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Research notes from NERI No. 236, 2007

Danish emission inventories for road transport and other mobile sources

Inventories until year 2004

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Morten Winther

Data sheet

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Abstract: This report explains the parts of the Danish inventories related to road transport and other mobile sources. Emission results for CO_2, CH_4, N_2O, SO_2, NO_X, NMVOC, CO, particulate matter (PM), heavy metals, dioxins and PAH are shown from 1985 to 2004. In this period the fuel use and CO_2 emissions for road transport have increased by 48%. The emission decreases for PM (exhaust only), CO, NO_X and NMVOC are 35, 58, 34 and 66% respectively, due to the introduction of vehicles complying with gradually stricter emission standards. A N_2O emission increase of 301% is related to the high emissions from gasoline catalyst cars. For other mobile sources the fuel use and CO_2 emissions have decreased by 15% from 1985 to 2004. The PM, NOx and NMVOC emission declines are 46, 14 and 10%, respectively. For SO_2 the emission drop is 74% from 1985 to 2004, due to gradually lower fuel sulphur contents. For CO the 1985 and 2004 emissions are the same. Uncertainties for the emissions and trends have been estimated.

Keywords:	Road transport, military, railways, domestic navigation, domestic aviation, working equipment and machinery, SO_2, NO_X, NMVOC, CH_4, CO, CO_2, N_2O, PM, heavy metals, dioxin, PAH, greenhouse gases, acidifying components.
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Contents

Preface

The Danish National Environmental Research Institute prepares the Danish atmospheric emission inventories and reports the results on an annual basis to the UNFCCC (United Nations Framework Convention on Climate Change) and the UNECE LRTAP (United Nations Economic Commission for Europe Convention on Long Range Transboundary Pollutants) conventions. This report explains the parts of the Danish inventories related to road transport and other mobile sources. In the report emission results for CO_2, CH_4, N_2O, SO_2, NO_X, NMVOC, CO, particulate matter (PM), heavy metals, dioxins and PAH are shown from 1985 to 2004 grouped according to the UNFCCC Common Reporting Format (CRF) codes.

Summary

This report explains the road transport and other mobile sources, which are part of the annual Danish emission inventories reported to the UNFCCC (United Nations Framework Convention on Climate Change) and the UNECE LRTAP (United Nations Economic Commission for Europe Long Range Transboundary Pollution) conventions. The sub-sectors for other mobile sources are military, railways, navigation, fisheries, civil aviation and non-road machinery in agriculture, forestry, industry and household/gardening.

The emissions of CO_2, CH_4, N_2O, SO_2, NO_X, NMVOC, CO, particulate matter (PM), heavy metals, dioxins and PAH are shown in a 1985-2004 time-series grouped according to the UNFCCC Common Reporting Format (CRF) classification codes.

Mobile sources	CRF codes
Road transport	1A3b Transport-Road
Military	1A5 Other
Railways	1A3c Railways
Inland waterways	1A3d Transport-Navigation
National sea traffic	1A3d Transport-Navigation
National fishing	1A4c Agriculture/forestry/fisheries
International sea traffic	1A3d Transport-Navigation (international)
Dom. airport traffic (LTO < 1000 m)	1A3a Transport-Civil aviation
Int. airport traffic (LTO < 1000 m)	1A3a Transport-Civil aviation (international)
Dom. cruise traffic (> 1000 m)	1A3a Transport-Civil aviation
Int. cruise traffic (> 1000 m)	1A3a Transport-Civil aviation (international)
Agriculture	1A4c Agriculture/forestry/fisheries
Forestry	1A4c Agriculture/forestry/fisheries
Industry	1A2f Industry-Other
Household and gardening	1A4b Residential

Methodologies

The emission calculations for road transport are made with a model developed by NERI, using the European COPERT III (COmputer Programme to calculate the Emissions from Road Transport) methodology. In COPERT III 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 is grouped according to average fuel consumption and emission behaviour. The emissions are estimated by combining vehicle and annual mileage numbers with hot emission factors, cold:hot ratios and evaporation factors (detailed methodology).

For air traffic the 2001-2004 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 EMEP/CORINAIR (European Evaluation and Monitoring Programme/CORe INventory on AIR emissions) guidelines (detailed methodology). For previous years the background data consist of LTO/aircraft type statistics from Copenhagen Airport and total LTO numbers from CAA-DK. With appropriate assumptions a consistent

time-series of emissions is produced back to 1985 using also the findings from a Danish city-pair emission inventory in 1998.

Non-road working machines and equipment, and recreational craft are grouped in the following sectors: Agriculture, Forestry, Industry, Household/Gardening and Inland Waterways. 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 (detailed methodology).

Fuel use data are obtained from the Danish energy statistics provided by the Danish Energy Authority. For road transport and aviation the emission results are adjusted in a fuel balance to ensure that all statistical fuel sold is accounted for in the calculations. For military, railways and navigation the emissions are calculated as the product of fuel use and emission factors.

Emissions from road transport

Set in relation to the Danish national emission totals, the largest emission shares for road transport are noted for CO, NO_X, NMVOC, CO_2 $PM_{2.5}$, PM_{10} and TSP. In 2004 the emission percentages were 38, 33, 23, 22, 18, 15 and 13, respectively. The emissions of N_2O, NH_3, SO_2 and CH_4 have marginal shares of 5, 2, 2 and 1%, respectively.

From 1985 to 2004 there has been an emission decrease of 35, 58, 34 and 66% for particulates (exhaust only: Size is below $PM_{2.5}$), CO, NO_X and NMVOC. In the same period the CO_2 (and fuel use), CH_4 and N_2O emissions have increased by 48, 8 and 301% (30% for CO_2, 3% for CH_4 and 237% for N_2O since 1990).

The most significant emission changes from 1985 to 2004 occur for SO_2 and NH_3. For SO_2 the emission drop is 97% (due to reduced sulphur content in the diesel fuel), whereas the NH_3 emissions increase by 3850% (due to the introduction of catalyst cars).

The highest particulate, NO_X and NMVOC emissions occur in 1991, after which the emissions drop by 45, 43 and 67%, until 2004.

Emissions from road transport in 2004, changes from 1985 to 2004, and 2004 shares of national emission totals

CRF ID	SO_2 [tons]	NO_x [tons]	NMVOC [tons]	CH_4 [tons]	CO [tons]	CO_2 [ktons]	N_2O [tons]	NH_3 [tons]	TSP [tons]	PM_{10} [tons]	$PM_{2.5}$ [tons]
Road, 2004	378	59085	26477	2526	232650	12024	1357	2443	3214	3214	3214
Road non-exhaust, 2004									2459	1593	865
Total Road, 2004	378	59085	26477	2526	232650	12024	1357	2443	5673	4807	4079
Total national, 2004	24429	181368	116499	274531	619359	53941	25268	97838	43255	31095	22850
Road-% of national, 2004	2	33	23	1	38	22	5	2	13	15	18
Road-% change 1985-2004	-97	-34	-66	8	-58	48	301	3850	-35[1]	-35[1]	-35[1]

Road transport exhaust PM emissions almost solely come from diesel fuelled vehicles. The largest sources are light duty trucks followed by heavy-duty vehicles and passenger cars in decreasing order. Since the mid-1990s the emissions from light and heavy duty vehicles have

[1] Exhaust only

decreased significantly due to gradually stricter Euro emission standards. For diesel passenger cars, the environmental benefit of introducing new engines with lower particulate emissions since 1990 is more or less compensated by an increase in vehicle new sales in the later years.

The trend in non-exhaust PM follows the traffic growth in general, and in 2004 the TSP, PM_{10} and $PM_{2.5}$ shares were 43, 33 and 21% of the respective road traffic totals. The non-exhaust PM is gaining more relative importance, in pace with the year by year reductions of exhaust PM.

Historically the emission totals of NO_X and especially NMVOC and CO have been dominated by the contributions coming from gasoline passenger cars. However, the emissions from this vehicle type have been reduced since the introduction of catalyst cars in 1990. A negative side effect of this technology though is the increase in N_2O and NH_3 emissions. The NO_X, NMVOC and CO emissions reductions are fortified by the introduction of new gradually stricter Euro emission standards for all other vehicle classes.

Emissions from other mobile sources

For other mobile sources the emissions of NO_X, CO, SO_2, $PM_{2.5}$, NMVOC, PM_{10} and TSP have the largest shares of the national totals in 2004. The shares are 25, 24, 15, 13, 13 10 and 7%, respectively. The 2004 CO_2 emission (and fuel use) share is 7%, whereas the emissions of N_2O, NH_3 and CH_4 have marginal shares of 1% or less in 2004.

The emissions of TSP, NO_X and NMVOC have decreased by 46, 14 and 10% from 1985 to 2004. For CO_2 (and fuel use) the decrease is 15% (and 11% from 1990), while the N_2O and CH_4 emission decreases are 10 and 5%, respectively. For SO_2 the emission drop is 74% from 1985 to 2004 (and 77% since 1980). For CO the 1985 and 2004 emissions are the same.

Emissions from other mobile sources in 2004, changes from 1985 to 2004, and 2004 shares of national emission totals

CRF ID	SO_2 [tons]	NO_x [tons]	NMVOC [tons]	CH_4 [tons]	CO [tons]	CO_2 [ktons]	N_2O [tons]	NH_3 [tons]	TSP [tons]	PM_{10} [tons]	$PM_{2.5}$ [tons]
Industry-Other (1A2f)	263	10744	1676	46	7600	912	39	2	1037	1037	1037
Civil Aviation (1A3a)	41	552	158	6	857	128	8	0	3	3	3
Railways (1A3c)	7	3478	217	8	599	216	6	1	115	115	115
Navigation (1A3d)	2259	7990	1474	34	7767	490	28	0	533	514	496
Residential (1A4b)	9	317	8731	290	114073	298	5	0	87	87	87
Ag./for./fish. (1A4c)	951	20501	2528	78	17445	1507	73	3	1283	1269	1256
Military (1A5)	46	1079	129	11	718	239	12	1	53	53	53
Total other mobile	3576	44661	14913	473	149058	3791	170	7	3110	3077	3046
Total national, 2004	24429	181368	116499	274531	619359	53941	25268	97838	43255	31095	22850
Other mobile-% of national, 2004	15	25	13	0	24	7	1	0	7	10	13
Other mobile -% change 1985-2004	-74	-14	-10	-5	0	-15	-10	1	-46	-46	-46

The largest source of NO_X and particulate emissions are agriculture/forestry/fisheries, followed by industry and navigation. For NMVOC and CO most of the emissions come from gasoline fuelled working machinery in the residential sector.

Heavy metals

For heavy metals the development in emissions follows the fuel use trends. The road transport shares for copper (Cu), zinc (Zn), chromium (Cr) and cadmium (Cd) are 71, 16, 16 and 7% of national totals in 2004, and for other mobile sources the lead (Pb), Cu and nickel (Ni) shares are 27, 17 and 14%. For the remaining components the emission shares are less than 5%.

The road transport emissions have increased by 30% from 1990 to 2004. For Pb though there has been an almost 100% emission decline, due to the phasing out of leaded gasoline fuels until 1994. For other mobile sources many of the components have emission decreases of about 10-20% in the same time period. The emissions of Pb, Ni, Selenium (Se) and Mercury (Hg) decrease even further. The respective emission declines are 79, 54, 33 and 27%. For Ni, Se and Hg the emission decreases are due to a reduction in residual oil fuel use, and for Pb the reason for the emission drop is the contemporary phasing out of gasoline fuelled tractors and lead in gasoline fuel.

PAH's

The PAH emission shares for road transport and other mobile sources are 5% or less of the national total in 2002.

Uncertainties

For mobile sources in 2004 the CO_2 emissions are determined with the highest accuracy, followed by the CH_4, SO_2, NMVOC, CO, NO_X, PM_{10}, $PM_{2.5}$, TSP and N_2O emissions with increasing levels of uncertainties. The uncertainties are 5, 7, 46, 48, 50, 52, 55, 55, 56 and 64%, respectively. The uncertainties for the 1990-2004 emission trends are 5, 7, 6, 10, 13, 8, 8, 7 and 253% for the emissions in the same consecutive order. For NH_3, heavy metals and POPs the 2002 emissions have uncertainty levels of between 700 and 1000%. In this case the emission trend uncertainties are significantly lower; still large fluctuations exist between the calculated values for the different emission components. The smallest and largest uncertainties are 16 for Indeno(1,2,3-c,d)pyrene and 121 for dioxins.

Sammenfatning

Denne rapport dokumenterer de årlige danske emissionsopgørelser for vejtransport og andre mobile kilder. Opgørelserne laves som en del af de samlede danske opgørelser, og rapporteres til UNFCCC (United Nations Framework Convention on Climate Change) og UNECE LRTAP (United Nations Economic Commission for Europe Long Range Transboundary Pollution) konventionerne. Underkategorierne for andre mobile kilder er: Militær, jernbane, søfart, fiskeri, civil flyvning, og arbejdsredskaber- og maskiner i landbrug, skovbrug, industri samt have/hushold.

For CO_2, CH_4, N_2O, SO_2, NO_X, NMVOC, CO, partikler (PM), tungmetaller, dioxin og PAH er de beregnede emissioner grupperet iht. IPCCs (Intergovernmental Panel on Climate Changes) CRF koder og er vist i tidsserier fra 1985 til 2004.

Mobile kilder	CRF koder
Vejtrafik	1A3b Transport-Road
Militær	1A5 Other
Jernbane	1A3c Railways
Småbåde og fritidsfartøjer	1A3d Transport-Navigation
Indenrigs skibstrafik	1A3d Transport-Navigation
Indenrigs fiskeri	1A4c Agriculture/forestry/fisheries
Udenrigs skibstrafik	1A3d Transport-Navigation (international)
Indenrigs flytrafik (LTO < 1000 m)	1A3a Transport-Civil aviation
Udenrigs flytrafik (LTO < 1000 m)	1A3a Transport-Civil aviation (international)
Indenrigs cruise trafik (> 1000 m)	1A3a Transport-Civil aviation
Udenrigs cruise trafik (> 1000 m)	1A3a Transport-Civil aviation (international)
Landbrug	1A4c Agriculture/forestry/fisheries
Skovbrug	1A4c Agriculture/forestry/fisheries
Industri	1A2f Industry-Other
Have- og hushold	1A4b Residential

Metoder

Emissionerne for vejtrafik beregnes med en model udviklet af DMU der benytter samme modelprincip som den europæiske emissionsmodel COPERT III (COmputer Programme to calculate the Emissions from Road Transport). I modellen beregnes emissionerne for køretøjer med driftsvarme motorer, under koldstart og som følge af brændstoffordampning. Modellen tager også højde for de forøgede emissioner som følge af katalysatorslid. Input data for køretøjsbestand og årskørsler oplyses af Vejdirektoratet og køretøjerne grupperes iht. gennemsnitligt brændstofforbrug og emissioner. Emissionerne beregnes som produktet af antal køretøjer, årskørsler, varme emissionsfaktorer, kold/varm-forhold og fordampningsfaktorer (detaljeret metode).

For luftfart opgøres emissionerne for 2001-2004 på city-pair basis. Til beregningerne bruges flydata fra Statens Luftfartsvæsen (SLV) samt LTO og cruise emissionsfaktorer pr. fløjet distance fra EMEP/CORINAIR (European Evaluation and Monitoring Programme/ CORe INventory on AIR emissions). For årene før 2001 bruges som baggrundsdata en LTO/flytype statistik fra Københavns Lufthavn samt SLVs tal for antallet af starter og landinger. En konsistent

emissionsopgørelse er beregnet tilbage til 1985 ved at gøre passende antagelser og ved at bruge resultaterne fra en dansk city-pair emissionsopgørelse for 1998.

Arbejdsredskaber- og maskiner samt småbåde og lystfartøjer opgøres i sektorerne: Småbåde/fritidsfartøjer, landbrug, skovbrug, industri samt have/hushold. Emissionerne beregnes som produktet af antallet af maskiner, lastfaktorer, motorstørrelser, årlige driftstider og emissionsfaktorer (detaljeret metode).

Data for energiforbrug stammer fra Energistyrelsens energistatistik. For vejtransport og luftfart justeres emissionsresultaterne ud fra en brændstofbalance. Dermed sikres at hele det oplyste brændstofsalg ligger til grund for emissionsopgørelserne. For militær, jernbane, søfart og fiskeri beregnes emissionerne som produktet af brændstofsalg og emissionsfaktorer.

Emissioner fra vejtrafik

Set i forhold til landets samlede emissionstotal beregnes vejtrafikkens største emissionsandele for CO, NO_X, NMVOC, CO_2 $PM_{2.5}$, PM_{10} og TSP. Procentandelene for disse stoffer ligger på hhv. 38, 33, 23, 22, 18, 15 og 13 i 2004. Emissionsandelene for N_2O, NH_3, SO_2 og CH_4 er små og ligger på hhv. 5, 2, 2 og 1%.

Fra 1985 til 2004 har der været et fald i emissionerne for partikler (kun udstødning: < $PM_{2.5}$), CO, NO_X and NMVOC på hhv. 35, 58, 34 and 66%. I samme periode er CO_2 (og energiforbrug), CH_4 og N_2O emissionerne steget med hhv. 48, 8 og 301% (30% for CO_2, 3% for CH_4 og 237% for N_2O siden 1990).

De mest markante emissionsændringer fra 1985 til 2002 sker for SO_2 og NH_3. SO_2 emissionerne falder med 97% (pga. et lavere svovlindhold i diesel), hvorimod NH_3 emissionerne stiger med 3850% (pga. indførslen af katalysatorbiler).

De største $PM_{2.5}$-, NO_X- og NMVOC emissioner registreres i 1991. Herefter falder emissionerne med hhv. 45, 43, og 67% frem til 2004.

Emissioner fra vejtrafik i 2004, ændringer fra 1985 til 2004, og 2004 andele af den samlede danske emissionstotal

CRF ID	SO_2 [tons]	NO_x [tons]	NMVOC [tons]	CH_4 [tons]	CO [tons]	CO_2 [ktons]	N_2O [tons]	NH_3 [tons]	TSP [tons]	PM_{10} [tons]	$PM_{2.5}$ [tons]
Vej, 2004	378	59085	26477	2526	232650	12024	1357	2443	3214	3214	3214
Vej slidrelateret, 2004									2459	1593	865
Total Vej, 2004	378	59085	26477	2526	232650	12024	1357	2443	5673	4807	4079
Total national, 2004	24429	181368	116499	274531	619359	53941	25268	97838	43255	31095	22850
Vej-% af national, 2004	2	33	23	1	38	22	5	2	13	15	18
Vej-% ændring 1985-2004	-97	-34	-66	8	-58	48	301	3850	-35[2]	-35[1]	-35[1]

Partikelemissionerne fra vejtrafikkens udstødning kommer næsten udelukkende fra dieselkøretøjer. De største emissionskilder er varebi-

[2] Kun udstødning

ler, fulgt af tunge køretøjer og personbiler. Emissionerne fra varebiler og tunge køretøjer er faldet markant siden midten af 1990'erne pga. gradvist skærpede emissionsnormer, mens den miljømæssige fordel ved at indføre dieselpersonbiler med lavere partikelemissioner, siden 1990, mere eller mindre opvejes af de senere års stigende dieselpersonbilsalg.

Emissionsudviklingen for partikler fra dæk-, bremse-, og vejslid følger trafikkens generelle vækst. I forhold til vejtrafikkens samlede emissioner var TSP, PM_{10} og $PM_{2.5}$ emissionsandelene i 2004 på hhv. 43, 33 og 21%. De slidrelaterede partikelemissioner bliver mere og mere vigtige, i takt med at emissionerne fra udstødning falder år efter år.

Historisk set har benzinpersonbilernes emissionsbidrag domineret totalerne for NO_X, og specielt NMVOC og CO. Emissionerne for benzinpersonbiler er dog faldet en del i årene efter at katalysatorteknologien blev indført i 1990. En negativ sideeffekt af brugen af katalysatorer er, at N_2O emissionerne er steget i samme periode. Faldet i NO-, NMVOC- og CO emissionerne forstærkes yderligere af de gradvist skærpede Euro emissionsnormer for alle andre køretøjskategorier.

Emissioner fra andre mobile kilder

Andre mobile kilders NO_X, CO, SO_2, $PM_{2.5}$, NMVOC, PM_{10} og TSP emissioner udgjorde i 2004 hhv. 25, 24, 15, 13, 13 10 og 7% af landets total. I 2004 er emissionsandelen for CO_2 (og energiforbrug) på 7%, mens andelene for N_2O, NH_3 og CH_4 kun er på 1% eller mindre.

Partikel- og NO_X emissionerne er faldet med hhv. 46 og 14% fra´1985 til 2004. For CO_2 (og energiforbrug) er emissionsreduktionen i samme størrelsesorden, nemlig 15% (og 12% fra 1990). For N_2O falder emissionen med 16%, hvorimod CH_4 emissionen stiger med 6%. SO_2 emissionen er faldet med 74% fra 1985 til 2004 (og 77% siden 1980), mens NMVOC og CO emissionerne er steget med 32 og 6% i den samme periode.

TSP, NO_X og NMVOC emissionerne er faldet med hhv. 46, 14 og 10% fra 1985 til 2004. For CO_2 (og energiforbrug) beregnes emissionsfaldet til 15% (11% fra 1990), mens N_2O og CH_4 emissionerne falder med hhv. 10 and 5%. SO_2 emissionen er faldet med 74% fra 1985 til 2004 (og 77% siden 1980), hvorimod CO emissionerne for 1985 og 2004 ligger på samme niveau.

Emissioner fra andre mobile kilder i 2004, ændringer fra 1985 til 2004, og 2004 andele af den samlede danske emissionstotal

CRF ID	SO_2 [tons]	NO_x [tons]	NMVOC [tons]	CH_4 [tons]	CO [tons]	CO_2 [ktons]	N_2O [tons]	NH_3 [tons]	TSP [tons]	PM_{10} [tons]	$PM_{2.5}$ [tons]
Industri, arbejdsredskaber (1A2f)	263	10744	1676	46	7600	912	39	2	1037	1037	1037
Civil luftfart (1A3a)	41	552	158	6	857	128	8	0	3	3	3
Jernbane (1A3c)	7	3478	217	8	599	216	6	1	115	115	115
National søfart (1A3d)	2259	7990	1474	34	7767	490	28	0	533	514	496
Have-hushold (1A4b)	9	317	8731	290	114073	298	5	0	87	87	87
Landbrug/skovbrug/fiskeri (1A4c)	951	20501	2528	78	17445	1507	73	3	1283	1269	1256
Militær (1A5)	46	1079	129	11	718	239	12	1	53	53	53
Total andre mobile	3576	44661	14913	473	149058	3791	170	7	3110	3077	3046
Total national, 2004	24429	181368	116499	274531	619359	53941	25268	97838	43255	31095	22850
Andre mobile-% af national, 2004	15	25	13	0	24	7	1	0	7	10	13
Andre mobile -%-ændring 1985-2004	-74	-14	-10	-5	0	-15	-10	1	-46	-46	-46

De største emissionskilder for NO_X og partikler er dieselmaskiner der bruges indenfor landbrug/skovbrug/fiskeri, efterfulgt af industri og national søfart. Den største del af NMVOC- og CO-emissionerne kommer fra benzindrevne arbejdsredskaber og maskiner indenfor have- og hushold.

Tungmetaller

For tungmetaller følger emissionerne udviklingen i energiforbruget. I 2004 er vejtrafikkens emissionsandele af de nationale totaler for kobber (Cu), zink (Zn), chrom (Cr) og cadmium (Cd) på hhv. 71, 16, 16 og 7%, og for andre mobile kilder er bly (Pb), Cu and Nikkel (Ni) emissionsandelene på 27, 17 og 14%. For de øvrige komponenter er emissionsandelene på mindre end 5%.

Vejtrafikkens tungmetalemissioner er steget med 30% fra 1990 til 2004. Dog har der været et fald på næsten 100% for Pb, pga. udfasningen af bly i benzin frem til 1994. For andre mobile kilder stiger emissionerne i samme periode med mellem 10 og 20%, for de fleste komponenters vedkommende. For Pb, Ni, Selen (Se) og kviksølv (Hg) falder emissionerne yderligere. De respektive emissionsreduktioner er hhv. 79, 54, 33 og 27%. For Ni, Se og Hg skyldes emissionsfaldet en nedgang i forbruget af tung olie, mens grunden til de lavere Pb emissioner er udfasningen af bly i benzin.

PAH

PAH emissionsandelene for vejtransport og andre mobile kilder udgør 5% eller mindre af de nationale totaler i 2004.

Usikkerheder

I 2004 er CO_2 emissionerne de mest præcise, fulgt af CH_4-, SO_2-, NMVOC-, CO, NO_X-, PM_{10}, PM2.5, TSP og N_2O estimaterne med stigende usikkerheder. Usikkerhederne er på hhv. 5, 7, 46, 48, 50, 52, 55, 55, 56 og 64%. I samme emissionsrækkefølge er usikkerheden på emissionsudviklingen fra 1990 til 2004 på 5, 7, 6, 10, 13, 8, 8, 7 og 253%. For NH_3, tungmetaller og POP er 2002-emissionerne bestemt med en usikkerhed på mellem 700 og 1000%. Her er usikkerheden på 1990-2004 emissionsudviklingen signifikant lavere, men varierer dog

meget fra stof til stof. De mindste og største usikkerheder er hhv. 16 for Indeno(1,2,3-c,d)pyrene og 121 for dioxin.

1 Introduction

The Danish atmospheric emission inventories are prepared on an annual basis and the results are reported to the *UN Framework Convention on Climate Change* (UNFCCC or Climate Convention) and to the UNECE LRTAP (United Nations Economic Commission for Europe Long Range Transboundary Pollution) conventions. Furthermore, the greenhouse gas emission inventory is reported to the EU, due to the EU – as well as the individual member states – being party to the Climate Convention. The Danish atmospheric emission inventories are calculated by the Danish National Environmental Research Institute (NERI).

This report documents the Danish 1985-2004 emission inventories for road transport and other mobile sources in the sectors military, railways, navigation, fisheries, civil aviation and non-road machinery in agriculture, forestry, industry and household/gardening.

In Chapter 2 an overview is given of the Danish emissions in 2004, the UNFCCC and UNECE conventions and the Danish reduction targets. The inventory methodologies and references for road transport and other mobile sources are given in Chapter 3, while fuel use data and emission results are provided in Chapters 4 and 5, respectively. Chapters 6 and 7 explain the QA/QC procedures behind the inventories and uncertainties/time-series consistencies. In Chapter 8 the recalculations/improvements since 2003 (inventory year) are listed, whereas future improvements are given in Chapter 9.

2 Total Danish emissions, international conventions and reduction targets

2.1 Total Danish emissions

An overview of the Danish emission inventories for 2004 including all sectors is shown in Table 2.1-Table 2.4. The emission inventories reported to the LRTAP Convention and to the Climate Convention are organised in six main source categories and a number of sub categories. The emission source *1 Energy* covers combustion in stationary and mobile sources as well as fugitive emissions from the energy sector.

Links to the latest emission inventories can be found on the NERI home page: http://www2.dmu.dk/1_Viden/2_Miljoe-tilstand/3_luft/4_adaei/default_en.asp or via www.dmu.dk. Surveys of the latest inventories and the updated emission factors are also available on the NERI homepage.

Note that according to convention decisions the emissions from international transport as well as CO_2 emissions from renewable fuels are not included in the inventory emission totals. These emissions are reported as memo items and are thus estimated, but not included in the reported emissions.

Further emission data for mobile sources are provided in Chapter 5.

Table 2.1 Greenhouse gas emission for the year 2004 (Illerup et al. 2006a)

Pollutant	CO_2 (Gg)	CO_2 (Gg)	CH_4 (Gg)	N_2O (Gg)
1. Energy	52094		32.70	2.40
2. Industrial Processes	1731		-	2.5
3. Solvent and Other Product Use	113		-	-
4. Agriculture	-		178.10	20.19
5. Land-Use Change and Forestry	-	-2230	-	-
6. Waste	2		63.73	0.17
National total	53941	-2230	275	25
International transport	4992		0.10	0.25
Biomass	9647			

Table 2.2 Emissions 2004 reported to the LRTAP Convention (Illerup et al. 2006b).

Pollutant	NO_x Gg	CO Gg	NMVOC Gg	SO_2 Gg	TSP Mg	PM_{10} Mg	$PM_{2.5}$ Mg
1. Energy	181	619	77	24	26658	23559	21095
2. Industrial Processes	0	0	1	-	192	153	115
3. Solvent and Other Product Use	-	-	36	-	-	-	-
4. Agriculture	-	-	2	-	16405	7383	1640
5. Land-Use Change and Forestry	-	-	-	-	-	-	-
6. Waste	0	0	0	0	0	0	0
Total Danish emission	181	619	116	24	43255	31095	22850
International transport	80,14	7,78	2,31	35,60	4189	3981	3784

Table 2.3 Emissions 2004 reported to the LRTAP Convention (Illerup et al. 2006b).

Pollutant	Pb Mg	Cd Mg	Hg Mg	As Mg	Cr Mg	Cu Mg	Ni Mg	Se Mg	Zn Mg
1. Energy	5,19	0,57	1,06	0,66	1,16	8,98	9,55	1,84	22,78
2. Industrial Processes	0,07	0,00	-	-	-	0,05	-	-	0,63
3. Solvent and Other Product Use	-	-	-	-	-	-	-	-	-
4. Agriculture	-	-	-	-	-	-	-	-	-
5. Land-Use Change and Forestry	-	-	-	-	-	-	-	-	-
6. Waste	-	-	-	-	-	-	-	-	-
Total Danish emission	5,25	0,58	1,06	0,66	1,16	9,03	9,55	1,84	23,41
International transport	0,23	0,02	0,14	1,55	0,03	12,77	0,23	0,25	1,35

Table 2.4 Emissions 2004 reported to the LRTAP Convention (Illerup et al. 2006b).

Pollutant	Benzo(a)-pyrene Mg	Benzo(b)fluo-ranthene Mg	Benzo(k)-fluoranthene Mg	Indeno(1,2,3-c,d)pyrene Mg
1. Energy	3,30	4,39	1,50	2,42
2. Industrial Processes	-	-	-	-
3. Solvent and Other Product Use	-	-	-	-
4. Agriculture	-	-	-	-
5. Land-Use Change and Forestry	-	-	-	-
6. Waste	-	-	-	-
7. Other	-	-	-	-
Total Danish emission	3,30	4,39	1,50	2,42
International transport	0,00	0,01	0,01	0,02

2.2 International conventions and reduction targets

Denmark is a party to two international conventions with regard to emissions from road transport and other mobile sources:

- The UNECE Convention on Long Range Transboundary Air Pollution (LRTAP Convention or the Geneva Convention)
- The UN Framework Convention on Climate Change (UNFCCC). The convention is also called the Climate Convention.

The LRTAP Convention is a framework convention and has expanded to cover eight protocols:

1. EMEP Protocol, 1984 (Geneva).
2. Protocol on Reduction of Sulphur Emissions, 1985 (Helsinki).
3. Protocol concerning the Control of Emissions of Nitrogen Oxides, 1988 (Sofia).
4. Protocol concerning the Control of Emissions of Volatile Organic Compounds, 1991 (Geneva).
5. Protocol on Further Reduction of Sulphur Emissions, 1994 (Oslo).
6. Protocol on Heavy Metals, 1988 (Aarhus).
7. Protocol on Persistent Organic Pollutants (POPs), 1998 (Aarhus).
8. Protocol to Abate Acidification, Eutrophication and Ground-level Ozone, 1999 (Gothenburg).

The reduction targets/emission ceilings included in the Gothenburg protocol are stated in Table 2.5.

Table 2.5 Danish reduction targets / emission ceiling, Gothenburg protocol

Pollutant	Reduction/emission ceiling	Reference	Comment
SO_2	55 Gg in 2010	Gothenburg protocol	The ceiling equals 229% of the 2004 emission
NO_X	127 Gg in 2010	Gothenburg protocol	The ceiling equals 70% of the 2004 emission
NMVOC	85 Gg in 2010	Gothenburg protocol	The ceiling equals 73% of the 2004 emission

The Climate Convention is a framework convention from 1992. The Kyoto protocol is a protocol to the Climate Convention.

The Kyoto protocol sets legally binding emission targets and timetables for six greenhouse gases: CO_2, CH_4, N_2O, HFC, PFC and SF_6. The greenhouse gas emission of each of the six pollutants is combined to CO_2 equivalents, which can be totalled to produce total greenhouse gas (GHG) emissions in CO_2 equivalents. Denmark is obliged to reduce the average 2008-2010 GHG emissions by 21% compared to the 1990 emission level.

EU is a party to the Climate Convention and, thereby, EU countries are obliged to submit emission data to the EU Monitoring Mechanism for CO_2 and other Greenhouse Gases.

3 Methodology and references

The Danish emission inventory is based on the CORINAIR (CORe INventory on AIR emissions) system, which is a European programme 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, prepared by the UNECE/EMEP Task Force on Emissions Inventories and Projections (EMEP/CORINAIR, 2003). Emission data are stored in an Access database from which data are transferred to the reporting formats.

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 come from different European sources, however, for railways specific Danish measurements 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 CORINAIR 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 CRF classification codes shown in Table 3.1 (mobile sources only).

Table 3.1 SNAP – NFR correspondence table for transport

SNAP classification	CRF codes
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

Military transport activities (land and air) refer to the CRF sector Other (1A5), while the Transport-Navigation sector (1A3d) comprises national sea transport (ship movements between two Danish ports) and small boats and pleasure crafts. The working machinery and materiel in industry is grouped in Industry-Other (1A2f), while agricultural and forestry machinery is accounted for in the Agriculture/forestry/fisheries (1A4c) sector together with fishing activities.

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

3.1 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/CORINAIR Emission Inventory Guidebook (EMEP/CORINAIR, 2003). The actual calculations are made with a model developed by NERI, using the European COPERT III model methodology. The latter model approach is explained by Ntziachristos et al. (2000). In COPERT III 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.

3.1.1 Vehicle fleet and mileage data

Corresponding to the COPERT fleet classification all present and future vehicles in the Danish traffic 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 3.2 gives an overview of the different model classes and sub-classes, and the layer level with implementation years are shown in Annex 1.

Table 3.2 Model vehicle classes and sub-classes, trip speeds and mileage split

			Trip speed [km/h]			Mileage split [%]		
Vehicle classes	Fuel type	Engine size/weight	Urban	Rural	Highway	Urban	Rural	Highway
PC	Gasoline	< 1.4 l.	40	70	100	35	46	19
PC	Gasoline	1.4 – 2 l.	40	70	100	35	46	19
PC	Gasoline	> 2 l.	40	70	100	35	46	19
PC	Diesel	< 2 l.	40	70	100	35	46	19
PC	Diesel	> 2 l.	40	70	100	35	46	19
PC	LPG		40	70	100	35	46	19
PC	2-stroke		40	70	100	35	46	19
LDV	Gasoline		40	65	80	35	50	15
LDV	Diesel		40	65	80	35	50	15
Trucks	Gasoline		35	60	80	32	47	21
Trucks	Diesel	3.5 – 7.5 tonnes	35	60	80	32	47	21
Trucks	Diesel	7.5 – 16 tonnes	35	60	80	32	47	21
Trucks	Diesel	16 – 32 tonnes	35	60	80	19	45	36
Trucks	Diesel	> 32 tonnes	35	60	80	19	45	36
Urban buses	Diesel		30	50	70	51	41	8
Coaches	Diesel		35	60	80	32	47	21
Mopeds	Gasoline		30	30	-	81	19	0
Motorcycles	Gasoline	2 stroke	40	70	100	47	39	14
Motorcycles	Gasoline	< 250 cc.	40	70	100	47	39	14
Motorcycles	Gasoline	250 – 750 cc.	40	70	100	47	39	14
Motorcycles	Gasoline	> 750 cc.	40	70	100	47	39	14

Information of the vehicle stock and annual mileage is obtained from the Danish Road Directorate (Ekman, 2005). This covers data for the number of vehicles and annual mileage per first registration year for all vehicle sub-classes, and mileage split between urban, rural and

highway driving and the respective average speeds. Additional data for the moped fleet and motorcycle fleet disaggregation information is given by the National Motorcycle Association (Markamp, 2005).

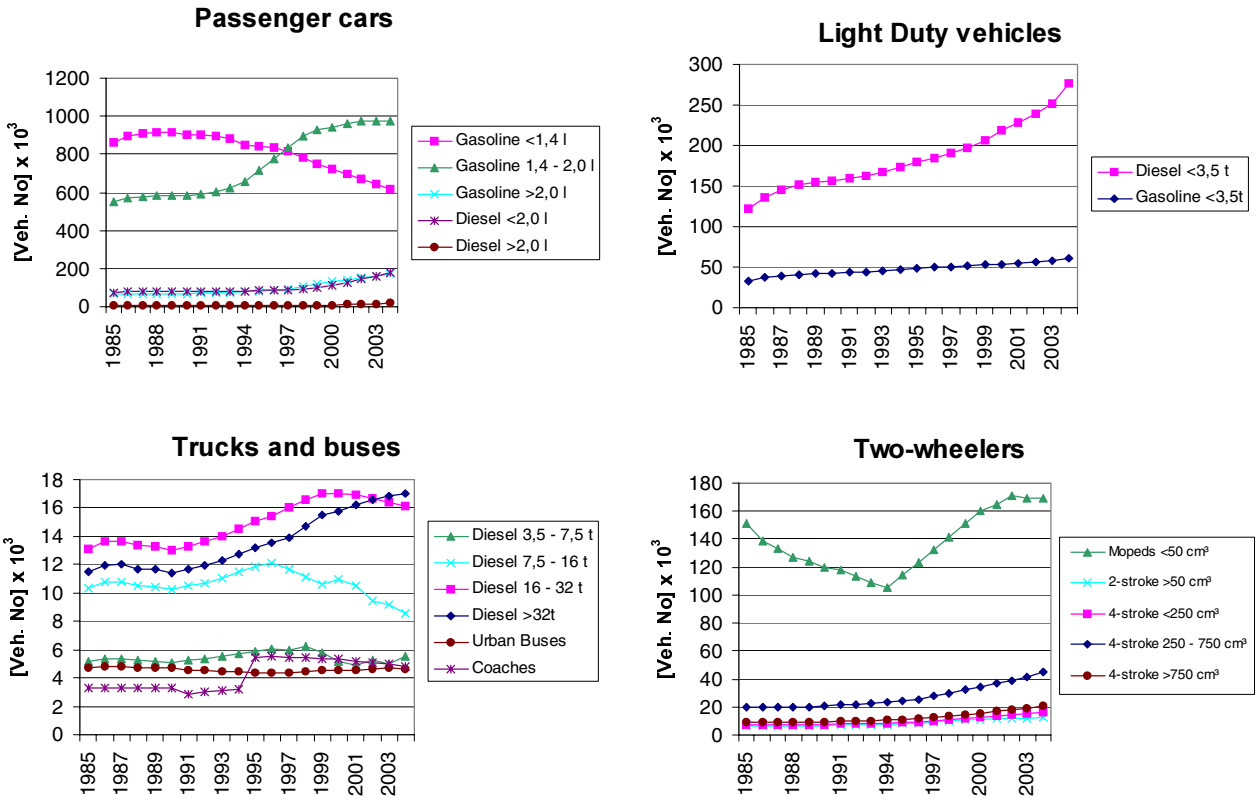

Figure 3.1 Number of vehicles in sub-classes in 1985-2004

The vehicle numbers per sub-class are shown in Figure 3.1. 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). In recent years there has been a decrease in the number of cars with engine sizes smaller than 1.4 litres.

There has been a considerable growth in the number of diesel light duty trucks from 1985 to 2004. The two largest truck sizes have also increased in numbers during the 1990s. From 2000 onwards this growth has continued for trucks larger than 32 tons, whereas the number of trucks with gross vehicle weights between 16 and 32 tons has decreased slightly.

The number of urban buses has been very constant from 1985 to 2004. 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 1985-2004 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 3.2) by using the correspondence between layers and first registration year:

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

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

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

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

Vehicle numbers and weighted annual mileages per layer are shown in Annex 1 and 2 for 1985-2004. The trends in vehicle numbers per layer are also shown in Figure 3.2. The latter figure shows how vehicles complying with the gradually stricter EU emission levels (Euro I, II, III etc.) have been introduced into the Danish motor fleet. The emission level penetration curves for diesel passenger cars are very inaccurate at present, but will be improved in next year's inventory.

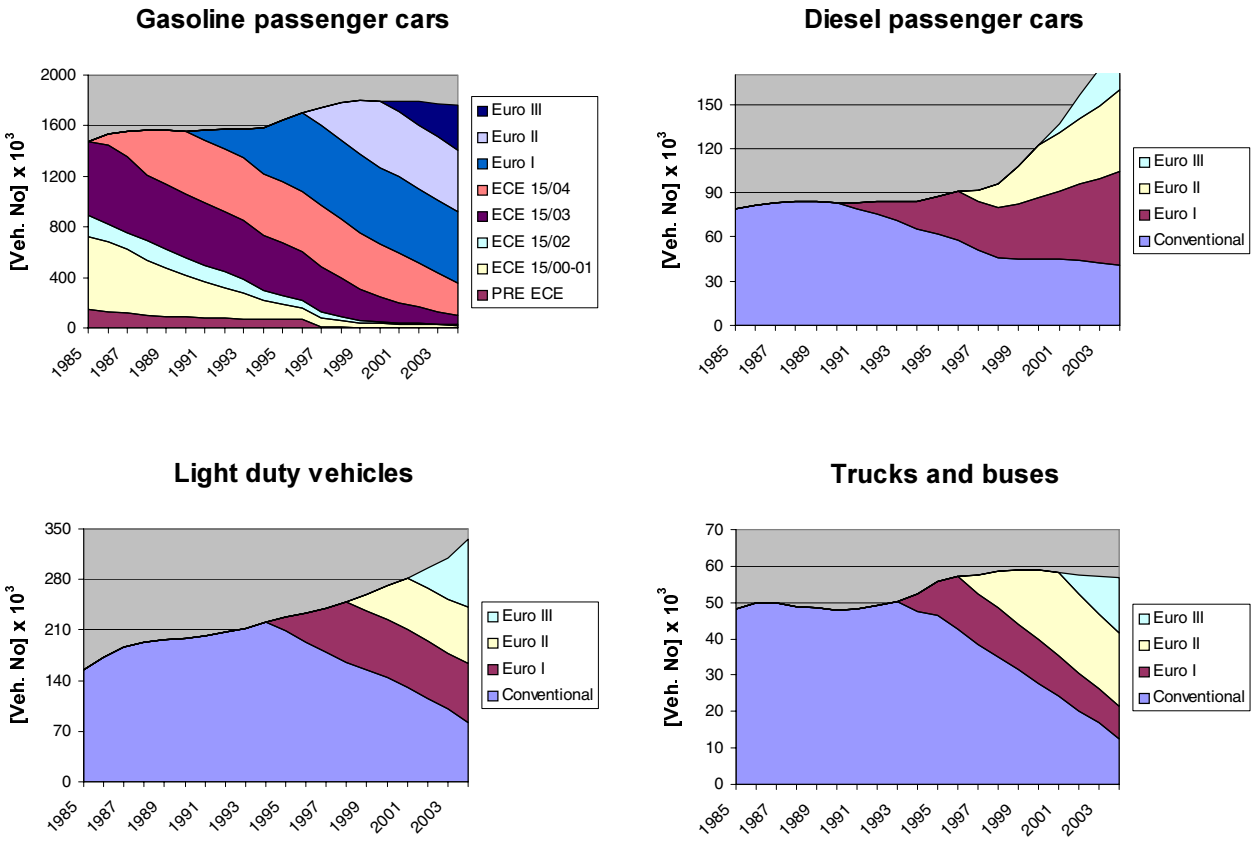

Figure 3.2 Layer distribution of vehicle numbers per vehicle type in 1985-2004

3.1.2 Emission legislation

For passenger cars and light duty trucks the emission approval tests are made on a chassis dynamometer. The test cycle used in the EU for emission approval testing of Euro I-IV passenger cars and light duty trucks is the EU NEDC (New European Driving Cycle (see Nørgaard and Hansen, 2004). The EU NEDC test is also used 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[3] (average speed: 19 km/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/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 3.3. The emission directives distinguish between three vehicle classes according to vehicle reference mass[4]: 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 3.

No specific emission legislation exists for CO_2; an EU strategy is, however, formulated to improve the fuel efficiency for new vehicles being sold in the EU. The goal is to bring down the average CO_2 emissions to 120 g/km in 2010. The means of which the CO_2 target should be met are:

- An agreement with the car manufacturers in Europe, Japan and Korea that new passenger cars sold in the EU in 2008/2009 on average have CO_2 emissions of 140 or less g/km.
- Energy labelling information from EU member states to car buyers.
- The use of fiscal instruments to promote fuel efficient cars

[3] For Euro III 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.
[4] Reference mass: net vehicle weight + mass of fuel and other liquids + 100 kg.

Table 3.3 Simplified overview of the existing EU emission directives for road transport vehicles

Vehicle category	Emission layer	EU directive	First reg. year start
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	1991[e]
	Euro II	94/12	1997
	Euro III	98/69	2001
	Euro IV	98/69	2006
Passenger cars (diesel and LPG)		Conventional	0
	ECE 15/04	83/351	1987[d]
	Euro I	91/441	1991[e]
	Euro II	94/12	1997
	Euro III	98/69	2001
	Euro IV	98/69	2006
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	1995
	Euro II	96/69	1999
	Euro III	98/69	2002
	Euro IV	98/69	2007
Heavy duty vehicles		Conventional	0
	Euro 0	88/77	1991
	Euro I	91/542	1994
	Euro II	91/542	1997
	Euro III	1999/96	2002
	Euro IV	1999/96	2007
	Euro V	1999/96	2010
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.

In practice the emissions from vehicles in the 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 only in a minor way reflect the large variety of emission influencing factors in the real traffic 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, which derives from numerous emissions measurements, must be chosen, using a broad range of real world driving patterns and sufficient numbers of test vehicles. It is similarly 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/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 Euro norm and installed exhaust gas after treatment system. A description of the test cycles are given by Nørgaard and Hansen, 2004. Measurement results in g/kWh from emission approval tests cannot be directly used for inventory work. Instead, emission factors used for national estimates must be transformed into g/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.

3.1.3 Fuel use and emission factors

Trip speed dependent basis factors for fuel use and emission are taken from the COPERT model using trip speeds as shown in Table 3.22. However, the SO_2 emission factors are fuel related and country specific, and for particulates from gasoline and LPG fuel use the emission factors from the TNO/CEPMEIP database are used[5]. The factors are listed in Annex 4. The scientific basis for COPERT III is fuel use and emission information from various European measurement programmes, transformed into trip speed dependent fuel use and emission factors for all vehicle categories and layers. For passenger cars and light duty trucks, real measurement results are behind the emission factors for Euro I vehicles and prior vehicle technologies, whereas the experimental basis for heavy duty vehicles are computer simulated emission factors for pre Euro I engines. In both cases, the emission factors for later engine technologies are produced by using the reduction factors given in Annex 5. 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. For further explanation, see Ntziachristos et al. (2000) or Illerup et al. (2002).

3.1.4 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.

[5] Particulate matter from exhaust is generally denomined as PM. The PM size fraction for road transport is well below $PM_{2.5}$

For each forecast year the deterioration factors are calculated per first registration year by using deterioration coefficients and cut-off mileages, as given in Ntziachristos et al. (2000) or Illerup et al. (2002) for the corresponding layer. The deterioration coefficients are given for the two driving cycles "Urban Driving Cycle" (UDC) and "Extra Urban Driving Cycle" (EUDC: urban and rural), with trip speeds of 19 and 63 km/h, respectively.

Firstly, the deterioration factors are calculated for the corresponding trip speeds of 19 and 63 km/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":

$$UDF = U_A \cdot MTC + U_B \text{ , MTC} < U_{MAX} \quad (3)$$

$$UDF = U_A \cdot U_{MAX} + U_B \text{ , MTC} >= U_{MAX} \quad (4)$$

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

In the case of trip speeds below 19 km/h the deterioration factor, DF, equals UDF, whereas for trip speeds exceeding 63 km/h DF=EUDF. For trip speeds between 19 and 63 km/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 the vehicle numbers and annual mileages per first registration year:

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

where DF is the deterioration factor.

3.1.5 Emissions and fuel use 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 use and emission factors (and deterioration factors for catalyst vehicles), number of vehicles, annual mileage numbers and their road type shares given in Table 3.22. For non-catalyst vehicles this yields:

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

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

For catalyst vehicles the calculation becomes:

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

3.1.6 Extra emissions and fuel use for cold engines

Extra emissions of SO_2, NO_X, NMVOC, CH_4, CO, CO_2, PM and fuel consumption from cold start are simulated separately. In the COPERT III model each trip is associated with an amount of cold start emission and is assumed to take place under urban driving conditions. The number of trips is distributed evenly in 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 2004, 2000-2003, 1990-1999 and 1980-1989 are given in Cappelen et al. (2005) and Cappelen (2004, 2000 and 2003). 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 time periods for future Euro standards. Correspondingly the β-factor for gasoline vehicles is step-wise reduced for Euro II vehicles onwards.

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.

3.1.7 Evaporative emissions from gasoline vehicles

For each year evaporative emissions of hydrocarbons are simulated in the forecast model as hot and warm running loss, hot and warm soak, and diurnal emissions. All emission types depend on RVP (Reid Vapour Pressure) and the ambient temperature. The emission factors are shown in Ntziachristos et al. (2000).

Running loss emissions originate from vapour generated in the fuel tank during operation. The distinction between hot and warm running loss emissions depends on the engine temperature. In the model hot and warm running loss occurs for hot and cold engines, respectively. The emissions are calculated as the annual mileage (broken down on cold and hot mileage totals using the β-factor) times respective emission factors. For vehicles equipped with evaporation control

(catalyst cars) the emission factors are only one tenth of the uncontrolled factors used by conventional gasoline vehicles.

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

where R is the 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:

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

where S^C is the soak emission, l_{trip} = the average trip length and HS and WS is 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 per month are used in combination with diurnal emission factors to estimate the diurnal emissions from uncontrolled vehicles $E^d(U)$:

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

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

3.1.8 Fuel use balance

The calculated fuel use in COPERT III must equal the statistical fuel sale and energy forecast totals from the Danish Energy Authority (DEA, 2005) according to the UNFCCC and UNECE emissions reporting format. 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.

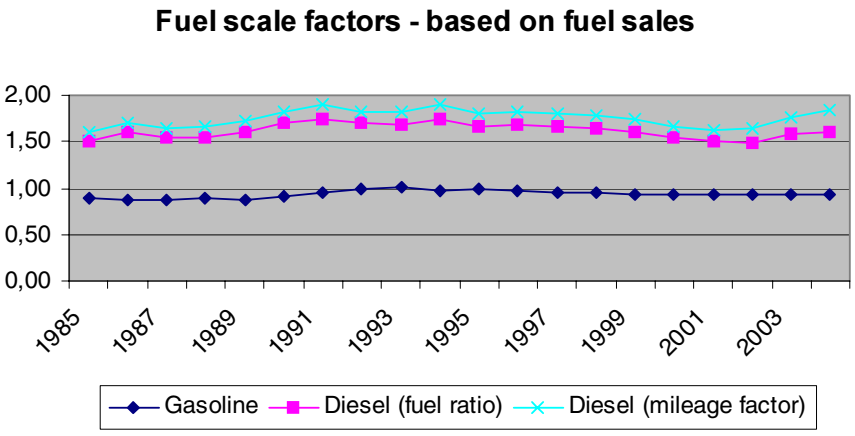

Figure 3.3 DEA:NERI Fuel ratios and diesel mileage adjustment factor based on DEA fuel sales data and NERI fuel consumption estimates

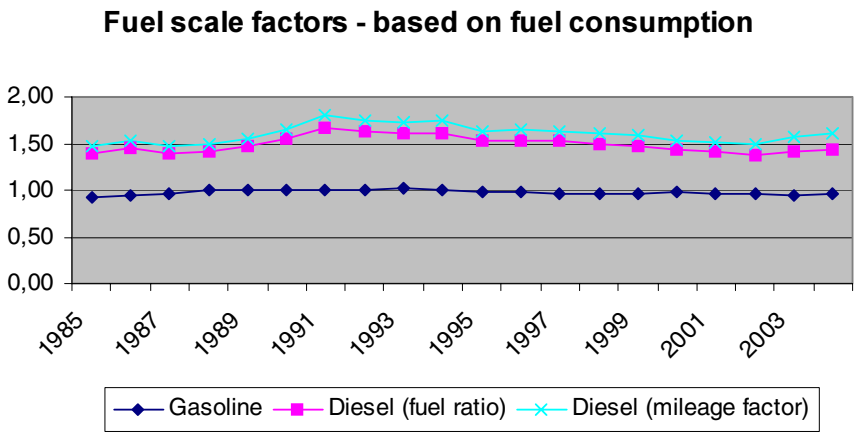

Figure 3.4 DEA:NERI Fuel ratios and diesel mileage adjustment factor based on DEA fuel consumption data and NERI fuel consumption estimates

In the figures 3.3 and 3.4 the COPERT III:DEA gasoline and diesel fuel use ratios are shown for fuel sales and fuel consumption from 1985-2004. The actual data are shown in Annex 8. The fuel consumption figures are related to the traffic on Danish roads.

For gasoline vehicles all mileage numbers are equally scaled in order to obtain gasoline fuel equilibrium, and hence the gasoline mileage factor used is the reciprocal value of the COPERT III:DEA gasoline fuel use ratio.

For diesel the fuel balance is made adjusting the mileage for light and heavy-duty vehicles and buses, given that the mileage and fuel consumption factors for these vehicles are regarded as the most uncertain parameters in the diesel engine emission simulations. Consequently, the diesel mileage factor used is slightly higher than the reciprocal value of the COPERT III:DEA diesel fuel use ratio.

From the Figures 3.3 and 3.4 it appears that the inventory fuel balances for gasoline and diesel would be improved, if the DEA statistical figures for fuel consumption were used instead of fuel sale numbers. The fuel difference for diesel is, however, still significant. The reasons for this inaccuracy are a combination of the uncertainties related to COPERT III fuel use factors, allocation of vehicle numbers in sub-categories, annual mileage, trip speeds and mileage splits for urban, rural and highway driving conditions.

For future inventories it is intended to use improved fleet and mileage data from the Danish vehicle inspection programme (performed by the Danish motor vehicle inspection office) and improved data for trip speed and mileage split for urban, rural and highway driving. The update of road traffic fleet and mileage data will be made as soon as this information is provided from the Danish Ministry of Transport and Energy in a COPERT model input format. In addition, a new version of the COPERT model – COPERT IV - will be available in 2006. The scientific basis for the new model version is the work on emission models and measurements performed in the EU 5th framework programme.

In Table 3.4 the aggregated emission factors for CH_4, CO_2, N_2O, SO_2, NO_X, NMVOC and PM are shown per fuel type for the Danish road transport.

Table 3.4 Fuel based emission factors for CH_4, CO_2, N_2O, SO_2, NO_X, NMVOC and PM for road transport in Denmark (2004)

				Emission factors6 [g/GJ]						
SNAP ID	Category	Fuel type	Mode	CH_4	CO_2	N_2O	SO_2	NO_X	NMVOC	PM
70101	Passenger cars	Diesel	Highway	4.31	74	13.24	2.34	278.56	11.59	38.99
70101	Passenger cars	Gasoline 2-stroke	Highway	10.03	73	2.01	2.28	288.90	2357.34	48.15
70101	Passenger cars	Gasoline conv.	Highway	11.45	73	2.20	2.28	1362.36	333.59	10.38
70101	Passenger cars	Gasoline catalyst	Highway	3.58	73	16.92	2.28	243.63	27.94	0.34
70101	Passenger cars	LPG	Highway	10.06	65	6.04	0.00	1151.70	187.09	10.06
70102	Passenger cars	Diesel	Rural	2.58	74	15.02	2.34	250.86	18.93	25.07
70102	Passenger cars	Gasoline 2-stroke	Rural	13.84	73	1.73	2.28	352.84	2476.82	41.51
70102	Passenger cars	Gasoline conv.	Rural	14.16	73	2.43	2.28	1163.16	452.60	11.59
70102	Passenger cars	Gasoline catalyst	Rural	4.14	73	8.58	2.28	175.60	29.93	0.38
70102	Passenger cars	LPG	Rural	16.91	65	7.25	0.00	1248.46	305.18	14.49
70103	Passenger cars	Diesel	Urban	2.52	74	10.14	2.34	256.86	53.08	46.58
70103	Passenger cars	Gasoline 2-stroke	Urban	43.97	73	0.82	2.28	51.89	4470.04	19.72
70103	Passenger cars	Gasoline conv.	Urban	52.55	73	1.61	2.28	635.44	858.78	11.28
70103	Passenger cars	Gasoline catalyst	Urban	48.77	73	15.33	2.28	169.53	213.29	0.32
70103	Passenger cars	LPG	Urban	33.68	65	4.44	0.00	618.83	421.82	11.83
70201	Light duty veh.	Diesel	Highway	1.59	74	6.06	2.34	312.66	30.60	49.23
70201	Light duty veh.	Gasoline conv.	Highway	10.11	73	2.43	2.28	1369.26	170.29	16.17
70201	Light duty veh.	Gasoline catalyst	Highway	2.51	73	12.03	2.28	140.96	16.71	0.24
70202	Light duty veh.	Diesel	Rural	1.74	74	6.63	2.34	330.79	35.07	45.72
70202	Light duty veh.	Gasoline conv.	Rural	15.25	73	2.29	2.28	1188.86	262.59	15.25
70202	Light duty veh.	Gasoline catalyst	Rural	2.87	73	5.19	2.28	124.02	22.63	0.23
70203	Light duty veh.	Diesel	Urban	2.27	74	4.81	2.34	364.26	56.95	56.50
70203	Light duty veh.	Gasoline conv.	Urban	59.59	73	1.34	2.28	626.11	685.91	8.91
70203	Light duty veh.	Gasoline catalyst	Urban	22.88	73	10.07	2.28	132.44	124.38	0.17
70301	Heavy duty veh.	Diesel	Highway	4.31	74	2.85	2.34	472.55	51.41	20.16
70301	Heavy duty veh.	Gasoline	Highway	9.69	73	0.83	2.28	1037.78	474.61	55.35
70302	Heavy duty veh.	Diesel	Rural	4.71	74	2.89	2.34	559.70	64.29	24.82
70302	Heavy duty veh.	Gasoline	Rural	16.74	73	0.91	2.28	1141.55	820.40	60.88
70303	Heavy duty veh.	Diesel	Urban	7.93	74	2.35	2.34	606.35	73.07	29.34
70303	Heavy duty veh.	Gasoline	Urban	14.21	73	0.61	2.28	456.62	696.09	40.59
704	Mopeds	Gasoline		158.08	73	0.91	2.28	25.40	6338.24	109.59
70501	Motorcycles	Gasoline	Highway	119.98	73	1.27	2.28	218.43	1170.15	31.96
70502	Motorcycles	Gasoline	Rural	143.85	73	1.52	2.28	175.99	1404.95	38.31
70503	Motorcycles	Gasoline	Urban	144.82	73	1.53	2.28	94.93	1877.22	38.57

3.1.9 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 2000-2004 as prescribed by the UNECE convention reporting format. The emissions are calculated by multiplying the total annual mileage per vehicle category with the correspondent average emission factors for each source type. The calculation procedure is consistent with the COPERT III model approach used to estimate the Dan-

6 References. CO_2 and SO_2: Country specific; NO_X, NMVOC, CH_4 and N_2O: COPERT III; PM diesel: COPERT III; PM gasoline and LPG: TNO/CEPMEIP database

ish national emissions coming from exhaust. A more thorough explanation of the calculations is given by Winther (2004) and emission factors are taken from EMEP/CORINAIR (2003). The emission factors and total emissions for 2004 are shown in Annex 13.

3.2 Methodologies and references for other mobile sources

The other mobile sources are divided into several sub-sectors; sea transport, fishery, air traffic, railways, military and the 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/CORINAIR Emission Inventory Guidebook (EMEP/CORINAIR, 2003) for air traffic and off road working machinery and equipment, while for the remaining sectors the simple method is used.

3.2.1 Activity data

Air traffic

The activity data for air traffic consist of air traffic statistics provided by the Danish Civil Aviation Agency (CAA-DK) and Copenhagen Airport. For 2001 onwards records are given per flight by CAA-DK as data for aircraft type and origin and destination airports. 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. Fuel statistics for jet fuel use and aviation gasoline is obtained from the Danish energy statistics (DEA, 2005).

