Highway	LPG	0,00	74,28	10,46	1,74	860,66	65,00	0,44	0,00	10,04
2009	070202	Light duty vehicles	Rural	Diesel	0,47	237,74	24,06	0,51	111,29	73,89	1,66	0,40	17,90
2009	070202	Light duty vehicles	Rural	Gasoline	0,45	140,14	27,94	2,92	411,60	72,78	2,28	21,84	1,24
2009	070202	Light duty vehicles	Rural	LPG	0,00	81,85	14,66	2,92	386,57	65,00	0,99	0,00	14,45
2009	070203	Light duty vehicles	Urban	Diesel	0,47	227,90	40,68	1,11	136,49	73,89	3,11	0,29	24,98
2009	070203	Light duty vehicles	Urban	Gasoline	0,45	119,52	148,31	7,07	2931,76	72,78	3,89	5,74	0,85
2009	070203	Light duty vehicles	Urban	LPG	0,00	54,81	36,84	4,79	428,25	65,00	2,29	0,00	13,82
2009	070301	Heavy duty vehicles	Highway	Diesel	0,47	552,97	12,59	3,55	89,59	73,89	3,13	0,31	9,16
2009	070301	Heavy duty vehicles	Highway	Gasoline	0,45	1037,78	474,61	9,69	7610,35	72,78	0,83	0,28	55,35
2009	070302	Heavy duty vehicles	Rural	Diesel	0,47	567,88	15,12	3,74	92,25	73,89	2,85	0,29	9,35
2009	070302	Heavy duty vehicles	Rural	Gasoline	0,45	1141,55	820,40	16,74	8371,39	72,78	0,91	0,30	60,88
2009	070303	Heavy duty vehicles	Urban	Diesel	0,47	572,06	19,24	4,70	106,84	73,89	2,21	0,22	10,85
2009	070303	Heavy duty vehicles	Urban	Gasoline	0,45	456,62	696,09	14,21	7102,99	72,78	0,61	0,20	40,59
2009	070400	Mopeds	Urban	Gasoline	0,45	129,62	8889,08	142,19	9581,58	72,78	1,24	1,24	139,02
2009	070501	Motorcycles	Highway	Gasoline	0,45	269,39	854,98	102,85	12090,75	72,78	1,28	1,28	22,72
2009	070502	Motorcycles	Rural	Gasoline	0,45	192,38	832,68	124,55	11313,83	72,78	1,56	1,56	27,72
2009	070503	Motorcycles	Urban	Gasoline	0,45	118,86	1019,07	127,53	10859,93	72,78	1,52	1,52	27,03
2009	080100	Military		AvGas	22,99	859,00	1242,60	21,90	6972,00	73,00	2,00	1,60	10,00
2009	080100	Military		Diesel	0,47	389,51	18,42	2,05	82,75	74,00	2,73	0,35	14,50
2009	080100	Military		Gasoline	0,46	129,33	175,09	7,54	1503,62	73,00	1,75	23,22	1,69
2009	080100	Military		Jet fuel	22,99	250,57	24,94	2,65	229,89	72,00	2,30	0,00	1,16
2009	080200	Railways		Diesel	0,47	836,81	55,89	2,15	144,66	74,00	2,04	0,20	27,13
2009	080300	Inland waterways		Diesel	46,84	842,80	162,30	2,64	445,05	74,00	2,97	0,17	99,56

Continued

Year	SNAP ID	Category	Fuel type	SO_2	NO_x	NMVOC	CH_4	CO	CO_2	N_2O	NH_3	TSP
				g pr GJ	g pr GJ	g pr GJ	g pr GJ	g pr GJ	g pr GJ	g pr GJ	g pr GJ	g pr GJ
2009	080300	Inland waterways	Gasoline	0,46	517,18	1365,08	61,52	13946,94	73,00	1,41	0,10	47,96
2009	080402	National sea traffic	Diesel	46,84	970,74	52,37	1,51	86,75	74,00	4,68	0,00	21,55
2009	080402	National sea traffic	Residual oil	586,80	1886,45	62,25	1,93	205,36	78,00	4,89	0,00	51,05
2009	080403	Fishing	Diesel	46,84	1367,70	57,22	1,77	188,76	74,00	4,68	0,00	21,55
2009	080403	Fishing	LPG	0,00	1249,00	384,94	20,26	443,00	65,00	0,00	0,00	0,20
2009	080404	International sea traffic	Diesel	46,84	1562,60	56,55	1,75	186,57	74,00	4,68	0,00	21,55
2009	080404	International sea traffic	Residual oil	733,50	2100,18	62,13	1,92	204,97	78,00	4,89	0,00	63,83
2009	080501	Air traffic, Dom. < 3000 ft.	AvGas	22,83	859,00	1242,60	21,90	6972,00	73,00	2,00	1,60	10,00
2009	080501	Air traffic, Dom. < 3000 ft.	Jet fuel	22,99	299,23	71,46	7,59	192,55	72,00	10,85	0,00	1,16
2009	080502	Air traffic, Int. < 3000 ft.	AvGas	22,83	859,00	1242,60	21,90	6972,00	73,00	2,00	1,60	10,00
2009	080502	Air traffic, Int. < 3000 ft.	Jet fuel	22,99	294,91	23,08	2,45	176,23	72,00	7,90	0,00	1,16
2009	080503	Air traffic, Dom. > 3000 ft.	Jet fuel	22,99	275,78	19,38	2,06	113,69	72,00	2,30	0,00	1,16
2009	080504	Air traffic, Int. > 3000 ft.	Jet fuel	22,99	238,94	7,14	0,76	54,53	72,00	2,30	0,00	1,16
2009	080600	Agriculture	Diesel	2,34	623,15	61,56	1,00	350,97	74,00	3,17	0,18	48,30
2009	080600	Agriculture	Gasoline	0,46	111,21	1198,25	160,47	21741,45	73,00	1,72	1,52	31,17
2009	080700	Forestry	Diesel	2,34	453,17	33,45	0,54	248,17	74,00	3,21	0,18	27,86
2009	080700	Forestry	Gasoline	0,46	76,20	6037,15	49,79	17249,02	73,00	0,44	0,09	79,13
2009	080800	Industry	Diesel	2,34	586,11	65,50	1,07	332,21	74,00	3,09	0,18	56,52
2009	080800	Industry	Gasoline	0,46	207,71	1551,34	108,68	13776,12	73,00	1,48	0,10	16,59
2009	080800	Industry	LPG	0,00	1328,11	146,09	7,69	104,85	65,00	3,50	0,21	4,89
2009	080900	Household and gardening	Gasoline	0,46	97,45	2401,47	76,04	29381,95	73,00	1,25	0,09	16,51
2009	081100	Commercial and institutional	Gasoline	0,46	92,03	2160,09	70,04	30239,09	73,00	1,11	0,09	27,90
2009	080501	Air traffic, Dom. < 3000 ft.	AvGas	22,83	859,00	1242,60	21,90	6972,00	73,00	2,00	1,60	10,00
2009	080501	Air traffic, Dom. < 3000 ft.	Jet fuel	22,99	285,51	108,59	11,53	263,98	72,00	6,46	0,00	1,16
2009	080502	Air traffic, Int. < 3000 ft.	AvGas	22,83	859,00	1242,60	21,90	6972,00	73,00	2,00	1,60	10,00
2009	080502	Air traffic, Int. < 3000 ft.	Jet fuel	22,99	337,22	72,55	7,70	272,32	72,00	3,87	0,00	1,16
2009	080503	Air traffic, Dom. > 3000 ft.	Jet fuel	22,99	280,51	18,06	1,92	61,14	72,00	2,30	0,00	1,16
2009	080504	Air traffic, Int. > 3000 ft.	Jet fuel	22,99	310,99	10,91	1,16	33,10	72,00	2,30	0,00	1,16

1990 emissions for CO_2, CH_4, N_2O, SO_2, NO_x; NMVOC, NH_3 and TSP.

Year	SNAP ID	Category		Fuel type	Fuel	SO_2	NO_x	NMVOC	CH_4	CO	CO_2	N_2O	NH_3	TSP
					PJ	tonnes	tonnes	tonnes	tonnes	tonnes	ktonnes	tonnes	tonnes	tonnes
1990	070101	Passenger cars	Highway	Diesel	1,226	114,87	345,56	30,74	4,59	220,35	90,74	0,00	0,57	97,47
1990	070101	Passenger cars	Highway	Gasoline	10,527	24,04	14126,19	3924,34	115,65	36550,79	768,50	28,92	8,90	129,66
1990	070101	Passenger cars	Highway	LPG	0,011	0,00	12,22	1,99	0,11	41,54	0,69	0,00	0,00	0,11
1990	070102	Passenger cars	Rural	Diesel	2,564	240,15	725,44	107,91	17,48	687,24	189,71	0,00	1,46	192,60
1990	070102	Passenger cars	Rural	Gasoline	23,760	54,25	27498,37	11640,51	329,26	94459,77	1734,49	73,48	22,61	337,77
1990	070102	Passenger cars	Rural	LPG	0,022	0,00	28,06	6,86	0,38	25,76	1,46	0,00	0,00	0,33
1990	070103	Passenger cars	Urban	Diesel	3,295	308,69	752,51	276,29	27,73	1044,98	243,85	0,00	1,15	402,81
1990	070103	Passenger cars	Urban	Gasoline	28,666	65,45	17672,12	27035,58	1432,67	284073,19	2092,60	88,92	17,78	384,77
1990	070103	Passenger cars	Urban	LPG	0,029	0,00	17,94	12,70	0,68	38,03	1,88	0,00	0,00	0,34
1990	070201	Light duty vehicles	Highway	Diesel	1,840	172,39	498,11	55,56	4,78	633,30	136,18	0,00	0,60	192,27
1990	070201	Light duty vehicles	Highway	Gasoline	0,265	0,60	362,30	45,06	2,67	790,46	19,32	0,70	0,21	4,28
1990	070201	Light duty vehicles	Highway	LPG	0,008	0,00	8,68	1,41	0,08	29,51	0,49	0,00	0,00	0,08
1990	070202	Light duty vehicles	Rural	Diesel	5,886	551,40	1761,44	195,56	25,09	2109,75	435,58	0,00	2,09	634,13
1990	070202	Light duty vehicles	Rural	Gasoline	0,982	2,24	1167,44	257,85	14,98	2274,44	71,68	2,43	0,75	14,98
1990	070202	Light duty vehicles	Rural	LPG	0,022	0,00	27,45	6,71	0,37	25,20	1,43	0,00	0,00	0,32
1990	070203	Light duty vehicles	Urban	Diesel	5,804	543,73	2828,44	324,26	36,60	2385,57	429,52	0,00	1,51	762,91
1990	070203	Light duty vehicles	Urban	Gasoline	1,218	2,78	763,60	868,35	49,43	8926,67	88,95	2,71	0,54	10,84
1990	070203	Light duty vehicles	Urban	LPG	0,026	0,00	16,15	11,44	0,62	34,27	1,69	0,00	0,00	0,31
1990	070301	Heavy duty vehicles	Highway	Diesel	9,549	894,51	9763,34	458,80	59,29	1809,63	706,62	28,81	2,88	367,64
1990	070301	Heavy duty vehicles	Highway	Gasoline	0,047	0,11	48,50	22,18	0,45	355,68	3,41	0,04	0,01	2,59
1990	070302	Heavy duty vehicles	Rural	Diesel	16,737	1567,87	17426,38	1004,08	111,45	3390,48	1238,54	46,73	4,67	676,90
1990	070302	Heavy duty vehicles	Rural	Gasoline	0,082	0,19	93,21	66,99	1,37	683,54	5,96	0,07	0,02	4,97
1990	070303	Heavy duty vehicles	Urban	Diesel	13,045	1222,03	12992,09	1037,60	152,14	3197,03	965,34	27,85	2,79	606,28
1990	070303	Heavy duty vehicles	Urban	Gasoline	0,077	0,18	35,05	53,43	1,09	545,19	5,60	0,05	0,02	3,12
1990	070400	Mopeds	Urban	Gasoline	0,291	0,66	5,31	3636,22	58,16	3665,17	21,23	0,27	0,27	49,93
1990	070501	Motorcycles	Highway	Gasoline	0,056	0,13	14,88	60,41	7,32	918,58	4,11	0,08	0,08	1,79
1990	070502	Motorcycles	Rural	Gasoline	0,135	0,31	25,04	132,60	21,52	2131,72	9,86	0,22	0,22	5,25
1990	070503	Motorcycles	Urban	Gasoline	0,173	0,40	19,58	199,25	26,89	2633,25	12,66	0,28	0,28	6,57
1990	080100	Military		AvGas	0,005	0,11	4,22	6,11	0,11	34,26	0,36	0,01	0,01	0,05
1990	080100	Military		Diesel	0,146	13,69	114,82	8,51	1,07	37,74	10,82	0,25	0,04	9,59
1990	080100	Military		Gasoline	0,001	0,00	0,92	1,14	0,03	6,51	0,07	0,00	0,00	0,01
1990	080100	Military		Jet fuel	1,497	34,41	375,06	37,33	3,96	344,09	107,77	3,44		1,74
1990	080200	Railways		Diesel	4,010	375,64	4912,78	320,54	12,32	895,07	296,74	8,18	0,82	201,55
1990	080200	Railways		Gasoline	0,000	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00

Continued	SNAP ID	Category	Fuel type	Fuel	SO_2	NO_x	NMVOC	CH_4	CO	CO_2	N_2O	NH_3	TSP
Year				PJ	tonnes	tonnes	tonnes	tonnes	tonnes	ktonnes	tonnes	tonnes	tonnes
1990	080200	Railways	Kerosene	0,000	0,00	0,00	0,00	0,00	0,00	0,01	0,00		0,01
1990	080300	Inland waterways	Diesel	0,343	32,10	337,02	58,86	0,96	155,43	25,35	1,01	0,06	36,64
1990	080300	Inland waterways	Gasoline	0,309	0,71	90,06	1114,91	15,58	4282,54	22,57	0,24	0,02	56,40
1990	080402	National sea traffic	Diesel	5,285	495,12	5836,01	267,28	8,27	881,74	391,12	24,76		122,69
1990	080402	National sea traffic	Kerosene	0,000	0,00	0,02	0,00	0,00	0,01	0,03	0,00		0,00
1990	080402	National sea traffic	LPG	0,002		2,24	0,69	0,04	0,79	0,12	0,00		0,00
1990	080402	National sea traffic	Residual oil	4,571	5901,32	7383,82	244,28	7,56	805,87	356,56	22,35		682,25
1990	080403	Fishing	Diesel	7,920	741,91	8332,71	389,10	12,03	1283,63	586,07	37,10		183,85
1990	080403	Fishing	Gasoline	0,000	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
1990	080403	Fishing	Kerosene	0,026	0,06	1,29	0,08	0,18	0,52	1,86	0,00		0,13
1990	080403	Fishing	LPG	0,042		52,86	16,29	0,86	18,75	2,75	0,00		0,01
1990	080403	Fishing	Residual oil	0,000	0,00	0,00	0,00	0,00	0,00	0,00	0,00		0,00
1990	080404	International sea traffic	Diesel	11,289	1057,56	13644,52	558,38	17,27	1842,07	835,42	52,88		262,07
1990	080404	International sea traffic	Residual oil	27,815	40259,78	46994,61	1501,54	46,44	4953,54	2169,54	136,01		5268,82
1990	080501	Air traffic, Dom. < 3000 ft.	AvGas	0,105	2,40	90,15	130,41	2,30	731,69	7,66	0,21	0,17	1,05
1990	080501	Air traffic, Dom. < 3000 ft.	Jet fuel	0,422	9,71	132,78	6,30	0,67	38,17	30,40	2,40		0,49
1990	080502	Air traffic, Int. < 3000 ft.	AvGas	0,031	0,70	26,34	38,10	0,67	213,76	2,24	0,06	0,05	0,31
1990	080502	Air traffic, Int. < 3000 ft.	Jet fuel	0,132	3,04	40,93	2,18	0,23	22,36	9,53	0,94		0,15
1990	080503	Air traffic, Dom. > 3000 ft.	Jet fuel	1,026	23,59	338,70	12,68	1,35	93,11	73,87	2,36		1,19
1990	080504	Air traffic, Int. > 3000 ft.	Jet fuel	1,612	37,06	393,62	10,45	1,11	87,20	116,06	3,71		1,87
1990	080600	Agriculture	Diesel	16,496	1545,32	12518,46	2587,36	42,07	10483,86	1220,72	48,34	2,76	2382,90
1990	080600	Agriculture	Gasoline	0,709	1,62	22,40	673,10	62,68	33688,19	51,75	0,91	0,06	4,65
1990	080700	Forestry	Diesel	0,145	13,62	124,63	22,74	0,37	93,84	10,76	0,43	0,02	21,66
1990	080700	Forestry	Gasoline	0,341	0,78	13,79	2460,65	20,63	6165,33	24,92	0,13	0,03	34,56
1990	080800	Industry	Diesel	10,158	951,61	9483,66	1810,53	29,44	6661,90	751,72	29,87	1,71	1569,49
1990	080800	Industry	Gasoline	0,175	0,40	23,88	282,25	21,13	2592,92	12,79	0,23	0,02	2,17
1990	080800	Industry	LPG	1,185	0,00	1573,62	173,10	9,11	124,23	77,02	4,14	0,25	5,80
1990	080900	Household and gardening	Gasoline	0,535	1,22	34,24	1801,26	50,96	17606,46	39,06	0,62	0,04	11,10
1990	081100	Commercial and institutional	Gasoline	1,010	2,31	69,51	2303,07	98,83	30181,04	73,72	1,10	0,08	24,24
1990	080501	Air traffic, Dom. < 3000 ft.	AvGas	0,009	0,20	7,42	10,74	0,19	60,25	0,63	0,02	0,01	0,09
1990	080501	Air traffic, Dom. < 3000 ft.	Jet fuel	0,502	11,54	142,54	10,41	1,11	65,13	36,16	2,30		0,58
1990	080502	Air traffic, Int. < 3000 ft.	AvGas	0,006	0,13	4,82	6,97	0,12	39,13	0,41	0,01	0,01	0,06
1990	080502	Air traffic, Int. < 3000 ft.	Jet fuel	2,001	46,00	650,12	68,54	7,28	314,49	144,09	7,58		2,32
1990	080503	Air traffic, Dom. > 3000 ft.	Jet fuel	1,305	30,00	410,96	15,38	1,63	109,71	93,97	3,00		1,51
1990	080504	Air traffic, Int. > 3000 ft.	Jet fuel	20,330	467,36	5899,81	204,92	21,76	765,45	1463,78	46,74		23,58

2009 emissions for CO_2, CH_4, N_2O, SO_2, NO_x; NMVOC, NH_3 and TSP.

Year	SNAP ID	Category		Fuel type	Fuel PJ	SO_2 tonnes	NO_x tonnes	NMVOC tonnes	CH_4 tonnes	CO tonnes	CO_2 ktonnes	N_2O tonnes	NH_3 tonnes	TSP tonnes
2009	070101	Passenger cars	Highway	Diesel	6,306	2,95	1912,49	36,58	0,89	83,43	466,01	12,27	3,00	97,40
2009	070101	Passenger cars	Highway	Gasoline	11,464	5,21	1631,36	370,29	34,06	7862,70	834,34	8,22	354,07	10,36
2009	070101	Passenger cars	Highway	LPG	0,000	0,00	0,03	0,00	0,00	0,16	0,01	0,00	0,00	0,00
2009	070102	Passenger cars	Rural	Diesel	13,692	6,40	3554,78	114,81	3,84	350,59	1011,79	28,44	6,95	173,18
2009	070102	Passenger cars	Rural	Gasoline	25,166	11,43	2874,53	914,03	88,70	13552,89	1831,53	33,91	867,50	21,38
2009	070102	Passenger cars	Rural	LPG	0,000	0,00	0,06	0,01	0,00	0,12	0,01	0,00	0,00	0,00
2009	070103	Passenger cars	Urban	Diesel	13,537	6,33	3504,44	323,03	10,27	892,42	1000,30	61,58	5,13	268,63
2009	070103	Passenger cars	Urban	Gasoline	27,513	12,50	3644,75	6105,62	260,89	65430,50	2002,30	66,97	315,26	25,29
2009	070103	Passenger cars	Urban	LPG	0,000	0,00	0,04	0,03	0,00	0,19	0,01	0,00	0,00	0,00
2009	070201	Light duty vehicles	Highway	Diesel	3,177	1,49	722,43	67,56	0,71	411,35	234,73	4,83	1,17	69,33
2009	070201	Light duty vehicles	Highway	Gasoline	0,329	0,15	52,75	6,21	0,90	178,95	23,96	0,49	7,50	0,46
2009	070201	Light duty vehicles	Highway	LPG	0,000	0,00	0,02	0,00	0,00	0,20	0,02	0,00	0,00	0,00
2009	070202	Light duty vehicles	Rural	Diesel	9,269	4,33	2203,66	222,99	4,75	1031,53	684,94	15,41	3,72	165,96
2009	070202	Light duty vehicles	Rural	Gasoline	1,113	0,51	156,03	31,11	3,25	458,25	81,03	2,54	24,32	1,38
2009	070202	Light duty vehicles	Rural	LPG	0,001	0,00	0,05	0,01	0,00	0,24	0,04	0,00	0,00	0,01
2009	070203	Light duty vehicles	Urban	Diesel	8,840	4,13	2014,60	359,58	9,77	1206,54	653,22	27,49	2,53	220,87
2009	070203	Light duty vehicles	Urban	Gasoline	1,316	0,60	157,24	195,12	9,31	3857,12	95,75	5,12	7,55	1,12
2009	070203	Light duty vehicles	Urban	LPG	0,001	0,00	0,03	0,02	0,00	0,25	0,04	0,00	0,00	0,01
2009	070301	Heavy duty vehicles	Highway	Diesel	11,255	5,26	6223,44	141,71	39,93	1008,30	831,65	35,23	3,52	103,12
2009	070301	Heavy duty vehicles	Highway	Gasoline	0,034	0,02	35,12	16,06	0,33	257,53	2,46	0,03	0,01	1,87
2009	070302	Heavy duty vehicles	Rural	Diesel	18,173	8,50	10320,21	274,73	68,06	1676,57	1342,90	51,85	5,18	169,97
2009	070302	Heavy duty vehicles	Rural	Gasoline	0,057	0,03	65,54	47,10	0,96	480,63	4,18	0,05	0,02	3,50
2009	070303	Heavy duty vehicles	Urban	Diesel	12,926	6,04	7394,17	248,75	60,81	1380,94	955,12	28,52	2,85	140,22
2009	070303	Heavy duty vehicles	Urban	Gasoline	0,053	0,02	24,14	36,81	0,75	375,57	3,85	0,03	0,01	2,15
2009	070400	Mopeds	Urban	Gasoline	0,209	0,09	27,08	1857,34	29,71	2002,03	15,21	0,26	0,26	29,05
2009	070501	Motorcycles	Highway	Gasoline	0,117	0,05	31,59	100,25	12,06	1417,67	8,53	0,15	0,15	2,66
2009	070502	Motorcycles	Rural	Gasoline	0,258	0,12	49,56	214,53	32,09	2914,89	18,75	0,40	0,40	7,14
2009	070503	Motorcycles	Urban	Gasoline	0,310	0,14	36,85	315,95	39,54	3366,97	22,56	0,47	0,47	8,38
2009	080100	Military		AvGas	0,005	0,12	4,33	6,26	0,11	35,12	0,37	0,01	0,01	0,05
2009	080100	Military		Diesel	1,099	0,51	428,08	20,24	2,25	90,95	81,33	3,00	0,39	15,93
2009	080100	Military		Gasoline	0,009	0,00	1,14	1,55	0,07	13,29	0,65	0,02	0,21	0,01
2009	080100	Military		Jet fuel	1,079	24,79	270,25	26,90	2,86	247,94	77,65	2,48	0,00	1,25
2009	080200	Railways		Diesel	3,111	1,46	2603,18	173,87	6,68	450,01	230,20	6,35	0,62	84,40
2009	080200	Railways		Gasoline	0,000	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00

Continued													
Year	SNAP ID	Category	Fuel type	Fuel PJ	SO_2 tonnes	NO_x tonnes	NMVOC tonnes	CH_4 tonnes	CO tonnes	CO_2 ktonnes	N_2O tonnes	NH_3 tonnes	TSP tonnes
2009	080200	Railways	Kerosene	0,000	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
2009	080300	Inland waterways	Diesel	1,002	46,94	844,61	162,65	2,64	446,01	74,16	2,98	0,17	99,78
2009	080300	Inland waterways	Gasoline	0,353	0,16	182,53	481,79	21,71	4922,43	25,76	0,50	0,04	16,93
2009	080402	National sea traffic	Diesel	4,315	202,10	4188,54	225,97	6,53	374,33	319,30	20,21	0,00	92,97
2009	080402	National sea traffic	Kerosene	0,000									
2009	080402	National sea traffic	LPG	0,000									
2009	080402	National sea traffic	Residual oil	2,289	1343,34	4318,62	142,51	4,41	470,13	178,56	11,19		116,87
2009	080403	Fishing	Diesel	7,517	352,07	10280,54	430,08	13,30	1418,81	556,23	35,21	0,00	161,96
2009	080403	Fishing	Gasoline	0,000	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
2009	080403	Fishing	Kerosene	0,000									
2009	080403	Fishing	LPG	0,012	0,00	15,11	4,66	0,25	5,36	0,79	0,00	0,00	0,00
2009	080403	Fishing	Residual oil	0,000	0,00	0,00	0,00	0,00	0,00	0,00	0,00		0,00
2009	080404	International sea traffic	Diesel	10,164	476,06	15881,99	574,80	17,78	1896,25	752,12	47,61		219,00
2009	080404	International sea traffic	Residual oil	9,416	6906,88	19776,10	585,04	18,09	1930,03	734,48	46,05		601,09
2009	080501	Air traffic, Dom. < 3000 ft.	AvGas	0,073	1,66	62,54	90,47	1,59	507,62	5,31	0,15	0,12	0,73
2009	080501	Air traffic, Dom. < 3000 ft.	Jet fuel	0,229	5,27	68,56	16,37	1,74	44,12	16,50	2,49		0,27
2009	080502	Air traffic, Int. < 3000 ft.	AvGas	0,003	0,08	2,89	4,18	0,07	23,47	0,25	0,01	0,01	0,03
2009	080502	Air traffic, Int. < 3000 ft.	Jet fuel	0,261	6,00	77,00	6,03	0,64	46,01	18,80	2,06		0,30
2009	080503	Air traffic, Dom. > 3000 ft.	Jet fuel	0,586	13,47	161,53	11,35	1,21	66,59	42,17	1,35		0,68
2009	080504	Air traffic, Int. > 3000 ft.	Jet fuel	2,834	65,15	677,17	20,24	2,15	154,54	204,05	6,52		3,29
2009	080600	Agriculture	Diesel	16,646	38,98	10372,88	1024,68	16,66	5842,16	1231,79	52,73	3,01	803,91
2009	080600	Agriculture	Gasoline	0,501	0,23	55,71	600,30	80,39	10892,04	36,57	0,86	0,76	15,61
2009	080700	Forestry	Diesel	0,159	0,37	72,08	5,32	0,09	39,48	11,77	0,51	0,03	4,43
2009	080700	Forestry	Gasoline	0,073	0,03	5,55	439,44	3,62	1255,55	5,31	0,03	0,01	5,76
2009	080800	Industry	Diesel	10,284	24,09	6027,83	673,63	10,95	3416,61	761,05	31,82	1,82	581,23
2009	080800	Industry	Gasoline	0,118	0,05	24,44	182,51	12,79	1620,75	8,59	0,17	0,01	1,95
2009	080800	Industry	LPG	0,817	0,00	1085,11	119,36	6,28	85,67	53,11	2,86	0,17	4,00
2009	080900	Household and gardening	Gasoline	0,862	0,39	84,05	2071,21	65,58	25341,18	62,96	1,08	0,08	14,24
2009	081100	Commercial and institutional	Gasoline	2,389	1,09	219,82	5159,43	167,29	72226,83	174,36	2,65	0,21	66,64
2009	080501	Air traffic, Dom. < 3000 ft.	AvGas	0,001	0,01	0,50	0,72	0,01	4,07	0,04	0,00	0,00	0,01
2009	080501	Air traffic, Dom. < 3000 ft.	Jet fuel	0,286	6,59	81,79	31,11	3,30	75,62	20,63	1,85		0,33
2009	080502	Air traffic, Int. < 3000 ft.	AvGas	0,000	0,01	0,42	0,61	0,01	3,42	0,04	0,00	0,00	0,00
2009	080502	Air traffic, Int. < 3000 ft.	Jet fuel	2,517	57,87	848,84	182,61	19,39	685,49	181,24	9,73	0,00	2,92

Continued													
Year	SNAP ID	Category	Fuel type	Fuel PJ	SO_2 tonnes	NO_x tonnes	NMVOC tonnes	CH_4 tonnes	CO tonnes	CO_2 ktonnes	N_2O tonnes	NH_3 tonnes	TSP tonnes
2009	080503	Air traffic, Dom. > 3000 ft.	Jet fuel	0,984	22,63	276,13	17,78	1,89	60,19	70,88	2,26	0,00	1,14
2009	080504	Air traffic, Int. > 3000 ft.	Jet fuel	26,520	609,67	8247,70	289,26	30,72	877,84	1909,47	60,97	0,00	30,76

Non-exhaust emission factors, activity data and total non-exhaust emissions of TSP, PM_{10} and $PM_{2.5}$ in 2009.