Prior to emission calculations the aircraft types are grouped into a smaller number of representative aircrafts for which fuel use and emission data exist in the EMEP/CORINAIR databank. In this procedure the actual aircraft types are classified according to their overall aircraft type (jets, turbo props, helicopters and piston engine). Secondly, information on the aircraft MTOM (Maximum Take Off Mass) and number of engines are used to append a representative aircraft to the aircraft type in question. A more thorough explanation is given in Winther (2001a, b).

Non-road working machinery and equipment

The non-road working machinery and equipment are used in agriculture, forestry and industry, for household/gardening purposes and inland waterways (recreational craft). A new Danish research project has provided new information of the number of different types of machines, their load factors, engine sizes and annual working hours (Winther et al., 2006). The stock development from 1985-2004 for the most important types of machinery are shown in the following Figures 3.5-3.12. The stock data are also listed in Annex 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).

For agriculture, the total number of agricultural tractors and harvesters per year are shown in the Figures 3.5-3.6, respectively. The figures clearly show a decrease in the number of small machines, being replaced by machines in the large engine size ranges.

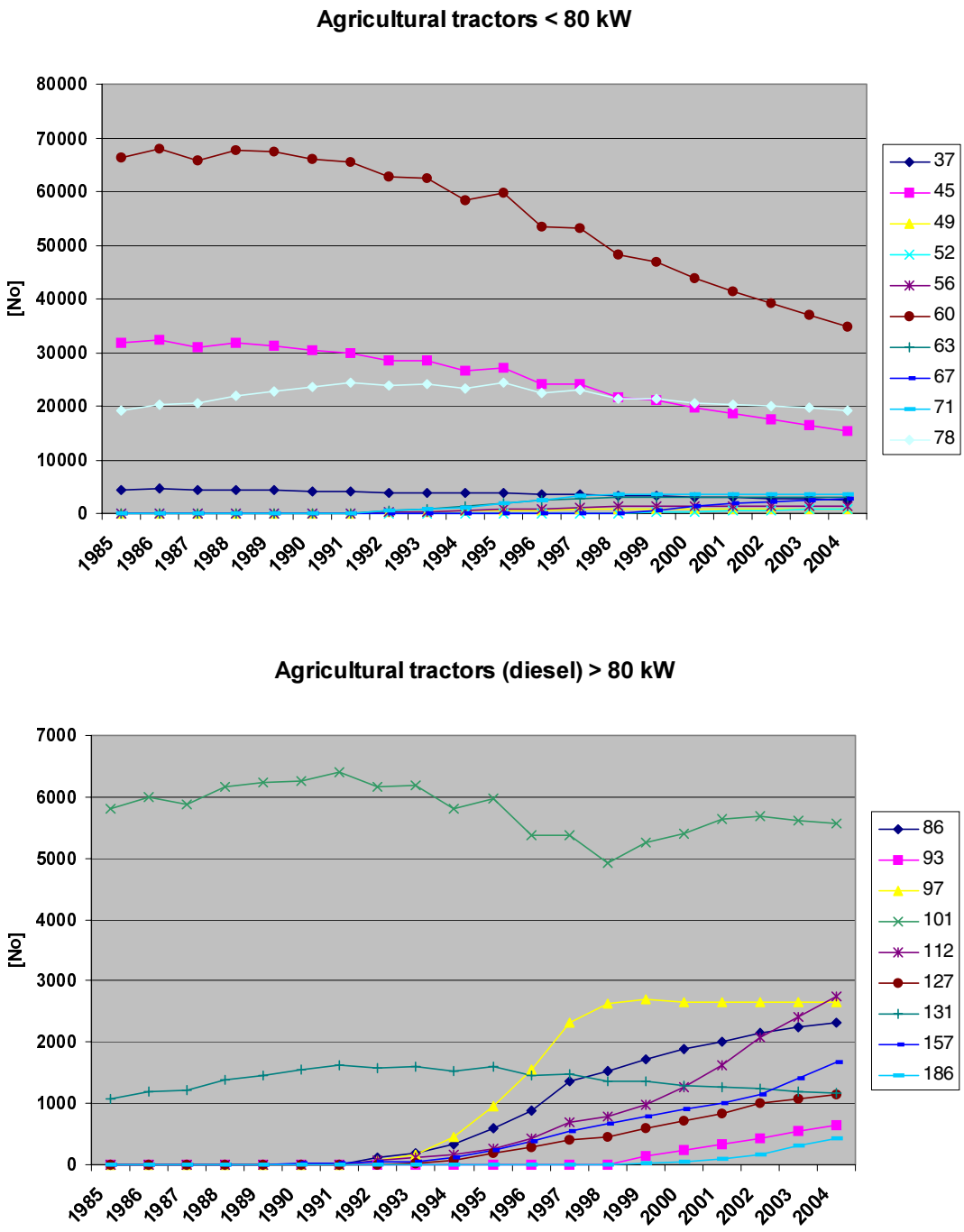

Figure 3.5 Total numbers in kW classes for tractors from 1985 to 2004

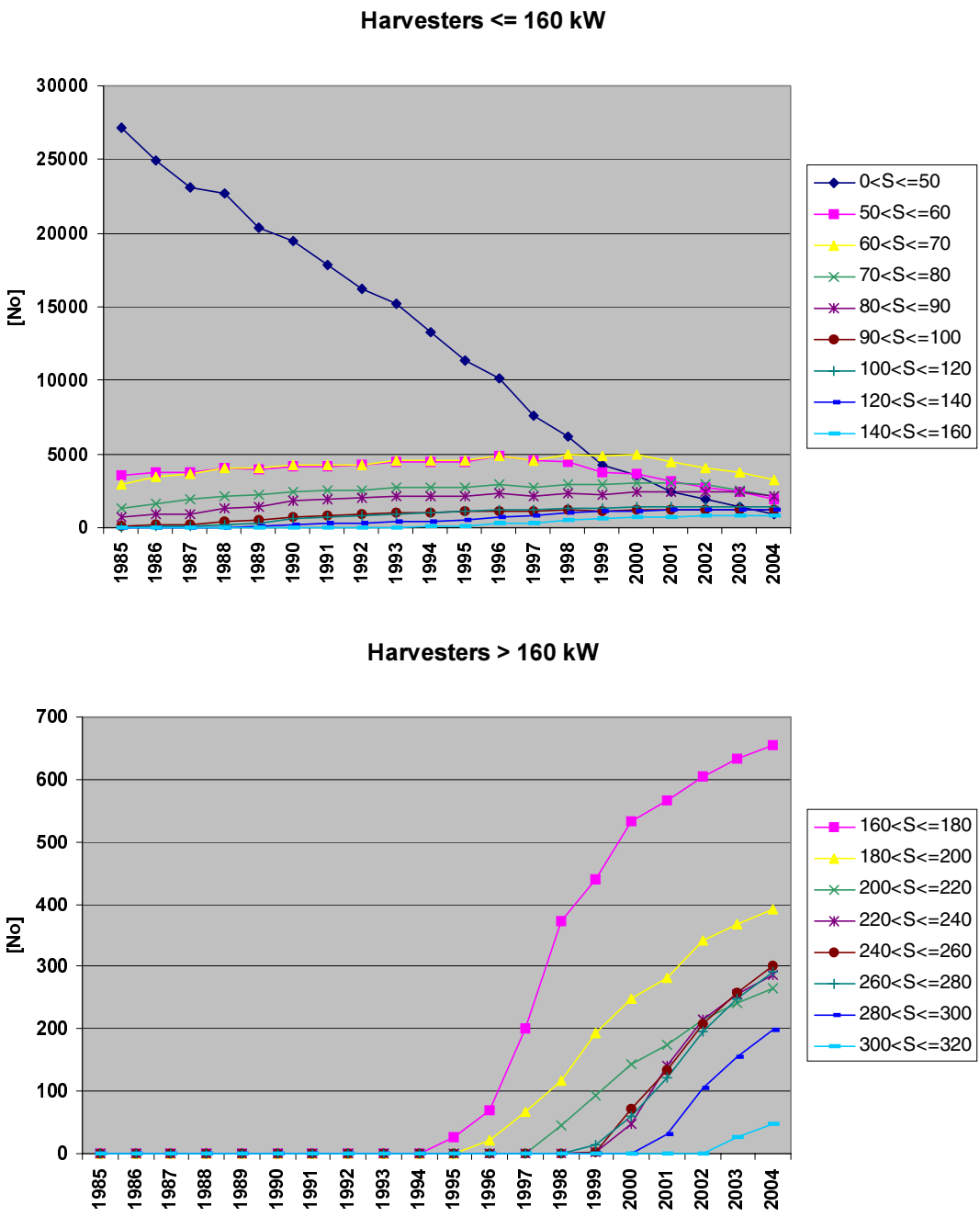

Figure 3.6 Total numbers in kW classes for harvesters from 1985 to 2004

The tractor and harvester developments towards fewer vehicles and larger engines, shown in Figure 3.7, are very clear. From 1985 to 2004, the tractors and harvester numbers decrease by about 20 and 50%, respectively, whereas the average engine size increase for tractors is 16%, and more than 100% for harvesters, in the same time period.

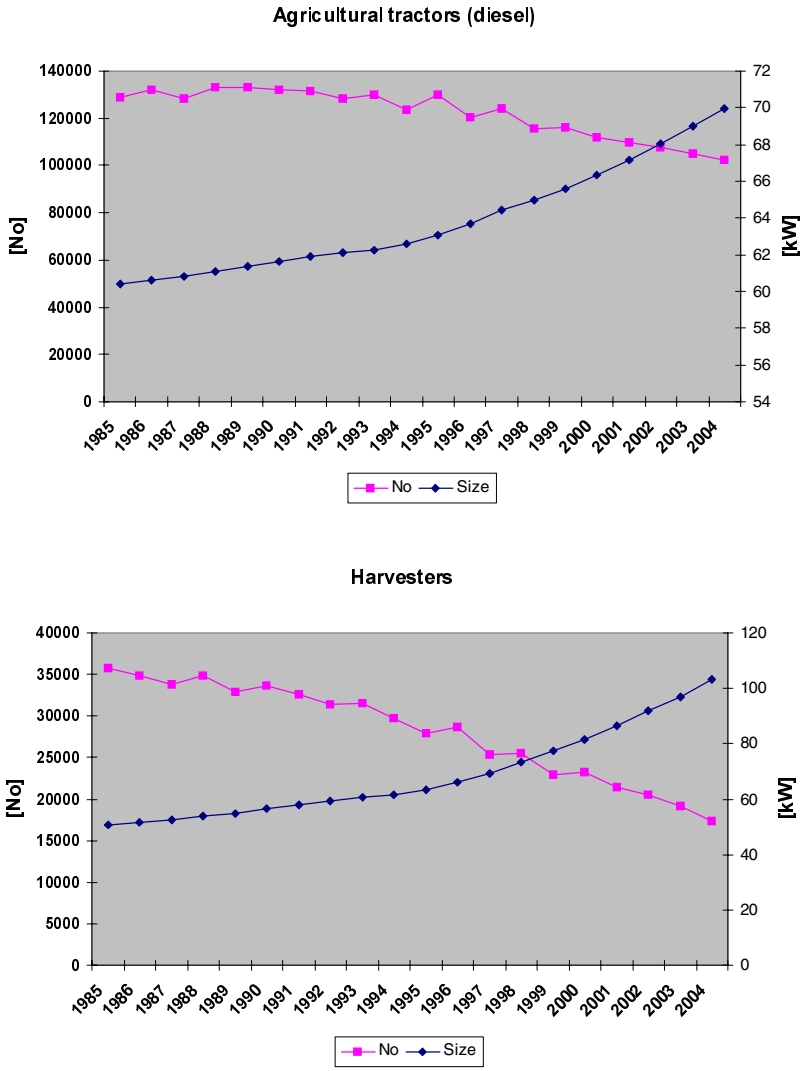

Figure 3.7 Total numbers and average engine size for tractors and harvesters (1985 to 2004)

The most important machinery types for industrial use are different types of construction machinery and fork lifts. The Figures 3.8 and 3.9 show the 1985-2004 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 tons), and telescopic loaders first enter into use in 1991 and 1995, respectively.

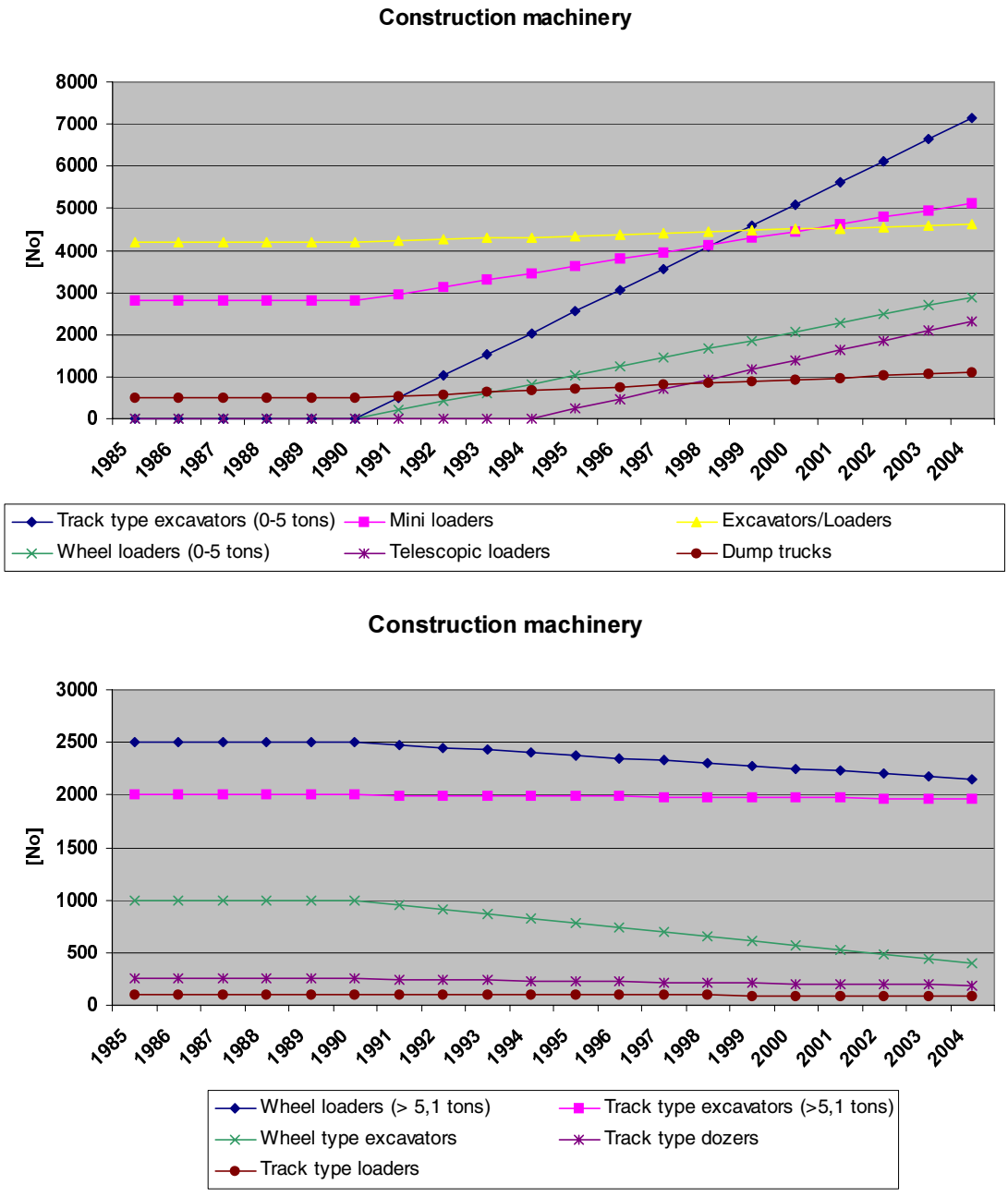

Figure 3.8 1985-2004 stock development for specific types of construction machinery

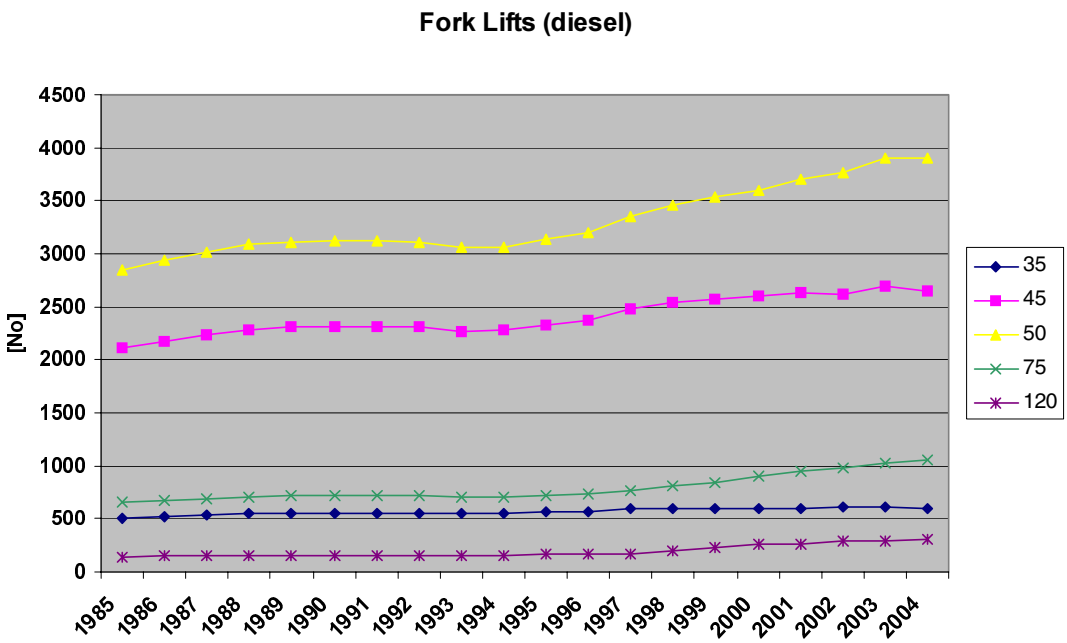

Figure 3.9 Total numbers of diesel fork lifts in kW classes from 1985 to 2004

The emission level shares for tractors, harvesters, construction machinery and diesel fork lifts are shown in Figure 3.10. These emission levels 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 rely on 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 3.10. Due to scarce data for construction machinery, the emission level penetration rates are assumed to be linear and the general technology turn-over pattern is as shown in Figure 3.10.

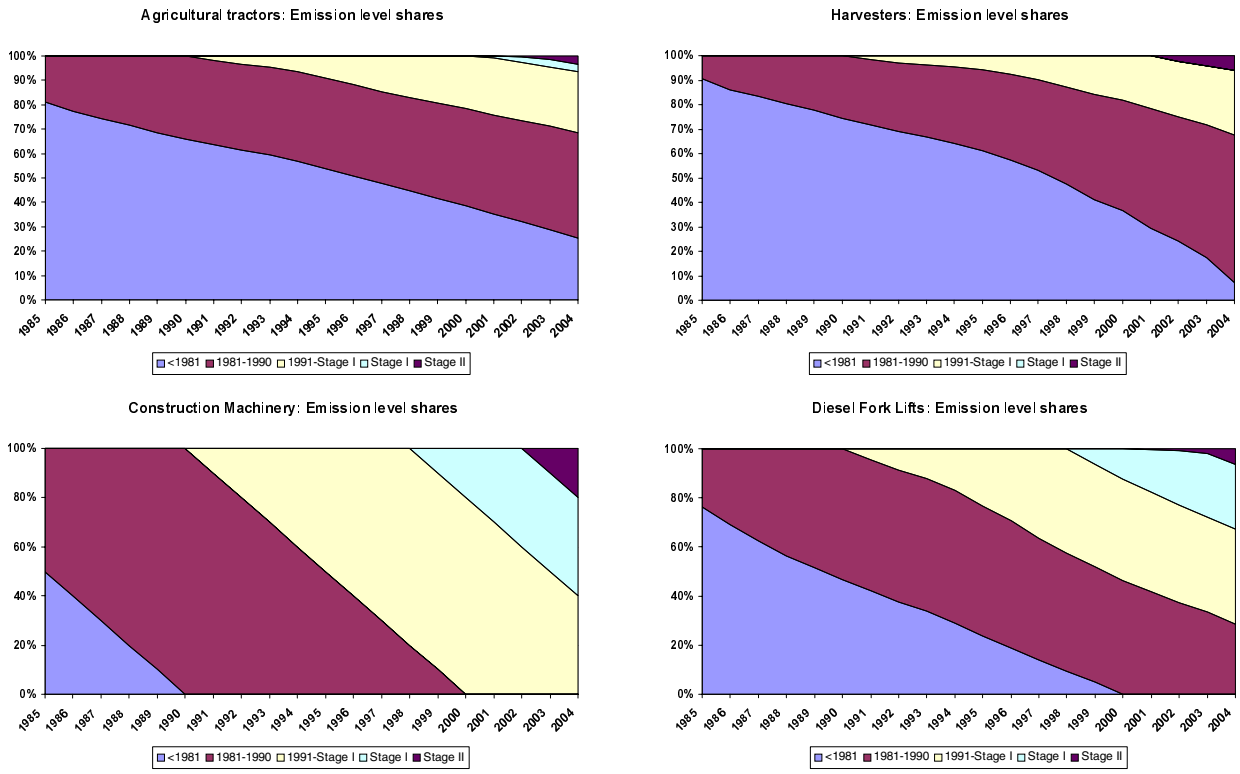

Figure 3.10 Emission level shares for tractors, harvesters, construction machinery and diesel fork lifts (1985 to 2004)

The 1985-2004 stock development for the most important household and gardening machinery types are shown in Figure 3.11. For lawn movers and cultivators the machinery stock remain the same for all years, whereas the stock figures for riders, chain saws, shrub clearers, trimmers and hedge cutters increase from 1990 and onwards. In most cases the yearly stock increases become larger after 2000. The lifetimes for gasoline machinery are short and thus there is a quick penetration of new emission levels (not shown).

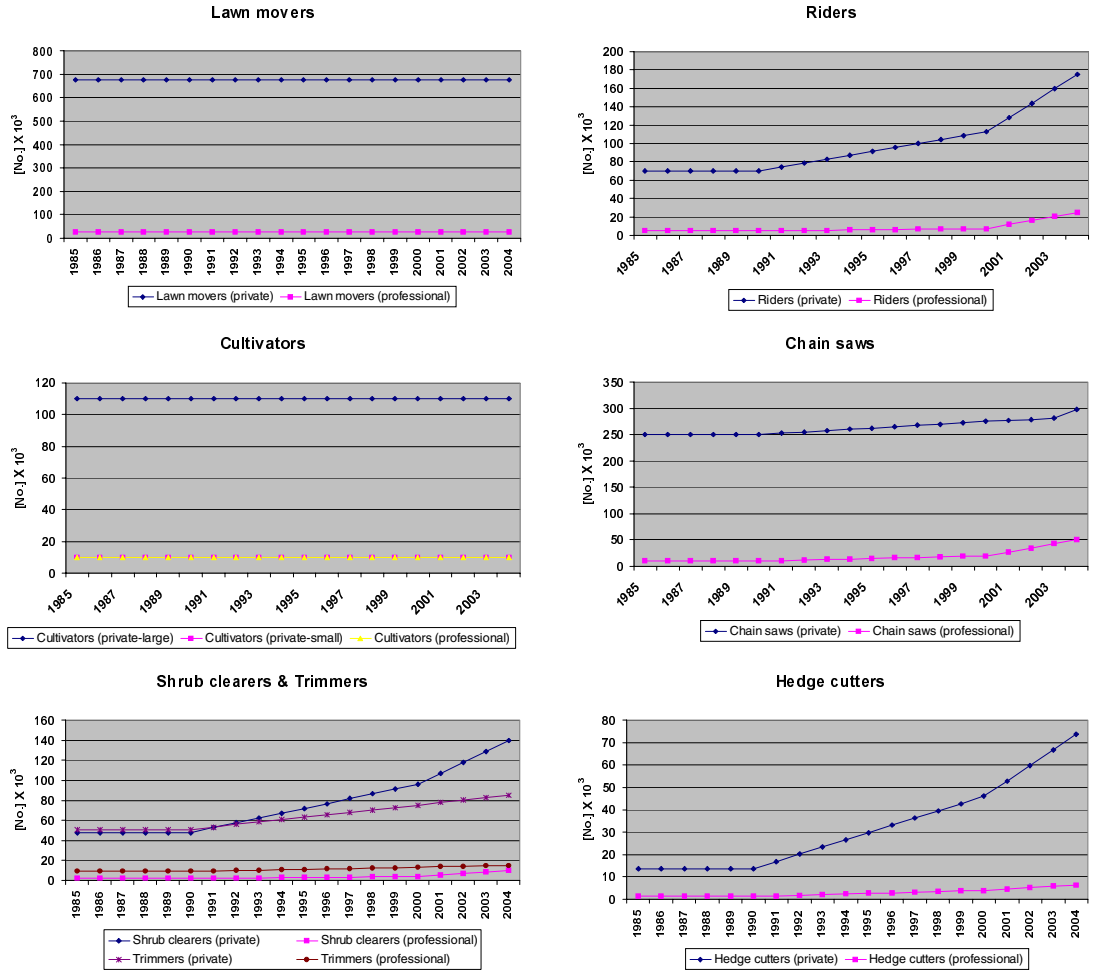

Figure 3.11 Stock development 1985-2004 for the most important household and gardening machinery types

Figure 3.12 shows the development in numbers of different recreational craft from 1985-2004. 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 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 about 25% are expected. Due to lack of specific Danish information the shifting rate from 2-stroke to 4-stroke gasoline engines is based on a German non-road study (IFEU, 2004).

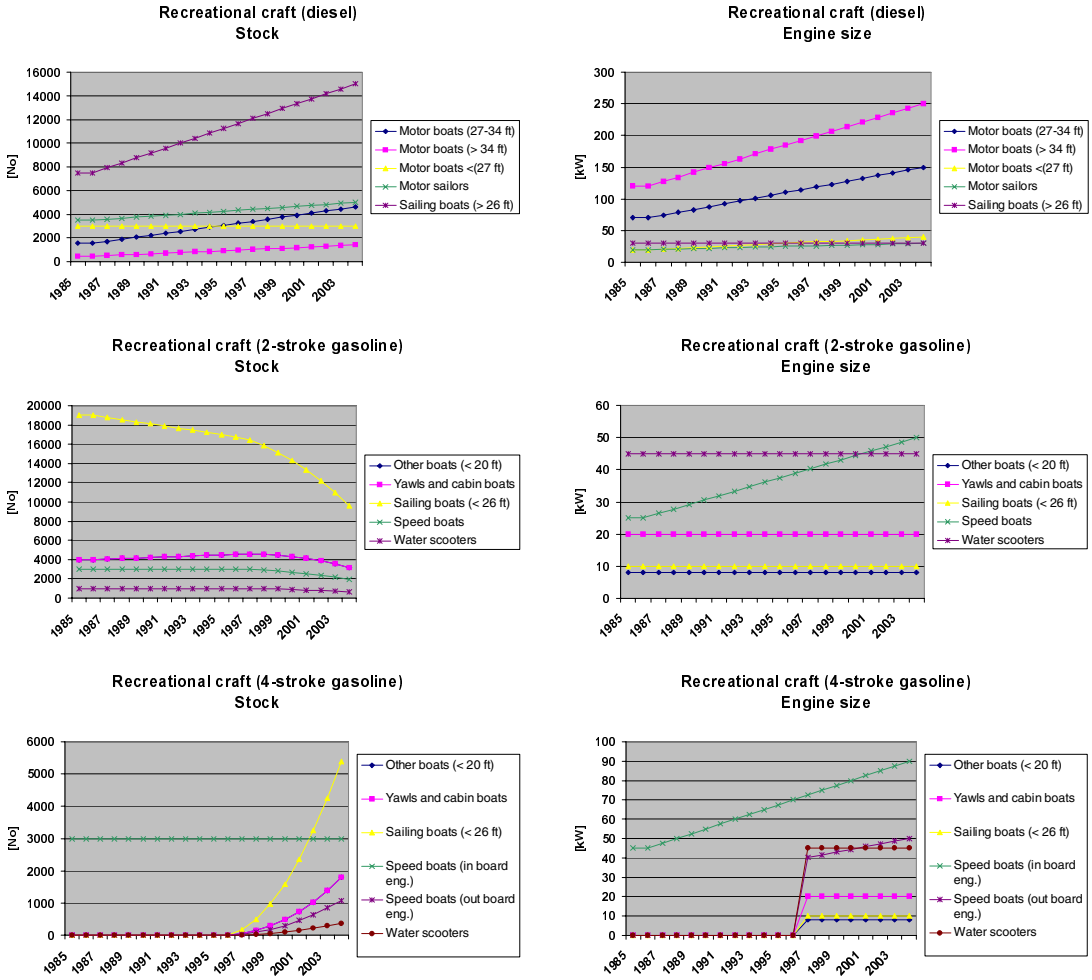

Figure 3.12 1985-2004 Stock and engine size development for recreational craft

Other sectors

The activity data for military, railways, sea transport and fishery consists of fuel use information from DEA (2005). For sea transport the basis is fuel sold in Danish ports and depending on the destination of the vessels in question the traffic is defined as either national or international as prescribed by the IPCC guidelines.

For all sectors fuel use figures are given in Annex 12 for the years 1990 and 2004 in CollectER format.

3.2.2 Emission legislation

For non-road working machinery and equipment, recreational craft and locomotives/rail cars, the emission directives (Tables 3.5-3.8) list specific emission limit values (g/kWh) for CO, VOC, NO_x (or VOC + NO_x) and TSP, depending on engine size (kW for diesel, cm^3 for gasoline) and date of implementation (referring to engine production date).

No legislation limits exist for specific fuel use and the directly fuel dependent emissions of CO_2. The engines, however, have to comply with the emission legislation limits agreed by the EU; and except for ships the VOC emission limits influence the emissions of CH_4, the latter emissions being a part of total VOC.

For diesel, the directives 97/68 and 2004/26 relates to non-road machinery other than agricultural and forestry tractors. The directives have different implementation dates for machinery operating under intermittent and constant speeds. 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 (SN) 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 of the machinery type in question. The test cycles are described in more details in the directives. For stage IIIB and IV a transient test procedure must be used to measure PM. It is optional for the engine manufacturers to use the same test procedure for other emission components.

Table 3.5 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/kWh]					EU directive	Intermittent	Constant	directive	date
Stage I										
130<=P<560	5	1.3	9.2		0,54	97/68	1/1 1999	-	2000/25	1/7 2001
75<=P<130	5	1.3	9.2		0,70		1/1 1999	-		1/7 2001
37<=P<75	6.5	1.3	9.2	-	0.85		1/4 1999	-		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 3.6 Overview of the EU emission directive 2002/88 for gasoline fuelled non-road machinery

	Category	Engine size [ccm]	CO [g/kWh]	HC [g/kWh]	NO_x [g/kWh]	HC+NO_x [g/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 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 given in the calculation formulas in Table 3.7. For NO_x, a constant limit value is given for each of the three engine types. For PM, the constant emission limit regards diesel engines only.

Table 3.7 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	PM
		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

Table 3.8 Overview of the EU emission directive 2004/26 for locomotives and rail cars

	Engine size [kW]		CO [g/kWh]	HC [g/kWh]	NOx [g/kWh]	HC+Nox [g/kWh]	PM [g/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 legislation

is relevant for aircraft engines with rated engine thrust larger than 26.7 kN. A further description of the emission legislation and emission limits is given in ICAO Annex 16 (1993).

For sea going vessels the 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 larger than 130 kW installed on ships constructed on or after 1st January 2000, and diesel engines with a power output larger than 130 kW, which have undergone major conversion on or after 1st January 2000.

3.2.3 Emission factors

The CO_2 emission factors are country specific and come from the DEA. The N_2O emission factors are taken from the EMEP/CORINAIR guidebook (CORINAIR, 2003). The SO_2 emission factors are fuel related and country specific. For military ground machinery, aggregated emission factors for gasoline and diesel are derived from the road traffic emission simulations. For aviation gasoline, fuel use aggregated emission factors for conventional cars are used. For railways specific Danish measurements from the Danish State Railways (DSB) (see Næraa, 2005) are used to calculate the emission factors of NO_x, VOC, CO and PM, 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 PM 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).

The source for aviation (jet fuel) and navigation emission factors is the EMEP/CORINAIR guidebook (CORINAIR, 2003). The same emission factor source is used for all other mobile sources in relation to NH_3, heavy metal and PAH emissions.

For all sectors emission factors are given in CollectER format in Annex 12 for the years 1990 and 2004.

Table 3.9 shows the aggregated emission factors for CH_4, CO_2, N_2O, SO_2, NO_X, NMVOC and PM[7] for other mobile sources in Denmark in 2004.

[7] PM is well below $PM_{2.5}$ except for national and international sea traffic and fishing. For the latter categories a small amount of the particulate emissions fall in the PM_{10} and TSP categories

Table 3.9 Fuel based emission factors for CH_4, CO_2, N_2O, SO_2, NO_X, NMVOC and PM for other mobile sources in Denmark (2004)

					Emission factors[8] [g/GJ]						
SNAP ID	NFR ID	Category	Fuel type	Mode	CH_4	CO_2	N_2O	SO_2	NO_X	NMVOC	PM
801	1A5	Military	Diesel		3.88	74	5.45	2.34	429.41	51.37	35.73
801	1A5	Military	Jet fuel	< 3000 ft	2.65	72	2.30	22.99	250.57	24.94	1.16
801	1A5	Military	Jet fuel	> 3000 ft	2.65	72	2.30	22.99	250.57	24.94	1.16
801	1A5	Military	Gasoline		27.72	73	11.32	2.28	288.90	279.15	2.60
801	1A5	Military	Av. gasoline		21.90	73	2.00	22.99	859.00	1242.60	10.00
802	1A3c	Railways	Diesel		2.86	74	2.04	2.34	1190.53	74.44	39.28
803	1A3d	Inland waterways	Diesel		2.76	74	2.97	93.68	877.17	170.01	104.92
803	1A3d	Inland waterways	Gasoline		54.65	73	1.07	2.28	398.23	2524.24	120.51
80402	1A3d	National sea traffic	Residual oil		1.76	78	4.90	1101.71	1393.60	56.90	139.40
80402	1A3d	National sea traffic	Diesel		1.69	74	4.70	93.68	1334.90	54.50	42.15
80402	1A3d	National sea traffic	Kerosene		7.00	72	2.00	4.60	50.00	3.00	97.56
80402	1A3d	National sea traffic	LPG		20.30	65	2.00	0.00	1249.00	384.90	12.44
80403	1A4c	Fishing	Residual oil		1.76	78	4.90	1101.71	1393.60	56.90	139.40
80403	1A4c	Fishing	Diesel		1.69	74	4.70	93.68	1334.90	54.50	42.15
80403	1A4c	Fishing	Kerosene		7.00	72	2.00	4.60	50.00	3.00	97.56
80403	1A4c	Fishing	Gasoline		108.10	73	0.52	2.28	64.34	10809.60	23.25
80403	1A4c	Fishing	LPG		20.30	65	2.00	0.00	1249.00	384.90	12.44
80404	Memo item	International sea traffic	Residual oil		1.76	78	4.90	1575.67	2127.10	56.90	200.50
80404	Memo item	International sea traffic	Diesel		1.69	74	4.70	468.38	2037.50	54.50	42.15
80501	1A3a	Air traffic, other airports	Jet fuel	Dom. < 3000 ft	3.12	72	21.05	22.99	252.17	29.42	1.16
80501	1A3a	Air traffic, other airports	Av. gasoline		21.90	73	2.00	22.83	859.00	1242.60	10.00
80502	Memo item	Air traffic, other airports	Jet fuel	Int. < 3000 ft	1.55	72	8.47	22.99	299.33	14.63	1.16
80502	Memo item	Air traffic, other airports	Av. gasoline		21.90	73	2.00	22.83	859.00	1242.60	10.00
80503	1A3a	Air traffic, other airports	Jet fuel	Dom. > 3000 ft	2.23	72	2.30	22.99	280.06	21.04	1.16
80504	Memo item	Air traffic, other airports	Jet fuel	Int. > 3000 ft	0.62	72	2.30	22.99	242.26	5.87	1.16
806	1A4c	Agriculture	Diesel		1.63	74	3.12	23.42	878.84	100.12	73.73
806	1A4c	Agriculture	Gasoline		129.17	73	1.54	2.28	86.41	1032.34	22.10
807	1A4c	Forestry	Diesel		1.06	74	3.20	23.42	822.93	65.33	45.59
807	1A4c	Forestry	Gasoline		52.96	73	0.41	2.28	48.43	6386.40	74.18
808	1A2f	Industry	Diesel		1.85	74	3.08	23.42	827.97	113.65	91.66
808	1A2f	Industry	Gasoline		101.67	73	1.39	2.28	191.31	1458.32	12.99
808	1A2f	Industry	LPG		7.69	65	3.50	0.00	1328.11	146.09	4.89
809	1A4b	Household and gardening	Gasoline		71.19	73	1.17	2.28	77.77	2141.22	21.37
80501	1A3a	Air traffic, Copenhagen airport	Jet fuel	Dom. < 3000 ft	4.16	72	11.22	22.99	255.88	39.13	1.16
80501	1A3a	Air traffic, Copenhagen airport	Av. gasoline		21.90	73	2.00	22.83	859.00	1242.60	10.00
80502	Memo item	Air traffic, Copenhagen airport	Jet fuel	Int. < 3000 ft	4.05	72	4.13	22.99	335.05	38.17	1.16
80502	Memo item	Air traffic, Copenhagen airport	Av. gasoline		21.90	73	2.00	22.83	859.00	1242.60	10.00
80503	1A3a	Air traffic, Copenhagen airport	Jet fuel	Dom. > 3000 ft	2.02	72	2.30	22.99	286.55	18.99	1.16
80504	Memo item	Air traffic, Copenhagen airport	Jet fuel	Int. > 3000 ft	1.17	72	2.30	22.99	310.56	11.03	1.16

3.2.4 Calculation method

Air traffic

For aviation the estimates are made separately for landing and take offs (LTOs < 3000 ft) and cruise (> 3000 ft). From 2001 the estimates are made on a city-pair level by combining activity data and emission factors and subsequently group the emission results into domestic and international totals. The overall fuel precision in the model is approximately 0.8, derived as the fuel ratio between model estimates and statistical sales. The fuel difference is accounted for by adjusting

[8] References. CO_2 and SO_2: Country specific; N_2O: EMEP/CORINAIR; Military: Aggregated emission factors for road transport; Railways (NO_x, NMVOC, CH_4 and PM): Danish State Railways; Agriculture, forestry, industry, household gardening and inland waterways (NO_x, VOC and PM): IFEU (2004); Aviation (jet fuel) and navigation (NO_X, NMVOC, CH_4 and PM): EMEP/CORINAIR; Aviation (av.gasoline): Aggregated emission factors for conventional gasoline cars. PM is counted as $PM_{2.5}$ except for national and international sea traffic and fishing. For the latter categories PM factors in Table 3.9 is total TSP

the cruise fuel use and emissions in the model according to the domestic and international cruise fuel shares.

Prior to 2001 the calculation scheme was to first estimate each year's fuel use and emissions for LTO. Then the total cruise fuel use was found year by year as the statistical fuel use total minus the calculated fuel use for LTO. Lastly the cruise fuel use was split into domestic and international parts 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:

$$E_{Basis}(X)_{i,j,k} = N_{i,j,k} \cdot HRS_{i,j,k} \cdot P \cdot LF_i \cdot EF_{y,z} \quad (13)$$

Where E_{Basis} = fuel use/emissions in the basis 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/kWh, i = machinery type, j = engine size, k = engine age, y = engine size class and z = emission level. The basis fuel use and emission factors are shown in Annex 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:

$$DF_{i,j,k}(X) = \frac{K_{i,j,k}}{LT_i} \cdot DF_{y,z} \quad (14)$$

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:

$$DF_{i,j,k}(X) = \sqrt{\frac{K_{i,j,k}}{LT_i}} \cdot DF_{y,z} \quad (15)$$

The deterioration factors inserted in (14) and (15) are shown in Annex 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, only rely on emission level and the load factor, and is denominated as:

$$TF_{i,j,k}(X) = TF_z \quad (16)$$

Where i = machinery type, j = engine size, k = engine age and z = emission level.

The transient factors inserted in (16) are shown in Annex 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, are the product of the expressions 13-16:

$$E(X)_{i,j,k} = E_{Basis}(X)_{i,j,k} \cdot TF(X)_{i,j,k} \cdot (1 + DF(X)_{i,j,k}) \quad (17)$$

The evaporative hydrocarbon emissions from fuelling are calculated as:

$$E_{Evap,fueling,i} = FC_i \cdot EF_{Evap,fueling} \quad (18)$$

Where $E_{Evap,fueling}$, = hydrocarbon emissions from fuelling, i = machinery type, FC = fuel consumption in kg, $EF_{Evap,fueling}$ = emission factor in g NMVOC/kg fuel.

For tank evaporation the hydrocarbon emissions are found from:

$$E_{Evap,\tan k,i} = N_i \cdot EF_{Evap,\tan k,i} \quad (19)$$

Where $E_{Evap,tank,i}$ = hydrocarbon emissions from tank evaporation, N = number of engines, i = machinery type, $EF_{Evap,fueling}$ = emission factor in g NMVOC/year.

Other sectors
For military, railways, national sea traffic and fishing the emissions are estimated with the simple method using fuel-related emission factors and fuel use from the DEA:

$$E = FC \cdot EF \quad (20)$$

Where E = emission, FC = fuel consumption, EF = emission factor. The calculated emissions for other mobile sources are shown in CollectER format in Annex 12 for the years 1990 and 2004, and as time-series 1985-2004 in Annex 16 (NFR format).

3.2.5 DEA sub-sector totals and NERI non-road estimates

For diesel and LPG the estimated non-road fuel use 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 use total. In addition a certain fuel amount 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 crafts the calculated fuel use totals are subsequently subtracted from the DEA fishery (diesel) and road transport (gasoline) sectors.

3.2.6 Bunkers

The distinction between domestic and international emissions from aviation and navigation must 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 in the Faroe Islands the jet fuel sold is treated as domestic. This decision becomes sensible since in the real world almost no fuel is bunkered in Greenland/Faroe Islands by other flights 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 Greenland all marine fuel sales are treated as domestic. In the Faroe Islands the 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).

To comply with the IPCC classification rules the fuel used by vessels sailing to Greenland and the Faroe Islands must be a part of the domestic total. To improve the fuel data quality for Greenland and the Faroe Islands the fuel sales must be grouped according to vessel destination and IPCC classifications made, subsequently.

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 navigation purposes in the Kingdom of Denmark.

4 Fuel consumption

Table 4.1 Fuel use (PJ) for domestic transport in 2004 in NFR sectors

NFR ID	Fuel use (PJ)
Industry-Other (1A2f)	12
Civil Aviation (1A3a)	2
Road (1A3b)	164
Railways (1A3c)	3
Navigation (1A3d)	7
Residential (1A4b)	4
Ag./for./fish. (1A4c)	20
Military (1A5)	3
Total	215

Table 4.1 shows the fuel use for domestic transport based on DEA statistics for 2004 in NFR sectors. The fuel use figures in time-series 1990-2004 are given in Annex 16 (NFR format) and are shown for 1990 and 2004 in Annex 12 (CollectER format). Road transport has a major share of the fuel consumption for domestic transport. In 2004 this sector's fuel use share is 76%, while the fuel use shares for agriculture/forestry/fisheries and industry-other are 9 and 6%, respectively. For the remaining sectors the total fuel use share is 9%.

From 1985 to 2004 the diesel and gasoline fuel uses have increased with 32 and 29%, respectively, and in 2004 the fuel use shares for diesel and gasoline were 58 and 39%, respectively (Figures 4.1 and 4.2). Other fuels only have a 3% share of the domestic transport total. Almost all gasoline is used in road transportation vehicles. Gardening machinery and private boats and pleasure crafts are merely small consumers. Regarding diesel there is a considerable fuel use in most of the domestic transport categories, whereas a more limited use of residual oil and jet fuel, respectively, is taking place in the fisheries/navigation sectors and by aviation (civil and military flights).

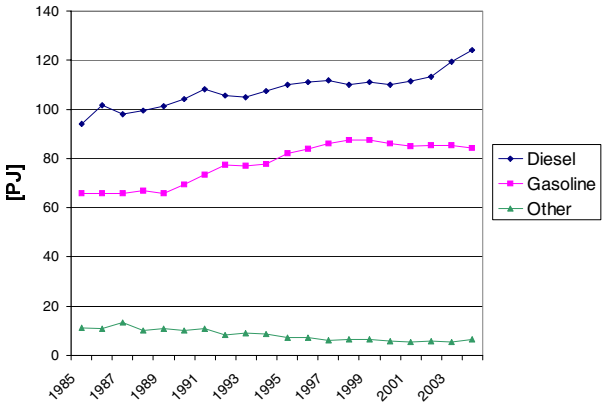

Figure 4.1 Fuel consumption per fuel type for domestic transport 1985-2004

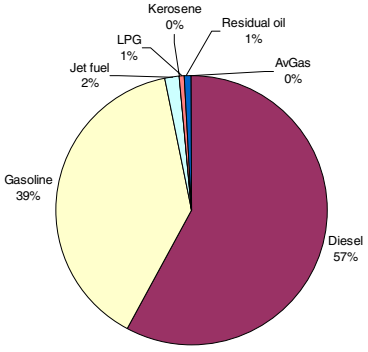

Figure 4.2 Fuel use share per fuel type for domestic transport in 2004

4.1 Road transport

As shown in Figure 4.3 the energy use for road transport increased until 2000, where a small fuel use decline is noted. From 2002 onwards the fuel use increases. The fuel use development is due to a slight decrease in the use of gasoline fuels from 1999 onwards combined with a steady growth in the diesel fuel use. Within sub-sectors passenger cars is the most fuel consuming vehicle category followed by heavy-duty vehicles, light duty trucks and 2-wheelers in decreasing order (Figure 4.4).

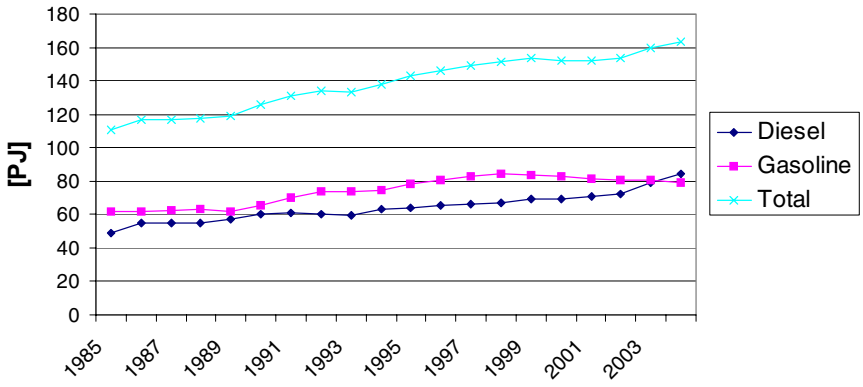

Figure 4.3 Fuel consumption per fuel type and as totals for road transport 1985-2004

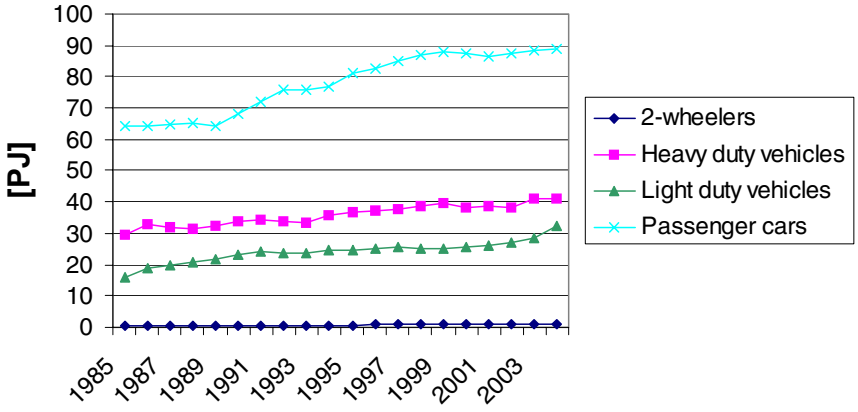

Figure 4.4 Total fuel consumption per vehicle type for road transport 1985-2004

As shown in Figure 4.5 the fuel use development for gasoline passenger cars dominates the total gasoline fuel use trend. The recent year's development in diesel fuel use (Figure 4.6) is characterised by an increasing fuel use for diesel passenger cars and light duty trucks, whereas the fuel use for trucks and buses (heavy-duty vehicles) has fluctuated since 1999. However, for the latter vehicle types the sudden fuel use increase in 2003 is very significant.

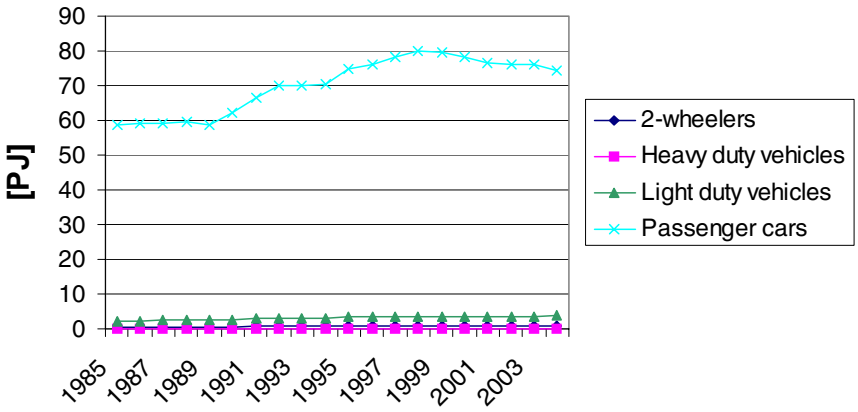

Figure 4.5 Gasoline fuel consumption per vehicle type for road transport 1985-2004

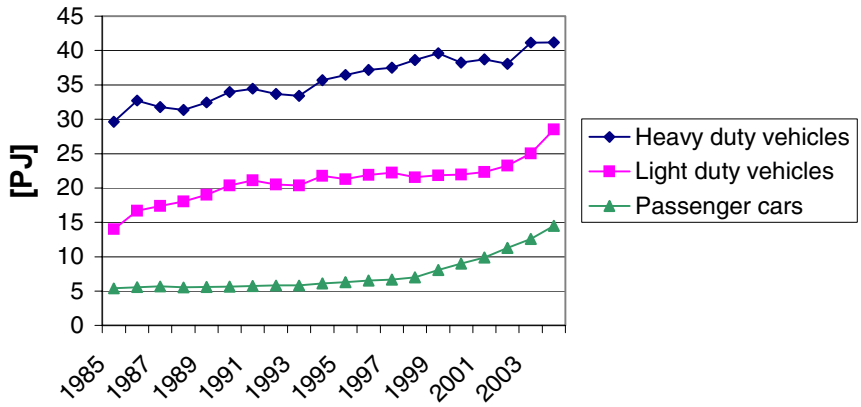

Figure 4.6 Diesel fuel consumption per vehicle type for road transport 1985-2004

In 2004 the fuel use shares for gasoline passenger cars, heavy-duty vehicles, diesel light duty trucks, diesel passenger cars and gasoline light duty trucks were 46, 25, 17, 9 and 2%, respectively (Figure 4.7).

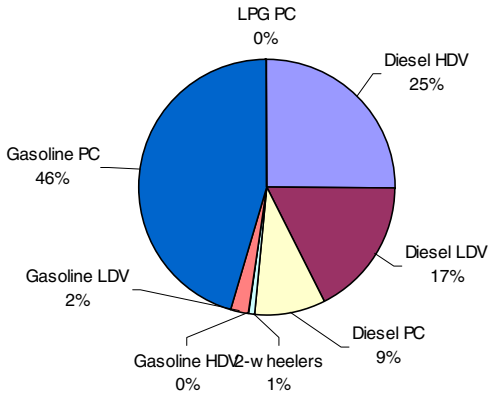

Figure 4.7 Fuel use share (PJ) per vehicle type for road transport in 2004

4.2 Other mobile sources

It must be noted that the fuel use 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 use information and fuel use totals are subsequently estimated from activity data and fuel use factors.

As seen in Figure 4.8 - classified according to NFR - 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 use: 1A5) and residential (1A4b).

The 1985-2004 time-series are shown per fuel type in Figures 4.9-4.11 for diesel, gasoline and jet fuel, respectively.

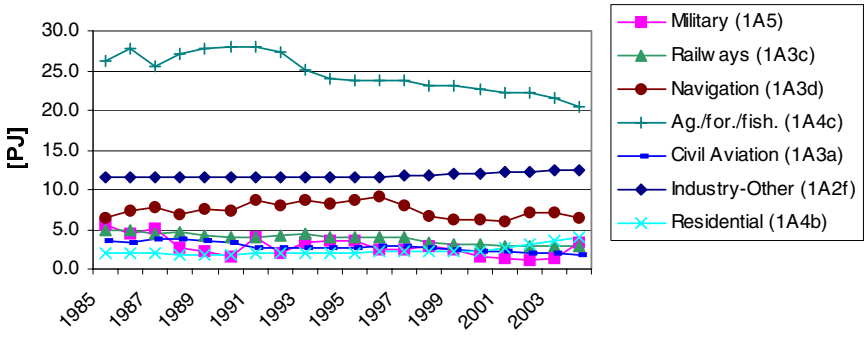

Figure 4.8 Total fuel use in NFR sectors for other mobile sources 1985-2004

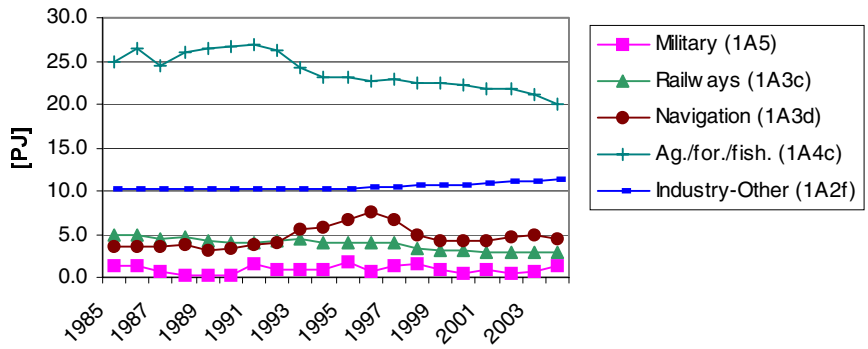

Figure 4.9 Diesel fuel use in NFR sectors for other mobile sources 1985-2004

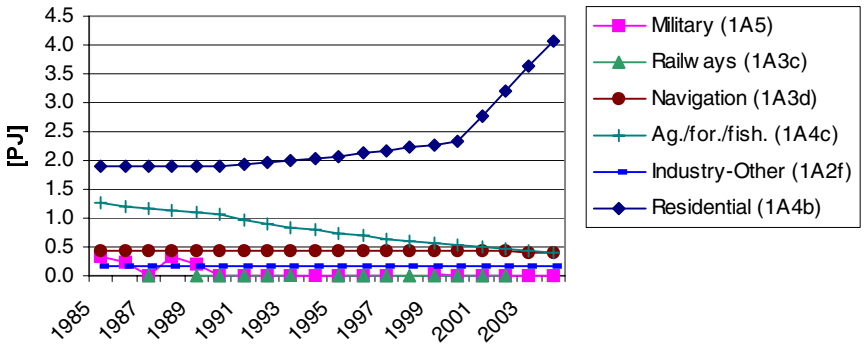

Figure 4.10 Gasoline fuel use in NFR sectors for other mobile sources 1985-2004

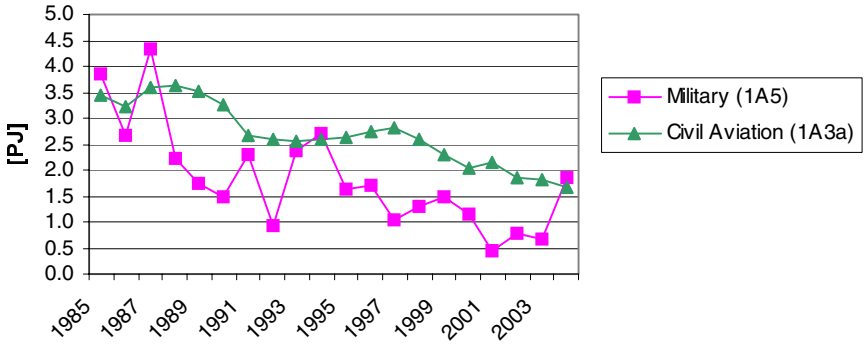

Figure 4.11 Jet fuel use in NFR sectors for other mobile sources 1985-2004

In the agriculture/forestry/fisheries sector the diesel fuel use by agricultural machines accounts for two thirds of the total fuel use. The fuel use decrease is the result of fluctuations in the diesel fuel use for fishery and the steady fuel use decrease for agricultural machines, most markedly from the beginning of the 1990s.

The navigation sector comprises national sea transport (fuel use between two Danish ports) and recreational craft. For the latter category the fuel use has increased significantly from 1985 to 2004 due to more gasoline and diesel fuelled private boats. For national sea transport the diesel fuel use has shown some fluctuations in the same time period. Though, for 1997 and 1998 there is a sudden fuel use decline. The most important explanation is the shut down of ferry service connections in connection with the opening of the Great Belt Bridge in 1997.

The largest gasoline fuel use is found for household and gardening machinery in the residential (1A4b) sector, and especially from 2001 and onwards there is a significant fuel use increase due to a large growth in the machinery stock. The decline in gasoline fuel use for agriculture/forestry/fisheries (1A4c) is due to the gradually phase out of gasoline fuelled agricultural tractors.

The considerable year by year variations in military jet fuel use is due to planning and budget-wise reasons and the passing demand for flying activities. Consequently, for some years a certain degree of jet fuel stock building might disturb the real picture of aircraft fuel use. Civil aviation has decreased since the building of the Great Belt

Bridge, both in terms of number of flights and total jet fuel use. For railways the gradual shift towards electrification explains the lowering trend in diesel fuel use and emissions for this transport sector. The fuel used (and associated emissions) to produce electricity are accounted for in the stationary source part of the Danish inventories.

4.3 Bunkers

The residual oil and diesel oil fuel use 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.

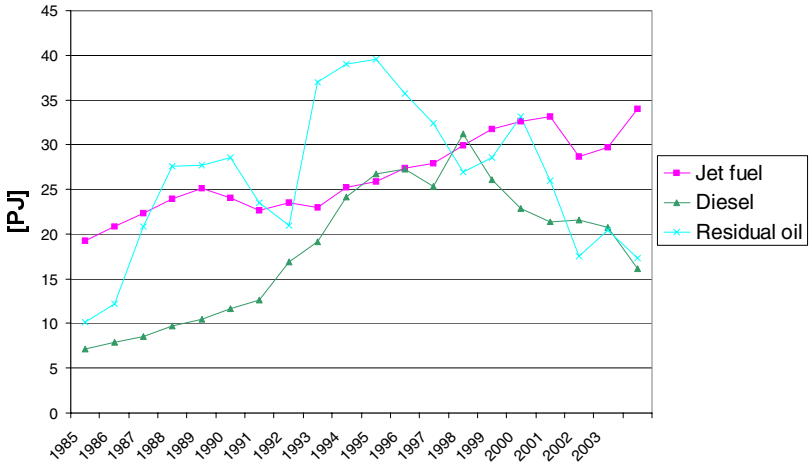

Figure 4.12 Bunker fuel use 1985-2004

5 Emissions

5.1 CO_2, CH_4 and N_2O

In Table 5.1 the CO_2, CH_4 and N_2O emissions for road transport and other mobile sources is shown for 2004 in CRF sectors. The emission figures in time-series 1985-2004 are given in Annex 16 (CRF format) and are shown for 1990 and 2004 in Annex 12 (CollectER format).

The road transport shares of national totals for CO_2, CH_4 and N_2O are 22, 1 and 5%, respectively in 2004. From 1985 to 2004 the CO_2, CH_4 and N_2O emissions have increased with 48, 8 and 301%, respectively, whereas the 1990-2004 emission increases are 30, 3 and 237%, respectively (from Figures 5.1-5.3). For other mobile sources the 2004 emission shares are 7% for CO_2 and less than 1% for CH_4 and N_2O. The other mobile CO_2 emissions have decreased with 15 and 11% from 1985 and 1990, respectively, to 2004 (from Figures 5.5-5.7).