Year	Source	Category	Mileage kmkveh	TSP mg pr km	PM_{10} mg pr km	$PM_{2.5}$ mg pr km	As µg pr km	Cd µg pr km	Cr µg pr km	Cu µg pr km	Hg µg pr km	Ni µg pr km	Pb µg pr km	Se µg pr km	Zn µg pr km
2009	Brake wear	1	40824463,63	7,5	7,4	2,9	0,1	0,1	0,8	789,2	0,0	0,8	104,1	0,2	151,4
2009	Brake wear	2	8142866,592	13,6	13,3	5,3	0,1	0,1	1,4	1427,8	0,0	1,4	188,3	0,3	274,0
2009	Brake wear	3	3236089,017	34,3	33,6	13,4	0,3	0,1	5,6	258,7	0,0	3,9	14,0	0,7	257,9
2009	Brake wear	4	674010,8652	47,1	46,1	18,4	0,5	0,1	3,0	644,5	0,0	7,5	34,4	0,9	439,4
2009	Brake wear	5	259079,8056	6,2	6,1	2,4	0,1	0,1	0,7	649,2	0,0	0,7	85,6	0,1	124,6
2009	Brake wear	6	513019,3691	4,2	4,1	1,6	0,0	0,0	0,4	441,0	0,0	0,4	58,1	0,1	84,6
2009	Road abrasion	1	40824463,63	15,0	7,5	4,1	0,0	0,0	0,3	0,1	0,0	0,2	0,7	0,0	1,1
2009	Road abrasion	2	8142866,592	15,0	7,5	4,1	0,0	0,0	0,3	0,1	0,0	0,2	0,7	0,0	1,1
2009	Road abrasion	3	3236089,017	75,1	37,6	20,3	0,0	0,0	1,5	0,8	0,0	1,2	3,5	0,0	5,7
2009	Road abrasion	4	674010,8652	76,0	38,0	20,5	0,0	0,0	1,5	0,8	0,0	1,2	3,6	0,0	5,7
2009	Road abrasion	5	259079,8056	6,0	3,0	1,6	0,0	0,0	0,1	0,1	0,0	0,1	0,3	0,0	0,5
2009	Road abrasion	6	513019,3691	6,0	3,0	1,6	0,0	0,0	0,1	0,1	0,0	0,1	0,3	0,0	0,5
2009	Tyre wear	1	40824463,63	10,8	6,5	4,6	0,0	0,0	0,0	0,2	0,0	0,3	0,9	0,2	118,5
2009	Tyre wear	2	8142866,592	17,2	10,3	7,2	0,0	0,0	0,1	0,3	0,0	0,4	1,4	0,3	187,7
2009	Tyre wear	3	3236089,017	65,6	39,3	27,5	0,1	0,2	0,2	1,0	0,0	1,7	5,3	1,3	716,9
2009	Tyre wear	4	674010,8652	60,8	36,5	25,5	0,0	0,2	0,2	0,9	0,0	1,6	4,9	1,2	664,8
2009	Tyre wear	5	259079,8056	14,2	8,5	6,0	0,0	0,0	0,1	0,2	0,0	0,4	1,1	0,3	154,9
2009	Tyre wear	6	513019,3691	17,8	10,7	7,5	0,0	0,0	0,1	0,3	0,0	0,5	1,4	0,4	194,1
2009	Total	1	40824464	33,3	21,4	11,5	0,1	0,1	1,1	789,5	0,0	1,3	105,6	0,4	271,1
2009	Total	2	8142867	45,8	31,1	16,6	0,1	0,2	1,8	1428,3	0,0	2,1	190,3	0,6	462,9
2009	Total	3	3236089	175,0	110,5	61,2	0,4	0,3	7,4	260,5	0,0	6,8	22,8	2,0	980,4
2009	Total	4	674011	183,9	120,6	64,4	0,5	0,3	4,7	646,2	0,0	10,2	42,8	2,2	1110,0
2009	Total	5	259080	26,3	17,6	10,0	0,1	0,1	0,8	649,5	0,0	1,1	87,0	0,4	280,0
2009	Total	6	513019	27,9	17,8	10,7	0,1	0,1	0,6	441,3	0,0	1,0	59,9	0,4	279,2

Year	Source	Category	TSP	PM_{10}	$PM_{2.5}$	As	Cd	Cr	Cu	Hg	Ni	Pb	Se	Zn
			tonnes	tonnes	tonnes	kg	kg	kg	kg	kg	kg	kg	kg	kg
2009	Brake wear	1	307	300	120	3,066	3,008	32,257	32217,063		32,288	4247,846	6,133	6182,811
2009	Brake wear	2	111	108	43	1,107	1,086	11,641	11626,702		11,652	1532,990	2,213	2231,293
2009	Brake wear	3	111	109	43	1,111	0,341	18,216	837,319		12,662	45,207	2,221	834,547
2009	Brake wear	4	32	31	12	0,317	0,096	2,031	434,416		5,044	23,173	0,634	296,163
2009	Brake wear	5	2	2	1	0,016	0,016	0,168	168,201		0,169	22,177	0,032	32,280
2009	Brake wear	6	2	2	1	0,022	0,021	0,227	226,226		0,227	29,828	0,043	43,415
2009	Road abrasion	1	612	306	165	0,000	0,058	12,152	6,118	0,035	9,721	28,797	0,000	46,270
2009	Road abrasion	2	122	61	33	0,000	0,012	2,424	1,220	0,007	1,939	5,744	0,000	9,229
2009	Road abrasion	3	243	122	66	0,000	0,023	4,823	2,428	0,014	3,858	11,430	0,000	18,365
2009	Road abrasion	4	51	26	14	0,000	0,005	1,017	0,512	0,003	0,813	2,409	0,000	3,871
2009	Road abrasion	5	2	1	0	0,000	0,000	0,031	0,016	0,000	0,025	0,073	0,000	0,117
2009	Road abrasion	6	3	2	1	0,000	0,000	0,061	0,031	0,000	0,049	0,145	0,000	0,233
2009	Tyre wear	1	442	265	186	0,354	1,150	1,592	6,899		11,278	35,602	8,845	4836,610
2009	Tyre wear	2	140	84	59	0,112	0,363	0,503	2,181		3,565	11,253	2,796	1528,698
2009	Tyre wear	3	212	127	89	0,170	0,552	0,764	3,309		5,409	17,076	4,243	2319,820
2009	Tyre wear	4	41	25	17	0,033	0,107	0,148	0,639		1,045	3,299	0,820	448,105
2009	Tyre wear	5	4	2	2	0,003	0,010	0,013	0,057		0,094	0,295	0,073	40,138
2009	Tyre wear	6	9	5	4	0,007	0,024	0,033	0,142		0,232	0,733	0,182	99,584
2009	Total	1	1361	872	471	3,420	4,216	46,002	32230,079	0,035	53,287	4312,245	14,978	11065,692
2009	Total	2	373	253	135	1,218	1,461	14,568	11630,102	0,007	17,156	1549,987	5,009	3769,220
2009	Total	3	566	358	198	1,280	0,916	23,803	843,056	0,014	21,930	73,713	6,464	3172,732
2009	Total	4	124	81	43	0,350	0,207	3,195	435,567	0,003	6,902	28,881	1,454	748,139
2009	Total	5	7	5	3	0,019	0,025	0,212	168,274	0,000	0,287	22,546	0,105	72,535
2009	Total	6	14	9	5	0,029	0,045	0,320	226,399	0,000	0,508	30,706	0,225	143,232

Exhaust heavy metal emission factors for 1990 and 2009 in CollectER format.

Year	SNAP ID	Category		Fuel type	Arsenic mg pr GJ	Cadmium mg pr GJ	Chromium mg pr GJ	Copper mg pr GJ	Mercury mg pr GJ	Nickel mg pr GJ	Lead mg pr GJ	Selenium mg pr GJ	Zinc mg pr GJ
1990	070101	Passenger cars	Highway	Diesel	0,002	0,287	0,914	0,648	0,124	0,291	1,727	0,002	57,591
1990	070101	Passenger cars	Highway	Gasoline	0,007	0,266	0,379	1,016	0,199	0,314	1471,982	0,005	52,967
1990	070101	Passenger cars	Highway	LPG	0,000	0,295	0,266	1,034	0,000	0,295	0,886	0,000	59,059
1990	070102	Passenger cars	Rural	Diesel	0,002	0,349	1,068	0,759	0,124	0,352	2,096	0,002	69,910
1990	070102	Passenger cars	Rural	Gasoline	0,007	0,299	0,408	1,132	0,199	0,346	1472,080	0,005	59,541
1990	070102	Passenger cars	Rural	LPG	0,000	0,354	0,319	1,240	0,000	0,354	1,063	0,000	70,871
1990	070103	Passenger cars	Urban	Diesel	0,002	0,214	0,731	0,516	0,124	0,217	1,287	0,002	42,946
1990	070103	Passenger cars	Urban	Gasoline	0,007	0,196	0,316	0,774	0,199	0,244	1471,774	0,005	39,083
1990	070103	Passenger cars	Urban	LPG	0,000	0,217	0,195	0,758	0,000	0,217	0,650	0,000	43,335
1990	070201	Light duty vehicles	Highway	Diesel	0,002	0,190	0,672	0,474	0,124	0,194	1,147	0,002	38,267
1990	070201	Light duty vehicles	Highway	Gasoline	0,007	0,245	0,360	0,944	0,199	0,293	1471,920	0,005	48,812
1990	070201	Light duty vehicles	Highway	LPG	0,000	0,195	0,175	0,681	0,000	0,195	0,584	0,000	38,924
1990	070202	Light duty vehicles	Rural	Diesel	0,002	0,208	0,717	0,506	0,124	0,212	1,254	0,002	41,830
1990	070202	Light duty vehicles	Rural	Gasoline	0,007	0,231	0,348	0,896	0,199	0,279	1471,878	0,005	46,074
1990	070202	Light duty vehicles	Rural	LPG	0,000	0,234	0,210	0,817	0,000	0,234	0,701	0,000	46,709
1990	070203	Light duty vehicles	Urban	Diesel	0,002	0,153	0,579	0,407	0,124	0,157	0,924	0,002	30,817
1990	070203	Light duty vehicles	Urban	Gasoline	0,007	0,137	0,263	0,565	0,199	0,185	1471,595	0,005	27,191
1990	070203	Light duty vehicles	Urban	LPG	0,000	0,143	0,128	0,500	0,000	0,143	0,428	0,000	28,551
1990	070301	Heavy duty vehicles	Highway	Diesel	0,002	0,148	0,566	0,397	0,124	0,151	0,891	0,002	29,743
1990	070301	Heavy duty vehicles	Highway	Gasoline	0,007	0,207	0,326	0,812	0,199	0,255	1471,806	0,005	41,266
1990	070302	Heavy duty vehicles	Rural	Diesel	0,002	0,137	0,539	0,379	0,124	0,141	0,829	0,002	27,650
1990	070302	Heavy duty vehicles	Rural	Gasoline	0,007	0,221	0,338	0,859	0,199	0,269	1471,847	0,005	43,989
1990	070303	Heavy duty vehicles	Urban	Diesel	0,002	0,106	0,461	0,322	0,124	0,109	0,640	0,002	21,359
1990	070303	Heavy duty vehicles	Urban	Gasoline	0,007	0,146	0,271	0,597	0,199	0,194	1471,622	0,005	29,002
1990	070400	Mopeds	Urban	Gasoline	0,007	0,005	0,144	0,103	0,199	0,053	1471,199	0,005	0,753
1990	070501	Motorcycles	Highway	Gasoline	0,007	0,106	0,235	0,456	0,199	0,153	1471,501	0,005	20,940
1990	070502	Motorcycles	Rural	Gasoline	0,007	0,128	0,255	0,536	0,199	0,176	1471,570	0,005	25,500
1990	070503	Motorcycles	Urban	Gasoline	0,007	0,125	0,252	0,524	0,199	0,173	1471,560	0,005	24,847
1990	080100	Military		AvGas	0,007	0,253	0,367	0,972	0,198	0,301	12785,388	0,005	50,452
1990	080100	Military		Diesel	0,002	0,186	0,660	0,465	0,124	0,189	1,118	0,002	37,295
1990	080100	Military		Gasoline	0,007	0,253	0,367	0,972	0,198	0,301	0,773	0,005	50,452
1990	080100	Military		Jet fuel	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000
1990	080200	Railways		Diesel	0,002	0,186	0,660	0,465	0,124	0,189	1,118	0,002	37,295
1990	080200	Railways		Kerosene	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000

Continued	SNAP ID	Category	Fuel type	Arsenic mg pr GJ	Cadmium mg pr GJ	Chromium mg pr GJ	Copper mg pr GJ	Mercury mg pr GJ	Nickel mg pr GJ	Lead mg pr GJ	Selenium mg pr GJ	Zinc mg pr GJ
1990	080300	Inland waterways	Diesel	0,002	0,186	0,660	0,465	0,124	0,189	1,118	0,002	37,295
1990	080300	Inland waterways	Gasoline	0,007	0,253	0,367	0,972	0,198	0,301	0,773	0,005	50,452
1990	080402	National sea traffic	Diesel	1,171	0,234	0,937	1,171	1,170	1,639	2,340	4,684	11,710
1990	080402	National sea traffic	Kerosene	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000
1990	080402	National sea traffic	LPG	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000
1990	080402	National sea traffic	Residual oil	12,225	0,733	4,890	12,225	0,490	733,496	4,890	9,780	22,005
1990	080403	Fishing	Diesel	1,171	0,234	0,937	1,171	1,170	1,639	2,340	4,684	11,710
1990	080403	Fishing	Kerosene	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000
1990	080403	Fishing	LPG	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000
1990	080404	International sea traffic	Diesel	1,171	0,234	0,937	1,171	1,170	1,639	2,340	4,684	11,710
1990	080404	International sea traffic	Residual oil	12,225	0,733	4,890	12,225	0,490	733,496	4,890	9,780	22,005
1990	080501	Air traffic, Dom. < 3000 ft.	AvGas	0,007	0,253	0,367	0,972	0,198	0,301	13505,692	0,005	50,452
1990	080501	Air traffic, Dom. < 3000 ft.	Jet fuel	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000
1990	080502	Air traffic, Int. < 3000 ft.	AvGas	0,007	0,253	0,367	0,972	0,198	0,301	13505,692	0,005	50,452
1990	080502	Air traffic, Int. < 3000 ft.	Jet fuel	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000
1990	080503	Air traffic, Dom. > 3000 ft.	Jet fuel	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000
1990	080504	Air traffic, Int. > 3000 ft.	Jet fuel	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000
1990	080600	Agriculture	Diesel	0,002	0,186	0,660	0,465	0,124	0,189	1,118	0,002	37,295
1990	080600	Agriculture	Gasoline	0,007	0,253	0,367	0,972	0,198	0,301	0,773	0,005	50,452
1990	080700	Forestry	Diesel	0,002	0,186	0,660	0,465	0,124	0,189	1,118	0,002	37,295
1990	080700	Forestry	Gasoline	0,007	0,253	0,367	0,972	0,198	0,301	0,773	0,005	50,452
1990	080800	Industry	Diesel	0,002	0,186	0,660	0,465	0,124	0,189	1,118	0,002	37,295
1990	080800	Industry	Gasoline	0,007	0,253	0,367	0,972	0,198	0,301	0,773	0,005	50,452
1990	080800	Industry	LPG	0,000	0,131	0,118	0,457	0,000	0,131	0,392	0,000	26,126
1990	080900	Household and gardening	Gasoline	0,007	0,253	0,367	0,972	0,198	0,301	0,773	0,005	50,452
1990	081100	Commercial and institutional	Gasoline	0,007	0,253	0,367	0,972	0,198	0,301	0,773	0,005	50,452
1990	080501	Air traffic, Dom. < 3000 ft.	AvGas	0,007	0,253	0,367	0,972	0,198	0,301	13505,692	0,005	50,452
1990	080501	Air traffic, Dom. < 3000 ft.	Jet fuel	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000
1990	080502	Air traffic, Int. < 3000 ft.	AvGas	0,007	0,253	0,367	0,972	0,198	0,301	13505,692	0,005	50,452
1990	080502	Air traffic, Int. < 3000 ft.	Jet fuel	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000
1990	080503	Air traffic, Dom. > 3000 ft.	Jet fuel	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000
1990	080504	Air traffic, Int. > 3000 ft.	Jet fuel	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000

Continued	SNAP ID	Category		Fuel type	Arsenic mg pr GJ	Cadmium mg pr GJ	Chromium mg pr GJ	Copper mg pr GJ	Mercury mg pr GJ	Nickel mg pr GJ	Lead mg pr GJ	Selenium mg pr GJ	Zinc mg pr GJ
2009	070101	Passenger cars	Highway	Diesel	0,002	0,262	0,852	0,603	0,124	0,266	1,578	0,002	52,645
2009	070101	Passenger cars	Highway	Gasoline	0,007	0,287	0,398	1,091	0,198	0,335	0,875	0,005	57,253
2009	070101	Passenger cars	Highway	LPG	0,000	0,267	0,241	0,936	0,000	0,267	0,802	0,000	53,465
2009	070102	Passenger cars	Rural	Diesel	0,002	0,280	0,896	0,635	0,124	0,283	1,684	0,002	56,180
2009	070102	Passenger cars	Rural	Gasoline	0,007	0,303	0,412	1,147	0,198	0,351	0,922	0,005	60,419
2009	070102	Passenger cars	Rural	LPG	0,000	0,320	0,288	1,122	0,000	0,320	0,961	0,000	64,099
2009	070103	Passenger cars	Urban	Diesel	0,002	0,209	0,719	0,508	0,124	0,213	1,261	0,002	42,065
2009	070103	Passenger cars	Urban	Gasoline	0,007	0,206	0,325	0,808	0,198	0,254	0,632	0,005	41,050
2009	070103	Passenger cars	Urban	LPG	0,000	0,224	0,201	0,782	0,000	0,224	0,671	0,000	44,710
2009	070201	Light duty vehicles	Highway	Diesel	0,002	0,211	0,723	0,511	0,124	0,214	1,270	0,002	42,370
2009	070201	Light duty vehicles	Highway	Gasoline	0,007	0,221	0,339	0,861	0,198	0,269	0,678	0,005	44,114
2009	070201	Light duty vehicles	Highway	LPG	0,000	0,152	0,137	0,531	0,000	0,152	0,455	0,000	30,365
2009	070202	Light duty vehicles	Rural	Diesel	0,002	0,231	0,772	0,546	0,124	0,234	1,389	0,002	46,318
2009	070202	Light duty vehicles	Rural	Gasoline	0,007	0,209	0,328	0,819	0,198	0,257	0,641	0,005	41,686
2009	070202	Light duty vehicles	Rural	LPG	0,000	0,182	0,164	0,637	0,000	0,182	0,546	0,000	36,399
2009	070203	Light duty vehicles	Urban	Diesel	0,002	0,165	0,608	0,428	0,124	0,168	0,993	0,002	33,119
2009	070203	Light duty vehicles	Urban	Gasoline	0,007	0,122	0,249	0,514	0,198	0,170	0,380	0,005	24,287
2009	070203	Light duty vehicles	Urban	LPG	0,000	0,131	0,118	0,457	0,000	0,131	0,392	0,000	26,126
2009	070301	Heavy duty vehicles	Highway	Diesel	0,002	0,146	0,561	0,394	0,124	0,150	0,882	0,002	29,416
2009	070301	Heavy duty vehicles	Highway	Gasoline	0,007	0,247	0,362	0,951	0,198	0,295	0,755	0,005	49,253
2009	070302	Heavy duty vehicles	Rural	Diesel	0,002	0,134	0,532	0,373	0,124	0,138	0,811	0,002	27,052
2009	070302	Heavy duty vehicles	Rural	Gasoline	0,007	0,279	0,391	1,064	0,198	0,327	0,852	0,005	55,722
2009	070303	Heavy duty vehicles	Urban	Diesel	0,002	0,105	0,459	0,320	0,124	0,109	0,635	0,002	21,206
2009	070303	Heavy duty vehicles	Urban	Gasoline	0,007	0,190	0,311	0,753	0,198	0,238	0,585	0,005	37,931
2009	070400	Mopeds	Urban	Gasoline	0,007	0,005	0,143	0,102	0,198	0,052	0,027	0,005	0,751
2009	070501	Motorcycles	Highway	Gasoline	0,007	0,136	0,261	0,561	0,198	0,183	0,420	0,005	26,963
2009	070502	Motorcycles	Rural	Gasoline	0,007	0,164	0,287	0,662	0,198	0,212	0,507	0,005	32,730
2009	070503	Motorcycles	Urban	Gasoline	0,007	0,160	0,284	0,648	0,198	0,208	0,495	0,005	31,925
2009	080100	Military		AvGas	0,007	0,253	0,367	0,972	0,198	0,301	12785,390	0,005	50,452
2009	080100	Military		Diesel	0,002	0,186	0,660	0,465	0,124	0,189	1,118	0,002	37,295
2009	080100	Military		Gasoline	0,007	0,253	0,367	0,972	0,198	0,301	0,773	0,005	50,452
2009	080100	Military		Jet fuel	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000
2009	080200	Railways		Diesel	0,002	0,186	0,660	0,465	0,124	0,189	1,118	0,002	37,295
2009	080300	Inland waterways		Diesel	0,002	0,186	0,660	0,465	0,124	0,189	1,118	0,002	37,295
2009	080300	Inland waterways		Gasoline	0,007	0,253	0,367	0,972	0,198	0,301	0,773	0,005	50,452

Continued	SNAP ID	Category	Fuel type	Arsenic mg pr GJ	Cadmium mg pr GJ	Chromium mg pr GJ	Copper mg pr GJ	Mercury mg pr GJ	Nickel mg pr GJ	Lead mg pr GJ	Selenium mg pr GJ	Zinc mg pr GJ
2009	080402	National sea traffic	Diesel	1,170	0,230	0,940	1,170	1,170	1,640	2,340	4,680	11,710
2009	080402	National sea traffic	Residual oil	12,220	0,730	4,890	12,220	0,490	733,500	4,890	9,780	22,000
2009	080403	Fishing	Diesel	1,170	0,230	0,940	1,170	1,170	1,640	2,340	4,680	11,710
2009	080403	Fishing	LPG	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000
2009	080404	International sea traffic	Diesel	1,170	0,230	0,940	1,170	1,170	1,640	2,340	4,680	11,710
2009	080404	International sea traffic	Residual oil	12,220	0,730	4,890	12,220	0,490	733,500	4,890	9,780	22,000
2009	080501	Air traffic, Dom. < 3000 ft.	AvGas	0,007	0,253	0,367	0,972	0,198	0,301	13505,692	0,005	50,452
2009	080501	Air traffic, Dom. < 3000 ft.	Jet fuel	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000
2009	080502	Air traffic, Int. < 3000 ft.	AvGas	0,007	0,253	0,367	0,972	0,198	0,301	13505,692	0,005	50,452
2009	080502	Air traffic, Int. < 3000 ft.	Jet fuel	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000
2009	080503	Air traffic, Dom. > 3000 ft.	Jet fuel	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000
2009	080504	Air traffic, Int. > 3000 ft.	Jet fuel	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000
2009	080600	Agriculture	Diesel	0,002	0,186	0,660	0,465	0,124	0,189	1,118	0,002	37,295
2009	080600	Agriculture	Gasoline	0,007	0,253	0,367	0,972	0,198	0,301	0,773	0,005	50,452
2009	080700	Forestry	Diesel	0,002	0,186	0,660	0,465	0,124	0,189	1,118	0,002	37,295
2009	080700	Forestry	Gasoline	0,007	0,253	0,367	0,972	0,198	0,301	0,773	0,005	50,452
2009	080800	Industry	Diesel	0,002	0,186	0,660	0,465	0,124	0,189	1,118	0,002	37,295
2009	080800	Industry	Gasoline	0,007	0,253	0,367	0,972	0,198	0,301	0,773	0,005	50,452
2009	080800	Industry	LPG	0,000	0,131	0,118	0,457	0,000	0,131	0,392	0,000	26,126
2009	080900	Household and gardening	Gasoline	0,007	0,253	0,367	0,972	0,198	0,301	0,773	0,005	50,452
2009	081100	Commercial and institutional	Gasoline	0,007	0,253	0,367	0,972	0,198	0,301	0,773	0,005	50,452
2009	080501	Air traffic, Dom. < 3000 ft.	AvGas	0,007	0,253	0,367	0,972	0,198	0,301	13505,692	0,005	50,452
2009	080501	Air traffic, Dom. < 3000 ft.	Jet fuel	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000
2009	080502	Air traffic, Int. < 3000 ft.	AvGas	0,007	0,253	0,367	0,972	0,198	0,301	13505,692	0,005	50,452
2009	080502	Air traffic, Int. < 3000 ft.	Jet fuel	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000
2009	080503	Air traffic, Dom. > 3000 ft.	Jet fuel	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000
2009	080504	Air traffic, Int. > 3000 ft.	Jet fuel	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000

Heavy metal emissions for 1990 and 2009 in CollectER format.

	SNAP ID	Category		Fuel type	Arsenic	Cadmium	Chromium	Copper	Mercury	Nickel	Lead	Selenium	Zinc
					kg	kg	kg	kg	kg	kg	kg	kg	kg
1990	070101	Passenger cars	Highway	Diesel	0,003	0,352	1,120	0,795	0,152	0,356	2,117	0,003	70,620
1990	070101	Passenger cars	Highway	Gasoline	0,072	2,796	3,988	10,701	2,091	3,301	15496,108	0,048	557,602
1990	070101	Passenger cars	Highway	LPG	0,000	0,003	0,003	0,011	0,000	0,003	0,009	0,000	0,627
1990	070102	Passenger cars	Rural	Diesel	0,006	0,894	2,737	1,945	0,318	0,903	5,374	0,006	179,223
1990	070102	Passenger cars	Rural	Gasoline	0,163	7,092	9,703	26,885	4,719	8,232	34976,787	0,108	1414,691
1990	070102	Passenger cars	Rural	LPG	0,000	0,008	0,007	0,028	0,000	0,008	0,024	0,000	1,593
1990	070103	Passenger cars	Urban	Diesel	0,008	0,705	2,408	1,701	0,409	0,716	4,242	0,008	141,519
1990	070103	Passenger cars	Urban	Gasoline	0,196	5,625	9,067	22,173	5,694	6,999	42189,428	0,131	1120,333
1990	070103	Passenger cars	Urban	LPG	0,000	0,006	0,006	0,022	0,000	0,006	0,019	0,000	1,253
1990	070201	Light duty vehicles	Highway	Diesel	0,004	0,350	1,237	0,872	0,228	0,357	2,111	0,004	70,421
1990	070201	Light duty vehicles	Highway	Gasoline	0,002	0,065	0,095	0,250	0,053	0,077	389,467	0,001	12,916
1990	070201	Light duty vehicles	Highway	LPG	0,000	0,001	0,001	0,005	0,000	0,001	0,004	0,000	0,293
1990	070202	Light duty vehicles	Rural	Diesel	0,014	1,226	4,218	2,979	0,731	1,246	7,381	0,014	246,220
1990	070202	Light duty vehicles	Rural	Gasoline	0,007	0,227	0,342	0,880	0,195	0,274	1445,356	0,004	45,243
1990	070202	Light duty vehicles	Rural	LPG	0,000	0,005	0,005	0,018	0,000	0,005	0,015	0,000	1,027
1990	070203	Light duty vehicles	Urban	Diesel	0,014	0,889	3,361	2,363	0,720	0,909	5,361	0,014	178,871
1990	070203	Light duty vehicles	Urban	Gasoline	0,008	0,167	0,320	0,689	0,242	0,225	1793,089	0,006	33,131
1990	070203	Light duty vehicles	Urban	LPG	0,000	0,004	0,003	0,013	0,000	0,004	0,011	0,000	0,743
1990	070301	Heavy duty vehicles	Highway	Diesel	0,022	1,411	5,401	3,795	1,185	1,445	8,512	0,022	284,015
1990	070301	Heavy duty vehicles	Highway	Gasoline	0,000	0,010	0,015	0,038	0,009	0,012	68,787	0,000	1,929
1990	070302	Heavy duty vehicles	Rural	Diesel	0,039	2,298	9,028	6,336	2,077	2,357	13,867	0,039	462,772
1990	070302	Heavy duty vehicles	Rural	Gasoline	0,001	0,018	0,028	0,070	0,016	0,022	120,180	0,000	3,592
1990	070303	Heavy duty vehicles	Urban	Diesel	0,031	1,381	6,011	4,200	1,619	1,427	8,347	0,031	278,638
1990	070303	Heavy duty vehicles	Urban	Gasoline	0,001	0,011	0,021	0,046	0,015	0,015	112,955	0,000	2,226
1990	070400	Mopeds	Urban	Gasoline	0,002	0,001	0,042	0,030	0,058	0,015	427,859	0,001	0,219
1990	070501	Motorcycles	Highway	Gasoline	0,000	0,006	0,013	0,026	0,011	0,009	82,913	0,000	1,180
1990	070502	Motorcycles	Rural	Gasoline	0,001	0,017	0,034	0,072	0,027	0,024	198,768	0,001	3,444
1990	070503	Motorcycles	Urban	Gasoline	0,001	0,022	0,044	0,091	0,034	0,030	255,141	0,001	4,308
1990	080100	Military		AvGas	0,000	0,001	0,002	0,005	0,001	0,001	62,821	0,000	0,248
1990	080100	Military		Diesel	0,000	0,027	0,096	0,068	0,018	0,028	0,163	0,000	5,451
1990	080100	Military		Gasoline	0,000	0,000	0,000	0,001	0,000	0,000	0,001	0,000	0,050
1990	080100	Military		Jet fuel		0,000	0,000	0,000		0,000		0,000	0,000
1990	080200	Railways		Diesel	0,009	0,744	2,645	1,865	0,497	0,758	4,483	0,009	149,554
1990	080200	Railways		Gasoline		0,000	0,000	0,000		0,000	0,000	0,000	0,000

Continued												
	SNAP ID	Category	Fuel type	Arsenic	Cadmium	Chromium	Copper	Mercury	Nickel	Lead	Selenium	Zinc
				kg	kg	kg	kg	kg	kg	kg	kg	kg
1990	080300	Inland waterways	Diesel	0,001	0,064	0,226	0,159	0,042	0,065	0,383	0,001	12,778
1990	080300	Inland waterways	Gasoline	0,002	0,078	0,113	0,301	0,061	0,093	0,239	0,001	15,597
1990	080402	National sea traffic	Diesel	6,189	1,238	4,951	6,189	6,184	8,665	12,368	24,756	61,890
1990	080402	National sea traffic	Residual oil	55,884	3,353	22,353	55,884	2,240	3353,024	22,354	44,707	100,591
1990	080403	Fishing	Diesel	9,274	1,855	7,419	9,274	9,266	12,983	18,533	37,096	92,739
1990	080403	Fishing	Gasoline		0,000	0,000	0,000		0,000	0,000	0,000	0,000
1990	080403	Fishing	Residual oil	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000
1990	080404	International sea traffic	Diesel	13,220	2,644	10,576	13,220	13,209	18,507	26,417	52,878	132,196
1990	080404	International sea traffic	Residual oil	340,032	20,402	136,013	340,032	13,629	20401,916	136,013	272,026	612,057
1990	080501	Air traffic, Dom. < 3000 ft.	AvGas	0,001	0,027	0,039	0,102	0,021	0,032	1417,384	0,000	5,295
1990	080501	Air traffic, Dom. < 3000 ft.	Jet fuel		0,000	0,000	0,000		0,000		0,000	0,000
1990	080502	Air traffic, Int. < 3000 ft.	AvGas	0,000	0,008	0,011	0,030	0,006	0,009	414,079	0,000	1,547
1990	080502	Air traffic, Int. < 3000 ft.	Jet fuel		0,000	0,000	0,000		0,000		0,000	0,000
1990	080503	Air traffic, Dom. > 3000 ft.	Jet fuel		0,000	0,000	0,000		0,000		0,000	0,000
1990	080504	Air traffic, Int. > 3000 ft.	Jet fuel		0,000	0,000	0,000		0,000		0,000	0,000
1990	080600	Agriculture	Diesel	0,039	3,061	10,883	7,674	2,045	3,119	18,442	0,039	615,231
1990	080600	Agriculture	Gasoline	0,005	0,179	0,260	0,689	0,140	0,213	0,548	0,003	35,764
1990	080700	Forestry	Diesel	0,000	0,027	0,096	0,068	0,018	0,027	0,162	0,000	5,421
1990	080700	Forestry	Gasoline	0,002	0,086	0,125	0,332	0,068	0,103	0,264	0,002	17,226
1990	080800	Industry	Diesel	0,024	1,885	6,702	4,725	1,259	1,920	11,356	0,024	378,860
1990	080800	Industry	Gasoline	0,001	0,044	0,064	0,170	0,035	0,053	0,135	0,001	8,841
1990	080800	Industry	LPG	0,000	0,155	0,139	0,542	0,000	0,155	0,464	0,000	30,956
1990	080900	Household and gardening	Gasoline	0,004	0,135	0,196	0,520	0,106	0,161	0,414	0,002	26,999
1990	081100	Commercial and institutio-nal	Gasoline	0,007	0,256	0,371	0,982	0,200	0,304	0,780	0,005	50,948
1990	080501	Air traffic, Dom. < 3000 ft.	AvGas	0,000	0,002	0,003	0,008	0,002	0,003	116,719	0,000	0,436
1990	080501	Air traffic, Dom. < 3000 ft.	Jet fuel		0,000	0,000	0,000		0,000		0,000	0,000
1990	080502	Air traffic, Int. < 3000 ft.	AvGas	0,000	0,001	0,002	0,005	0,001	0,002	75,798	0,000	0,283
1990	080502	Air traffic, Int. < 3000 ft.	Jet fuel		0,000	0,000	0,000		0,000		0,000	0,000
1990	080503	Air traffic, Dom. > 3000 ft.	Jet fuel		0,000	0,000	0,000		0,000		0,000	0,000
1990	080504	Air traffic, Int. > 3000 ft.	Jet fuel		0,000	0,000	0,000		0,000		0,000	0,000

Continued

	SNAP ID	Category		Fuel type	Arsenic	Cadmium	Chromium	Copper	Mercury	Nickel	Lead	Selenium	Zinc
					kg	kg	kg	kg	kg	kg	kg	kg	kg
2009	070101	Passenger cars	Highway	Diesel	0,015	1,654	5,370	3,805	0,782	1,676	9,954	0,015	332,003
2009	070101	Passenger cars	Highway	Gasoline	0,078	3,291	4,559	12,510	2,270	3,839	10,030	0,052	656,376
2009	070101	Passenger cars	Highway	LPG	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,006
2009	070102	Passenger cars	Rural	Diesel	0,032	3,833	12,265	8,696	1,697	3,881	23,064	0,032	769,243
2009	070102	Passenger cars	Rural	Gasoline	0,172	7,623	10,366	28,856	4,984	8,826	23,212	0,115	1520,518
2009	070102	Passenger cars	Rural	LPG	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,014
2009	070103	Passenger cars	Urban	Diesel	0,032	2,834	9,738	6,878	1,678	2,882	17,070	0,032	569,432
2009	070103	Passenger cars	Urban	Gasoline	0,188	5,669	8,935	22,221	5,448	6,984	17,383	0,125	1129,420
2009	070103	Passenger cars	Urban	LPG	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,010
2009	070201	Light duty vehicles	Highway	Diesel	0,007	0,670	2,297	1,623	0,394	0,681	4,035	0,007	134,591
2009	070201	Light duty vehicles	Highway	Gasoline	0,002	0,073	0,111	0,284	0,065	0,089	0,223	0,001	14,522
2009	070201	Light duty vehicles	Highway	LPG	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,007
2009	070202	Light duty vehicles	Rural	Diesel	0,022	2,138	7,160	5,064	1,149	2,170	12,871	0,022	429,331
2009	070202	Light duty vehicles	Rural	Gasoline	0,008	0,233	0,365	0,912	0,220	0,286	0,714	0,005	46,411
2009	070202	Light duty vehicles	Rural	LPG	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,023
2009	070203	Light duty vehicles	Urban	Diesel	0,021	1,456	5,370	3,780	1,096	1,487	8,775	0,021	292,773
2009	070203	Light duty vehicles	Urban	Gasoline	0,009	0,161	0,328	0,677	0,261	0,224	0,500	0,006	31,953
2009	070203	Light duty vehicles	Urban	LPG	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,015
2009	070301	Heavy duty vehicles	Highway	Diesel	0,026	1,645	6,316	4,437	1,395	1,684	9,922	0,026	331,068
2009	070301	Heavy duty vehicles	Highway	Gasoline	0,000	0,008	0,012	0,032	0,007	0,010	0,026	0,000	1,667
2009	070302	Heavy duty vehicles	Rural	Diesel	0,042	2,441	9,662	6,778	2,252	2,505	14,732	0,042	491,624
2009	070302	Heavy duty vehicles	Rural	Gasoline	0,000	0,016	0,022	0,061	0,011	0,019	0,049	0,000	3,199
2009	070303	Heavy duty vehicles	Urban	Diesel	0,030	1,358	5,927	4,141	1,602	1,404	8,211	0,030	274,093
2009	070303	Heavy duty vehicles	Urban	Gasoline	0,000	0,010	0,016	0,040	0,010	0,013	0,031	0,000	2,006
2009	070400	Mopeds	Urban	Gasoline	0,001	0,001	0,030	0,021	0,041	0,011	0,006	0,001	0,157
2009	070501	Motorcycles	Highway	Gasoline	0,001	0,016	0,031	0,066	0,023	0,022	0,049	0,001	3,161
2009	070502	Motorcycles	Rural	Gasoline	0,002	0,042	0,074	0,171	0,051	0,055	0,131	0,001	8,433
2009	070503	Motorcycles	Urban	Gasoline	0,002	0,050	0,088	0,201	0,061	0,065	0,153	0,001	9,898
2009	080100	Military		AvGas	0,000	0,001	0,002	0,005	0,001	0,002	64,411	0,000	0,254
2009	080100	Military		Diesel	0,003	0,204	0,725	0,511	0,136	0,208	1,229	0,003	40,989
2009	080100	Military		Gasoline	0,000	0,002	0,003	0,009	0,002	0,003	0,007	0,000	0,446
2009	080100	Military		Jet fuel	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000
2009	080200	Railways		Diesel	0,007	0,577	2,052	1,447	0,386	0,588	3,478	0,007	116,019
2009	080200	Railways		Gasoline		0,000	0,000	0,000		0,000	0,000	0,000	0,000

Continued

	SNAP ID	Category	Fuel type	Arsenic	Cadmium	Chromium	Copper	Mercury	Nickel	Lead	Selenium	Zinc
				kg	kg	kg	kg	kg	kg	kg	kg	kg
2009	080300	Inland waterways	Diesel	0,002	0,186	0,661	0,466	0,124	0,189	1,120	0,002	37,375
2009	080300	Inland waterways	Gasoline	0,002	0,089	0,130	0,343	0,070	0,106	0,273	0,002	17,807
2009	080402	National sea traffic	Diesel	5,048	0,992	4,056	5,048	5,048	7,076	10,097	20,193	50,526
2009	080402	National sea traffic	Residual oil	27,975	1,671	11,195	27,975	1,122	1679,189	11,195	22,389	50,364
2009	080403	Fishing	Diesel	8,795	1,729	7,066	8,795	8,795	12,327	17,589	35,178	88,020
2009	080403	Fishing	Gasoline		0,000	0,000	0,000		0,000	0,000	0,000	0,000
2009	080403	Fishing	Residual oil	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000
2009	080404	International sea traffic	Diesel	11,892	2,338	9,554	11,892	11,892	16,669	23,783	47,567	119,018
2009	080404	International sea traffic	Residual oil	115,068	6,874	46,046	115,068	4,614	6906,919	46,046	92,092	207,160
2009	080501	Air traffic, Dom. < 3000 ft.	AvGas	0,000	0,018	0,027	0,071	0,014	0,022	983,322	0,000	3,673
2009	080501	Air traffic, Dom. < 3000 ft.	Jet fuel		0,000	0,000	0,000		0,000	0,000	0,000	0,000
2009	080502	Air traffic, Int. < 3000 ft.	AvGas	0,000	0,001	0,001	0,003	0,001	0,001	45,460	0,000	0,170
2009	080502	Air traffic, Int. < 3000 ft.	Jet fuel		0,000	0,000	0,000		0,000	0,000	0,000	0,000
2009	080503	Air traffic, Dom. > 3000 ft.	Jet fuel		0,000	0,000	0,000		0,000	0,000	0,000	0,000
2009	080504	Air traffic, Int. > 3000 ft.	Jet fuel		0,000	0,000	0,000		0,000	0,000	0,000	0,000
2009	080600	Agriculture	Diesel	0,039	3,088	10,981	7,743	2,063	3,147	18,609	0,039	620,808
2009	080600	Agriculture	Gasoline	0,003	0,127	0,184	0,487	0,099	0,151	0,387	0,002	25,276
2009	080700	Forestry	Diesel	0,000	0,030	0,105	0,074	0,020	0,030	0,178	0,000	5,932
2009	080700	Forestry	Gasoline	0,000	0,018	0,027	0,071	0,014	0,022	0,056	0,000	3,672
2009	080800	Industry	Diesel	0,024	1,908	6,785	4,784	1,275	1,944	11,497	0,024	383,560
2009	080800	Industry	Gasoline	0,001	0,030	0,043	0,114	0,023	0,035	0,091	0,001	5,936
2009	080800	Industry	LPG	0,000	0,107	0,096	0,374	0,000	0,107	0,320	0,000	21,346
2009	080900	Household and gardening	Gasoline	0,006	0,218	0,317	0,838	0,171	0,259	0,667	0,004	43,514
2009	081100	Commercial and institutional	Gasoline	0,016	0,604	0,877	2,322	0,473	0,719	1,846	0,011	120,506
2009	080501	Air traffic, Dom. < 3000 ft.	AvGas	0,000	0,000	0,000	0,001	0,000	0,000	7,876	0,000	0,029
2009	080501	Air traffic, Dom. < 3000 ft.	Jet fuel		0,000	0,000	0,000		0,000		0,000	0,000
2009	080502	Air traffic, Int. < 3000 ft.	AvGas	0,000	0,000	0,000	0,000	0,000	0,000	6,621	0,000	0,025
2009	080502	Air traffic, Int. < 3000 ft.	Jet fuel	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000
2009	080503	Air traffic, Dom. > 3000 ft.	Jet fuel	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000
2009	080504	Air traffic, Int. > 3000 ft.	Jet fuel	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000

PAH emission factors for 1990 and 2009 in CollectER format.

	SNAP ID	Category		Fuel type	Dioxins/ μg pr GJ	Flouranthene mg pr GJ	Benzo(b) mg pr GJ	Benzo(k) mg pr GJ	Benzo(a) mg pr GJ	Benzo(g,h,i) mg pr GJ	indeno(1,2,3-c,d) mg pr GJ
1990	070101	Passenger cars	Highway	Diesel	0,001	12,250	0,748	0,678	0,818	1,589	0,771
1990	070101	Passenger cars	Highway	Gasoline	0,013	8,506	0,553	0,425	0,468	1,106	0,425
1990	070101	Passenger cars	Highway	LPG	0,000	0,000	0,000	0,000	0,000	0,000	0,000
1990	070102	Passenger cars	Rural	Diesel	0,001	14,889	0,909	0,824	0,994	1,932	0,937
1990	070102	Passenger cars	Rural	Gasoline	0,015	9,539	0,620	0,477	0,524	1,240	0,477
1990	070102	Passenger cars	Rural	LPG	0,000	0,000	0,000	0,000	0,000	0,000	0,000
1990	070103	Passenger cars	Urban	Diesel	0,001	9,303	0,568	0,515	0,621	1,207	0,586
1990	070103	Passenger cars	Urban	Gasoline	0,010	6,426	0,418	0,321	0,353	0,835	0,321
1990	070103	Passenger cars	Urban	LPG	0,000	0,000	0,000	0,000	0,000	0,000	0,000
1990	070201	Light duty vehicles	Highway	Diesel	0,000	8,505	0,519	0,470	0,568	1,104	0,536
1990	070201	Light duty vehicles	Highway	Gasoline	0,013	8,086	0,526	0,404	0,445	1,051	0,404
1990	070201	Light duty vehicles	Highway	LPG	0,000	0,000	0,000	0,000	0,000	0,000	0,000
1990	070202	Light duty vehicles	Rural	Diesel	0,001	9,306	0,568	0,515	0,622	1,207	0,586
1990	070202	Light duty vehicles	Rural	Gasoline	0,012	7,625	0,495	0,381	0,419	0,991	0,381
1990	070202	Light duty vehicles	Rural	LPG	0,000	0,000	0,000	0,000	0,000	0,000	0,000
1990	070203	Light duty vehicles	Urban	Diesel	0,000	6,954	0,425	0,385	0,464	0,902	0,438
1990	070203	Light duty vehicles	Urban	Gasoline	0,007	4,558	0,296	0,228	0,251	0,592	0,228
1990	070203	Light duty vehicles	Urban	LPG	0,000	0,000	0,000	0,000	0,000	0,000	0,000
1990	070301	Heavy duty vehicles	Highway	Diesel	0,001	2,086	0,526	0,780	0,097	0,078	0,136
1990	070301	Heavy duty vehicles	Highway	Gasoline	0,000	0,000	0,000	0,000	0,000	0,000	0,000
1990	070302	Heavy duty vehicles	Rural	Diesel	0,001	2,208	0,557	0,825	0,103	0,082	0,144
1990	070302	Heavy duty vehicles	Rural	Gasoline	0,000	0,000	0,000	0,000	0,000	0,000	0,000
1990	070303	Heavy duty vehicles	Urban	Diesel	0,001	1,788	0,451	0,668	0,083	0,067	0,117
1990	070303	Heavy duty vehicles	Urban	Gasoline	0,000	0,000	0,000	0,000	0,000	0,000	0,000
1990	070400	Mopeds	Urban	Gasoline	0,000	0,000	0,000	0,000	0,000	0,000	0,000
1990	070501	Motorcycles	Highway	Gasoline	0,020	12,673	0,824	0,634	0,697	1,647	0,634
1990	070502	Motorcycles	Rural	Gasoline	0,024	15,176	0,986	0,759	0,834	1,973	0,759
1990	070503	Motorcycles	Urban	Gasoline	0,024	15,300	0,994	0,765	0,841	1,989	0,765
1990	080100	Military		AvGas	0,005	4,329	0,209	0,071	0,114	0,689	0,245
1990	080100	Military		Diesel	0,001	4,391	0,571	0,568	0,290	0,550	0,290
1990	080100	Military		Gasoline	0,006	5,257	0,277	0,116	0,142	0,825	0,300
1990	080100	Military		Jet fuel	0,000	0,000	0,000	0,000	0,000	0,000	0,000
1990	080200	Railways		Diesel	0,001	1,366	0,348	0,389	0,057	0,049	0,089
1990	080200	Railways		Kerosene	0,000	0,000	0,000	0,000	0,000	0,000	0,000

Continued	SNAP ID	Category	Fuel type	Dioxins/ µg pr GJ	Flouranthene mg pr GJ	Benzo(b) mg pr GJ	Benzo(k) mg pr GJ	Benzo(a) mg pr GJ	Benzo(g,h,i) mg pr GJ	indeno(1,2,3-c,d) mg pr GJ
1990	080300	Inland waterways	Diesel	0,001	4,391	0,571	0,568	0,290	0,550	0,290
1990	080300	Inland waterways	Gasoline	0,005	4,329	0,209	0,071	0,114	0,689	0,245
1990	080402	National sea traffic	Diesel	0,012	7,420	0,640	0,300	0,150	1,430	1,180
1990	080402	National sea traffic	Kerosene	0,000	0,000	0,000	0,000	0,000	0,000	0,000
1990	080402	National sea traffic	LPG	0,000	0,000	0,000	0,000	0,000	0,000	0,000
1990	080402	National sea traffic	Residual oil	0,013	5,190	0,270	0,050	0,020	0,070	0,030
1990	080403	Fishing	Diesel	0,012	7,420	0,640	0,300	0,150	1,430	1,180
1990	080403	Fishing	Kerosene	0,000	0,000	0,000	0,000	0,000	0,000	0,000
1990	080403	Fishing	LPG	0,000	0,000	0,000	0,000	0,000	0,000	0,000
1990	080404	International sea traffic	Diesel	0,012	7,420	0,640	0,300	0,150	1,430	1,180
1990	080404	International sea traffic	Residual oil	0,013	4,120	0,200	0,090	0,070	0,260	0,200
1990	080501	Air traffic, Dom. < 3000 ft.	AvGas	0,005	4,329	0,209	0,071	0,114	0,689	0,245
1990	080501	Air traffic, Dom. < 3000 ft.	Jet fuel	0,000	0,000	0,000	0,000	0,000	0,000	0,000
1990	080502	Air traffic, Int. < 3000 ft.	AvGas	0,005	4,329	0,209	0,071	0,114	0,689	0,245
1990	080502	Air traffic, Int. < 3000 ft.	Jet fuel	0,000	0,000	0,000	0,000	0,000	0,000	0,000
1990	080503	Air traffic, Dom. > 3000 ft.	Jet fuel	0,000	0,000	0,000	0,000	0,000	0,000	0,000
1990	080504	Air traffic, Int. > 3000 ft.	Jet fuel	0,000	0,000	0,000	0,000	0,000	0,000	0,000
1990	080600	Agriculture	Diesel	0,001	4,391	0,571	0,568	0,290	0,550	0,290
1990	080600	Agriculture	Gasoline	0,005	4,329	0,209	0,071	0,114	0,689	0,245
1990	080700	Forestry	Diesel	0,001	4,391	0,571	0,568	0,290	0,550	0,290
1990	080700	Forestry	Gasoline	0,005	4,329	0,209	0,071	0,114	0,689	0,245
1990	080800	Industry	Diesel	0,001	4,391	0,571	0,568	0,290	0,550	0,290
1990	080800	Industry	Gasoline	0,005	4,329	0,209	0,071	0,114	0,689	0,245
1990	080800	Industry	LPG	0,000	0,000	0,000	0,000	0,000	0,000	0,000
1990	080900	Household and gardening	Gasoline	0,005	4,329	0,209	0,071	0,114	0,689	0,245
1990	081100	Commercial and institutional	Gasoline	0,005	4,329	0,209	0,071	0,114	0,689	0,245
1990	080501	Air traffic, Dom. < 3000 ft.	AvGas	0,005	4,329	0,209	0,071	0,114	0,689	0,245
1990	080501	Air traffic, Dom. < 3000 ft.	Jet fuel	0,000	0,000	0,000	0,000	0,000	0,000	0,000
1990	080502	Air traffic, Int. < 3000 ft.	AvGas	0,005	4,329	0,209	0,071	0,114	0,689	0,245
1990	080502	Air traffic, Int. < 3000 ft.	Jet fuel	0,000	0,000	0,000	0,000	0,000	0,000	0,000
1990	080503	Air traffic, Dom. > 3000 ft.	Jet fuel	0,000	0,000	0,000	0,000	0,000	0,000	0,000
1990	080504	Air traffic, Int. > 3000 ft.	Jet fuel	0,000	0,000	0,000	0,000	0,000	0,000	0,000

Continued											
	SNAP ID	Category		Fuel type	Dioxins/ microg pr GJ	Flouranthene mg pr GJ	Benzo(b) mg pr GJ	Benzo(k) mg pr GJ	Benzo(a) mg pr GJ	Benzo(g,h,i) mg pr GJ	indeno(1,2,3-c,d) mg pr GJ
2009	070101	Passenger cars	Highway	Diesel	0,000	12,815	0,782	0,709	0,856	1,663	0,807
2009	070101	Passenger cars	Highway	Gasoline	0,000	1,092	0,206	0,251	0,204	0,412	0,298
2009	070101	Passenger cars	Highway	LPG	0,000	0,000	0,000	0,000	0,000	0,000	0,000
2009	070102	Passenger cars	Rural	Diesel	0,001	14,593	0,891	0,807	0,975	1,894	0,919
2009	070102	Passenger cars	Rural	Gasoline	0,000	1,208	0,230	0,279	0,227	0,459	0,333
2009	070102	Passenger cars	Rural	LPG	0,000	0,000	0,000	0,000	0,000	0,000	0,000
2009	070103	Passenger cars	Urban	Diesel	0,001	9,684	0,591	0,536	0,647	1,257	0,610
2009	070103	Passenger cars	Urban	Gasoline	0,000	0,692	0,127	0,154	0,125	0,255	0,183
2009	070103	Passenger cars	Urban	LPG	0,000	0,000	0,000	0,000	0,000	0,000	0,000
2009	070201	Light duty vehicles	Highway	Diesel	0,001	9,234	0,564	0,511	0,617	1,198	0,581
2009	070201	Light duty vehicles	Highway	Gasoline	0,001	1,041	0,159	0,185	0,155	0,319	0,217
2009	070201	Light duty vehicles	Highway	LPG	0,000	0,000	0,000	0,000	0,000	0,000	0,000
2009	070202	Light duty vehicles	Rural	Diesel	0,001	10,103	0,617	0,559	0,675	1,311	0,636
2009	070202	Light duty vehicles	Rural	Gasoline	0,001	0,983	0,150	0,175	0,146	0,301	0,205
2009	070202	Light duty vehicles	Rural	LPG	0,000	0,000	0,000	0,000	0,000	0,000	0,000
2009	070203	Light duty vehicles	Urban	Diesel	0,000	7,261	0,443	0,402	0,485	0,942	0,457
2009	070203	Light duty vehicles	Urban	Gasoline	0,000	0,568	0,087	0,101	0,084	0,174	0,118
2009	070203	Light duty vehicles	Urban	LPG	0,000	0,000	0,000	0,000	0,000	0,000	0,000
2009	070301	Heavy duty vehicles	Highway	Diesel	0,001	2,030	0,512	0,759	0,095	0,076	0,133
2009	070301	Heavy duty vehicles	Highway	Gasoline	0,000	0,000	0,000	0,000	0,000	0,000	0,000
2009	070302	Heavy duty vehicles	Rural	Diesel	0,001	2,066	0,521	0,772	0,096	0,077	0,135
2009	070302	Heavy duty vehicles	Rural	Gasoline	0,000	0,000	0,000	0,000	0,000	0,000	0,000
2009	070303	Heavy duty vehicles	Urban	Diesel	0,001	1,676	0,423	0,626	0,078	0,063	0,110
2009	070303	Heavy duty vehicles	Urban	Gasoline	0,000	0,000	0,000	0,000	0,000	0,000	0,000
2009	070400	Mopeds	Urban	Gasoline	0,000	0,000	0,000	0,000	0,000	0,000	0,000
2009	070501	Motorcycles	Highway	Gasoline	0,020	12,799	0,832	0,640	0,704	1,664	0,640
2009	070502	Motorcycles	Rural	Gasoline	0,024	15,331	0,996	0,766	0,843	1,993	0,766
2009	070503	Motorcycles	Urban	Gasoline	0,024	15,500	1,007	0,775	0,852	2,015	0,775
2009	080100	Military		AvGas	0,005	4,329	0,209	0,071	0,114	0,689	0,245
2009	080100	Military		Diesel	0,001	4,350	0,510	0,496	0,256	0,464	0,264
2009	080100	Military		Gasoline	0,007	2,152	0,180	0,115	0,118	0,358	0,179
2009	080100	Military		Jet fuel	0,000	0,000	0,000	0,000	0,000	0,000	0,000
2009	080200	Railways		Diesel	0,001	1,411	0,360	0,402	0,059	0,051	0,092
2009	080300	Inland waterways		Diesel	0,001	4,350	0,510	0,496	0,256	0,464	0,264

Continued

	SNAP ID	Category	Fuel type	Dioxins/ microg pr GJ	Flouranthene mg pr GJ	Benzo(b) mg pr GJ	Benzo(k) mg pr GJ	Benzo(a) mg pr GJ	Benzo(g,h,i) mg pr GJ	indeno(1,2,3-c,d) mg pr GJ
2009	080300	Inland waterways	Gasoline	0,005	4,329	0,209	0,071	0,114	0,689	0,245
2009	080402	National sea traffic	Diesel	0,012	7,420	0,640	0,300	0,150	1,430	1,180
2009	080402	National sea traffic	Residual oil	0,013	5,190	0,270	0,050	0,020	0,070	0,030
2009	080403	Fishing	Diesel	0,012	7,420	0,640	0,300	0,150	1,430	1,180
2009	080403	Fishing	LPG	0,000	0,000	0,000	0,000	0,000	0,000	0,000
2009	080404	International sea traffic	Diesel	0,012	7,420	0,640	0,300	0,150	1,430	1,180
2009	080404	International sea traffic	Residual oil	0,013	4,120	0,200	0,090	0,070	0,260	0,200
2009	080501	Air traffic, Dom. < 3000 ft.	AvGas	0,005	4,329	0,209	0,071	0,114	0,689	0,245
2009	080501	Air traffic, Dom. < 3000 ft.	Jet fuel	0,000	0,000	0,000	0,000	0,000	0,000	0,000
2009	080502	Air traffic, Int. < 3000 ft.	AvGas	0,005	4,329	0,209	0,071	0,114	0,689	0,245
2009	080502	Air traffic, Int. < 3000 ft.	Jet fuel	0,000	0,000	0,000	0,000	0,000	0,000	0,000
2009	080503	Air traffic, Dom. > 3000 ft.	Jet fuel	0,000	0,000	0,000	0,000	0,000	0,000	0,000
2009	080504	Air traffic, Int. > 3000 ft.	Jet fuel	0,000	0,000	0,000	0,000	0,000	0,000	0,000
2009	080600	Agriculture	Diesel	0,001	4,350	0,510	0,496	0,256	0,464	0,264
2009	080600	Agriculture	Gasoline	0,005	4,329	0,209	0,071	0,114	0,689	0,245
2009	080700	Forestry	Diesel	0,001	4,350	0,510	0,496	0,256	0,464	0,264
2009	080700	Forestry	Gasoline	0,005	4,329	0,209	0,071	0,114	0,689	0,245
2009	080800	Industry	Diesel	0,001	4,350	0,510	0,496	0,256	0,464	0,264
2009	080800	Industry	Gasoline	0,005	4,329	0,209	0,071	0,114	0,689	0,245
2009	080800	Industry	LPG	0,000	0,000	0,000	0,000	0,000	0,000	0,000
2009	080900	Household and gardening	Gasoline	0,005	4,329	0,209	0,071	0,114	0,689	0,245
2009	081100	Commercial and institutional	Gasoline	0,005	4,329	0,209	0,071	0,114	0,689	0,245
2009	080501	Air traffic, Dom. < 3000 ft.	AvGas	0,005	4,329	0,209	0,071	0,114	0,689	0,245
2009	080501	Air traffic, Dom. < 3000 ft.	Jet fuel	0,000	0,000	0,000	0,000	0,000	0,000	0,000
2009	080502	Air traffic, Int. < 3000 ft.	AvGas	0,005	4,329	0,209	0,071	0,114	0,689	0,245
2009	080502	Air traffic, Int. < 3000 ft.	Jet fuel	0,000	0,000	0,000	0,000	0,000	0,000	0,000
2009	080503	Air traffic, Dom. > 3000 ft.	Jet fuel	0,000	0,000	0,000	0,000	0,000	0,000	0,000
2009	080504	Air traffic, Int. > 3000 ft.	Jet fuel	0,000	0,000	0,000	0,000	0,000	0,000	0,000

PAH emissions for 1990 and 2008 in CollectER format.