Table 5.1 Emissions of CO_2, CH_4 and N_2O in 2004 for road transport and other mobile sources, and shares of national emission totals

CRF Sector	CH_4	N_2O	CO_2	CH_4	CO_2	N_2O
	[tons]	[tons]	[ktons]	% of national total		
Industry-Other (1A2f)	46	39	912	0	2	0
Civil Aviation (1A3a)	6	8	128	0	0	0
Railways (1A3c)	8	6	216	0	0	0
Navigation (1A3d)	34	28	490	0	1	0
Residential (1A4b)	290	5	298	0	1	0
Ag./for./fish. (1A4c)	78	73	1507	0	3	0
Military (1A5)	11	12	239	0	0	0
Total other mobile	473	170	3791	0	7	1
Road (1A3b)	2526	1357	12024	1	22	5
Total mobile	2999	1527	15815	1	29	6
Total national	274531	25268	53941	100	100	100

5.1.1 Road transport

The CO_2 emissions are directly fuel use dependent and in this way the emission development reflects the trend in fuel use. As shown in Figure 5.1 the most important emission source for road transport is passenger cars followed by heavy-duty vehicles, light duty trucks and 2-wheelers in decreasing order. In 2004 the respective emission shares were 54, 25, 20 and 1%, respectively (Figure 5.4).

The majority of the CH_4 emissions from road transport come from gasoline passenger cars (Figure 5.2). The emission increase from 1990 to 1996 for this vehicle category is a result of the somewhat higher emission factors for Euro I gasoline cars (introduced in 1990) than the ones for conventional gasoline cars. The emission drop from 1997 onwards is explained by the penetration of Euro II and III catalyst cars (1997 and 2001) into the Danish traffic. The newer technology stages have lower CH_4 emission factors than conventional gasoline

vehicles. The 2004 emission shares for CH_4 was 80, 9, 6 and 5% for passenger cars, heavy-duty vehicles, 2-wheelers and light duty trucks, respectively (Figure 5.4).

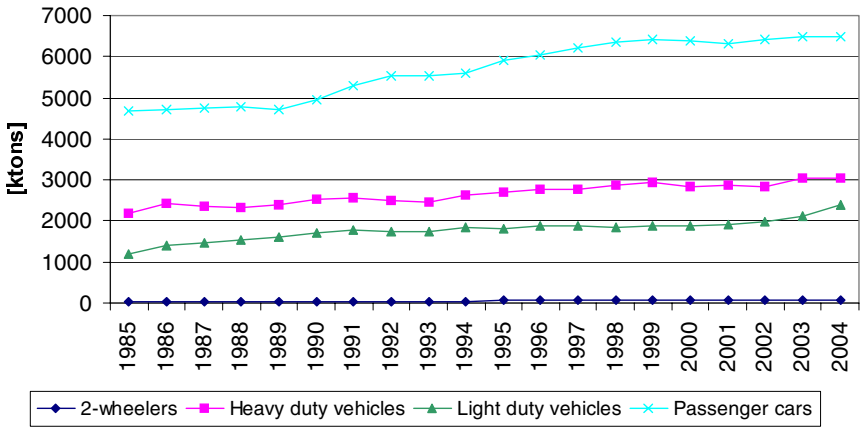

Figure 5.1 CO_2 emissions (ktons) per vehicle type for road transport 1985-2004

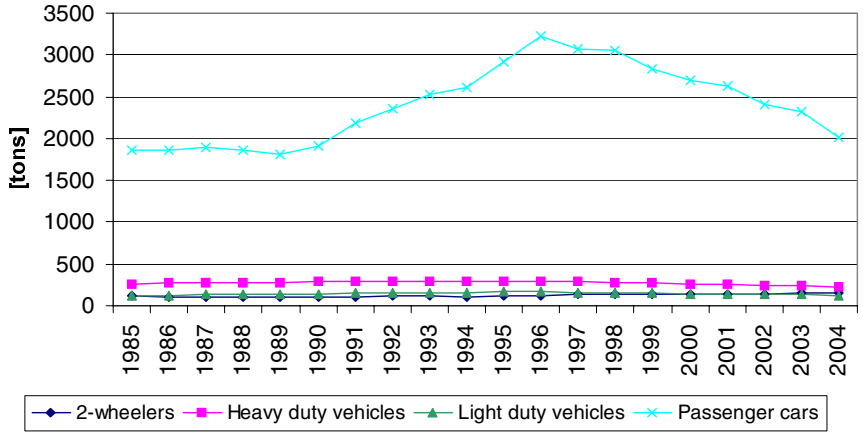

Figure 5.2 CH_4 emissions (tons) per vehicle type for road transport 1985-2004

An undesirable environmental side effect of the introduction of catalyst cars is the increase in the emissions of N_2O from 1990 and onwards (Figure 5.3). However, the total road transport N_2O and CH_4 emission contributions are still small compared to the emissions from the agricultural sector. In 2004 the emission shares for passenger cars, light and heavy-duty vehicles were 78, 14, 8%, respectively, of the total road transport N_2O (Figure 5.4).

According to IPCC 1 g CH_4 and 1 g N_2O have the greenhouse effect of 21 and 310 g CO_2, respectively. In spite of the relatively large CH_4 and N_2O global warming potentials, the largest contribution to the total CO_2 emission equivalents for road transport comes from CO_2, and the CO_2 emission equivalent shares per vehicle category are almost the same as for CO_2.

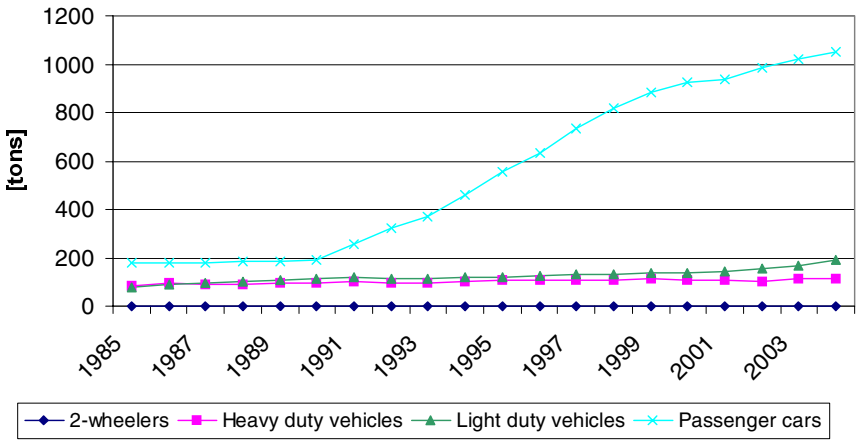

Figure 5.3 N_2O emissions (tons) per vehicle type for road transport 1985-2004

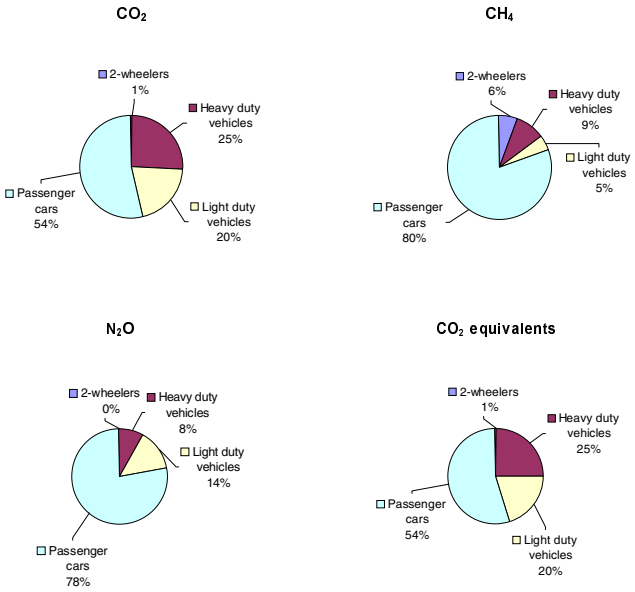

Figure 5.4 CO_2, CH_4 and N_2O emission shares and GHG equivalent emission distribution for road transport in 2004

5.1.2 Other mobile sources

For other mobile sources the biggest CO_2 emissions come from agriculture/forestry/fisheries (1A4c), industry-other (1A2f), navigation (1A3d) with shares of 40, 24 and 13%, respectively, in 2004 (Figure 5.8). The 1985-2004 emission trend is directly related to the fuel use development in the same time-period (see Chapter 4). Minor CO_2 emission contributors are sectors such as residential (1A4b), railways (1A3c), military (1A5) and civil aviation (1A3a). In 2004 the CO_2 emission shares for these sectors were 8, 6, 6 and 3%, respectively (Figure 5.8).

For CH_4 far the most important sector is residential (1A4b), see Figure 3.34. The emission share of 62% in 2004 is due to a relatively large gasoline fuel use for gardening machinery. The 2004 emission shares for agriculture/forestry/fisheries (1A4c), industry (1A2f) and navigation (1A3d) are 16, 10 and 7%, respectively, whereas the remaining sectors have emission shares of 2% or less.

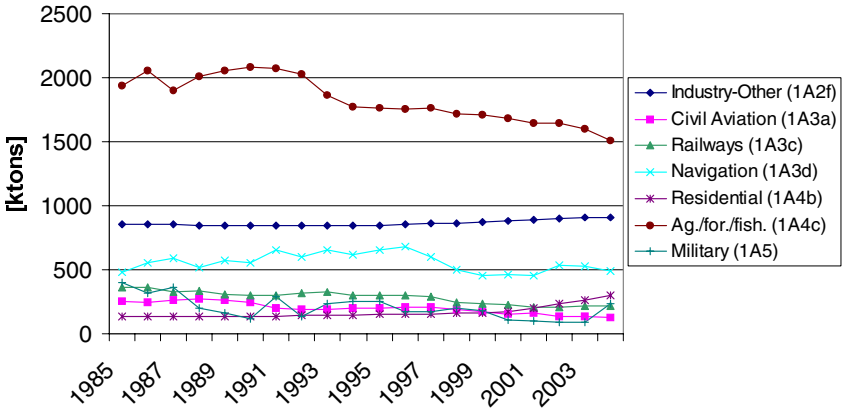

Figure 5.5 CO_2 emissions (ktons) in CRF sectors for other mobile sources 1985-2004

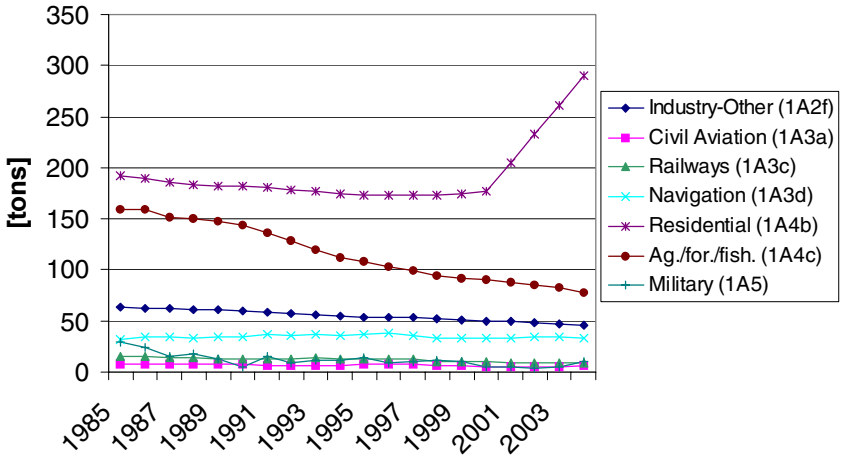

Figure 5.6 CH_4 emissions (tons) in CRF sectors for other mobile sources 1985-2004

For N_2O the emission trend in sub-sectors is the same as for fuel use and CO_2 emissions (Figure 5.7).

As for road transport, CO_2 alone contributes with far the most of the CO_2 emission equivalents in the case of other mobile sources and the sectoral CO_2 emission equivalent shares are almost the same as for CO_2 (Figure 5.8).

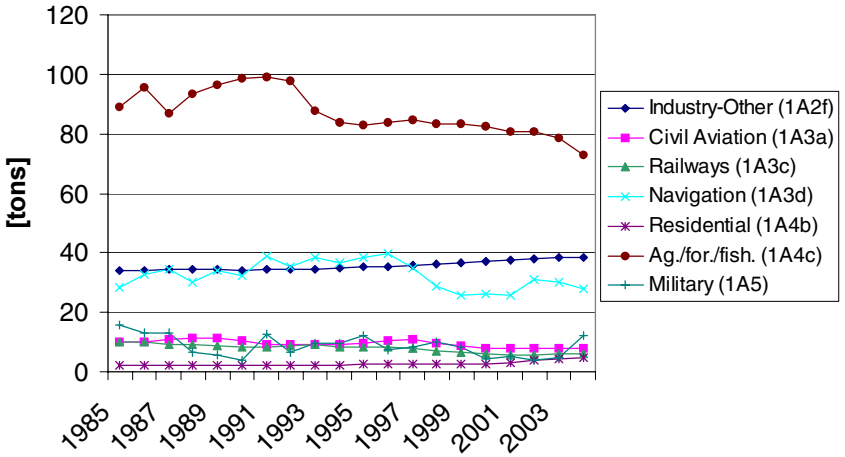

Figure 5.7 N_2O emissions (tons) in CRF sectors for other mobile sources 1985-2004

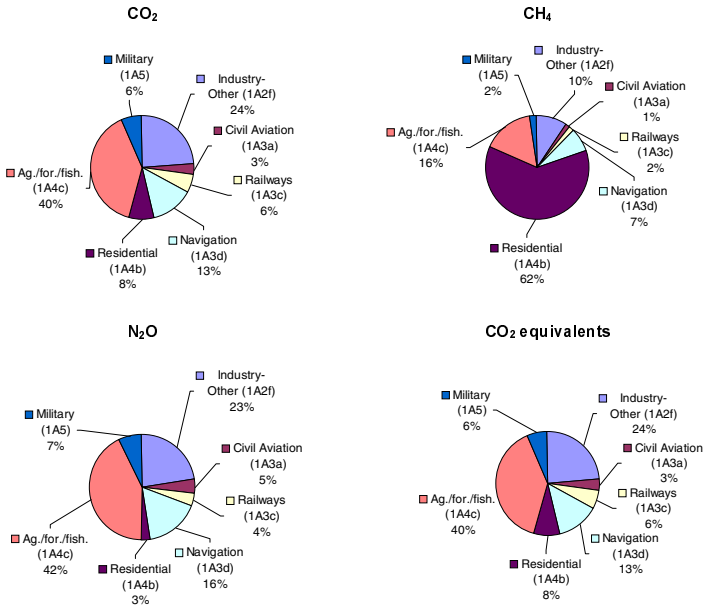

Figure 5.8 CO_2, CH_4 and N_2O emission shares and GHG equivalent emission distribution for other mobile sources in 2004

5.2 SO_2, NO_X, NMVOC, CO and NH_3

In Table 5.2 the SO_2, NO_X, NMVOC, CO and NH_3 emissions for road transport and other mobile sources are shown for 2004 in CRF sectors. The emission figures in time-series 1985-2004 are given in Annex 16 (CRF format) and are shown for 1990 and 2004 in Annex 12 (CollectER format).

The road transport emission shares of national totals for CO, NO_X and NMVOC are 38, 33 and 23%, respectively, in 2004, and for NH_3 and SO_2 the shares are 2 and 1%, respectively. From 1985 to 2004 the road transport emissions of NMVOC, CO and NO_X emissions have decreased by 66, 58 and 34%, respectively (Figures 5.10-5.12). The highest CO, NO_X and NMVOC emissions occur in 1991, after which the emissions drop by 50, 43 and 67%, respectively, until 2004.

The other mobile emission shares for NO_X, NMVOC, CO, SO_2 and NH_3 are 25, 13, 24, 15 and 0%, respectively in 2004. For other mobile sources the emissions of NO_X has decreased by 14% from 1985 to 2004 and for SO_2 the emission drop is as much as 73%. In the same period the emissions of NMVOC have declined by 10%, whereas the 1985 and 2004 CO emission totals are the same (Figures 5.15-5.17).

Table 5.2 Emissions of SO_2, NO_x, NMVOC, CO and NH_3 in 2004 for road transport and other mobile sources, and shares of national emission totals

CRF ID	SO_2 [tons]	NO_x [tons]	NMVOC [tons]	CO [tons]	NH_3 [tons]	SO_2	NO_x	NMVOC	CO	NH_3
						% of national total				
Industry-Other (1A2f)	263	10744	1676	7600	2	1	6	1	1	0
Civil Aviation (1A3a)	41	552	158	857	0	0	0	0	0	0
Railways (1A3c)	7	3478	217	599	1	0	2	0	0	0
Navigation (1A3d)	2259	7990	1474	7767	0	9	4	1	1	0
Residential (1A4b)	9	317	8731	114073	0	0	0	7	18	0
Ag./for./fish. (1A4c)	951	20501	2528	17445	3	4	11	2	3	0
Military (1A5)	46	1079	129	718	1	0	1	0	0	0
Total other mobile	3576	44661	14913	149058	7	15	25	13	24	0
Road (1A3b)	378	59085	26477	232650	2443	2	33	23	38	2
Total mobile	3955	103746	41390	381709	2450	16	57	36	62	3
Total national	24429	181368	116499	619359	97838	100	100	100	100	100

5.2.1 Road transport

The step-wise lowering of the sulphur content in diesel fuel has brought along a substantial decrease in the road transport emissions of SO_2 (Figure 5.9) In 1999 the sulphur content was reduced from 500 ppm to the present level of 50 ppm (the same as for gasoline). Since Danish diesel and gasoline fuels have the same sulphur-percentages at present, the 2004 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; 53, 26, 20 and 1%, respectively (Figure 5.13).

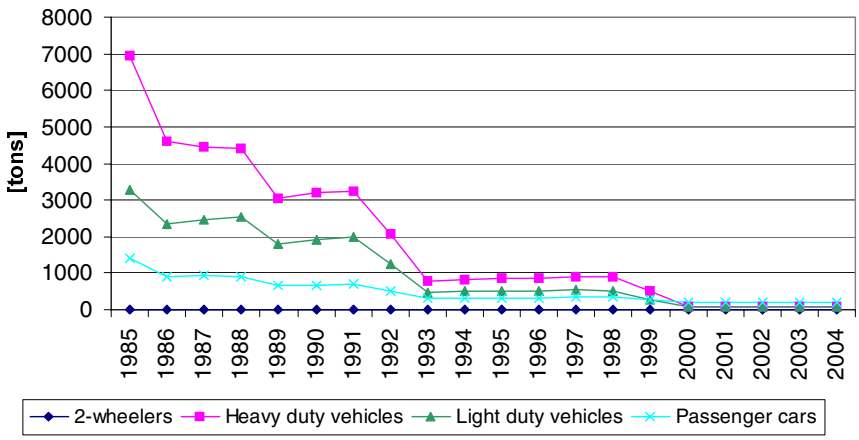

Figure 5.9 SO_2 emissions (ktons) per vehicle type for road transport 1985-2004

Historically the emission totals of NO_x and especially NMVOC and CO have been very dominated by the contributions coming from passenger cars, as shown in the Figures 5.10-5.12. However, the emissions from this vehicle type have shown a steady decreasing tendency since the introduction of catalyst passenger cars in 1990 (Euro I), and the introduction of even more emission efficient Euro II and III passenger cars (introduced in 1997 and 2001, respectively). In general, the total emission reductions of NO_x, NMVOC and CO are fortified by the introduction of new gradually stricter Euro emission standards

for all other vehicle classes. However, the significant increase in the diesel fuel use causes the NO_x emissions to increase for light duty trucks in 2004 and for heavy-duty vehicles in 2003.

In 2004 the emission shares for passenger cars, heavy-duty vehicles, light-duty vehicles and 2-wheelers were 43, 38, 19 and 0%, respectively, for NO_x, 70, 10, 8 and 12%, respectively, for NMVOC and 87, 2, 6 and 5%, respectively, for CO (Figure 5.13).

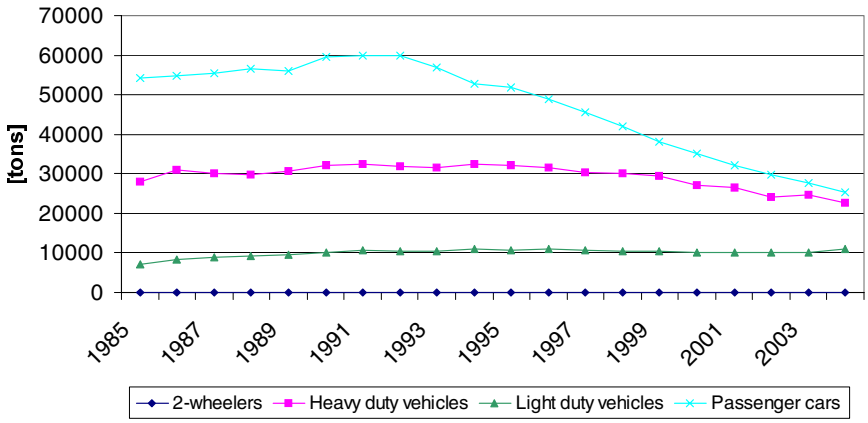

Figure 5.10 NO_x emissions (tons) per vehicle type for road transport 1985-2004

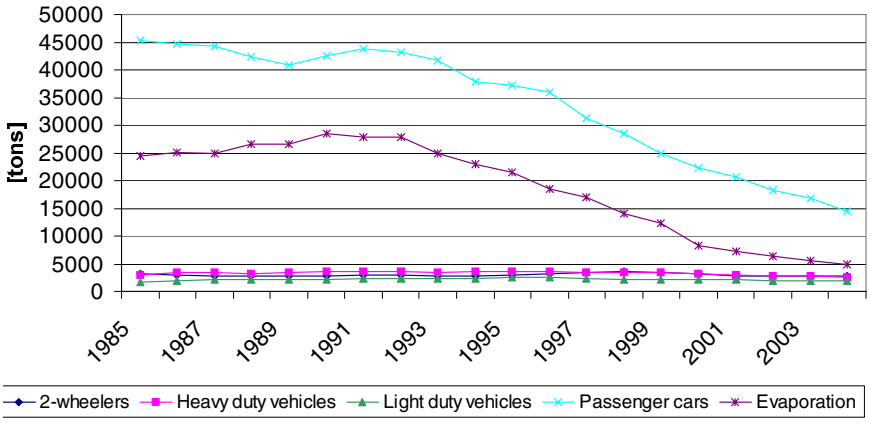

Figure 5.11 NMVOC emissions (tons) per vehicle type for road transport 1985-2004

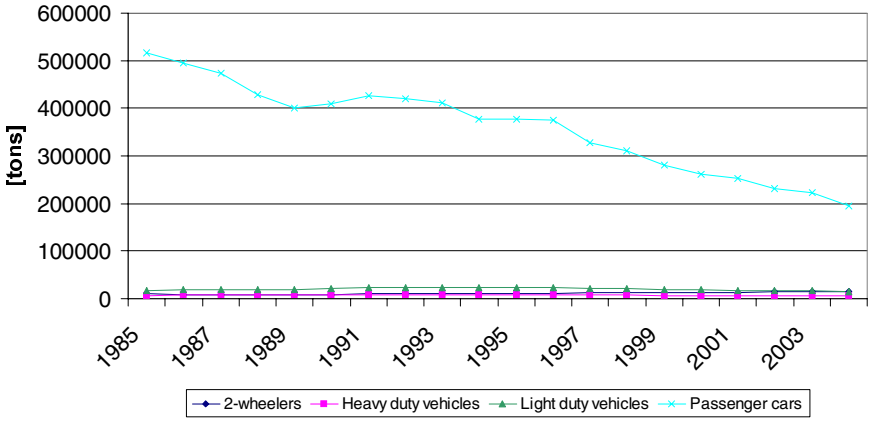

Figure 5.12 CO emissions (tons) per vehicle type for road transport 1985-2004

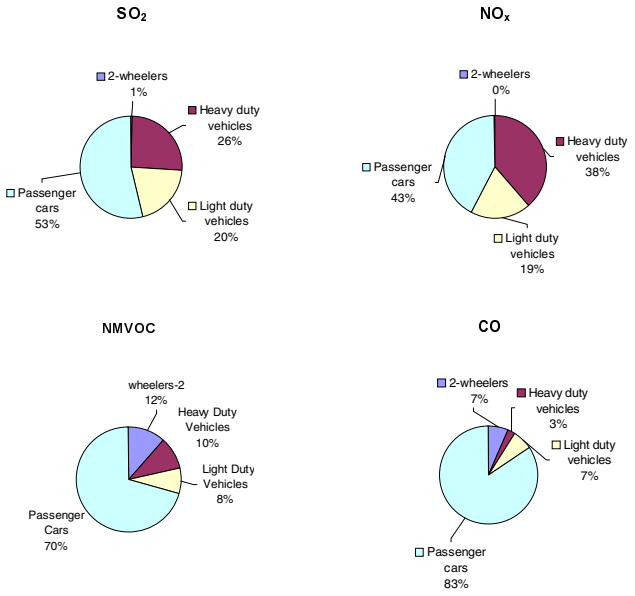

Figure 5.13 SO_2, NO_X, NMVOC and CO emission shares per vehicle type for road transport in 2004

5.2.2 Other mobile sources

The SO_2 emissions decreased significantly from 1985 to 1996, as shown in Figure 5.14. The lowering is due to the reduction of the sulphur content for marine diesel fuel in navigation (1A3d) and diesel fuel used by, among others, railways (1A3c) and non-road machinery in agriculture/forestry/fisheries (1A4c) and industry (1A2f).

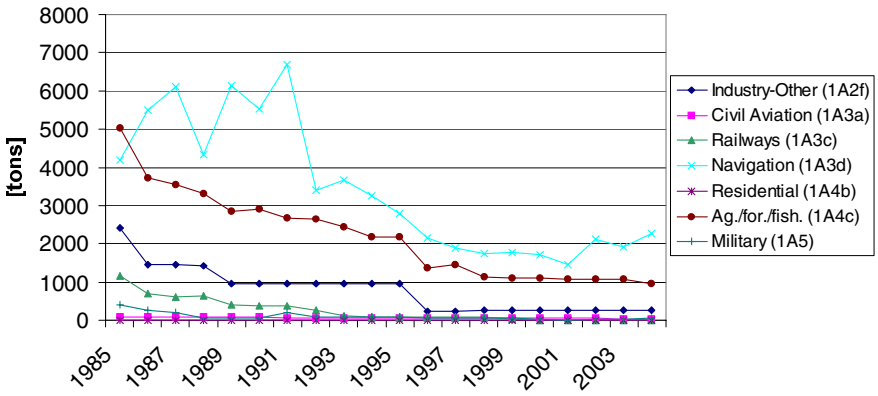

Figure 5.14 SO_2 emissions (ktons) in NFR sectors for other mobile sources 1985-2004

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 the implementation of a two-stage EU emission directive.

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 5.15. The 2004 emission shares are 46, 24, 18 and 8%, respectively (Figure 5.18). Minor emissions come from civil aviation (1A3a), military (1A5) and residential (1A4b).

The NO_x emission trend for agriculture/forestry/fisheries is determined by fuel use (and hence emissions) fluctuations for fishery and the development of fuel use and emission factors for diesel fuelled agricultural machines. For the latter machinery types there is a generally decreasing total fuel use (most markedly from the beginning of the 1990s), 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 for industry NO_x is the product of a slight fuel use increase from 1985 to 2004, and a development in emission factors as explained for agricultural machinery. The development in fuel use for national sea transport explains the emission trend for navigation. The most influential parameter is the shut down of ferry service connections 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 use and NO_x emissions for this transport sector.

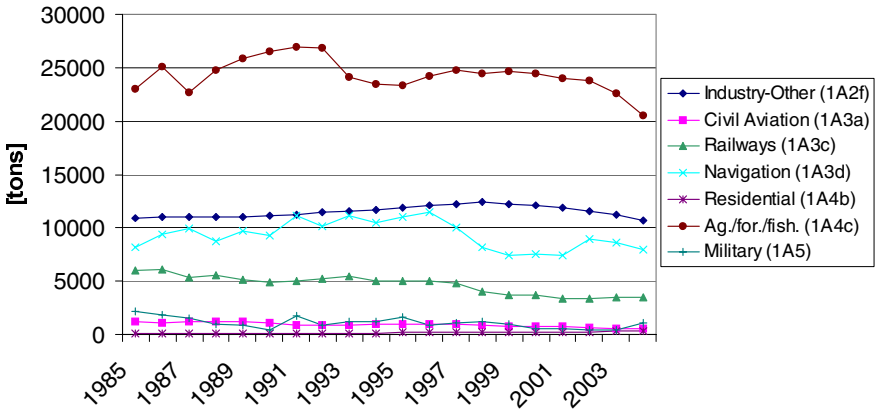

Figure 5.15 NO_x emissions (tons) in NFR sectors for other mobile sources 1985-2004

The 1985-2004 time-series of NMVOC and CO emissions are shown in the Figures 5.16 and 5.17 for other mobile sources. The 2004 sector emission shares are shown in Figure 5.18. For NMVOC the most important sectors are residential (1A4b), agriculture/forestry/fisheries (1A4c), industry (1A2f) and navigation (1A3d) with 2004 emission shares of 59, 17, 11 and 10%, respectively. The same four sectors also contribute with most of the CO emissions in the same consecutive order; the emission shares are 77, 12, 5 and 5%, 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 residential sector 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 industry sector, which is dominated by diesel fuelled machinery. From 1997 and 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 1985-2004 CO emission decrease for agriculture/forestry/fisheries is the phase out of gasoline tractors.

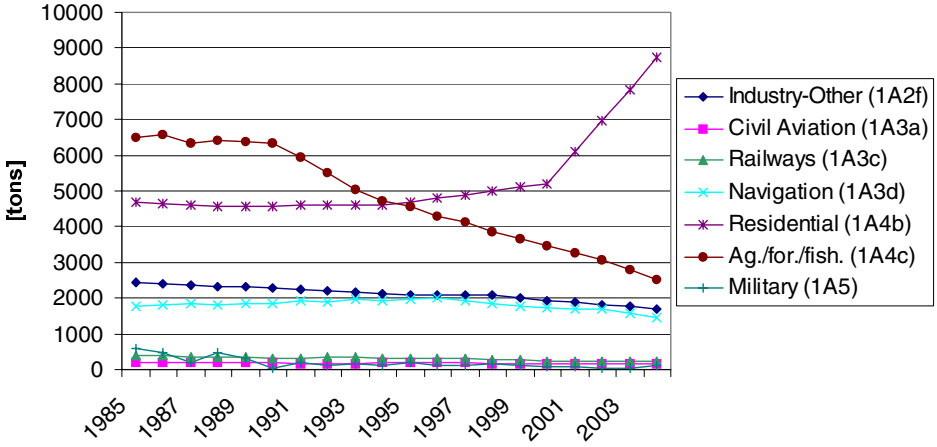

Figure 5.16 NMVOC emissions (tons) in NFR sectors for other mobile sources 1985-2004

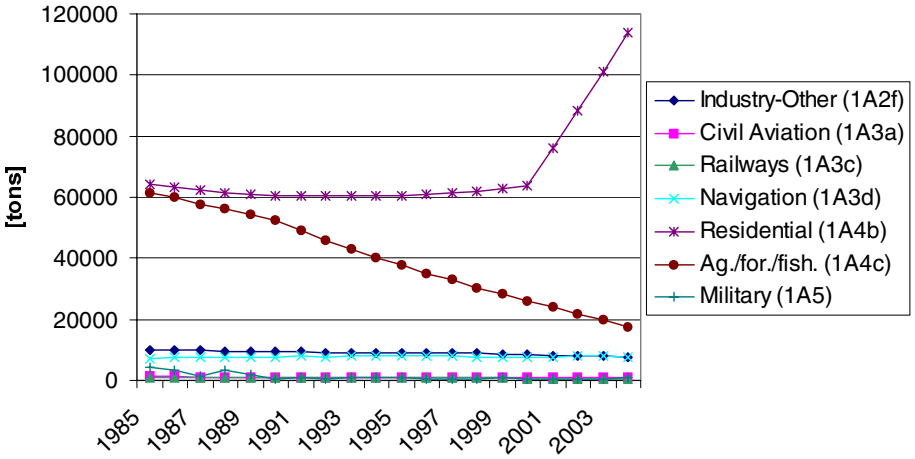

Figure 5.17 CO emissions (tons) in NFR sectors for other mobile sources 1985-2004

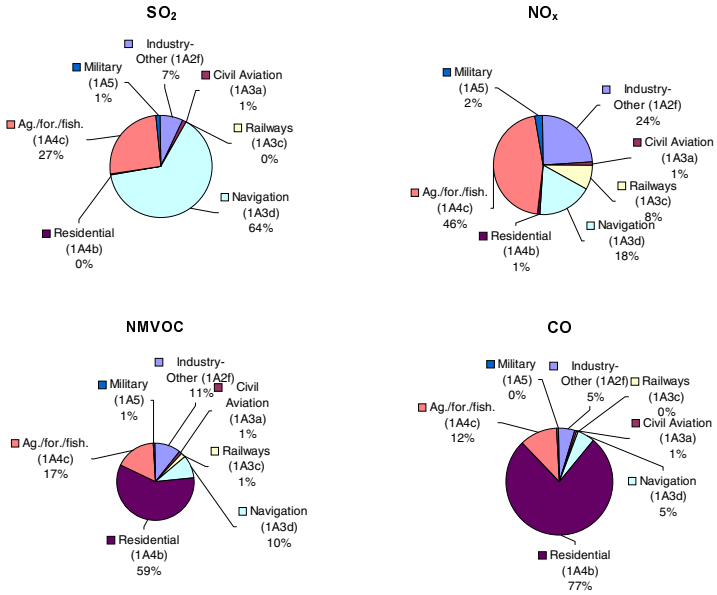

Figure 5.18 SO_2, NO_X, NMVOC and CO emission shares for other mobile sources in 2004

5.3 Particulate matter (PM)

The Danish emission inventories comprise the exhaust emission estimates of particulate matter (PM) for all mobile sources. In addition, the inventories include the non-exhaust PM emissions coming from road transport brake and tyre wear and road abrasion.

In Table 5.3 the TSP, PM_{10} and $PM_{2.5}$ emissions for road transport and other mobile sources are shown for 2004 in CRF sectors. The emission figures (exhaust only) in time-series 1985-2004 are given in Annex 16 (CRF format). Exhaust PM emissions are also shown for 1990 and 2004 in Annex 12 (CollectER format), while 2004 non-exhaust emission figures are shown in Annex 13.

The road transport shares of national totals for TSP, PM_{10} and $PM_{2.5}$ are 13, 15 and 18%, respectively in 2004. The totals include both exhaust and non-exhaust emissions. From 1985 to 2004 the PM emissions (exhaust only) have decreased by 35% (from Figure 5.19). The highest emissions occur in 1991, after which the emissions drop by 45%, until 2004.

For other mobile sources the 2004 shares are 7, 10 and 13% for TSP, PM_{10} and $PM_{2.5}$, respectively. The TSP emissions have decreased by 46% from 1985 to 2004 (from Figure 5.21).

Table 5.3 Emissions of TSP, PM_{10} and $PM_{2.5}$ in 2004 from road transport and other mobile sources

CRF Sector	TSP [tons]	PM_{10} [tons]	$PM_{2.5}$ [tons]	TSP % of national total	PM_{10}	$PM_{2.5}$
Industry-Other (1A2f)	1037	1037	1037	2	3	5
Civil Aviation (1A3a)	3	3	3	0	0	0
Railways (1A3c)	115	115	115	0	0	1
Navigation (1A3d)	533	514	496	1	2	2
Residential (1A4b)	87	87	87	0	0	0
Ag./for./fish. (1A4c)	1283	1269	1256	3	4	5
Military (1A5)	53	53	53	0	0	0
Total other mobile	3110	3077	3046	7	10	13
Road exhaust (1A3b)	3214	3214	3214	7	10	14
Road Brake wear	574	562	224	1	2	1
Road Tyre wear	880	528	370	2	2	2
Road abrasion	1004	502	271	2	2	1
Total Road non-exhaust	2459	1593	865	6	5	4
Total Road	5673	4807	4079	13	15	18
Total mobile	6324	6292	6261	15	20	27
Total national	43255	31095	22850	100	100	100

5.3.1 PM emissions from exhaust

Exhaust particulate emissions from road transportation vehicles are well below $PM_{2.5}$. The largest emission contributor in 2004 was light duty trucks (45%) followed by heavy-duty vehicles (32%), passenger cars (21%) and 2-wheelers (2%), as shown in Figure 5.20.

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 passenger cars with lower particulate emissions since 1990 is more or less out-balanced by an increase in vehicle new sales in recent years. (Figure 5.19).

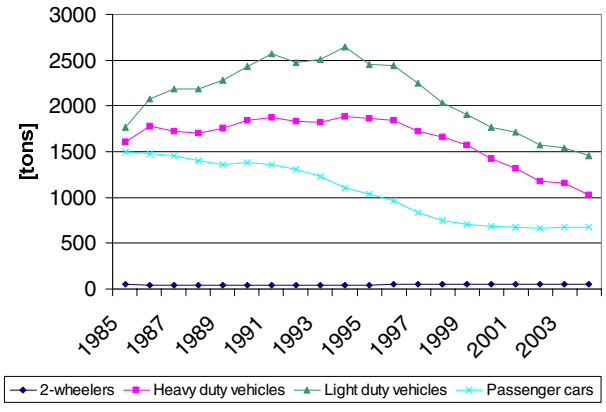

Figure 5.19 Exhaust particulate emissions ($PM_{2.5}$) in tons from 1985-2004 for road transport

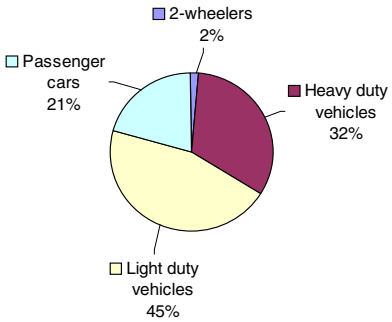

Figure 5.20 Exhaust particulate emission ($PM_{2.5}$) shares for road transport in 2004

As shown in Figure 5.22 for other mobile sources the largest TSP contributors in 2004 are agriculture/forestry/fisheries (1A4c), industry (1A2f) and navigation (1A3d), with emission shares of 41, 33 and 17%, respectively. The remaining sectors: railways (1A3c), civil aviation (1A3a), military (1A5) and residential (1A4b) are only minor emission sources.

As for NO_X, the 1985-2004 TSP emission trend for agriculture/forestry/fisheries is determined by the fuel use (and hence emissions) fluctuations for fishery, and the generally decreasing total diesel fuel use and gradually lower emission factors throughout the time period.

The TSP emission development for industrial non-road machinery is the product of a slight fuel use increase from 1985 to 2004, and a development in emission factors as explained for agricultural machinery. The TSP emission explanations for national sea transport and railways are the same as for NO_x (Figure 5.21).

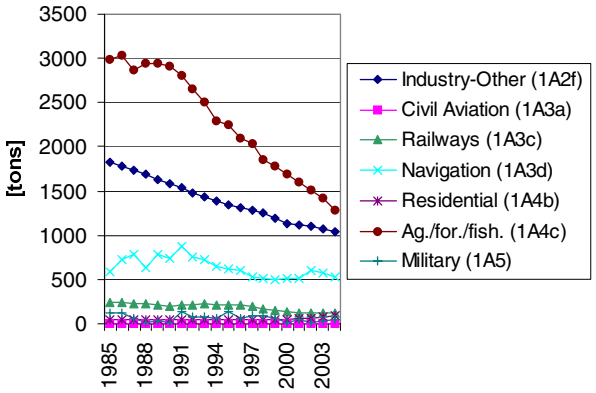

Figure 5.21 Exhaust particulate emissions (TSP) in tons from 1985-2004 for other mobile sources

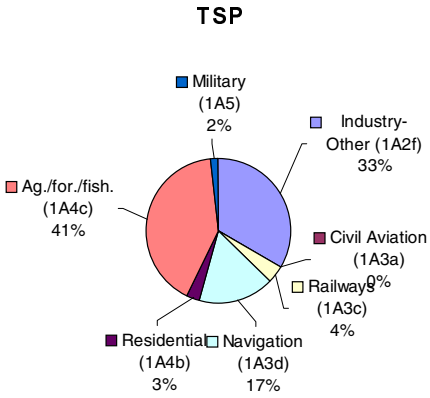

Figure 5.22 Exhaust particulate emissions (TSP) shares for other mobile sources in 2004

5.3.2 Non-exhaust PM

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 and tyre wear and road abrasion, and hence only the PM_{10} distributions are shown in Figure 5.23. For brake and tyre wear passenger cars cause the highest emissions in 2004, followed by light duty trucks, trucks, buses and 2-wheelers. Trucks cause more road abrasion emissions than light duty trucks, but apart from that the size order of emission sources is the same as for brake and tyre wear.

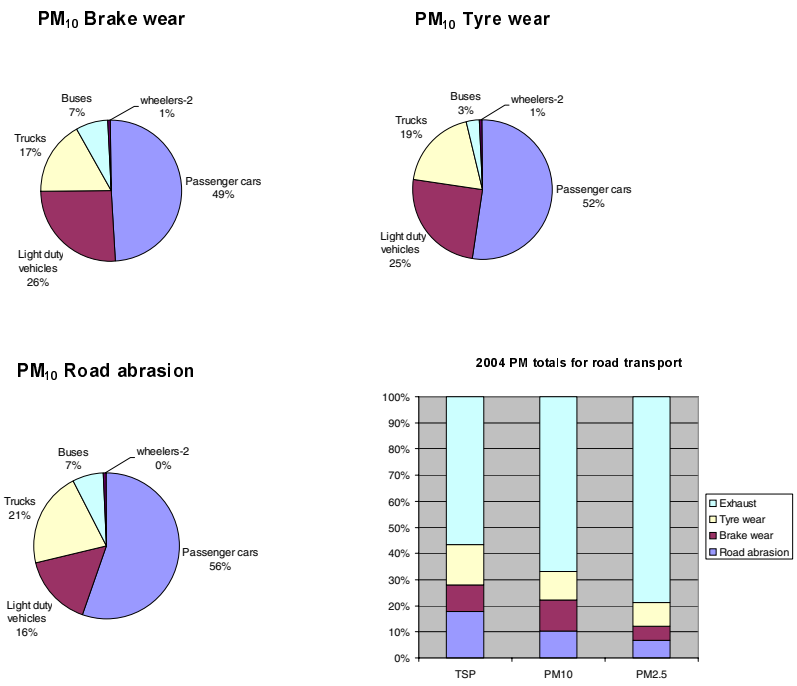

Figure 5.23 Brake and tyre wear and road abrasion PM_{10} emission shares and PM exhaust-non exhaust distributions for road traffic in 2004

The exhaust emission shares of total road transport TSP, PM_{10} and $PM_{2.5}$ are 57, 67 and 79%, respectively in 2004. For brake and tyre wear and road abrasion the TSP shares are 10, 16 and 18%, respectively. The same three sources have PM_{10} shares of 12, 11 and 10%, respectively, and $PM_{2.5}$ shares of 5, 9 and 7%, 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.

5.4 Heavy metals

In Table 5.4 the heavy-metal emissions for road transport and other mobile sources are shown for 2004 in NFR sectors. The emission figures in time-series 1990-2004 are given in Annex 16 (NFR format) and are shown for 1990 and 2004 in Annex 12 (CollectER format).

The heavy metal emission factors (except Pb) are taken from the EMEP/CORINAIR guidebook and are constant throughout the 1990-2004 period. Consequently the emission development follows the trends in fuel use. The road transport emissions have increased by 30% from 1990 to 2004. For Pb, though, there has been an almost 100% emission decline, due to the phasing out of leaded gasoline fuels until 1994 (Figure 5.25). For other mobile sources the emissions generally decrease throughout the time period, and the phasing out of lead is also a reason for the 79% decline in Pb emissions for other mobile sources. Here, household and gardening equipment and recreational craft are the main gasoline fuel consumers. In addition, from 1990 to 2004 the gasoline fuel use has become almost zero for

agricultural tractors. The 54% decline in Ni emissions is due to a smaller residual fuel use in navigation.

Table 5.4 Heavy metal emissions in 2004 for road transport and other mobile sources

NFR Sector	As [kg]	Cd [kg]	Cr [kg]	Cu [kg]	Hg [kg]	Ni [kg]	Pb [kg]	Se [kg]	Zn [kg]
Industry-Other (1A2f)		3	13	454		19	0	3	267
Civil Aviation (1A3a)	0	0	2	69	0	3	1304	0	41
Railways (1A3c)		1	3	116		5		1	68
Navigation (1A3d)	24	2	13	80	5	1233	17	33	110
Residential (1A4b)		1	5	158		7	3	1	93
Ag./for./fish. (1A4c)	8	5	22	564	7	59	15	33	402
Military (1A5)	0	1	4	129	0	5	82	1	76
Total other mobile	32	12	63	1570	12	1330	1421	71	1057
Road (1A3b)		38	189	6432		265	54	38	3784
Total mobile	32	50	252	8002	12	1594	1476	109	4841
Total national	657	577	1161	9027	1064	9546	5254	1837	23412

Table 5.5 Heavy metal emission shares in 2004 for road transport and other mobile sources

CRF Sector	As	Cd	Cr	Cu	Hg	Ni	Pb	Se	Zn
	% of national total								
Industry-Other (1A2f)	0	0	1	5	0	0	0	0	1
Civil Aviation (1A3a)	0	0	0	1	0	0	25	0	0
Railways (1A3c)	0	0	0	1	0	0	0	0	0
Navigation (1A3d)	4	0	1	1	0	13	0	2	0
Residential (1A4b)	0	0	0	2	0	0	0	0	0
Ag./for./fish. (1A4c)	1	1	2	6	1	1	0	2	2
Military (1A5)	0	0	0	1	0	0	2	0	0
Total other mobile	5	2	5	17	1	14	27	4	5
Road (1A3b)	0	7	16	71	0	3	1	2	16
Total mobile	5	9	22	89	1	17	28	6	21
Total national	100	100	100	100	100	100	100	100	100

As shown in Figure 5.24, the road transport emissions of Cd, Cr, Cu and Zn account for approximately two thirds of the total for all mobile sources in 2004. No road transport emissions occur for As and Hg. Instead the emissions of these species come from the use of marine diesel oil and residual oil in fisheries and navigation. The latter sector also has large emissions of Ni (from residual oil), whereas the Se emissions in almost equal shares come from agriculture/forestry/fisheries, road transport and navigation.

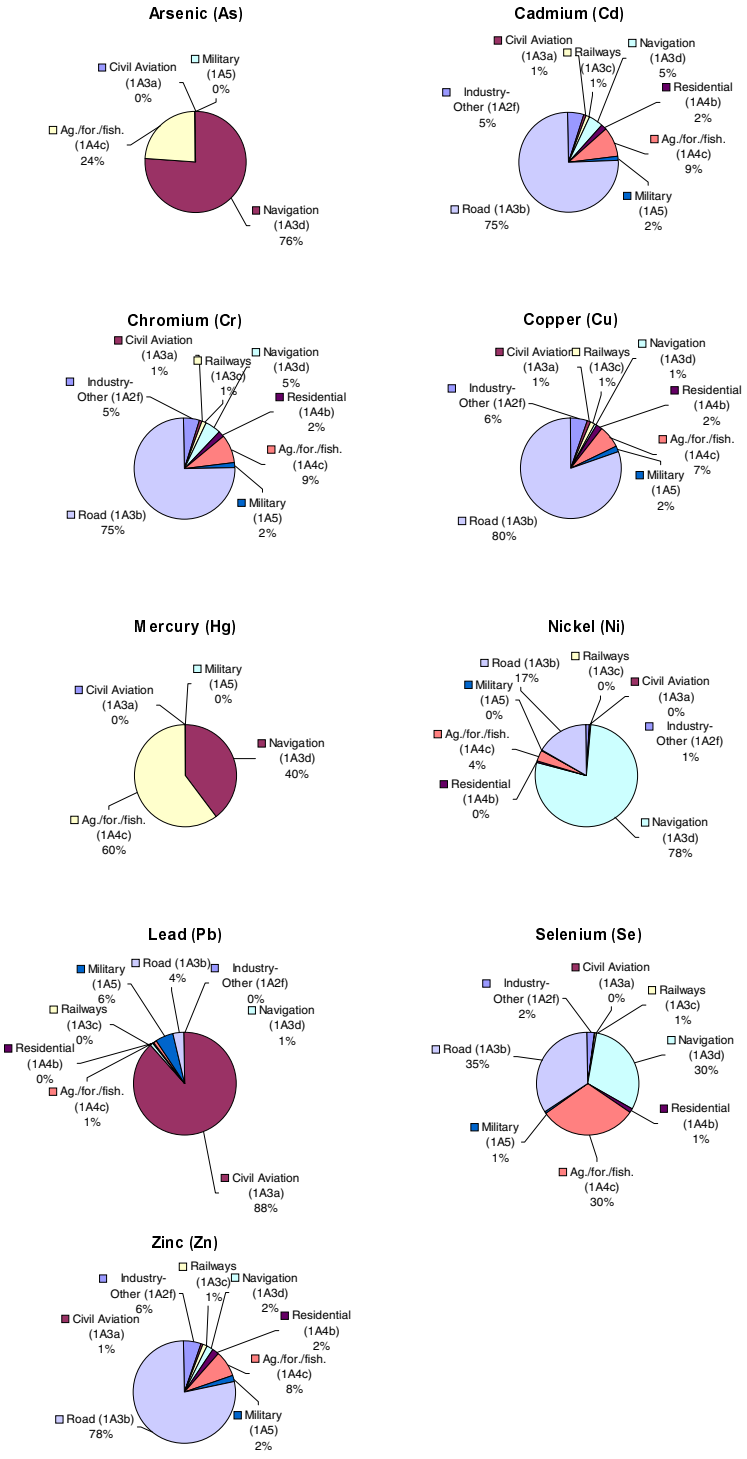

Figure 5.24 Heavy metal emission shares for road transport and other mobile sources in 2004

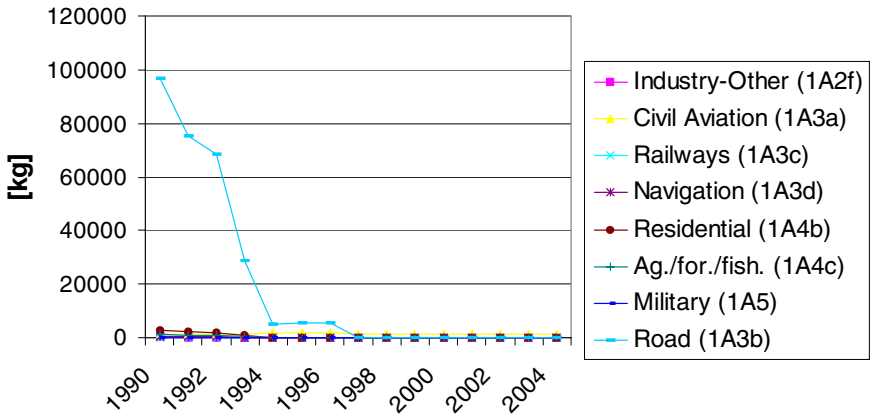

Figure 5.25 Pb emissions (kg) in NFR sectors for road transport and other mobile sources 1990-2004

5.5 Dioxin and PAH

In Table 5.6 the dioxin and PAH emissions for road transport and other mobile sources are shown for 2004 in CRF sectors. The emission figures in time-series 1990-2004 are given in Annex 16 (CRF format) and are shown for 1990 and 2004 in Annex 12 (CollectER format).

The PAH emission shares for road transport and other mobile sources are 5% or less of the national total in 2005.

Table 5.6 Dioxin and PAH emissions in 2004 for road transport and other mobile sources

NFR ID	Dioxins/ Furans [g]	Flouranthene [kg]	Benzo(b) flouranthene [kg]	Benzo(k) flouranthene [kg]	Benzo(a) pyrene [kg]	Benzo(g,h,i) perylene [kg]	Indeno (1,2,3-c,d) pyrene [kg]
Industry-Other (1A2f)	0	50	6	6	3	5	3
Civil Aviation (1A3a)	0	0	0	0	0	0	0
Railways (1A3c)	0	4	1	1	0	0	0
Navigation (1A3d)	0	40	3	2	1	6	5
Residential (1A4b)	0	18	1	0	0	3	1
Ag./for./fish. (1A4c)	0	108	11	9	4	16	11
Military (1A5)	0	6	1	1	0	1	0
Total other mobile	0	226	23	18	9	30	20
Road (1A3b)	0	655	64	72	49	93	54
Total mobile	0	881	86	90	58	124	74

For mobile sources road transport has the largest emissions of dioxins and PAH (Figure 5.26). The dioxin emission share for road transport is 54% of all mobile emissions in 2004, whereas agriculture/forestry/fisheries and navigation have smaller shares of 22% and 16%. For the different PAH components the road transport shares are approximately two thirds or more of the 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.

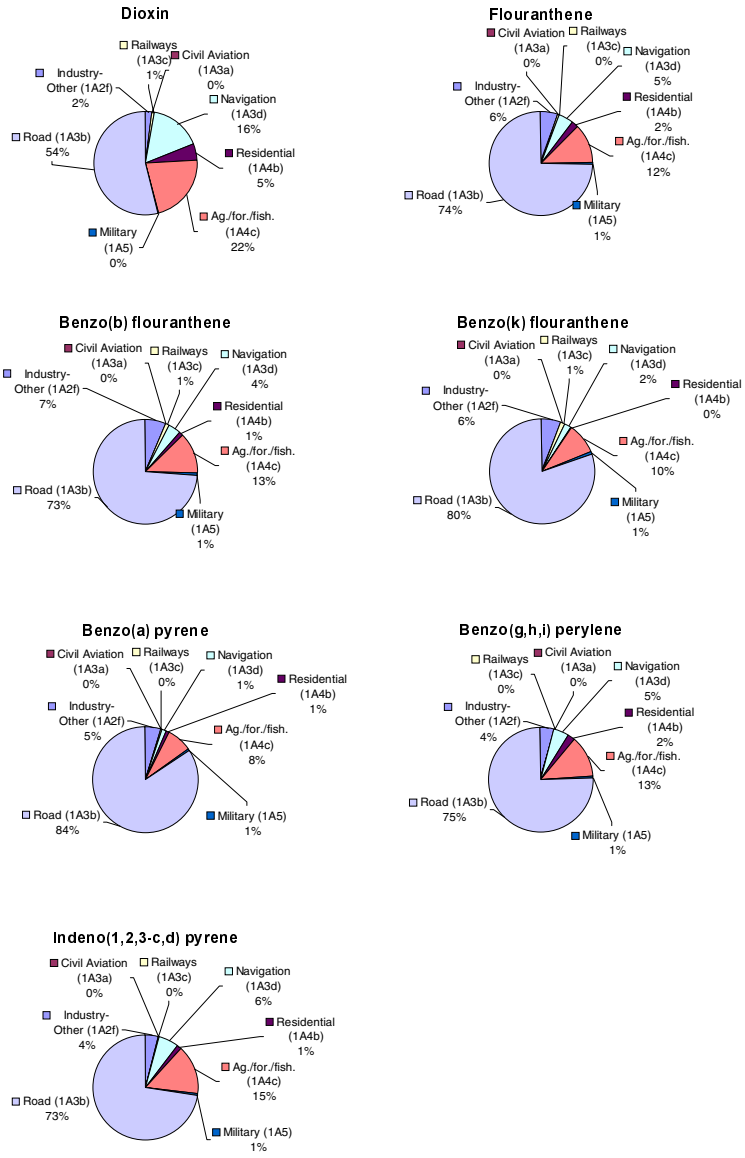

Figure 5.26 Dioxin and PAH emission shares for road transport and other mobile sources in 2004

5.6 Bunkers

The most important emissions from bunker fuel use (fuel use for international transport) are SO_2, NO_X, CO_2 and TSP. The total figures are shown in Table 5.7 for 2004 split into sea transport and civil aviation. All emission figures in time-series 1985-2004 are given in Annex 16 (CRF format). In Annex 12 the emissions are also given in CollectER format for the years 1990 and 2004 for other components than heavy metals and PAH, while the emissions for heavy metals and PAH's are shown in Annex 14 and 15, respectively.

Table 5.7 Emissions in 2004 for international transport and national totals

CRF sector	SO_2	NO_X	CO_2	TSP
Navigation int. (1A3d)	34821	69705	2545	4149
Civil Aviation int. (1A3a)	781	10439	2447	40
International total	35603	80144	4992	4189
National total	24429	181368	53941	43255

The differences in emissions between navigation and civil aviation are much larger than differences in fuel use (and derived CO_2 emissions) and display a poor emission performance for international sea transport. In broad terms the emission trends shown in Figure 5.27 are similar to the fuel use development. Minor differences occur for navigation (SO_2, NO_X, CO_2 and TSP) due to shifting amounts of marine diesel and residual oil, and for civil aviation (NO_X) due to yearly variations in LTO/aircraft type (earlier than 2001) and city-pair (2001 onwards) statistics.

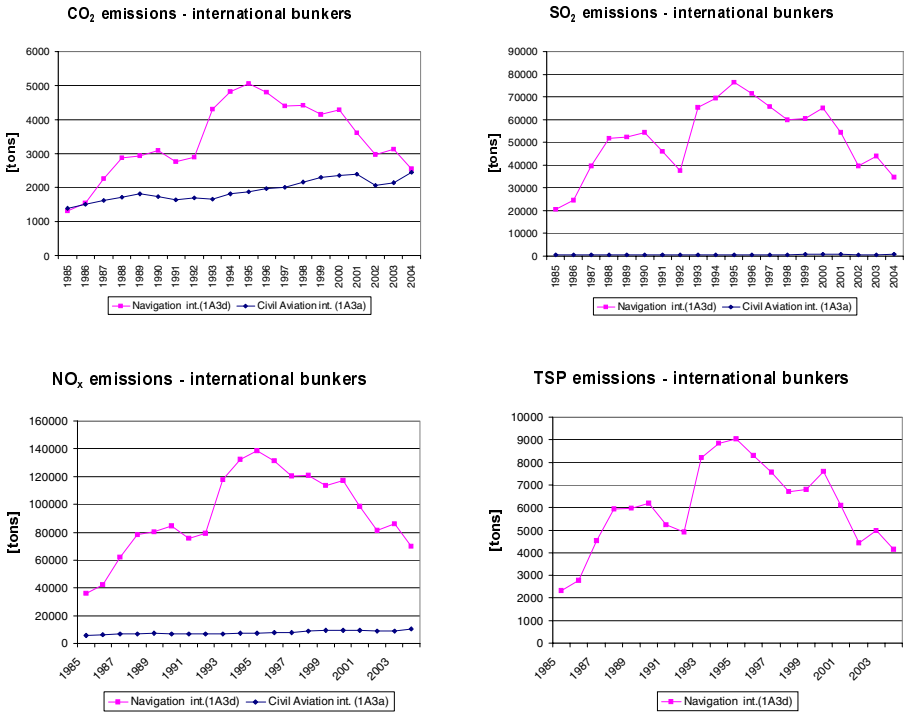

Figure 5.27 CO_2, SO_2, NO_X and TSP emissions for international transport 1985-2004

Compared to the Danish national emission total (all sources) the CO_2 emissions from bunkers are small (Figure 5.28). Most remarkably are the large SO_2 emissions coming from the residual fuel used by international sea transport. The international:domestic emission ratio has shown a major increase in the later years as most fuels (other than maritime types) have become more clean. The same trend is also visible for NO_X, though, with a relatively smaller emission importance.

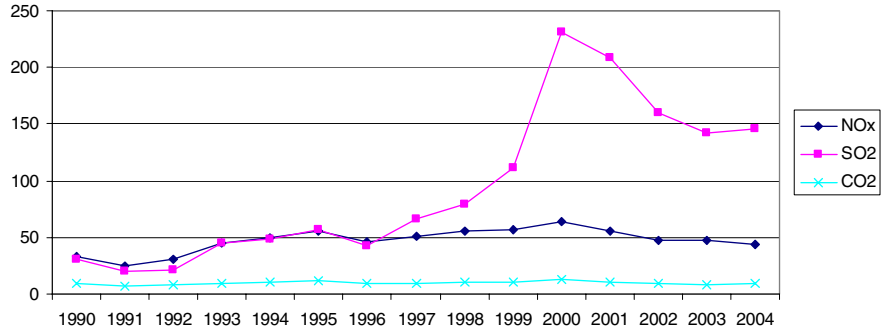

Figure 5.28 Domestic (all sources)/international transport total emission ratio for CO_2, SO_2, NO_X 1990-2004

6 Quality assurance/quality control (QA/QC)

The QA/QC descriptions of the Danish emission inventories for transport have been substantially expanded and documentation is given in Illerup et al. (2006).