	SNAP ID	Category		Fuel type	Dioxins/	Flouranthene	Benzo(b)	Benzo(k)	Benzo(a)	Benzo(g,h,i)	indeno(1,2,3-c,d)
					g	kg	kg	kg	kg	kg	kg
1990	070101	Passenger cars	Highway	Diesel	0,001	15,021	0,917	0,831	1,003	1,949	0,946
1990	070101	Passenger cars	Highway	Gasoline	0,141	89,544	5,820	4,476	4,924	11,639	4,476
1990	070101	Passenger cars	Highway	LPG							
1990	070102	Passenger cars	Rural	Diesel	0,002	38,171	2,331	2,112	2,549	4,953	2,403
1990	070102	Passenger cars	Rural	Gasoline	0,357	226,652	14,730	11,328	12,462	29,465	11,328
1990	070102	Passenger cars	Rural	LPG							
1990	070103	Passenger cars	Urban	Diesel	0,002	30,655	1,871	1,696	2,047	3,978	1,930
1990	070103	Passenger cars	Urban	Gasoline	0,290	184,212	11,972	9,208	10,131	23,943	9,208
1990	070103	Passenger cars	Urban	LPG							
1990	070201	Light duty vehicles	Highway	Diesel	0,001	15,652	0,955	0,866	1,045	2,031	0,986
1990	070201	Light duty vehicles	Highway	Gasoline	0,003	2,140	0,139	0,107	0,118	0,278	0,107
1990	070201	Light duty vehicles	Highway	LPG	0,000	0,000	0,000	0,000	0,000	0,000	0,000
1990	070202	Light duty vehicles	Rural	Diesel	0,003	54,776	3,344	3,031	3,659	7,108	3,449
1990	070202	Light duty vehicles	Rural	Gasoline	0,012	7,488	0,487	0,374	0,412	0,973	0,374
1990	070202	Light duty vehicles	Rural	LPG	0,000	0,000	0,000	0,000	0,000	0,000	0,000
1990	070203	Light duty vehicles	Urban	Diesel	0,002	40,364	2,464	2,233	2,696	5,237	2,542
1990	070203	Light duty vehicles	Urban	Gasoline	0,009	5,554	0,361	0,278	0,305	0,722	0,278
1990	070203	Light duty vehicles	Urban	LPG	0,000	0,000	0,000	0,000	0,000	0,000	0,000
1990	070301	Heavy duty vehicles	Highway	Diesel	0,010	19,916	5,025	7,445	0,930	0,742	1,302
1990	070301	Heavy duty vehicles	Highway	Gasoline							
1990	070302	Heavy duty vehicles	Rural	Diesel	0,019	36,955	9,325	13,813	1,725	1,380	2,415
1990	070302	Heavy duty vehicles	Rural	Gasoline							
1990	070303	Heavy duty vehicles	Urban	Diesel	0,012	23,322	5,884	8,716	1,088	0,871	1,524
1990	070303	Heavy duty vehicles	Urban	Gasoline							
1990	070400	Mopeds	Urban	Gasoline							
1990	070501	Motorcycles	Highway	Gasoline	0,001	0,714	0,046	0,036	0,039	0,093	0,036
1990	070502	Motorcycles	Rural	Gasoline	0,003	2,050	0,133	0,102	0,113	0,266	0,102
1990	070503	Motorcycles	Urban	Gasoline	0,004	2,653	0,172	0,133	0,146	0,345	0,133
1990	080100	Military		AvGas	0,000	0,021	0,001	0,000	0,001	0,003	0,001
1990	080100	Military		Diesel	0,000	0,642	0,083	0,083	0,042	0,080	0,042
1990	080100	Military		Gasoline	0,000	0,005	0,000	0,000	0,000	0,001	0,000
1990	080100	Military		Jet fuel	0,000	0,000	0,000	0,000	0,000	0,000	0,000
1990	080200	Railways		Diesel	0,003	5,477	1,396	1,559	0,230	0,197	0,358
1990	080200	Railways		Gasoline	0,000	0,000	0,000	0,000	0,000	0,000	0,000

Continued										
	SNAP ID	Category	Fuel type	Dioxins/	Flouranthene	Benzo(b)	Benzo(k)	Benzo(a)	Benzo(g,h,i)	indeno(1,2,3-c,d)
				g	kg	kg	kg	kg	kg	kg
1990	080300	Inland waterways	Diesel	0,000	1,505	0,196	0,195	0,099	0,188	0,099
1990	080300	Inland waterways	Gasoline	0,002	1,338	0,065	0,022	0,035	0,213	0,076
1990	080402	National sea traffic	Diesel	0,063	39,218	3,383	1,586	0,793	7,558	6,237
1990	080402	National sea traffic	Residual oil	0,061	23,725	1,234	0,229	0,091	0,320	0,137
1990	080403	Fishing	Diesel	0,095	58,766	5,069	2,376	1,188	11,325	9,346
1990	080403	Fishing	Gasoline	0,000	0,000	0,000	0,000	0,000	0,000	0,000
1990	080403	Fishing	Residual oil	0,000	0,000	0,000	0,000	0,000	0,000	0,000
1990	080404	International sea traffic	Diesel	0,136	83,768	7,225	3,387	1,693	16,144	13,322
1990	080404	International sea traffic	Residual oil	0,373	114,596	5,563	2,503	1,947	7,232	5,563
1990	080501	Air traffic, Dom. < 3000 ft.	AvGas	0,001	0,454	0,022	0,007	0,012	0,072	0,026
1990	080501	Air traffic, Dom. < 3000 ft.	Jet fuel	0,000	0,000	0,000	0,000	0,000	0,000	0,000
1990	080502	Air traffic, Int. < 3000 ft.	AvGas	0,000	0,133	0,006	0,002	0,003	0,021	0,008
1990	080502	Air traffic, Int. < 3000 ft.	Jet fuel	0,000	0,000	0,000	0,000	0,000	0,000	0,000
1990	080503	Air traffic, Dom. > 3000 ft.	Jet fuel	0,000	0,000	0,000	0,000	0,000	0,000	0,000
1990	080504	Air traffic, Int. > 3000 ft.	Jet fuel	0,000	0,000	0,000	0,000	0,000	0,000	0,000
1990	080600	Agriculture	Diesel	0,012	72,442	9,413	9,375	4,780	9,073	4,786
1990	080600	Agriculture	Gasoline	0,004	3,068	0,148	0,051	0,081	0,488	0,173
1990	080700	Forestry	Diesel	0,000	0,638	0,083	0,083	0,042	0,080	0,042
1990	080700	Forestry	Gasoline	0,002	1,478	0,071	0,024	0,039	0,235	0,084
1990	080800	Industry	Diesel	0,007	44,610	5,797	5,773	2,943	5,587	2,947
1990	080800	Industry	Gasoline	0,001	0,758	0,037	0,012	0,020	0,121	0,043
1990	080800	Industry	LPG							
1990	080900	Household and gardening	Gasoline	0,003	2,316	0,112	0,038	0,061	0,369	0,131
1990	081100	Commercial and institutional	Gasoline	0,005	4,371	0,211	0,072	0,115	0,696	0,247
1990	080501	Air traffic, Dom. < 3000 ft.	AvGas	0,000	0,037	0,002	0,001	0,001	0,006	0,002
1990	080501	Air traffic, Dom. < 3000 ft.	Jet fuel	0,000	0,000	0,000	0,000	0,000	0,000	0,000
1990	080502	Air traffic, Int. < 3000 ft.	AvGas	0,000	0,024	0,001	0,000	0,001	0,004	0,001
1990	080502	Air traffic, Int. < 3000 ft.	Jet fuel	0,000	0,000	0,000	0,000	0,000	0,000	0,000
1990	080503	Air traffic, Dom. > 3000 ft.	Jet fuel	0,000	0,000	0,000	0,000	0,000	0,000	0,000
1990	080504	Air traffic, Int. > 3000 ft.	Jet fuel	0,000	0,000	0,000	0,000	0,000	0,000	0,000

Continued

	SNAP ID	Category		Fuel type	Dioxins/ g	Flouranthene kg	Benzo(b) kg	Benzo(k) kg	Benzo(a) kg	Benzo(g,h,i) kg	indeno(1,2,3-c,d) kg
2009	070101	Passenger cars	Highway	Diesel	0,000	80,817	4,932	4,471	5,398	10,488	5,089
2009	070101	Passenger cars	Highway	Gasoline	0,004	12,524	2,364	2,873	2,338	4,729	3,421
2009	070101	Passenger cars	Highway	LPG							
2009	070102	Passenger cars	Rural	Diesel	0,011	199,816	12,201	11,057	13,346	25,929	12,583
2009	070102	Passenger cars	Rural	Gasoline	0,010	30,393	5,779	7,030	5,717	11,563	8,374
2009	070102	Passenger cars	Rural	LPG							
2009	070103	Passenger cars	Urban	Diesel	0,008	131,086	8,005	7,253	8,753	17,011	8,255
2009	070103	Passenger cars	Urban	Gasoline	0,007	19,042	3,499	4,231	3,453	7,005	5,032
2009	070103	Passenger cars	Urban	LPG							
2009	070201	Light duty vehicles	Highway	Diesel	0,002	29,332	1,791	1,623	1,959	3,806	1,847
2009	070201	Light duty vehicles	Highway	Gasoline	0,000	0,343	0,052	0,061	0,051	0,105	0,071
2009	070201	Light duty vehicles	Highway	LPG	0,000	0,000	0,000	0,000	0,000	0,000	0,000
2009	070202	Light duty vehicles	Rural	Diesel	0,005	93,648	5,718	5,182	6,254	12,152	5,896
2009	070202	Light duty vehicles	Rural	Gasoline	0,001	1,095	0,167	0,194	0,163	0,335	0,228
2009	070202	Light duty vehicles	Rural	LPG	0,000	0,000	0,000	0,000	0,000	0,000	0,000
2009	070203	Light duty vehicles	Urban	Diesel	0,004	64,188	3,919	3,550	4,285	8,329	4,041
2009	070203	Light duty vehicles	Urban	Gasoline	0,001	0,747	0,114	0,133	0,111	0,229	0,156
2009	070203	Light duty vehicles	Urban	LPG	0,000	0,000	0,000	0,000	0,000	0,000	0,000
2009	070301	Heavy duty vehicles	Highway	Diesel	0,012	22,852	5,764	8,542	1,067	0,854	1,494
2009	070301	Heavy duty vehicles	Highway	Gasoline							
2009	070302	Heavy duty vehicles	Rural	Diesel	0,019	37,547	9,474	14,036	1,753	1,400	2,456
2009	070302	Heavy duty vehicles	Rural	Gasoline							
2009	070303	Heavy duty vehicles	Urban	Diesel	0,011	21,659	5,464	8,094	1,011	0,808	1,417
2009	070303	Heavy duty vehicles	Urban	Gasoline							
2009	070400	Mopeds	Urban	Gasoline							
2009	070501	Motorcycles	Highway	Gasoline	0,002	1,501	0,098	0,075	0,083	0,195	0,075
2009	070502	Motorcycles	Rural	Gasoline	0,006	3,950	0,257	0,197	0,217	0,513	0,197
2009	070503	Motorcycles	Urban	Gasoline	0,008	4,805	0,312	0,240	0,264	0,625	0,240
2009	080100	Military		AvGas	0,000	0,022	0,001	0,000	0,001	0,003	0,001
2009	080100	Military		Diesel	0,001	4,781	0,561	0,545	0,281	0,510	0,290
2009	080100	Military		Gasoline	0,000	0,019	0,002	0,001	0,001	0,003	0,002
2009	080100	Military		Jet fuel	0,000	0,000	0,000	0,000	0,000	0,000	0,000
2009	080200	Railways		Diesel	0,002	4,390	1,119	1,250	0,185	0,158	0,287
2009	080200	Railways		Gasoline	0,000	0,000	0,000	0,000	0,000	0,000	0,000

Continued										
	SNAP ID	Category	Fuel type	Dioxins/ g	Flouranthene kg	Benzo(b) kg	Benzo(k) kg	Benzo(a) kg	Benzo(g,h,i) kg	indeno(1,2,3-c,d) kg
2009	080300	Inland waterways	Diesel	0,001	4,359	0,512	0,497	0,256	0,465	0,265
2009	080300	Inland waterways	Gasoline	0,002	1,528	0,074	0,025	0,040	0,243	0,086
2009	080402	National sea traffic	Diesel	0,052	32,016	2,761	1,294	0,647	6,170	5,091
2009	080402	National sea traffic	Residual oil	0,031	11,881	0,618	0,114	0,046	0,160	0,069
2009	080403	Fishing	Diesel	0,090	55,774	4,811	2,255	1,128	10,749	8,870
2009	080403	Fishing	Gasoline	0,000	0,000	0,000	0,000	0,000	0,000	0,000
2009	080403	Fishing	Residual oil	0,000	0,000	0,000	0,000	0,000	0,000	0,000
2009	080404	International sea traffic	Diesel	0,122	75,416	6,505	3,049	1,525	14,534	11,993
2009	080404	International sea traffic	Residual oil	0,126	38,796	1,883	0,847	0,659	2,448	1,883
2009	080501	Air traffic, Dom. < 3000 ft.	AvGas	0,000	0,315	0,015	0,005	0,008	0,050	0,018
2009	080501	Air traffic, Dom. < 3000 ft.	Jet fuel	0,000	0,000	0,000	0,000	0,000	0,000	0,000
2009	080502	Air traffic, Int. < 3000 ft.	AvGas	0,000	0,015	0,001	0,000	0,000	0,002	0,001
2009	080502	Air traffic, Int. < 3000 ft.	Jet fuel	0,000	0,000	0,000	0,000	0,000	0,000	0,000
2009	080503	Air traffic, Dom. > 3000 ft.	Jet fuel	0,000	0,000	0,000	0,000	0,000	0,000	0,000
2009	080504	Air traffic, Int. > 3000 ft.	Jet fuel	0,000	0,000	0,000	0,000	0,000	0,000	0,000
2009	080600	Agriculture	Diesel	0,012	72,407	8,497	8,255	4,257	7,731	4,400
2009	080600	Agriculture	Gasoline	0,003	2,169	0,105	0,036	0,057	0,345	0,123
2009	080700	Forestry	Diesel	0,000	0,692	0,081	0,079	0,041	0,074	0,042
2009	080700	Forestry	Gasoline	0,000	0,315	0,015	0,005	0,008	0,050	0,018
2009	080800	Industry	Diesel	0,007	44,736	5,250	5,100	2,630	4,777	2,718
2009	080800	Industry	Gasoline	0,001	0,509	0,025	0,008	0,013	0,081	0,029
2009	080800	Industry	LPG							
2009	080900	Household and gardening	Gasoline	0,004	3,733	0,180	0,061	0,098	0,594	0,211
2009	081100	Commercial and institutional	Gasoline	0,012	10,339	0,499	0,170	0,272	1,646	0,584
2009	080501	Air traffic, Dom. < 3000 ft.	AvGas	0,000	0,003	0,000	0,000	0,000	0,000	0,000
2009	080501	Air traffic, Dom. < 3000 ft.	Jet fuel	0,000	0,000	0,000	0,000	0,000	0,000	0,000
2009	080502	Air traffic, Int. < 3000 ft.	AvGas	0,000	0,002	0,000	0,000	0,000	0,000	0,000
2009	080502	Air traffic, Int. < 3000 ft.	Jet fuel	0,000	0,000	0,000	0,000	0,000	0,000	0,000
2009	080503	Air traffic, Dom. > 3000 ft.	Jet fuel	0,000	0,000	0,000	0,000	0,000	0,000	0,000
2009	080504	Air traffic, Int. > 3000 ft.	Jet fuel	0,000	0,000	0,000	0,000	0,000	0,000	0,000

Annex 2B-15: Fuel consumption and emissions in CRF format

Fuel

IPCC ID	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Industry-Other (1A2f)	11,7	11,7	11,6	11,6	11,6	11,5	11,5	11,5	11,5	11,5	11,6	11,7	11,7	11,9	11,9
Civil Aviation (1A3a)	3,6	3,3	3,7	3,8	3,6	3,4	2,8	2,7	2,6	2,7	2,8	2,8	2,9	2,7	2,4
Road (1A3b)	111,2	117,5	117,7	118,4	119,7	126,3	132,0	134,4	136,1	142,9	144,2	146,6	149,5	152,0	154,0
Railways (1A3c)	4,9	4,9	4,4	4,6	4,2	4,0	4,1	4,3	4,5	4,1	4,1	4,1	4,0	3,3	3,1
Navigation (1A3d)	10,4	10,3	10,4	10,4	10,5	10,5	10,6	10,9	10,7	10,8	11,3	12,2	12,0	10,0	8,8
Comm./Inst. (1A4a)	1,0	1,0	1,0	1,0	1,0	1,0	1,0	1,0	1,0	1,0	1,1	1,1	1,1	1,1	1,2
Residential (1A4b)	0,5	0,5	0,5	0,5	0,5	0,5	0,5	0,5	0,5	0,5	0,5	0,5	0,6	0,6	0,6
Ag./for./fish. (1A4c)	24,4	26,0	23,8	25,5	25,3	25,7	25,7	24,3	23,8	22,9	23,4	22,2	21,0	20,4	21,1
Military (1A5)	5,5	4,3	5,0	2,7	2,3	1,6	3,9	1,9	3,3	3,5	3,4	2,4	2,3	2,8	2,5
Navigation int. (1A3d)	16,2	19,0	28,4	36,2	37,1	39,1	34,9	36,7	55,0	62,0	65,1	62,0	56,7	57,2	53,3
Civil Aviation int. (1A3a)	19,3	20,9	22,4	24,0	25,1	24,1	22,7	23,5	23,0	25,2	25,9	27,4	27,9	30,0	31,8

Continued

IPCC ID	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Industry-Other (1A2f)	12,0	12,1	12,3	12,4	12,5	13,0	13,9	14,8	15,1	11,2
Civil Aviation (1A3a)	2,1	2,3	2,0	1,9	1,8	1,9	2,0	2,2	2,2	2,2
Road (1A3b)	152,5	152,8	154,5	160,6	164,8	166,1	171,3	179,5	176,0	165,1
Railways (1A3c)	3,1	2,9	2,8	3,0	2,9	3,1	3,1	3,1	3,2	3,1
Navigation (1A3d)	7,9	7,9	7,7	7,7	7,9	7,8	7,8	7,8	7,9	8,0
Comm./Inst. (1A4a)	1,2	1,3	1,5	1,8	2,0	2,2	2,4	2,4	2,4	2,4
Residential (1A4b)	0,6	0,6	0,7	0,7	0,8	0,8	0,8	0,9	0,9	0,9
Ag./for./fish. (1A4c)	21,8	23,9	24,3	23,9	22,2	23,8	23,7	23,4	25,2	24,9
Military (1A5)	1,5	1,3	1,2	1,3	3,3	3,7	1,7	2,4	1,5	2,2
Navigation int. (1A3d)	54,6	43,3	35,5	37,5	30,2	30,7	40,8	42,7	36,6	20
Civil Aviation int. (1A3a)	32,6	33,1	28,6	29,7	34,0	35,7	35,9	36,8	36,8	32

Emissions

pol_name	IPCC ID	Unit	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
SO_2	Industry-Other (1A2f)	[tonnes]	2402	1441	1440	1438	956	952	955	957	957	959	968	244	246	249	251
SO_2	Civil Aviation (1A3a)	[tonnes]	82	77	85	86	83	77	64	62	61	63	63	65	68	62	56
SO_2	Road (1A3b)	[tonnes]	11621	7862	7847	7857	5488	5767	5903	3820	1569	1669	1682	1721	1744	1768	1088
SO_2	Railways (1A3c)	[tonnes]	1152	695	618	641	393	376	382	263	105	95	96	95	93	78	40
SO_2	Navigation (1A3d)	[tonnes]	7480	7480	7484	7228	7231	6429	5111	3506	4410	4974	5588	4400	3650	2283	2051
SO_2	Comm./Inst. (1A4a)	[tonnes]	2	2	2	2	2	2	2	2	2	2	2	2	3	3	3
SO_2	Residential (1A4b)	[tonnes]	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
SO_2	Ag./for./fish. (1A4c)	[tonnes]	4766	3484	3173	3073	2269	2303	2317	2186	2150	2072	2120	978	853	856	931
SO_2	Military (1A5)	[tonnes]	408	260	193	72	70	48	206	82	76	80	80	56	54	65	47
SO_2	Navigation int. (1A3d)	[tonnes]	17037	20752	35647	46755	47058	41317	33277	30084	58492	58965	65049	61075	55822	46756	49282
SO_2	Civil Aviation int. (1A3a)	[tonnes]	444	480	515	551	578	554	521	541	530	580	596	629	642	689	731
NO_x	Industry-Other (1A2f)	[tonnes]	10903	10964	11011	11044	11065	11081	11282	11440	11558	11677	11882	12080	12248	12425	12262
NO_x	Civil Aviation (1A3a)	[tonnes]	1203	1132	1237	1252	1208	1123	920	902	900	940	958	971	998	911	815
NO_x	Road (1A3b)	[tonnes]	93787	99472	100001	101422	103009	109035	111706	109581	106554	105932	100249	95644	91557	87186	83506
NO_x	Railways (1A3c)	[tonnes]	6025	6063	5391	5589	5145	4913	4995	5284	5485	4971	5015	4977	4846	4089	3730
NO_x	Navigation (1A3d)	[tonnes]	13299	13339	13414	13486	13568	13649	13180	12882	12753	12999	13679	14757	13544	11175	8720
NO_x	Comm./Inst. (1A4a)	[tonnes]	66	67	68	70	70	70	75	80	85	89	93	95	98	101	102
NO_x	Residential (1A4b)	[tonnes]	31	32	33	34	34	34	36	38	40	42	43	45	46	48	49
NO_x	Ag./for./fish. (1A4c)	[tonnes]	18159	19915	18153	20143	20342	21066	21722	20824	20763	20524	21442	21138	20176	20119	21495
NO_x	Military (1A5)	[tonnes]	2353	2026	1627	992	882	495	1864	1014	1296	1279	1760	958	1197	1386	1074
NO_x	Navigation int. (1A3d)	[tonnes]	22455	26921	42068	54983	56940	60639	53939	55808	87852	99296	105113	100507	93239	92360	89143
NO_x	Civil Aviation int. (1A3a)	[tonnes]	5663	6129	6569	7035	7313	7016	6586	6846	6702	7317	7517	7904	8058	8662	9204
NMVOC	Industry-Other (1A2f)	[tonnes]	2422	2395	2368	2339	2304	2266	2231	2191	2147	2107	2088	2095	2083	2074	1997
NMVOC	Civil Aviation (1A3a)	[tonnes]	216	213	190	198	193	186	168	164	161	191	206	194	186	169	162
NMVOC	Road (1A3b)	[tonnes]	79097	79021	78423	78147	76478	80071	82252	80674	77375	73439	68119	63461	58265	52828	46451
NMVOC	Railways (1A3c)	[tonnes]	393	396	352	365	336	321	326	345	358	324	327	325	316	267	276
NMVOC	Navigation (1A3d)	[tonnes]	1560	1560	1592	1622	1654	1686	1719	1761	1786	1820	1879	1975	1969	1873	1776
NMVOC	Comm./Inst. (1A4a)	[tonnes]	2347	2333	2318	2303	2303	2303	2314	2302	2265	2285	2367	2458	2547	2636	2741
NMVOC	Residential (1A4b)	[tonnes]	1844	1833	1821	1809	1805	1801	1797	1792	1789	1785	1780	1774	1767	1759	1758
NMVOC	Ag./for./fish. (1A4c)	[tonnes]	6357	6417	6216	6284	6207	6149	5777	5298	4944	4638	4516	4208	3966	3691	3563
NMVOC	Military (1A5)	[tonnes]	587	457	172	483	309	53	162	87	122	119	148	90	103	114	105
NMVOC	Navigation int. (1A3d)	[tonnes]	825	974	1472	1892	1947	2060	1839	1928	2933	3318	3501	3343	3082	3102	2929
NMVOC	Civil Aviation int. (1A3a)	[tonnes]	261	288	313	342	361	331	309	316	309	308	343	360	365	386	395
CH_4	Industry-Other (1A2f)	[tonnes]	63	63	62	61	61	60	58	57	56	54	53	53	53	53	51

Continued

pol_name	IPCC ID	Unit	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
CH_4	Civil Aviation (1A3a)	[tonnes]	8	8	8	8	8	7	6	6	6	7	7	7	7	7	6
CH_4	Road (1A3b)	[tonnes]	2267	2327	2343	2368	2361	2503	2590	2574	2528	2472	2344	2231	2132	2032	1905
CH_4	Railways (1A3c)	[tonnes]	15	15	14	14	13	12	13	13	14	12	13	12	12	10	11
CH_4	Navigation (1A3d)	[tonnes]	30	30	31	31	32	32	33	34	34	35	36	38	38	35	34
CH_4	Comm./Inst. (1A4a)	[tonnes]	104	102	100	99	99	99	97	95	92	90	89	89	89	89	90
CH_4	Residential (1A4b)	[tonnes]	55	54	53	52	51	51	50	49	48	48	47	46	45	45	45
CH_4	Ag./for./fish. (1A4c)	[tonnes]	155	154	147	146	142	139	132	123	116	110	106	100	94	89	88
CH_4	Military (1A5)	[tonnes]	30	25	17	18	13	5	18	10	13	13	18	10	12	14	11
CH_4	Navigation int. (1A3d)	[tonnes]	26	30	46	59	60	64	57	60	91	103	108	103	95	96	91
CH_4	Civil Aviation int. (1A3a)	[tonnes]	25	27	30	32	33	31	29	30	29	31	35	37	38	40	41
CO	Industry-Other (1A2f)	[tonnes]	9863	9784	9702	9611	9502	9379	9294	9188	9070	8956	8910	8963	8939	8907	8647
CO	Civil Aviation (1A3a)	[tonnes]	1256	1241	1118	1167	1140	1098	989	955	930	1098	1180	1117	1085	973	932
CO	Road (1A3b)	[tonnes]	564556	538653	514377	477172	445400	453681	470593	453523	438888	408350	385944	373173	336203	313050	276439
CO	Railways (1A3c)	[tonnes]	1098	1105	982	1018	937	895	910	963	999	906	914	907	883	745	717
CO	Navigation (1A3d)	[tonnes]	5472	5473	5636	5797	5962	6126	6297	6491	6623	6805	7057	7246	7150	6983	6779
CO	Comm./Inst. (1A4a)	[tonnes]	31348	30972	30583	30181	30181	30181	29610	28987	28319	27809	27575	27800	28012	28211	28817
CO	Residential (1A4b)	[tonnes]	19086	18725	18352	17968	17789	17606	17238	16880	16708	16556	16422	16311	16217	16136	16286
CO	Ag./for./fish. (1A4c)	[tonnes]	61165	59707	57256	55768	53717	51734	48771	45427	42608	39735	37673	34858	32455	29823	27820
CO	Military (1A5)	[tonnes]	4171	3074	1306	3133	1936	423	1001	507	841	865	876	613	590	669	675
CO	Navigation int. (1A3d)	[tonnes]	2722	3214	4855	6243	6424	6796	6065	6361	9677	10946	11548	11030	10168	10233	9662
CO	Civil Aviation int. (1A3a)	[tonnes]	1103	1207	1289	1416	1564	1442	1357	1399	1388	1342	1421	1502	1564	1662	1743
CO_2	Industry-Other (1A2f)	[ktonnes]	852	852	851	849	845	842	843	843	842	841	848	853	860	867	873
CO_2	Civil Aviation (1A3a)	[ktonnes]	256	241	268	271	262	243	199	193	190	196	199	205	212	194	174
CO_2	Road (1A3b)	[ktonnes]	8166	8631	8643	8700	8795	9282	9697	9870	9995	10491	10588	10766	10978	11167	11312
CO_2	Railways (1A3c)	[ktonnes]	364	366	326	338	311	297	302	319	331	300	303	301	293	247	232
CO_2	Navigation (1A3d)	[ktonnes]	784	784	787	790	793	796	803	817	803	814	850	917	898	745	655
CO_2	Comm./Inst. (1A4a)	[ktonnes]	74	74	74	74	74	74	74	75	75	77	78	80	81	83	85
CO_2	Residential (1A4b)	[ktonnes]	40	40	39	39	39	39	39	39	39	39	40	40	41	41	42
CO_2	Ag./for./fish. (1A4c)	[ktonnes]	1806	1922	1758	1887	1874	1899	1903	1794	1760	1695	1728	1642	1554	1510	1564
CO_2	Military (1A5)	[ktonnes]	402	316	361	196	165	119	287	141	237	252	252	176	171	204	182
CO_2	Navigation int. (1A3d)	[ktonnes]	1238	1454	2179	2786	2854	3005	2673	2797	4214	4744	4976	4725	4326	4337	4053
CO_2	Civil Aviation int. (1A3a)	[ktonnes]	1391	1503	1613	1725	1809	1736	1632	1693	1659	1818	1867	1971	2010	2159	2290
N_2O	Industry-Other (1A2f)	[tonnes]	34	34	34	34	34	34	34	35	35	35	35	36	36	36	37
N_2O	Civil Aviation (1A3a)	[tonnes]	10	10	11	11	11	10	9	9	9	9	10	11	11	9	9

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pol_name	IPCC ID	Unit	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
N_2O	Road (1A3b)	[tonnes]	268	281	281	284	287	302	321	341	355	386	408	429	448	453	457
N_2O	Railways (1A3c)	[tonnes]	10	10	9	9	9	8	8	9	9	8	8	8	8	7	6
N_2O	Navigation (1A3d)	[tonnes]	48	48	48	48	48	48	49	50	49	49	51	55	54	44	39
N_2O	Comm./Inst. (1A4a)	[tonnes]	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
N_2O	Residential (1A4b)	[tonnes]	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
N_2O	Ag./for./fish. (1A4c)	[tonnes]	81	87	78	85	85	87	88	83	81	79	81	77	71	70	74
N_2O	Military (1A5)	[tonnes]	12	9	11	6	5	4	8	4	7	8	7	5	5	6	6
N_2O	Navigation int. (1A3d)	[tonnes]	78	92	137	175	179	189	168	176	265	298	313	297	272	273	255
N_2O	Civil Aviation int. (1A3a)	[tonnes]	47	50	54	58	61	59	56	58	57	63	64	69	70	75	80
NH_3	Industry-Other (1A2f)	[tonnes]	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
NH_3	Civil Aviation (1A3a)	[tonnes]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NH_3	Road (1A3b)	[tonnes]	61	63	64	65	65	69	183	415	635	948	1245	1512	1887	2281	2578
NH_3	Railways (1A3c)	[tonnes]	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
NH_3	Navigation (1A3d)	[tonnes]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NH_3	Comm./Inst. (1A4a)	[tonnes]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NH_3	Residential (1A4b)	[tonnes]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NH_3	Ag./for./fish. (1A4c)	[tonnes]	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
NH_3	Military (1A5)	[tonnes]	1	1	0	0	0	0	0	0	0	0	1	0	0	0	1
NH_3	Navigation int. (1A3d)	[tonnes]		0						0	0						
NH_3	Civil Aviation int. (1A3a)	[tonnes]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TSP	Industry-Other (1A2f)	[tonnes]	1823	1778	1733	1686	1634	1577	1533	1484	1433	1383	1349	1317	1284	1249	1193
TSP	Civil Aviation (1A3a)	[tonnes]	5	5	5	5	5	5	4	4	4	4	4	4	4	4	4
TSP	Road (1A3b)	[tonnes]	4341	4701	4708	4623	4676	4891	5026	4831	4791	4883	4670	4452	4027	3656	3331
TSP	Railways (1A3c)	[tonnes]	247	249	222	229	211	202	205	217	225	204	206	204	199	168	146
TSP	Navigation (1A3d)	[tonnes]	1099	1099	1103	1098	1103	898	710	519	660	762	919	723	670	451	417
TSP	Comm./Inst. (1A4a)	[tonnes]	24	24	24	24	24	24	24	23	22	23	24	25	27	28	29
TSP	Residential (1A4b)	[tonnes]	12	12	12	12	11	11	11	11	11	11	11	11	11	11	11
TSP	Ag./for./fish. (1A4c)	[tonnes]	2783	2820	2673	2723	2665	2628	2534	2362	2300	2119	2087	1892	1783	1633	1576
TSP	Military (1A5)	[tonnes]	100	100	49	18	26	11	112	66	62	54	114	44	70	73	44
TSP	Navigation int. (1A3d)	[tonnes]	2832	3448	5914	7810	7866	5531	4371	3999	8648	8194	10076	9968	9231	7717	8177
TSP	Civil Aviation int. (1A3a)	[tonnes]	23	24	26	28	30	28	27	28	27	29	30	32	32	35	37
PM_{10}	Industry-Other (1A2f)	[tonnes]	1823	1778	1733	1686	1634	1577	1533	1484	1433	1383	1349	1317	1284	1249	1193
PM_{10}	Civil Aviation (1A3a)	[tonnes]	5	5	5	5	5	5	4	4	4	4	4	4	4	4	4
PM_{10}	Road (1A3b)	[tonnes]	4341	4701	4708	4623	4676	4891	5026	4831	4791	4883	4670	4452	4027	3656	3331

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pol_name	IPCC ID	Unit	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
PM_{10}	Railways (1A3c)	[tonnes]	247	249	222	229	211	202	205	217	225	204	206	204	199	168	146
PM_{10}	Navigation (1A3d)	[tonnes]	1089	1089	1093	1088	1093	890	704	515	655	756	911	717	664	448	414
PM_{10}	Comm./Inst. (1A4a)	[tonnes]	24	24	24	24	24	24	24	23	22	23	24	25	27	28	29
PM_{10}	Residential (1A4b)	[tonnes]	12	12	12	12	11	11	11	11	11	11	11	11	11	11	11
PM_{10}	Ag./for./fish. (1A4c)	[tonnes]	2781	2818	2671	2721	2663	2626	2532	2360	2298	2117	2086	1891	1782	1632	1575
PM_{10}	Military (1A5)	[tonnes]	100	100	49	18	26	11	112	66	62	54	114	44	70	73	44
PM_{10}	Navigation int. (1A3d)	[tonnes]	2803	3413	5855	7732	7788	5476	4327	3959	8561	8112	9975	9869	9139	7639	8095
PM_{10}	Civil Aviation int. (1A3a)	[tonnes]	23	24	26	28	30	28	27	28	27	29	30	32	32	35	37
$PM_{2.5}$	Industry-Other (1A2f)	[tonnes]	1823	1778	1733	1686	1634	1577	1533	1484	1433	1383	1349	1317	1284	1249	1193
$PM_{2.5}$	Civil Aviation (1A3a)	[tonnes]	5	5	5	5	5	5	4	4	4	4	4	4	4	4	4
$PM_{2.5}$	Road (1A3b)	[tonnes]	4341	4701	4708	4623	4676	4891	5026	4831	4791	4883	4670	4452	4027	3656	3331
$PM_{2.5}$	Railways (1A3c)	[tonnes]	247	249	222	229	211	202	205	217	225	204	206	204	199	168	146
$PM_{2.5}$	Navigation (1A3d)	[tonnes]	1084	1084	1088	1083	1088	886	701	513	652	753	907	714	662	446	413
$PM_{2.5}$	Comm./Inst. (1A4a)	[tonnes]	24	24	24	24	24	24	24	23	22	23	24	25	27	28	29
$PM_{2.5}$	Residential (1A4b)	[tonnes]	12	12	12	12	11	11	11	11	11	11	11	11	11	11	11
$PM_{2.5}$	Ag./for./fish. (1A4c)	[tonnes]	2780	2817	2670	2720	2662	2625	2531	2359	2297	2116	2085	1890	1781	1631	1574
$PM_{2.5}$	Military (1A5)	[tonnes]	100	100	49	18	26	11	112	66	62	54	114	44	70	73	44
$PM_{2.5}$	Navigation int. (1A3d)	[tonnes]	2789	3396	5825	7693	7748	5448	4305	3939	8518	8071	9925	9819	9093	7601	8054
$PM_{2.5}$	Civil Aviation int. (1A3a)	[tonnes]	23	24	26	28	30	28	27	28	27	29	30	32	32	35	37
Arsenic	Industry-Other (1A2f)	[kg]						0	0	0	0	0	0	0	0	0	0
Arsenic	Civil Aviation (1A3a)	[kg]						0	0	0	0	0	0	0	0	0	0
Arsenic	Road (1A3b)	[kg]						1	1	1	1	1	1	1	1	1	1
Arsenic	Railways (1A3c)	[kg]						0	0	0	0	0	0	0	0	0	0
Arsenic	Navigation (1A3d)	[kg]						62	55	47	47	49	50	44	36	28	25
Arsenic	Comm./Inst. (1A4a)	[kg]						0	0	0	0	0	0	0	0	0	0
Arsenic	Residential (1A4b)	[kg]						0	0	0	0	0	0	0	0	0	0
Arsenic	Ag./for./fish. (1A4c)	[kg]						9	10	9	8	8	8	8	6	7	7
Arsenic	Military (1A5)	[kg]						0	0	0	0	0	0	0	0	0	0
Arsenic	Navigation int. (1A3d)	[kg]						353	292	267	465	496	505	325	417	357	369
Arsenic	Civil Aviation int. (1A3a)	[kg]						0	0	0	0	0	0	0	0	0	0
Cadmium	Industry-Other (1A2f)	[kg]						2	2	2	2	2	2	2	2	2	2
Cadmium	Civil Aviation (1A3a)	[kg]						0	0	0	0	0	0	0	0	0	0
Cadmium	Road (1A3b)	[kg]						26	27	28	28	30	30	30	31	31	32
Cadmium	Railways (1A3c)	[kg]						1	1	1	1	1	1	1	1	1	1

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pol_name	IPCC ID	Unit	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Cadmium	Navigation (1A3d)	[kg]						5	4	4	4	4	4	4	4	3	3
Cadmium	Comm./Inst. (1A4a)	[kg]						0	0	0	0	0	0	0	0	0	0
Cadmium	Residential (1A4b)	[kg]						0	0	0	0	0	0	0	0	0	0
Cadmium	Ag./for./fish. (1A4c)	[kg]						5	5	5	5	5	5	4	4	4	4
Cadmium	Military (1A5)	[kg]						0	0	0	0	0	0	0	0	0	0
Cadmium	Navigation int. (1A3d)	[kg]						23	20	19	31	34	35	20	29	26	26
Cadmium	Civil Aviation int. (1A3a)	[kg]						0	0	0	0	0	0	0	0	0	0
Chromium	Industry-Other (1A2f)	[kg]						7	7	7	7	7	7	7	7	7	7
Chromium	Civil Aviation (1A3a)	[kg]						0	0	0	0	0	0	0	0	0	0
Chromium	Road (1A3b)	[kg]						59	62	62	63	66	67	68	69	71	72
Chromium	Railways (1A3c)	[kg]						3	3	3	3	3	3	3	3	2	2
Chromium	Navigation (1A3d)	[kg]						28	25	23	22	23	24	22	19	15	14
Chromium	Comm./Inst. (1A4a)	[kg]						0	0	0	0	0	0	0	0	0	0
Chromium	Residential (1A4b)	[kg]						0	0	0	0	0	0	0	0	0	0
Chromium	Ag./for./fish. (1A4c)	[kg]						19	19	18	17	17	17	16	15	15	16
Chromium	Military (1A5)	[kg]						0	1	1	1	1	1	0	1	1	1
Chromium	Navigation int. (1A3d)	[kg]						147	123	115	195	210	214	131	178	157	160
Chromium	Civil Aviation int. (1A3a)	[kg]						0	0	0	0	0	0	0	0	0	0
Copper	Industry-Other (1A2f)	[kg]						5	5	5	5	5	5	6	6	6	6
Copper	Civil Aviation (1A3a)	[kg]						0	0	0	0	0	0	0	0	0	0
Copper	Road (1A3b)	[kg]						87	92	95	97	102	103	104	106	108	109
Copper	Railways (1A3c)	[kg]						2	2	2	2	2	2	2	2	2	1
Copper	Navigation (1A3d)	[kg]						63	56	48	47	49	50	45	36	29	26
Copper	Comm./Inst. (1A4a)	[kg]						1	1	1	1	1	1	1	1	1	1
Copper	Residential (1A4b)	[kg]						1	1	1	1	1	1	1	1	1	1
Copper	Ag./for./fish. (1A4c)	[kg]						18	18	17	16	16	16	17	14	14	15
Copper	Military (1A5)	[kg]						0	1	0	0	0	1	0	1	1	0
Copper	Navigation int. (1A3d)	[kg]						353	292	267	465	496	505	325	417	357	369
Copper	Civil Aviation int. (1A3a)	[kg]						0	0	0	0	0	0	0	0	0	0
Mercury	Industry-Other (1A2f)	[kg]						1	1	1	1	1	1	1	1	1	1
Mercury	Civil Aviation (1A3a)	[kg]						0	0	0	0	0	0	0	0	0	0
Mercury	Road (1A3b)	[kg]						21	22	22	23	24	24	24	25	25	25
Mercury	Railways (1A3c)	[kg]						0	1	1	1	1	1	1	0	0	0
Mercury	Navigation (1A3d)	[kg]						9	9	10	9	10	10	11	12	10	8

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pol_name	IPCC ID	Unit	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Mercury	Comm./Inst. (1A4a)	[kg]						0	0	0	0	0	0	0	0	0	0
Mercury	Residential (1A4b)	[kg]						0	0	0	0	0	0	0	0	0	0
Mercury	Ag./for./fish. (1A4c)	[kg]						12	12	11	10	10	10	10	8	8	9
Mercury	Military (1A5)	[kg]						0	0	0	0	0	0	0	0	0	0
Mercury	Navigation int. (1A3d)	[kg]						27	25	29	40	47	50	14	45	49	43
Mercury	Civil Aviation int. (1A3a)	[kg]						0	0	0	0	0	0	0	0	0	0
Nickel	Industry-Other (1A2f)	[kg]						2	2	2	2	2	2	2	2	2	2
Nickel	Civil Aviation (1A3a)	[kg]						0	0	0	0	0	0	0	0	0	0
Nickel	Road (1A3b)	[kg]						29	30	32	32	34	34	34	35	36	36
Nickel	Railways (1A3c)	[kg]						1	1	1	1	1	1	1	1	1	1
Nickel	Navigation (1A3d)	[kg]						3362	2889	2360	2359	2477	2492	2087	1520	1179	1077
Nickel	Comm./Inst. (1A4a)	[kg]						0	0	0	0	0	0	0	0	0	0
Nickel	Residential (1A4b)	[kg]						0	0	0	0	0	0	0	0	0	0
Nickel	Ag./for./fish. (1A4c)	[kg]						16	17	16	15	15	15	14	12	12	13
Nickel	Military (1A5)	[kg]						0	0	0	0	0	0	0	0	0	0
Nickel	Navigation int. (1A3d)	[kg]						20420	16701	14894	26627	28129	28488	19451	23291	19285	20431
Nickel	Civil Aviation int. (1A3a)	[kg]						0	0	0	0	0	0	0	0	0	0
Lead	Industry-Other (1A2f)	[kg]						12	12	12	12	12	12	12	12	12	12
Lead	Civil Aviation (1A3a)	[kg]						1534	1423	1378	1328	1639	1788	1640	1559	1399	1387
Lead	Road (1A3b)	[kg]						97614	75966	68886	29930	120	122	123	126	128	131
Lead	Railways (1A3c)	[kg]						4	5	5	5	5	5	5	4	4	4
Lead	Navigation (1A3d)	[kg]						35	34	33	32	33	34	35	32	26	23
Lead	Comm./Inst. (1A4a)	[kg]						1	1	1	1	1	1	1	1	1	1
Lead	Residential (1A4b)	[kg]						0	0	0	0	0	0	0	0	0	0
Lead	Ag./for./fish. (1A4c)	[kg]						38	38	36	35	34	35	33	30	29	31
Lead	Military (1A5)	[kg]						63	81	62	121	86	104	99	125	118	79
Lead	Navigation int. (1A3d)	[kg]						162	140	138	221	243	251	132	214	201	196
Lead	Civil Aviation int. (1A3a)	[kg]						490	465	452	456	153	175	126	145	145	124
Selenium	Industry-Other (1A2f)	[kg]						0	0	0	0	0	0	0	0	0	0
Selenium	Civil Aviation (1A3a)	[kg]						0	0	0	0	0	0	0	0	0	0
Selenium	Road (1A3b)	[kg]						0	0	0	0	1	1	1	1	1	1
Selenium	Railways (1A3c)	[kg]						0	0	0	0	0	0	0	0	0	0
Selenium	Navigation (1A3d)	[kg]						69	67	64	63	64	66	67	62	50	43
Selenium	Comm./Inst. (1A4a)	[kg]						0	0	0	0	0	0	0	0	0	0

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pol_name	IPCC ID	Unit	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Selenium	Residential (1A4b)	[kg]						0	0	0	0	0	0	0	0	0	0
Selenium	Ag./for./fish. (1A4c)	[kg]						37	38	35	33	33	33	32	25	26	30
Selenium	Military (1A5)	[kg]						0	0	0	0	0	0	0	0	0	0
Selenium	Navigation int. (1A3d)	[kg]						325	279	275	442	486	503	264	427	402	391
Selenium	Civil Aviation int. (1A3a)	[kg]						0	0	0	0	0	0	0	0	0	0
Zinc	Industry-Other (1A2f)	[kg]						419	420	420	419	419	422	425	428	432	435
Zinc	Civil Aviation (1A3a)	[kg]						6	5	5	5	6	7	6	6	5	5
Zinc	Road (1A3b)	[kg]						5119	5379	5549	5644	5917	5986	6037	6180	6285	6361
Zinc	Railways (1A3c)	[kg]						150	152	161	167	151	153	152	148	124	117
Zinc	Navigation (1A3d)	[kg]						191	187	184	183	188	195	202	193	165	151
Zinc	Comm./Inst. (1A4a)	[kg]						51	51	52	52	53	54	55	56	57	59
Zinc	Residential (1A4b)	[kg]						27	27	27	27	27	27	28	28	28	29
Zinc	Ag./for./fish. (1A4c)	[kg]						766	762	724	717	683	698	664	655	626	632
Zinc	Military (1A5)	[kg]						6	62	37	34	30	67	27	49	57	39
Zinc	Navigation int. (1A3d)	[kg]						744	643	638	1017	1121	1162	595	991	940	910
Zinc	Civil Aviation int. (1A3a)	[kg]						2	2	2	2	1	1	0	1	1	0
Dioxins/furans	Industry-Other (1A2f)	[g]						0	0	0	0	0	0	0	0	0	0
Dioxins/furans	Civil Aviation (1A3a)	[g]						0	0	0	0	0	0	0	0	0	0
Dioxins/furans	Road (1A3b)	[g]						1	1	1	1	1	1	1	1	0	0
Dioxins/furans	Railways (1A3c)	[g]						0	0	0	0	0	0	0	0	0	0
Dioxins/furans	Navigation (1A3d)	[g]						0	0	0	0	0	0	0	0	0	0
Dioxins/furans	Comm./Inst. (1A4a)	[g]						0	0	0	0	0	0	0	0	0	0
Dioxins/furans	Residential (1A4b)	[g]						0	0	0	0	0	0	0	0	0	0
Dioxins/furans	Ag./for./fish. (1A4c)	[g]						0	0	0	0	0	0	0	0	0	0
Dioxins/furans	Military (1A5)	[g]						0	0	0	0	0	0	0	0	0	0
Dioxins/furans	Navigation int. (1A3d)	[g]						1	0	0	1	1	1	1	1	1	1
Dioxins/furans	Civil Aviation int. (1A3a)	[g]						0	0	0	0	0	0	0	0	0	0
Flouranthene	Industry-Other (1A2f)	[kg]						45	44	45	46	45	46	46	46	46	46
Flouranthene	Civil Aviation (1A3a)	[kg]						0	0	0	0	1	1	1	0	0	0
Flouranthene	Road (1A3b)	[kg]						796	814	795	770	752	702	659	630	599	576
Flouranthene	Railways (1A3c)	[kg]						5	5	6	6	6	6	6	6	5	4
Flouranthene	Navigation (1A3d)	[kg]						66	68	71	70	70	74	82	82	67	58
Flouranthene	Comm./Inst. (1A4a)	[kg]						4	4	4	4	5	5	5	5	5	5
Flouranthene	Residential (1A4b)	[kg]						2	2	2	2	2	2	2	2	2	2

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pol_name	IPCC ID	Unit	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Flouranthene	Ag./for./fish. (1A4c)	[kg]						136	135	128	127	121	124	117	107	104	110
Flouranthene	Military (1A5)	[kg]						1	7	4	4	3	8	3	6	6	4
Flouranthene	Navigation int. (1A3d)	[kg]						198	184	205	288	334	355	344	316	338	304
Flouranthene	Civil Aviation int. (1A3a)	[kg]						0	0	0	0	0	0	0	0	0	0
Benzo(b) flouranthene	Industry-Other (1A2f)	[kg]						6	6	6	6	6	6	6	6	6	6
Benzo(b) flouranthene	Civil Aviation (1A3a)	[kg]						0	0	0	0	0	0	0	0	0	0
Benzo(b) flouranthene	Road (1A3b)	[kg]						66	68	67	66	67	64	63	62	61	60
Benzo(b) flouranthene	Railways (1A3c)	[kg]						1	1	1	2	1	1	1	1	1	1
Benzo(b) flouranthene	Navigation (1A3d)	[kg]						5	5	6	5	5	6	7	7	6	5
Benzo(b) flouranthene	Comm./Inst. (1A4a)	[kg]						0	0	0	0	0	0	0	0	0	0
Benzo(b) flouranthene	Residential (1A4b)	[kg]						0	0	0	0	0	0	0	0	0	0
Benzo(b) flouranthene	Ag./for./fish. (1A4c)	[kg]						15	15	14	14	13	13	13	12	11	12
Benzo(b) flouranthene	Military (1A5)	[kg]						0	1	1	1	0	1	0	1	1	1
Benzo(b) flouranthene	Navigation int. (1A3d)	[kg]						13	12	15	19	23	25	24	22	25	22
Benzo(b) flouranthene	Civil Aviation int. (1A3a)	[kg]						0	0	0	0	0	0	0	0	0	0
Benzo(k) flouranthene	Industry-Other (1A2f)	[kg]						6	6	6	6	6	6	6	6	6	6
Benzo(k) flouranthene	Civil Aviation (1A3a)	[kg]						0	0	0	0	0	0	0	0	0	0
Benzo(k) flouranthene	Road (1A3b)	[kg]						67	69	68	68	70	69	69	69	69	69
Benzo(k) flouranthene	Railways (1A3c)	[kg]						2	2	2	2	2	2	2	2	1	1
Benzo(k) flouranthene	Navigation (1A3d)	[kg]						2	2	2	2	2	3	3	3	3	2
Benzo(k) flouranthene	Comm./Inst. (1A4a)	[kg]						0	0	0	0	0	0	0	0	0	0
Benzo(k) flouranthene	Residential (1A4b)	[kg]						0	0	0	0	0	0	0	0	0	0
Benzo(k) flouranthene	Ag./for./fish. (1A4c)	[kg]						12	12	11	11	11	11	10	10	9	9
Benzo(k) flouranthene	Military (1A5)	[kg]						0	1	1	1	0	1	0	1	1	1
Benzo(k) flouranthene	Navigation int. (1A3d)	[kg]						6	6	7	9	11	11	11	10	12	10
Benzo(k) flouranthene	Civil Aviation int. (1A3a)	[kg]						0	0	0	0	0	0	0	0	0	0
Benzo(a) pyrene	Industry-Other (1A2f)	[kg]						3	3	3	3	3	3	3	3	3	3
Benzo(a) pyrene	Civil Aviation (1A3a)	[kg]						0	0	0	0	0	0	0	0	0	0
Benzo(a) pyrene	Road (1A3b)	[kg]						45	47	47	46	46	44	43	43	42	41
Benzo(a) pyrene	Railways (1A3c)	[kg]						0	0	0	0	0	0	0	0	0	0
Benzo(a) pyrene	Navigation (1A3d)	[kg]						1	1	1	1	1	1	2	2	1	1
Benzo(a) pyrene	Comm./Inst. (1A4a)	[kg]						0	0	0	0	0	0	0	0	0	0
Benzo(a) pyrene	Residential (1A4b)	[kg]						0	0	0	0	0	0	0	0	0	0
Benzo(a) pyrene	Ag./for./fish. (1A4c)	[kg]						6	6	6	6	5	5	5	5	5	5