It is the intention to publish an annual sector report for road transport and other mobile sources. Due to lack of time resources the last sector report concerned the 2002 inventory. Prior to its publication the draft report is reviewed by two external experts. The expert recommendations are used to improve the work on inventories and documentation. The recommendation of the 2002 sector report reviewers were to include some text in the sector report for each transport mode explaining the existing emission legislation and the associated emission test procedures. In addition, more documentation of background data and trends should be given in cases where Tier 2 estimates are made. Apart from civil aviation, these recommendations have subsequently been taken onboard in the present NIR report.

Formal agreements of data deliverance have been made between NERI as an inventory agency and relevant institutions to ensure the provision of consistent, accurate and timely background data used in the national inventory. The institutions are the Danish State Railways (emission factors for diesel locomotives), CAA-DK (flight data) and DEA (energy statistics). At the moment a formal agreement is being negotiated with the Danish Ministry of Transport (road transport fleet and mileage data).

7 Uncertainties and time-series consistency

Uncertainty estimates for all emission components are made for road transport and other mobile sources using the guidelines formulated in the Good Practice Guidance and Uncertainty Management in the National Greenhouse Gas Inventories (IPCC, 2000). For road transport, railways and a part of navigation (large vessels) the latter source provides uncertainty factors for activity data that are used in the Danish situation. For other sectors the factors reflect specific national knowledge (Winther et al., 2006). These sectors are (SNAP categories): inland waterways (a part of 1A3d: navigation), agriculture and forestry (parts of 1A4c: agriculture/forestry/fisheries), industry (mobile part of (1A2f: industry-other) and residential (1A4b).

The activity data uncertainty factor for civil aviation is based on own judgement.

Table 7.1 Uncertainties for activity data, emission factors and total emissions in 2004 and as a trend

Category	Activity data	CO_2	CH_4	N_2O
	%	%	%	%
Road transport	2	5	40	50
Military	2	5	100	1000
Railways	2	5	100	1000
Navigation (small boats)	42	5	100	1000
Navigation (large vessels)	2	5	100	1000
Fisheries	2	5	100	1000
Agriculture	26	5	100	1000
Forestry	32	5	100	1000
Industry (mobile)	36	5	100	1000
Residential	36	5	100	1000
Civil aviation	10	5	100	1000
Overall uncertainty in 2004		5	35	64
Trend uncertainty		5	7	253

The emission factor uncertainties for other emission components than greenhouse gases are taken from Pulles et al. (2001). The factors are broad values given for road transport and other mobile sources, and hence the uncertainty factors for activities must comply with this level of information. The activity data uncertainty factor is assumed to be 2% and 10% for road transport and other mobile sources based on own judgment. For TSP, Pulles et al. (2001) indicate no uncertainty factor, and instead this factor is based on own judgment.

Table 7.2 Uncertainties for emission factors and total emissions in 2004 and as a trend

Pollutant	Emission factor uncertainties [%] Road	Other	Emission uncertainties [%] Overall 2004	Trend
SO_2	50	50	46	6
NO_x	50	100	52	8
NMVOC	50	100	48	10
CO	50	100	50	13
NH_3	1000	1000	997	3507
TSP	50	100	56	4
PM_{10}	50	100	55	8
$PM_{2.5}$	50	100	55	7
Arsenic	1000	1000	1000	7
Cadmium	1000	1000	792	151
Chromium	1000	1000	791	156
Copper	1000	1000	827	91
Mercury	1000	1000	1000	10
Nickel	1000	1000	850	73
Lead	1000	1000	964	18
Selenium	1000	1000	740	150
Zinc	1000	1000	812	113
Dioxins	1000	1000	709	121
Flouranthene	1000	1000	786	22
Benzo(b) flouranthene	1000	1000	782	38
Benzo(k) flouranthene	1000	1000	824	72
Benzo(a) pyrene	1000	1000	856	33
Benzo(g,h,i) perylene	1000	1000	784	47
indeno(1,2,3-c,d) pyrene	1000	1000	761	16

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 17 for all emission components.

As regards time-series consistency background flight data cannot be made available on a city-pair level from 2000 and backward. However, aided by LTO/aircraft statistics for these years and the use of proper assumptions a sound level of consistency is obtained anyhow 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.

8 Recalculations/Improvements since reporting in 2005

The following recalculations and improvements of the emission inventories have been made since the emission reporting in 2005 (inventory year 2003).

8.1 Road transport

A revision of the 1985-2003 time-series of emissions has been made based on revised fleet and mileage data from the Danish Road Directorate, and corrections of road transport gasoline fuel use according to a new gasoline fuel use estimate for non-road machinery. Additionally, NERI has developed a new model based on the COPERT methodology and emission factors. This decision was made in order to gain flexibility in output formats and to save working time during inventory update and debugging procedures.

8.2 Other mobile sources

Military
A revision of the 1985-2003 time-series of emission factors has been made based on new aggregated emission factors from road transport.

Corrections of aviation gasoline fuel use and emissions have been made for 1994.

Railways
No changes have been made.

Fishery
A complete revision of the 1985-2003 time-series of diesel fuel use and emissions has been made using changed amounts of diesel fuel use for small boats (inland waterways), which are subtracted from the Danish energy statistics diesel fuel use sum for fishery. The latter diesel fuel results are from the specific Danish non-road research project reported by Winther et al. (2006).

Aviation
Small changes of 2001-2002 fuel use and emissions have been made for large aircraft, based on changes in representative aircraft groupings. For 2003 an error in jet fuel use has been corrected, thus influencing the total emission figures.

For 2002 and 2003 errors in aviation gasoline fuel use have been corrected, thus influencing the total emission figures.

Inland waterways/agriculture/forestry/household-gardening
A complete revision of the 1985-2003 time-series of fuel use and emissions has been made using results from Winther et al. (2006).

9 Future improvements

9.1 National sea transport and fisheries

A research project is currently carried out at NERI in order to improve the emission estimates for sea going vessels. Fuel use and emissions for ferries will be calculated for each ferry/ferry line combination in a time-series from 1990-2005. In addition the fuel use and emissions for fishing vessels will be disaggregated into vessel length classes.

9.2 Road transport

For future inventories it is intended to use improved fleet and mileage data from the Danish vehicle inspection programme (performed by the Danish motor vehicle inspection office) and improved data for trip speed and mileage split for urban, rural and highway driving. The update of road traffic fleet and mileage data will be made as soon as this information is provided from the Danish Ministry of Transport and Energy in a COPERT model input format. In addition, a new version of the COPERT model – COPERT IV - will be available in 2006. The scientific basis for the new model version is the work on emission models and measurements performed in the EU 5th framework programme.

9.3 Heavy metal and POP emission factors

A research project is currently made to achieve updated emission factors for heavy metal and POP emission components. The main heavy metal sources considered are engine exhaust (from fuel and engine oil), and brake and tyre wear and road abrasion. For POP the emissions come from the exhaust.

10 Conclusion

The annual Danish emission inventories are prepared and reported by NERI. For mobile sources the inventory basis is fuel use data from the Danish energy statistics and additional background data for road transport (fleet, mileage), air traffic (aircraft type, flight numbers, origin and destination airports) and non-road machinery (engine no. and size, load factor, annual working hours). Emission data mainly come from the EMEP/CORINAIR Emission Inventory Guidebook, however, for railways specific Danish measurements are used.

Road transport

Set in relation to the Danish national emission totals, the largest emission shares for road transport are noted for CO, NO_X, NMVOC, CO_2 $PM_{2.5}$, PM_{10} and TSP. In 2004 the emission percentages were 38, 33, 23, 22, 18, 15 and 13, respectively. The emissions of N_2O, NH_3, SO_2 and CH_4 have marginal shares of 5, 2, 2 and 1%, respectively.

From 1985 to 2004 there has been an emission decrease of 35, 58, 34 and 66% for particulates (exhaust only: size is below $PM_{2.5}$), CO, NO_X and NMVOC. In the same period the CO_2 (and fuel use), CH_4 and N_2O emissions have increased by 48, 8 and 301% (30% for CO_2, 3% for CH_4 and 237% for N_2O since 1990).

Road transport exhaust PM emissions almost solely come from diesel fuelled vehicles. The largest sources are light duty trucks followed by heavy-duty vehicles and passenger cars in decreasing order. Since the mid-1990s the emissions from light and heavy-duty vehicles have decreased significantly due to gradually stricter Euro emission standards, whereas the environmental benefit of introducing diesel passenger cars with lower particulate emissions since 1990 is more or less outbalanced by an increase in vehicle new sales in recent years.

The trend in non-exhaust PM follows the traffic growth in general, and in 2004 the TSP, PM_{10} and $PM_{2.5}$ shares were 43, 33 and 21%, respectively, of the respective road traffic totals. The non-exhaust PM are gaining relatively more importance, in pace with the year by year reductions of exhaust PM.

Historically the emission totals of NO_X and especially NMVOC and CO have been dominated by the contributions coming from gasoline passenger cars. However, the emissions from this vehicle type have been reduced since the introduction of catalyst cars in 1990. A negative side effect of this technology, though, is the increase in N_2O emissions. The NO_X, NMVOC and CO emissions reductions are fortified by the introduction of new gradually stricter Euro emission standards for all other vehicle classes.

Other mobile sources

For other mobile sources the emissions of NO_X, CO, SO_2, $PM_{2.5}$, NMVOC, PM_{10} and TSP have the largest shares of the national totals in 2004. The shares are 25, 24, 15, 13, 13 10 and 7%, respectively. The

2004 CO_2 emission (and fuel use) share is 7%, whereas the emissions of N_2O, NH_3 and CH_4 have marginal shares of 1% or less in 2004.

The emissions of TSP, NO_X and NMVOC have decreased by 46, 14 and 10% from 1985 to 2004. For CO_2 (and fuel use) the decrease is 15% (and 11% from 1990), while the N_2O and CH_4 emission decreases are 10 and 5%, respectively. For SO_2 the emission drop is 74% from 1985 to 2004 (and 77% since 1980). For CO the 1985 and 2004 emissions are the same.

The largest source of NO_X and particulate emissions are agriculture/forestry/fisheries, followed by industry and navigation. For NMVOC and CO most of the emissions come from gasoline fuelled working machinery in the residential sector.

Heavy metals

For heavy metals the development in emissions follows the fuel use trends. The road transport shares for copper (Cu), zinc (Zn), chromium (Cr) and cadmium (Cd) are 71, 16, 16 and 7%, respectively, of national totals in 2004, and for other mobile sources the lead (Pb), Cu and nickel (Ni) shares are 27, 17 and 14%, respectively. For the remaining components the emission shares are less than 5%.

The road transport emissions have increased by 30% from 1990 to 2004. For Pb though there has been an almost 100% emission decline due to the phasing out of leaded gasoline fuels until 1994. For other mobile sources many of the components have emission decreases of around 10-20% in the same time period. The emissions of Pb, Ni, Selenium (Se) and Mercury (Hg) decrease even further. The respective emission declines are 79, 54, 33 and 27%. For Ni, Se and Hg the emission decreases are due to a reduction in residual oil fuel use, and for Pb the reason for the emission drop is the contemporary phasing out of gasoline fuelled tractors and lead in gasoline fuel.

PAH's

The PAH emission shares for road transport and other mobile sources are 5% or less of the national total in 2002.

Uncertainties

For mobile sources in 2004 the CO_2 emissions are determined with the most accuracy, followed by the CH_4, SO_2, NMVOC, CO, NO_X, PM10, PM2.5, TSP and N_2O emissions with increasing levels of uncertainties. The uncertainties are 5, 7, 46, 48, 50, 52, 55, 55, 56 and 64%, respectively. The uncertainties for the 1990-2004 emission trends are 5, 7, 6, 10, 13, 8, 8, 7 and 253% for the emissions in the same consecutive order. For NH_3, heavy metals and POPs the 2002 emissions have uncertainty levels of between 700 and 1000%. In this case the emission trend uncertainties are significantly lower, still large fluctuations exist between the calculated values for the different emission components. The smallest and largest uncertainties are 16 for indeno(1,2,3-c,d)pyrene and 121 for dioxins.

References

Cappelen, J., Jørgensen, B.V. 2005: The Climate of Denmark 2004, Tecnical report No 05-01, pp. 88, Danish Meteorological Institute.

Cappelen, J. 2004: The Climate of Denmark - Key climatic Figures 2000-2003, Tecnical report No 04-05, pp 23, Danish Meteorological Institute

Cappelen, J. 2003: The Climate of Denmark - Key climatic Figures 1980-1989, Technical report No 03-15, pp 47, Danish Meteorological Institute

Cappelen, J. 2000: The Climate of Denmark - Key climatic Figures 1990-1999, Technical report No 00-08, pp 47, Danish Meteorological Institute

Danish Energy Authority, 2005: The Danish energy statistics, Available on the Internet at: http://www.ens.dk/graphics/Energi_i_tal_-og_kort/statistik/aarsstatistik/Statistik2004/Figurer2004_internet.xls

Ekman, B. 2005: Unpublished data material from the Danish Road Directorate.

EMEP/CORINAIR, 2003: EMEP/CORINAIR Emission Inventory Guidebook 3rd Edition September 2003 Update, Technical Report no 20, European Environmental Agency, Copenhagen. http://reports.-eea.eu.int/EMEPCORINAIR4/en.

ICAO Annex 16: "International standards and recommended practices", Volume II "Aircraft Engine Emissions", 2th ed. (1993), plus amendments: Amendment 3 20th March 1997 and amendment 4 4 November 1999.

IFEU 2004: Entwicklung eines Modells zur Berechnung der Luftschadstoffemissionen und des Kraftstoffverbrauchs von Verbrennungsmotoren in mobilen Geräten und Maschinen - Endbericht, UFOPLAN Nr. 299 45 113, pp. 122, Heidelberg.

Illerup, J.B., Birr-Pedersen, K., Mikkelsen, M.H., Winther, M., Gyldenkærne, S., Bruun, H.G. & Fenhann, J. 2002: Projection Models 2010. Danish emissions of SO_2, NO_x, NMVOC and NH_3. National Environmental Research Institute, Denmark. 192 pg - NERI Technical Report No. 414.

Illerup, J.B., Lyck, E., Nielsen, M., Winther, M., Mikkelsen, M.H., Hoffmann, L., Sørensen, P.B., Vesterdal, L. & Fauser, P. 2006a: Denmark's National Inventory Report - Submitted under the United Nations Framework Convention on Climate Change, 1990-2004. Emission inventories. National Environmental Research Institute, Denmark. (in press).

Illerup, J.B., Lyck, E., Nielsen, M., Winther, M., Hoffmann, L., & Mikkelsen, M.H. 2006b: Annual Danish Emission Inventory Report to

UNECE. Inventories from the base year of the protocols to year 2004. National Environmental Research Institute, Denmark. Research Notes from NERI (in press).

IPCC, 2000: Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories, IPCC, May 2000. Available at http://www.ipcc-nggip.iges.or.jp/public/gp/english/ (06-07-2004).

Lastein, L. & Winther, M. 2003: Emission of greenhouse gases and long-range transboundary air pollutants in the Faroe Islands 1990-2001. National Environmental Research Institute. - NERI Technical Report 477: 62 pp. (electronic). Available at: http://www-.dmu.dk/1_viden/2_Publikationer/3_fagrapporter/FR477.PDF

Markamp 2005: Personal communication, Henrik Markamp, The National Motorcycle Association.

Marpol 73/78 Annex VI: Regulations for the prevention of air pollution from ships, technical and operational implications, DNV, 21 February 2005.

Ntziachristos, L. & Samaras, Z. 2000: COPERT III Computer Programme to Calculate Emissions from Road Transport - Methodology and Emission Factors (Version 2.1). Technical report No 49. European Environment Agency, November 2000, Copenhagen. Available at: http://reports.eea.eu.int/Technical_report_No_49/en (June 13, 2003).

Næraa, R. 2005: Unpublished data material from the Danish State Railways.

Nørgaard, T. & Hansen, K.F. 2004: Chiptuning af køretøjer - miljømæssig effekt, Miljøprojekt nr. 888, Miljøstyrelsen.

Pulles, T., Aardenne J.v., Tooly, L. & Rypdal, K. 2001: Good Practice Guidance for CLRTAP Emission Inventories, Draft chapter for the UNECE CORINAIR Guidebook, 7 November 2001, 42pp.

TNO (2001): TNO CEPMEIP database (www.air.sk/tno/cepmeip).

USEPA 2004: Conversion Factors for Hydrocarbon Emission Components. EPA420-P-04-001, US Environmental Protection Agency, 5 pp.

Winther, M. 2001a: 1998 Fuel Use and Emissions for Danish IFR Flights. Environmental Project no. 628, 2001. 112 p. Danish EPA. Prepared by the National Environmental Research Institute, Denmark. Available at http://www.mst.dk/udgiv/Publications/2001/87-7944-661-2/html/.

Winther, M. 2001b: Improving fuel statistics for Danish aviation. National Environmental Research Institute, Denmark. 56 p. – NERI Technical Report No. 387.

Winther, M. 2004: Danish Non-Exhaust Emissions Calculated with the Detailed EMEP/CORINAIR methodology. In: Dilara, P., Muntean, M., Angelino, E.: Proceedings of the PM Emission Inventories

Scientific Workshop, pp. 70-77. Lago Maggiore, Italy, 18 October 2004.

Winther, M. & Nielsen O. 2006: Fuel use and emissions from non-road machinery in Denmark from 1985-2004 - and projections from 2005-2030. Environmental Project 1092. The Danish Environmental Protection Agency. 238 pp. Available at: http://www.mst.dk-/udgiv/Publi-cations/2006/87-7052-0852/pdf/87-7052-086-0.pdf.

Annex Transport

List of content

Annex 1: Fleet data 1990-2004 for road transport (No. vehicles)

Sector	Subsector	Tech	FYear	LYear	1985	1986	1987	1988	1989	1990	1991	1992	1993
Passenger Cars	Gasoline <1.4 l	PRE ECE	0	1969	80570	70965	61916	53661	49471	46208	44014	42804	36466
Passenger Cars	Gasoline <1.4 l	ECE 15/00-01	1970	1978	333714	319739	297370	247511	217970	187911	161642	139011	119423
Passenger Cars	Gasoline <1.4 l	ECE 15/02	1979	1980	104223	81798	75344	97293	92422	86056	79240	72588	65798
Passenger Cars	Gasoline <1.4 l	ECE 15/03	1981	1985	345946	374460	359056	308509	306989	301692	295678	288944	280769
Passenger Cars	Gasoline <1.4 l	ECE 15/04	1986	1990		46574	114381	206106	245261	282011	280180	278685	278152
Passenger Cars	Gasoline <1.4 l	Euro I	1991	1996							39608	73527	101489
Passenger Cars	Gasoline <1.4 l	Euro II	1997	2000									
Passenger Cars	Gasoline <1.4 l	Euro III	2001	2005									
Passenger Cars	Gasoline 1.4 - 2.0 l	PRE ECE	0	1969	61592	54869	48157	41737	38477	35940	34233	33292	28362
Passenger Cars	Gasoline 1.4 - 2.0 l	ECE 15/00-01	1970	1978	218181	211819	199591	168672	148280	127631	109640	94187	80843
Passenger Cars	Gasoline 1.4 - 2.0 l	ECE 15/02	1979	1980	60836	50077	46439	62263	59148	55063	50674	46402	42040
Passenger Cars	Gasoline 1.4 - 2.0 l	ECE 15/03	1981	1985	210573	222174	211067	178826	177843	174544	170748	166595	161592
Passenger Cars	Gasoline 1.4 - 2.0 l	ECE 15/04	1986	1990		31049	74328	131279	159911	190297	188948	187873	187524
Passenger Cars	Gasoline 1.4 - 2.0 l	Euro I	1991	1996							35647	75763	119561
Passenger Cars	Gasoline 1.4 - 2.0 l	Euro II	1997	2000									
Passenger Cars	Gasoline 1.4 - 2.0 l	Euro III	2001	2005									
Passenger Cars	Gasoline >2.0 l	PRE ECE	0	1969	5923	5243	4586	3975	3665	3423	3260	3171	2701
Passenger Cars	Gasoline >2.0 l	ECE 15/00-01	1970	1978	18531	17532	16672	14346	12566	10780	9234	7914	6782
Passenger Cars	Gasoline >2.0 l	ECE 15/02	1979	1980	8729	6326	4457	4966	4718	4392	4042	3702	3355
Passenger Cars	Gasoline >2.0 l	ECE 15/03	1981	1985	31066	33255	31913	25237	25111	24666	24157	23596	22911
Passenger Cars	Gasoline >2.0 l	ECE 15/04	1986	1990		4085	9932	19410	22965	25679	25524	25389	25338
Passenger Cars	Gasoline >2.0 l	Euro I	1991	1996							3961	8129	12434
Passenger Cars	Gasoline >2.0 l	Euro II	1997	2000									
Passenger Cars	Gasoline >2.0 l	Euro III	2001	2005									
Passenger Cars	Diesel <2.0 l	Euro I	1991	1996							4042	8018	11873
Passenger Cars	Diesel <2.0 l	Euro II	1997	2000									
Passenger Cars	Diesel <2.0 l	Euro III	2001	2005									
Passenger Cars	Diesel <2.0 l	Conventional	0	1990	75827	78430	79758	80200	80188	79714	75795	72294	68535
Passenger Cars	Diesel >2.0 l	Euro I	1991	1996							213	436	667
Passenger Cars	Diesel >2.0 l	Euro II	1997	2000									
Passenger Cars	Diesel >2.0 l	Euro III	2001	2005									

Passenger Cars	Diesel >2.0 l	Conventional	0	1990	3451	3566	3627	3647	3706	3704	3557	3423	3280

Sector	Subsector	Tech	FYear	LYear	1985	1986	1987	1988	1989	1990	1991	1992	1993
Passenger Cars	LPG	Euro I	1991	1996	0	0	0	0	0	0	0	0	0
Passenger Cars	LPG	Euro II	1997	2000	0	0	0	0	0	0	0	0	0
Passenger Cars	LPG	Euro III	2001	2005	0	0	0	0	0	0	0	0	0
Passenger Cars	LPG	Conventional	0	1990	287	287	287	287	287	286	286	288	289
Passenger Cars	2-Stroke	Conventional	0	9999	4823	5402	5997	6026	5853	5417	4804	4308	3747
Light Duty Vehicles	Gasoline <3.5t	Conventional	0	1994	33049	36810	39724	41321	41967	42333	43215	44179	45487
Light Duty Vehicles	Gasoline <3.5t	Euro I	1995	1998									
Light Duty Vehicles	Gasoline <3.5t	Euro II	1999	2001									
Light Duty Vehicles	Gasoline <3.5t	Euro III	2002	2006									
Light Duty Vehicles	Diesel <3.5 t	Conventional	0	1994	121431	135248	145954	151822	154198	155543	158782	162324	167129
Light Duty Vehicles	Diesel <3.5 t	Euro I	1995	1998									
Light Duty Vehicles	Diesel <3.5 t	Euro II	1999	2001									
Light Duty Vehicles	Diesel <3.5 t	Euro III	2002	2006									
Heavy Duty Vehicles	Gasoline >3.5 t	Conventional	0	9999	251	261	262	255	254	250	255	261	267
Heavy Duty Vehicles	Diesel 3.5 - 7.5 t	Conventional	0	1993	5140	5338	5353	5228	5194	5108	5214	5331	5487
Heavy Duty Vehicles	Diesel 3.5 - 7.5 t	Euro I	1994	1996									
Heavy Duty Vehicles	Diesel 3.5 - 7.5 t	Euro II	1997	2001									
Heavy Duty Vehicles	Diesel 3.5 - 7.5 t	Euro III	2002	2006									
Heavy Duty Vehicles	Diesel 7.5 - 16 t	Conventional	0	1993	10350	10750	10779	10528	10460	10286	10500	10735	11052
Heavy Duty Vehicles	Diesel 7.5 - 16 t	Euro I	1994	1996									
Heavy Duty Vehicles	Diesel 7.5 - 16 t	Euro II	1997	2001									
Heavy Duty Vehicles	Diesel 7.5 - 16 t	Euro III	2002	2006									
Heavy Duty Vehicles	Diesel 16 - 32 t	Conventional	0	1993	13115	13623	13659	13342	13255	13034	13306	13603	14006
Heavy Duty Vehicles	Diesel 16 - 32 t	Euro I	1994	1996									
Heavy Duty Vehicles	Diesel 16 - 32 t	Euro II	1997	2001									
Heavy Duty Vehicles	Diesel 16 - 32 t	Euro III	2002	2006									
Heavy Duty Vehicles	Diesel >32t	Conventional	0	1993	11517	11962	11994	11715	11640	11446	11683	11944	12299
Heavy Duty Vehicles	Diesel >32t	Euro I	1994	1996									
Heavy Duty Vehicles	Diesel >32t	Euro II	1997	2001									
Heavy Duty Vehicles	Diesel >32t	Euro III	2002	2006									

Sector	Subsector	Tech	FYear	LYear	1985	1986	1987	1988	1989	1990	1991	1992	1993
Buses	Urban Buses	Conventional	0	1993	4712	4768	4771	4761	4724	4753	4561	4522	4489
Buses	Urban Buses	Euro I	1994	1996									
Buses	Urban Buses	Euro II	1997	2001									
Buses	Urban Buses	Euro III	2002	2006									
Buses	Coaches	Conventional	0	1993	3298	3337	3339	3332	3307	3327	2868	3007	3086
Buses	Coaches	Euro I	1994	1996									
Buses	Coaches	Euro II	1997	2001									
Buses	Coaches	Euro III	2002	2006									
Mopeds	<50 cm³	Conventional	0	1999	151000	139000	133000	127000	124000	120000	118000	113000	109000
Mopeds	<50 cm³	97/24/EC I	2000	2002									
Mopeds	<50 cm³	97/24/EC II	2003	9999									
Motorcycles	2-stroke >50 cm³	Conventional	0	1999	6209	6280	6368	6368	6488	6617	6804	6904	7111
Motorcycles	4-stroke <250 cm³	Conventional	0	1999	7037	7118	7218	7217	7353	7499	7712	7824	8059
Motorcycles	4-stroke <250 cm³	97/24/EC	2000	2003									
Motorcycles	4-stroke <250 cm³	Stage II	2004	2006									
Motorcycles	4-stroke 250 - 750 cm³	Conventional	0	1999	19352	19573	19848	19845	20222	20622	21207	21516	22162
Motorcycles	4-stroke 250 - 750 cm³	97/24/EC	2000	2003									
Motorcycles	4-stroke 250 - 750 cm³	Stage II	2004	2006									
Motorcycles	4-stroke >750 cm³	Conventional	0	1999	8796	8897	9022	9021	9192	9374	9639	9780	10074
Motorcycles	4-stroke >750 cm³	97/24/EC	2000	2003									
Motorcycles	4-stroke >750 cm³	Stage II	2004	2006									

Sector	Subsector	Tech	FYear	LYear	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Passenger Cars	Gasoline <1.4 l	PRE ECE	0	1969	39959	37597	37130	3434	2761	2103	1744	1614	1475	1392	1313
Passenger Cars	Gasoline <1.4 l	ECE 15/00-01	1970	1978	80742	67991	53301	44337	31104	22513	17979	15837	14154	13149	12404
Passenger Cars	Gasoline <1.4 l	ECE 15/02	1979	1980	49613	42977	34748	25889	17457	10806	7298	5510	4177	3128	2433
Passenger Cars	Gasoline <1.4 l	ECE 15/03	1981	1985	262502	250449	233657	215509	183239	147179	118980	97964	79041	60724	45825
Passenger Cars	Gasoline <1.4 l	ECE 15/04	1986	1990	275858	272988	269954	275190	264791	254033	235890	219215	194543	171430	142491
Passenger Cars	Gasoline <1.4 l	Euro I	1991	1996	139813	169133	205235	210861	208282	206804	204184	201708	197423	192152	185489
Passenger Cars	Gasoline <1.4 l	Euro II	1997	2000				38465	74494	108508	135031	132813	130153	128898	126401
Passenger Cars	Gasoline <1.4 l	Euro III	2001	2005								21858	47428	70311	99658
Passenger Cars	Gasoline 1.4 - 2.0 l	PRE ECE	0	1969	31079	29242	28879	2671	2148	1635	1356	1255	1147	1083	1021
Passenger Cars	Gasoline 1.4 - 2.0 l	ECE 15/00-01	1970	1978	54600	45990	36078	30465	21519	15648	12537	11078	9923	9231	8708
Passenger Cars	Gasoline 1.4 - 2.0 l	ECE 15/02	1979	1980	31712	27445	22172	16510	11141	6870	4642	3500	2658	1987	1545
Passenger Cars	Gasoline 1.4 - 2.0 l	ECE 15/03	1981	1985	150612	143385	133411	122642	103931	83270	67222	55301	44572	34237	25811
Passenger Cars	Gasoline 1.4 - 2.0 l	ECE 15/04	1986	1990	186046	184195	182297	186155	179510	172582	160800	149915	133745	118448	99092
Passenger Cars	Gasoline 1.4 - 2.0 l	Euro I	1991	1996	201006	288095	375253	383871	378062	375137	370803	367135	359958	351646	340424
Passenger Cars	Gasoline 1.4 - 2.0 l	Euro II	1997	2000				95358	196046	274022	326267	320971	314678	311808	305622
Passenger Cars	Gasoline 1.4 - 2.0 l	Euro III	2001	2005								49700	105324	147067	195431
Passenger Cars	Gasoline >2.0 l	PRE ECE	0	1969	2960	2785	2750	254	205	156	129	120	109	103	97
Passenger Cars	Gasoline >2.0 l	ECE 15/00-01	1970	1978	4568	3849	3022	2619	1882	1367	1110	989	885	823	777
Passenger Cars	Gasoline >2.0 l	ECE 15/02	1979	1980	2531	2190	1770	1318	889	549	371	280	212	158	123
Passenger Cars	Gasoline >2.0 l	ECE 15/03	1981	1985	21429	20432	19054	17570	14933	12016	9723	8008	6459	4965	3744
Passenger Cars	Gasoline >2.0 l	ECE 15/04	1986	1990	25119	24845	24547	24976	23976	22975	21252	19699	17377	15265	12606
Passenger Cars	Gasoline >2.0 l	Euro I	1991	1996	20068	27915	35769	36617	36081	35807	35387	35024	34329	33515	32430
Passenger Cars	Gasoline >2.0 l	Euro II	1997	2000				12432	27315	44922	61899	60799	59506	58896	57816
Passenger Cars	Gasoline >2.0 l	Euro III	2001	2005								15179	30712	45080	65819
Passenger Cars	Diesel <2.0 l	Euro I	1991	1996	18305	24557	31178	31314	31728	35117	39313	43578	48670	53462	59969
Passenger Cars	Diesel <2.0 l	Euro II	1997	2000				7046	14640	23084	31540	34764	38841	43327	49262
Passenger Cars	Diesel <2.0 l	Euro III	2001	2005								5482	13338	21371	33648
Passenger Cars	Diesel <2.0 l	Conventional	0	1990	62145	58846	55003	48252	43894	43002	42599	42638	42101	40524	38623
Passenger Cars	Diesel >2.0 l	Euro I	1991	1996	1078	1499	1921	1929	1951	2161	2420	2683	2998	3294	3698
Passenger Cars	Diesel >2.0 l	Euro II	1997	2000				655	1478	2710	4232	4658	5196	5789	6592
Passenger Cars	Diesel >2.0 l	Euro III	2001	2005								1163	2681	4432	7505
Passenger Cars	Diesel >2.0 l	Conventional	0	1990	3041	2904	2749	2461	2267	2234	2228	2228	2190	2097	1977

Sector	Subsector	Tech	FYear	LYear	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Passenger Cars	LPG	Euro I	1991	1996	0	0	0	0	0	0	0	0	0	0	0
Passenger Cars	LPG	Euro II	1997	2000	0	0	0	0	0	0	0	0	0	0	0
Passenger Cars	LPG	Euro III	2001	2005	0	0	0	0	0	0	0	0	0	0	0
Passenger Cars	LPG	Conventional	0	1990	289	301	311	172	97	44	32	63	21	15	15
Passenger Cars	2-Stroke	Conventional	0	9999	3029	2443	1824	1248	761	400	300	200	150	100	50
Light Duty Vehicles	Gasoline <3.5t	Conventional	0	1994	47260	44601	41519	37209	34454	31490	28488	25423	21615	18838	14577
Light Duty Vehicles	Gasoline <3.5t	Euro I	1995	1998		4259	8524	12645	17212	16632	15979	15528	15050	13949	14793
Light Duty Vehicles	Gasoline <3.5t	Euro II	1999	2001						4705	9300	14017	13916	13805	14126
Light Duty Vehicles	Gasoline <3.5t	Euro III	2002	2006									5140	10719	16724
Light Duty Vehicles	Diesel <3.5 t	Conventional	0	1994	173650	163878	152553	142109	131572	122991	115694	105397	92990	82926	66760
Light Duty Vehicles	Diesel <3.5 t	Euro I	1995	1998		15648	31318	48292	65728	64964	64894	64370	64743	61407	67752
Light Duty Vehicles	Diesel <3.5 t	Euro II	1999	2001						18376	37766	58112	59870	60772	64698
Light Duty Vehicles	Diesel <3.5 t	Euro III	2002	2006									22112	47185	76596
Heavy Duty Vehicles	Gasoline >3.5 t	Conventional	0	9999	278	288	295	262	274	251	257	248	249	248	233
Heavy Duty Vehicles	Diesel 3.5 - 7.5 t	Conventional	0	1993	5205	4891	4532	3999	3692	3079	2406	1978	1739	1407	1069
Heavy Duty Vehicles	Diesel 3.5 - 7.5 t	Euro I	1994	1996	497	1004	1506	1440	1434	1269	1056	951	956	814	902
Heavy Duty Vehicles	Diesel 3.5 - 7.5 t	Euro II	1997	2001				529	1088	1487	1702	1990	2064	1872	2036
Heavy Duty Vehicles	Diesel 3.5 - 7.5 t	Euro III	2002	2006									484	941	1541
Heavy Duty Vehicles	Diesel 7.5 - 16 t	Conventional	0	1993	10482	9850	9126	7801	6604	5613	5085	4211	3136	2571	1639
Heavy Duty Vehicles	Diesel 7.5 - 16 t	Euro I	1994	1996	1001	2022	3034	2808	2565	2313	2234	2025	1724	1485	1384
Heavy Duty Vehicles	Diesel 7.5 - 16 t	Euro II	1997	2001				1032	1945	2709	3601	4235	3724	3421	3123
Heavy Duty Vehicles	Diesel 7.5 - 16 t	Euro III	2002	2006									872	1721	2364
Heavy Duty Vehicles	Diesel 16 - 32 t	Conventional	0	1993	13283	12481	11564	10719	9831	8982	7933	6815	5525	4571	3110
Heavy Duty Vehicles	Diesel 16 - 32 t	Euro I	1994	1996	1268	2562	3844	3859	3821	3702	3486	3276	3037	2642	2627
Heavy Duty Vehicles	Diesel 16 - 32 t	Euro II	1997	2001				1419	2896	4336	5616	6853	6560	6082	5926
Heavy Duty Vehicles	Diesel 16 - 32 t	Euro III	2002	2006									1537	3058	4484
Heavy Duty Vehicles	Diesel >32t	Conventional	0	1993	11665	10961	10155	9337	8720	8180	7361	6527	5486	4716	3283
Heavy Duty Vehicles	Diesel >32t	Euro I	1994	1996	1114	2250	3375	3362	3389	3372	3234	3138	3016	2726	2772
Heavy Duty Vehicles	Diesel >32t	Euro II	1997	2001				1236	2568	3948	5211	6564	6513	6275	6253
Heavy Duty Vehicles	Diesel >32t	Euro III	2002	2006									1526	3155	4732

Sector	Subsector	Tech	FYear	LYear	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Buses	Urban Buses	Conventional	0	1993	4083	3635	3261	2946	2793	2542	2319	2158	1976	1860	1711
Buses	Urban Buses	Euro I	1994	1996	390	746	1084	1060	972	913	852	792	752	714	663
Buses	Urban Buses	Euro II	1997	2001				390	728	1053	1346	1596	1525	1446	1345
Buses	Urban Buses	Euro III	2002	2006									346	669	951
Buses	Coaches	Conventional	0	1993	2928	4507	4156	3662	3370	3006	2723	2444	2165	1962	1773
Buses	Coaches	Euro I	1994	1996	280	925	1381	1318	1174	1079	1001	896	823	752	688
Buses	Coaches	Euro II	1997	2001				485	879	1246	1580	1807	1670	1527	1394
Buses	Coaches	Euro III	2002	2006									379	706	986
Mopeds	<50 cm³	Conventional	0	1999	105000	114167	123333	132500	141667	150833	143607	136249	128209	120305	112262
Mopeds	<50 cm³	97/24/EC I	2000	2002							16393	28751	42791	40611	38395
Mopeds	<50 cm³	97/24/EC II	2003	9999										8084	18343
Motorcycles	2-stroke >50 cm³	Conventional	0	1999	7406	7672	8214	8980	9598	10385	11054	11367	11582	11850	12326
Motorcycles	2-stroke >50 cm³	97/24/EC	2000	2003	0	0	0	0	0	0	0	0	0		0
Motorcycles	2-stroke >50 cm³	Stage II	2004	9999											
Motorcycles	4-stroke <250 cm³	Conventional	0	1999	8394	8695	9310	10177	10878	11769	11670	12487	12882	13380	14078
Motorcycles	4-stroke <250 cm³	97/24/EC	2000	2003							858	918	1348	1806	1816
Motorcycles	4-stroke <250 cm³	Stage II	2004	9999											604
Motorcycles	4-stroke 250 - 750 cm³	Conventional	0	1999	23083	23911	25602	27986	29914	32365	32093	34338	35424	36794	38714
Motorcycles	4-stroke 250 - 750 cm³	97/24/EC	2000	2003							2360	2525	3707	4967	4993
Motorcycles	4-stroke 250 - 750 cm³	Stage II	2004	9999											1661
Motorcycles	4-stroke >750 cm³	Conventional	0	1999	10492	10869	11637	12721	13597	14712	14588	15608	16102	16725	17597
Motorcycles	4-stroke >750 cm³	97/24/EC	2000	2003							1073	1148	1685	2258	2270
Motorcycles	4-stroke >750 cm³	Stage II	2004	9999											755

Annex 2: Mileage data 1990-2004 for road transport (km)

Sector	Subsector	Tech	FYear	LYear	1985	1986	1987	1988	1989	1990	1991	1992	1993
Passenger Cars	Gasoline <1.4 l	PRE ECE	0	1969	9579	9371.7	9286.7	9480	9566.2	10410	11215	11916	11961
Passenger Cars	Gasoline <1.4 l	ECE 15/00-01	1970	1978	12134	11492	11034	10690	10079	10410	11215	11916	11961
Passenger Cars	Gasoline <1.4 l	ECE 15/02	1979	1980	16077	14937	13860	13562	13205	13297	12204	11916	11961
Passenger Cars	Gasoline <1.4 l	ECE 15/03	1981	1985	18829	17755	16960	16559	15737	16477	16988	17032	16112
Passenger Cars	Gasoline <1.4 l	ECE 15/04	1986	1990		20401	19818	19551	19317	20164	20649	20997	19980
Passenger Cars	Gasoline <1.4 l	Euro I	1991	1996							24415	25479	24809
Passenger Cars	Gasoline <1.4 l	Euro II	1997	2000									
Passenger Cars	Gasoline <1.4 l	Euro III	2001	2005									
Passenger Cars	Gasoline 1.4 - 2.0 l	PRE ECE	0	1969	9579	9371.7	9286.7	9480	9566.2	10410	11215	11916	11961
Passenger Cars	Gasoline 1.4 - 2.0 l	ECE 15/00-01	1970	1978	12052	11426	10978	10642	10052	10410	11215	11916	11961
Passenger Cars	Gasoline 1.4 - 2.0 l	ECE 15/02	1979	1980	16070	14949	13860	13560	13203	13291	12193	11916	11961
Passenger Cars	Gasoline 1.4 - 2.0 l	ECE 15/03	1981	1985	18912	17820	16975	16522	15701	16440	16953	16997	16053
Passenger Cars	Gasoline 1.4 - 2.0 l	ECE 15/04	1986	1990		20401	19825	19573	19366	20308	20805	21135	20127
Passenger Cars	Gasoline 1.4 - 2.0 l	Euro I	1991	1996							24415	25538	25030
Passenger Cars	Gasoline 1.4 - 2.0 l	Euro II	1997	2000									
Passenger Cars	Gasoline 1.4 - 2.0 l	Euro III	2001	2005									
Passenger Cars	Gasoline >2.0 l	PRE ECE	0	1969	9579	9371.7	9286.7	9480	9566.2	10410	11215	11916	11961
Passenger Cars	Gasoline >2.0 l	ECE 15/00-01	1970	1978	12071	11335	10877	10548	10019	10410	11215	11916	11961
Passenger Cars	Gasoline >2.0 l	ECE 15/02	1979	1980	16075	15017	13902	13563	13206	13300	12209	11916	11961
Passenger Cars	Gasoline >2.0 l	ECE 15/03	1981	1985	18863	17813	17033	16598	15766	16506	17015	17075	16182
Passenger Cars	Gasoline >2.0 l	ECE 15/04	1986	1990		20401	19821	19486	19280	20009	20515	20893	19826
Passenger Cars	Gasoline >2.0 l	Euro I	1991	1996							24415	25523	24981
Passenger Cars	Gasoline >2.0 l	Euro II	1997	2000									
Passenger Cars	Gasoline >2.0 l	Euro III	2001	2005									
Passenger Cars	Diesel <2.0 l	Euro I	1991	1996							44774	44798	43686
Passenger Cars	Diesel <2.0 l	Euro II	1997	2000									
Passenger Cars	Diesel <2.0 l	Euro III	2001	2005									
Passenger Cars	Diesel <2.0 l	Conventional	0	1990	30140	30143	30146	29412	29852	30226	30006	29506	28618
Passenger Cars	Diesel >2.0 l	Euro I	1991	1996							44774	44824	43778
Passenger Cars	Diesel >2.0 l	Euro II	1997	2000									
Passenger Cars	Diesel >2.0 l	Euro III	2001	2005									
Passenger Cars	Diesel >2.0 l	Conventional	0	1990	31387	31386	31387	30749	31224	31385	31124	30558	29450

Sector	Subsector	Tech	FYear	LYear	1985	1986	1987	1988	1989	1990	1991	1992	1993
Passenger Cars	LPG	Euro I	1991	1996	0	0	0	0	0	0	0	0	0
Passenger Cars	LPG	Euro II	1997	2000	0	0	0	0	0	0	0	0	0
Passenger Cars	LPG	Euro III	2001	2005	0	0	0	0	0	0	0	0	0
Passenger Cars	LPG	Conventional	0	1990	18862	17780	16967	16544	15723	16463	16974	17018	16091
Passenger Cars	2-Stroke	Conventional	0	9999	18862	17780	16967	16544	15723	16463	16974	17018	16091
Light Duty Vehicles	Gasoline <3.5t	Conventional	0	1994	19874	19443	19267	19668	19215	20316	20772	21385	20746
Light Duty Vehicles	Gasoline <3.5t	Euro I	1995	1998									
Light Duty Vehicles	Gasoline <3.5t	Euro II	1999	2001									
Light Duty Vehicles	Gasoline <3.5t	Euro III	2002	2006									
Light Duty Vehicles	Diesel <3.5 t	Conventional	0	1994	35513	37963	36672	36790	38329	40670	41136	39162	37638
Light Duty Vehicles	Diesel <3.5 t	Euro I	1995	1998									
Light Duty Vehicles	Diesel <3.5 t	Euro II	1999	2001									
Light Duty Vehicles	Diesel <3.5 t	Euro III	2002	2006									
Heavy Duty Vehicles	Gasoline >3.5 t	Conventional	0	9999	22450	21964	21765	22218	21707	24538	25088	25829	25057
Heavy Duty Vehicles	Diesel 3.5 - 7.5 t	Conventional	0	1993	31444	33613	32470	32575	33937	41507	41982	39966	38412
Heavy Duty Vehicles	Diesel 3.5 - 7.5 t	Euro I	1994	1996									
Heavy Duty Vehicles	Diesel 3.5 - 7.5 t	Euro II	1997	2001									
Heavy Duty Vehicles	Diesel 3.5 - 7.5 t	Euro III	2002	2006									
Heavy Duty Vehicles	Diesel 7.5 - 16 t	Conventional	0	1993	43811	46833	45241	45387	47285	50173	50747	48311	46432
Heavy Duty Vehicles	Diesel 7.5 - 16 t	Euro I	1994	1996									
Heavy Duty Vehicles	Diesel 7.5 - 16 t	Euro II	1997	2001									
Heavy Duty Vehicles	Diesel 7.5 - 16 t	Euro III	2002	2006									
Heavy Duty Vehicles	Diesel 16 - 32 t	Conventional	0	1993	60901	65102	62888	63092	65730	69745	70543	67157	64545
Heavy Duty Vehicles	Diesel 16 - 32 t	Euro I	1994	1996									
Heavy Duty Vehicles	Diesel 16 - 32 t	Euro II	1997	2001									
Heavy Duty Vehicles	Diesel 16 - 32 t	Euro III	2002	2006									
Heavy Duty Vehicles	Diesel >32t	Conventional	0	1993	60901	65102	62888	63092	65730	69745	70543	67157	64545
Heavy Duty Vehicles	Diesel >32t	Euro I	1994	1996									
Heavy Duty Vehicles	Diesel >32t	Euro II	1997	2001									
Heavy Duty Vehicles	Diesel >32t	Euro III	2002	2006									

Sector	Subsector	Tech	FYear	LYear	1985	1986	1987	1988	1989	1990	1991	1992	1993
Buses	Urban Buses	Conventional	0	1993	91883	98221	94881	95188	99168	105226	108958	105212	104456
Buses	Urban Buses	Euro I	1994	1996									
Buses	Urban Buses	Euro II	1997	2001									
Buses	Urban Buses	Euro III	2002	2006									
Buses	Coaches	Conventional	0	1993	82367	89984	90154	90858	94640	94328	99821	99971	99704
Buses	Coaches	Euro I	1994	1996									
Buses	Coaches	Euro II	1997	2001									
Buses	Coaches	Euro III	2002	2006									
Mopeds	<50 cm³	Conventional	0	1999	2017	1973	1955	1996	1950	2062	2158	2254	2258
Mopeds	<50 cm³	97/24/EC I	2000	2002	0	0	0	0	0	0	0	0	0
Mopeds	<50 cm³	97/24/EC II	2003	9999	0	0	0	0	0	0	0	0	0
Motorcycles	2-stroke >50 cm³	Conventional	0	1999	5705	5582	5531	5646	5516	5832	6131	6425	6427
Motorcycles	2-stroke >50 cm³	97/24/EC	2000	2003	0	0	0	0	0	0	0	0	0
Motorcycles	4-stroke <250 cm³	Conventional	0	1999	5705	5582	5531	5646	5516	5832	6131	6425	6427
Motorcycles	4-stroke <250 cm³	97/24/EC	2000	2003									
Motorcycles	4-stroke <250 cm³	Stage II	2004	9999									
Motorcycles	4-stroke 250 - 750 cm³	Conventional	0	1999	5705	5582	5531	5646	5516	5832	6131	6425	6427
Motorcycles	4-stroke 250 - 750 cm³	97/24/EC	2000	2003									
Motorcycles	4-stroke 250 - 750 cm³	Stage II	2004	9999									
Motorcycles	4-stroke >750 cm³	Conventional	0	1999	5705	5582	5531	5646	5516	5832	6131	6425	6427
Motorcycles	4-stroke >750 cm³	97/24/EC	2000	2003									
Motorcycles	4-stroke >750 cm³	Stage II	2004	9999									

Sector	Subsector	Tech	FYear	LYear	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Passenger Cars	Gasoline <1.4 l	PRE ECE	0	1969	11947	12148	11930	11913	11873	11671	11563	11362	11487	11484	11497
Passenger Cars	Gasoline <1.4 l	ECE 15/00-01	1970	1978	11947	12148	11930	11913	11873	11671	11563	11362	11487	11484	11497
Passenger Cars	Gasoline <1.4 l	ECE 15/02	1979	1980	11947	12148	11930	11913	11873	11671	11563	11362	11487	11484	11497
Passenger Cars	Gasoline <1.4 l	ECE 15/03	1981	1985	15150	14269	12818	11913	11873	11671	11563	11362	11487	11484	11497
Passenger Cars	Gasoline <1.4 l	ECE 15/04	1986	1990	18877	18427	17364	16286	14812	13545	12675	11803	11487	11484	11497
Passenger Cars	Gasoline <1.4 l	Euro I	1991	1996	24465	24045	23055	22047	20728	19419	18242	17209	16501	15216	14295
Passenger Cars	Gasoline <1.4 l	Euro II	1997	2000				25933	25403	24304	23596	21890	20971	20039	18922
Passenger Cars	Gasoline <1.4 l	Euro III	2001	2005								24734	24632	25527	23691
Passenger Cars	Gasoline 1.4 - 2.0 l	PRE ECE	0	1969	11947	12148	11930	11913	11873	11671	11563	11362	11487	11484	11497
Passenger Cars	Gasoline 1.4 - 2.0 l	ECE 15/00-01	1970	1978	11947	12148	11930	11913	11873	11671	11563	11362	11487	11484	11497
Passenger Cars	Gasoline 1.4 - 2.0 l	ECE 15/02	1979	1980	11947	12148	11930	11913	11873	11671	11563	11362	11487	11484	11497
Passenger Cars	Gasoline 1.4 - 2.0 l	ECE 15/03	1981	1985	15080	14224	12800	11913	11873	11671	11563	11362	11487	11484	11497
Passenger Cars	Gasoline 1.4 - 2.0 l	ECE 15/04	1986	1990	18987	18548	17477	16395	14982	13730	12835	11886	11487	11484	11497
Passenger Cars	Gasoline 1.4 - 2.0 l	Euro I	1991	1996	24848	24782	23824	22740	21414	20014	18769	17719	17032	15922	15075
Passenger Cars	Gasoline 1.4 - 2.0 l	Euro II	1997	2000				25933	25429	24289	23491	21803	20844	19933	18874
Passenger Cars	Gasoline 1.4 - 2.0 l	Euro III	2001	2005								24734	24623	25273	23550
Passenger Cars	Gasoline >2.0 l	PRE ECE	0	1969	11947	12148	11930	11913	11873	11671	11563	11362	11487	11484	11497
Passenger Cars	Gasoline >2.0 l	ECE 15/00-01	1970	1978	11947	12148	11930	11913	11873	11671	11563	11362	11487	11484	11497
Passenger Cars	Gasoline >2.0 l	ECE 15/02	1979	1980	11947	12148	11930	11913	11873	11671	11563	11362	11487	11484	11497
Passenger Cars	Gasoline >2.0 l	ECE 15/03	1981	1985	15186	14290	12826	11913	11873	11671	11563	11362	11487	11484	11497
Passenger Cars	Gasoline >2.0 l	ECE 15/04	1986	1990	18775	18326	17264	16166	14623	13409	12568	11733	11487	11484	11497
Passenger Cars	Gasoline >2.0 l	Euro I	1991	1996	24775	24661	23694	22620	21297	19908	18680	17632	16939	15805	14945
Passenger Cars	Gasoline >2.0 l	Euro II	1997	2000				25933	25455	24485	23852	22229	21286	20301	19127
Passenger Cars	Gasoline >2.0 l	Euro III	2001	2005								24734	24605	25454	23717
Passenger Cars	Diesel <2.0 l	Euro I	1991	1996	45013	43827	42670	41081	38968	37769	35666	33848	32622	30618	29048
Passenger Cars	Diesel <2.0 l	Euro II	1997	2000				47363	46792	46335	45147	42127	40440	39001	37072
Passenger Cars	Diesel <2.0 l	Euro III	2001	2005								47735	47693	46789	46315
Passenger Cars	Diesel <2.0 l	Conventional	0	1990	28903	27774	26548	25802	24873	24478	23626	22534	22247	22433	22566
Passenger Cars	Diesel >2.0 l	Euro I	1991	1996	45168	44095	42927	41309	39200	37968	35855	34029	32806	30876	29333
Passenger Cars	Diesel >2.0 l	Euro II	1997	2000				47363	46854	46700	45781	42902	41224	39658	37540
Passenger Cars	Diesel >2.0 l	Euro III	2001	2005								47735	47653	46802	46550
Passenger Cars	Diesel >2.0 l	Conventional	0	1990	29540	28241	26855	25911	24753	24315	23450	22412	22247	22433	22566

Sector	Subsector	Tech	FYear	LYear	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Passenger Cars	LPG	Euro I	1991	1996	0	0	0	0	0	0	0	0	0		0
Passenger Cars	LPG	Euro II	1997	2000	0	0	0	0	0	0	0	0	0		0
Passenger Cars	LPG	Euro III	2001	2005	0	0	0	0	0	0	0	0	0		0
Passenger Cars	LPG	Conventional	0	1990	15123	14251	12811	11913	11873	11671	11563	11362	11487	11484	11497
Passenger Cars	2-Stroke	Conventional	0	9999	15123	14251	12811	11913	11873	11671	11563	11362	11487	11484	11497
Light Duty Vehicles	Gasoline <3.5t	Conventional	0	1994	19693	20175	19973	19783	18763	18198	18190	18247	18252	17408	17877
Light Duty Vehicles	Gasoline <3.5t	Euro I	1995	1998		20175	19973	19783	18763	18198	18190	18247	18252	17408	17877
Light Duty Vehicles	Gasoline <3.5t	Euro II	1999	2001						18198	18190	18247	18252	17408	17877
Light Duty Vehicles	Gasoline <3.5t	Euro III	2002	2006									18252	17408	17877
Light Duty Vehicles	Diesel <3.5 t	Conventional	0	1994	38875	37046	37446	37191	35122	34377	32931	32240	32281	33225	35171
Light Duty Vehicles	Diesel <3.5 t	Euro I	1995	1998		37046	37446	37191	35122	34377	32931	32240	32281	33225	35171
Light Duty Vehicles	Diesel <3.5 t	Euro II	1999	2001						34377	32931	32240	32281	33225	35171
Light Duty Vehicles	Diesel <3.5 t	Euro III	2002	2006									32281	33225	35171
Heavy Duty Vehicles	Gasoline >3.5 t	Conventional	0	9999	23785	24367	24124	21382	21560	21408	22116	25464	25159	25344	24344
Heavy Duty Vehicles	Diesel 3.5 - 7.5 t	Conventional	0	1993	39673	37807	38216	30943	31912	33764	34395	44252	44011	49367	46588
Heavy Duty Vehicles	Diesel 3.5 - 7.5 t	Euro I	1994	1996	39673	37807	38216	30943	31912	33764	34395	44252	44011	49367	46588
Heavy Duty Vehicles	Diesel 3.5 - 7.5 t	Euro II	1997	2001				30943	31912	33764	34395	44252	44011	49367	46588
Heavy Duty Vehicles	Diesel 3.5 - 7.5 t	Euro III	2002	2006									44011	49367	46588
Heavy Duty Vehicles	Diesel 7.5 - 16 t	Conventional	0	1993	47957	45702	46194	43396	42485	39368	37712	21018	18001	19957	19691
Heavy Duty Vehicles	Diesel 7.5 - 16 t	Euro I	1994	1996	47957	45702	46194	43396	42485	39368	37712	21018	18001	19957	19691
Heavy Duty Vehicles	Diesel 7.5 - 16 t	Euro II	1997	2001				43396	42485	39368	37712	21018	18001	19957	19691
Heavy Duty Vehicles	Diesel 7.5 - 16 t	Euro III	2002	2006									18001	19957	19691
Heavy Duty Vehicles	Diesel 16 - 32 t	Conventional	0	1993	66665	63530	64216	65012	65865	67197	64369	68491	67300	72548	72157
Heavy Duty Vehicles	Diesel 16 - 32 t	Euro I	1994	1996	66665	63530	64216	65012	65865	67197	64369	68491	67300	72548	72157
Heavy Duty Vehicles	Diesel 16 - 32 t	Euro II	1997	2001				65012	65865	67197	64369	68491	67300	72548	72157
Heavy Duty Vehicles	Diesel 16 - 32 t	Euro III	2002	2006									67300	72548	72157
Heavy Duty Vehicles	Diesel >32t	Conventional	0	1993	66665	63530	64216	65012	65865	67197	64369	68491	67300	72548	72157
Heavy Duty Vehicles	Diesel >32t	Euro I	1994	1996	66665	63530	64216	65012	65865	67197	64369	68491	67300	72548	72157
Heavy Duty Vehicles	Diesel >32t	Euro II	1997	2001				65012	65865	67197	64369	68491	67300	72548	72157
Heavy Duty Vehicles	Diesel >32t	Euro III	2002	2006									67300	72548	72157

Sector	Subsector	Tech	FYear	LYear	1994	1995	1996	1997	1998	1999	2000	2001	2002		2003
Buses	Urban Buses	Conventional	0	1993	109250	103609	104411	103783	102642	100407	96179	93914	94414	101833	105708
Buses	Urban Buses	Euro I	1994	1996	109250	103609	104411	103783	102642	100407	96179	93914	94414	101833	105708
Buses	Urban Buses	Euro II	1997	2001				103783	102642	100407	96179	93914	94414	101833	105708
Buses	Urban Buses	Euro III	2002	2006									94414	101833	105708
Buses	Coaches	Conventional	0	1993	104261	90357	85396	83925	82776	81456	78186	76384	76791	82825	85977
Buses	Coaches	Euro I	1994	1996	104261	90357	85396	83925	82776	81456	78186	76384	76791	82825	85977
Buses	Coaches	Euro II	1997	2001				83925	82776	81456	78186	76384	76791	82825	85977
Buses	Coaches	Euro III	2002	2006									76791	82825	85977
Mopeds	<50 cm³	Conventional	0	1999	2171	2213	2184	2165	2151	1806	1622	1290	1295	1295	1304
Mopeds	<50 cm³	97/24/EC I	2000	2002							1622	1290	1295	1295	1304
Mopeds	<50 cm³	97/24/EC II	2003	9999										1295	1304
Motorcycles	2-stroke >50 cm³	Conventional	0	1999	6174	6284	6210	6175	6168	6010	6058	6108	6179	6212	6300
Motorcycles	2-stroke >50 cm³	97/24/EC	2000	2003	0	0	0	0	0	0	0	0	0		0
Motorcycles	4-stroke <250 cm³	Conventional	0	1999	6174	6284	6210	6175	6168	6010	6058	6108	6179	6212	6300
Motorcycles	4-stroke <250 cm³	97/24/EC	2000	2003							6058	6108	6179	6212	6300
Motorcycles	4-stroke <250 cm³	Stage II	2004	9999											6300
Motorcycles	4-stroke 250 - 750 cm³	Conventional	0	1999	6174	6284	6210	6175	6168	6010	6058	6108	6179	6212	6300
Motorcycles	4-stroke 250 - 750 cm³	97/24/EC	2000	2003							6058	6108	6179	6212	6300
Motorcycles	4-stroke 250 - 750 cm³	Stage II	2004	9999											6300
Motorcycles	4-stroke >750 cm³	Conventional	0	1999	6174	6284	6210	6175	6168	6010	6058	6108	6179	6212	6300
Motorcycles	4-stroke >750 cm³	97/24/EC	2000	2003							6058	6108	6179	6212	6300
Motorcycles	4-stroke >750 cm³	Stage II	2004	9999											6300

Annex 3: EU directive emission limits for road transportation vehicles

Private cars and light duty vehicles I (<1305 kg)

g/km		**EURO 1**	**EURO 2**	**EURO 3**[1)]	**EURO 4**
Normal temp.					
CO	Gasoline	2,72	2,2	2,3	1,0
	Diesel	2,72	1,0	0,64	0,5
HC	Gasoline	-	-	0,20	0,10
NO_x	Gasoline	-	-	0,15	0,08
	Diesel	-	-	0,5	0,25
$HC+NO_x$	Gasoline	0,97	0,5	-	-
	Diesel	0,97	0,7/0,9[2)]	0,56	0,30
Particulates	Diesel	0,14	0,08/0,10[2)]	0,05	0,025
Low temp.					
CO	Gasoline	-	-	-	15
HC	Gasoline	-	-	-	1,8
Evaporation					
HC[3)]	Gasoline	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/km		EURO 1	EURO 2	EURO 3[1)]	EURO 4
Normal temp.					
CO	Gasoline	5,17	4,0	4,17	1,81
	Diesel	5,17	1,25	0,80	0,63
HC	Gasoline	-	-	0,25	0,13
NO_x	Gasoline	-	-	0,18	0,10
	Diesel	-	-	0,65	0,33
HC+NO_x	Gasoline	1,4	0,6	-	-
	Diesel	1,4	1,0/1,3[2)]	0,72	0,39
Particulates	Diesel	0,19	0,12/0,14[2)]	0,07	0,04
Low temp.					
CO	Gasoline	-	-	-	24
HC	Gasoline	-	-		2,7
Evaporation					
HC[3)]	Gasoline	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/km		EURO 1	EURO 2	EURO 3[1)]	EURO 4
Normal temp.					
CO	Gasoline	6,9	5,0	5,22	2,27
	Diesel	6,9	1,5	0,95	0,74
HC	Gasoline	-	-	0,29	0,16
NO_x	Gasoline	-	-	0,21	0,11
	Diesel	-	-	0,78	0,39
HC+NO_x	Gasoline	1,7	0,7	-	-
	Diesel	1,7	1,2/1,6[2)]	0,86	0,46
Particulates	Diesel	0,25	0,17/0,20[2)]	0,10	0,06
Low temp.					
CO	Gasoline	-	-	-	30
HC	Gasoline	-	-	-	3,2
Evaporation					
HC[3)]	Gasoline	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/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 4: Basis emission factors (g/km)