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pol_name	IPCC ID	Unit	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Benzo(a) pyrene	Military (1A5)	[kg]						0	0	0	0	0	1	0	0	0	0
Benzo(a) pyrene	Navigation int. (1A3d)	[kg]						4	3	4	5	6	7	6	6	6	6
Benzo(a) pyrene	Civil Aviation int. (1A3a)	[kg]						0	0	0	0	0	0	0	0	0	0
Benzo(g,h,i) perylene	Industry-Other (1A2f)	[kg]						6	6	6	6	5	6	5	5	5	5
Benzo(g,h,i) perylene	Civil Aviation (1A3a)	[kg]						0	0	0	0	0	0	0	0	0	0
Benzo(g,h,i) perylene	Road (1A3b)	[kg]						96	99	98	96	96	91	87	85	83	81
Benzo(g,h,i) perylene	Railways (1A3c)	[kg]						0	0	0	0	0	0	0	0	0	0
Benzo(g,h,i) perylene	Navigation (1A3d)	[kg]						8	9	11	10	10	11	13	14	11	10
Benzo(g,h,i) perylene	Comm./Inst. (1A4a)	[kg]						1	1	1	1	1	1	1	1	1	1
Benzo(g,h,i) perylene	Residential (1A4b)	[kg]						0	0	0	0	0	0	0	0	0	0
Benzo(g,h,i) perylene	Ag./for./fish. (1A4c)	[kg]						21	21	20	19	19	19	18	16	15	16
Benzo(g,h,i) perylene	Military (1A5)	[kg]						0	1	1	1	0	1	0	1	1	0
Benzo(g,h,i) perylene	Navigation int. (1A3d)	[kg]						23	23	29	36	44	48	48	44	51	44
Benzo(g,h,i) perylene	Civil Aviation int. (1A3a)	[kg]						0	0	0	0	0	0	0	0	0	0
indeno(1,2,3-c,d) pyrene	Industry-Other (1A2f)	[kg]						3	3	3	3	3	3	3	3	3	3
indeno(1,2,3-c,d) pyrene	Civil Aviation (1A3a)	[kg]						0	0	0	0	0	0	0	0	0	0
indeno(1,2,3-c,d) pyrene	Road (1A3b)	[kg]						44	45	46	46	47	46	45	46	46	46
indeno(1,2,3-c,d) pyrene	Railways (1A3c)	[kg]						0	0	0	0	0	0	0	0	0	0
indeno(1,2,3-c,d) pyrene	Navigation (1A3d)	[kg]						7	7	8	8	8	9	10	11	9	8
indeno(1,2,3-c,d) pyrene	Comm./Inst. (1A4a)	[kg]						0	0	0	0	0	0	0	0	0	0
indeno(1,2,3-c,d) pyrene	Residential (1A4b)	[kg]						0	0	0	0	0	0	0	0	0	0
indeno(1,2,3-c,d) pyrene	Ag./for./fish. (1A4c)	[kg]						14	15	14	13	13	13	12	11	11	11
indeno(1,2,3-c,d) pyrene	Military (1A5)	[kg]						0	0	0	0	0	1	0	0	0	0
indeno(1,2,3-c,d) pyrene	Navigation int. (1A3d)	[kg]						19	19	23	29	36	39	39	36	42	36
indeno(1,2,3-c,d) pyrene	Civil Aviation int. (1A3a)	[kg]						0	0	0	0	0	0	0	0	0	0

pol_name	IPCC ID	Unit	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
SO_2	Industry-Other (1A2f)	[tonnes]	253	256	258	261	263	28	30	32	33	24
SO_2	Civil Aviation (1A3a)	[tonnes]	49	52	45	44	41	43	46	51	52	50
SO_2	Road (1A3b)	[tonnes]	352	353	357	371	381	77	79	83	81	76
SO_2	Railways (1A3c)	[tonnes]	7	7	7	7	7	1	1	1	1	1
SO_2	Navigation (1A3d)	[tonnes]	1844	1733	1582	1984	2319	2339	2431	1686	1510	1593
SO_2	Comm./Inst. (1A4a)	[tonnes]	3	3	4	4	5	1	1	1	1	1
SO_2	Residential (1A4b)	[tonnes]	1	1	2	2	2	0	0	0	0	0
SO_2	Ag./for./fish. (1A4c)	[tonnes]	1021	1209	1237	1204	1022	852	800	690	419	392
SO_2	Military (1A5)	[tonnes]	27	12	19	17	46	57	26	40	19	25
SO_2	Navigation int. (1A3d)	[tonnes]	55367	43830	30036	30982	26540	34283	50417	25652	19326	7383
SO_2	Civil Aviation int.	[tonnes]	750	761	657	683	781	822	824	845	845	739
NO_x	Industry-Other (1A2f)	[tonnes]	12096	11869	11617	11214	10744	10664	10807	10667	9978	7137
NO_x	Civil Aviation (1A3a)	[tonnes]	723	752	641	595	551	583	601	692	697	651
NO_x	Road (1A3b)	[tonnes]	78585	75589	72264	71168	69121	65533	63829	61849	54591	46637
NO_x	Railways (1A3c)	[tonnes]	3727	3396	3396	3540	3478	3724	3542	3555	2920	2603
NO_x	Navigation (1A3d)	[tonnes]	8087	8197	8315	8443	8469	8634	8979	9057	9316	9534
NO_x	Comm./Inst. (1A4a)	[tonnes]	104	112	124	138	155	177	199	215	222	220
NO_x	Residential (1A4b)	[tonnes]	50	54	59	64	69	72	76	79	82	84
NO_x	Ag./for./fish. (1A4c)	[tonnes]	22807	25787	26041	25297	22457	24018	22840	20896	22034	20802
NO_x	Military (1A5)	[tonnes]	544	695	476	524	1279	1308	605	759	481	704
NO_x	Navigation int. (1A3d)	[tonnes]	94441	75429	60383	65339	53439	56540	78012	83555	70401	35658
NO_x	Civil Aviation int.	[tonnes]	9446	9601	8725	9085	10472	11026	11164	11411	11299	9854
NMVOC	Industry-Other (1A2f)	[tonnes]	1926	1873	1815	1754	1676	1620	1583	1498	1357	976
NMVOC	Civil Aviation (1A3a)	[tonnes]	156	155	151	144	158	165	156	164	148	168
NMVOC	Road (1A3b)	[tonnes]	39084	35413	31951	29419	25590	23290	20433	18073	15924	13685
NMVOC	Railways (1A3c)	[tonnes]	253	248	243	223	217	235	230	231	205	174
NMVOC	Navigation (1A3d)	[tonnes]	1731	1702	1661	1602	1534	1423	1305	1190	1096	1013
NMVOC	Comm./Inst. (1A4a)	[tonnes]	2845	3504	4188	4897	5631	5775	5922	6022	5844	5159
NMVOC	Residential (1A4b)	[tonnes]	1757	1824	1894	1972	2053	2084	2115	2134	2109	2071
NMVOC	Ag./for./fish. (1A4c)	[tonnes]	3414	3378	3199	2987	2698	2712	2662	2598	2631	2504
NMVOC	Military (1A5)	[tonnes]	55	54	46	45	100	106	51	68	40	55
NMVOC	Navigation int. (1A3d)	[tonnes]	3045	2433	1989	2130	1731	1792	2418	2563	2195	1160
NMVOC	Civil Aviation int.	[tonnes]	407	405	389	398	449	468	491	505	484	503
CH_4	Industry-Other (1A2f)	[tonnes]	50	49	48	47	46	45	44	43	40	30
CH_4	Civil Aviation (1A3a)	[tonnes]	5	6	5	5	6	7	6	7	6	10

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pol_name	IPCC ID	Unit	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
CH_4	Road (1A3b)	[tonnes]	1770	1645	1531	1449	1345	1224	1125	1018	859	712
CH_4	Railways (1A3c)	[tonnes]	10	10	9	9	8	9	9	9	8	7
CH_4	Navigation (1A3d)	[tonnes]	33	33	34	34	35	35	35	35	35	35
CH_4	Comm./Inst. (1A4a)	[tonnes]	92	101	113	127	144	157	169	175	174	167
CH_4	Residential (1A4b)	[tonnes]	45	48	51	55	60	62	64	65	66	66
CH_4	Ag./for./fish. (1A4c)	[tonnes]	88	90	90	89	85	90	97	104	111	114
CH_4	Military (1A5)	[tonnes]	6	6	5	5	12	12	6	7	4	5
CH_4	Navigation int. (1A3d)	[tonnes]	94	75	62	66	54	55	75	79	68	36
CH_4	Civil Aviation int.	[tonnes]	42	42	40	41	47	49	52	54	50	53
CO	Industry-Other (1A2f)	[tonnes]	8395	8227	8030	7842	7600	7497	7515	7383	7010	5123
CO	Civil Aviation (1A3a)	[tonnes]	895	891	863	835	858	861	842	902	824	758
CO	Road (1A3b)	[tonnes]	252115	240986	220720	211083	186503	178194	158413	141197	127495	110199
CO	Railways (1A3c)	[tonnes]	694	637	627	611	599	648	626	629	526	450
CO	Navigation (1A3d)	[tonnes]	6832	7034	7217	7408	7601	7631	7281	6915	6565	6213
CO	Comm./Inst. (1A4a)	[tonnes]	29423	32889	37681	43798	51239	58128	64197	67870	70290	72227
CO	Residential (1A4b)	[tonnes]	16451	17390	18463	19890	21444	22482	23547	24366	25092	25341
CO	Ag./for./fish. (1A4c)	[tonnes]	25842	24444	22573	20674	18579	17659	17417	18151	18995	19453
CO	Military (1A5)	[tonnes]	396	301	308	296	694	787	373	528	292	387
CO	Navigation int. (1A3d)	[tonnes]	10044	8025	6562	7025	5709	5912	7977	8454	7243	3826
CO	Civil Aviation int.	[tonnes]	1790	1795	1609	1668	1849	1913	1870	1933	2002	1791
CO_2	Industry-Other (1A2f)	[ktonnes]	879	888	897	907	912	950	1021	1089	1109	823
CO_2	Civil Aviation (1A3a)	[ktonnes]	154	163	141	138	128	135	143	161	162	156
CO_2	Road (1A3b)	[ktonnes]	11203	11223	11352	11806	12115	12214	12587	13187	12938	12125
CO_2	Railways (1A3c)	[ktonnes]	228	211	210	218	216	232	227	228	237	230
CO_2	Navigation (1A3d)	[ktonnes]	588	587	578	576	588	585	588	586	593	598
CO_2	Comm./Inst. (1A4a)	[ktonnes]	87	98	112	129	149	162	172	175	176	174
CO_2	Residential (1A4b)	[ktonnes]	43	46	49	53	57	59	61	62	63	63
CO_2	Ag./for./fish. (1A4c)	[ktonnes]	1615	1770	1794	1771	1642	1761	1752	1729	1865	1842
CO_2	Military (1A5)	[ktonnes]	111	97	89	92	239	271	126	175	108	160
CO_2	Navigation int. (1A3d)	[ktonnes]	4168	3304	2691	2853	2299	2352	3136	3292	2809	1487
CO_2	Civil Aviation int.	[ktonnes]	2350	2384	2058	2141	2447	2574	2582	2647	2648	2314
N_2O	Industry-Other (1A2f)	[tonnes]	37	38	38	38	39	40	43	46	47	35
N_2O	Civil Aviation (1A3a)	[tonnes]	8	8	8	8	8	8	8	9	9	8
N_2O	Road (1A3b)	[tonnes]	451	443	437	440	440	425	424	433	417	384

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pol_name	IPCC ID	Unit	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
N_2O	Railways (1A3c)	[tonnes]	6	6	6	6	6	6	6	6	7	6
N_2O	Navigation (1A3d)	[tonnes]	34	34	34	33	34	34	34	34	35	35
N_2O	Comm./Inst. (1A4a)	[tonnes]	1	1	2	2	2	2	3	3	3	3
N_2O	Residential (1A4b)	[tonnes]	1	1	1	1	1	1	1	1	1	1
N_2O	Ag./for./fish. (1A4c)	[tonnes]	78	88	90	88	80	87	86	83	91	89
N_2O	Military (1A5)	[tonnes]	3	3	3	3	8	9	4	6	4	6
N_2O	Navigation int. (1A3d)	[tonnes]	262	208	170	180	145	148	197	207	177	94
N_2O	Civil Aviation int.	[tonnes]	82	82	72	75	85	89	89	91	91	79
NH_3	Industry-Other (1A2f)	[tonnes]	2	2	2	2	2	2	2	3	3	2
NH_3	Civil Aviation (1A3a)	[tonnes]	0	0	0	0	0	0	0	0	0	0
NH_3	Road (1A3b)	[tonnes]	2767	2753	2699	2616	2518	2298	2127	1982	1794	1612
NH_3	Railways (1A3c)	[tonnes]	1	1	1	1	1	1	1	1	1	1
NH_3	Navigation (1A3d)	[tonnes]	0	0	0	0	0	0	0	0	0	0
NH_3	Comm./Inst. (1A4a)	[tonnes]	0	0	0	0	0	0	0	0	0	0
NH_3	Residential (1A4b)	[tonnes]	0	0	0	0	0	0	0	0	0	0
NH_3	Ag./for./fish. (1A4c)	[tonnes]	3	3	3	3	3	3	3	4	4	4
NH_3	Military (1A5)	[tonnes]	0	0	0	0	1	1	0	0	1	1
NH_3	Navigation int. (1A3d)	[tonnes]										
NH_3	Civil Aviation int.	[tonnes]	0	0	0	0	0	0	0	0	0	0
TSP	Industry-Other (1A2f)	[tonnes]	1135	1121	1098	1075	1037	1002	991	938	854	587
TSP	Civil Aviation (1A3a)	[tonnes]	3	4	3	3	3	3	3	3	3	3
TSP	Road (1A3b)	[tonnes]	2986	2760	2520	2457	2328	2233	2170	2083	1818	1523
TSP	Railways (1A3c)	[tonnes]	141	125	124	119	115	124	120	120	101	84
TSP	Navigation (1A3d)	[tonnes]	383	373	357	387	430	425	421	336	327	327
TSP	Comm./Inst. (1A4a)	[tonnes]	30	38	46	55	63	65	66	66	67	67
TSP	Residential (1A4b)	[tonnes]	11	11	12	13	13	13	14	14	14	14
TSP	Ag./for./fish. (1A4c)	[tonnes]	1507	1498	1428	1351	1244	1213	1144	1075	1044	992
TSP	Military (1A5)	[tonnes]	15	31	14	17	38	32	15	15	11	17
TSP	Navigation int. (1A3d)	[tonnes]	8791	7143	4988	4501	3978	5761	7888	2365	1873	820
TSP	Civil Aviation int.	[tonnes]	38	38	33	35	40	42	42	43	43	37
PM_{10}	Industry-Other (1A2f)	[tonnes]	1135	1121	1098	1075	1037	1002	991	938	854	587
PM_{10}	Civil Aviation (1A3a)	[tonnes]	3	4	3	3	3	3	3	3	3	3
PM_{10}	Road (1A3b)	[tonnes]	2986	2760	2520	2457	2328	2233	2170	2083	1818	1523
PM_{10}	Railways (1A3c)	[tonnes]	141	125	124	119	115	124	120	120	101	84

Continued												
pol_name	IPCC ID	Unit	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
PM_{10}	Navigation (1A3d)	[tonnes]	381	371	355	384	427	422	418	334	325	324
PM_{10}	Comm./Inst. (1A4a)	[tonnes]	30	38	46	55	63	65	66	66	67	67
PM_{10}	Residential (1A4b)	[tonnes]	11	11	12	13	13	13	14	14	14	14
PM_{10}	Ag./for./fish. (1A4c)	[tonnes]	1505	1496	1426	1349	1242	1211	1142	1074	1043	990
PM_{10}	Military (1A5)	[tonnes]	15	31	14	17	38	32	15	15	11	17
PM_{10}	Navigation int. (1A3d)	[tonnes]	8703	7072	4938	4456	3938	5703	7809	2341	1854	812
PM_{10}	Civil Aviation int.	[tonnes]	38	38	33	35	40	42	42	43	43	37
$PM_{2.5}$	Industry-Other (1A2f)	[tonnes]	1135	1121	1098	1075	1037	1002	991	938	854	587
$PM_{2.5}$	Civil Aviation (1A3a)	[tonnes]	3	4	3	3	3	3	3	3	3	3
$PM_{2.5}$	Road (1A3b)	[tonnes]	2986	2760	2520	2457	2328	2233	2170	2083	1818	1523
$PM_{2.5}$	Railways (1A3c)	[tonnes]	141	125	124	119	115	124	120	120	101	84
$PM_{2.5}$	Navigation (1A3d)	[tonnes]	379	370	354	383	425	421	417	333	324	323
$PM_{2.5}$	Comm./Inst. (1A4a)	[tonnes]	30	38	46	55	63	65	66	66	67	67
$PM_{2.5}$	Residential (1A4b)	[tonnes]	11	11	12	13	13	13	14	14	14	14
$PM_{2.5}$	Ag./for./fish. (1A4c)	[tonnes]	1504	1495	1425	1347	1241	1210	1141	1073	1042	989
$PM_{2.5}$	Military (1A5)	[tonnes]	15	31	14	17	38	32	15	15	11	17
$PM_{2.5}$	Navigation int. (1A3d)	[tonnes]	8659	7036	4913	4434	3918	5675	7770	2330	1845	808
$PM_{2.5}$	Civil Aviation int.	[tonnes]	38	38	33	35	40	42	42	43	43	37
Arsenic	Industry-Other (1A2f)	[kg]	0	0	0	0	0	0	0	0	0	0
Arsenic	Civil Aviation (1A3a)	[kg]	0	0	0	0	0	0	0	0	0	0
Arsenic	Road (1A3b)	[kg]	1	1	1	1	1	1	1	1	1	1
Arsenic	Railways (1A3c)	[kg]	0	0	0	0	0	0	0	0	0	0
Arsenic	Navigation (1A3d)	[kg]	24	23	23	28	28	28	30	30	31	33
Arsenic	Comm./Inst. (1A4a)	[kg]	0	0	0	0	0	0	0	0	0	0
Arsenic	Residential (1A4b)	[kg]	0	0	0	0	0	0	0	0	0	0
Arsenic	Ag./for./fish. (1A4c)	[kg]	9	11	11	11	9	10	10	8	10	9
Arsenic	Military (1A5)	[kg]	0	0	0	0	0	0	0	0	0	0
Arsenic	Navigation int. (1A3d)	[kg]	422	329	227	257	213	250	381	424	326	127
Arsenic	Civil Aviation int.	[kg]	0	0	0	0	0	0	0	0	0	0
Cadmium	Industry-Other (1A2f)	[kg]	2	2	2	2	2	2	3	3	3	2
Cadmium	Civil Aviation (1A3a)	[kg]	0	0	0	0	0	0	0	0	0	0
Cadmium	Road (1A3b)	[kg]	32	32	32	34	35	35	36	37	37	35
Cadmium	Railways (1A3c)	[kg]	1	1	1	1	1	1	1	1	1	1
Cadmium	Navigation (1A3d)	[kg]	3	2	2	3	3	3	3	3	3	3

Continued												
pol_name	IPCC ID	Unit	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Cadmium	Comm./Inst. (1A4a)	[kg]	0	0	0	0	1	1	1	1	1	1
Cadmium	Residential (1A4b)	[kg]	0	0	0	0	0	0	0	0	0	0
Cadmium	Ag./for./fish. (1A4c)	[kg]	4	5	5	5	4	5	5	5	5	5
Cadmium	Military (1A5)	[kg]	0	0	0	0	0	0	0	0	0	0
Cadmium	Navigation int. (1A3d)	[kg]	29	23	17	18	15	17	24	27	21	9
Cadmium	Civil Aviation int.	[kg]	0	0	0	0	0	0	0	0	0	0
Chromium	Industry-Other (1A2f)	[kg]	7	7	7	8	8	8	9	9	9	7
Chromium	Civil Aviation (1A3a)	[kg]	0	0	0	0	0	0	0	0	0	0
Chromium	Road (1A3b)	[kg]	72	73	74	78	82	84	87	94	93	89
Chromium	Railways (1A3c)	[kg]	2	2	2	2	2	2	2	2	2	2
Chromium	Navigation (1A3d)	[kg]	13	12	12	14	14	14	15	15	15	16
Chromium	Comm./Inst. (1A4a)	[kg]	0	0	1	1	1	1	1	1	1	1
Chromium	Residential (1A4b)	[kg]	0	0	0	0	0	0	0	0	0	0
Chromium	Ag./for./fish. (1A4c)	[kg]	16	18	19	18	17	18	18	17	19	18
Chromium	Military (1A5)	[kg]	0	1	0	0	1	1	0	0	0	1
Chromium	Navigation int. (1A3d)	[kg]	179	140	100	111	92	106	157	174	136	56
Chromium	Civil Aviation int.	[kg]	0	0	0	0	0	0	0	0	0	0
Copper	Industry-Other (1A2f)	[kg]	6	6	6	6	6	6	7	7	7	5
Copper	Civil Aviation (1A3a)	[kg]	0	0	0	0	0	0	0	0	0	0
Copper	Road (1A3b)	[kg]	108	108	110	113	116	114	116	119	117	111
Copper	Railways (1A3c)	[kg]	1	1	1	1	1	1	1	1	1	1
Copper	Navigation (1A3d)	[kg]	25	24	24	29	29	29	31	31	32	34
Copper	Comm./Inst. (1A4a)	[kg]	1	1	1	2	2	2	2	2	2	2
Copper	Residential (1A4b)	[kg]	1	1	1	1	1	1	1	1	1	1
Copper	Ag./for./fish. (1A4c)	[kg]	16	18	18	18	16	17	17	16	18	17
Copper	Military (1A5)	[kg]	0	0	0	0	1	1	0	0	0	1
Copper	Navigation int. (1A3d)	[kg]	422	329	227	257	213	250	381	424	326	127
Copper	Civil Aviation int.	[kg]	0	0	0	0	0	0	0	0	0	0
Mercury	Industry-Other (1A2f)	[kg]	1	1	1	1	1	1	2	2	2	1
Mercury	Civil Aviation (1A3a)	[kg]	0	0	0	0	0	0	0	0	0	0
Mercury	Road (1A3b)	[kg]	25	25	25	26	26	26	27	28	27	25
Mercury	Railways (1A3c)	[kg]	0	0	0	0	0	0	0	0	0	0
Mercury	Navigation (1A3d)	[kg]	7	7	7	6	6	6	6	6	6	6
Mercury	Comm./Inst. (1A4a)	[kg]	0	0	0	0	0	0	0	0	0	0

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pol_name	IPCC ID	Unit	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Mercury	Residential (1A4b)	[kg]	0	0	0	0	0	0	0	0	0	0
Mercury	Ag./for./fish. (1A4c)	[kg]	11	13	13	13	10	12	12	10	12	11
Mercury	Military (1A5)	[kg]	0	0	0	0	0	0	0	0	0	0
Mercury	Navigation int. (1A3d)	[kg]	42	34	30	31	24	23	27	27	25	17
Mercury	Civil Aviation int.	[kg]	0	0	0	0	0	0	0	0	0	0
Nickel	Industry-Other (1A2f)	[kg]	2	2	2	2	2	2	3	3	3	2
Nickel	Civil Aviation (1A3a)	[kg]	0	0	0	0	0	0	0	0	0	0
Nickel	Road (1A3b)	[kg]	36	36	37	38	39	39	40	41	41	39
Nickel	Railways (1A3c)	[kg]	1	1	1	1	1	1	1	1	1	1
Nickel	Navigation (1A3d)	[kg]	1068	1036	1026	1374	1367	1371	1494	1479	1578	1687
Nickel	Comm./Inst. (1A4a)	[kg]	0	0	0	1	1	1	1	1	1	1
Nickel	Residential (1A4b)	[kg]	0	0	0	0	0	0	0	0	0	0
Nickel	Ag./for./fish. (1A4c)	[kg]	15	18	19	18	15	17	16	15	17	16
Nickel	Military (1A5)	[kg]	0	0	0	0	0	0	0	0	0	0
Nickel	Navigation int. (1A3d)	[kg]	23829	18510	12366	14147	11846	14256	22148	24842	18832	6924
Nickel	Civil Aviation int.	[kg]	0	0	0	0	0	0	0	0	0	0
Lead	Industry-Other (1A2f)	[kg]	13	13	13	13	13	14	15	16	16	12
Lead	Civil Aviation (1A3a)	[kg]	1369	1343	1328	1252	1304	1297	1245	1329	1182	991
Lead	Road (1A3b)	[kg]	130	132	135	143	149	151	157	168	168	161
Lead	Railways (1A3c)	[kg]	3	3	3	3	3	4	3	3	4	3
Lead	Navigation (1A3d)	[kg]	21	20	20	21	21	21	22	22	22	23
Lead	Comm./Inst. (1A4a)	[kg]	1	1	1	1	2	2	2	2	2	2
Lead	Residential (1A4b)	[kg]	0	0	1	1	1	1	1	1	1	1
Lead	Ag./for./fish. (1A4c)	[kg]	33	38	39	38	34	37	36	34	38	37
Lead	Military (1A5)	[kg]	114	89	106	79	84	60	47	81	40	66
Lead	Navigation int. (1A3d)	[kg]	210	166	126	137	112	121	172	186	151	70
Lead	Civil Aviation int.	[kg]	118	114	113	106	111	117	22	10	113	52
Selenium	Industry-Other (1A2f)	[kg]	0	0	0	0	0	0	0	0	0	0
Selenium	Civil Aviation (1A3a)	[kg]	0	0	0	0	0	0	0	0	0	0
Selenium	Road (1A3b)	[kg]	1	1	1	1	1	1	1	1	1	1
Selenium	Railways (1A3c)	[kg]	0	0	0	0	0	0	0	0	0	0
Selenium	Navigation (1A3d)	[kg]	39	38	37	39	40	40	41	40	42	43
Selenium	Comm./Inst. (1A4a)	[kg]	0	0	0	0	0	0	0	0	0	0
Selenium	Residential (1A4b)	[kg]	0	0	0	0	0	0	0	0	0	0

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pol_name	IPCC ID	Unit	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Selenium	Ag./for./fish. (1A4c)	[kg]	35	44	45	44	34	41	38	33	38	35
Selenium	Military (1A5)	[kg]	0	0	0	0	0	0	0	0	0	0
Selenium	Navigation int. (1A3d)	[kg]	421	331	252	274	224	243	345	372	302	140
Selenium	Civil Aviation int.	[kg]	0	0	0	0	0	0	0	0	0	0
Zinc	Industry-Other (1A2f)	[kg]	438	443	447	452	455	474	510	544	555	411
Zinc	Civil Aviation (1A3a)	[kg]	5	5	5	5	5	5	5	5	4	4
Zinc	Road (1A3b)	[kg]	6340	6366	6498	6756	6970	6948	7109	7456	7364	7052
Zinc	Railways (1A3c)	[kg]	115	106	106	110	109	117	114	115	119	116
Zinc	Navigation (1A3d)	[kg]	142	143	143	149	152	152	153	152	154	156
Zinc	Comm./Inst. (1A4a)	[kg]	60	68	77	89	103	112	119	121	122	121
Zinc	Residential (1A4b)	[kg]	29	32	34	36	39	41	42	43	44	44
Zinc	Ag./for./fish. (1A4c)	[kg]	630	658	663	660	646	669	680	699	739	744
Zinc	Military (1A5)	[kg]	14	33	17	22	53	48	24	26	24	42
Zinc	Navigation int. (1A3d)	[kg]	973	766	588	637	519	560	788	848	692	326
Zinc	Civil Aviation int.	[kg]	0	0	0	0	0	0	0	0	0	0
Dioxins/furans	Industry-Other (1A2f)	[g]	0	0	0	0	0	0	0	0	0	0
Dioxins/furans	Civil Aviation (1A3a)	[g]	0	0	0	0	0	0	0	0	0	0
Dioxins/furans	Road (1A3b)	[g]	0	0	0	0	0	0	0	0	0	0
Dioxins/furans	Railways (1A3c)	[g]	0	0	0	0	0	0	0	0	0	0
Dioxins/furans	Navigation (1A3d)	[g]	0	0	0	0	0	0	0	0	0	0
Dioxins/furans	Comm./Inst. (1A4a)	[g]	0	0	0	0	0	0	0	0	0	0
Dioxins/furans	Residential (1A4b)	[g]	0	0	0	0	0	0	0	0	0	0
Dioxins/furans	Ag./for./fish. (1A4c)	[g]	0	0	0	0	0	0	0	0	0	0
Dioxins/furans	Military (1A5)	[g]	0	0	0	0	0	0	0	0	0	0
Dioxins/furans	Navigation int. (1A3d)	[g]	1	1	0	0	0	0	1	1	0	0
Dioxins/furans	Civil Aviation int.	[g]	0	0	0	0	0	0	0	0	0	0
Flouranthene	Industry-Other (1A2f)	[kg]	48	48	49	49	50	52	56	60	61	45
Flouranthene	Civil Aviation (1A3a)	[kg]	0	0	0	0	0	0	0	0	0	0
Flouranthene	Road (1A3b)	[kg]	556	547	551	581	610	633	675	755	774	755
Flouranthene	Railways (1A3c)	[kg]	4	4	4	4	4	4	4	4	5	4
Flouranthene	Navigation (1A3d)	[kg]	52	51	50	49	50	50	49	49	50	50
Flouranthene	Comm./Inst. (1A4a)	[kg]	5	6	7	8	9	10	10	10	10	10
Flouranthene	Residential (1A4b)	[kg]	3	3	3	3	3	3	4	4	4	4
Flouranthene	Ag./for./fish. (1A4c)	[kg]	118	133	135	133	119	130	128	123	134	131