Sector	Subsector	Tech	FCu	FCr	FCh	CO2u	CO2r	CO2h	CH4u	CH4r	CH4h	N2Ou	N2Or	N2Oh
Passenger Cars	Gasoline <1.4 l	PRE ECE	67.5	55.0	62.7	216	176	201	0.092	0.029	0.026	0.005	0.005	0.005
Passenger Cars	Gasoline <1.4 l	ECE 15/00-01	58.2	44.5	48.6	186	142	155	0.092	0.029	0.026	0.005	0.005	0.005
Passenger Cars	Gasoline <1.4 l	ECE 15/02	53.2	45.2	51.2	170	144	164	0.092	0.029	0.026	0.005	0.005	0.005
Passenger Cars	Gasoline <1.4 l	ECE 15/03	53.2	45.2	51.2	170	144	164	0.092	0.029	0.026	0.005	0.005	0.005
Passenger Cars	Gasoline <1.4 l	ECE 15/04	51.4	43.4	47.7	164	139	153	0.092	0.029	0.026	0.005	0.005	0.005
Passenger Cars	Gasoline <1.4 l	Euro I	51.1	38.0	43.9	164	121	140	0.038	0.018	0.021	0.053	0.016	0.035
Passenger Cars	Gasoline 1.4 - 2.0 l	PRE ECE	79.3	67.0	76.4	253	214	244	0.092	0.029	0.026	0.005	0.005	0.005
Passenger Cars	Gasoline 1.4 - 2.0 l	ECE 15/00-01	67.8	51.1	60.3	217	163	193	0.092	0.029	0.026	0.005	0.005	0.005
Passenger Cars	Gasoline 1.4 - 2.0 l	ECE 15/02	61.7	50.7	59.7	197	162	191	0.092	0.029	0.026	0.005	0.005	0.005
Passenger Cars	Gasoline 1.4 - 2.0 l	ECE 15/03	61.7	50.7	59.7	197	162	191	0.092	0.029	0.026	0.005	0.005	0.005
Passenger Cars	Gasoline 1.4 - 2.0 l	ECE 15/04	61.7	49.1	52.1	197	157	166	0.092	0.029	0.026	0.005	0.005	0.005
Passenger Cars	Gasoline 1.4 - 2.0 l	Euro I	65.9	44.0	48.0	211	141	154	0.039	0.017	0.016	0.053	0.016	0.035
Passenger Cars	Gasoline >2.0 l	PRE ECE	96.5	80.0	88.3	309	256	282	0.092	0.029	0.026	0.005	0.005	0.005
Passenger Cars	Gasoline >2.0 l	ECE 15/00-01	73.8	57.1	66.3	236	183	212	0.092	0.029	0.026	0.005	0.005	0.005
Passenger Cars	Gasoline >2.0 l	ECE 15/02	75.3	63.3	70.7	241	202	226	0.092	0.029	0.026	0.005	0.005	0.005
Passenger Cars	Gasoline >2.0 l	ECE 15/03	75.3	63.3	70.7	241	202	226	0.092	0.029	0.026	0.005	0.005	0.005
Passenger Cars	Gasoline >2.0 l	ECE 15/04	71.1	58.1	69.9	227	186	223	0.092	0.029	0.026	0.005	0.005	0.005
Passenger Cars	Gasoline >2.0 l	Euro I	79.4	46.4	51.1	254	148	163	0.040	0.017	0.010	0.053	0.016	0.035
Passenger Cars	Diesel <2.0 l	Euro I	52.7	42.2	47.4	167	133	150	0.004	0.005	0.009	0.027	0.027	0.027
Passenger Cars	Diesel <2.0 l	Conventional	57.5	41.2	50.1	182	130	158	0.004	0.005	0.009	0.027	0.027	0.027
Passenger Cars	Diesel >2.0 l	Euro I	52.7	42.2	47.4	167	133	150	0.004	0.005	0.009	0.027	0.027	0.027
Passenger Cars	Diesel >2.0 l	Conventional	57.5	41.2	50.1	182	130	158	0.004	0.005	0.009	0.027	0.027	0.027
Passenger Cars	LPG	Conventional	59.0	45.0	54.0	176	135	161	0.080	0.035	0.025	0.015	0.015	0.015
Passenger Cars	2-Stroke	Conventional	111.5	66.0	56.9	357	211	182	0.150	0.040	0.025	0.005	0.005	0.005

Sector	Subsector	Tech	FCu	FCr	FCh	CO2u	CO2r	CO2h	CH4u	CH4r	CH4h	N2Ou	N2Or	N2Oh
Light Duty Vehicles	Gasoline <3.5t	Conventional	82.3	59.9	56.5	263	191	181	0.150	0.040	0.025	0.006	0.006	0.006
Light Duty Vehicles	Gasoline <3.5t	Euro I	96.5	70.4	66.5	308	225	212	0.038	0.020	0.016	0.053	0.016	0.035
Light Duty Vehicles	Diesel <3.5 t	Conventional	76.7	65.9	72.1	242	208	228	0.005	0.005	0.005	0.017	0.017	0.017
Light Duty Vehicles	Diesel <3.5 t	Euro I	68.9	58.2	63.7	218	184	201	0.005	0.005	0.005	0.017	0.017	0.017
Heavy Duty Vehicles	Gasoline >3.5 t	Conventional	225.0	150.0	165.0	719	480	528	0.140	0.110	0.070	0.006	0.006	0.006
Heavy Duty Vehicles	Diesel 3.5 - 7.5 t	Conventional	95.8	87.1	109.2	303	275	345	0.085	0.023	0.020	0.030	0.030	0.030
Heavy Duty Vehicles	Diesel 3.5 - 7.5 t	Euro I	95.8	87.1	109.2	303	275	345	0.085	0.023	0.020	0.030	0.030	0.030
Heavy Duty Vehicles	Diesel 7.5 - 16 t	Conventional	186.8	147.0	169.1	590	465	534	0.085	0.023	0.020	0.030	0.030	0.030
Heavy Duty Vehicles	Diesel 7.5 - 16 t	Euro I	186.8	147.0	169.1	590	465	534	0.085	0.023	0.020	0.030	0.030	0.030
Heavy Duty Vehicles	Diesel 16 - 32 t	Conventional	295.3	227.0	230.7	933	717	729	0.175	0.080	0.070	0.030	0.030	0.030
Heavy Duty Vehicles	Diesel 16 - 32 t	Euro I	295.3	227.0	230.7	933	717	729	0.175	0.080	0.070	0.030	0.030	0.030
Heavy Duty Vehicles	Diesel >32t	Conventional	392.8	311.5	297.4	1241	984	940	0.175	0.080	0.070	0.030	0.030	0.030
Heavy Duty Vehicles	Diesel >32t	Euro I	392.8	311.5	297.4	1241	984	940	0.175	0.080	0.070	0.030	0.030	0.030
Buses	Urban Buses	Conventional	315.8	253.3	219.0	998	800	692	0.175	0.080	0.070	0.030	0.030	0.030
Buses	Urban Buses	Euro I	315.8	253.3	219.0	998	800	692	0.175	0.080	0.070	0.030	0.030	0.030
Buses	Coaches	Conventional	281.8	214.6	198.3	890	678	627	0.175	0.080	0.070	0.030	0.030	0.030
Buses	Coaches	Euro I	281.8	214.6	198.3	890	678	627	0.175	0.080	0.070	0.030	0.030	0.030
Mopeds	<50 cm³	Conventional	25.0	25.0	0.0	80	80	0	0.219	0.000	0.000	0.001	0.000	0.000
Motorcycles	2-stroke >50 cm³	Conventional	30.4	32.4	37.0	97	104	118	0.150	0.150	0.150	0.002	0.002	0.002
Motorcycles	4-stroke <250 cm³	Conventional	23.2	26.7	35.6	74	85	114	0.200	0.200	0.200	0.002	0.002	0.002
Motorcycles	4-stroke 250 - 750 cm³	Conventional	28.6	28.6	34.7	92	92	111	0.200	0.200	0.200	0.002	0.002	0.002
Motorcycles	4-stroke >750 cm³	Conventional	37.5	34.4	38.6	120	110	123	0.200	0.200	0.200	0.002	0.002	0.002

Sector	Subsector	Tech	COu	COr	COh	NOxu	NOxr	NOxh	NMVOCu	NMVOCr	NMVOCh
Passenger Cars	Gasoline <1.4 l	PRE ECE	27.505	19.333	15.520	1.849	2.062	2.023	2.262	1.568	1.221
Passenger Cars	Gasoline <1.4 l	ECE 15/00-01	18.966	14.480	18.620	1.849	2.062	2.023	1.770	1.227	1.095
Passenger Cars	Gasoline <1.4 l	ECE 15/02	15.859	8.200	8.260	1.619	2.102	2.909	1.757	1.032	0.924
Passenger Cars	Gasoline <1.4 l	ECE 15/03	16.752	8.793	7.620	1.680	2.253	3.276	1.757	1.032	0.924
Passenger Cars	Gasoline <1.4 l	ECE 15/04	9.087	4.956	4.292	1.691	2.089	2.662	1.388	0.866	0.672
Passenger Cars	Gasoline <1.4 l	Euro I	1.898	0.557	3.176	0.314	0.356	0.593	0.175	0.064	0.082
Passenger Cars	Gasoline 1.4 - 2.0 l	PRE ECE	27.505	19.333	15.520	2.164	2.683	3.130	2.262	1.568	1.221
Passenger Cars	Gasoline 1.4 - 2.0 l	ECE 15/00-01	18.966	14.480	18.620	2.164	2.683	3.130	1.770	1.227	1.095
Passenger Cars	Gasoline 1.4 - 2.0 l	ECE 15/02	15.859	8.200	8.260	1.831	2.377	3.283	1.757	1.032	0.924
Passenger Cars	Gasoline 1.4 - 2.0 l	ECE 15/03	16.752	8.793	7.620	1.917	2.580	3.472	1.757	1.032	0.924
Passenger Cars	Gasoline 1.4 - 2.0 l	ECE 15/04	9.087	4.956	4.292	2.122	2.757	3.524	1.388	0.866	0.672
Passenger Cars	Gasoline 1.4 - 2.0 l	Euro I	2.583	0.937	2.402	0.323	0.349	0.530	0.138	0.066	0.067
Passenger Cars	Gasoline >2.0 l	PRE ECE	27.505	19.333	15.520	2.860	4.090	5.500	2.262	1.568	1.221
Passenger Cars	Gasoline >2.0 l	ECE 15/00-01	18.966	14.480	18.620	2.860	4.090	5.500	1.770	1.227	1.095
Passenger Cars	Gasoline >2.0 l	ECE 15/02	15.859	8.200	8.260	2.066	2.675	3.680	1.757	1.032	0.924
Passenger Cars	Gasoline >2.0 l	ECE 15/03	16.752	8.793	7.620	2.806	3.441	4.604	1.757	1.032	0.924
Passenger Cars	Gasoline >2.0 l	ECE 15/04	9.087	4.956	4.292	2.293	2.750	3.687	1.388	0.866	0.672
Passenger Cars	Gasoline >2.0 l	Euro I	3.838	0.814	0.976	0.427	0.406	0.521	0.232	0.147	0.105
Passenger Cars	Diesel <2.0 l	Euro I	0.432	0.109	0.165	0.679	0.488	0.619	0.073	0.028	0.020
Passenger Cars	Diesel <2.0 l	Conventional	0.651	0.472	0.384	0.520	0.433	0.528	0.141	0.081	0.052
Passenger Cars	Diesel >2.0 l	Euro I	0.432	0.109	0.165	0.679	0.488	0.619	0.073	0.028	0.020
Passenger Cars	Diesel >2.0 l	Conventional	0.651	0.472	0.384	0.824	0.723	0.861	0.141	0.081	0.052
Passenger Cars	LPG	Conventional	2.043	2.373	9.723	2.203	2.584	2.861	1.002	0.632	0.465
Passenger Cars	2-Stroke	Conventional	20.700	7.500	8.700	0.300	1.020	0.720	15.250	7.160	5.875

Sector	Subsector	Tech	COu	COr	COh	NOxu	NOxr	NOxh	NMVOCu	NMVOCr	NMVOCh
Light Duty Vehicles	Gasoline <3.5t	Conventional	14.925	6.075	7.389	2.671	3.118	3.387	1.727	0.689	0.421
Light Duty Vehicles	Gasoline <3.5t	Euro I	4.187	0.862	1.087	0.427	0.400	0.429	0.181	0.090	0.062
Light Duty Vehicles	Diesel <3.5 t	Conventional	1.124	1.009	1.060	1.673	0.843	0.834	0.126	0.101	0.096
Light Duty Vehicles	Diesel <3.5 t	Euro I	0.393	0.328	0.423	1.138	0.975	1.022	0.126	0.101	0.096
Heavy Duty Vehicles	Gasoline >3.5 t	Conventional	70.000	55.000	55.000	4.500	7.500	7.500	6.860	5.390	3.430
Heavy Duty Vehicles	Diesel 3.5 - 7.5 t	Conventional	3.156	2.170	1.777	3.247	2.169	2.615	1.688	1.082	0.838
Heavy Duty Vehicles	Diesel 3.5 - 7.5 t	Euro I	3.156	2.170	1.777	3.247	2.169	2.615	1.688	1.082	0.838
Heavy Duty Vehicles	Diesel 7.5 - 16 t	Conventional	3.156	2.170	1.777	6.684	4.293	4.091	1.688	1.082	0.838
Heavy Duty Vehicles	Diesel 7.5 - 16 t	Euro I	3.156	2.170	1.777	6.684	4.293	4.091	1.688	1.082	0.838
Heavy Duty Vehicles	Diesel 16 - 32 t	Conventional	3.156	2.170	1.777	12.561	9.060	7.610	1.598	1.025	0.788
Heavy Duty Vehicles	Diesel 16 - 32 t	Euro I	3.156	2.170	1.777	12.561	9.060	7.610	1.598	1.025	0.788
Heavy Duty Vehicles	Diesel >32t	Conventional	3.156	2.170	1.777	18.269	13.523	11.517	1.598	1.025	0.788
Heavy Duty Vehicles	Diesel >32t	Euro I	3.156	2.170	1.777	18.269	13.523	11.517	1.598	1.025	0.788
Buses	Urban Buses	Conventional	4.687	3.204	2.494	15.288	11.731	9.853	1.138	0.696	0.479
Buses	Urban Buses	Euro I	4.687	3.204	2.494	15.288	11.731	9.853	1.138	0.696	0.479
Buses	Coaches	Conventional	3.227	2.053	1.612	12.210	8.260	7.844	1.713	1.090	0.837
Buses	Coaches	Euro I	3.227	2.053	1.612	12.210	8.260	7.844	1.713	1.090	0.837
Mopeds	<50 cm^3	Conventional	15.000	15.000	0.000	0.030	0.030	0.000	8.781	9.000	0.000
Mopeds	<50 cm^3	97/24/EC I	15.000	15.000	0.000	0.030	0.030	0.000	8.781	9.000	0.000
Motorcycles	2-stroke >50 cm^3	Conventional	23.380	25.490	27.500	0.032	0.088	0.133	9.190	8.252	8.210
Motorcycles	4-stroke <250 cm^3	Conventional	22.380	26.300	38.600	0.130	0.242	0.362	1.350	0.760	1.120
Motorcycles	4-stroke 250 - 750 cm^3	Conventional	20.440	21.517	25.810	0.136	0.251	0.374	1.150	0.744	0.810
Motorcycles	4-stroke >750 cm^3	Conventional	14.880	18.030	24.300	0.148	0.266	0.392	2.320	1.410	0.990

Annex 5: Reduction factors for road transport emission factors

Sector	Subsector	Tech	COuR	COrR	COhR	NOxuR	NOxrR	NOxhR	VOCuR	VOCrR	VOChR
Passenger Cars	Gasoline <1.4 l	Euro I - 91/441/EEC	0	0	0	0	0	0	0	0	0
Passenger Cars	Gasoline <1.4 l	Euro II - 94/12/EC	32	32	32	64	64	64	79	79	79
Passenger Cars	Gasoline <1.4 l	Euro III - 98/69/EC Stage2000	44	44	44	76	76	76	85	85	85
Passenger Cars	Gasoline <1.4 l	Euro IV - 98/69/EC Stage2005	66	66	66	87	87	87	97	97	97
Passenger Cars	Gasoline 1.4 - 2.0 l	Euro I - 91/441/EEC	0	0	0	0	0	0	0	0	0
Passenger Cars	Gasoline 1.4 - 2.0 l	Euro II - 94/12/EC	32	32	32	64	64	64	79	79	79
Passenger Cars	Gasoline 1.4 - 2.0 l	Euro III - 98/69/EC Stage2000	44	44	44	76	76	76	86	86	86
Passenger Cars	Gasoline 1.4 - 2.0 l	Euro IV - 98/69/EC Stage2005	66	66	66	87	87	87	97	97	97
Passenger Cars	Gasoline >2.0 l	Euro I - 91/441/EEC	0	0	0	0	0	0	0	0	0
Passenger Cars	Gasoline >2.0 l	Euro II - 94/12/EC	32	32	32	64	64	64	76	76	76
Passenger Cars	Gasoline >2.0 l	Euro III - 98/69/EC Stage2000	44	44	44	76	76	76	84	84	84
Passenger Cars	Gasoline >2.0 l	Euro IV - 98/69/EC Stage2005	65	65	65	87	87	87	95	95	95
Passenger Cars	Diesel <2.0 l	Euro I - 91/441/EEC	0	0	0	0	0	0	0	0	0
Passenger Cars	Diesel <2.0 l	Euro II - 94/12/EC	0	0	0	0	0	0	0	0	0
Passenger Cars	Diesel <2.0 l	Euro III - 98/69/EC Stage2000	0	0	0	23	23	23	15	15	15
Passenger Cars	Diesel <2.0 l	Euro IV - 98/69/EC Stage2005	0	0	0	62	62	62	31	31	31
Passenger Cars	Diesel >2.0 l	Euro I - 91/441/EEC	0	0	0	0	0	0	0	0	0
Passenger Cars	Diesel >2.0 l	Euro II - 94/12/EC	0	0	0	0	0	0	0	0	0
Passenger Cars	Diesel >2.0 l	Euro III - 98/69/EC Stage2000	0	0	0	23	23	23	15	15	15
Passenger Cars	Diesel >2.0 l	Euro IV - 98/69/EC Stage2005	0	0	0	62	62	62	31	31	31
Light Duty Vehicles	Gasoline <3.5t	Euro I - 93/59/EEC	0	0	0	0	0	0	0	0	0
Light Duty Vehicles	Gasoline <3.5t	Euro II - 96/69/EC	39	39	39	66	66	66	76	76	76
Light Duty Vehicles	Gasoline <3.5t	Euro III - 98/69/EC Stage2000	48	48	48	79	79	79	86	86	86
Light Duty Vehicles	Gasoline <3.5t	Euro IV - 98/69/EC Stage2005	72	72	72	90	90	90	94	94	94
Light Duty Vehicles	Diesel <3.5 t	Euro I - 93/59/EEC	0	0	0	0	0	0	0	0	0
Light Duty Vehicles	Diesel <3.5 t	Euro II - 96/69/EC	0	0	0	0	0	0	0	0	0
Light Duty Vehicles	Diesel <3.5 t	Euro III - 98/69/EC Stage2000	18	18	18	35	35	35	38	38	38
Light Duty Vehicles	Diesel <3.5 t	Euro IV - 98/69/EC Stage2005	35	35	35	67	67	67	77	77	77

Sector	Subsector	Tech	COuR	COrR	COhR	NOxuR	NOxrR	NOxhR	VOCuR	VOCrR	VOChR
Heavy Duty Vehicles	Diesel 3.5 - 7.5 t	Conventional	0	0	0	0	0	0	0	0	0
Heavy Duty Vehicles	Diesel 3.5 - 7.5 t	Euro I - 91/542/EEC Stage I	50	40	45	30	30	10	25	25	25
Heavy Duty Vehicles	Diesel 3.5 - 7.5 t	Euro II - 91/542/EEC Stage II	60	45	50	50	45	35	30	30	30
Heavy Duty Vehicles	Diesel 3.5 - 7.5 t	Euro III - 2000 Standards	72	61.5	65	65	61.5	54.5	51	51	51
Heavy Duty Vehicles	Diesel 3.5 - 7.5 t	Euro IV - 2005 Standards	79.6	71.9	74.5	75.5	73.1	68.2	65.7	65.7	65.7
Heavy Duty Vehicles	Diesel 3.5 - 7.5 t	Euro V - 2008 Standards	79.6	71.9	74.5	86	84.6	81.8	65.7	65.7	65.7
Heavy Duty Vehicles	Diesel 7.5 - 16 t	Conventional	0	0	0	0	0	0	0	0	0
Heavy Duty Vehicles	Diesel 7.5 - 16 t	Euro I - 91/542/EEC Stage I	50	40	45	30	30	10	25	25	25
Heavy Duty Vehicles	Diesel 7.5 - 16 t	Euro II - 91/542/EEC Stage II	60	45	50	50	45	35	30	30	30
Heavy Duty Vehicles	Diesel 7.5 - 16 t	Euro III - 2000 Standards	72	61.5	65	65	61.5	54.5	51	51	51
Heavy Duty Vehicles	Diesel 7.5 - 16 t	Euro IV - 2005 Standards	79.6	71.9	74.5	75.5	73.1	68.2	65.7	65.7	65.7
Heavy Duty Vehicles	Diesel 7.5 - 16 t	Euro V - 2008 Standards	79.6	71.9	74.5	86	84.6	81.8	65.7	65.7	65.7
Heavy Duty Vehicles	Diesel 16 - 32 t	Conventional	0	0	0	0	0	0	0	0	0
Heavy Duty Vehicles	Diesel 16 - 32 t	Euro I - 91/542/EEC Stage I	45	40	35	45	40	45	50	35	25
Heavy Duty Vehicles	Diesel 16 - 32 t	Euro II - 91/542/EEC Stage II	55	50	35	60	55	55	55	40	35
Heavy Duty Vehicles	Diesel 16 - 32 t	Euro III - 2000 Standards	68.5	65	54.5	72	68.5	68.5	68.5	58	54.5
Heavy Duty Vehicles	Diesel 16 - 32 t	Euro IV - 2005 Standards	77	74.5	66.8	80.4	78	78	78	70.6	68.2
Heavy Duty Vehicles	Diesel 16 - 32 t	Euro V - 2008 Standards	77	74.5	66.8	88.8	87.4	87.4	78	70.6	68.2
Heavy Duty Vehicles	Diesel >32t	Conventional	0	0	0	0	0	0	0	0	0
Heavy Duty Vehicles	Diesel >32t	Euro I - 91/542/EEC Stage I	45	40	35	45	40	45	50	35	25
Heavy Duty Vehicles	Diesel >32t	Euro II - 91/542/EEC Stage II	55	50	35	60	55	55	55	40	35
Heavy Duty Vehicles	Diesel >32t	Euro III - 2000 Standards	68.5	65	54.5	72	68.5	68.5	68.5	58	54.5
Heavy Duty Vehicles	Diesel >32t	Euro IV - 2005 Standards	77	74.5	66.8	80.4	78	78	78	70.6	68.2
Heavy Duty Vehicles	Diesel >32t	Euro V - 2008 Standards	77	74.5	66.8	88.8	87.4	87.4	78	70.6	68.2
Buses	Urban Buses	Conventional	0	0	0	0	0	0	0	0	0
Buses	Urban Buses	Euro I - 91/542/EEC Stage I	50	40	45	30	30	10	25	25	25
Buses	Urban Buses	Euro II - 91/542/EEC Stage II	60	45	50	50	45	35	30	30	30
Buses	Urban Buses	Euro III - 2000 Standards	72	61.5	65	65	61.5	54.5	51	51	51
Buses	Urban Buses	Euro IV - 2005 Standards	79.6	71.9	74.5	75.5	73.1	68.2	65.7	65.7	65.7
Buses	Urban Buses	Euro V - 2008 Standards	79.6	71.9	74.5	86	84.6	81.8	65.7	65.7	65.7
Buses	Coaches	Conventional	0	0	0	0	0	0	0	0	0
Buses	Coaches	Euro I - 91/542/EEC Stage I	45	40	35	45	40	45	50	35	25
Buses	Coaches	Euro II - 91/542/EEC Stage II	55	50	35	60	55	55	55	40	35
Buses	Coaches	Euro III - 2000 Standards	68.5	65	54.5	72	68.5	68.5	68.5	58	54.5
Buses	Coaches	Euro IV - 2005 Standards	77	74.5	66.8	80.4	78	78	78	70.6	68.2
Buses	Coaches	Euro V - 2008 Standards	77	74.5	66.8	88.8	87.4	87.4	78	70.6	68.2

Sector	Subsector	Tech	COuR	COrR	COhR	NOxuR	NOxrR	NOxhR	VOCuR	VOCrR	VOChR
Mopeds	<50 cm³	Conventional	0	0	0	0	0	0	0	0	0
Mopeds	<50 cm³	97/24/EC Stage I	50	50	100	0	0	100	55	55	100
Mopeds	<50 cm³	97/24/EC Stage II	90	90	100	67	67	100	78	78	100
Motorcycles	2-stroke >50 cm³	97/24/EC	0	0	0	0	0	0	0	0	0
Motorcycles	2-stroke >50 cm³	97/24/EC Stage II (proposal)	31	31	31	-200	-200	-200	70	70	70
Motorcycles	2-stroke >50 cm³	97/24/EC Stage III (proposal)	75	75	75	-50	-50	-50	80	80	80
Motorcycles	4-stroke <250 cm³	97/24/EC	0	0	0	0	0	0	0	0	0
Motorcycles	4-stroke <250 cm³	97/24/EC Stage II (proposal)	58	58	58	0	0	0	67	67	67
Motorcycles	4-stroke <250 cm³	97/24/EC Stage III (proposal)	85	85	85	50	50	50	90	90	90
Motorcycles	4-stroke 250 - 750 cm³	97/24/EC	0	0	0	0	0	0	0	0	0
Motorcycles	4-stroke 250 - 750 cm³	97/24/EC Stage II (proposal)	58	58	58	0	0	0	67	67	67
Motorcycles	4-stroke 250 - 750 cm³	97/24/EC Stage III (proposal)	85	85	85	50	50	50	90	90	90
Motorcycles	4-stroke >750 cm³	97/24/EC	0	0	0	0	0	0	0	0	0
Motorcycles	4-stroke >750 cm³	97/24/EC Stage II (proposal)	58	58	58	0	0	0	67	67	67
Motorcycles	4-stroke >750 cm³	97/24/EC Stage III (proposal)	85	85	85	50	50	50	90	90	90

Annex 6: Fuel use factors (MJ/km) and emission factors (g/km)

Sector	ForecastYear	FCu (MJ)	FCr (MJ)	FCh (MJ)	CO2u	CO2r	CO2h	CH4u	CH4r	CH4h	N2Ou	N2Or	N2Oh	SO2u	SO2r	SO2h	NOxu	NOxr	NOxh
Passenger Cars	1985	3.352	2.100	2.409	245	153	176	0.167	0.027	0.024	0.007	0.007	0.007	0.074	0.044	0.054	1.873	2.191	2.804
Passenger Cars	1986	3.317	2.090	2.391	242	153	175	0.164	0.027	0.024	0.007	0.007	0.007	0.048	0.029	0.035	1.865	2.191	2.814
Passenger Cars	1987	3.306	2.079	2.369	242	152	173	0.166	0.027	0.024	0.007	0.007	0.007	0.048	0.029	0.035	1.867	2.188	2.811
Passenger Cars	1988	3.227	2.068	2.345	236	151	171	0.157	0.027	0.024	0.007	0.007	0.007	0.046	0.028	0.034	1.848	2.188	2.816
Passenger Cars	1989	3.194	2.063	2.335	233	151	171	0.153	0.027	0.024	0.007	0.007	0.007	0.033	0.020	0.024	1.838	2.185	2.822
Passenger Cars	1990	3.180	2.062	2.327	232	151	170	0.153	0.027	0.024	0.007	0.007	0.007	0.032	0.020	0.023	1.844	2.198	2.845
Passenger Cars	1991	3.212	2.044	2.304	235	149	168	0.169	0.026	0.024	0.010	0.008	0.009	0.031	0.019	0.023	1.771	2.066	2.681
Passenger Cars	1992	3.197	2.027	2.283	234	148	167	0.174	0.026	0.023	0.013	0.008	0.011	0.022	0.014	0.016	1.690	1.944	2.531
Passenger Cars	1993	3.234	2.011	2.262	236	147	165	0.191	0.025	0.023	0.016	0.009	0.013	0.013	0.008	0.009	1.632	1.831	2.396
Passenger Cars	1994	3.229	1.990	2.234	236	145	163	0.198	0.024	0.022	0.021	0.010	0.016	0.013	0.008	0.009	1.513	1.642	2.166
Passenger Cars	1995	3.264	1.975	2.213	239	144	162	0.213	0.023	0.021	0.024	0.011	0.018	0.013	0.008	0.009	1.441	1.508	2.001
Passenger Cars	1996	3.319	1.959	2.191	243	143	160	0.236	0.022	0.021	0.028	0.012	0.020	0.013	0.008	0.009	1.378	1.379	1.841
Passenger Cars	1997	3.279	1.929	2.152	240	141	157	0.217	0.019	0.018	0.032	0.013	0.022	0.013	0.008	0.009	1.259	1.216	1.645
Passenger Cars	1998	3.305	1.917	2.136	242	140	156	0.214	0.017	0.016	0.035	0.013	0.024	0.013	0.008	0.009	1.160	1.073	1.463
Passenger Cars	1999	3.303	1.905	2.122	241	139	155	0.197	0.015	0.015	0.037	0.014	0.026	0.011	0.006	0.007	1.074	0.952	1.305
Passenger Cars	2000	3.298	1.897	2.112	241	139	154	0.189	0.014	0.014	0.039	0.015	0.027	0.008	0.004	0.005	1.011	0.862	1.187
Passenger Cars	2001	3.335	1.891	2.105	244	138	154	0.189	0.013	0.013	0.040	0.015	0.028	0.008	0.004	0.005	0.955	0.791	1.093
Passenger Cars	2002	3.309	1.885	2.098	242	138	153	0.168	0.012	0.012	0.041	0.016	0.029	0.008	0.004	0.005	0.883	0.713	0.988
Passenger Cars	2003	3.325	1.880	2.092	243	138	153	0.161	0.011	0.011	0.042	0.016	0.030	0.008	0.004	0.005	0.823	0.646	0.895
Passenger Cars	2004	3.274	1.874	2.086	240	137	153	0.138	0.010	0.010	0.043	0.017	0.030	0.008	0.004	0.005	0.759	0.580	0.804
Light Duty Vehicles	1985	4.030	2.790	3.000	298	206	222	0.049	0.010	0.008	0.016	0.016	0.016	0.802	0.573	0.627	2.056	1.143	1.171
Light Duty Vehicles	1986	4.007	2.792	3.006	296	206	222	0.045	0.009	0.007	0.016	0.016	0.016	0.485	0.348	0.381	2.037	1.121	1.146
Light Duty Vehicles	1987	4.020	2.791	3.005	297	206	222	0.046	0.009	0.008	0.016	0.016	0.016	0.485	0.347	0.379	2.045	1.127	1.153
Light Duty Vehicles	1988	3.963	2.791	3.003	293	206	222	0.044	0.009	0.008	0.016	0.016	0.016	0.477	0.346	0.379	2.011	1.132	1.158
Light Duty Vehicles	1989	3.938	2.792	3.008	291	206	222	0.041	0.009	0.007	0.016	0.016	0.016	0.319	0.233	0.255	1.992	1.116	1.140
Light Duty Vehicles	1990	3.932	2.792	3.008	290	206	222	0.041	0.009	0.007	0.016	0.016	0.016	0.319	0.233	0.255	1.988	1.115	1.139
Light Duty Vehicles	1991	3.968	2.792	3.007	293	206	222	0.043	0.009	0.007	0.016	0.016	0.016	0.321	0.233	0.254	2.011	1.117	1.142
Light Duty Vehicles	1992	3.952	2.790	3.002	292	206	222	0.044	0.010	0.008	0.016	0.016	0.016	0.206	0.150	0.164	2.006	1.137	1.164
Light Duty Vehicles	1993	3.989	2.790	3.001	295	206	222	0.046	0.010	0.008	0.016	0.016	0.016	0.081	0.058	0.063	2.028	1.139	1.167
Light Duty Vehicles	1994	3.957	2.792	3.007	292	206	222	0.043	0.009	0.007	0.016	0.016	0.016	0.081	0.059	0.064	2.005	1.118	1.143
Light Duty Vehicles	1995	3.955	2.771	2.980	292	205	220	0.045	0.009	0.007	0.016	0.016	0.016	0.080	0.058	0.063	1.957	1.120	1.149
Light Duty Vehicles	1996	3.973	2.752	2.959	293	203	219	0.046	0.009	0.007	0.017	0.016	0.016	0.080	0.057	0.062	1.918	1.100	1.130
Light Duty Vehicles	1997	3.900	2.732	2.939	288	202	217	0.041	0.009	0.007	0.017	0.016	0.017	0.079	0.057	0.062	1.826	1.077	1.108
Light Duty Vehicles	1998	3.883	2.714	2.918	287	200	216	0.041	0.008	0.007	0.018	0.016	0.017	0.078	0.056	0.062	1.770	1.064	1.097

Light Duty Vehicles	1999	3.846	2.697	2.900	284	199	214	0.038	0.008	0.007	0.018	0.016	0.017	0.043	0.031	0.034	1.701	1.042	1.076
Light Duty Vehicles	2000	3.816	2.681	2.882	282	198	213	0.036	0.008	0.007	0.018	0.016	0.017	0.009	0.006	0.007	1.640	1.027	1.061
Light Duty Vehicles	2001	3.833	2.665	2.864	283	197	212	0.036	0.007	0.006	0.019	0.016	0.018	0.009	0.006	0.007	1.602	1.011	1.047
Light Duty Vehicles	2002	3.779	2.647	2.845	279	196	210	0.031	0.007	0.006	0.019	0.016	0.018	0.009	0.006	0.007	1.487	0.962	0.998
Light Duty Vehicles	2003	3.765	2.629	2.830	278	194	209	0.028	0.006	0.006	0.019	0.017	0.018	0.009	0.006	0.007	1.404	0.914	0.948
Light Duty Vehicles	2004	3.686	2.605	2.806	272	192	207	0.023	0.006	0.005	0.019	0.017	0.018	0.009	0.006	0.007	1.279	0.868	0.903
Sector	ForecastYear	FCu (MJ)	FCr (MJ)	FCh (MJ)	CO2u	CO2r	CO2h	CH4u	CH4r	CH4h	N2Ou	N2Or	N2Oh	SO2u	SO2r	SO2h	NOxu	NOxr	NOxh
Heavy Duty Vehicles	1985	11.446	9.640	10.283	847	713	761	0.138	0.063	0.060	0.030	0.030	0.030	2.672	2.253	2.405	11.344	8.920	8.329
Heavy Duty Vehicles	1986	11.447	9.641	10.284	847	713	761	0.138	0.063	0.060	0.030	0.030	0.030	1.604	1.352	1.443	11.347	8.921	8.329
Heavy Duty Vehicles	1987	11.446	9.640	10.283	847	713	761	0.138	0.063	0.060	0.030	0.030	0.030	1.604	1.352	1.443	11.346	8.921	8.329
Heavy Duty Vehicles	1988	11.446	9.640	10.283	847	713	761	0.138	0.063	0.060	0.030	0.030	0.030	1.604	1.352	1.443	11.346	8.921	8.329
Heavy Duty Vehicles	1989	11.447	9.641	10.284	847	713	761	0.138	0.063	0.060	0.030	0.030	0.030	1.069	0.902	0.962	11.347	8.921	8.329
Heavy Duty Vehicles	1990	11.328	9.570	10.240	838	708	758	0.137	0.063	0.060	0.030	0.030	0.030	1.058	0.895	0.958	11.215	8.841	8.285
Heavy Duty Vehicles	1991	11.328	9.570	10.240	838	708	758	0.137	0.063	0.060	0.030	0.030	0.030	1.058	0.895	0.958	11.215	8.840	8.285
Heavy Duty Vehicles	1992	11.327	9.569	10.240	838	708	758	0.137	0.063	0.060	0.030	0.030	0.030	0.688	0.582	0.623	11.213	8.840	8.285
Heavy Duty Vehicles	1993	11.328	9.570	10.240	838	708	758	0.137	0.063	0.060	0.030	0.030	0.030	0.264	0.224	0.240	11.213	8.840	8.285
Heavy Duty Vehicles	1994	11.328	9.570	10.240	838	708	758	0.132	0.061	0.059	0.030	0.030	0.030	0.265	0.224	0.240	10.807	8.543	7.983
Heavy Duty Vehicles	1995	11.328	9.570	10.240	838	708	758	0.127	0.059	0.058	0.030	0.030	0.030	0.264	0.224	0.240	10.416	8.259	7.694
Heavy Duty Vehicles	1996	11.328	9.570	10.240	838	708	758	0.123	0.057	0.056	0.030	0.030	0.030	0.265	0.224	0.240	10.045	7.988	7.420
Heavy Duty Vehicles	1997	11.697	9.804	10.378	866	725	768	0.120	0.057	0.056	0.030	0.030	0.030	0.273	0.229	0.243	9.874	7.840	7.183
Heavy Duty Vehicles	1998	11.818	9.891	10.430	874	732	772	0.116	0.056	0.055	0.030	0.030	0.030	0.276	0.231	0.244	9.463	7.547	6.884
Heavy Duty Vehicles	1999	12.059	10.052	10.526	892	744	779	0.113	0.055	0.054	0.030	0.030	0.030	0.155	0.129	0.135	9.203	7.355	6.654
Heavy Duty Vehicles	2000	12.112	10.086	10.550	896	746	781	0.108	0.054	0.053	0.030	0.030	0.030	0.028	0.024	0.025	8.780	7.048	6.373
Heavy Duty Vehicles	2001	12.530	10.368	10.704	927	767	792	0.107	0.055	0.053	0.030	0.030	0.030	0.029	0.024	0.025	8.657	6.967	6.197
Heavy Duty Vehicles	2002	12.599	10.426	10.742	932	771	795	0.100	0.052	0.050	0.030	0.030	0.030	0.030	0.024	0.025	8.017	6.498	5.767
Heavy Duty Vehicles	2003	12.632	10.456	10.767	935	774	797	0.094	0.049	0.048	0.030	0.030	0.030	0.030	0.024	0.025	7.456	6.077	5.399
Heavy Duty Vehicles	2004	12.635	10.468	10.778	935	775	798	0.085	0.046	0.044	0.030	0.030	0.030	0.030	0.025	0.025	6.655	5.491	4.873
Buses	1985	13.074	10.124	8.802	967	749	651	0.175	0.080	0.070	0.030	0.030	0.030	3.062	2.371	2.061	14.418	10.279	8.603
Buses	1986	13.068	10.116	8.798	967	749	651	0.175	0.080	0.070	0.030	0.030	0.030	1.836	1.421	1.236	14.405	10.260	8.593
Buses	1987	13.057	10.101	8.790	966	747	650	0.175	0.080	0.070	0.030	0.030	0.030	1.835	1.419	1.235	14.382	10.229	8.576
Buses	1988	13.055	10.099	8.790	966	747	650	0.175	0.080	0.070	0.030	0.030	0.030	1.834	1.419	1.235	14.379	10.226	8.573
Buses	1989	13.055	10.099	8.789	966	747	650	0.175	0.080	0.070	0.030	0.030	0.030	1.223	0.946	0.823	14.379	10.225	8.573
Buses	1990	13.074	10.124	8.802	967	749	651	0.175	0.080	0.070	0.030	0.030	0.030	1.225	0.948	0.825	14.418	10.279	8.603
Buses	1991	13.099	10.158	8.820	969	752	653	0.175	0.080	0.070	0.030	0.030	0.030	1.227	0.952	0.826	14.471	10.350	8.644
Buses	1992	13.072	10.121	8.801	967	749	651	0.175	0.080	0.070	0.030	0.030	0.030	0.796	0.616	0.536	14.414	10.273	8.600
Buses	1993	13.061	10.106	8.793	966	748	651	0.175	0.080	0.070	0.030	0.030	0.030	0.306	0.237	0.206	14.390	10.241	8.582
Buses	1994	13.048	10.089	8.785	966	747	650	0.170	0.078	0.068	0.030	0.030	0.030	0.306	0.236	0.206	13.939	9.906	8.334
Buses	1995	12.897	9.901	8.699	954	733	644	0.165	0.076	0.067	0.030	0.030	0.030	0.302	0.232	0.204	13.200	9.231	7.879

Buses	1996	12.910	9.916	8.705	955	734	644	0.160	0.074	0.066	0.030	0.030	0.030	0.302	0.232	0.204	12.837	8.993	7.671
Buses	1997	12.923	9.931	8.711	956	735	645	0.154	0.072	0.064	0.030	0.030	0.030	0.303	0.233	0.204	12.239	8.618	7.352
Buses	1998	12.934	9.944	8.717	957	736	645	0.151	0.070	0.062	0.030	0.030	0.030	0.303	0.233	0.204	11.835	8.371	7.140
Buses	1999	12.939	9.950	8.720	957	736	645	0.147	0.069	0.061	0.030	0.030	0.030	0.167	0.128	0.112	11.376	8.080	6.896
Buses	2000	12.940	9.952	8.721	958	736	645	0.143	0.067	0.060	0.030	0.030	0.030	0.030	0.023	0.020	10.963	7.816	6.676
Buses	2001	12.952	9.967	8.727	958	738	646	0.141	0.066	0.059	0.030	0.030	0.030	0.030	0.023	0.020	10.661	7.634	6.521
Buses	2002	12.964	9.981	8.733	959	739	646	0.135	0.063	0.057	0.030	0.030	0.030	0.030	0.023	0.020	10.168	7.309	6.245
Buses	2003	12.976	9.996	8.740	960	740	647	0.131	0.062	0.055	0.030	0.030	0.030	0.030	0.023	0.020	9.780	7.055	6.028
Buses	2004	12.982	10.003	8.744	961	740	647	0.127	0.060	0.053	0.030	0.030	0.030	0.030	0.023	0.020	9.414	6.810	5.821
Sector	ForecastYear	FCu (MJ)	FCr (MJ)	FCh (MJ)	CO2u	CO2r	CO2h	CH4u	CH4r	CH4h	N2Ou	N2Or	N2Oh	SO2u	SO2r	SO2h	NOxu	NOxr	NOxh
Mopeds	1985	1.095	1.095		80	80		0.219	0.219		0.001	0.001		0.003	0.003		0.030	0.030	
Mopeds	1986	1.095	1.095		80	80		0.219	0.219		0.001	0.001		0.003	0.003		0.030	0.030	
Mopeds	1987	1.095	1.095		80	80		0.219	0.219		0.001	0.001		0.003	0.003		0.030	0.030	
Mopeds	1988	1.095	1.095		80	80		0.219	0.219		0.001	0.001		0.003	0.003		0.030	0.030	
Mopeds	1989	1.095	1.095		80	80		0.219	0.219		0.001	0.001		0.003	0.003		0.030	0.030	
Mopeds	1990	1.095	1.095		80	80		0.219	0.219		0.001	0.001		0.003	0.003		0.030	0.030	
Mopeds	1991	1.095	1.095		80	80		0.219	0.219		0.001	0.001		0.003	0.003		0.030	0.030	
Mopeds	1992	1.095	1.095		80	80		0.219	0.219		0.001	0.001		0.003	0.003		0.030	0.030	
Mopeds	1993	1.095	1.095		80	80		0.219	0.219		0.001	0.001		0.003	0.003		0.030	0.030	
Mopeds	1994	1.095	1.095		80	80		0.219	0.219		0.001	0.001		0.003	0.003		0.030	0.030	
Mopeds	1995	1.095	1.095		80	80		0.219	0.219		0.001	0.001		0.003	0.003		0.030	0.030	
Mopeds	1996	1.095	1.095		80	80		0.219	0.219		0.001	0.001		0.003	0.003		0.030	0.030	
Mopeds	1997	1.095	1.095		80	80		0.219	0.219		0.001	0.001		0.003	0.003		0.030	0.030	
Mopeds	1998	1.095	1.095		80	80		0.219	0.219		0.001	0.001		0.003	0.003		0.030	0.030	
Mopeds	1999	1.095	1.095		80	80		0.219	0.219		0.001	0.001		0.003	0.003		0.030	0.030	
Mopeds	2000	1.095	1.095		80	80		0.207	0.207		0.001	0.001		0.003	0.003		0.030	0.030	
Mopeds	2001	1.095	1.095		80	80		0.198	0.198		0.001	0.001		0.003	0.003		0.030	0.030	
Mopeds	2002	1.095	1.095		80	80		0.189	0.189		0.001	0.001		0.003	0.003		0.030	0.030	
Mopeds	2003	1.095	1.095		80	80		0.182	0.182		0.001	0.001		0.003	0.003		0.029	0.029	
Mopeds	2004	1.095	1.095		80	80		0.173	0.173		0.001	0.001		0.003	0.003		0.028	0.028	
Motorcycles	1985	1.307	1.318	1.578	95	96	115	0.193	0.193	0.193	0.002	0.002	0.002	0.003	0.003	0.004	0.122	0.228	0.340
Motorcycles	1986	1.307	1.318	1.578	95	96	115	0.193	0.193	0.193	0.002	0.002	0.002	0.003	0.003	0.004	0.122	0.228	0.340
Motorcycles	1987	1.307	1.318	1.578	95	96	115	0.193	0.193	0.193	0.002	0.002	0.002	0.003	0.003	0.004	0.122	0.228	0.340
Motorcycles	1988	1.307	1.318	1.578	95	96	115	0.192	0.192	0.192	0.002	0.002	0.002	0.003	0.003	0.004	0.122	0.228	0.340
Motorcycles	1989	1.307	1.318	1.578	95	96	115	0.193	0.193	0.193	0.002	0.002	0.002	0.003	0.003	0.004	0.122	0.228	0.340
Motorcycles	1990	1.307	1.318	1.578	95	96	115	0.192	0.192	0.192	0.002	0.002	0.002	0.003	0.003	0.004	0.122	0.228	0.340
Motorcycles	1991	1.307	1.318	1.578	95	96	115	0.193	0.193	0.193	0.002	0.002	0.002	0.003	0.003	0.004	0.122	0.228	0.340
Motorcycles	1992	1.307	1.318	1.578	95	96	115	0.192	0.192	0.192	0.002	0.002	0.002	0.003	0.003	0.004	0.122	0.228	0.340

Motorcycles	1993	1.307	1.318	1.578	95	96	115	0.192	0.192	0.192	0.002	0.002	0.002	0.003	0.003	0.004	0.122	0.228	0.340
Motorcycles	1994	1.307	1.318	1.578	95	96	115	0.193	0.193	0.193	0.002	0.002	0.002	0.003	0.003	0.004	0.122	0.228	0.340
Motorcycles	1995	1.307	1.318	1.578	95	96	115	0.193	0.193	0.193	0.002	0.002	0.002	0.003	0.003	0.004	0.122	0.228	0.340
Motorcycles	1996	1.307	1.318	1.578	95	96	115	0.193	0.193	0.193	0.002	0.002	0.002	0.003	0.003	0.004	0.122	0.228	0.340
Motorcycles	1997	1.307	1.318	1.578	95	96	115	0.192	0.192	0.192	0.002	0.002	0.002	0.003	0.003	0.004	0.122	0.228	0.340
Motorcycles	1998	1.307	1.318	1.578	95	96	115	0.193	0.193	0.193	0.002	0.002	0.002	0.003	0.003	0.004	0.122	0.228	0.340
Motorcycles	1999	1.307	1.318	1.578	95	96	115	0.192	0.192	0.192	0.002	0.002	0.002	0.003	0.003	0.004	0.122	0.228	0.340
Motorcycles	2000	1.307	1.318	1.578	95	96	115	0.193	0.193	0.193	0.002	0.002	0.002	0.003	0.003	0.004	0.122	0.228	0.340
Motorcycles	2001	1.307	1.317	1.578	95	96	115	0.193	0.193	0.193	0.002	0.002	0.002	0.003	0.003	0.004	0.122	0.229	0.341
Motorcycles	2002	1.307	1.317	1.578	95	96	115	0.193	0.193	0.193	0.002	0.002	0.002	0.003	0.003	0.004	0.123	0.230	0.342
Motorcycles	2003	1.307	1.316	1.577	95	96	115	0.193	0.193	0.193	0.002	0.002	0.002	0.003	0.003	0.004	0.124	0.231	0.343
Motorcycles	2004	1.307	1.315	1.577	95	96	115	0.189	0.189	0.189	0.002	0.002	0.002	0.003	0.003	0.004	0.124	0.232	0.344

Sector	ForecastYear	NMVOCu (exh)	NMVOCr (exh)	NMVOCh (exh)	NMVOCu (tot)	NMVOCr (tot)	NMVOCh (tot)	COu	COr	COh
Passenger Cars	1985	3.368	1.048	0.923	5.597	1.424	0.973	40.810	10.109	10.525
Passenger Cars	1986	3.256	1.026	0.898	5.490	1.403	0.948	38.410	9.606	9.893
Passenger Cars	1987	3.217	1.002	0.869	5.426	1.376	0.919	36.822	9.035	9.225
Passenger Cars	1988	2.958	0.974	0.833	5.260	1.363	0.885	32.048	8.298	8.333
Passenger Cars	1989	2.845	0.955	0.811	5.167	1.347	0.864	30.059	7.893	7.799
Passenger Cars	1990	2.802	0.944	0.797	5.139	1.339	0.850	29.076	7.606	7.398
Passenger Cars	1991	2.775	0.878	0.741	4.921	1.241	0.790	29.147	7.057	6.936
Passenger Cars	1992	2.593	0.816	0.689	4.621	1.159	0.735	27.232	6.547	6.560
Passenger Cars	1993	2.573	0.756	0.638	4.385	1.062	0.680	27.389	6.036	6.227
Passenger Cars	1994	2.308	0.659	0.556	3.934	0.934	0.593	24.650	5.245	5.631
Passenger Cars	1995	2.199	0.588	0.498	3.635	0.831	0.530	23.852	4.705	5.355
Passenger Cars	1996	2.157	0.520	0.441	3.374	0.726	0.468	23.919	4.182	5.079
Passenger Cars	1997	1.806	0.428	0.366	2.868	0.608	0.390	19.973	3.361	4.573
Passenger Cars	1998	1.644	0.362	0.310	2.506	0.508	0.330	18.882	2.904	4.268
Passenger Cars	1999	1.433	0.306	0.262	2.174	0.431	0.279	16.767	2.513	4.005
Passenger Cars	2000	1.303	0.265	0.228	1.799	0.349	0.239	15.681	2.247	3.841
Passenger Cars	2001	1.248	0.234	0.202	1.676	0.306	0.212	15.628	2.051	3.704
Passenger Cars	2002	1.085	0.202	0.175	1.457	0.265	0.183	13.970	1.838	3.504
Passenger Cars	2003	1.005	0.176	0.152	1.320	0.229	0.159	13.433	1.652	3.291
Passenger Cars	2004	0.845	0.149	0.130	1.114	0.195	0.136	11.564	1.465	3.059
Light Duty Vehicles	1985	0.685	0.178	0.139	0.958	0.221	0.147	6.399	1.679	1.897
Light Duty Vehicles	1986	0.642	0.172	0.136	0.896	0.212	0.143	5.948	1.629	1.834
Light Duty Vehicles	1987	0.657	0.174	0.137	0.914	0.214	0.144	6.108	1.643	1.852
Light Duty Vehicles	1988	0.622	0.175	0.137	0.893	0.217	0.145	5.803	1.653	1.864
Light Duty Vehicles	1989	0.587	0.171	0.135	0.846	0.211	0.143	5.448	1.617	1.820
Light Duty Vehicles	1990	0.582	0.171	0.135	0.841	0.211	0.142	5.404	1.615	1.818
Light Duty Vehicles	1991	0.610	0.172	0.135	0.868	0.212	0.143	5.655	1.621	1.825
Light Duty Vehicles	1992	0.621	0.177	0.138	0.902	0.220	0.146	5.805	1.665	1.879
Light Duty Vehicles	1993	0.649	0.177	0.138	0.922	0.220	0.146	6.066	1.670	1.886
Light Duty Vehicles	1994	0.604	0.172	0.135	0.867	0.213	0.143	5.604	1.623	1.827
Light Duty Vehicles	1995	0.615	0.170	0.134	0.871	0.210	0.142	5.764	1.568	1.777
Light Duty Vehicles	1996	0.615	0.164	0.130	0.836	0.198	0.137	5.754	1.466	1.668
Light Duty Vehicles	1997	0.550	0.156	0.126	0.751	0.187	0.132	5.144	1.356	1.548
Light Duty Vehicles	1998	0.533	0.151	0.123	0.709	0.178	0.128	5.022	1.273	1.461
Light Duty Vehicles	1999	0.491	0.144	0.119	0.650	0.168	0.123	4.574	1.175	1.354
Light Duty Vehicles	2000	0.462	0.138	0.116	0.574	0.156	0.119	4.313	1.097	1.271

Light Duty Vehicles	2001	0.460	0.133	0.112	0.557	0.148	0.115	4.267	1.018	1.187
Light Duty Vehicles	2002	0.403	0.123	0.105	0.484	0.136	0.108	3.749	0.912	1.070
Light Duty Vehicles	2003	0.367	0.113	0.098	0.430	0.123	0.100	3.350	0.809	0.954
Light Duty Vehicles	2004	0.305	0.103	0.091	0.351	0.110	0.092	2.770	0.692	0.826
Sector	ForecastYear	NMVOCu (exh)	NMVOCr (exh)	NMVOCh (exh)	NMVOCu (tot)	NMVOCr (tot)	NMVOCh (tot)	COu	COr	COh
Heavy Duty Vehicles	1985	1.654	1.054	0.802	1.654	1.054	0.802	3.405	2.315	1.871
Heavy Duty Vehicles	1986	1.652	1.053	0.802	1.652	1.053	0.802	3.384	2.303	1.863
Heavy Duty Vehicles	1987	1.653	1.053	0.802	1.653	1.053	0.802	3.390	2.307	1.866
Heavy Duty Vehicles	1988	1.653	1.053	0.802	1.653	1.053	0.802	3.394	2.309	1.867
Heavy Duty Vehicles	1989	1.652	1.052	0.802	1.652	1.052	0.802	3.380	2.300	1.862
Heavy Duty Vehicles	1990	1.653	1.053	0.803	1.653	1.053	0.803	3.390	2.307	1.867
Heavy Duty Vehicles	1991	1.654	1.054	0.803	1.654	1.054	0.803	3.393	2.309	1.867
Heavy Duty Vehicles	1992	1.655	1.054	0.803	1.655	1.054	0.803	3.412	2.320	1.875
Heavy Duty Vehicles	1993	1.655	1.055	0.803	1.655	1.055	0.803	3.413	2.320	1.875
Heavy Duty Vehicles	1994	1.598	1.025	0.785	1.598	1.025	0.785	3.264	2.233	1.810
Heavy Duty Vehicles	1995	1.546	0.998	0.769	1.546	0.998	0.769	3.159	2.172	1.763
Heavy Duty Vehicles	1996	1.495	0.972	0.753	1.495	0.972	0.753	3.037	2.100	1.709
Heavy Duty Vehicles	1997	1.423	0.935	0.728	1.423	0.935	0.728	2.844	1.984	1.635
Heavy Duty Vehicles	1998	1.362	0.904	0.706	1.362	0.904	0.706	2.712	1.904	1.586
Heavy Duty Vehicles	1999	1.301	0.873	0.686	1.301	0.873	0.686	2.570	1.817	1.534
Heavy Duty Vehicles	2000	1.254	0.849	0.668	1.254	0.849	0.668	2.474	1.759	1.500
Heavy Duty Vehicles	2001	1.185	0.819	0.648	1.185	0.819	0.648	2.395	1.700	1.469
Heavy Duty Vehicles	2002	1.102	0.772	0.614	1.102	0.772	0.614	2.236	1.594	1.394
Heavy Duty Vehicles	2003	1.034	0.731	0.583	1.034	0.731	0.583	2.081	1.494	1.323
Heavy Duty Vehicles	2004	0.941	0.679	0.545	0.941	0.679	0.545	1.870	1.361	1.229
Buses	1985	1.301	0.861	0.702	1.301	0.861	0.702	4.274	2.722	1.945
Buses	1986	1.303	0.863	0.703	1.303	0.863	0.703	4.268	2.716	1.941
Buses	1987	1.308	0.867	0.706	1.308	0.867	0.706	4.257	2.706	1.933
Buses	1988	1.308	0.867	0.707	1.308	0.867	0.707	4.256	2.705	1.932
Buses	1989	1.308	0.867	0.707	1.308	0.867	0.707	4.256	2.705	1.932
Buses	1990	1.301	0.861	0.702	1.301	0.861	0.702	4.274	2.722	1.945
Buses	1991	1.291	0.853	0.694	1.291	0.853	0.694	4.299	2.746	1.963
Buses	1992	1.301	0.862	0.702	1.301	0.862	0.702	4.272	2.720	1.944
Buses	1993	1.306	0.865	0.705	1.306	0.865	0.705	4.261	2.710	1.936
Buses	1994	1.271	0.846	0.693	1.271	0.846	0.693	4.067	2.604	1.861
Buses	1995	1.283	0.865	0.712	1.283	0.865	0.712	3.759	2.392	1.721
Buses	1996	1.238	0.839	0.695	1.238	0.839	0.695	3.613	2.320	1.670
Buses	1997	1.188	0.809	0.672	1.188	0.809	0.672	3.426	2.230	1.615

Buses	1998	1.155	0.789	0.656	1.155	0.789	0.656	3.307	2.174	1.582
Buses	1999	1.121	0.769	0.639	1.121	0.769	0.639	3.166	2.104	1.539
Buses	2000	1.091	0.751	0.625	1.091	0.751	0.625	3.039	2.041	1.501
Buses	2001	1.066	0.735	0.613	1.066	0.735	0.613	2.947	1.999	1.475
Buses	2002	1.020	0.705	0.588	1.020	0.705	0.588	2.801	1.918	1.419
Buses	2003	0.983	0.680	0.567	0.983	0.680	0.567	2.688	1.855	1.375
Buses	2004	0.950	0.658	0.549	0.950	0.658	0.549	2.581	1.794	1.332
Sector	ForecastYear	NMVOCu (exh)	NMVOCr (exh)	NMVOCh (exh)	NMVOCu (tot)	NMVOCr (tot)	NMVOCh (tot)	COu	COr	COh
Mopeds	1985	8.781	8.781		9.095	9.095		15.000	15.000	
Mopeds	1986	8.781	8.781		9.098	9.098		15.000	15.000	
Mopeds	1987	8.781	8.781		9.092	9.092		15.000	15.000	
Mopeds	1988	8.781	8.781		9.111	9.111		15.000	15.000	
Mopeds	1989	8.781	8.781		9.119	9.119		15.000	15.000	
Mopeds	1990	8.781	8.781		9.119	9.119		15.000	15.000	
Mopeds	1991	8.781	8.781		9.110	9.110		15.000	15.000	
Mopeds	1992	8.781	8.781		9.119	9.119		15.000	15.000	
Mopeds	1993	8.781	8.781		9.100	9.100		15.000	15.000	
Mopeds	1994	8.781	8.781		9.117	9.117		15.000	15.000	
Mopeds	1995	8.781	8.781		9.115	9.115		15.000	15.000	
Mopeds	1996	8.781	8.781		9.100	9.100		15.000	15.000	
Mopeds	1997	8.781	8.781		9.119	9.119		15.000	15.000	
Mopeds	1998	8.781	8.781		9.104	9.104		15.000	15.000	
Mopeds	1999	8.781	8.781		9.139	9.139		15.000	15.000	
Mopeds	2000	8.286	8.286		8.583	8.583		14.232	14.232	
Mopeds	2001	7.939	7.939		8.264	8.264		13.693	13.693	
Mopeds	2002	7.572	7.572		7.909	7.909		13.123	13.123	
Mopeds	2003	7.293	7.293		7.627	7.627		12.552	12.552	
Mopeds	2004	6.940	6.940		7.272	7.272		11.831	11.831	
Motorcycles	1985	2.639	2.014	2.011	3.464	2.236	2.045	20.029	22.185	27.917
Motorcycles	1986	2.639	2.014	2.011	3.470	2.237	2.045	20.029	22.185	27.917
Motorcycles	1987	2.639	2.014	2.011	3.458	2.234	2.045	20.029	22.185	27.917
Motorcycles	1988	2.639	2.015	2.011	3.495	2.244	2.047	20.029	22.185	27.917
Motorcycles	1989	2.639	2.014	2.011	3.509	2.248	2.047	20.029	22.185	27.917
Motorcycles	1990	2.639	2.014	2.011	3.511	2.248	2.047	20.029	22.185	27.917
Motorcycles	1991	2.639	2.014	2.011	3.493	2.243	2.046	20.029	22.185	27.917
Motorcycles	1992	2.639	2.015	2.011	3.509	2.248	2.047	20.029	22.185	27.917
Motorcycles	1993	2.639	2.014	2.011	3.472	2.238	2.046	20.029	22.185	27.917
Motorcycles	1994	2.639	2.014	2.011	3.506	2.247	2.047	20.029	22.185	27.917

Motorcycles	1995	2.639	2.014	2.011	3.502	2.246	2.047	20.029	22.185	27.917
Motorcycles	1996	2.639	2.014	2.011	3.472	2.238	2.045	20.029	22.185	27.917
Motorcycles	1997	2.639	2.014	2.011	3.511	2.248	2.047	20.029	22.185	27.917
Motorcycles	1998	2.639	2.014	2.011	3.481	2.240	2.046	20.029	22.185	27.917
Motorcycles	1999	2.639	2.014	2.011	3.509	2.248	2.047	20.029	22.185	27.917
Motorcycles	2000	2.639	2.014	2.011	3.325	2.198	2.039	20.029	22.185	27.917
Motorcycles	2001	2.600	1.978	1.975	3.276	2.159	2.003	20.010	22.166	27.919
Motorcycles	2002	2.562	1.941	1.938	3.252	2.126	1.967	19.990	22.146	27.922
Motorcycles	2003	2.523	1.904	1.902	3.207	2.088	1.930	19.970	22.127	27.924
Motorcycles	2004	2.453	1.848	1.846	3.147	2.034	1.874	19.591	21.708	27.410

Annex 7: Fuel use (GJ) and emissions (tons) per vehicle category and as totals

Sector	Year	FC (PJ)	SO2	NOx	NMVOC	CH4	CO	CO2	N2O	NH3
Passenger Cars	1985	64	1395	54217	69102	1862	516779	4685	176	47
Passenger Cars	1986	64	916	54954	68768	1861	494176	4713	180	48
Passenger Cars	1987	65	930	55400	68330	1890	474552	4730	182	48
Passenger Cars	1988	65	912	56462	68016	1855	428732	4764	183	49
Passenger Cars	1989	64	658	56050	66506	1811	401081	4708	184	49
Passenger Cars	1990	68	669	59653	69953	1917	409520	4968	191	52
Passenger Cars	1991	72	690	60008	70514	2183	426126	5277	254	224
Passenger Cars	1992	76	513	59977	69855	2348	420560	5540	321	410
Passenger Cars	1993	76	295	56866	65494	2519	412178	5529	370	568
Passenger Cars	1994	77	304	52694	59616	2619	376184	5608	462	839
Passenger Cars	1995	81	318	51707	57508	2917	377712	5916	555	1103
Passenger Cars	1996	83	326	48919	53498	3227	375653	6043	632	1334
Passenger Cars	1997	85	334	45598	47178	3067	326831	6207	737	1641
Passenger Cars	1998	87	347	41900	41756	3064	311583	6357	821	1884
Passenger Cars	1999	88	286	38237	36461	2835	280381	6411	885	2048
Passenger Cars	2000	87	200	35106	30061	2702	260867	6385	924	2139
Passenger Cars	2001	86	198	32109	27213	2633	252270	6317	939	2166
Passenger Cars	2002	88	201	29798	24080	2401	231251	6404	986	2258
Passenger Cars	2003	89	203	27593	21836	2314	222391	6483	1019	2317
Passenger Cars	2004	89	204	25308	18651	2020	195780	6495	1051	2347
Light Duty Vehicles	1985	16	3285	7289	2323	114	16714	1195	77	6
Light Duty Vehicles	1986	19	2345	8454	2579	126	18552	1404	92	7
Light Duty Vehicles	1987	20	2447	8885	2745	135	19802	1470	96	7
Light Duty Vehicles	1988	21	2538	9235	2835	136	20072	1528	100	7
Light Duty Vehicles	1989	22	1789	9578	2844	135	20073	1600	105	8
Light Duty Vehicles	1990	23	1913	10234	3028	144	21356	1711	113	8
Light Duty Vehicles	1991	24	1983	10653	3202	154	22762	1776	116	8
Light Duty Vehicles	1992	24	1254	10553	3269	156	22970	1742	114	8
Light Duty Vehicles	1993	23	484	10523	3287	160	23446	1732	113	8
Light Duty Vehicles	1994	25	517	11002	3314	158	23405	1834	120	9
Light Duty Vehicles	1995	25	506	10823	3292	164	23426	1814	121	16
Light Duty Vehicles	1996	25	521	10964	3249	170	23630	1870	127	24
Light Duty Vehicles	1997	26	528	10842	3036	160	21869	1890	133	31

Light Duty Vehicles	1998	25	512	10394	2818	156	20641	1840	132	37
Light Duty Vehicles	1999	25	289	10293	2660	147	19264	1862	136	43
Light Duty Vehicles	2000	25	59	10181	2422	142	18370	1876	140	49
Light Duty Vehicles	2001	26	60	10214	2390	144	18209	1914	145	57
Light Duty Vehicles	2002	27	63	10078	2217	133	16886	1987	154	64
Light Duty Vehicles	2003	29	67	10229	2128	128	16135	2118	166	69
Light Duty Vehicles	2004	32	76	10959	2066	125	15515	2399	192	83
Heavy Duty Vehicles	1985	22	5083	19694	2356	168	5140	1609	63	6
Heavy Duty Vehicles	1986	24	3387	21863	2614	187	5675	1787	70	7
Heavy Duty Vehicles	1987	23	3280	21177	2532	181	5506	1731	68	7
Heavy Duty Vehicles	1988	23	3214	20752	2482	177	5400	1696	67	7
Heavy Duty Vehicles	1989	24	2218	21478	2567	183	5568	1755	69	7
Heavy Duty Vehicles	1990	25	2325	22486	2715	193	5900	1840	73	7
Heavy Duty Vehicles	1991	26	2400	23217	2803	199	6096	1900	75	8
Heavy Duty Vehicles	1992	25	1519	22599	2731	194	5964	1849	73	7
Heavy Duty Vehicles	1993	25	578	22364	2703	192	5903	1830	73	7
Heavy Duty Vehicles	1994	27	620	23151	2816	199	6087	1963	78	8
Heavy Duty Vehicles	1995	26	611	22016	2700	190	5826	1935	77	8
Heavy Duty Vehicles	1996	27	633	22009	2719	191	5825	2003	80	8
Heavy Duty Vehicles	1997	28	643	21357	2584	187	5454	2035	79	8
Heavy Duty Vehicles	1998	29	671	21204	2574	188	5413	2122	82	8
Heavy Duty Vehicles	1999	30	384	21132	2542	190	5302	2211	84	8
Heavy Duty Vehicles	2000	29	68	19521	2380	177	4959	2141	81	8
Heavy Duty Vehicles	2001	30	70	19192	2278	177	4806	2198	81	8
Heavy Duty Vehicles	2002	29	68	17358	2081	162	4390	2148	79	8
Heavy Duty Vehicles	2003	31	74	17486	2122	165	4443	2323	85	9
Heavy Duty Vehicles	2004	31	73	15621	1946	151	4023	2306	85	8
Buses	1985	8	1855	8363	727	85	2325	586	21	2
Buses	1986	9	1213	9107	795	92	2529	639	23	2
Buses	1987	8	1187	8904	782	90	2470	625	23	2
Buses	1988	8	1191	8927	784	91	2476	627	23	2
Buses	1989	9	821	9228	811	94	2560	648	23	2
Buses	1990	9	857	9661	840	98	2685	677	24	2
Buses	1991	9	828	9358	803	94	2609	654	23	2
Buses	1992	9	531	9210	802	93	2559	646	23	2
Buses	1993	9	204	9184	804	93	2549	645	23	2
Buses	1994	9	216	9419	831	96	2583	682	25	2
Buses	1995	10	242	10075	958	105	2697	766	28	3

Buses	1996	10	238	9624	911	100	2556	752	28	3
Buses	1997	10	236	9090	866	96	2412	744	27	3
Buses	1998	10	235	8769	840	93	2330	742	27	3
Buses	1999	10	126	8234	795	89	2187	723	27	3
Buses	2000	9	22	7613	743	83	2021	693	25	3
Buses	2001	9	21	7171	702	79	1904	670	25	2
Buses	2002	9	21	6864	674	76	1822	672	25	2
Buses	2003	10	23	7153	703	80	1898	727	27	3
Buses	2004	10	24	7073	698	79	1877	747	27	3
Mopeds	1985	0	1	9	2770	67	4568	24	0	0
Mopeds	1986	0	1	8	2496	60	4114	22	0	0
Mopeds	1987	0	1	8	2364	57	3901	21	0	0
Mopeds	1988	0	1	8	2310	56	3802	20	0	0
Mopeds	1989	0	1	7	2205	53	3627	19	0	0
Mopeds	1990	0	1	7	2256	54	3711	20	0	0
Mopeds	1991	0	1	8	2320	56	3820	20	0	0
Mopeds	1992	0	1	8	2322	56	3820	20	0	0
Mopeds	1993	0	1	7	2240	54	3692	20	0	0
Mopeds	1994	0	1	7	2078	50	3419	18	0	0
Mopeds	1995	0	1	8	2303	55	3790	20	0	0
Mopeds	1996	0	1	8	2452	59	4041	22	0	0
Mopeds	1997	0	1	9	2616	63	4304	23	0	0
Mopeds	1998	0	1	9	2774	67	4570	24	0	0
Mopeds	1999	0	1	8	2489	60	4085	22	0	0
Mopeds	2000	0	1	8	2227	54	3693	21	0	0
Mopeds	2001	0	1	6	1759	42	2914	17	0	0
Mopeds	2002	0	1	7	1752	42	2907	18	0	0
Mopeds	2003	0	1	6	1669	40	2746	17	0	0
Mopeds	2004	0	1	6	1602	38	2607	18	0	0
Motorcycles	1985	0	1	46	658	45	5190	23	0	0
Motorcycles	1986	0	1	45	652	45	5135	23	0	0
Motorcycles	1987	0	1	46	654	45	5160	23	0	0
Motorcycles	1988	0	1	46	672	46	5267	24	0	0
Motorcycles	1989	0	1	46	671	46	5243	24	0	0
Motorcycles	1990	0	1	50	724	50	5653	25	1	1
Motorcycles	1991	0	1	54	780	54	6111	27	1	1
Motorcycles	1992	0	1	57	832	57	6498	29	1	1
Motorcycles	1993	0	1	59	850	59	6695	30	1	1

Motorcycles	1994	0	1	59	857	59	6698	30	1	1
Motorcycles	1995	0	1	62	903	62	7063	32	1	1
Motorcycles	1996	0	1	66	949	65	7473	33	1	1
Motorcycles	1997	0	1	72	1040	71	8123	36	1	1
Motorcycles	1998	1	1	77	1104	76	8673	39	1	1
Motorcycles	1999	1	1	81	1170	80	9143	41	1	1
Motorcycles	2000	1	1	87	1208	86	9811	44	1	1
Motorcycles	2001	1	1	93	1275	92	10514	47	1	1
Motorcycles	2002	1	2	100	1346	99	11215	50	1	1
Motorcycles	2003	1	2	107	1413	105	11956	54	1	1
Motorcycles	2004	1	2	118	1514	113	12849	59	1	1
Total	1985	111	11620	89618	77938	2341	550715	8123	339	62
Total	1986	117	7861	94432	77903	2371	530183	8588	366	64
Total	1987	117	7846	94420	77406	2398	511392	8600	369	65
Total	1988	118	7856	95431	77098	2361	465749	8658	374	66
Total	1989	119	5486	96389	75603	2322	438153	8754	382	66
Total	1990	126	5766	102091	79517	2456	448826	9241	402	70
Total	1991	131	5902	103297	80422	2739	467522	9654	471	243
Total	1992	134	3819	102403	79811	2904	462370	9825	532	429
Total	1993	133	1562	99004	75378	3076	454463	9785	579	586
Total	1994	138	1658	96332	69511	3181	418376	10135	686	859
Total	1995	143	1679	94690	67664	3493	420514	10483	782	1131
Total	1996	146	1720	91590	63777	3813	419178	10723	868	1370
Total	1997	149	1743	86967	57320	3644	368994	10936	977	1684
Total	1998	151	1766	82353	51865	3644	353211	11124	1063	1933
Total	1999	153	1087	77984	46118	3400	320362	11270	1134	2104
Total	2000	152	351	72515	39042	3244	299720	11159	1172	2200
Total	2001	152	351	68785	35617	3167	290617	11163	1191	2234
Total	2002	154	355	64205	32150	2913	268471	11279	1244	2334
Total	2003	159	369	62574	29871	2832	259570	11722	1298	2398
Total	2004	164	378	59085	26477	2526	232650	12024	1357	2443

Annex 8: COPERT III:DEA statistics fuel use ratios and mileage adjustment factors

		1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Fuel ratio	DEA:COPERT III	0.89	0.88	0.87	0.89	0.86	0.91	0.96	1.00	1.00	0.96	0.98	0.97	0.96	0.95	0.92	0.92	0.92	0.93	0.93	0.93
	DEA:COPERT III	1.50	1.59	1.55	1.55	1.61	1.70	1.75	1.69	1.68	1.75	1.67	1.68	1.67	1.65	1.61	1.54	1.50	1.49	1.58	1.61
Mileage factor	DEA:COPERT III	0.89	0.88	0.87	0.89	0.86	0.91	0.96	1.00	1.00	0.96	0.98	0.97	0.96	0.95	0.92	0.92	0.92	0.93	0.93	0.93
	DEA:COPERT III	1.60	1.71	1.65	1.66	1.72	1.83	1.90	1.83	1.82	1.90	1.80	1.82	1.81	1.79	1.75	1.67	1.63	1.64	1.77	1.84

Annex 9: Basis fuel use and emission factors, deterioration factors, transient factors 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	NH_3	TSP	Fuel
					[g/kWh]			
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	NH_3	TSP	Fuel
				[g/kWh]						
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/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 use and emission factors LPG fork lifts

NO_x [g/kWh]	VOC [g/kWh]	CO [g/kWh]	NH_3 [g/kWh]	N_2O [g/kWh]	TSP [g/kWh]	FC [g/kWh]
19	2.2	1.5	0.003	0.05	0.07	311

Fuel use and emission factors for All Terrain Vehicles (ATV's)

ATV type	NO_x [g/GJ]	VOC [g/GJ]	CO [g/GJ]	NH_3 [g/GJ]	N_2O [g/GJ]	TSP [g/GJ]	Fuel [kg/hour]
Professional	108	1077	16306	2	2	32	1.125
Private	128	1527	22043	2	2	39	0.75

Fuel use 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/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

Annex 10: Stock and activity data for non-road working machinery and equipment

Stock data for diesel tractors 1985-2004

Size (kW)	Emission Level	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
37	<1981	3882	3792	3542	3543	3403	3234	3106	2922	2861	2610	2605	2273	2193	1918	1796	1601	1442	1282	1121	961
37	1981-1990	635	731	760	835	855	879	889	883	915	887	945	883	918	869	888	871	871	871	871	871
37	1991-Stage I							25	107	153	201	278	354	445	496	554	568	569	569	569	569
37	Stage I																	33	55	81	81
37	Stage II																				26
45	<1981	25988	25387	23709	23718	22781	21650	20796	19563	19154	17475	17441	15219	14684	12840	12025	10715	9652	8580	7507	6435
45	1981-1990	5740	6808	7263	8075	8476	8770	8867	8805	9128	8848	9419	8807	9151	8668	8856	8681	8688	8688	8688	8688
45	1991-Stage I							203	202	209	203	216	202	210	199	203	199	199	199	199	199
49	1991-Stage I								154	281	485	602	618	702	749	765	750	750	750	750	750
52	1991-Stage I															247	358	359	359	359	359
52	Stage I																	132	239	368	368
52	Stage II																				129
56	1991-Stage I								201	338	428	747	943	1181	1280	1307	1281	1282	1282	1282	1282
60	<1981	54651	53387	49857	49877	47907	45529	43732	41140	40278	36747	36676	32004	30879	27001	25287	22533	20297	18042	15787	13532
60	1981-1990	11751	14613	15795	17797	19395	20542	20770	20624	21380	20725	22063	20628	21434	20304	20744	20333	20351	20351	20351	20351
60	1991-Stage I							863	857	888	861	917	857	891	844	862	845	846	846	846	846
63	1991-Stage I								468	855	1325	2014	2384	2837	3011	3076	3015	3018	3018	3018	3018
67	1991-Stage I															671	1343	1344	1344	1344	1344
67	Stage I																	530	824	1088	1088
67	Stage II																				263
71	1991-Stage I								411	715	1179	1949	2507	3344	3594	3672	3600	3603	3603	3603	3603
78	<1981	14558	14221	13281	13286	12761	12128	11649	10959	10729	9789	9770	8525	8226	7192	6736	6002	5407	4806	4205	3605
78	1981-1990	4592	6152	7196	8559	10026	11323	11448	11368	11785	11424	12162	11371	11815	11192	11434	11208	11218	11218	11218	11218
78	1991-Stage I							1233	1503	1713	1945	2429	2561	2946	2994	3287	3436	3709	3709	3709	3709
78	Stage I																		321	321	321
78	Stage II																			222	443
86	1991-Stage I								108	193	333	589	880	1364	1532	1718	1876	2013	2013	2013	2013
86	Stage I																		133	133	133
86	Stage II																			89	178
93	1991-Stage I															149	245	323	323	323	323
93	Stage I																		112	112	112

93	Stage II																			104	208
97	1991-Stage I								71	175	443	962	1556	2327	2638	2695	2642	2644	2644	2644	2644
101	<1981	4659	4551	4250	4252	4084	3881	3728	3507	3433	3132	3126	2728	2632	2302	2156	1921	1730	1538	1346	1153
101	1981-1990	1158	1434	1618	1921	2156	2377	2403	2387	2474	2398	2553	2387	2480	2350	2400	2353	2355	2355	2355	2355
101	1991-Stage I							266	264	274	266	283	264	275	260	696	1116	1559	1559	1559	1559
101	Stage I																		229	229	229
101	Stage II																			133	265
112	1991-Stage I								63	114	166	252	422	690	790	978	1265	1618	1618	1618	1618
112	Stage I																		459	459	459
112	Stage II																			329	659
127	1991-Stage I								12	36	81	193	279	408	457	590	707	843	843	843	843
127	Stage I																		150	150	150
127	Stage II																			77	153
131	<1981	798	780	728	728	700	665	639	601	588	537	536	467	451	394	369	329	296	263	231	198
131	1981-1990	288	421	500	651	753	887	897	890	923	895	952	890	925	876	895	878	878	878	878	878
131	1991-Stage I							97	97	100	97	103	97	100	95	97	95	95	95	95	95
157	1981-1990		2	3	6	11	15	15	15	16	15	16	15	16	15	15	15	15	15	15	15
157	1991-Stage I							9	23	39	102	232	357	545	648	784	900	901	901	901	901
157	Stage I																	88	88	88	88
157	Stage II																		147	406	665
186	1991-Stage I															23	53	53	53	53	53
186	Stage I																	47	47	47	47
186	Stage II																		67	202	337

Stock data for gasoline tractors 1985-2004

Size (kW)	Emission Level	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Certified	<1981	13176	12541	11906	11270	10635	10000	9053	8148	7285	6465	5687	4951	4258	3607	2998	2432	1908	1427	987	591
Non certified	<1981	26352	25082	23811	22541	21270	20000	19042	18041	16998	15913	14785	13616	12403	11149	9852	8512	7131	5707	4240	2732

Stock data for harvesters 1985-2004

Size Group	Emission Level	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
0<S<=50	<1981	26601	24394	22599	22144	19842	18915	17241	15607	14575	12673	10700	9491	6966	5446	3589	2873	1743	1169	659	217
0<S<=50	1981-1990	519	534	550	582	566	591	594	601	635	636	633	683	641	686	672	715	713	713	713	713
50<S<=60	<1981	2703	2648	2634	2785	2711	2828	2847	2876	3040	3044	3029	3271	3068	2930	2235	1999	1477	1155	784	316
50<S<=60	1981-1990	853	1102	1164	1275	1258	1333	1341	1355	1432	1434	1427	1541	1446	1548	1516	1612	1609	1609	1609	1609
50<S<=60	1991-Stage I							8	8	8	8	8	9	9	9	9	10	10	10	10	10
60<S<=70	<1981	1786	1750	1741	1841	1792	1869	1881	1901	2009	2012	2002	2162	2028	2171	2127	2073	1550	1228	857	390
60<S<=70	1981-1990	1138	1679	1943	2237	2213	2348	2363	2388	2524	2527	2515	2716	2547	2727	2671	2841	2834	2834	2834	2834
60<S<=70	1991-Stage I							8	16	18	21	22	24	23	24	24	25	25	25	25	25
70<S<=80	<1981	929	910	905	958	932	972	979	989	1045	1046	1041	1125	1055	1129	1106	1176	1174	1013	642	174
70<S<=80	1981-1990	383	699	1026	1165	1318	1493	1502	1518	1604	1606	1598	1726	1619	1733	1698	1806	1802	1802	1802	1802
70<S<=80	1991-Stage I							72	77	83	86	87	96	91	98	96	102	102	102	102	102
70<S<=80	Stage I															1	1	1	1	1	1
80<S<=90	<1981	323	317	315	333	324	338	340	344	363	364	362	391	367	393	385	409	408	408	408	174
80<S<=90	1981-1990	383	562	645	967	1107	1466	1475	1491	1575	1577	1570	1695	1590	1702	1667	1773	1769	1769	1769	1769
80<S<=90	1991-Stage I							61	158	181	200	200	217	207	222	217	231	231	231	231	231
80<S<=90	Stage I															1	1	1	1	1	1
90<S<=100	1981-1990	89	175	235	387	515	670	674	681	720	721	717	775	726	778	762	810	808	808	808	808
90<S<=100	1991-Stage I							180	257	320	329	351	382	367	393	385	410	409	409	409	409
90<S<=100	Stage I															1	1	1	1	1	1
100<S<=120	1981-1990		54	106	219	334	589	592	599	633	634	630	681	639	684	670	712	711	711	711	711
100<S<=120	1991-Stage I							129	253	316	375	440	567	586	673	660	702	700	700	700	700
100<S<=120	Stage I															2	2	2	2	2	2
120<S<=140	1981-1990				4	69	183	184	186	197	197	196	212	199	213	208	222	221	221	221	221
120<S<=140	1991-Stage I							70	148	189	215	319	484	626	804	860	918	920	920	920	920
120<S<=140	Stage I															21	26	30	30	30	30
120<S<=140	Stage II																		5	8	10
140<S<=160	1991-Stage I								8	36	69	112	271	354	554	632	715	747	747	747	747
140<S<=160	Stage II																		24	41	55
160<S<=180	1991-Stage I											26	69	200	374	440	534	566	566	566	566
160<S<=180	Stage II																		39	66	89
180<S<=200	1991-Stage I												20	67	117	193	249	282	282	282	282
180<S<=200	Stage II																		59	86	109
200<S<=220	1991-Stage I														45	92	143	175	175	175	175
200<S<=220	Stage II																		39	66	89
220<S<=240	1991-Stage I															3	48	142	142	142	142

220<S<=240	Stage II					74	113	146
240<S<=260	1991-Stage I	3	71	133	133	133	133	
240<S<=260	Stage II					74	125	168
260<S<=280	1991-Stage I	14	61	123	123	123	123	
260<S<=280	Stage II					74	125	168
280<S<=300	1991-Stage I			31	31	31	31	
280<S<=300	Stage II					74	125	168
300<S<=320	Stage II						26	47

Stock data for fork lifts 1985-2004

Fuel type	Size (kW)	Emission Level	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Diesel	35	<1981	387	361	336	311	285	260	234	209	183	158	133	107	84	58	30					
Diesel	35	1981-1990	120	162	202	239	270	297	297	297	297	297	297	297	297	297	297	297	277	249	232	198
Diesel	35	1991-Stage I							26	49	65	93	131	168	218	247	275	304	304	304	304	304
Diesel	35	Stage II																	23	53	75	89
Diesel	45	<1981	1612	1506	1400	1294	1188	1082	976	870	764	658	552	446	349	243	126					
Diesel	45	1981-1990	499	674	839	994	1122	1233	1233	1233	1233	1233	1233	1233	1233	1233	1233	1233	1151	1036	964	820
Diesel	45	1991-Stage I							108	203	270	386	544	699	905	1063	1063	1063	1063	1063	1063	1063
Diesel	45	Stage I															151	303	422	524	664	664
Diesel	45	Stage II																				104
Diesel	50	<1981	2173	2031	1888	1745	1602	1459	1316	1174	1031	888	745	602	471	328	170					
Diesel	50	1981-1990	673	909	1131	1340	1512	1662	1662	1662	1662	1662	1662	1662	1662	1662	1662	1662	1551	1396	1299	1105
Diesel	50	1991-Stage I							145	273	363	519	732	940	1217	1469	1469	1469	1469	1469	1469	1469
Diesel	50	Stage I															240	461	682	897	1135	1135
Diesel	50	Stage II																				187
Diesel	75	<1981	497	465	432	399	367	334	301	269	236	203	170	138	108	75	39					
Diesel	75	1981-1990	154	208	259	307	347	382	382	382	382	382	382	382	382	382	382	382	357	321	299	255
Diesel	75	1991-Stage I							33	63	84	120	169	217	281	354	354	354	354	354	354	354
Diesel	75	Stage I															70	162	234	311	311	311
Diesel	75	Stage II																			58	129
Diesel	120	<1981	111	103	96	89	81	74	67	60	52	45	38	31	24	17	9					
Diesel	120	1981-1990	34	46	57	68	77	85	85	85	85	85	85	85	85	85	85	85	80	72	67	57
Diesel	120	1991-Stage I							7	14	19	27	38	49	63	97	97	97	97	97	97	97
Diesel	120	Stage I															32	71	89	118	118	118
Diesel	120	Stage II																			16	38
LPG	33		5420	5427	5390	5323	5265	5215	5156	5068	4947	4863	4835	4792	4732	4765	4712	4718	4677	4655	4595	4494
LPG	40		4917	4923	4889	4828	4775	4730	4676	4596	4486	4410	4384	4344	4289	4295	4223	4218	4214	4244	4224	4166
LPG	50		2149	2151	2137	2110	2087	2067	2044	2008	1960	1926	1915	1897	1874	1926	1941	1897	1938	2003	2020	2018
LPG	78		97	97	96	95	94	93	92	91	89	88	88	87	86	90	92	88	95	98	99	104
LPG	120															1	2	2	2	3	3	3

Stock data for construction machinery 1985-2004

EquipmentName (Eng)	Emission Level	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
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	206	201	177	154	132
Track type dozers	Stage II																		20	38	56
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	91	91	81	71	62
Track type loaders	Stage II																		9	18	26
Wheel loaders (0-5 tons)	1981-1990							186	331	434	496	517	496	434	331	186					
Wheel loaders (0-5 tons)	1991-Stage I							21	83	186	331	517	744	1013	1323	1674	2067	2046	1984	1881	1736
Wheel loaders (0-5 tons)	Stage II																	227	496	806	1158
Wheel loaders (> 5,1 tons)	<1981	1250	1000	750	500	250															
Wheel loaders (> 5,1 tons)	1981-1990	1250	1500	1750	2000	2250	2500	2228	1960	1698	1441	1188	941	698	460	228					
Wheel loaders (> 5,1 tons)	1991-Stage I							248	490	728	960	1188	1411	1629	1841	1822	1802	1559	1322	1089	861
Wheel loaders (> 5,1 tons)	Stage I															228	450	668	881	871	861
Wheel loaders (> 5,1 tons)	Stage II																			218	431
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	459	372	293	223	162
Wheel type excavators	Stage I															62	115	160	196	179	162
Wheel type excavators	Stage II																			45	81
Track type excavators (0-5 t)	1981-1990							459	816	1071	1224	1275	1224	1071	816	459					
Track type excavators (0-5 t)	1991-Stage I							51	204	459	816	1275	1837	2500	3265	4132	5101	5050	4897	4642	4285
Track type excavators (0-5 t)	Stage II																	561	1224	1990	2857
Track type excavators (> 5,1 t)	<1981	1000	800	600	400	200															
Track type excavators (> 5,1 t)	1981-1990	1000	1200	1400	1600	1800	2000	1798	1596	1394	1194	993	794	594	396	198					
Track type excavators (> 5,1 t)	1991-Stage I							200	399	598	796	993	1190	1387	1583	1581	1579	1380	1181	983	785
Track type excavators (> 5,1 t)	Stage I															198	395	591	787	786	785
Track type excavators (> 5,1 t)	Stage II																			197	393
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	3599	3170	2735	2295	1848
Excavators/Loaders	Stage I															447	900	1359	1824	2295	2310
Excavators/Loaders	Stage II																				462
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	745	682	611	530	442
Dump trucks	Stage I															89	186	292	407	530	552
Dump trucks	Stage II																				110
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	1273	990	684	354	
Mini loaders	1991-Stage I							212	447	706	989	1296	1626	1980	2357	2758	3183	3301	3419	3537	3656
Mini loaders	Stage II																	330	684	1061	1462
Telescopic loaders	1981-1990											149	265	348	398	414	398	348	265	149	
Telescopic loaders	1991-Stage I											83	199	348	530	746	994	1160	1326	1491	1657
Telescopic loaders	Stage II																	116	265	447	663

Stock data for machine pools 1985-2004

Name	FuelCode	Emission Level	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Tractors	205B	<1981	1236	627																		
Tractors	205B	1981-1990	3091	3763	4575	4515	4370	4100	3643	2808	2368	1786	1214	604								
Tractors	205B	1991-Stage I							607	1123	1776	2382	3035	3624	4324	4210	4336	3956	4069	3323	2566	2053
Tractors	205B	Stage I																		554	513	513
Tractors	205B	Stage II																			513	1027
Harvesters	205B	<1981	969	776	661	472	287	139														
Harvesters	205B	1981-1990	807	932	1157	1257	1294	1385	1385	1197	927	794	712	512	421	282	162	78				
Harvesters	205B	1991-Stage I							139	266	348	454	593	615	737	751	729	778	779	651	531	472
Harvesters	205B	Stage II																		65	118	177
Self-propelled vehicles	205B	1981-1990									72	61	38									
Self-propelled vehicles	205B	1991-Stage I									72	122	190	263	278	277	295	289	314	237	203	153
Self-propelled vehicles	205B	Stage II																		47	102	153

Stock data for household and gardening 1985-2004

Name	Emission Level	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Lawn movers (private)	<1981	253125	168750	84375																	
Lawn movers (private)	1981-1990	421875	506250	590625	675000	675000	675000	590625	506250	421875	337500	253125	168750	84375							
Lawn movers (private)	1991-Stage I							84375	168750	253125	337500	421875	506250	590625	675000	675000	675000	675000	675000	675000	675000
Lawn movers (professional)	1981-1990	25000	25000	25000	25000	25000	25000	18750	12500	6250											
Lawn movers (professional)	1991-Stage I							6250	12500	18750	25000	25000	25000	25000	25000	25000	25000	25000	25000	25000	25000
Cultivators (private-large)	1981-1990	110000	110000	110000	110000	110000	110000	88000	66000	44000	22000										
Cultivators (private-large)	1991-Stage I							22000	44000	66000	88000	110000	110000	110000	110000	110000	110000	110000	110000	110000	110000
Cultivators (private-small)	<1981	6667	6000	5333	4667	4000	3333	2667	2000	1333	667										
Cultivators (private-small)	1981-1990	3333	4000	4667	5333	6000	6667	6667	6667	6667	6667	6667	6000	5333	4667	4000	3333	2667	2000	1333	667
Cultivators (private-small)	1991-Stage I							667	1333	2000	2667	3333	4000	4667	5333	6000	6667	7333	8000	8667	9333
Cultivators (professional)	<1981	3750	2500	1250																	
Cultivators (professional)	1981-1990	6250	7500	8750	10000	10000	10000	8750	7500	6250	5000	3750	2500	1250							
Cultivators (professional)	1991-Stage I							1250	2500	3750	5000	6250	7500	8750	10000	10000	10000	10000	10000	10000	10000
Chain saws (private)	<1981	125000	100000	75000	50000	25000															
Chain saws (private)	1981-1990	125000	150000	175000	200000	225000	250000	227250	204000	180250	156000	131250	106000	80250	54000	27250					
Chain saws (private)	1991-Stage I							25250	51000	77250	104000	131250	159000	187250	216000	245250	275000	277003	279006	281009	298000
Chain saws (professional)	1981-1990	10000	10000	10000	10000	10000	10000	7333	4000												
Chain saws (professional)	1991-Stage I							3667	8000	13000	14000	15000	16000	17000	18000	19000	20000	27500	35000	42500	50000
Chain saws (forestry)	1981-1990	8000	8000	8000	8000	8000	8000	5048	2381												
Chain saws (forestry)	1991-Stage I							2524	4762	6714	6286	5857	5429	5000	4571	4143	3714	3286	2857	2429	2000
Riders (private)	<1981	40950	35100	29250	23400	17550	11700	6205													
Riders (private)	1981-1990	29250	35100	40950	46800	52650	58500	62050	65600	62235	58160	53375	47880	41675	34760	27135	18800	10696			
Riders (private)	1991-Stage I							6205	13120	20745	29080	38125	47880	58345	69520	81405	94000	117654	143900	159450	175000
Riders (professional)	1981-1990	4800	4800	4800	4800	4800	4800	4032	3168	2208	1152										
Riders (professional)	1991-Stage I							1008	2112	3312	4608	6000	6240	6480	6720	6960	7200	11650	16100	20550	25000
Shrub clearers (private)	<1981	24000	19200	14400	9600	4800															
Shrub clearers (private)	1981-1990	24000	28800	33600	38400	43200	48000	47520	46080	43680	40320	36000	30720	24480	17280	9120					
Shrub clearers (private)	1991-Stage I							5280	11520	18720	26880	36000	46080	57120	69120	82080	96000	107000	118000	129000	140000
Shrub clearers (professional)	1981-1990	2000	2000	2000	2000	2000	2000	1650	1200	650											
Shrub clearers (professional)	1991-Stage I							550	1200	1950	2800	3000	3200	3400	3600	3800	4000	5500	7000	8500	10000
Hedge cutters (private)	<1981	6850	5480	4110	2740	1370															
Hedge cutters (private)	1981-1990	6850	8220	9590	10960	12330	13700	15237	16128	16373	15972	14925	13232	10893	7908	4277					
Hedge cutters (private)	1991-Stage I							1693	4032	7017	10648	14925	19848	25417	31632	38493	46000	52900	59800	66700	73600
Hedge cutters (professional)	1981-1990	1300	1300	1300	1300	1300	1300	1178	920	528											

Hedge cutters (professional)	1991-Stage I							393	920	1583	2380	2650	2920	3190	3460	3730	4000	4600	5200	5800	6400
Trimmers (private)	<1981	25500	20400	15300	10200	5100															
Trimmers (private)	1981-1990	25500	30600	35700	40800	45900	51000	48086	44686	40800	36429	31571	26229	20400	14086	7286					
Trimmers (private)	1991-Stage I							5343	11171	17486	24286	31571	39343	47600	56343	65571	75286	77714	80143	82571	85000
Trimmers (professional)	1981-1990	9000	9000	9000	9000	9000	9000	7071	4929	2571											
Trimmers (professional)	1991-Stage I							2357	4929	7714	10714	11143	11571	12000	12429	12857	13286	13714	14143	14571	15000

Stock data for small boats and pleasure crafts 1985-2004

Motortype	Boat type	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Diesel	Motor boats (27-34 ft)	1550	1550	1719	1889	2058	2228	2397	2567	2736	2906	3075	3244	3414	3583	3753	3922	4092	4261	4431	4600
Diesel	Motor boats (> 34 ft)	450	450	503	556	608	661	714	767	819	872	925	978	1031	1083	1136	1189	1242	1294	1347	1400
Diesel	Motor boats <(27 ft)	3000	3000	3000	3000	3000	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	4667	4750	4833	4917	5000
Diesel	Sailing boats (> 26 ft)	7500	7500	7917	8333	8750	9167	9583	10000	10417	10833	11250	11667	12083	12500	12917	13333	13750	14167	14583	15000
2-takt	Other boats (< 20 ft)	4000	4000	4056	4111	4167	4222	4278	4333	4389	4444	4500	4556	4564,89	4526,99	4438,68	4300,2	4108,05	3862,31	3559,68	3200
2-takt	Yawls and cabin boats	4000	4000	4056	4111	4167	4222	4278	4333	4389	4444	4500	4556	4564,89	4526,99	4438,68	4300,2	4108,05	3862,31	3559,68	3200
2-takt	Sailing boats (< 26 ft)	19000	19000	18778	18556	18333	18111	17889	17667	17444	17222	17000	16778	16390,44	15843,01	15144,34	14300,1	13316,95	12200,76	10959,84	9600
2-takt	Speed boats	3000	3000	3000	3000	3000	3000	3000	3000	3000	3000	3000	3000	2970	2910	2820	2700	2550	2370	2160	1920
2-takt	Water scooters	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	990	970	940	900	850	790	720	640
4-takt	Other boats (< 20 ft)													46,11	140,01	283,32	477,8	724,95	1026,69	1384,32	1800
4-takt	Yawls and cabin boats													46,11	140,01	283,32	477,8	724,95	1026,69	1384,32	1800
4-takt	Sailing boats (< 26 ft)													165,56	489,99	966,66	1588,9	2350,05	3243,24	4262,16	5400
4-takt	Speed boats (in board eng.)	3000	3000	3000	3000	3000	3000	3000	3000	3000	3000	3000	3000	3000	3000	3000	3000	3000	3000	3000	3000
4-takt	Speed boats (out board eng.)													30	90	180	300	450	630	840	1080
4-takt	Water scooters													10	30	60	100	150	210	280	360
4-takt	Speed boats (out board eng.)													30	90	180	300	450	630	840	1080
4-takt	Water scooters													10	30	60	100	150	210	280	360

Engine sizes (kW) for small boats and pleasure crafts 1985-2004

Motortype	Boat type	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Diesel	Motor boats (27-34 ft)	70	70	74	79	83	88	92	97	101	106	110	114	119	123	128	132	137	141	146	8
Diesel	Motor boats (> 34 ft)	120	120	127	134	142	149	156	163	171	178	185	192	199	207	214	221	228	236	243	20
Diesel	Motor boats <(27 ft)	20	20	21,1	22,2	23,3	24,4	25,6	26,7	27,8	28,9	30	31,1	32,2	33,3	34,4	35,6	36,7	37,8	38,9	10
Diesel	Motor sailors	20	20	21	21	22	22	23	23	24	24	25	26	26	27	27	28	28	29	29	50
Diesel	Sailing boats (> 26 ft)	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	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	45	47,5	50	52,5	55	57,5	60	62,5	65	67,5	70	72,5	75	77,5	80	82,5	85	87,5	90
4-takt	Speed boats (out board eng.)													40,3	41,7	43,1	44,4	45,8	47,2	48,6	50
4-takt	Water scooters													45	45	45	45	45	45	45	45

Annex 11: Fuel use and emission factors, and fuel use and emissions for non-road working machinery and equipment

Fuel use and emissions (tons) for diesel tractors 1985-2004

Year	FC (TJ)	SO_2	NO_x	NMVOC	CH_4	CO	CO_2	N_2O	NH_3	TSP
1985	12345	2891	8760	2048	33	8078	914	36	2	1907
1986	12842	1805	9267	2100	34	8322	950	37	2	1937
1987	12479	1754	9138	2018	33	8034	923	36	2	1851
1988	12892	1811	9576	2062	34	8248	954	38	2	1883
1989	12898	1208	9723	2041	33	8198	954	38	2	1854
1990	12739	1193	9742	1995	32	8048	943	37	2	1806
1991	12614	1182	9881	1942	32	7892	933	37	2	1737
1992	12050	1129	9592	1834	30	7502	892	36	2	1629
1993	11862	1111	9571	1789	29	7359	878	35	2	1582
1994	11063	1036	9096	1645	27	6812	819	33	2	1438
1995	11519	1079	9695	1680	27	7012	852	34	2	1443
1996	10660	250	9205	1522	25	6400	789	32	2	1277
1997	10999	258	9748	1533	25	6505	814	33	2	1252
1998	10106	237	9134	1382	22	5912	748	31	2	1104
1999	10066	236	9275	1350	22	5821	745	31	2	1052
2000	9712	227	9122	1276	21	5547	719	30	2	967
2001	9628	225	9140	1231	20	5392	713	30	2	910
2002	9596	225	8988	1165	19	5164	710	30	2	853
2003	9538	223	8714	1098	18	4940	706	30	2	799
2004	9467	222	8398	1031	17	4713	701	29	2	748

Emission factors (g/GJ) for diesel tractors 1985-2004

Year	SO_2	NO_x	NMVOC	CH_4	CO	CO_2	N_2O	NH_3	TSP
1985	234	710	166	2,7	654	74	2,9	0,2	154
1986	141	722	164	2,7	648	74	2,9	0,2	151
1987	141	732	162	2,6	644	74	2,9	0,2	148
1988	141	743	160	2,6	640	74	2,9	0,2	146
1989	94	754	158	2,6	636	74	2,9	0,2	144
1990	94	765	157	2,5	632	74	2,9	0,2	142
1991	94	783	154	2,5	626	74	2,9	0,2	138
1992	94	796	152	2,5	623	74	3,0	0,2	135

1993	94	807	151	2,5	620	74	3,0	0,2	133
1994	94	822	149	2,4	616	74	3,0	0,2	130
1995	94	842	146	2,4	609	74	3,0	0,2	125
1996	23	864	143	2,3	600	74	3,0	0,2	120
1997	23	886	139	2,3	591	74	3,0	0,2	114
1998	23	904	137	2,2	585	74	3,0	0,2	109
1999	23	921	134	2,2	578	74	3,0	0,2	105
2000	23	939	131	2,1	571	74	3,1	0,2	100
2001	23	949	128	2,1	560	74	3,1	0,2	95
2002	23	937	121	2,0	538	74	3,1	0,2	89
2003	23	914	115	1,9	518	74	3,1	0,2	84
2004	23	887	109	1,8	498	74	3,1	0,2	79

Fuel use and emissions (tons) for gasoline tractors 1985-2004

EquipmentName (Eng)	Year	Emission Level	FC (TJ)	SO_2	NO_x	NMVOC	CH_4	CO	CO_2	N_2O	NH_3	TSP
Tractors (gasoline-certified)	1985	<1981	373	1	11	356	33	17999	27	0	0	2
Tractors (gasoline-certified)	1986	<1981	355	1	10	340	32	17228	26	0	0	2
Tractors (gasoline-certified)	1987	<1981	337	1	9	325	30	16446	25	0	0	2
Tractors (gasoline-certified)	1988	<1981	319	1	9	309	29	15652	23	0	0	2
Tractors (gasoline-certified)	1989	<1981	301	1	8	293	28	14847	22	0	0	2
Tractors (gasoline-certified)	1990	<1981	283	1	7	277	26	14032	21	0	0	2
Tractors (gasoline-certified)	1991	<1981	256	1	7	252	24	12766	19	0	0	2
Tractors (gasoline-certified)	1992	<1981	231	1	6	228	21	11545	17	0	0	2
Tractors (gasoline-certified)	1993	<1981	206	0	5	204	19	10372	15	0	0	1
Tractors (gasoline-certified)	1994	<1981	183	0	5	182	17	9247	13	0	0	1
Tractors (gasoline-certified)	1995	<1981	161	0	4	161	15	8172	12	0	0	1
Tractors (gasoline-certified)	1996	<1981	140	0	3	141	13	7147	10	0	0	1
Tractors (gasoline-certified)	1997	<1981	121	0	3	122	11	6173	9	0	0	1
Tractors (gasoline-certified)	1998	<1981	102	0	2	103	10	5252	7	0	0	1
Tractors (gasoline-certified)	1999	<1981	85	0	2	86	8	4385	6	0	0	1
Tractors (gasoline-certified)	2000	<1981	69	0	2	70	7	3571	5	0	0	0
Tractors (gasoline-certified)	2001	<1981	54	0	1	55	5	2814	4	0	0	0
Tractors (gasoline-certified)	2002	<1981	40	0	1	42	4	2112	3	0	0	0
Tractors (gasoline-certified)	2003	<1981	28	0	1	29	3	1468	2	0	0	0
Tractors (gasoline-certified)	2004	<1981	17	0	0	17	2	881	1	0	0	0
Tractors (gasoline-non certified)	1985	<1981	373	1	11	357	33	17999	27	0	0	2
Tractors (gasoline-non certified)	1986	<1981	355	1	10	342	32	17228	26	0	0	2
Tractors (gasoline-non certified)	1987	<1981	337	1	9	326	30	16446	25	0	0	2
Tractors (gasoline-non certified)	1988	<1981	319	1	9	310	29	15652	23	0	0	2
Tractors (gasoline-non certified)	1989	<1981	301	1	8	294	28	14847	22	0	0	2
Tractors (gasoline-non certified)	1990	<1981	283	1	7	278	26	14032	21	0	0	2
Tractors (gasoline-non certified)	1991	<1981	270	1	7	266	25	13426	20	0	0	2
Tractors (gasoline-non certified)	1992	<1981	256	1	7	253	24	12782	19	0	0	2
Tractors (gasoline-non certified)	1993	<1981	241	1	6	240	22	12101	18	0	0	2
Tractors (gasoline-non certified)	1994	<1981	225	1	6	225	21	11381	16	0	0	2
Tractors (gasoline-non certified)	1995	<1981	209	0	5	210	20	10623	15	0	0	1
Tractors (gasoline-non certified)	1996	<1981	193	0	5	194	18	9827	14	0	0	1
Tractors (gasoline-non certified)	1997	<1981	176	0	4	178	17	8991	13	0	0	1
Tractors (gasoline-non certified)	1998	<1981	158	0	4	160	15	8117	12	0	0	1
Tractors (gasoline-non certified)	1999	<1981	140	0	3	142	13	7203	10	0	0	1

Tractors (gasoline-non certified)	2000	<1981	121	0	3	123	12	6250	9	0	0	1
Tractors (gasoline-non certified)	2001	<1981	101	0	2	104	10	5257	7	0	0	1
Tractors (gasoline-non certified)	2002	<1981	81	0	2	83	8	4224	6	0	0	1
Tractors (gasoline-non certified)	2003	<1981	60	0	1	62	6	3151	4	0	0	0
Tractors (gasoline-non certified)	2004	<1981	39	0	1	40	4	2038	3	0	0	0

Emission factors (g/GJ) for gasoline tractors 1985-2004

EquipmentName (Eng)	Year	Emission Level	SO_2	NO_x	NMVOC	CH_4	CO	CO_2	N_2O	NH_3	TSP
Tractors (gasoline-certified)	1985	<1981	2,3	28	953	89	48219	73	1,3	0,1	6,4
Tractors (gasoline-certified)	1986	<1981	2,3	28	958	90	48492	73	1,3	0,1	6,5
Tractors (gasoline-certified)	1987	<1981	2,3	27	963	90	48759	73	1,3	0,1	6,5
Tractors (gasoline-certified)	1988	<1981	2,3	27	967	91	49021	73	1,3	0,1	6,5
Tractors (gasoline-certified)	1989	<1981	2,3	27	972	91	49278	73	1,3	0,1	6,6
Tractors (gasoline-certified)	1990	<1981	2,3	26	977	92	49529	73	1,3	0,1	6,6
Tractors (gasoline-certified)	1991	<1981	2,3	26	982	92	49776	73	1,3	0,1	6,7
Tractors (gasoline-certified)	1992	<1981	2,3	26	986	93	50019	73	1,3	0,1	6,7
Tractors (gasoline-certified)	1993	<1981	2,3	25	990	93	50258	73	1,3	0,1	6,7
Tractors (gasoline-certified)	1994	<1981	2,3	25	995	94	50493	73	1,3	0,1	6,8
Tractors (gasoline-certified)	1995	<1981	2,3	25	999	94	50724	73	1,3	0,1	6,8
Tractors (gasoline-certified)	1996	<1981	2,3	25	1003	95	50952	73	1,3	0,1	6,8
Tractors (gasoline-certified)	1997	<1981	2,3	24	1008	95	51177	73	1,3	0,1	6,9
Tractors (gasoline-certified)	1998	<1981	2,3	24	1012	96	51399	73	1,3	0,1	6,9
Tractors (gasoline-certified)	1999	<1981	2,3	24	1016	96	51618	73	1,3	0,1	6,9
Tractors (gasoline-certified)	2000	<1981	2,3	23	1020	97	51834	73	1,3	0,1	7,0
Tractors (gasoline-certified)	2001	<1981	2,3	23	1024	97	52047	73	1,3	0,1	7,0
Tractors (gasoline-certified)	2002	<1981	2,3	23	1028	97	52258	73	1,3	0,1	7,0
Tractors (gasoline-certified)	2003	<1981	2,3	23	1032	98	52466	73	1,3	0,1	7,1
Tractors (gasoline-certified)	2004	<1981	2,3	22	1035	98	52672	73	1,3	0,1	7,1
Tractors (gasoline-non certified)	1985	<1981	2,3	28	957	89	48219	73	1,3	0,1	6,4
Tractors (gasoline-non certified)	1986	<1981	2,3	28	962	90	48492	73	1,3	0,1	6,5
Tractors (gasoline-non certified)	1987	<1981	2,3	27	967	90	48759	73	1,3	0,1	6,5
Tractors (gasoline-non certified)	1988	<1981	2,3	27	972	91	49021	73	1,3	0,1	6,5
Tractors (gasoline-non certified)	1989	<1981	2,3	27	977	91	49278	73	1,3	0,1	6,6
Tractors (gasoline-non certified)	1990	<1981	2,3	26	981	92	49529	73	1,3	0,1	6,6
Tractors (gasoline-non certified)	1991	<1981	2,3	26	986	92	49776	73	1,3	0,1	6,7
Tractors (gasoline-non certified)	1992	<1981	2,3	26	990	93	50019	73	1,3	0,1	6,7
Tractors (gasoline-non certified)	1993	<1981	2,3	25	995	93	50258	73	1,3	0,1	6,7
Tractors (gasoline-non certified)	1994	<1981	2,3	25	999	94	50493	73	1,3	0,1	6,8
Tractors (gasoline-non certified)	1995	<1981	2,3	25	1004	94	50724	73	1,3	0,1	6,8
Tractors (gasoline-non certified)	1996	<1981	2,3	25	1008	95	50952	73	1,3	0,1	6,8
Tractors (gasoline-non certified)	1997	<1981	2,3	24	1012	95	51177	73	1,3	0,1	6,9
Tractors (gasoline-non certified)	1998	<1981	2,3	24	1016	96	51399	73	1,3	0,1	6,9
Tractors (gasoline-non certified)	1999	<1981	2,3	24	1020	96	51618	73	1,3	0,1	6,9

Tractors (gasoline-non certified)	2000	<1981	2,3	23	1024	97	51834	73	1,3	0,1	7,0
Tractors (gasoline-non certified)	2001	<1981	2,3	23	1028	97	52047	73	1,3	0,1	7,0
Tractors (gasoline-non certified)	2002	<1981	2,3	23	1032	97	52258	73	1,3	0,1	7,0
Tractors (gasoline-non certified)	2003	<1981	2,3	23	1036	98	52466	73	1,3	0,1	7,1
Tractors (gasoline-non certified)	2004	<1981	2,3	22	1040	98	52672	73	1,3	0,1	7,1

Fuel use and emissions (tons) for harvesters 1985-2004

Year	FC (TJ)	SO_2	NO_x	NMVOC	CH_4	CO	CO_2	N_2O	NH_3	TSP
1985	2134	500	1376	398	6	1584	158	6	0	412
1986	2152	302	1424	392	6	1565	159	6	0	400
1987	2121	298	1430	380	6	1525	157	6	0	386
1988	2222	312	1536	393	6	1580	164	6	0	396
1989	2137	200	1512	372	6	1503	158	6	0	373
1990	2249	211	1642	385	6	1558	166	7	0	381
1991	2203	206	1655	369	6	1505	163	6	0	362
1992	2145	201	1651	352	6	1448	159	6	0	343
1993	2144	201	1676	348	6	1437	159	6	0	337
1994	2025	190	1606	324	5	1347	150	6	0	313
1995	1927	180	1561	301	5	1263	143	6	0	289
1996	2033	48	1688	305	5	1300	150	6	0	291
1997	1894	44	1614	269	4	1170	140	6	0	255
1998	2030	48	1776	270	4	1204	150	6	0	253
1999	1949	46	1740	244	4	1116	144	6	0	228
2000	2059	48	1868	244	4	1144	152	6	0	228
2001	2046	48	1892	227	4	1094	151	6	0	210
2002	2090	49	1863	212	3	1050	155	7	0	194
2003	2070	48	1803	195	3	990	153	6	0	176
2004	2019	47	1724	176	3	917	149	6	0	155

Emission factors (g/GJ) for harvesters 1985-2004

Year	SO_2	NO_x	NMVOC	CH_4	CO	CO_2	N_2O	NH_3	TSP
1985	234	645	186	3,0	742	74	2,8	0,2	193
1986	141	662	182	3,0	727	74	2,9	0,2	186
1987	141	674	179	2,9	719	74	2,9	0,2	182
1988	141	691	177	2,9	711	74	2,9	0,2	178
1989	94	707	174	2,8	703	74	2,9	0,2	174
1990	94	730	171	2,8	693	74	2,9	0,2	169
1991	94	751	167	2,7	683	74	2,9	0,2	164
1992	94	769	164	2,7	675	74	2,9	0,2	160
1993	94	782	162	2,6	670	74	2,9	0,2	157
1994	94	793	160	2,6	665	74	2,9	0,2	155
1995	94	810	156	2,5	656	74	3,0	0,2	150
1996	23	830	150	2,4	639	74	3,0	0,2	143

1997	23	852	142	2,3	618	74	3,0	0,2	135
1998	23	875	133	2,2	593	74	3,0	0,2	125
1999	23	893	125	2,0	573	74	3,1	0,2	117
2000	23	907	119	1,9	555	74	3,1	0,2	111
2001	23	925	111	1,8	535	74	3,1	0,2	103
2002	23	892	101	1,6	502	74	3,1	0,2	93
2003	23	871	94	1,5	478	74	3,1	0,2	85
2004	23	854	87	1,4	454	74	3,1	0,2	77

Fuel use and emissions (tons) for machine pool machinery 1985-2004

Name	Year	FC (TJ)	SO_2	NO_x	NMVOC	CH_4	CO	CO_2	N_2O	NH_3	TSP
Harvesters	1985	188	44	170	31	0	126	14	1	0	30
Harvesters	1986	192	27	176	31	1	127	14	1	0	30
Harvesters	1987	217	30	201	34	1	142	16	1	0	33
Harvesters	1988	211	30	249	22	0	78	16	1	0	24
Harvesters	1989	204	19	233	21	0	76	15	1	0	23
Harvesters	1990	207	19	228	20	0	78	15	1	0	23
Harvesters	1991	217	20	230	20	0	82	16	1	0	23
Harvesters	1992	219	21	231	19	0	83	16	1	0	23
Harvesters	1993	201	19	210	17	0	76	15	1	0	20
Harvesters	1994	206	19	214	16	0	78	15	1	0	19
Harvesters	1995	225	21	233	17	0	86	17	1	0	20
Harvesters	1996	203	5	210	14	0	78	15	1	0	17
Harvesters	1997	218	5	224	14	0	84	16	1	0	17
Harvesters	1998	203	5	207	13	0	78	15	1	0	15
Harvesters	1999	183	4	185	11	0	71	14	1	0	13
Harvesters	2000	183	4	184	10	0	71	14	1	0	12
Harvesters	2001	173	4	173	8	0	67	13	1	0	10
Harvesters	2002	166	4	158	8	0	63	12	1	0	9
Harvesters	2003	157	4	141	7	0	57	12	1	0	8
Harvesters	2004	157	4	134	7	0	55	12	1	0	7
Self-propelled vehicles	1993	154	14	160	11	0	59	11	0	0	14
Self-propelled vehicles	1994	195	18	199	13	0	76	14	1	0	15
Self-propelled vehicles	1995	241	23	244	14	0	94	18	1	0	17
Self-propelled vehicles	1996	276	6	277	14	0	109	20	1	0	16
Self-propelled vehicles	1997	292	7	292	14	0	115	22	1	0	17
Self-propelled vehicles	1998	291	7	291	14	0	114	22	1	0	17
Self-propelled vehicles	1999	310	7	310	15	0	122	23	1	0	18
Self-propelled vehicles	2000	304	7	304	15	0	119	22	1	0	18
Self-propelled vehicles	2001	330	8	330	16	0	130	24	1	0	19
Self-propelled vehicles	2002	299	7	272	14	0	110	22	1	0	16
Self-propelled vehicles	2003	321	8	264	14	0	110	24	1	0	15
Self-propelled vehicles	2004	321	8	235	13	0	101	24	1	0	12
Tractors	1985	1201	281	801	181	3	761	89	3	0	176
Tractors	1986	1224	172	835	180	3	764	91	4	0	171
Tractors	1987	1282	180	895	184	3	786	95	4	0	169

Tractors	1988	1285	181	897	184	3	788	95	4	0	169
Tractors	1989	1266	119	884	181	3	777	94	4	0	167
Tractors	1990	1212	114	846	173	3	743	90	4	0	160
Tractors	1991	1271	119	937	177	3	766	94	4	0	157
Tractors	1992	1185	111	921	160	3	702	88	4	0	135
Tractors	1993	1262	118	1032	165	3	732	93	4	0	131
Tractors	1994	1283	120	1102	163	3	729	95	4	0	119
Tractors	1995	1327	124	1196	163	3	737	98	4	0	108
Tractors	1996	1325	31	1507	160	3	733	98	4	0	93
Tractors	1997	1390	33	1619	161	3	749	103	4	0	79
Tractors	1998	1377	32	1604	159	3	741	102	4	0	78
Tractors	1999	1455	34	1695	168	3	784	108	5	0	83
Tractors	2000	1360	32	1584	157	3	732	101	4	0	77
Tractors	2001	1433	34	1669	166	3	772	106	5	0	81
Tractors	2002	1407	33	1548	148	2	700	104	4	0	75
Tractors	2003	1348	32	1348	125	2	613	100	4	0	67
Tractors	2004	1392	33	1251	112	2	572	103	4	0	64