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pol_name	IPCC ID	Unit	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Flouranthene	Military (1A5)	[kg]	2	4	2	3	6	6	3	3	3	5
Flouranthene	Navigation int. (1A3d)	[kg]	298	238	208	215	171	164	203	205	187	114
Flouranthene	Civil Aviation int.	[kg]	0	0	0	0	0	0	0	0	0	0
Benzo(b) flouranthene	Industry-Other (1A2f)	[kg]	6	6	6	6	6	6	7	7	7	5
Benzo(b) flouranthene	Civil Aviation (1A3a)	[kg]	0	0	0	0	0	0	0	0	0	0
Benzo(b) flouranthene	Road (1A3b)	[kg]	59	58	58	61	64	65	68	74	74	70
Benzo(b) flouranthene	Railways (1A3c)	[kg]	1	1	1	1	1	1	1	1	1	1
Benzo(b) flouranthene	Navigation (1A3d)	[kg]	4	4	4	4	4	4	4	4	4	4
Benzo(b) flouranthene	Comm./Inst. (1A4a)	[kg]	0	0	0	0	0	0	0	1	1	0
Benzo(b) flouranthene	Residential (1A4b)	[kg]	0	0	0	0	0	0	0	0	0	0
Benzo(b) flouranthene	Ag./for./fish. (1A4c)	[kg]	12	13	13	13	12	13	13	13	14	14
Benzo(b) flouranthene	Military (1A5)	[kg]	0	0	0	0	1	1	0	0	0	1
Benzo(b) flouranthene	Navigation int. (1A3d)	[kg]	21	17	15	16	12	11	13	12	12	8
Benzo(b) flouranthene	Civil Aviation int.	[kg]	0	0	0	0	0	0	0	0	0	0
Benzo(k) flouranthene	Industry-Other (1A2f)	[kg]	6	5	5	6	6	6	6	7	7	5
Benzo(k) flouranthene	Civil Aviation (1A3a)	[kg]	0	0	0	0	0	0	0	0	0	0
Benzo(k) flouranthene	Road (1A3b)	[kg]	68	67	68	71	74	76	79	85	84	79
Benzo(k) flouranthene	Railways (1A3c)	[kg]	1	1	1	1	1	1	1	1	1	1
Benzo(k) flouranthene	Navigation (1A3d)	[kg]	2	2	2	2	2	2	2	2	2	2
Benzo(k) flouranthene	Comm./Inst. (1A4a)	[kg]	0	0	0	0	0	0	0	0	0	0
Benzo(k) flouranthene	Residential (1A4b)	[kg]	0	0	0	0	0	0	0	0	0	0
Benzo(k) flouranthene	Ag./for./fish. (1A4c)	[kg]	9	10	10	10	9	10	10	10	11	11
Benzo(k) flouranthene	Military (1A5)	[kg]	0	0	0	0	1	1	0	0	0	1
Benzo(k) flouranthene	Navigation int. (1A3d)	[kg]	10	8	7	7	6	5	6	6	6	4
Benzo(k) flouranthene	Civil Aviation int.	[kg]	0	0	0	0	0	0	0	0	0	0
Benzo(a) pyrene	Industry-Other (1A2f)	[kg]	3	3	3	3	3	3	3	4	4	3
Benzo(a) pyrene	Civil Aviation (1A3a)	[kg]	0	0	0	0	0	0	0	0	0	0
Benzo(a) pyrene	Road (1A3b)	[kg]	41	41	42	44	46	48	51	56	58	56
Benzo(a) pyrene	Railways (1A3c)	[kg]	0	0	0	0	0	0	0	0	0	0
Benzo(a) pyrene	Navigation (1A3d)	[kg]	1	1	1	1	1	1	1	1	1	1
Benzo(a) pyrene	Comm./Inst. (1A4a)	[kg]	0	0	0	0	0	0	0	0	0	0
Benzo(a) pyrene	Residential (1A4b)	[kg]	0	0	0	0	0	0	0	0	0	0
Benzo(a) pyrene	Ag./for./fish. (1A4c)	[kg]	5	5	5	5	5	5	5	5	6	5
Benzo(a) pyrene	Military (1A5)	[kg]	0	0	0	0	0	0	0	0	0	0

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pol_name	IPCC ID	Unit	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Benzo(a) pyrene	Navigation int. (1A3d)	[kg]	6	4	4	4	3	3	4	4	3	2
Benzo(a) pyrene	Civil Aviation int.	[kg]	0	0	0	0	0	0	0	0	0	0
Benzo(g,h,i) perylene	Industry-Other (1A2f)	[kg]	5	5	5	5	5	6	6	6	7	5
Benzo(g,h,i) perylene	Civil Aviation (1A3a)	[kg]	0	0	0	0	0	0	0	0	0	0
Benzo(g,h,i) perylene	Road (1A3b)	[kg]	79	79	80	84	88	90	96	106	108	106
Benzo(g,h,i) perylene	Railways (1A3c)	[kg]	0	0	0	0	0	0	0	0	0	0
Benzo(g,h,i) perylene	Navigation (1A3d)	[kg]	8	8	8	7	7	7	7	7	7	7
Benzo(g,h,i) perylene	Comm./Inst. (1A4a)	[kg]	1	1	1	1	1	2	2	2	2	2
Benzo(g,h,i) perylene	Residential (1A4b)	[kg]	0	0	0	0	1	1	1	1	1	1
Benzo(g,h,i) perylene	Ag./for./fish. (1A4c)	[kg]	18	20	21	20	17	20	19	18	20	19
Benzo(g,h,i) perylene	Military (1A5)	[kg]	0	0	0	0	1	1	0	0	0	1
Benzo(g,h,i) perylene	Navigation int. (1A3d)	[kg]	40	32	31	31	24	21	23	21	22	17
Benzo(g,h,i) perylene	Civil Aviation int.	[kg]	0	0	0	0	0	0	0	0	0	0
indeno(1,2,3-c,d) pyre-	Industry-Other (1A2f)	[kg]	3	3	3	3	3	3	3	4	4	3
indeno(1,2,3-c,d) pyre-	Civil Aviation (1A3a)	[kg]	0	0	0	0	0	0	0	0	0	0
indeno(1,2,3-c,d) pyre-	Road (1A3b)	[kg]	46	46	47	50	52	54	57	62	63	61
indeno(1,2,3-c,d) pyre-	Railways (1A3c)	[kg]	0	0	0	0	0	0	0	0	0	0
indeno(1,2,3-c,d) pyre-	Navigation (1A3d)	[kg]	7	7	6	6	6	6	6	6	6	6
indeno(1,2,3-c,d) pyre-	Comm./Inst. (1A4a)	[kg]	0	0	0	0	0	1	1	1	1	1
indeno(1,2,3-c,d) pyre-	Residential (1A4b)	[kg]	0	0	0	0	0	0	0	0	0	0
indeno(1,2,3-c,d) pyre-	Ag./for./fish. (1A4c)	[kg]	13	15	15	15	13	14	14	13	14	13
indeno(1,2,3-c,d) pyre-	Military (1A5)	[kg]	0	0	0	0	0	0	0	0	0	0
indeno(1,2,3-c,d) pyre-	Navigation int. (1A3d)	[kg]	33	26	25	25	20	17	19	17	18	14
indeno(1,2,3-c,d) pyre-	Civil Aviation int.	[kg]	0	0	0	0	0	0	0	0	0	0

Annex 2B-16: Uncertainty estimates

Uncertainty estimation, SO_2.

	Gas	Base year emission	Year t emission	Activity data uncertainty	Emission factor uncertainty	Combined uncertainty	Combined uncertainty as % of total national emissions in year t	Type A sensitivity	Type B sensitivity	Uncertainty in trend in national emissions in-troduced by emission factor uncertainty	Uncertainty in trend in national emissions in-troduced by activity data uncertainty	Uncertainty introduced into the trend in total national emissions
		Input data Gg SO_2	Input data Gg SO_2	Input data %	Input data %	%	%	%	%	%	%	%
Road Transportation	SO_2	5767	76	2	50	50,040	1,745	- 0,044692307	0,0048	-2,2346153	0,01354194	2,23465637
Other mobile sources	SO_2	10186	2114	10	50	50,990	49,212	0,0445693	0,1325	2,22846498	1,874276829	2,91186706
Total		15952,627	2190,6017				2424,900					13,4726589
Total uncertainties					**Year (%):**		**49,243**			**Trend (%):**		**3,671**

Uncertainty estimation, NO_X.

	Gas	Base year emission	Year t emission	Activity data uncertain-ty	Emission factor uncertainty	Combined uncertainty	Combined uncertainty as % of total national emissions in year t	Type A sensitivity	Type B sensitivity	Uncertainty in trend in national emissions in-troduced by emission factor uncertainty	Uncertainty in trend in national emissions in-troduced by activity data uncertainty	Uncertainty introduced into the trend in total national emissions
		Input data Gg NO_X	Input data Gg NO_X	Input data %	Input data %	%	%	%	%	%	%	%
Road Transportation	NO_X	109035	46637	2	50	50,040	26,262	- 0,082333789	0,2889	-4,1166895	0,817086989	4,19699456
Other mobile sources	NO_X	52403	42227	10	100	100,499	47,756	0,08262168	0,2616	8,262168	3,699112593	9,05245016
Total	NO_X	161438,52	88863,938				2970,278					99,5616173
Total uncertainties					**Year (%):**		**54,500**			**Trend (%):**		**9,978**

Uncertainty estimation, NMVOC.

	Gas	Base year emission	Year t emission	Activity data uncertainty	Emission factor uncertainty	Combined uncertainty	Combined uncertainty as % of total national emissions in year t	Type A sensitivity	Type B sensitivity	Uncertainty in trend in national emissions in-troduced by emission factor uncertainty	Uncertainty in trend in national emissions in-troduced by activity data uncertainty	Uncertainty introduced into the trend in total national emissions
		Input data Gg NMVOC	Input data Gg NMVOC	Input data %	Input data %	%	%	%	%	%	%	%
Road Transportation	NMVOC	80071	13685	2	50	50,040	26,370	- 0,085881592	0,1442	-4,2940796	0,407775902	4,31339784
Other mobile sources	NMVOC	14853	12284	10	100	100,499	47,539	0,086470727	0,1294	8,64707265	1,83019263	8,8386351
Total	NMVOC	94923,677	25969,667				2955,314					96,7268715
Total uncertainties					**Year (%):**		**54,363**			**Trend (%):**		**9,835**

Uncertainty estimation, CO.

	Gas	Base year emission	Year t emission	Activity data uncertainty	Emission factor uncertainty	Combined uncertainty	Combined uncertainty as % of total national emissions in year t	Type A sensitivity	Type B sensitivity	Uncertainty in trend in national emissions introduced by emission factor uncertainty	Uncertainty in trend in national emissions in-troduced by activity data uncertainty	Uncertainty introduced into the trend in total national emissions
		Input data Gg CO	Input data Gg CO	Input data %	Input data %	%	%	%	%	%	%	%
Road Transportation	CO	453681	110199	2	50	50,040	22,902	-0,140512145	0,1928	-7,0256072	0,545376449	7,04674339
Other mobile sources	CO	117830	130584	10	100	100,499	54,504	0,141336173	0,2285	14,1336173	3,231335749	14,4982988
Total	CO	571510,79	240783				3495,145					259,857261
Total uncertainties					**Year (%):**		**59,120**			**Trend (%):**		**16,120**

Uncertainty estimation, NH_3.

	Gas	Base year emission	Year t emission	Activity data uncertainty	Emission factor uncertainty	Combined uncertainty	Combined uncertainty as % of total national emissions in year t	Type A sensitivity	Type B sensitivity	Uncertainty in trend in national emissions introduced by emission factor uncertainty	Uncertainty in trend in national emissions introduced by activity data uncertainty	Uncertainty introduced into the trend in total national emissions
		Input data	Input data	Input data	Input data							
		Gg NH_3	Gg NH_3	%	%	%	%	%	%	%	%	%
Road Transportation	NH_3	69	1612	2	1000	1000,002	995,279	1,630329665	21,3258	1630,32967	60,31837698	1631,4451
Other mobile sources	NH_3	6	8	10	1000	1000,050	4,724	- 1,643964088	0,1012	-1643,9641	1,431281229	1643,96471
Total	NH_3	75,56906	1619,2163				990601,906					5364233,1
Total uncertainties					**Year (%):**		**995,290**			**Trend (%):**		**2316**

Uncertainty estimation, TSP.

	Gas	Base year emission	Year t emission	Activity data uncertainty	Emission factor uncertainty	Combined uncertainty	Combined uncertainty as % of total national emissions in year t	Type A sensitivity	Type B sensitivity	Uncertainty in trend in national emissions introduced by emission factor uncertainty	Uncertainty in trend in national emissions introduced by activity data uncertainty	Uncertainty introduced into the trend in total national emissions
		Input data	Input data	Input data	Input data							
		Gg TSP	Gg TSP	%	%	%	%	%	%	%	%	%
Road Transportation	TSP	6675	3969	2	50	50,040	32,764	-0,011754567	0,4008	-0,5877283	1,133525716	1,27683403
Other mobile sources	TSP	3227	2093	10	100	100,499	34,696	0,011795363	0,2113	1,17953631	2,988331905	3,21269878
Total	TSP	9902,7128	6061,1419				2277,295					11,9517386
Total uncertainties					**Year (%):**		**47,721**			**Trend (%):**		**3,457**

Uncertainty estimation, Arsenic.

	Gas	Base year emission	Year t emission	Activity data uncertainty	Emission factor uncertainty	Combined uncertainty	Combined uncertainty as % of total national emissions in year t	Type A sensitivity	Type B sensitivity	Uncertainty in trend in national emissions introduced by emission factor uncertainty	Uncertainty in trend in national emissions introduced by activity data uncertainty	Uncertainty introduced into the trend in total national emissions
		Input data	Input data	Input data	Input data							
		kg	kg	%	%	%	%	%	%	%	%	%
Road Transportation	Arsenic	5	7	2	1000	1000,002	143,219	0,047611253	0,0914	47,6112529	0,258429209	47,6119542
Other mobile sources	Arsenic	71	42	10	1000	1000,050	856,825	-0,047204195	0,5466	-47,204195	7,730069349	47,8329385
Total	Arsenic	76,698665	48,931215				754659,901					4554,88819
Total uncertainties					**Year (%):**		**868,712**			**Trend (%):**		**67,490**

Uncertainty estimation, Cadmium.

	Gas	Base year emission	Year t emission	Activity data uncertainty	Emission factor uncertainty	Combined uncertainty	Combined uncertainty as % of total national emissions in year t	Type A sensitivity	Type B sensitivity	Uncertainty in trend in national emissions introduced by emission factor uncertainty	Uncertainty in trend in national emissions introduced by activity data uncertainty	Uncertainty introduced into the trend in total national emissions
		Input data	Input data	Input data	Input data							
		kg	kg	%	%	%	%	%	%	%	%	%
Road Transportation	Cadmium	30	42	2	1000	1000,002	783,925	0,105861776	0,9637	105,861776	2,725627998	105,896859
Other mobile sources	Cadmium	13	12	10	1000	1000,050	216,088	-0,106278046	0,2656	-106,27805	3,756395687	106,34441
Total	Cadmium	43,680812	53,695612				661231,839					22523,2781
Total uncertainties					**Year (%):**		**813,162**			**Trend (%):**		**150,078**

Uncertainty estimation, Chromium.

	Gas	Base year emission	Year t emission	Activity data uncertainty	Emission factor uncertainty	Combined uncertainty	Combined uncertainty as % of total national emissions in year t	Type A sensitivity	Type B sensitivity	Uncertainty in trend in national emissions introduced by emission factor uncertainty	Uncertainty in trend in national emissions introduced by activity data uncertainty	Uncertainty introduced into the trend in total national emissions
		Input data kg	Input data kg	Input data %	Input data %	%	%	%	%	%	%	%
Road Transportation	Chromium	125	177	2	1000	1000,002	796,243	0,131202936	0,9740	131,202936	2,754942315	131,231856
Other mobile sources	Chromium	57	45	10	1000	1000,050	203,769	-0,131695373	0,2493	-131,69537	3,524957643	131,742539
Total	Chromium	181,87078	222,47731				675524,535					34577,8965
Total uncertainties					**Year (%):**		**821,903**			**Trend (%):**		**185,951**

Uncertainty estimation, Copper.

	Gas	Base year emission	Year t emission	Activity data uncertainty	Emission factor uncertainty	Combined uncertainty	Combined uncertainty as % of total national emissions in year t	Type A sensitivity	Type B sensitivity	Uncertainty in trend in national emissions introduced by emission factor uncertainty	Uncertainty in trend in national emissions introduced by activity data uncertainty	Uncertainty introduced into the trend in total national emissions
		Input data kg	Input data kg	Input data %	Input data %	%	%	%	%	%	%	%
Road Transportation	Copper	31399	45645	2	1000	1000,002	998,657	0,002155919	1,4496	2,15591886	4,099977322	4,63225649
Other mobile sources	Copper	90	61	10	1000	1000,050	1,345	-0,002177355	0,0020	-2,1773548	0,027612439	2,17752984
Total	Copper	31488,661	45706,213				997317,321					26,1994364
Total uncertainties					**Year (%):**		**998,658**			**Trend (%):**		**5,119**

Uncertainty estimation, Mercury.

	Gas	Base year emission	Year t emission	Activity data uncertainty	Emission factor uncertainty	Combined uncertainty	Combined uncertainty as % of total national emissions in year t	Type A sensitivity	Type B sensitivity	Uncertainty in trend in national emissions introduced by emission factor uncertainty	Uncertainty in trend in national emissions introduced by activity data uncertainty	Uncertainty introduced into the trend in total national emissions
		Input data	Input data	Input data	Input data							
		kg	kg	%	%	%	%	%	%	%	%	%
Road Transportation	Mercury	21	26	2	1000	1000,002	563,006	0,085607234	0,5963	85,6072343	1,686583114	85,6238467
Other mobile sources	Mercury	22	20	10	1000	1000,050	437,017	-0,085576213	0,4628	-85,576213	6,545490154	85,8261714
Total	Mercury	42,859171	45,393572				507959,595					14697,5748
Total uncertainties					Year (%):		712,713			Trend (%):		121,234

Uncertainty estimation, Nickel.

	Gas	Base year emission	Year t emission	Activity data uncertainty	Emission factor uncertainty	Combined uncertainty	Combined uncertainty as % of total national emissions in year t	Type A sensitivity	Type B sensitivity	Uncertainty in trend in national emissions introduced by emission factor uncertainty	Uncertainty in trend in national emissions introduced by activity data uncertainty	Uncertainty introduced into the trend in total national emissions
		Input data	Input data	Input data	Input data							
		kg	kg	%	%	%	%	%	%	%	%	%
Road Transportation	Nickel	103	139	2	1000	1000,002	75,274	0,024200401	0,0399	24,2004009	0,112725219	24,2006634
Other mobile sources	Nickel	3382	1706	10	1000	1000,050	924,772	-0,023974889	0,4896	-23,974889	6,924058952	24,9547169
Total	Nickel	3484,699	1845,0062				860870,317					1208,41
Total uncertainties					Year (%):		927,831			Trend (%):		34,762

Uncertainty estimation, Lead.

	Gas	Base year emission	Year t emission	Activity data uncertainty	Emission factor uncertainty	Combined uncertainty	Combined uncertainty as % of total national emissions in year t	Type A sensitivity	Type B sensitivity	Uncertainty in trend in national emissions introduced by emission factor uncertainty	Uncertainty in trend in national emissions introduced by activity data uncertainty	Uncertainty introduced into the trend in total national emissions
		Input data kg	Input data kg	Input data %	Input data %	%	%	%	%	%	%	%
Road Transportation	Lead	101734	6179	2	1000	1000,002	838,937	-0,009834779	0,0595	-9,8347794	0,168195585	9,83621753
Other mobile sources	Lead	2178	1186	10	1000	1000,050	161,073	0,009928985	0,0114	9,92898488	0,161456571	9,93029753
Total	Lead	103911,57	7365,5456				729760,009					195,361984
Total uncertainties					**Year (%):**		**854,260**			**Trend (%):**		**13,977**

Uncertainty estimation, Selenium.

	Gas	Base year emission	Year t emission	Activity data uncertainty	Emission factor uncertainty	Combined uncertainty	Combined uncertainty as % of total national emissions in year t	Type A sensitivity	Type B sensitivity	Uncertainty in trend in national emissions introduced by emission factor uncertainty	Uncertainty in trend in national emissions introduced by activity data uncertainty	Uncertainty introduced into the trend in total national emissions
		Input data kg	Input data kg	Input data %	Input data %	%	%	%	%	%	%	%
Road Transportation	Selenium	21	29	2	1000	1000,002	269,834	0,088190403	0,2255	88,1904029	0,637825013	88,1927093
Other mobile sources	Selenium	107	78	10	1000	1000,050	730,203	-0,087602911	0,6102	-87,602911	8,629730211	88,0269401
Total	Selenium	127,58811	106,62784				606006,687					15526,6962
Total uncertainties					**Year (%):**		**778,464**			**Trend (%):**		**124,606**

Uncertainty estimation, Zinc.

	Gas	Base year emission	Year t emission	Activity data uncertainty	Emission factor uncertainty	Combined uncertainty	Combined uncertainty as % of total national emissions in year t	Type A sensitivity	Type B sensitivity	Uncertainty in trend in national emissions introduced by emission factor uncertainty	Uncertainty in trend in national emissions introduced by activity data uncertainty	Uncertainty introduced into the trend in total national emissions
		Input data kg	Input data kg	Input data %	Input data %	%	%	%	%	%	%	%
Road Transportation	Zinc	18637	26024	2	1000	1000,002	940,846	0,02796886	1,2849	27,96886	3,634258409	28,2039884
Other mobile sources	Zinc	1617	1636	10	1000	1000,050	59,159	-0,028203709	0,0808	-28,203709	1,142533486	28,2268418
Total	Zinc	20253,261	27659,751				888690,315					1592,21956
Total uncertainties					**Year (%):**		**942,704**			**Trend (%):**		**39,903**

Uncertainty estimation, Dioxins.

	Gas	Base year emission	Year t emission	Activity data uncertainty	Emission factor uncertainty	Combined uncertainty	Combined uncertainty as % of total national emissions in year t	Type A sensitivity	Type B sensitivity	Uncertainty in trend in national emissions introduced by emission factor uncertainty	Uncertainty in trend in national emissions introduced by activity data uncertainty	Uncertainty introduced into the trend in total national emissions
		Input data g dioxins	Input data g dioxins	Input data %	Input data %	%	%	%	%	%	%	%
Road Transportation	Dioxins	1	0	2	1000	1000,002	335,851	-0,125544272	0,0976	-125,54427	0,275927487	125,544576
Other mobile sources	Dioxins	0	0	10	1000	1000,050	664,183	0,126224151	0,1929	126,224151	2,728259671	126,253633
Total	Dioxins	1,1311908	0,3285795				553934,975					31701,4202
Total uncertainties					**Year (%):**		**744,268**			**Trend (%):**		**178,049**

Uncertainty estimation, Flouranthene.

	Gas	Base year emission	Year t emission	Activity data uncertainty	Emission factor uncertainty	Combined uncertainty	Combined uncertainty as % of total national emissions in year t	Type A sensitivity	Type B sensitivity	Uncertainty in trend in national emissions introduced by emission factor uncertainty	Uncertainty in trend in national emissions introduced by activity data uncertainty	Uncertainty introduced into the trend in total national emissions
		Input data	Input data	Input data	Input data							
		kg	kg	%	%	%	%	%	%	%	%	%
Road Transportation	Flouranthene	796	755	2	1000	1000,002	751,328	-0,001596111	0,7147	-1,5961108	2,021484176	2,57564905
Other mobile sources	Flouranthene	261	250	10	1000	1000,050	248,686	0,001604168	0,2366	1,60416778	3,345350131	3,7100838
Total	Flouranthene	1056,8644	1005,3471				626338,276					20,3986898
Total uncertainties					**Year (%):**		**791,415**			**Trend (%):**		**4,516**

Uncertainty estimation, Benzo(b) flouranthene.

	Gas	Base year emission	Year t emission	Activity data uncertainty	Emission factor uncertainty	Combined uncertainty	Combined uncertainty as % of total national emissions in year t	Type A sensitivity	Type B sensitivity	Uncertainty in trend in national emissions introduced by emission factor uncertainty	Uncertainty in trend in national emissions introduced by activity data uncertainty	Uncertainty introduced into the trend in total national emissions
		Input data	Input data	Input data	Input data							
		kg	kg	%	%	%	%	%	%	%	%	%
Road Transportation	Benzo(b) flouranthene	66	70	2	1000	1000,002	735,615	0,028841447	0,7493	28,8414468	2,119219237	28,9192003
Other mobile sources	Benzo(b) flouranthene	27	25	10	1000	1000,050	264,400	-0,028960558	0,2693	-28,960558	3,808335624	29,2098838
Total	Benzo(b) flouranthene	93,306599	95,03717				611036,708					1689,53746
Total uncertainties					**Year (%):**		**781,688**			**Trend (%):**		**41,104**

Uncertainty estimation, Benzo(k) flouranthene.

	Gas	Base year emission	Year t emission	Activity data uncertainty	Emission factor uncertainty	Combined uncertainty	Combined uncertainty as % of total national emissions in year t	Type A sensitivity	Type B sensitivity	Uncertainty in trend in national emissions introduced by emission factor uncertainty	Uncertainty in trend in national emissions introduced by activity data uncertainty	Uncertainty introduced into the trend in total national emissions
		Input data kg	Input data kg	Input data %	Input data %	%	%	%	%	%	%	%
Road Transportation	Benzo(k) flouranthene	67	79	2	1000	1000,002	800,068	0,048195075	0,8932	48,1950752	2,526277117	48,2612407
Other mobile sources	Benzo(k) flouranthene	21	20	10	1000	1000,050	199,944	-0,048441781	0,2232	-48,441781	3,156542832	48,544515
Total	Benzo(k) flouranthene	88,273939	98,54683				680085,831					4685,71729
Total uncertainties					**Year (%):**		**824,673**			**Trend (%):**		**68,452**

Uncertainty estimation, Benzo(a) pyrene.

	Gas	Base year emission	Year t emission	Activity data uncertainty	Emission factor uncertainty	Combined uncertainty	Combined uncertainty as % of total national emissions in year t	Type A sensitivity	Type B sensitivity	Uncertainty in trend in national emissions introduced by emission factor uncertainty	Uncertainty in trend in national emissions introduced by activity data uncertainty	Uncertainty introduced into the trend in total national emissions
		Input data kg	Input data kg	Input data %	Input data %	%	%	%	%	%	%	%
Road Transportation	Benzo(a) pyrene	45	56	2	1000	1000,002	849,383	0,045034525	1,0045	45,0345245	2,841263623	45,1240643
Other mobile sources	Benzo(a) pyrene	11	10	10	1000	1000,050	150,626	-0,045314105	0,1781	-45,314105	2,51917403	45,3840761
Total	Benzo(a) pyrene	55,969897	66,193968				744139,561					4095,89554
Total uncertainties					**Year (%):**		**862,635**			**Trend (%):**		**63,999**

Uncertainty estimation, Benzo(g,h,i) perylene.

	Gas	Base year emission	Year t emission	Activity Data uncertainty	Emission factor uncertainty	Combined uncertainty	Combined uncertainty as % of total national emissions in year t	Type A sensitivity	Type B sensitivity	Uncertainty in trend in national emissions introduced by emission factor uncertainty	Uncertainty in trend in national emissions introduced by activity data uncertainty	Uncertainty introduced into the trend in total national emissions
		Input data kg	Input data kg	Input data %	Input data %	%	%	%	%	%	%	%
Road Transportation	Benzo(g,h,i) perylene	96	106	2	1000	1000,002	758,281	0,036201889	0,7999	36,2018888	2,262441548	36,2725157
Other mobile sources	Benzo(g,h,i) perylene	37	34	10	1000	1000,050	241,732	-0,036363419	0,2550	-36,363419	3,606039001	36,5417813
Total	Benzo(g,h,i) perylene	132,61208	139,88974				633425,232					2650,99718
Total uncertainties					**Year (%):**		**795,880**			**Trend (%):**		**51,488**

Uncertainty estimation, indeno(1,2,3-c,d) pyrene.