Emission factors (g/GJ) for machine pool machinery 1985-2004

Name	Year	SO_2	NO_x	NMVOC	CH_4	CO	CO_2	N_2O	NH_3	TSP
Harvesters	1985	234	901	163	2,6	668	74	3,0	0,2	162
Harvesters	1986	141	914	160	2,6	662	74	3,0	0,2	158
Harvesters	1987	141	928	158	2,6	655	74	3,0	0,2	153
Harvesters	1988	141	1179	106	1,7	372	74	3,1	0,2	113
Harvesters	1989	94	1141	103	1,7	373	74	3,1	0,2	113
Harvesters	1990	94	1103	99	1,6	374	74	3,1	0,2	111
Harvesters	1991	94	1059	91	1,5	377	74	3,1	0,2	107
Harvesters	1992	94	1053	87	1,4	378	74	3,1	0,2	103
Harvesters	1993	94	1047	83	1,3	380	74	3,2	0,2	98
Harvesters	1994	94	1042	79	1,3	381	74	3,2	0,2	94
Harvesters	1995	94	1036	75	1,2	382	74	3,2	0,2	89
Harvesters	1996	23	1030	70	1,1	384	74	3,2	0,2	85
Harvesters	1997	23	1024	66	1,1	385	74	3,2	0,2	80
Harvesters	1998	23	1018	62	1,0	386	74	3,2	0,2	74
Harvesters	1999	23	1012	58	0,9	388	74	3,2	0,2	69
Harvesters	2000	23	1006	54	0,9	389	74	3,2	0,2	63
Harvesters	2001	23	1000	49	0,8	391	74	3,2	0,2	57
Harvesters	2002	23	952	47	0,8	377	74	3,2	0,2	54
Harvesters	2003	23	903	46	0,7	364	74	3,2	0,2	51
Harvesters	2004	23	855	44	0,7	350	74	3,2	0,2	47
Self-propelled vehicles	1993	94	1034	73	1,2	385	74	3,2	0,2	88
Self-propelled vehicles	1994	94	1023	65	1,1	388	74	3,2	0,2	79
Self-propelled vehicles	1995	94	1012	57	0,9	390	74	3,2	0,2	69
Self-propelled vehicles	1996	23	1001	49	0,8	393	74	3,2	0,2	58
Self-propelled vehicles	1997	23	1001	49	0,8	393	74	3,2	0,2	58
Self-propelled vehicles	1998	23	1001	49	0,8	393	74	3,2	0,2	58
Self-propelled vehicles	1999	23	1001	49	0,8	393	74	3,2	0,2	58
Self-propelled vehicles	2000	23	1001	49	0,8	393	74	3,2	0,2	58
Self-propelled vehicles	2001	23	1001	49	0,8	393	74	3,2	0,2	58
Self-propelled vehicles	2002	23	912	46	0,7	368	74	3,2	0,2	52
Self-propelled vehicles	2003	23	823	43	0,7	342	74	3,2	0,2	45
Self-propelled vehicles	2004	23	733	39	0,6	315	74	3,2	0,2	38
Tractors	1985	234	667	151	2,5	634	74	2,9	0,2	147
Tractors	1986	141	682	147	2,4	624	74	2,9	0,2	139

Tractors	1987	141	698	143	2,3	613	74	3,0	0,2	132
Tractors	1988	141	698	143	2,3	613	74	3,0	0,2	132
Tractors	1989	94	698	143	2,3	613	74	3,0	0,2	132
Tractors	1990	94	698	143	2,3	613	74	3,0	0,2	132
Tractors	1991	94	737	139	2,3	603	74	3,0	0,2	123
Tractors	1992	94	777	135	2,2	592	74	3,0	0,2	114
Tractors	1993	94	818	131	2,1	580	74	3,0	0,2	104
Tractors	1994	94	859	127	2,1	568	74	3,0	0,2	93
Tractors	1995	94	901	123	2,0	555	74	3,1	0,2	81
Tractors	1996	23	1137	121	2,0	553	74	3,2	0,2	70
Tractors	1997	23	1165	116	1,9	538	74	3,2	0,2	57
Tractors	1998	23	1165	116	1,9	538	74	3,2	0,2	57
Tractors	1999	23	1165	116	1,9	538	74	3,2	0,2	57
Tractors	2000	23	1165	116	1,9	538	74	3,2	0,2	57
Tractors	2001	23	1165	116	1,9	538	74	3,2	0,2	57
Tractors	2002	23	1100	105	1,7	497	74	3,2	0,2	53
Tractors	2003	23	1000	93	1,5	455	74	3,2	0,2	50
Tractors	2004	23	898	80	1,3	411	74	3,2	0,2	46

Fuel use and emissions (tons) for other machinery in agriculture 1985-2004

Fuel type	Year	FC (TJ)	SO_2	NO_x	NMVOC	CH_4	CO	CO_2	N_2O	NH_3	TSP
Diesel	1985	91	21	57	15	0	60	7	0	0	15
Diesel	1986	91	13	58	14	0	59	7	0	0	14
Diesel	1987	91	13	58	14	0	59	7	0	0	14
Diesel	1988	90	13	58	14	0	58	7	0	0	14
Diesel	1989	90	8	59	14	0	57	7	0	0	13
Diesel	1990	90	8	59	14	0	57	7	0	0	13
Diesel	1991	89	8	61	13	0	56	7	0	0	12
Diesel	1992	88	8	63	13	0	54	7	0	0	12
Diesel	1993	88	8	65	12	0	53	6	0	0	11
Diesel	1994	87	8	66	12	0	52	6	0	0	10
Diesel	1995	86	8	68	12	0	51	6	0	0	9
Diesel	1996	86	2	70	11	0	50	6	0	0	9
Diesel	1997	86	2	71	11	0	49	6	0	0	9
Diesel	1998	85	2	72	11	0	49	6	0	0	8
Diesel	1999	85	2	72	10	0	46	6	0	0	8
Diesel	2000	85	2	72	10	0	44	6	0	0	7
Diesel	2001	85	2	71	9	0	42	6	0	0	6
Diesel	2002	84	2	71	8	0	40	6	0	0	6
Diesel	2003	84	2	70	8	0	37	6	0	0	5
Diesel	2004	84	2	69	7	0	35	6	0	0	4
Gasoline	1985	168	0	7	149	14	7180	12	0	0	1
Gasoline	1986	162	0	7	142	13	6862	12	0	0	1
Gasoline	1987	157	0	7	136	12	6547	11	0	0	1
Gasoline	1988	152	0	7	130	12	6236	11	0	0	1
Gasoline	1989	147	0	7	124	11	5928	11	0	0	1
Gasoline	1990	142	0	7	118	11	5625	10	0	0	1
Gasoline	1991	137	0	8	113	10	5370	10	0	0	1
Gasoline	1992	132	0	8	108	10	5112	10	0	0	1
Gasoline	1993	128	0	8	103	9	4855	9	0	0	1
Gasoline	1994	123	0	8	98	9	4599	9	0	0	1
Gasoline	1995	118	0	7	93	8	4346	9	0	0	1
Gasoline	1996	113	0	7	88	8	4096	8	0	0	1
Gasoline	1997	109	0	7	83	7	3850	8	0	0	1
Gasoline	1998	104	0	7	78	7	3608	8	0	0	1
Gasoline	1999	99	0	7	73	6	3372	7	0	0	1

Gasoline	2000	95	0	7	69	6	3141	7	0	0	1
Gasoline	2001	91	0	6	66	6	3006	7	0	0	1
Gasoline	2002	87	0	6	63	5	2870	6	0	0	1
Gasoline	2003	83	0	6	60	5	2735	6	0	0	1
Gasoline	2004	79	0	6	57	5	2599	6	0	0	1

Emission factors (g/GJ) for other machinery in agriculture 1985-2004

Fuel type	Year	SO_2	NO_x	NMVOC	CH_4	CO	CO_2	N_2O	NH_3	TSP
Diesel	1985	234	626	161	3	654	74	2,8	0,2	161
Diesel	1986	141	633	159	3	650	74	2,9	0,2	158
Diesel	1987	141	640	158	3	646	74	2,9	0,2	155
Diesel	1988	141	647	156	3	642	74	2,9	0,2	153
Diesel	1989	94	654	154	3	637	74	2,9	0,2	150
Diesel	1990	94	661	152	2	633	74	2,9	0,2	147
Diesel	1991	94	686	149	2	624	74	2,9	0,2	140
Diesel	1992	94	711	145	2	614	74	2,9	0,2	133
Diesel	1993	94	737	141	2	605	74	3,0	0,2	125
Diesel	1994	94	763	137	2	595	74	3,0	0,2	117
Diesel	1995	94	790	134	2	584	74	3,0	0,2	109
Diesel	1996	23	809	132	2	579	74	3,0	0,2	105
Diesel	1997	23	828	130	2	574	74	3,0	0,2	100
Diesel	1998	23	847	128	2	568	74	3,0	0,2	95
Diesel	1999	23	846	121	2	544	74	3,1	0,2	88
Diesel	2000	23	844	114	2	520	74	3,1	0,2	81
Diesel	2001	23	842	107	2	495	74	3,1	0,2	74
Diesel	2002	23	841	100	2	469	74	3,1	0,2	67
Diesel	2003	23	839	93	2	443	74	3,1	0,2	59
Diesel	2004	23	825	85	1	416	74	3,1	0,2	51
Gasoline	1985	2	44	886	81	42831	73	1,3	0,1	6
Gasoline	1986	2	46	876	80	42235	73	1,3	0,1	6
Gasoline	1987	2	47	866	79	41606	73	1,3	0,1	6
Gasoline	1988	2	49	855	77	40946	73	1,3	0,1	6
Gasoline	1989	2	51	844	76	40257	73	1,3	0,1	6
Gasoline	1990	2	52	832	75	39539	73	1,3	0,1	6
Gasoline	1991	2	55	825	74	39097	73	1,3	0,1	6
Gasoline	1992	2	57	816	73	38593	73	1,3	0,1	6
Gasoline	1993	2	59	807	72	38040	73	1,3	0,1	6
Gasoline	1994	2	61	797	71	37444	73	1,4	0,1	6
Gasoline	1995	2	63	786	70	36809	73	1,4	0,1	6
Gasoline	1996	2	65	775	68	36138	73	1,4	0,1	6
Gasoline	1997	2	67	762	67	35432	73	1,4	0,1	7
Gasoline	1998	2	68	750	66	34693	73	1,4	0,1	7
Gasoline	1999	2	70	736	64	33922	73	1,4	0,1	7

Gasoline	2000	2	71	722	63	33120	73	1,4	0,1	7
Gasoline	2001	2	71	722	63	33115	73	1,4	0,1	7
Gasoline	2002	2	71	723	63	33110	73	1,4	0,1	7
Gasoline	2003	2	71	723	63	33105	73	1,4	0,1	7
Gasoline	2004	2	72	723	63	33099	73	1,4	0,1	7

Fuel use and emissions (tons) for ATV's 1985-2004

FuelType	Year	Emission Level	FC (TJ)	SO_2	NO_x	NMVOC	CH_4	CO	CO_2	N_2O	NH_3	TSP
Gasoline	1992	Conv. MC urban	5	0	0	5	1	74	0	0	0	0
Gasoline	1993	Conv. MC urban	10	0	1	10	2	159	1	0	0	0
Gasoline	1994	Conv. MC urban	16	0	2	17	3	262	1	0	0	1
Gasoline	1995	Conv. MC urban	24	0	3	25	4	387	2	0	0	1
Gasoline	1996	Conv. MC urban	32	0	4	35	5	530	2	0	0	1
Gasoline	1997	Conv. MC urban	42	0	5	45	7	691	3	0	0	1
Gasoline	1998	Conv. MC urban	54	0	6	58	9	887	4	0	0	2
Gasoline	1999	Conv. MC urban	70	0	8	75	11	1148	5	0	0	2
Gasoline	2000	Conv. MC urban	94	0	10	104	15	1576	7	0	0	3
Gasoline	2001	Conv. MC urban	116	0	13	132	19	1993	9	0	0	4
Gasoline	2002	Conv. MC urban	138	0	15	158	23	2393	10	0	0	5
Gasoline	2003	Conv. MC urban	158	0	18	183	26	2771	12	0	0	5
Gasoline	2004	Conv. MC urban	178	0	20	207	30	3130	13	0	0	6

Emission factors (g/GJ) for ATV's 1985-2004

FuelType	Year	Emission Level	SO_2	NO_x	NMVOC	CH_4	CO	CO_2	N_2O	NH_3	TSP
Gasoline	1992	Conv. MC urban	2,3	108	1070	160	16306	73	1,6	1,6	32
Gasoline	1993	Conv. MC urban	2,3	108	1070	160	16306	73	1,6	1,6	32
Gasoline	1994	Conv. MC urban	2,3	108	1070	160	16306	73	1,6	1,6	32
Gasoline	1995	Conv. MC urban	2,3	108	1070	160	16306	73	1,6	1,6	32
Gasoline	1996	Conv. MC urban	2,3	108	1070	160	16306	73	1,6	1,6	32
Gasoline	1997	Conv. MC urban	2,3	108	1070	160	16306	73	1,6	1,6	32
Gasoline	1998	Conv. MC urban	2,3	108	1070	160	16306	73	1,6	1,6	32
Gasoline	1999	Conv. MC urban	2,3	108	1070	160	16306	73	1,6	1,6	32
Gasoline	2000	Conv. MC urban	2,3	110	1107	163	16808	73	1,6	1,6	33
Gasoline	2001	Conv. MC urban	2,3	111	1129	165	17115	73	1,6	1,6	33
Gasoline	2002	Conv. MC urban	2,3	112	1145	166	17329	73	1,7	1,7	33
Gasoline	2003	Conv. MC urban	2,3	113	1157	167	17496	73	1,7	1,7	33
Gasoline	2004	Conv. MC urban	2,3	113	1167	168	17633	73	1,7	1,7	34

Annex 12: Emission factors and total emissions for 1990 and 2004 in CollectER format

Year	SNAP ID	Category	Fuel type	Mode	Fuel	SO2	NOx	NMVOC	CH4	CO	CO2	N2O	NH3	TSP
					[GJ]	[g/GJ]	[g/GJ]	[g/GJ]	[g/GJ]	[g/GJ]	[kg/GJ]	[g/GJ]	[g/GJ]	[g/GJ]
1990	070101	Passenger cars	Diesel	Highway driving	1026361.98	93.68	254.03	24.51	4.30	179.70	74	12.62	0.47	79.48
1990	070101	Passenger cars	Gasoline 2-stroke	Highway driving	42228.54	2.28	288.90	2357.34	10.03	3490.86	73	2.01	0.80	48.15
1990	070101	Passenger cars	Gasoline conventional	Highway driving	10933475.43	2.28	1317.10	364.60	11.09	3459.93	73	2.13	0.85	12.09
1990	070101	Passenger cars	LPG	Highway driving	2222.18	0.00	1151.70	187.09	10.06	3914.25	65	6.04	0.00	10.06
1990	070102	Passenger cars	Diesel	Rural driving	2044346.39	93.68	253.60	46.16	2.75	268.08	74	15.34	0.57	75.13
1990	070102	Passenger cars	Gasoline 2-stroke	Rural driving	118588.34	2.28	352.84	2476.82	13.84	2594.44	73	1.73	0.69	41.51
1990	070102	Passenger cars	Gasoline conventional	Rural driving	23583528.44	2.28	1140.07	483.50	13.92	3992.26	73	2.39	0.96	13.93
1990	070102	Passenger cars	LPG	Rural driving	4483.34	0.00	1248.46	305.18	16.91	1146.38	65	7.25	0.00	14.49
1990	070103	Passenger cars	Diesel	Urban driving	2553249.62	93.68	207.02	90.62	2.50	318.49	74	9.35	0.35	123.32
1990	070103	Passenger cars	Gasoline 2-stroke	Urban driving	191303.14	2.28	51.72	4548.72	44.74	7572.79	73	0.82	0.33	19.58
1990	070103	Passenger cars	Gasoline conventional	Urban driving	27472979.47	2.28	618.14	929.13	52.43	9975.92	73	1.56	0.63	13.25
1990	070103	Passenger cars	LPG	Urban driving	5612.94	0.00	615.87	430.04	34.34	1329.22	65	4.40	0.00	11.74
1990	070201	Light duty vehicles	Diesel	Highway driving	2923030.83	93.68	270.67	31.16	1.62	344.14	74	5.52	0.32	104.48
1990	070201	Light duty vehicles	Gasoline conventional	Highway driving	319077.58	2.28	1369.26	170.29	10.11	2987.40	73	2.43	0.81	16.17
1990	070202	Light duty vehicles	Diesel	Rural driving	8905022.64	93.68	299.25	35.71	1.78	358.42	74	6.04	0.36	107.73
1990	070202	Light duty vehicles	Gasoline conventional	Rural driving	1127865.12	2.28	1188.86	262.59	15.25	2316.18	73	2.29	0.76	15.25
1990	070203	Light duty vehicles	Diesel	Urban driving	8528115.24	93.68	486.72	60.32	2.40	412.68	74	4.41	0.26	132.54
1990	070203	Light duty vehicles	Gasoline conventional	Urban driving	1361243.26	2.28	624.03	697.98	60.64	7400.03	73	1.33	0.44	8.85
1990	070301	Heavy duty vehicles	Diesel	Highway driving	8796092.68	93.68	826.66	78.10	6.08	178.52	74	2.98	0.30	45.35
1990	070301	Heavy duty vehicles	Gasoline	Highway driving	9310.17	2.28	1037.78	474.61	9.69	7610.35	73	0.83	0.28	55.35
1990	070302	Heavy duty vehicles	Diesel	Rural driving	14205820.64	93.68	946.46	102.84	6.87	237.23	74	3.09	0.31	54.49
1990	070302	Heavy duty vehicles	Gasoline	Rural driving	18942.77	2.28	1141.55	820.40	16.74	8371.39	73	0.91	0.30	60.88
1990	070303	Heavy duty vehicles	Diesel	Urban driving	10964874.28	93.68	1038.79	125.29	12.66	299.01	74	2.50	0.25	60.95
1990	070303	Heavy duty vehicles	Gasoline	Urban driving	19345.80	2.28	456.62	696.09	14.21	7102.99	73	0.61	0.20	40.59
1990	0704	Mopeds	Gasoline	Mopeds and Motorcycles < 50 cm3	270914.31	2.28	27.40	8019.18	200.00	13698.63	73	0.91	0.91	109.59
1990	070501	Motorcycles	Gasoline	Highway driving	56842.05	2.28	215.21	1274.28	121.98	17689.89	73	1.27	1.27	32.95
1990	070502	Motorcycles	Gasoline	Rural driving	132229.46	2.28	173.17	1528.62	146.07	16834.36	73	1.52	1.52	39.46
1990	070503	Motorcycles	Gasoline	Urban driving	158064.73	2.28	93.28	2018.58	147.26	15322.43	73	1.53	1.53	39.78

Year	SNAP ID	Category	Fuel type	Mode	Fuel	SO2	NOx	NMVOC	CH4	CO	CO2	N2O	NH3	TSP

					[GJ]	[g/GJ]	[g/GJ]	[g/GJ]	[g/GJ]	[g/GJ]	[kg/GJ]	[g/GJ]	[g/GJ]	[g/GJ]
1990	0801	Military	Diesel		146162.10	93.68	684.30	80.01	5.79	291.62	74	4.56	0.31	79.84
1990	0801	Military	Jet fuel	< 3000 ft	149678.28	22.99	250.57	24.94	2.65	229.89	72	2.30		
1990	0801	Military	Jet fuel	> 3000 ft	1347104.52	22.99	250.57	24.94	2.65	229.89	72	2.30		
1990	0801	Military	Gasoline		985.50	2.28	927.71	1135.23	32.03	6553.48	73	1.96	0.79	
1990	0801	Military	Aviation gasoline		4913.48	22.83	859.00	1242.60	21.90	6972.00	73	2.00	1.60	
1990	0802	Railways	Diesel		4010006.53	93.68	1225.13	79.94	3.07	223.21	74	2.04	0.20	50.26
1990	0802	Railways	Kerosene		69.60	5.00	50.00	3.00	7.00	20.00	72	2.00		
1990	0802	Railways	Gasoline		0.00	2.28	871.06	1129.29	33.78	6687.29	73	2.24	1.63	
1990	0803	Inland waterways	Diesel		538329.24	93.68	942.01	171.10	2.78	453.27	74	2.96	0.17	106.15
1990	0803	Inland waterways	Gasoline		433014.39	2.28	327.19	3235.89	50.26	14293.02	73	0.86	0.08	
1990	080402	Maritime activities	Residual oil		3559805.60	1466.99	1393.64	56.92	1.76	180.93	78	4.89		139.36
1990	080402	Maritime activities	Diesel		2782388.36	93.68	1334.89	54.52	1.69	173.30	74	4.68		42.15
1990	080402	Maritime activities	Kerosene		452.40	4.60	50.00	3.00	7.00	20.00	72	2.00		
1990	080402	Maritime activities	LPG		1794.00		1249.00	384.90	20.30	443.00	65	2.00		
1990	080403	Maritime activities	Residual oil		285426.00	1466.99	1393.64	56.92	1.76	180.93	78	4.89		139.36
1990	080403	Maritime activities	Diesel		10051142.58	93.68	1334.89	54.52	1.69	173.30	74	4.68		42.15
1990	080403	Maritime activities	Kerosene		25786.80	4.60	50.00	3.00	7.00	20.00	72	2.00		
1990	080403	Maritime activities	Gasoline		0.00	2.28	64.34	10809.58	108.10	18485.08	73	0.52	0.10	
1990	080403	Maritime activities	LPG		42320.00		1249.00	384.90	20.30	443.00	65	2.00		
1990	080404	Maritime activities	Residual oil		28543367.60	1711.49	2127.14	56.92	1.76	180.93	78	4.89		200.49
1990	080404	Maritime activities	Diesel		11632673.89	468.38	2037.47	54.52	1.69	173.30	74	4.68		42.15
1990	080501	Air traffic	Jet fuel	Dom. < 3000 ft	422173.05	22.99	314.51	14.93	1.59	90.41	72	5.70		
1990	080501	Air traffic	Aviation gasoline		104947.19	22.83	859.00	1242.60	21.90	6972.00	73	2.00	1.60	
1990	080502	Air traffic	Jet fuel	Int. < 3000 ft	132339.29	22.99	309.25	16.47	1.75	168.98	72	7.10		
1990	080502	Air traffic	Aviation gasoline		30659.59	22.83	859.00	1242.60	21.90	6972.00	73	2.00	1.60	
1990	080503	Air traffic	Jet fuel	Dom. > 3000 ft	1026021.25	22.99	330.11	12.36	1.31	90.75	72	2.30		
1990	080504	Air traffic	Jet fuel	Int. > 3000 ft	1611914.81	22.99	244.20	6.48	0.69	54.10	72	2.30		
1990	0806	Agriculture	Diesel		16496272.63	93.68	758.87	156.85	2.55	635.53	74	2.93	0.17	144.45
1990	0806	Agriculture	Gasoline		708864.21	2.28	31.60	949.55	88.42	47524.17	73	1.28	0.09	
1990	0807	Forestry	Diesel		145345.57	93.68	857.48	156.47	2.54	645.65	74	2.97	0.17	149.05
1990	0807	Forestry	Gasoline		341429.76	2.28	40.39	7206.91	60.42	18057.40	73	0.37	0.07	
1990	0808	Industry	Diesel		10158405.86	93.68	933.58	178.23	2.90	655.80	74	2.94	0.17	154.50
1990	0808	Industry	Gasoline		175227.11	2.28	136.27	1610.77	120.61	14797.46	73	1.33	0.09	
1990	0808	Industry	LPG		1184855.79	0.00	1328.11	146.09	7.69	104.85	65	3.50	0.21	4.89
1990	0809	Household and gardening	Gasoline		1883802.80	2.28	65.27	2420.87	96.45	32167.96	73	1.14	0.08	
1990	80501.00	Air traffic, Copenhagen airport	Jet fuel	Dom. < 3000 ft	502153.07	22.99	283.87	20.73	2.20	129.70	72	4.58		
1990	80501.00	Air traffic, Copenhagen airport	Aviation gasoline		8642.20	22.83	859.00	1242.60	21.90	6972.00	73	2.00	1.60	

1990	80502.00	Air traffic, Copenhagen airport	Jet fuel	Int. < 3000 ft	2001203.83	22.99	324.87	34.25	3.64	157.15	72	3.79		
1990	80502.00	Air traffic, Copenhagen airport	Aviation gasoline		5612.28	22.83	859.00	1242.60	21.90	6972.00	73	2.00	1.60	
1990	80503.00	Air traffic, Copenhagen airport	Jet fuel	Dom. > 3000 ft	1305208.09	22.99	314.86	11.78	1.25	84.05	72	2.30		
1990	80504.00	Air traffic, Copenhagen airport	Jet fuel	Int. > 3000 ft	20330315.02	22.99	290.20	10.08	1.07	37.65	72	2.30		

Year	SNAP ID	Category	Fuel type	Mode	Fuel	SO2	NOx	NMVOC	CH4	CO	CO2	N2O	NH3	TSP
					[GJ]	[g/GJ]	[g/GJ]	[g/GJ]	[g/GJ]	[g/GJ]	[kg/GJ]	[g/GJ]	[g/GJ]	[g/GJ]
2004	70101	Passenger cars	Diesel	Highway driving	2367692.82	2.34	278.56	11.59	4.31	95.36	74	13.24	0.49	38.99
2004	70101	Passenger cars	Gasoline 2-stroke	Highway driving	560.94	2.28	288.90	2357.34	10.03	3490.86	73	2.01	0.80	48.15
2004	70101	Passenger cars	Gasoline conventional	Highway driving	2431463.24	2.28	1362.36	333.59	11.45	2637.78	73	2.20	0.88	10.38
2004	70101	Passenger cars	Gasoline catalyst	Highway driving	10334217.85	2.28	243.63	27.94	3.58	1613.44	73	16.92	48.33	0.34
2004	70101	Passenger cars	LPG	Highway driving	83.86	0.00	1151.70	187.09	10.06	3914.25	65	6.04	0.00	10.06
2004	70102	Passenger cars	Diesel	Rural driving	5033891.32	2.34	250.86	18.93	2.58	88.15	74	15.02	0.56	25.07
2004	70102	Passenger cars	Gasoline 2-stroke	Rural driving	1575.25	2.28	352.84	2476.82	13.84	2594.44	73	1.73	0.69	41.51
2004	70102	Passenger cars	Gasoline conventional	Rural driving	5327550.38	2.28	1163.16	452.60	14.16	3155.17	73	2.43	0.97	11.59
2004	70102	Passenger cars	Gasoline catalyst	Rural driving	22410272.74	2.28	175.60	29.93	4.14	541.79	73	8.58	53.60	0.38
2004	70102	Passenger cars	LPG	Rural driving	169.20	0.00	1248.46	305.18	16.91	1146.38	65	7.25	0.00	14.49
2004	70103	Passenger cars	Diesel	Urban driving	5771889.77	2.34	256.86	53.08	2.52	241.10	74	10.14	0.38	46.58
2004	70103	Passenger cars	Gasoline 2-stroke	Urban driving	2024.84	2.28	51.89	4470.04	43.97	7400.54	73	0.82	0.33	19.72
2004	70103	Passenger cars	Gasoline conventional	Urban driving	6225773.06	2.28	635.44	858.78	52.55	8038.06	73	1.61	0.64	11.28
2004	70103	Passenger cars	Gasoline catalyst	Urban driving	31280010.90	2.28	169.53	213.29	48.77	3546.92	73	15.33	20.25	0.32
2004	70103	Passenger cars	LPG	Urban driving	213.26	0.00	618.83	421.82	33.68	1298.79	65	4.44	0.00	11.83
2004	70201	Light duty vehicles	Diesel	Highway driving	3535197.72	2.34	312.66	30.60	1.59	198.22	74	6.06	0.36	49.23
2004	70201	Light duty vehicles	Gasoline conventional	Highway driving	122385.19	2.28	1369.26	170.29	10.11	2987.40	73	2.43	0.81	16.17
2004	70201	Light duty vehicles	Gasoline catalyst	Highway driving	294121.96	2.28	140.96	16.71	2.51	666.52	73	12.03	34.36	0.24
2004	70202	Light duty vehicles	Diesel	Rural driving	10770333.75	2.34	330.79	35.07	1.74	185.83	74	6.63	0.39	45.72
2004	70202	Light duty vehicles	Gasoline conventional	Rural driving	432603.23	2.28	1188.86	262.59	15.25	2316.18	73	2.29	0.76	15.25
2004	70202	Light duty vehicles	Gasoline catalyst	Rural driving	1038500.57	2.28	124.02	22.63	2.87	498.99	73	5.19	32.44	0.23
2004	70203	Light duty vehicles	Diesel	Urban driving	10489915.52	2.34	364.26	56.95	2.27	216.85	74	4.81	0.28	56.50
2004	70203	Light duty vehicles	Gasoline conventional	Urban driving	525645.81	2.28	626.11	685.91	59.59	7231.71	73	1.34	0.45	8.91
2004	70203	Light duty vehicles	Gasoline catalyst	Urban driving	1258563.91	2.28	132.44	124.38	22.88	3250.80	73	10.07	13.30	0.17
2004	70301	Heavy duty vehicles	Diesel	Highway driving	11307971.46	2.34	472.55	51.41	4.31	112.12	74	2.85	0.28	20.16
2004	70301	Heavy duty vehicles	Gasoline	Highway driving	9556.80	2.28	1037.78	474.61	9.69	7610.35	73	0.83	0.28	55.35
2004	70302	Heavy duty vehicles	Diesel	Rural driving	17202120.67	2.34	559.70	64.29	4.71	132.98	74	2.89	0.29	24.82
2004	70302	Heavy duty vehicles	Gasoline	Rural driving	19444.56	2.28	1141.55	820.40	16.74	8371.39	73	0.91	0.30	60.88
2004	70303	Heavy duty vehicles	Diesel	Urban driving	12286671.47	2.34	606.35	73.07	7.93	158.40	74	2.35	0.23	29.34

2004	70303	Heavy duty vehicles	Gasoline	Urban driving	19858.28	2.28	456.62	696.09	14.21	7102.99	73	0.61	0.20	40.59	
2004	704	Mopeds	Gasoline		211381.41	2.28	25.40	6338.24	158.08	10804.39	73	0.91	0.91	109.59	
2004	70501	Motorcycles	Gasoline	Highway driving	119292.56	2.28	218.43	1170.15	119.98	17378.93	73	1.27	1.27	31.96	
2004	70502	Motorcycles	Gasoline	Rural driving	277434.16	2.28	175.99	1404.95	143.85	16502.09	73	1.52	1.52	38.31	
2004	70503	Motorcycles	Gasoline	Urban driving	330690.34	2.28	94.93	1877.22	144.82	14993.66	73	1.53	1.53	38.57	

Year	SNAP ID	Category	Fuel type	Mode	Fuel	SO2	NOx	NMVOC	CH4	CO	CO2	N2O	NH3	TSP
					[GJ]	[g/GJ]	[g/GJ]	[g/GJ]	[g/GJ]	[g/GJ]	[kg/GJ]	[g/GJ]	[g/GJ]	[g/GJ]
2004	801	Military	Diesel		585796.00	2.34	429.41	51.37	3.88	160.78	74	5.45	0.33	35.73
2004	801	Military	Jet fuel	< 3000 ft	66524.00	22.99	250.57	24.94	2.65	229.89	72	2.30	0.00	1.16
2004	801	Military	Jet fuel	> 3000 ft	598713.00	22.99	250.57	24.94	2.65	229.89	72	2.30	0.00	1.16
2004	801	Military	Gasoline		3975.00	2.28	288.90	279.15	27.72	2761.31	73	11.32	30.44	2.60
2004	801	Military	Aviation gasoline		6095.00	22.99	859.00	1242.60	21.90	6972.00	73	2.00	1.60	10.00
2004	802	Railways	Diesel		2950035.40	2.34	1190.53	74.44	2.86	204.95	74	2.04	0.20	39.28
2004	803	Inland waterways	Diesel		902453.33	93.68	877.17	170.01	2.76	452.68	74	2.97	0.17	104.92
2004	803	Inland waterways	Gasoline		1001571.20	2.28	398.23	2524.24	54.65	15863.15	73	1.07	0.09	120.51
2004	80402	National sea traffic	Residual oil		1822827.30	1101.71	1393.60	56.90	1.76	180.90	78	4.90		139.40
2004	80402	National sea traffic	Diesel		3827868.83	93.68	1334.90	54.50	1.69	173.30	74	4.70	0.00	42.15
2004	80402	National sea traffic	Kerosene		1078.80	4.60	50.00	3.00	7.00	20.00	72	2.00	2.00	97.56
2004	80402	National sea traffic	LPG		230.00	0.00	1249.00	384.90	20.30	443.00	65	2.00	0.00	12.44
2004	80403	Fishing	Residual oil		84023.55	1101.71	1393.60	56.90	1.76	180.90	78	4.90		139.40
2004	80403	Fishing	Diesel		8428083.30	93.68	1334.90	54.50	1.69	173.30	74	4.70	0.00	42.15
2004	80403	Fishing	Kerosene		730.80	4.60	50.00	3.00	7.00	20.00	72	2.00		97.56
2004	80403	Fishing	Gasoline		0.00	2.28	64.34	10809.60	108.10	18485.10	73	0.52	0.10	23.25
2004	80403	Fishing	LPG		20332.00	0.00	1249.00	384.90	20.30	443.00	65	2.00	0.00	12.44
2004	80404	International sea traffic	Residual oil		20461868.55	1575.67	2127.10	56.90	1.76	180.90	78	4.90		200.50
2004	80404	International sea traffic	Diesel		20729767.13	468.38	2037.50	54.50	1.69	173.30	74	4.70		42.15
2004	80501	Air traffic, other airports	Jet fuel	Dom. < 3000 ft	184147.19	22.99	252.17	29.42	3.12	163.42	72	21.05		1.16
2004	80501	Air traffic, other airports	Aviation gasoline		75380.00	22.83	859.00	1242.60	21.90	6972.00	73	2.00	1.60	10.00
2004	80502	Air traffic, other airports	Jet fuel	Int. < 3000 ft	239381.32	22.99	299.33	14.63	1.55	162.38	72	8.47		1.16
2004	80502	Air traffic, other airports	Aviation gasoline		5565.00	22.83	859.00	1242.60	21.90	6972.00	73	2.00	1.60	10.00
2004	80503	Air traffic, other airports	Jet fuel	Dom. > 3000 ft	531959.09	22.99	280.06	21.04	2.23	133.41	72	2.30		1.16
2004	80504	Air traffic, other airports	Jet fuel	Int. > 3000 ft	2378028.80	22.99	242.26	5.87	0.62	50.37	72	2.30		1.16
2004	806	Agriculture	Diesel		########	23.42	878.84	100.12	1.63	475.69	74	3.12	0.18	73.73
2004	806	Agriculture	Gasoline		489193.78	2.28	86.41	1032.34	129.17	27766.67	73	1.54	1.00	22.10

2004	807	Forestry	Diesel		4625.38	23.42	822.93	65.33	1.06	362.42	74	3.20	0.18	45.59
2004	807	Forestry	Gasoline		56785.69	2.28	48.43	6386.40	52.96	15880.08	73	0.41	0.08	74.18
2004	808	Industry	Diesel		8581033.78	23.42	827.97	113.65	1.85	478.43	74	3.08	0.18	91.66
2004	808	Industry	Gasoline		134440.46	2.28	191.31	1458.32	101.67	12652.23	73	1.39	0.10	12.99
2004	808	Industry	LPG		1498954.83	0.00	1328.11	146.09	7.69	104.85	65	3.50	0.21	4.89
2004	809	Household and gardening	Gasoline		1116969.62	2.28	77.77	2141.22	71.19	27974.82	73	1.17	0.09	21.37
2004	80501	Air traffic, Copenhagen airport	Jet fuel	Dom. < 3000 ft	229614.67	22.99	255.88	39.13	4.16	202.97	72	11.22		1.16
2004	80501	Air traffic, Copenhagen airport	Aviation gasoline		611.00	22.83	859.00	1242.60	21.90	6972.00	73	2.00	1.60	10.00
2004	80502	Air traffic, Copenhagen airport	Jet fuel	Int. < 3000 ft	2587577.02	22.99	335.05	38.17	4.05	214.71	72	4.13	0.00	1.16
2004	80502	Air traffic, Copenhagen airport	Aviation gasoline		885.00	22.83	859.00	1242.60	21.90	6972.00	73	2.00	1.60	10.00
2004	80503	Air traffic, Copenhagen airport	Jet fuel	Dom. > 3000 ft	890213.23	22.99	286.55	18.99	2.02	69.59	72	2.30	0.00	1.16
2004	80504	Air traffic, Copenhagen airport	Jet fuel	Int. > 3000 ft	25170689.68	22.99	310.56	11.03	1.17	35.96	72	2.30	0.00	1.16

	Category	Mode		SO2 [tons]	NOx [tons]	NMVOC [tons]	CH4 [tons]	CO [tons]	CO2 [ktons]	N2O [tons]	NH3 [tons]	TSP [tons]
1990	Passenger cars	Highway driving	70101	121	14676	4111	126	38170	877	36		
1990	Passenger cars	Rural driving	70102	246	27453	11792	336	95013	1882	88	10	216
1990	Passenger cars	Urban driving	70103	302	17524	26630	1456	276338	2209	67	24	487
1990	Light duty vehicles	Highway driving	70201	275	1228	145	8	1959	240	17	18	683
1990	Light duty vehicles	Rural driving	70202	837	4006	614	33	5804	741	56	1	311
1990	Light duty vehicles	Urban driving	70203	802	5000	1465	103	13593	730	39	4	977
1990	Heavy duty vehicles	Highway driving	70301	824	7281	691	54	1641	652	26	3	1142
1990	Heavy duty vehicles	Rural driving	70302	1331	13467	1476	98	3529	1053	44	3	399
1990	Heavy duty vehicles	Urban driving	70303	1027	11399	1387	139	3416	813	27	4	775
1990	Mopeds		704	1	7	2173	54	3711	20	0	3	669
1990	Motorcycles	Highway driving	70501	0	12	72	7	1006	4	0	0	30
1990	Motorcycles	Rural driving	70502	0	23	202	19	2226	10	0	0	2
1990	Motorcycles	Urban driving	70503	0	15	319	23	2422	12	0	0	5
1990	Evaporation		706	0	0	28438	0	0	0	0	0	6
1990	Military		801	48	480	56	5	427	119	4	0	0
1990	Railways		802	376	4913	321	12	895	297	8	0	1117
1990	Inland waterways		803	51	649	1493	23	6433	71	2	0	766
1990	National sea traffic		80402	5483	8678	355	11	1127	484	30	0	13
1990	Fishing		80403	1360	13869	581	18	1813	771	49	1	202
1990	International sea traffic		80404	54300	84417	2259	70	7180	3087	194	0	128
1990	Air traffic, Dom. < 3000 ft.		80501	24	373	158	4	895	75	5	0	614
1990	Air traffic, Int. < 3000 ft.		80502	50	722	116	8	590	156	9	0	466
1990	Air traffic, Dom. > 3000 ft.		80503	54	750	28	3	203	168	5	0	6213

1990	Air traffic, Int. > 3000 ft.	80504	504	6293	215	23	853	1580	50	0	2
1990	Agriculture	806	1547	12541	3260	105	44172	1272	49	0	3
1990	Forestry	807	14	138	2483	21	6259	36	1	0	3
1990	Industry	808	952	11081	2266	60	9379	842	34	0	25
1990	Household and gardening	809	4	123	4560	182	60598	138	2	3	2388

	Category	Mode		SO2 [tons]	NOx [tons]	NMVOC [tons]	CH4 [tons]	CO [tons]	CO2 [ktons]	N2O [tons]	NH3 [tons]	TSP [tons]
2004	Passenger cars	Highway driving	70101	34	5644	910	68	21463	1071	212		
2004	Passenger cars	Rural driving	70102	73	9851	2537	162	24881	2329	285	498	124
2004	Passenger cars	Urban driving	70103	97	9813	10918	1790	149436	3095	554	1206	193
2004	Light duty vehicles	Highway driving	70201	11	1459	147	8	1336	335	29	644	354
2004	Light duty vehicles	Rural driving	70202	33	4677	554	31	3731	1037	90	14	203
2004	Light duty vehicles	Urban driving	70203	32	4823	1151	86	10449	1027	73	46	574
2004	Heavy duty vehicles	Highway driving	70301	27	5382	589	49	1340	842	32	24	681
2004	Heavy duty vehicles	Rural driving	70302	41	9741	1131	82	2456	1287	50	3	230
2004	Heavy duty vehicles	Urban driving	70303	29	7572	924	99	2103	924	29	5	432
2004	Mopeds		704	1	6	1529	38	2607	18	0	3	367
2004	Motorcycles	Highway driving	70501	0	29	154	16	2292	10	0	0	26
2004	Motorcycles	Rural driving	70502	1	54	431	44	5057	22	0	0	4
2004	Motorcycles	Urban driving	70503	1	35	689	53	5500	27	1	0	12
2004	Evaporation		706	0	0	4814	0	0	0	0	1	14
2004	Military		801	46	1079	129	11	718	239	12	0	0
2004	Railways		802	7	3478	217	8	599	216	6	0	1454
2004	Inland waterways		803	95	1040	1191	25	6865	104	3	0	1004
2004	National sea traffic		80402	2164	6950	284	9	902	387	24	1	53
2004	Fishing		80403	632	8528	354	11	1112	473	30	1	115
2004	International sea traffic		80404	34821	69705	1865	58	5928	2545	161	0	154
2004	Air traffic, Dom. < 3000 ft.		80501	9	159	131	3	729	29	5	0	379
2004	Air traffic, Int. < 3000 ft.		80502	70	1015	120	12	696	219	14	0	272
2004	Air traffic, Dom. > 3000 ft.		80503	32	393	27	3	128	99	3	0	4149
2004	Air traffic, Int. > 3000 ft.		80504	711	9424	327	35	1152	2228	71	0	1
2004	Agriculture		806	315	11837	1667	62	15042	1017	42	0	4
2004	Forestry		807	4	135	506	4	1291	17	1	0	2
2004	Industry		808	263	10744	1676	46	7600	912	39	0	36
2004	Household and gardening		809	9	317	8731	290	114073	298	5	3	998

Annex 13: Non-exhaust emission factors and total non-exhaust emissions of TSP, PM_{10} and $PM_{2.5}$ in 2004

Year	Source	Category	Mileage [kmkveh]	TSP [mg/km]	PM_{10} [mg/km]	$PM_{2.5}$ [mg/km]	TSP [tons]	PM_{10} [tons]	$PM_{2.5}$ [tons]
2004	Brake wear	Passenger cars	36923001	7.6	7.5	7.5	281	276	110
2004	Brake wear	Light duty vehicles	10776935	13.7	13.4	13.4	148	145	58
2004	Brake wear	Heavy duty vehicles	2826388	34.8	34.1	34.1	98	96	38
2004	Brake wear	Buses	909872	47.1	46.2	46.2	43	42	17
2004	Brake wear	Mopeds	220331	6.2	6.1	6.1	1	1	1
2004	Brake wear	Motorcycles	597325	4.2	4.2	4.2	3	2	1
2004	Road abrasion	Passenger cars	36923001	15.0	7.5	7.5	554	277	150
2004	Road abrasion	Light duty vehicles	10776935	15.0	7.5	7.5	162	81	44
2004	Road abrasion	Heavy duty vehicles	2826388	76.0	38.0	38.0	215	107	58
2004	Road abrasion	Buses	909872	76.0	38.0	38.0	69	35	19
2004	Road abrasion	Mopeds	220331	6.0	3.0	3.0	1	1	0
2004	Road abrasion	Motorcycles	597325	6.0	3.0	3.0	4	2	1
2004	Tyre wear	Passenger cars	36923001	12.4	7.5	7.5	460	276	193
2004	Tyre wear	Light duty vehicles	10776935	20.5	12.3	12.3	220	132	93
2004	Tyre wear	Heavy duty vehicles	2826388	59.8	35.9	35.9	169	101	71
2004	Tyre wear	Buses	909872	29.4	17.6	17.6	27	16	11
2004	Tyre wear	Mopeds	220331	6.4	3.8	3.8	1	1	1
2004	Tyre wear	Motorcycles	597325	5.6	3.3	3.3	3	2	1
2004	Total	Passenger cars					1295	828	452
2004	Total	Light duty vehicles					530	358	194
2004	Total	Heavy duty vehicles					482	305	167
2004	Total	Buses					139	93	47
2004	Total	Mopeds					4	3	1
2004	Total	Motorcycles					9	6	3

Annex 14: Heavy metal emission factors and total emissions for 1990 and 2004 in CollectER format

SNAP ID	Category	Fuel type	Mode	Arsenic [g/GJ]	Cadmium [g/GJ]	Chromium [g/GJ]	Copper [g/GJ]	Mercury [g/GJ]	Nickel [g/GJ]	Lead [g/GJ]	Selenium [g/GJ]	Zinc [g/GJ]
070101	Passenger cars	Diesel	Highway driving		0,000234	0,001171	0,039812		0,001639	0,000000	0,000234	0,023419
070101	Passenger cars	Gasoline 2-stroke	Highway driving		0,000228	0,001141	0,038813		0,001598	0,000685	0,000228	0,022831
070101	Passenger cars	Gasoline conventional	Highway driving		0,000228	0,001141	0,038813		0,001598	0,000685	0,000228	0,022831
070101	Passenger cars	Gasoline catalyst	Highway driving		0,000228	0,001141	0,038813		0,001598	0,000685	0,000228	0,022831
070101	Passenger cars	LPG	Highway driving		0,000000	0,000000	0,000000		0,000000	0,000000	0,000000	0,000000
070102	Passenger cars	Diesel	Rural driving		0,000234	0,001171	0,039812		0,001639	0,000000	0,000234	0,023419
070102	Passenger cars	Gasoline 2-stroke	Rural driving		0,000228	0,001141	0,038813		0,001598	0,000685	0,000228	0,022831
070102	Passenger cars	Gasoline conventional	Rural driving		0,000228	0,001141	0,038813		0,001598	0,000685	0,000228	0,022831
070102	Passenger cars	Gasoline catalyst	Rural driving		0,000228	0,001141	0,038813		0,001598	0,000685	0,000228	0,022831
070102	Passenger cars	LPG	Rural driving		0,000000	0,000000	0,000000		0,000000	0,000000	0,000000	0,000000
070103	Passenger cars	Diesel	Urban driving		0,000234	0,001171	0,039812		0,001639	0,000000	0,000234	0,023419
070103	Passenger cars	Gasoline 2-stroke	Urban driving		0,000228	0,001141	0,038813		0,001598	0,000685	0,000228	0,022831
070103	Passenger cars	Gasoline conventional	Urban driving		0,000228	0,001141	0,038813		0,001598	0,000685	0,000228	0,022831
070103	Passenger cars	Gasoline catalyst	Urban driving		0,000228	0,001141	0,038813		0,001598	0,000685	0,000228	0,022831
070103	Passenger cars	LPG	Urban driving		0,000000	0,000000	0,000000		0,000000	0,000000	0,000000	0,000000
070201	Light duty vehicles	Diesel	Highway driving		0,000234	0,001171	0,039812		0,001639	0,000000	0,000234	0,023419
070201	Light duty vehicles	Gasoline conventional	Highway driving		0,000228	0,001141	0,038813		0,001598	0,000685	0,000228	0,022831
070201	Light duty vehicles	Gasoline catalyst	Highway driving		0,000228	0,001141	0,038813		0,001598	0,000685	0,000228	0,022831
070202	Light duty vehicles	Diesel	Rural driving		0,000234	0,001171	0,039812		0,001639	0,000000	0,000234	0,023419
070202	Light duty vehicles	Gasoline conventional	Rural driving		0,000228	0,001141	0,038813		0,001598	0,000685	0,000228	0,022831
070202	Light duty vehicles	Gasoline catalyst	Rural driving		0,000228	0,001141	0,038813		0,001598	0,000685	0,000228	0,022831
070203	Light duty vehicles	Diesel	Urban driving		0,000234	0,001171	0,039812		0,001639	0,000000	0,000234	0,023419
070203	Light duty vehicles	Gasoline conventional	Urban driving		0,000228	0,001141	0,038813		0,001598	0,000685	0,000228	0,022831
070203	Light duty vehicles	Gasoline catalyst	Urban driving		0,000228	0,001141	0,038813		0,001598	0,000685	0,000228	0,022831
070301	Heavy duty vehicles	Diesel	Highway driving		0,000234	0,001171	0,039812		0,001639	0,000000	0,000234	0,023419
070301	Heavy duty vehicles	Gasoline	Highway driving		0,000228	0,001141	0,038813		0,001598	0,000685	0,000228	0,022831
070302	Heavy duty vehicles	Diesel	Rural driving		0,000234	0,001171	0,039812		0,001639	0,000000	0,000234	0,023419
070302	Heavy duty vehicles	Gasoline	Rural driving		0,000228	0,001141	0,038813		0,001598	0,000685	0,000228	0,022831
070303	Heavy duty vehicles	Diesel	Urban driving		0,000234	0,001171	0,039812		0,001639	0,000000	0,000234	0,023419
070303	Heavy duty vehicles	Gasoline	Urban driving		0,000228	0,001141	0,038813		0,001598	0,000685	0,000228	0,022831
0704	Mopeds	Gasoline			0,000228	0,001141	0,038813		0,001598	0,000685	0,000228	0,022831
070501	Motorcycles	Gasoline	Highway driving		0,000228	0,001141	0,038813		0,001598	0,000685	0,000228	0,022831
070502	Motorcycles	Gasoline	Rural driving		0,000228	0,001141	0,038813		0,001598	0,000685	0,000228	0,022831

070503	Motorcycles	Gasoline	Urban driving	0,000228	0,001141	0,038813		0,001598	0,000685	0,000228	0,022831	

SNAP ID	Category	Fuel type	Mode	Arsenic [mg/GJ]	Cadmium [mg/GJ]	Chromium [mg/GJ]	Copper [mg/GJ]	Mercury [mg/GJ]	Nickel [mg/GJ]	Lead [mg/GJ]	Selenium [mg/GJ]	Zinc [mg/GJ]
0801	Military	Diesel			0,23	1,17	39,81		1,64		0,23	23,42
0801	Military	Jet fuel	< 3000 ft	0,00	0,23	1,14	38,81	0,00	1,60	0,00	0,23	22,83
0801	Military	Jet fuel	> 3000 ft	0,00	0,23	1,14	38,81	0,00	1,60	0,00	0,23	22,83
0801	Military	Gasoline			0,23	1,14	38,81		1,60	0,68	0,23	22,83
0801	Military	Aviation gasoline		0,00	0,23	1,14	38,81	0,00	1,60	12785,39	0,23	22,83
0802	Railways	Diesel			0,23	1,17	39,81		1,64		0,23	23,42
0802	Railways	Kerosene										
0802	Railways	Gasoline			0,23	1,14	38,81		1,60	0,68	0,23	22,83
0803	Inland waterways	Diesel			0,23	1,17	39,81		1,64		0,23	23,42
0803	Inland waterways	Gasoline			0,23	1,14	38,81		1,60	0,68	0,23	22,83
080402	National sea traffic	Residual oil		12,22	0,73	4,89	12,22	0,49	733,50	4,89	9,78	22,00
080402	National sea traffic	Diesel		1,17	0,23	0,94	1,17	1,17	1,64	2,34	4,68	11,71
080402	National sea traffic	Kerosene										
080402	National sea traffic	LPG										
080403	Fishing	Residual oil		12,22	0,73	4,89	12,22	0,49	733,50	4,89	9,78	22,00
080403	Fishing	Diesel		1,17	0,23	0,94	1,17	1,17	1,64	2,34	4,68	11,71
080403	Fishing	Kerosene										
080403	Fishing	Gasoline			0,23	1,14	38,81		1,60	0,68	0,23	22,83
080403	Fishing	LPG										
080404	International sea traffic	Residual oil		12,22	0,73	4,89	12,22	0,49	733,50	4,89	9,78	22,00
080404	International sea traffic	Diesel		1,17	0,23	0,94	1,17	1,17	1,64	2,34	4,68	11,71
080501	Air traffic, other airports	Jet fuel	Dom. < 3000 ft		0,23	1,14	38,81		1,60	0,00	0,23	22,83
080501	Air traffic, other airports	Aviation gasoline			0,23	1,14	38,81		1,60	13505,69	0,23	22,83
080502	Air traffic, other airports	Jet fuel	Int. < 3000 ft		0,23	1,14	38,81		1,60	0,00	0,23	22,83
080502	Air traffic, other airports	Aviation gasoline			0,23	1,14	38,81		1,60	13505,69	0,23	22,83
080503	Air traffic, other airports	Jet fuel	Dom. > 3000 ft		0,23	1,14	38,81		1,60	0,00	0,23	22,83
080504	Air traffic, other airports	Jet fuel	Int. > 3000 ft		0,23	1,14	38,81		1,60	0,00	0,23	22,83
0806	Agriculture	Diesel			0,23	1,17	39,81		1,64		0,23	23,42
0806	Agriculture	Gasoline			0,23	1,14	38,81		1,60	0,68	0,23	22,83
0807	Forestry	Diesel			0,23	1,17	39,81		1,64		0,23	23,42
0807	Forestry	Gasoline			0,23	1,14	38,81		1,60	0,68	0,23	22,83
0808	Industry	Diesel			0,23	1,17	39,81		1,64		0,23	23,42
0808	Industry	Gasoline			0,23	1,14	38,81		1,60	0,68	0,23	22,83
0808	Industry	LPG										
0809	Household and gardening	Gasoline			0,23	1,14	38,81		1,60	0,68	0,23	22,83
080501	Air traffic, CPH. airport	Jet fuel	Dom. < 3000 ft		0,23	1,14	38,81		1,60		0,23	22,83
080501	Air traffic, CPH. airport	Aviation gasoline			0,23	1,14	38,81		1,60	13505,69	0,23	22,83
080502	Air traffic, CPH. airport	Jet fuel	Int. < 3000 ft	0,00	0,23	1,14	38,81	0,00	1,60	0,00	0,23	22,83
080502	Air traffic, CPH. airport	Aviation gasoline		0,00	0,23	1,14	38,81	0,00	1,60	13505,69	0,23	22,83
080503	Air traffic, CPH. airport	Jet fuel	Dom. > 3000 ft	0,00	0,23	1,14	38,81	0,00	1,60	0,00	0,23	22,83

080504	Air traffic, CPH. airport	Jet fuel	Int. > 3000 ft	0,00	0,23	1,14	38,81	0,00	1,60	0,00	0,23	22,83	

Year	Category	Mode	SNAP ID	Arsenic [kg]	Cadmium [kg]	Chromium [kg]	Copper [kg]	Mercury [kg]	Nickel [kg]	Lead [kg]	Selenium [kg]	Zinc [kg]
1990	Passenger cars	Highway driving	70101	0	3	14	461	0	19	16147	3	271
1990	Passenger cars	Rural driving	70102	0	6	29	987	0	41	34871	6	581
1990	Passenger cars	Urban driving	70103	0	7	34	1164	0	48	40700	7	685
1990	Light duty vehicles	Highway driving	70201	0	1	4	133	0	5	469	1	78
1990	Light duty vehicles	Rural driving	70202	0	2	12	412	0	17	1659	2	242
1990	Light duty vehicles	Urban driving	70203	0	2	12	408	0	17	2003	2	240
1990	Heavy duty vehicles	Highway driving	70301	0	2	10	351	0	14	14	2	206
1990	Heavy duty vehicles	Rural driving	70302	0	3	17	567	0	23	28	3	333
1990	Heavy duty vehicles	Urban driving	70303	0	3	13	438	0	18	28	3	257
1990	Mopeds		704	0	0	0	14	0	1	399	0	8
1990	Motorcycles	Highway driving	70501	0	0	0	3	0	0	84	0	2
1990	Motorcycles	Rural driving	70502	0	0	0	7	0	0	195	0	4
1990	Motorcycles	Urban driving	70503	0	0	0	8	0	0	233	0	5
1990	Evaporation		706	0	0	0	0	0	0	0	0	0
1990	Military		801	0	0	0	0	0	0	0	0	0
1990	Railways		802	0	0	0	0	0	0	0	0	0
1990	Inland waterways		803	0	0	2	64	0	3	64	0	38
1990	National sea traffic		80402	0	1	5	160	0	7	0	1	94
1990	Fishing		80403	0	0	1	38	0	2	637	0	22
1990	International sea traffic		80404	47	3	20	47	5	2616	24	48	111
1990	Air traffic, Dom. < 3000 ft.		80501	15	3	11	15	12	226	25	50	124
1990	Air traffic, Int. < 3000 ft.		80502	363	24	150	363	28	20956	167	334	764
1990	Air traffic, Dom. > 3000 ft.		80503	0	0	1	40	0	2	1534	0	24
1990	Air traffic, Int. > 3000 ft.		80504	0	1	2	84	0	3	490	1	50
1990	Agriculture		806	0	1	3	90	0	4	0	1	53
1990	Forestry		807	0	5	25	852	0	35	0	5	501
1990	Industry		808	0	4	20	684	0	28	1043	4	403
1990	Household and gardening		809	0	0	1	19	0	1	502	0	11

Year	Category	Mode	SNAP ID	Arsenic [kg]	Cadmium [kg]	Chromium [kg]	Copper [kg]	Mercury [kg]	Nickel [kg]	Lead [kg]	Selenium [kg]	Zinc [kg]
2004	Passenger cars	Highway driving	70101	0	3	17	571	0	24	8	3	336
2004	Passenger cars	Rural driving	70102	0	7	37	1241	0	51	18	7	730
2004	Passenger cars	Urban driving	70103	0	10	48	1649	0	68	25	10	970
2004	Light duty vehicles	Highway driving	70201	0	1	5	180	0	7	0	1	106
2004	Light duty vehicles	Rural driving	70202	0	3	16	557	0	23	1	3	328
2004	Light duty vehicles	Urban driving	70203	0	3	16	552	0	23	1	3	324
2004	Heavy duty vehicles	Highway driving	70301	0	3	13	453	0	19	0	3	266
2004	Heavy duty vehicles	Rural driving	70302	0	4	20	692	0	29	0	4	407
2004	Heavy duty vehicles	Urban driving	70303	0	3	15	497	0	20	0	3	293
2004	Mopeds		704	0	0	0	9	0	0	0	0	6
2004	Motorcycles	Highway driving	70501	0	0	0	5	0	0	0	0	3
2004	Motorcycles	Rural driving	70502	0	0	0	12	0	0	0	0	7
2004	Motorcycles	Urban driving	70503	0	0	0	14	0	1	0	0	8
2004	Evaporation		706	0	0	0	0	0	0	0	0	0
2004	Military		801	0	0	0	0	0	0	0	0	0
2004	Railways		802	0	0	0	0	0	0	0	0	0
2004	Inland waterways		803	0	1	4	129	0	5	82	1	76
2004	National sea traffic		80402	0	1	3	116	0	5	0	1	68
2004	Fishing		80403	0	0	2	56	0	2	0	0	33
2004	International sea traffic		80404	24	2	11	24	5	1230	16	33	77
2004	Air traffic, Dom. < 3000 ft.		80501	8	1	6	8	7	36	15	30	75
2004	Air traffic, Int. < 3000 ft.		80502	230	16	100	230	27	12715	122	245	570
2004	Air traffic, Dom. > 3000 ft.		80503	0	0	0	15	0	1	1304	0	9
2004	Air traffic, Int. > 3000 ft.		80504	0	1	3	118	0	5	111	1	69
2004	Agriculture		806	0	0	2	54	0	2	0	0	32
2004	Forestry		807	0	7	35	1201	0	50	0	7	707
2004	Industry		808	0	3	16	547	0	23	0	3	322
2004	Household and gardening		809	0	0	0	9	0	0	0	0	6

Annex 15: PAH emission factors and total emissions for 1990 and 2004 in CollectER format