	Gas	Base year emission	Year t emission	Activity data uncertainty	Emission factor uncertainty	Combined uncertainty	Combined uncertainty as % of total national emissions in year t	Type A sensitivity	Type B sensitivity	Uncertainty in trend in national emissions introduced by emission factor uncertainty	Uncertainty in trend in national emissions introduced by activity data uncertainty	Uncertainty introduced into the trend in total national emissions
		Input data kg	Input data Kg	Input data %	Input data %	%	%	%	%	%	%	%
Road Transportation	indeno(1,2,3-c,d) pyr.	44	61	2	1000	1000,002	724,871	0,107048375	0,8909	107,048375	2,519964077	107,078031
Other mobile sources	indeno(1,2,3-c,d) pyr.	25	23	10	1000	1000,050	275,144	-0,107341097	0,3382	-107,3411	4,782372292	107,447578
Total	indeno(1,2,3-c,d) pyr.	68,325061	83,978785				601142,207					23010,6869
Total uncertainties					**Year (%):**		**775,334**			**Trend (%):**		**151,693**

Annex 2C - Agriculture

Annex 2C.1 Background information - NH_3 from Manure Management

1. N-excretion

The emission of NH_3 from manure management is calculated on the basis on nitrogen excreted from livestock. Most of the N excreted that is readily degradable and broken down to NH_4-N is found in the urine. Previously, the emission calculation has been based on the total N content in manure for all manure types. However, the relationship between NH_4-N and total N will not remain constant over time due to changes in feed composition and feed use efficiency.

In order to be able to implement the effect of NH_3-reducing measurements as improvements in feed intake and composition in the emission inventory, it is necessary to calculate the emission based on the Total Ammoniacal Nitrogen (TAN) content, which has been done to the extent possible. From 2007 the calculation of NH_3 emission from liquid manure is based on TAN. For solid manure and deep litter an emission factor for total N is still used.

The normative figures for both total nitrogen excretion and the content of TAN are provided by Faculty of Agricultural Science, Aarhus University (DJF).

In Table 2C.1 is given the average N-excretion (TAN) for each NFR livestock category from 1985 to 2009. These values includes N excretion from grassing animals. Notice that each livestock category is an aggregated average of different subcategories (see table 6.3 in chapter 6).

Table 2C.1a Nitrogen excretion rates in average, 1985 – 2009, kg N pr head pr year.

Livestock categories:	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
Dairy Cattle	121.49	123.66	125.82	128.05	130.33	129.49	128.63	127.76	126.89	126.06	125.23	125.08	124.94
Non-Dairy Cattle	35.73	35.76	35.91	36.12	36.32	36.56	36.67	36.80	36.91	36.64	36.56	36.62	36.73
Sheep	21.04	21.04	21.04	21.04	21.04	21.18	21.33	21.47	21.61	21.76	21.90	20.11	18.32
Goats	21.04	21.04	21.04	21.04	21.04	21.18	21.33	21.47	21.61	21.76	21.90	20.11	18.32
Horses	45.07	45.07	45.07	45.07	45.07	44.15	43.23	42.31	41.40	40.48	39.56	39.56	39.56
Swine	12.88	12.94	12.73	12.67	12.37	11.85	11.52	11.18	10.47	10.49	9.73	9.93	9.69
Laying hens	0.56	0.61	0.66	0.68	0.72	0.72	0.74	0.71	0.76	0.75	0.76	0.77	0.75
Broilers	0.40	0.40	0.42	0.50	0.49	0.55	0.56	0.48	0.47	0.55	0.50	0.46	0.49
Turkeys	0.98	1.06	0.81	1.10	1.22	1.47	1.17	2.05	1.61	1.97	1.68	2.24	2.32
Other poultry	0.31	0.31	0.30	0.32	0.34	0.30	0.32	0.28	0.30	0.34	0.40	0.33	0.32
Other	5.33	5.24	5.15	5.07	4.97	4.95	4.88	4.85	4.82	4.76	4.71	4.72	4.70
N-excretion, total (M kg N/year)	312	313	303	301	299	294	291	292	293	284	275	275	273

Continued

Livestock categories:	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Dairy Cattle	124.82	124.60	125.31	125.31	127.16	129.79	131.56	133.30	134.66	137.58	137.77	138.12
Non-Dairy Cattle	36.76	36.99	37.15	37.65	37.54	37.44	38.39	40.79	43.05	44.89	45.01	47.82
Sheep	16.53	14.75	16.95	16.95	16.95	16.95	16.95	16.95	16.95	16.95	16.95	16.95
Goats	16.53	14.75	16.95	16.95	16.36	16.36	16.36	16.36	16.36	15.65	16.32	16.37
Horses	39.56	39.56	39.56	39.56	39.56	39.56	39.56	39.56	39.56	39.56	39.56	39.56
Swine	9.64	9.99	9.62	9.55	9.95	9.55	9.74	9.22	8.56	8.56	8.68	8.40
Laying hens	0.77	0.77	0.75	0.77	0.79	0.90	0.91	0.95	1.14	0.97	0.89	0.90
Broilers	0.50	0.48	0.45	0.48	0.49	0.58	0.68	0.66	0.53	0.48	0.57	0.37
Turkeys	3.04	1.15	1.36	1.35	1.32	1.41	4.95	7.28	4.37	3.55	4.30	4.85
Other poultry	0.34	0.35	0.32	0.36	0.36	0.31	0.28	0.25	0.26	0.14	0.15	0.15
Other	4.69	4.69	4.68	4.67	4.66	4.66	5.14	5.42	5.22	5.22	5.33	5.55
N-excretion, total (M kg N/year)	279	272	271	278	281	276	280	278	267	274	268	263

Table 2C.1b Changes in N ex animal based on TAN, 2007-2009.

kg pr animal		2007	2008	2009
Cattle				
Dairy cows	TAN	66.67	67.00	65.70
Bulls[a]	TAN	16.11	16.11	16.11
Heifers[b]	TAN	35.84	35.44	35.54
Pigs				
Sows	TAN	19.77	19.20	19.34
Fattening pigs[c]	TAN	2.04	2.03	1.96
Weaners[c]		0.31	0.33	0.31
Fur animals				
Mink	TAN	3.85	3.93	4.11

[a] 6 mth to slaughter. Pr produced animal.

[b] 6 mth to calving.

[c] pr produced animal.

Source: Poulsen (2010).

2. Housing system

A systematic statement of the housing of husbandry for all farms does not exist from 1985 to 2004 and the stabling is therefore based on estimate from the Danish Agricultural Advisory Services (Rasmussen, J.B. and Lundgaard, N.H., pers. comm.). From 2005 the distribution of housing system is based on information from the Danish Plant Directorate. The structural development in the agricultural sector has an influence in change of housing types. The trend in housing system for dairy cattle goes from older tied-up housings, which is replaced by bigger housings with loose-holding. In 1985 85% of the dairy cattle were kept in tied-up housings and in 2009 the part is reduced to 12%. In loose-holding systems the cattle have more space and more straw bedding and this will in general increase the NH_3 emission per animal compared to the tied-up housings. In table 2C.2 the distribution of housing type for dairy cattle and fattening pigs from 1985-2009 is listed.

Table 2C.2 The percentage distribution of housing type – Dairy cattle and slaughtering pigs 1985 – 2009.

Distribution of housing type	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
Dairy cattle										
Tied-up stables	85	84	83	82	80	79	78	77	75	74
Loose-holdings with beds	14	15	15	16	17	18	18	19	20	21
Deep litter	1	1	2	2	3	3	4	4	5	5
Fattening pigs										
Full slatted floor	29	33	38	42	47	51	56	60	60	60
Partly slatted floor	30	29	27	26	24	23	21	20	21	23
Solid floor	40	36	33	29	26	22	19	15	14	12
Deep litter	1	2	2	3	3	4	4	5	5	5

Continued

Distribution of housing type	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Dairy cattle										
Tied-up stables	73	72	66	60	60	46	40	35	26	22
Loose-holdings with beds	21	22	26	30	30	43	49	54	63	67
Deep litter	6	6	8	10	10	11	11	11	11	11
Fattening pigs										
Full slatted floor	60	60	60	60	60	58	57	56	55	53
Partly slatted floor	24	25	26	28	29	31	33	34	35	38
Solid floor	11	9	8	6	5	5	4	4	4	3
Deep litter	5	6	6	6	6	6	6	6	6	6

Continued

Distribution of housing type	2005	2006	2007	2008	2009
Dairy cattle					
Tied-up stables	26	26	17	14	12
Loose-holdings with beds	66	66	76	79	82
Deep litter	8	8	7	7	6
Fattening pigs					
Full slatted floor	49	49	53	53	53
Partly slatted floor	38	38	38	41	41
Solid floor	7	7	4	2	2
Deep litter	6	6	5	4	3

3. Emission of NH_3

3.1 Housing

The emission from housings is thus determined by a number of different conditions that depends on housing type and the different kinds of manure disposal systems placed in these housings. Faculty of Agricultural Sciences, University of Aarhus has carried out a number of emission surveys and estimated emission coefficients for each type of housings (Poulsen et al., 2001 and Poulsen, 2010). In table 2C.3 is shown the emission from dairy cattle and fattening pigs in different housing systems. For the slurry and liquid manure is given TAN emission coefficients (TAN ex animal) and for solid and deep litter manure is given N ex animal.

Table 2C.3 NH_3 emission factors in different housing system 2009 – dairy cattle and fattening pigs.

Livestock category	Manure system	Manure type	NH_3 emission pct NH_3-N of N ex Animal	NH_3 emission pct NH_3-N of TAN ex Animal
Dairy cattle	Tied-up	Solid manure	6.0	
		+ Liquid		10.0
	Tied-up	Slurry		6.0
	Loose-holding with beds, slatted floor	Slurry		16.0
	Loose-holding with beds, slatted floor, scrapes	Slurry		12.0
	Loose-holding with beds, solid floor	Slurry		20.0
	Loose-holding with beds, drained floor	Slurry		8.0
	Deep litter (all)	Deep litter	6.0	
	Deep litter, slatted floor	Deep litter	6.0	
		+ Slurry		16.0
	Deep litter, slatted floor, scrapes	Deep litter	6.0	
		+ Slurry		12.0
	Deep litter, solid floor, scrapes	Deep litter	6.0	
		+ Slurry		20.0
Fattening pigs	Full slatted floor	Slurry		24.0
	Partly slatted floor (50-75% solid floor)	Slurry		13.0
	Partly slatted floor (25-49% solid floor)	Slurry		17.0
	Solid floor	Solid manure	25.0	
		+ Liquid		27.0
	Deep litter	Deep litter	25.0	
	Partly slatted floor and partly deep litter	Deep litter	25.0	
		+ Slurry		18.0

3.2 Storage

Livestock manure is collected either as solid manure or as slurry depending on housing type. In Table 2C.4 is shown the emission factor used for storage. It is assumed that the part of solid manure taken directly from the housing into the field is 65% from cattle, 25% from pigs, 50% sows, 15% from poultry and 5% from hens (Poulsen et al., 2010). The remaining part of the solid manure is deposited in stock piles in the field before field application.

By law all slurry tanks have to be covered by a crust in order to reduce NH_3 emission. However, investigations show that that slurry tanks were incompletely covered earlier (COWI 2000), which result in a higher NH_3 emission. In 2009 it is assumed that 5% of the tanks with pig slurry and 2% of tanks with cattle slurry are incompletely covered. This information has been incorporated in the emission inventory.

Table 2C.4 NH_3 emission factors for storage 2009.

		Liquid manure	Slurry	Solid manure	Deep litter
		Loss of NH_3-N in %			
Animal category		of TAN ex housing	of TAN exhousing	of N ex housing	of N ex housing
Cattle		2.2	3.5	4.0	1.05
Swine	Fattening pigs	2.2	2.9	19.0	9.75
	Sows		2.9	19.0	6.50
Poultry	Hens and pullet		2.0[a]	7.5	4.75
	Broilers, geese and ducks			7.5	6.80
	Turkeys			7.5	8.00
Fur farming			3.1	11.5	
Sheep/goats					3.0
Horses					3.0

[a] Loss of NH_3-N in % of N ex housing.

3.3 Spreading in fields

There is no statistical information on how the farmer handling the manure in practice. In calculation of emission from application of manure on the fields is used to different weighted emission factors, which distinguish between solid manure and liquid manure. In 2009 the emission factor for solid manure is estimated to 6 % and liquid manure is estimated to 15 % for cattle and 11% for swine of TAN ex storage.

The weighted emission factor will vary from year to year depending on changes in the practice of spreading. The weighted emission factor is based on background estimates of time of spreading, application methods, spreading in growing crops or on bare soil and the time from spreading to ploughing in soil. In table 2C.5 background information for 2009 are given.

Table 2C.5 Estimate for application method, time of spreading and time before the manure is incorporated in the soil.

Liquid manure				Length of time before incorporation into soil, hours							
Application methods	Application time	Percentage distribution of manure		0		4, and then harrowed		4, and then Ploughed		Not incorporated	
		Cattle	Pigs	Cattle	Pigs	Cattle	Pigs	Cattle	Pigs	Cattle	Pigs
Incorporated	winter-spring	49	24	49	24	-	-	-	-	-	-
Incorporated	summer-autumn	14	4	14	4	-	-	-	-	-	-
Trailing horses	winter-spring	26	64	-	-	2	3	2	2	22	59
Trailing horses	spring-summer	2	2	-	-	-	-	-	-	2	2
Trailing horses	late summer-autumn	9	6	-	-	3	2	2	1	4	3
Total		100	100	63	28	5	5	4	3	28	64
Solid manure				Length of time before incorporation into soil, hours							
Application methods	Application time	Percentage distribution of manure		0		4		6		Not incorporated	
		Cattle	Pigs	Cattle	Pigs	Cattle	Pigs	Cattle	Pigs	Cattle	Pigs
Broad spreading	winter-spring	81	81	-	-	60	60	12	12	9	9
Broad spreading	spring-summer	0	0	-	-	-	-	-	-	-	-
Broad spreading	late summer-autumn	19	19	-	-	8	8	9	9	2	2
Total		100	100	-	-	68	68	21	21	11	11

Annex 2C.2 Background information - NH_3 from Agricultural Soils

1. Synthetic fertiliser

Since 1985 there has been a significant decrease in use of synthetic fertiliser. This is due to requirements to utilising of nitrogen in manure as outlined for example in the Action Plan on the Aquatic Environment. Further, the use of different fertiliser types has changed. At present, urea constitutes less than 1% of the total nitrogen used as fertiliser (table 2C.6). It is estimated that 1.9% of the total nitrogen used in synthetic fertiliser is emitted as NH_3 in 2009. It means the implied emission factor for 2009 is 1.9% compared to 10% in the EMEP/EEA Guidebook.

Data on the use of synthetic fertiliser is based on the sale estimations collected by the Danish Plant Directorate (2010). Emission factors are based on the values given in EMEP/EEA (2009).

The use of synthetic fertiliser includes fertiliser used in parks, golf courses and private gardens. Approximately 1-2 percent of the synthetic fertiliser can be related to this use out side the agriculture area.

Table 2C.6 Synthetic fertiliser consumption 2009 and emission factors.

Synthetic fertiliser year 2009	NH_3 Emission factor[1], Kg NH_3-N pr kg N	Consumption[2], t N
Fertiliser type		
Calcium and boron calcium nitrate	0.01	0.2
Ammonium sulphate	0.02	3.8
Calcium ammonium nitrate and other nitrate types	0.01	121.5
Ammonium nitrate	0.01	9.7
Liquid ammonia	0.02	8.0
Urea	0.13	1.1
Other nitrogen fertiliser	0.06	18.8
Magnesium fertiliser	0.01	0.0
NPK-fertiliser	0.01	30.0
Diammonphosphate	0.01	0.5
Other NP fertiliser types	0.01	3.8
NK fertiliser	0.01	2.8
Total consumption of N in synthetic fertiliser		200.3
Total emission of NH_3-N (M kg)	4.00	
Average NH_3-N emission (FracGASF)	0.02	

[1] EMEP/EEA (2009).
[2] The Danish Plant Directorate.

2. Grazing

It is assumed that 5% of the manure from dairy cattle is deposited in the field, which corresponding to 18 days per year. For heifers 36% of the nitrogen in the manure is estimated deposited during grazing, 61% for suckling cows, 50% for horses and 73% for sheep and goats.

An emission factor of 7% of the total nitrogen content is assumed to evaporate as NH_3 (Jarvis *et al*. 1998a, Jarvis *et al*. 1989b and Bussink 1994). The emission factor is used on all animal categories.

Annex 2C.3 Background information - NH_3 from Agriculture Other

1. Crops

In the Danish emission inventory it is chosen to include NH_3 emission from crops, despite the uncertainties related to this emission source. Literature research shows that the volatilisation from crop types differs considerably (Andersen *et al*. 1999). The emission factors for crops are lowered from 5 to 2 % for crops and from 3 to 0.5 % for grass based on a literary survey (Gyldenkærne and Albrektsen, 2009). However, as for the emission ceiling given in the Gothenburg-Protocol and the EU NEC Directive the emission from crops is not taken into account.

Table 2C.7 Emission factor used to estimate the emission of ammonia from crops.

Emission factor	Crops kg N pr ha
Cash crops. beets and silage maize	2
Grass/clover in rotation	0.5
Permanent grass	0.5
Set-a side	0

2. NH_3 treated straw

NH_3 is used for conservation of straw for feeding. Investigations show that 80-90% of the supplied NH_3 (given in NH_3-N) will emit (Andersen *et al*. 1999). However, the emissions can be reduced particularly if the right dose is used. Therefore it is estimated that the emission factor is 65% of the applied NH_3-N. Information on ammonia used for treatment of straw is collected from the suppliers. Ammonia treated straw has been prohibited from 2006.

As for the emission ceiling given in the Gothenburg-Protocol and the EU NEC Directive the emission from NH_3 treated straw is not taken into account.

Annex 2C.4 Background information - Field burning of Agricultural Wastes

Table 2C.8 Emissions of pollutants from field burning of agricultural wastes, 1985-2009.

	Unit	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
NO_X	Gg	1.53	1.32	1.25	0.93	0.98	0.08	0.08	0.08	0.08	0.08	0.09	0.09	0.10
CO	Gg	37.58	32.29	30.67	22.93	24.13	1.89	1.97	1.88	2.06	1.98	2.24	2.23	2.37
NMVOC	Gg	4.02	3.45	3.28	2.45	2.58	0.20	0.21	0.20	0.22	0.21	0.24	0.24	0.25
SO_2	Gg	0.19	0.16	0.16	0.12	0.12	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
NH_3	Gg	1.53	1.32	1.25	0.93	0.98	0.08	0.08	0.08	0.08	0.08	0.09	0.09	0.10
TSP	Mg	3.70	3.18	3.02	2.26	2.38	0.19	0.19	0.19	0.20	0.20	0.22	0.22	0.23
PM10	Mg	3.70	3.18	3.02	2.26	2.38	0.19	0.19	0.19	0.20	0.20	0.22	0.22	0.23
PM2,5	Mg	3.51	3.01	2.86	2.14	2.25	0.18	0.18	0.18	0.19	0.19	0.21	0.21	0.22
Pb	Mg	0.55	0.47	0.45	0.34	0.35	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
Cd	Mg	0.03	0.03	0.03	0.02	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Hg	Mg	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
As	Mg	0.04	0.03	0.03	0.02	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Cr	Mg	0.14	0.12	0.11	0.09	0.09	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Cu	Mg	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ni	Mg	0.11	0.10	0.09	0.07	0.07	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Se	Mg	0.02	0.02	0.02	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Zn	Mg	0.02	0.02	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DIOX	g I-Teq	0.38	0.32	0.31	0.23	0.24	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
Benzo(a)pyrene	Mg	1.78	1.53	1.45	1.08	1.14	0.09	0.09	0.09	0.10	0.09	0.11	0.11	0.11
Benzo(b)fluoranthene	Mg	1.74	1.50	1.42	1.06	1.12	0.09	0.09	0.09	0.10	0.09	0.10	0.10	0.11
Benzo(k)fluoranthene	Mg	0.68	0.59	0.56	0.42	0.44	0.03	0.04	0.03	0.04	0.04	0.04	0.04	0.04
Indeno(1,2,3-cd)pyrene	Mg	0.65	0.56	0.53	0.40	0.42	0.03	0.03	0.03	0.04	0.03	0.04	0.04	0.04

Continued	Unit	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
NO_X	Gg	0.12	0.12	0.11	0.12	0.10	0.12	0.13	0.13	0.13	0.11	0.10	0.12
CO	Gg	2.98	2.83	2.79	2.93	2.44	2.93	3.07	3.12	3.16	2.73	2.53	2.98
NMVOC	Gg	0.32	0.30	0.30	0.31	0.26	0.31	0.33	0.33	0.34	0.29	0.27	0.32
SO_2	Gg	0.02	0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.02	0.01	0.01	0.02
NH_3	Gg	0.12	0.12	0.11	0.12	0.10	0.12	0.13	0.13	0.13	0.11	0.10	0.12
TSP	Mg	0.29	0.28	0.27	0.29	0.24	0.29	0.30	0.31	0.31	0.27	0.25	0.29
PM10	Mg	0.29	0.28	0.27	0.29	0.24	0.29	0.30	0.31	0.31	0.27	0.25	0.29
PM2,5	Mg	0.28	0.26	0.26	0.27	0.23	0.27	0.29	0.29	0.30	0.26	0.24	0.28
Pb	Mg	0.04	0.04	0.04	0.04	0.04	0.04	0.05	0.05	0.05	0.04	0.04	0.04
Cd	Mg	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Hg	Mg	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
As	Mg	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Cr	Mg	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Cu	Mg	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ni	Mg	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Se	Mg	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Zn	Mg	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DIOX	g I-Teq	0.03	0.03	0.03	0.03	0.02	0.03	0.03	0.03	0.03	0.03	0.03	0.03
Benzo(a)pyrene	Mg	0.14	0.13	0.13	0.14	0.12	0.14	0.15	0.15	0.15	0.13	0.12	0.14
Benzo(b)fluoranthene	Mg	0.14	0.13	0.13	0.14	0.11	0.14	0.14	0.14	0.15	0.13	0.12	0.14
Benzo(k)fluoranthene	Mg	0.05	0.05	0.05	0.05	0.04	0.05	0.06	0.06	0.06	0.05	0.05	0.05
Indeno(1,2,3-cd)pyrene	Mg	0.05	0.05	0.05	0.05	0.04	0.05	0.05	0.05	0.05	0.05	0.04	0.05

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Annex 3 – Completeness and use of notation keys

Not estimated categories

The Danish air emission inventory is generally complete. However, some categories and/or pollutants are reported as NE (Not estimated).

Stationary combustion

- NH_3 emissions from combustion for all sources except biomass and solid fuel appliances in sector 1A4b and waste incineration plants in sector 1A1a are not estimated, due to lack of available emission factors.

Mobile combustion

- Mercury and PAH emissions from tire and brake wear are not estimated, due to lack of emission factors.
- Arsenic and selenium from road abrasion are not estimated, due to lack of emission factors.
- HCB emissions from transport and mobile sources are not estimated, due to lack of resources.

Industrial processes

- Emissions from quarrying and mining of minerals other than coal have not been estimated.
- Emissions from construction and demolition are not estimated.
- Emissions from storage, handling and transport of mineral products are not estimated
- Emissions from storage, handling and transport of chemical products have not been estimated.
- Emissions from storage, handling and transport of metal products have not been estimated.
- Emissions from pulp and paper production have not been estimated.
- Emissions from wood processing have not been estimated.
- Emissions from production of POPs have not been estimated due to lack of emission factors.
- Emissions from consumption of POPs and heavy metals have not been estimated.

Solvent and other product use

- Emissions of POPs and heavy metals from solvent use. (Only NMVOC emissions are estimated from use of solvents)
- Emissions from several product uses are not estimated, e.g. use of tobacco, use of shoes, charcoal grilling. (Only emissions from fireworks are included)

Agriculture

- NMVOC from animal husbandry and manure management has not been estimated, due to lack of resources.

- NO_x emissions from agriculture have not been estimated, due to lack of resources.
- PM emissions from fur farming and from agricultural field operations have not been estimated, due to lack of resources.

Waste

- Emissions from solid waste disposal on land have not been estimated due to lack of resources.
- Emissions from waste-water handling have not been estimated due to lack of resources.
- Emissions from small scale waste burning have not been estimated due to lack of resources.
- The emission of selenium and HCB from accidental fires has not been estimated due to lack of available emission factors.

Categories reported as IE (Included Elsewhere)

The table below indicates the categories where the notation key IE has been used in the reporting.

Table A3.1. List of categories reported as included elsewhere.

1 A 2 a Iron and steel	1 A 2 f i Manufacturing industries and construction, Other
1 A 2 b Non-ferrous metals	1 A 2 f i Manufacturing industries and construction, Other
1 A 2 c Chemicals	1 A 2 f i Manufacturing industries and construction, Other
1 A 2 d Pulp, Paper and Print	1 A 2 f i Manufacturing industries and construction, Other
1 A 2 e Food processing, beverages and tobacco	1 A 2 f i Manufacturing industries and construction, Other
1 A 5 a Other stationary (including military)	1 A 4 a i Commercial / institutional: Stationary
2 A 1 Cement production	1 A 2 f i Manufacturing industries and construction, Other
2 A 2 Lime production	1 A 2 f i Manufacturing industries and construction, Other
2 A 3 Limestone and dolomite use	1 A 2 f i Manufacturing industries and construction, Other
2 A 4 Soda ash production and use	1 A 2 f i Manufacturing industries and construction, Other
6 C a Clinical waste incineration (d)	1 A 1 a Public electricity and heat production
6 C b Industrial waste incineration (d)	1 A 1 a Public electricity and heat production
6 C c Municipal waste incineration (d)	1 A 1 a Public electricity and heat production

The disaggregation of emissions from manufacturing industries and construction (1A2) to subsectors (1A2a-f) has not been done for the reporting to UNECE, due to lack of resources. For reporting to the UNFCCC emissions of SO_2, NO_x, NMVOC and CO have been disaggregated to subsectors.

Emissions from other stationary combustion including military (1A5a) have been reported as included elsewhere. Stationary fuel consumption is not available as an independent category in the Danish energy statistics. Fuel consumption and therefore also emissions are reported under commercial and institutional plants (1A4a i).

Emissions from cement production (2A1), lime production (2A2), limestone and dolomite use (2A3), and soda ash production and use (2A4) are included in manufacturing industries and construction (1A2f i). It is not possible to separate the process emissions from the energy related emissions.

Emissions from clinical, industrial and municipal waste incineration (6Ca, 6Cb and 6Cc) are reported under public electricity and heat production (1A1a). All incineration of these waste fractions in Denmark is done with energy recovery and therefore emissions and waste consumption are reported in the energy sector in accordance with the guidelines.

Annex 4 – Information on the energy balance

The official Danish energy balance is prepared by the Danish Energy Agency (DEA). The DEA is responsible for reporting of energy data to Eurostat and the IEA. NERI uses the energy balance as published by the DEA. However, some reallocations between sectors are made in connection with the bottom-up modelling done at NERI for different subsectors within transport and mobile sources. For a more in-depth discussion of the energy statistics please see Annex 2A-9. For information on the reallocation of fuels please see Chapter 3.3.

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Further information: www.neri.dk

National Environmental Research Institute
Frederiksborgvej 399
PO Box 358
DK-4000 Roskilde
Denmark
Tel: +45 4630 1200
Fax: +45 4630 1114

Management
Department of Arctic Environment
Department of Atmospheric Environment
Department of Environmental Chemistry and Microbiology
Department of Marine Ecology
Department of Policy Analysis

National Environmental Research Institute
Vejlsøvej 25
PO Box 314
DK-8600 Silkeborg
Denmark
Tel: +45 8920 1400
Fax: +45 8920 1414

Department of Freshwater Ecology
Department of Terrestrial Ecology

National Environmental Research Institute
Grenåvej 14, Kalø
DK-8410 Rønde
Denmark
Tel: +45 8920 1700
Fax: +45 8920 1514

Department of Wildlife Ecology and Biodiversity

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ANNUAL DANISH INFORMATIVE INVENTORY REPORT TO UNECE

Emission inventories from the base year of the protocols to year 2009

This report is a documentation report on the emission inventories for Denmark as reported to the UNECE Secretariat under the Convention on Long Range Transboundary Air Pollution due by 15 February 2011. The report contains information on Denmark's emission inventories regarding emissions of (1) SO_X for the years 1980-2009, (2) NO_X, CO, NMVOC and NH_3 for the years 1985-2009, (3) Particulate matter: TSP, PM_{10}, $PM_{2.5}$ for the years 2000-2009, (4) Heavy Metals: Pb, Cd, Hg, As, Cr, Cu, Ni, Se and Zn for the years 1990-2009, (5) Polyaromatic hydro-carbons (PAH): Benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene and indeno(1,2,3-cd)pyrene for the years 1990-2009 and (6) Dioxin and HCB. Further, the report contains information on background data for emissions inventory.

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