Year	SNAP ID	Category	Fuel type	Mode	Dioxins/ Furans [g/GJ]	Flouranthene [g/GJ]	Benzo(b) flouranthene [g/GJ]	Benzo(k) flouranthene [g/GJ]	Benzo(a) pyrene [g/GJ]	Benzo(g,h,i) perylene [g/GJ]	indeno(1,2,3-c,d) pyrene [g/GJ]
1990	070101	Passenger cars	Diesel	Highway driving	7.01E-10	1.22E-02	7.48E-04	6.78E-04	8.18E-04	1.59E-03	7.71E-04
1990	070101	Passenger cars	Gasoline 2-stroke	Highway driving							
1990	070101	Passenger cars	Gasoline conventional	Highway driving	1.34E-08	8.54E-03	5.55E-04	4.27E-04	4.69E-04	1.11E-03	4.27E-04
1990	070101	Passenger cars	Gasoline catalyst	Highway driving	0.00E+00	8.62E-04	1.92E-04	2.39E-04	1.92E-04	3.83E-04	2.87E-04
1990	070101	Passenger cars	LPG	Highway driving							
1990	070102	Passenger cars	Diesel	Rural driving	8.52E-10	1.49E-02	9.09E-04	8.24E-04	9.94E-04	1.93E-03	9.37E-04
1990	070102	Passenger cars	Gasoline 2-stroke	Rural driving							
1990	070102	Passenger cars	Gasoline conventional	Rural driving	1.51E-08	9.58E-03	6.23E-04	4.79E-04	5.27E-04	1.25E-03	4.79E-04
1990	070102	Passenger cars	Gasoline catalyst	Rural driving	0.00E+00	9.60E-04	2.13E-04	2.67E-04	2.13E-04	4.26E-04	3.20E-04
1990	070102	Passenger cars	LPG	Rural driving							
1990	070103	Passenger cars	Diesel	Urban driving	5.33E-10	9.30E-03	5.68E-04	5.15E-04	6.21E-04	1.21E-03	5.86E-04
1990	070103	Passenger cars	Gasoline 2-stroke	Urban driving							
1990	070103	Passenger cars	Gasoline conventional	Urban driving	1.02E-08	6.47E-03	4.20E-04	3.23E-04	3.56E-04	8.41E-04	3.23E-04
1990	070103	Passenger cars	Gasoline catalyst	Urban driving	0.00E+00	5.18E-04	1.15E-04	1.44E-04	1.15E-04	2.30E-04	1.72E-04
1990	070103	Passenger cars	LPG	Urban driving							
1990	070201	Light duty vehicles	Diesel	Highway driving	4.87E-10	8.51E-03	5.19E-04	4.70E-04	5.68E-04	1.10E-03	5.36E-04
1990	070201	Light duty vehicles	Gasoline conventional	Highway driving	1.27E-08	8.09E-03	5.26E-04	4.04E-04	4.45E-04	1.05E-03	4.04E-04
1990	070201	Light duty vehicles	Gasoline catalyst	Highway driving	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1990	070202	Light duty vehicles	Diesel	Rural driving	5.33E-10	9.31E-03	5.68E-04	5.15E-04	6.22E-04	1.21E-03	5.86E-04
1990	070202	Light duty vehicles	Gasoline conventional	Rural driving	1.20E-08	7.63E-03	4.95E-04	3.81E-04	4.19E-04	9.91E-04	3.81E-04
1990	070202	Light duty vehicles	Gasoline catalyst	Rural driving	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1990	070203	Light duty vehicles	Diesel	Urban driving	3.98E-10	6.95E-03	4.25E-04	3.85E-04	4.64E-04	9.02E-04	4.38E-04
1990	070203	Light duty vehicles	Gasoline conventional	Urban driving	7.18E-09	4.56E-03	2.96E-04	2.28E-04	2.51E-04	5.92E-04	2.28E-04
1990	070203	Light duty vehicles	Gasoline catalyst	Urban driving	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1990	070301	Heavy duty vehicles	Diesel	Highway driving	1.06E-09	2.09E-03	5.26E-04	7.80E-04	9.74E-05	7.78E-05	1.36E-04
1990	070301	Heavy duty vehicles	Gasoline	Highway driving							
1990	070302	Heavy duty vehicles	Diesel	Rural driving	1.12E-09	2.21E-03	5.57E-04	8.25E-04	1.03E-04	8.24E-05	1.44E-04
1990	070302	Heavy duty vehicles	Gasoline	Rural driving							
1990	070303	Heavy duty vehicles	Diesel	Urban driving	9.11E-10	1.79E-03	4.51E-04	6.68E-04	8.34E-05	6.67E-05	1.17E-04
1990	070303	Heavy duty vehicles	Gasoline	Urban driving							
1990	0704	Mopeds	Gasoline								
1990	070501	Motorcycles	Gasoline	Highway driving	2.00E-08	1.27E-02	8.24E-04	6.34E-04	6.97E-04	1.65E-03	6.34E-04
1990	070502	Motorcycles	Gasoline	Rural driving	2.39E-08	1.52E-02	9.86E-04	7.59E-04	8.34E-04	1.97E-03	7.59E-04

1990	070503	Motorcycles	Gasoline	Urban driving	2.41E-08	1.53E-02	9.94E-04	7.65E-04	8.41E-04	1.99E-03	7.65E-04

Year	SNAP ID	Category	Fuel type	Mode	Dioxins/ Furans [g/GJ]	Flouranthene [g/GJ]	Benzo(b) flouranthene [g/GJ]	Benzo(k) flouranthene [g/GJ]	Benzo(a) pyrene [g/GJ]	Benzo(g,h,i) perylene [g/GJ]	indeno(1,2,3-c,d) pyrene [g/GJ]
2004	070101	Passenger cars	Diesel	Highway driving	7.34E-10	1.28E-02	7.82E-04	7.09E-04	8.56E-04	1.66E-03	8.07E-04
2004	070101	Passenger cars	Gasoline 2-stroke	Highway driving							
2004	070101	Passenger cars	Gasoline conventional	Highway driving	1.39E-08	8.82E-03	5.73E-04	4.41E-04	4.85E-04	1.15E-03	4.41E-04
2004	070101	Passenger cars	Gasoline catalyst	Highway driving	0.00E+00	8.84E-04	1.96E-04	2.45E-04	1.96E-04	3.93E-04	2.95E-04
2004	070101	Passenger cars	LPG	Highway driving							
2004	070102	Passenger cars	Diesel	Rural driving	8.35E-10	1.46E-02	8.91E-04	8.07E-04	9.75E-04	1.89E-03	9.19E-04
2004	070102	Passenger cars	Gasoline 2-stroke	Rural driving							
2004	070102	Passenger cars	Gasoline conventional	Rural driving	1.53E-08	9.74E-03	6.33E-04	4.87E-04	5.36E-04	1.27E-03	4.87E-04
2004	070102	Passenger cars	Gasoline catalyst	Rural driving	0.00E+00	9.87E-04	2.19E-04	2.74E-04	2.19E-04	4.39E-04	3.29E-04
2004	070102	Passenger cars	LPG	Rural driving							
2004	070103	Passenger cars	Diesel	Urban driving	5.54E-10	9.68E-03	5.91E-04	5.36E-04	6.47E-04	1.26E-03	6.10E-04
2004	070103	Passenger cars	Gasoline 2-stroke	Urban driving							
2004	070103	Passenger cars	Gasoline conventional	Urban driving	9.99E-09	6.34E-03	4.12E-04	3.17E-04	3.49E-04	8.25E-04	3.17E-04
2004	070103	Passenger cars	Gasoline catalyst	Urban driving	0.00E+00	5.38E-04	1.19E-04	1.49E-04	1.19E-04	2.39E-04	1.79E-04
2004	070103	Passenger cars	LPG	Urban driving							
2004	070201	Light duty vehicles	Diesel	Highway driving	5.29E-10	9.23E-03	5.64E-04	5.11E-04	6.17E-04	1.20E-03	5.81E-04
2004	070201	Light duty vehicles	Gasoline conventional	Highway driving	1.27E-08	8.09E-03	5.26E-04	4.04E-04	4.45E-04	1.05E-03	4.04E-04
2004	070201	Light duty vehicles	Gasoline catalyst	Highway driving	0.00E+00	6.18E-04	1.37E-04	1.72E-04	1.37E-04	2.75E-04	2.06E-04
2004	070202	Light duty vehicles	Diesel	Rural driving	5.78E-10	1.01E-02	6.17E-04	5.59E-04	6.75E-04	1.31E-03	6.36E-04
2004	070202	Light duty vehicles	Gasoline conventional	Rural driving	1.20E-08	7.63E-03	4.95E-04	3.81E-04	4.19E-04	9.91E-04	3.81E-04
2004	070202	Light duty vehicles	Gasoline catalyst	Rural driving	0.00E+00	5.84E-04	1.30E-04	1.62E-04	1.30E-04	2.59E-04	1.95E-04
2004	070203	Light duty vehicles	Diesel	Urban driving	4.16E-10	7.26E-03	4.43E-04	4.02E-04	4.85E-04	9.42E-04	4.57E-04
2004	070203	Light duty vehicles	Gasoline conventional	Urban driving	6.92E-09	4.39E-03	2.85E-04	2.20E-04	2.42E-04	5.71E-04	2.20E-04
2004	070203	Light duty vehicles	Gasoline catalyst	Urban driving	0.00E+00	3.37E-04	7.49E-05	9.36E-05	7.49E-05	1.50E-04	1.12E-04
2004	070301	Heavy duty vehicles	Diesel	Highway driving	1.03E-09	2.03E-03	5.12E-04	7.59E-04	9.48E-05	7.59E-05	1.33E-04
2004	070301	Heavy duty vehicles	Gasoline	Highway driving							
2004	070302	Heavy duty vehicles	Diesel	Rural driving	1.05E-09	2.07E-03	5.21E-04	7.72E-04	9.65E-05	7.70E-05	1.35E-04
2004	070302	Heavy duty vehicles	Gasoline	Rural driving							
2004	070303	Heavy duty vehicles	Diesel	Urban driving	8.54E-10	1.68E-03	4.23E-04	6.26E-04	7.82E-05	6.25E-05	1.10E-04
2004	070303	Heavy duty vehicles	Gasoline	Urban driving							
2004	0704	Mopeds	Gasoline								
2004	070501	Motorcycles	Gasoline	Highway driving	2.02E-08	1.28E-02	8.32E-04	6.40E-04	7.04E-04	1.66E-03	6.40E-04
2003	070502	Motorcycles	Gasoline	Rural driving	2.41E-08	1.53E-02	9.96E-04	7.66E-04	8.43E-04	1.99E-03	7.66E-04
2003	070503	Motorcycles	Gasoline	Urban driving	2.44E-08	1.55E-02	1.01E-03	7.75E-04	8.52E-04	2.01E-03	7.75E-04

Year	SNAP ID	Category	Fuel type	Mode	Dioxins/ Furans [ng/GJ]	Flouranthene [microg/GJ]	Benzo(b) flouranthene [microg/GJ]	Benzo(k) flouranthene [microg/GJ]	Benzo(a) pyrene [microg/GJ]	Benzo(g,h,i) perylene [microg/GJ]	indeno(1,2,3-c,d) pyrene [microg/GJ]
1990	0801	Military	Diesel		0.71	4391.42	570.64	568.31	289.75	550.01	290.13
1990	0801	Military	Jet fuel	< 3000 ft	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1990	0801	Military	Jet fuel	> 3000 ft	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1990	0801	Military	Gasoline		6.27	5257.47	277.33	116.39	141.99	824.70	299.87
1990	0801	Military	Aviation gasoline		5.11	4328.53	209.06	71.27	114.03	688.95	244.70
1990	0802	Railways	Diesel		0.70	1365.92	348.03	388.90	57.47	49.17	89.40
1990	0802	Railways	Kerosene								
1990	0802	Railways	Gasoline		6.27	5257.47	277.33	116.39	141.99	824.70	299.87
1990	0803	Inland waterways	Diesel		0.71	4391.42	570.64	568.31	289.75	550.01	290.13
1990	0803	Inland waterways	Gasoline		5.11	4328.53	209.06	71.27	114.03	688.95	244.70
1990	080402	National sea traffic	Residual oil		13.42	5190.00	270.00	50.00	20.00	70.00	30.00
1990	080402	National sea traffic	Diesel		12.01	7420.00	640.00	300.00	150.00	1430.00	1180.00
1990	080402	National sea traffic	Kerosene								
1990	080402	National sea traffic	LPG								
1990	080403	Fishing	Residual oil		13.42	5190.00	270.00	50.00	20.00	70.00	30.00
1990	080403	Fishing	Diesel		12.01	7420.00	640.00	300.00	150.00	1430.00	1180.00
1990	080403	Fishing	Kerosene								
1990	080403	Fishing	Gasoline		11.42	3420.09	342.47	146.12	244.29	488.58	244.29
1990	080403	Fishing	LPG								
1990	080404	International sea traffic	Residual oil		13.42	4120.00	200.00	90.00	70.00	260.00	200.00
1990	080404	International sea traffic	Diesel		12.01	7420.00	640.00	300.00	150.00	1430.00	1180.00
1990	080501	Air traffic. other airports	Jet fuel	Dom. < 3000 ft	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1990	080501	Air traffic. other airports	Aviation gasoline		5.11	4328.53	209.06	71.27	114.03	688.95	244.70
1990	080502	Air traffic. other airports	Jet fuel	Int. < 3000 ft	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1990	080502	Air traffic. other airports	Aviation gasoline		5.11	4328.53	209.06	71.27	114.03	688.95	244.70
1990	080503	Air traffic. other airports	Jet fuel	Dom. > 3000 ft	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1990	080504	Air traffic. other airports	Jet fuel	Int. > 3000 ft	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1990	0806	Agriculture	Diesel		0.71	4391.42	570.64	568.31	289.75	550.01	290.13
1990	0806	Agriculture	Gasoline		5.11	4328.53	209.06	71.27	114.03	688.95	244.70
1990	0807	Forestry	Diesel		0.71	4391.42	570.64	568.31	289.75	550.01	290.13
1990	0807	Forestry	Gasoline		5.11	4328.53	209.06	71.27	114.03	688.95	244.70
1990	0808	Industry	Diesel		0.71	4391.42	570.64	568.31	289.75	550.01	290.13
1990	0808	Industry	Gasoline		5.11	4328.53	209.06	71.27	114.03	688.95	244.70
1990	0808	Industry	LPG								
1990	0809	Household and gardening	Gasoline		5.11	4328.53	209.06	71.27	114.03	688.95	244.70
1990	080501	Air traffic. CPH. airport	Jet fuel	Dom. < 3000 ft	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1990	080501	Air traffic. Copenhagen airport	Aviation gasoline		5.11	4328.53	209.06	71.27	114.03	688.95	244.70
1990	080502	Air traffic. Copenhagen airport	Jet fuel	Int. < 3000 ft	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1990	080502	Air traffic. Copenhagen airport	Aviation gasoline		5.11	4328.53	209.06	71.27	114.03	688.95	244.70
1990	080503	Air traffic. Copenhagen airport	Jet fuel	Dom. > 3000 ft	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1990	080504	Air traffic. Copenhagen airport	Jet fuel	Int. > 3000 ft	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Year	SNAP ID	Category	Fuel type	Mode	Dioxins/ Furans [g/GJ]	Flouranthene [g/GJ]	Benzo(b) flouranthene [g/GJ]	Benzo(k) flouranthene [g/GJ]	Benzo(a) pyrene [g/GJ]	Benzo(g,h,i) perylene [g/GJ]	indeno(1,2,3-c,d) pyrene [g/GJ]
2004	801	Military	Diesel		0.71	4349.86	510.47	495.91	255.72	464.46	264.30
2004	801	Military	Jet fuel	< 3000 ft	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2004	801	Military	Jet fuel	> 3000 ft	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2004	801	Military	Gasoline		6.89	2151.74	179.80	115.04	118.07	357.51	178.80
2004	801	Military	Aviation gasoline		5.11	4328.53	209.06	71.27	114.03	688.95	244.70
2004	802	Railways	Diesel		0.72	1411.28	359.58	401.81	59.38	50.80	92.37
2004	803	Inland waterways	Diesel		0.71	4349.86	510.47	495.91	255.72	464.46	264.30
2004	803	Inland waterways	Gasoline		5.11	4328.53	209.06	71.27	114.03	688.95	244.70
2004	80402	National sea traffic	Residual oil		13.42	5190.00	270.00	50.00	20.00	70.00	30.00
2004	80402	National sea traffic	Diesel		12.01	7420.00	640.00	300.00	150.00	1430.00	1180.00
2004	80402	National sea traffic	Kerosene								
2004	80402	National sea traffic	LPG								
2004	80403	Fishing	Residual oil		13.42	5190.00	270.00	50.00	20.00	70.00	30.00
2004	80403	Fishing	Diesel		12.01	7420.00	640.00	300.00	150.00	1430.00	1180.00
2004	80403	Fishing	Kerosene								
2004	80403	Fishing	Gasoline		11.42	3420.00	342.00	146.00	244.00	489.00	244.00
2004	80403	Fishing	LPG								
2004	80404	International sea traffic	Residual oil		13.42	4120.00	200.00	90.00	70.00	260.00	200.00
2004	80404	International sea traffic	Diesel		12.01	7420.00	640.00	300.00	150.00	1430.00	1180.00
2004	80501	Air traffic. other airports	Jet fuel	Dom. < 3000 ft	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2004	80501	Air traffic. other airports	Aviation gasoline		5.11	4328.53	209.06	71.27	114.03	688.95	244.70
2004	80502	Air traffic. other airports	Jet fuel	Int. < 3000 ft	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2004	80502	Air traffic. other airports	Aviation gasoline		5.11	4328.53	209.06	71.27	114.03	688.95	244.70
2004	80503	Air traffic. other airports	Jet fuel	Dom. > 3000 ft	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2004	80504	Air traffic. other airports	Jet fuel	Int. > 3000 ft	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2004	806	Agriculture	Diesel		0.71	4349.86	510.47	495.91	255.72	464.46	264.30
2004	806	Agriculture	Gasoline		5.11	4328.53	209.06	71.27	114.03	688.95	244.70
2004	807	Forestry	Diesel		0.71	4349.86	510.47	495.91	255.72	464.46	264.30
2004	807	Forestry	Gasoline		5.11	4328.53	209.06	71.27	114.03	688.95	244.70
2004	808	Industry	Diesel		0.71	4349.86	510.47	495.91	255.72	464.46	264.30
2004	808	Industry	Gasoline		5.11	4328.53	209.06	71.27	114.03	688.95	244.70
2004	808	Industry	LPG								

2004	809	Household and gardening	Gasoline		5.11	4328.53	209.06	71.27	114.03	688.95	244.70
2004	80501	Air traffic. Copenhagen airport	Jet fuel	Dom. < 3000 ft	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2004	80501	Air traffic. Copenhagen airport	Aviation gasoline		5.11	4328.53	209.06	71.27	114.03	688.95	244.70
2004	80502	Air traffic. Copenhagen airport	Jet fuel	Int. < 3000 ft	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2004	80502	Air traffic. Copenhagen airport	Aviation gasoline		5.11	4328.53	209.06	71.27	114.03	688.95	244.70
2004	80503	Air traffic. Copenhagen airport	Jet fuel	Dom. > 3000 ft	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2004	80504	Air traffic. Copenhagen airport	Jet fuel	Int. > 3000 ft	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Year	Category	Mode	SNAP ID	Dioxins/ Furans [kg]	Flouranthene [kg]	Benzo(b) flouranthene [kg]	Benzo(k) flouranthene [kg]	Benzo(a) pyrene [kg]	Benzo(g,h,i) perylene [kg]	indeno(1,2,3-c,d) pyrene [kg]
1990	Passenger cars	Highway driving	70101	0.2	105.9	6.8	5.4	6.0	13.8	5.5
1990	Passenger cars	Rural driving	70102	0.4	256.5	16.6	13.0	14.5	33.3	13.2
1990	Passenger cars	Urban driving	70103	0.3	201.4	13.0	10.2	11.4	26.2	10.4
1990	Light duty vehicles	Highway driving	70201	0.0	27.4	1.7	1.5	1.8	3.6	1.7
1990	Light duty vehicles	Rural driving	70202	0.0	91.5	5.6	5.0	6.0	11.9	5.7
1990	Light duty vehicles	Urban driving	70203	0.0	65.5	4.0	3.6	4.3	8.5	4.0
1990	Heavy duty vehicles	Highway driving	70301	0.0	18.4	4.6	6.9	0.9	0.7	1.2
1990	Heavy duty vehicles	Rural driving	70302	0.0	31.4	7.9	11.7	1.5	1.2	2.1
1990	Heavy duty vehicles	Urban driving	70303	0.0	19.6	5.0	7.3	0.9	0.7	1.3
1990	Mopeds		704	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1990	Motorcycles	Highway driving	70501	0.0	0.7	0.1	0.0	0.0	0.1	0.0
1990	Motorcycles	Rural driving	70502	0.0	2.0	0.1	0.1	0.1	0.3	0.1
1990	Motorcycles	Urban driving	70503	0.0	2.4	0.2	0.1	0.1	0.3	0.1
1990	Evaporation		706	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1990	Military		801	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1990	Railways		802	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1990	Inland waterways		803	0.0	0.7	0.1	0.1	0.0	0.1	0.0
1990	National sea traffic		80402	0.0	5.5	1.4	1.6	0.2	0.2	0.4
1990	Fishing		80403	0.0	4.2	0.4	0.3	0.2	0.6	0.3
1990	International sea traffic		80404	0.1	39.1	2.7	1.0	0.5	4.2	3.4
1990	Air traffic. Dom. < 3000 ft.		80501	0.1	76.1	6.5	3.0	1.5	14.4	11.9
1990	Air traffic. Int. < 3000 ft.		80502	0.5	203.9	13.2	6.1	3.7	24.1	19.4
1990	Air traffic. Dom. > 3000 ft.		80503	0.0	0.5	0.0	0.0	0.0	0.1	0.0
1990	Air traffic. Int. > 3000 ft.		80504	0.0	0.2	0.0	0.0	0.0	0.0	0.0
1990	Agriculture		806	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1990	Forestry		807	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1990	Industry		808	0.0	75.5	9.6	9.4	4.9	9.6	5.0

1990	Household and gardening		809	0.0	2.1	0.2	0.1	0.1	0.3	0.1

Year	Category	Mode	SNAP ID	Dioxins/ Furans [kg]	Flouranthene [kg]	Benzo(b) flouranthene [kg]	Benzo(k) flouranthene [kg]	Benzo(a) pyrene [kg]	Benzo(g,h,i) perylene [kg]	indeno(1,2,3-c,d) pyrene [kg]
2004	Passenger cars	Highway driving	70101	0.0	58.2	5.1	5.2	5.1	10.4	5.9
2004	Passenger cars	Rural driving	70102	0.1	141.4	12.3	12.5	12.4	25.3	14.4
2004	Passenger cars	Urban driving	70103	0.1	106.4	9.3	9.5	9.4	19.1	10.9
2004	Light duty vehicles	Highway driving	70201	0.0	38.7	2.4	2.2	2.6	5.1	2.5
2004	Light duty vehicles	Rural driving	70202	0.0	129.0	8.0	7.3	8.7	17.0	8.3
2004	Light duty vehicles	Urban driving	70203	0.0	89.4	5.5	5.1	6.0	11.8	5.7
2004	Heavy duty vehicles	Highway driving	70301	0.0	23.1	5.8	8.6	1.1	0.9	1.5
2004	Heavy duty vehicles	Rural driving	70302	0.0	35.9	9.1	13.4	1.7	1.3	2.4
2004	Heavy duty vehicles	Urban driving	70303	0.0	20.9	5.3	7.8	1.0	0.8	1.4
2004	Mopeds		704	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2004	Motorcycles	Highway driving	70501	0.0	1.7	0.1	0.1	0.1	0.2	0.1
2004	Motorcycles	Rural driving	70502	0.0	4.7	0.3	0.2	0.3	0.6	0.2
2004	Motorcycles	Urban driving	70503	0.0	5.7	0.4	0.3	0.3	0.7	0.3
2004	Evaporation		706	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2004	Military		801	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2004	Railways		802	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2004	Inland waterways		803	0.0	6.2	0.7	0.7	0.4	0.7	0.4
2004	National sea traffic		80402	0.0	4.1	1.1	1.2	0.2	0.2	0.3
2004	Fishing		80403	0.0	6.1	0.6	0.5	0.3	0.7	0.4
2004	International sea traffic		80404	0.1	34.4	2.7	1.1	0.6	5.1	4.1
2004	Air traffic. Dom. < 3000 ft.		80501	0.1	47.2	4.1	1.9	1.0	9.1	7.5
2004	Air traffic. Int. < 3000 ft.		80502	0.4	191.1	13.8	6.4	3.6	27.6	22.5
2004	Air traffic. Dom. > 3000 ft.		80503	0.0	0.4	0.0	0.0	0.0	0.1	0.0
2004	Air traffic. Int. > 3000 ft.		80504	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2004	Agriculture		806	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2004	Forestry		807	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2004	Industry		808	0.0	59.8	6.9	6.7	3.5	6.5	3.6
2004	Household and gardening		809	0.0	1.0	0.1	0.1	0.1	0.1	0.1

Annex 16: Fuel use and emissions in NFR format

Fuel

IPCC ID	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Industry-Other (1A2f)	11.7	11.7	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12
Civil Aviation (1A3a)	3.6	3.3	4	4	4	3	3	3	3	3	3	3	3	3	2	2	2	2	2	2
Road (1A3b)	110.6	116.9	117	118	119	126	131	134	133	138	143	146	149	151	153	152	152	154	159	164
Railways (1A3c)	4.9	4.9	4	5	4	4	4	4	4	4	4	4	4	3	3	3	3	3	3	3
Navigation (1A3d)	6.4	7.3	8	7	8	7	9	8	9	8	9	9	8	7	6	6	6	7	7	7
Residential (1A4b)	1.9	1.9	2	2	2	2	2	2	2	2	2	2	2	2	2	2	3	3	4	4
Ag./for./fish. (1A4c)	26.2	27.7	26	27	28	28	28	27	25	24	24	24	24	23	23	23	22	22	22	20
Military (1A5)	5.5	4.3	5	3	2	2	4	2	3	3	3	2	2	3	3	2	1	1	1	3
Navigation int. (1A3d)	17.3	20.1	29	37	38	40	36	38	56	63	66	63	58	58	55	56	47	39	41	33
Civil Aviation int. (1A3a)	19.3	20.9	22	24	25	24	23	24	23	25	26	27	28	30	32	33	33	29	30	34

pol_name	IPCC ID	Unit	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
SO2	Industry-Other (1A2f)	[tons]	2402	1441	1440	1438	956	952	955	957	957	959
SO2	Civil Aviation (1A3a)	[tons]	82	77	85	86	83	77	64	62	61	63
SO2	Road (1A3b)	[tons]	11620	7861	7846	7856	5486	5766	5902	3819	1562	1658
SO2	Railways (1A3c)	[tons]	1152	695	618	641	393	376	382	263	105	95
SO2	Navigation (1A3d)	[tons]	4178	5502	6122	4349	6133	5534	6698	3392	3664	3272
SO2	Residential (1A4b)	[tons]	4	4	4	4	4	4	4	4	5	5
SO2	Ag./for./fish. (1A4c)	[tons]	5047	3736	3545	3324	2844	2922	2689	2660	2436	2183
SO2	Military (1A5)	[tons]	408	260	193	72	70	48	206	82	76	80
SO2	Navigation int. (1A3d)	[tons]	20684	24627	39745	51685	52277	54300	46066	37478	65384	69311
SO2	Civil Aviation int. (1A3a)	[tons]	444	480	515	551	578	554	521	541	530	580
NOx	Industry-Other (1A2f)	[tons]	10903	10964	11011	11044	11065	11081	11282	11440	11558	11677
NOx	Civil Aviation (1A3a)	[tons]	1203	1132	1237	1252	1208	1123	920	902	900	940
NOx	Road (1A3b)	[tons]	89618	94432	94420	95431	96389	102091	103297	102403	99004	96332
NOx	Railways (1A3c)	[tons]	6025	6063	5391	5589	5145	4913	4995	5284	5485	4971
NOx	Navigation (1A3d)	[tons]	8153	9373	9972	8708	9731	9326	11117	10140	11079	10478
NOx	Residential (1A4b)	[tons]	114	117	119	122	122	123	134	143	152	161
NOx	Ag./for./fish. (1A4c)	[tons]	23067	25098	22736	24785	25885	26548	26979	26830	24161	23404
NOx	Military (1A5)	[tons]	2221	1884	1557	979	848	480	1698	915	1213	1200
NOx	Navigation int. (1A3d)	[tons]	36143	42057	61836	78416	80275	84417	75576	79058	117623	132160

NOx	Civil Aviation int. (1A3a)	[tons]	5663	6129	6569	7035	7313	7016	6586	6846	6702	7317
NMVOC	Industry-Other (1A2f)	[tons]	2422	2395	2368	2339	2304	2266	2231	2191	2147	2107
NMVOC	Civil Aviation (1A3a)	[tons]	216	213	190	198	193	186	168	164	161	191
NMVOC	Road (1A3b)	[tons]	77938	77903	77406	77098	75603	79517	80422	79811	75378	69511
NMVOC	Railways (1A3c)	[tons]	393	396	352	365	336	321	326	345	358	324
NMVOC	Navigation (1A3d)	[tons]	1763	1812	1847	1804	1855	1848	1931	1901	1953	1933
NMVOC	Residential (1A4b)	[tons]	4667	4637	4606	4574	4567	4560	4600	4609	4592	4606
NMVOC	Ag./for./fish. (1A4c)	[tons]	6500	6566	6358	6421	6385	6324	5945	5504	5049	4725
NMVOC	Military (1A5)	[tons]	608	481	185	477	311	56	197	109	143	137
NMVOC	Navigation int. (1A3d)	[tons]	967	1126	1655	2098	2148	2259	2022	2116	3149	3536
NMVOC	Civil Aviation int. (1A3a)	[tons]	261	288	313	342	361	331	309	316	309	308
CH4	Industry-Other (1A2f)	[tons]	63	63	62	61	61	60	58	57	56	54
CH4	Civil Aviation (1A3a)	[tons]	8	8	8	8	8	7	6	6	6	7
CH4	Road (1A3b)	[tons]	2341	2371	2398	2361	2322	2456	2739	2904	3076	3181
CH4	Railways (1A3c)	[tons]	15	15	14	14	13	12	13	13	14	12
CH4	Navigation (1A3d)	[tons]	32	34	35	33	35	34	37	36	37	36
CH4	Residential (1A4b)	[tons]	192	189	186	183	182	182	181	178	176	174
CH4	Ag./for./fish. (1A4c)	[tons]	160	159	151	150	148	144	137	129	119	112
CH4	Military (1A5)	[tons]	29	24	16	18	13	5	16	8	12	12
CH4	Navigation int. (1A3d)	[tons]	30	35	51	65	66	70	63	65	97	109
CH4	Civil Aviation int. (1A3a)	[tons]	25	27	30	32	33	31	29	30	29	31
CO	Industry-Other (1A2f)	[tons]	9863	9784	9702	9611	9502	9379	9294	9188	9070	8956
CO	Civil Aviation (1A3a)	[tons]	1256	1241	1118	1167	1140	1098	989	955	930	1098
CO	Road (1A3b)	[tons]	550715	530183	511392	465749	438153	448826	467522	462370	454463	418376
CO	Railways (1A3c)	[tons]	1098	1105	982	1018	937	895	910	963	999	906
CO	Navigation (1A3d)	[tons]	7319	7477	7577	7435	7590	7560	7815	7711	7859	7799
CO	Residential (1A4b)	[tons]	64155	63226	62266	61278	60942	60598	60675	60462	60379	60245
CO	Ag./for./fish. (1A4c)	[tons]	61580	60133	57669	56160	54237	52244	49256	46037	42898	39968
CO	Military (1A5)	[tons]	4153	3093	1325	3085	1927	427	1056	541	872	889
CO	Navigation int. (1A3d)	[tons]	3074	3578	5260	6670	6828	7180	6428	6725	10007	11241
CO	Civil Aviation int. (1A3a)	[tons]	1103	1207	1289	1416	1564	1442	1357	1399	1388	1342
CO2	Industry-Other (1A2f)	[ktons]	852	852	851	849	845	842	843	843	842	841
CO2	Civil Aviation (1A3a)	[ktons]	256	241	268	271	262	243	199	193	190	196
CO2	Road (1A3b)	[ktons]	8123	8588	8600	8658	8754	9241	9654	9825	9785	10135
CO2	Railways (1A3c)	[ktons]	364	366	326	338	311	297	302	319	331	300
CO2	Navigation (1A3d)	[ktons]	485	553	588	518	577	555	656	602	655	622

CO2	Residential (1A4b)	[ktons]	139	139	138	138	138	138	140	143	146	149
CO2	Ag./for./fish. (1A4c)	[ktons]	1936	2052	1897	2012	2057	2079	2075	2026	1861	1775
CO2	Military (1A5)	[ktons]	402	316	361	196	165	119	287	141	237	252
CO2	Navigation int. (1A3d)	[ktons]	1320	1537	2261	2869	2936	3087	2762	2887	4300	4829
CO2	Civil Aviation int. (1A3a)	[ktons]	1391	1503	1613	1725	1809	1736	1632	1693	1659	1818
N2O	Industry-Other (1A2f)	[tons]	34	34	34	34	34	34	34	35	35	35
N2O	Civil Aviation (1A3a)	[tons]	10	10	11	11	11	10	9	9	9	9
N2O	Road (1A3b)	[tons]	339	366	369	374	382	402	471	532	579	686
N2O	Railways (1A3c)	[tons]	10	10	9	9	9	8	8	9	9	8
N2O	Navigation (1A3d)	[tons]	28	33	35	30	34	32	39	35	39	36
N2O	Residential (1A4b)	[tons]	2	2	2	2	2	2	2	2	2	2
N2O	Ag./for./fish. (1A4c)	[tons]	89	96	87	93	97	98	99	98	87	84
N2O	Military (1A5)	[tons]	16	13	13	6	6	4	13	7	10	10
N2O	Navigation int. (1A3d)	[tons]	83	97	142	180	185	194	174	182	270	304
N2O	Civil Aviation int. (1A3a)	[tons]	47	50	54	58	61	59	56	58	57	63

pol_name	IPCC ID	Unit	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
SO2	Industry-Other (1A2f)	[tons]	968	244	246	249	251	253	256	258	261	263
SO2	Civil Aviation (1A3a)	[tons]	63	65	68	62	56	49	52	45	44	41
SO2	Road (1A3b)	[tons]	1679	1720	1743	1766	1087	351	351	355	369	378
SO2	Railways (1A3c)	[tons]	96	95	93	78	40	7	7	7	7	7
SO2	Navigation (1A3d)	[tons]	2780	2144	1905	1738	1780	1712	1452	2115	1927	2259
SO2	Residential (1A4b)	[tons]	5	5	5	5	5	5	6	7	8	9
SO2	Ag./for./fish. (1A4c)	[tons]	2189	1368	1447	1139	1115	1108	1066	1072	1088	951
SO2	Military (1A5)	[tons]	80	56	54	65	47	27	12	19	17	46
SO2	Navigation int. (1A3d)	[tons]	76281	71536	65585	59858	60339	65168	54366	39610	44114	34821
SO2	Civil Aviation int. (1A3a)	[tons]	596	629	642	689	731	750	761	658	684	781
NOx	Industry-Other (1A2f)	[tons]	11882	12080	12248	12425	12262	12096	11869	11617	11214	10744
NOx	Civil Aviation (1A3a)	[tons]	958	971	998	911	815	723	747	636	590	552
NOx	Road (1A3b)	[tons]	94690	91590	86967	82353	77984	72515	68785	64205	62574	59085
NOx	Railways (1A3c)	[tons]	5015	4977	4846	4089	3730	3727	3396	3396	3540	3478
NOx	Navigation (1A3d)	[tons]	11052	11456	10037	8225	7443	7518	7384	8902	8660	7990
NOx	Residential (1A4b)	[tons]	168	174	180	186	190	194	225	256	287	317
NOx	Ag./for./fish. (1A4c)	[tons]	23357	24170	24716	24407	24624	24482	24044	23730	22612	20501
NOx	Military (1A5)	[tons]	1586	888	1061	1221	956	497	580	416	447	1079
NOx	Navigation int. (1A3d)	[tons]	138528	131504	120575	120988	113827	117148	98722	81292	85761	69705

NOx	Civil Aviation int. (1A3a)	[tons]	7517	7904	8058	8662	9204	9446	9611	8738	9097	10439
NMVOC	Industry-Other (1A2f)	[tons]	2088	2095	2083	2074	1997	1926	1873	1815	1754	1676
NMVOC	Civil Aviation (1A3a)	[tons]	206	194	186	169	162	156	155	151	143	158
NMVOC	Road (1A3b)	[tons]	67664	63777	57320	51865	46118	39042	35617	32150	29871	26477
NMVOC	Railways (1A3c)	[tons]	327	325	316	267	276	253	248	243	223	217
NMVOC	Navigation (1A3d)	[tons]	1966	1992	1931	1843	1782	1745	1687	1683	1594	1474
NMVOC	Residential (1A4b)	[tons]	4699	4798	4894	4985	5099	5209	6083	6955	7837	8731
NMVOC	Ag./for./fish. (1A4c)	[tons]	4567	4309	4137	3854	3680	3474	3280	3063	2814	2528
NMVOC	Military (1A5)	[tons]	190	107	132	149	127	64	75	55	58	129
NMVOC	Navigation int. (1A3d)	[tons]	3707	3519	3226	3237	3045	3134	2641	2174	2294	1865
NMVOC	Civil Aviation int. (1A3a)	[tons]	343	360	365	386	395	407	406	391	399	448
CH4	Industry-Other (1A2f)	[tons]	53	53	53	53	51	50	49	48	47	46
CH4	Civil Aviation (1A3a)	[tons]	7	7	7	7	6	5	5	5	5	6
CH4	Road (1A3b)	[tons]	3493	3813	3644	3644	3400	3244	3167	2913	2832	2526
CH4	Railways (1A3c)	[tons]	13	12	12	10	11	10	10	9	9	8
CH4	Navigation (1A3d)	[tons]	37	38	36	34	33	33	33	35	34	34
CH4	Residential (1A4b)	[tons]	173	173	173	173	175	177	205	233	261	290
CH4	Ag./for./fish. (1A4c)	[tons]	108	104	99	94	92	90	88	85	82	78
CH4	Military (1A5)	[tons]	15	9	10	11	10	5	5	4	4	11
CH4	Navigation int. (1A3d)	[tons]	115	109	100	100	94	97	82	67	71	58
CH4	Civil Aviation int. (1A3a)	[tons]	35	37	38	40	41	42	42	41	42	47
CO	Industry-Other (1A2f)	[tons]	8910	8963	8939	8907	8647	8395	8227	8030	7842	7600
CO	Civil Aviation (1A3a)	[tons]	1180	1117	1085	973	932	895	888	860	832	857
CO	Road (1A3b)	[tons]	420514	419178	368994	353211	320362	299720	290617	268471	259570	232650
CO	Railways (1A3c)	[tons]	914	907	883	745	717	694	637	627	611	599
CO	Navigation (1A3d)	[tons]	7896	7971	7811	7602	7528	7567	7582	7812	7816	7767
CO	Residential (1A4b)	[tons]	60312	60886	61386	61815	62860	63852	76214	88416	101233	114073
CO	Ag./for./fish. (1A4c)	[tons]	37791	35139	32964	30305	28151	26013	24044	21943	19748	17445
CO	Military (1A5)	[tons]	919	632	620	702	714	405	320	316	309	718
CO	Navigation int. (1A3d)	[tons]	11783	11185	10256	10291	9681	9963	8396	6914	7294	5928
CO	Civil Aviation int. (1A3a)	[tons]	1421	1502	1564	1662	1743	1790	1796	1610	1670	1848
CO2	Industry-Other (1A2f)	[ktons]	848	853	860	867	873	879	888	897	907	912
CO2	Civil Aviation (1A3a)	[ktons]	199	205	212	194	174	154	161	140	137	128
CO2	Road (1A3b)	[ktons]	10483	10723	10936	11124	11270	11159	11163	11279	11722	12024
CO2	Railways (1A3c)	[ktons]	303	301	293	247	232	228	211	210	218	216
CO2	Navigation (1A3d)	[ktons]	655	678	600	501	458	463	456	541	527	490

CO2	Residential (1A4b)	[ktons]	152	155	159	162	166	169	201	233	265	298
CO2	Ag./for./fish. (1A4c)	[ktons]	1764	1752	1767	1715	1710	1684	1647	1645	1603	1507
CO2	Military (1A5)	[ktons]	252	176	171	204	182	111	97	89	92	239
CO2	Navigation int. (1A3d)	[ktons]	5061	4803	4403	4414	4155	4279	3605	2966	3130	2545
CO2	Civil Aviation int. (1A3a)	[ktons]	1867	1971	2010	2159	2290	2350	2385	2059	2142	2447
N2O	Industry-Other (1A2f)	[tons]	35	36	36	36	37	37	38	38	38	39
N2O	Civil Aviation (1A3a)	[tons]	10	11	11	9	9	8	8	8	8	8
N2O	Road (1A3b)	[tons]	782	868	977	1063	1134	1172	1191	1244	1298	1357
N2O	Railways (1A3c)	[tons]	8	8	8	7	6	6	6	6	6	6
N2O	Navigation (1A3d)	[tons]	38	40	35	29	26	26	26	31	30	28
N2O	Residential (1A4b)	[tons]	2	2	3	3	3	3	3	4	4	5
N2O	Ag./for./fish. (1A4c)	[tons]	83	84	85	83	83	83	81	81	79	73
N2O	Military (1A5)	[tons]	12	7	8	10	8	4	5	4	5	12
N2O	Navigation int. (1A3d)	[tons]	318	302	277	278	262	270	228	187	198	161
N2O	Civil Aviation int. (1A3a)	[tons]	64	69	70	75	80	82	82	72	75	85

TSP, PM_{10} and $PM_{2.5}$

pol_name	IPCC ID	Unit	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
TSP	Industry-Other (1A2f)	[tons]	1823	1778	1733	1686	1634	1577	1533	1484	1433	1383	1349	1317	1284	1249	1193	1135	1121	1098	1075	1037
TSP	Civil Aviation (1A3a)	[tons]	5	5	5	5	5	5	4	4	4	4	4	4	4	4	4	3	3	3	3	3
TSP	Road (1A3b)	[tons]	4931	5386	5418	5332	5442	5702	5859	5660	5599	5675	5411	5301	4857	4497	4251	3933	3756	3464	3438	3214
TSP	Railways (1A3c)	[tons]	247	249	222	229	211	202	205	217	225	204	206	204	199	168	146	141	125	124	119	115
TSP	Navigation (1A3d)	[tons]	594	719	781	638	792	742	874	760	719	656	621	598	535	516	501	511	506	605	572	533
TSP	Residential (1A4b)	[tons]	40	40	40	39	39	39	39	39	38	39	40	42	43	45	46	47	57	67	77	87
TSP	Ag./for./fish. (1A4c)	[tons]	2980	3034	2868	2944	2936	2910	2799	2659	2506	2300	2245	2104	2030	1858	1780	1689	1596	1512	1418	1283
TSP	Military (1A5)	[tons]	119	120	59	19	30	13	135	80	75	64	135	54	87	92	57	21	44	20	25	53
TSP	Navigation int. (1A3d)	[tons]	2332	2785	4547	5931	5990	6213	5236	4922	8222	8841	9049	8313	7569	6721	6819	7614	6099	4428	4976	4149
TSP	Civil Aviation int. (1A3a)	[tons]	23	24	26	28	30	28	27	28	27	29	30	32	32	35	37	38	38	33	35	40
PM10	Industry-Other (1A2f)	[tons]	1823	1778	1733	1686	1634	1577	1533	1484	1433	1383	1349	1317	1284	1249	1193	1135	1121	1098	1075	1037
PM10	Civil Aviation (1A3a)	[tons]	5	5	5	5	5	5	4	4	4	4	4	4	4	4	4	3	3	3	3	3
PM10	Railways (1A3c)	[tons]	4931	5386	5418	5332	5442	5702	5859	5660	5599	5675	5411	5301	4857	4497	4251	3933	3756	3464	3438	3214
PM10	Navigation (1A3d)	[tons]	247	249	222	229	211	202	205	217	225	204	206	204	199	168	146	141	125	124	119	115
PM10	Residential (1A4b)	[tons]	570	688	748	612	758	711	837	728	690	630	598	575	516	498	484	493	489	582	551	514

PM10	Ag./for./fish. (1A4c)	[tons]	40	40	40	39	39	39	39	39	38	39	40	42	43	45	46	47	57	67	77	87
PM10	Military (1A5)	[tons]	2962	3013	2850	2924	2914	2887	2776	2635	2487	2283	2229	2086	2012	1841	1762	1671	1579	1495	1401	1269
PM10	Navigation int. (1A3d)	[tons]	119	120	59	19	30	13	135	80	75	64	135	54	87	92	57	21	44	20	25	53
PM10	Civil Aviation int. (1A3a)	[tons]	2215	2646	4320	5634	5691	5903	4975	4675	7811	8399	8596	7898	7191	6385	6478	7233	5794	4206	4728	3942
PM2.5	Industry-Other (1A2f)	[tons]	23	24	26	28	30	28	27	28	27	29	30	32	32	35	37	38	38	33	35	40
PM2.5	Civil Aviation (1A3a)	[tons]	1823	1778	1733	1686	1634	1577	1533	1484	1433	1383	1349	1317	1284	1249	1193	1135	1121	1098	1075	1037
PM2.5	Railways (1A3c)	[tons]	5	5	5	5	5	5	4	4	4	4	4	4	4	4	4	3	3	3	3	3
PM2.5	Navigation (1A3d)	[tons]	4931	5386	5418	5332	5442	5702	5859	5660	5599	5675	5411	5301	4857	4497	4251	3933	3756	3464	3438	3214
PM2.5	Residential (1A4b)	[tons]	247	249	222	229	211	202	205	217	225	204	206	204	199	168	146	141	125	124	119	115
PM2.5	Ag./for./fish. (1A4c)	[tons]	547	660	716	587	727	682	801	699	662	606	575	554	498	481	468	476	472	561	531	496
PM2.5	Military (1A5)	[tons]	40	40	40	39	39	39	39	39	38	39	40	42	43	45	46	47	57	67	77	87
PM2.5	Navigation int. (1A3d)	[tons]	2944	2994	2833	2905	2893	2865	2754	2613	2469	2266	2213	2069	1994	1824	1746	1654	1564	1479	1386	1256
PM2.5	Civil Aviation int. (1A3a)	[tons]	119	120	59	19	30	13	135	80	75	64	135	54	87	92	57	21	44	20	25	53

Heavy metals

pol_name	IPCC ID	Unit	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Arsenic	Civil Aviation (1A3a)	[kg]										0	0	0	0	0	0
Arsenic	Navigation (1A3d)	[kg]	47	57	46	38	32	26	22	19	21	22	22	22	30	27	24
Arsenic	Ag./for./fish. (1A4c)	[kg]	15	14	15	11	10	9	12	12	10	10	10	9	9	10	8
Arsenic	Military (1A5)	[kg]					0					0	0	0	0	0	0
Arsenic	Navigation int. (1A3d)	[kg]	363	302	276	475	505	514	332	426	366	379	432	342	240	274	230
Arsenic	Civil Aviation int. (1A3a)	[kg]										0	0	0	0	0	0
Cadmium	Industry-Other (1A2f)	[kg]	2	2	2	2	2	2	2	2	3	2	3	3	3	3	3
Cadmium	Civil Aviation (1A3a)	[kg]	1	1	1	1	1	1	1	1	1	1	0	1	0	0	0
Cadmium	Road (1A3b)	[kg]	29	30	31	31	32	33	34	34	35	35	35	35	35	37	38
Cadmium	Railways (1A3c)	[kg]	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Cadmium	Navigation (1A3d)	[kg]	3	4	4	3	3	3	3	2	2	2	2	2	3	3	2
Cadmium	Residential (1A4b)	[kg]	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1
Cadmium	Ag./for./fish. (1A4c)	[kg]	7	7	7	6	6	6	6	6	5	5	5	5	5	5	5
Cadmium	Military (1A5)	[kg]	0	1	0	1	1	1	1	1	1	1	0	0	0	0	1
Cadmium	Navigation int. (1A3d)	[kg]	24	20	19	32	34	35	20	30	27	27	29	24	18	20	16
Cadmium	Civil Aviation int. (1A3a)	[kg]	6	5	5	5	6	6	6	6	7	7	8	8	7	7	8
Chromium	Industry-Other (1A2f)	[kg]	12	12	12	12	12	12	12	12	13	13	13	13	13	13	13
Chromium	Civil Aviation (1A3a)	[kg]	4	3	3	3	3	3	3	3	3	3	2	3	2	2	2
Chromium	Road (1A3b)	[kg]	146	152	155	154	159	165	169	172	175	177	175	176	177	184	189

Chromium	Railways (1A3c)	[kg]	5	5	5	5	5	5	5	5	4	4	4	3	3	3	3
Chromium	Navigation (1A3d)	[kg]	21	25	21	19	17	15	13	12	12	12	12	12	15	14	13
Chromium	Residential (1A4b)	[kg]	2	2	2	2	2	2	2	2	3	3	3	3	4	4	5
Chromium	Ag./for./fish. (1A4c)	[kg]	31	31	30	28	26	26	27	27	25	25	25	24	24	24	22
Chromium	Military (1A5)	[kg]	2	5	2	4	4	4	3	3	3	3	2	2	1	1	4
Chromium	Navigation int. (1A3d)	[kg]	150	127	118	199	213	218	133	182	161	164	184	147	106	120	100
Chromium	Civil Aviation int. (1A3a)	[kg]	28	26	27	26	29	30	31	32	34	36	37	38	33	34	39
Copper	Industry-Other (1A2f)	[kg]	411	413	413	413	414	418	421	425	429	432	435	440	445	450	454
Copper	Civil Aviation (1A3a)	[kg]	131	107	104	102	106	107	110	114	104	94	83	87	75	74	69
Copper	Road (1A3b)	[kg]	4950	5168	5255	5230	5418	5603	5732	5845	5946	6024	5966	5969	6033	6269	6432
Copper	Railways (1A3c)	[kg]	160	162	172	178	162	163	162	157	133	125	123	114	113	117	116
Copper	Navigation (1A3d)	[kg]	85	96	87	81	76	71	68	66	70	72	74	75	83	81	80
Copper	Residential (1A4b)	[kg]	73	75	76	78	79	81	83	84	86	88	90	107	124	141	158
Copper	Ag./for./fish. (1A4c)	[kg]	719	710	681	676	638	654	627	636	600	597	582	580	576	571	564
Copper	Military (1A5)	[kg]	64	154	76	128	136	136	95	92	110	98	60	52	48	50	129
Copper	Navigation int. (1A3d)	[kg]	363	302	276	475	505	514	332	426	366	379	432	342	240	274	230
Copper	Civil Aviation int. (1A3a)	[kg]	936	880	913	894	980	1006	1063	1084	1164	1234	1267	1286	1110	1155	1319
Mercury	Civil Aviation (1A3a)	[kg]										0	0	0	0	0	0
Mercury	Navigation (1A3d)	[kg]	5	6	6	7	7	8	8	7	5	5	5	5	5	5	5
Mercury	Ag./for./fish. (1A4c)	[kg]	12	12	12	10	10	9	9	9	10	10	10	9	9	9	7
Mercury	Military (1A5)	[kg]					0					0	0	0	0	0	0
Mercury	Navigation int. (1A3d)	[kg]	28	26	30	40	47	51	14	46	50	44	43	38	34	34	27
Mercury	Civil Aviation int. (1A3a)	[kg]										0	0	0	0	0	0
Nickel	Industry-Other (1A2f)	[kg]	17	17	17	17	17	17	17	17	18	18	18	18	18	19	19
Nickel	Civil Aviation (1A3a)	[kg]	5	4	4	4	4	4	5	5	4	4	3	4	3	3	3
Nickel	Road (1A3b)	[kg]	204	213	216	215	223	231	236	241	245	248	246	246	248	258	265
Nickel	Railways (1A3c)	[kg]	7	7	7	7	7	7	7	6	5	5	5	5	5	5	5
Nickel	Navigation (1A3d)	[kg]	2617	3173	2513	1955	1589	1166	864	709	992	1060	1114	1117	1523	1346	1233
Nickel	Residential (1A4b)	[kg]	3	3	3	3	3	3	3	3	4	4	4	4	5	6	7
Nickel	Ag./for./fish. (1A4c)	[kg]	255	128	214	148	45	53	199	229	58	38	37	36	39	97	59
Nickel	Military (1A5)	[kg]	3	6	3	5	6	6	4	4	5	4	2	2	2	2	5
Nickel	Navigation int. (1A3d)	[kg]	20956	17236	15429	27162	28664	29023	19856	23826	19820	20967	24364	19050	12906	15043	12715
Nickel	Civil Aviation int. (1A3a)	[kg]	39	36	38	37	40	41	44	45	48	51	52	53	46	48	54
Lead	Industry-Other (1A2f)	[kg]	258	187	160	67	12	12	12	0	0	0	0	0	0	0	0
Lead	Civil Aviation (1A3a)	[kg]	1534	1423	1378	1328	1639	1788	1640	1559	1399	1387	1369	1343	1328	1252	1304
Lead	Road (1A3b)	[kg]	96828	75333	68305	28741	5096	5390	5507	57	58	57	57	56	55	55	54

Lead	Railways (1A3c)	[kg]	0	0	0	0		0	0	0	0	0	0	0	0		
Lead	Navigation (1A3d)	[kg]	661	495	427	195	52	52	52	19	16	15	16	15	19	18	17
Lead	Residential (1A4b)	[kg]	2771	2066	1814	779	140	143	146	1	2	2	2	2	2	2	3
Lead	Ag./for./fish. (1A4c)	[kg]	1570	1075	867	350	73	69	67	20	20	20	20	19	19	18	15
Lead	Military (1A5)	[kg]	64	80	62	120	86	102	98	123	116	78	114	88	106	78	82
Lead	Navigation int. (1A3d)	[kg]	167	144	142	226	247	256	134	218	205	201	216	177	136	149	122
Lead	Civil Aviation int. (1A3a)	[kg]	490	465	452	456	153	175	126	145	145	124	118	114	113	106	111
Selenium	Industry-Other (1A2f)	[kg]	2	2	2	2	2	2	2	2	3	2	3	3	3	3	3
Selenium	Civil Aviation (1A3a)	[kg]	1	1	1	1	1	1	1	1	1	1	0	1	0	0	0
Selenium	Road (1A3b)	[kg]	29	30	31	31	32	33	34	34	35	35	35	35	35	37	38
Selenium	Railways (1A3c)	[kg]	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Selenium	Navigation (1A3d)	[kg]	48	58	50	49	45	44	43	37	33	30	31	30	38	36	33
Selenium	Residential (1A4b)	[kg]	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1
Selenium	Ag./for./fish. (1A4c)	[kg]	54	54	55	44	42	40	43	43	43	42	42	40	41	39	33
Selenium	Military (1A5)	[kg]	0	1	0	1	1	1	1	1	1	1	0	0	0	0	1
Selenium	Navigation int. (1A3d)	[kg]	334	289	284	451	495	512	269	436	410	401	431	354	273	297	245
Selenium	Civil Aviation int. (1A3a)	[kg]	6	5	5	5	6	6	6	6	7	7	8	8	7	7	8
Zinc	Industry-Other (1A2f)	[kg]	242	243	243	243	243	246	248	250	252	254	256	259	262	265	267
Zinc	Civil Aviation (1A3a)	[kg]	77	63	61	60	62	63	65	67	61	55	49	51	44	43	41
Zinc	Road (1A3b)	[kg]	2912	3040	3091	3077	3187	3296	3372	3438	3498	3544	3509	3511	3549	3688	3784
Zinc	Railways (1A3c)	[kg]	94	95	101	105	95	96	95	93	78	73	72	67	67	69	68
Zinc	Navigation (1A3d)	[kg]	133	157	140	141	132	132	132	118	106	101	103	102	121	117	110
Zinc	Residential (1A4b)	[kg]	43	44	45	46	47	48	49	50	51	52	53	63	73	83	93
Zinc	Ag./for./fish. (1A4c)	[kg]	538	534	518	491	465	469	460	465	445	443	434	428	427	419	402
Zinc	Military (1A5)	[kg]	38	91	45	75	80	80	56	54	65	58	35	31	28	29	76
Zinc	Navigation int. (1A3d)	[kg]	764	664	660	1038	1141	1183	607	1010	959	933	997	821	639	693	570
Zinc	Civil Aviation int. (1A3a)	[kg]	551	518	537	526	576	592	625	638	685	726	745	756	653	679	776

Dioxins and PAH

pol_name	IPCC ID	Unit	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Dioxins/furans	Industry-Other (1A2f)	[g]	0	0	0	0	0	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	0	0	0	0	0
Dioxins/furans	Road (1A3b)	[g]	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0
Dioxins/furans	Railways (1A3c)	[g]	0	0	0	0	0	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	0	0	0	0	0
Dioxins/furans	Residential (1A4b)	[g]	0	0	0	0	0	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	0	0	0	0	0
Dioxins/furans	Military (1A5)	[g]	0	0	0	0	0	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	1	1	0	1	0
Dioxins/furans	Civil Aviation int. (1A3a)	[g]	0	0	0	0	0	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	48	48	49	49	50
Flouranthene	Civil Aviation (1A3a)	[kg]	0	0	0	0	1	1	1	0	0	0	0	0	0	0	0
Flouranthene	Road (1A3b)	[kg]	823	829	817	781	754	732	702	671	637	618	600	590	597	619	655
Flouranthene	Railways (1A3c)	[kg]	5	5	6	6	6	6	6	6	5	4	4	4	4	4	4
Flouranthene	Navigation (1A3d)	[kg]	43	51	48	55	53	58	61	54	43	38	38	38	45	44	40
Flouranthene	Residential (1A4b)	[kg]	8	8	8	9	9	9	9	9	10	10	10	12	14	16	18
Flouranthene	Ag./for./fish. (1A4c)	[kg]	154	152	151	136	129	127	128	128	125	125	125	121	121	117	108
Flouranthene	Military (1A5)	[kg]	1	7	4	4	3	8	3	6	6	4	2	4	2	3	6
Flouranthene	Navigation int. (1A3d)	[kg]	204	190	212	294	340	361	349	322	343	311	306	266	232	238	191
Flouranthene	Civil Aviation int. (1A3a)	[kg]	0	0	0	0	0	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	6	6	6	6	6
Benzo(b) flouranthene	Civil Aviation (1A3a)	[kg]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Benzo(b) flouranthene	Road (1A3b)	[kg]	66	67	66	64	64	64	63	62	61	60	59	58	59	61	64
Benzo(b) flouranthene	Railways (1A3c)	[kg]	1	1	1	2	1	1	1	1	1	1	1	1	1	1	1
Benzo(b) flouranthene	Navigation (1A3d)	[kg]	3	4	4	4	4	5	5	5	4	3	3	3	4	4	3
Benzo(b) flouranthene	Residential (1A4b)	[kg]	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1
Benzo(b) flouranthene	Ag./for./fish. (1A4c)	[kg]	16	16	16	15	14	14	14	14	13	13	13	12	12	12	11
Benzo(b) flouranthene	Military (1A5)	[kg]	0	1	1	1	0	1	0	1	1	1	0	0	0	0	1
Benzo(b) flouranthene	Navigation int. (1A3d)	[kg]	13	13	15	20	23	25	25	23	25	22	21	19	17	17	14
Benzo(b) flouranthene	Civil Aviation int. (1A3a)	[kg]	0	0	0	0	0	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	6	5	5	6	6
Benzo(k) flouranthene	Civil Aviation (1A3a)	[kg]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Benzo(k) flouranthene	Road (1A3b)	[kg]	65	66	66	65	66	67	67	67	67	68	66	66	66	70	72
Benzo(k) flouranthene	Railways (1A3c)	[kg]	2	2	2	2	2	2	2	2	1	1	1	1	1	1	1
Benzo(k) flouranthene	Navigation (1A3d)	[kg]	1	2	2	2	2	2	3	2	2	2	2	2	2	2	2
Benzo(k) flouranthene	Residential (1A4b)	[kg]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Benzo(k) flouranthene	Ag./for./fish. (1A4c)	[kg]	13	12	12	12	11	11	11	11	10	10	10	9	9	9	9
Benzo(k) flouranthene	Military (1A5)	[kg]	0	1	1	1	0	1	0	1	1	1	0	0	0	0	1
Benzo(k) flouranthene	Navigation int. (1A3d)	[kg]	6	6	7	9	11	12	11	11	12	10	10	9	8	8	6
Benzo(k) flouranthene	Civil Aviation int. (1A3a)	[kg]	0	0	0	0	0	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	3	3	3	3	3
Benzo(a) pyrene	Civil Aviation (1A3a)	[kg]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Benzo(a) pyrene	Road (1A3b)	[kg]	47	48	48	47	46	46	46	45	44	44	43	43	44	46	49
Benzo(a) pyrene	Railways (1A3c)	[kg]	0	0	0	0	0	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	1	1	1	1	1
Benzo(a) pyrene	Residential (1A4b)	[kg]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Benzo(a) pyrene	Ag./for./fish. (1A4c)	[kg]	6	6	6	6	6	6	5	5	5	5	5	5	5	5	4
Benzo(a) pyrene	Military (1A5)	[kg]	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
Benzo(a) pyrene	Navigation int. (1A3d)	[kg]	4	4	4	5	6	7	7	6	7	6	6	5	4	5	4
Benzo(a) pyrene	Civil Aviation int. (1A3a)	[kg]	0	0	0	0	0	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	5	5	5	5	5
Benzo(g,h,i) perylene	Civil Aviation (1A3a)	[kg]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Benzo(g,h,i) perylene	Road (1A3b)	[kg]	100	102	102	99	96	95	93	91	88	86	85	84	86	88	93
Benzo(g,h,i) perylene	Railways (1A3c)	[kg]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Benzo(g,h,i) perylene	Navigation (1A3d)	[kg]	5	6	6	8	8	9	10	9	7	6	6	5	6	6	6
Benzo(g,h,i) perylene	Residential (1A4b)	[kg]	1	1	1	1	1	1	1	1	2	2	2	2	2	3	3
Benzo(g,h,i) perylene	Ag./for./fish. (1A4c)	[kg]	24	24	24	21	20	19	20	19	19	19	19	18	18	17	16
Benzo(g,h,i) perylene	Military (1A5)	[kg]	0	1	1	1	0	1	0	1	1	0	0	0	0	0	1
Benzo(g,h,i) perylene	Navigation int. (1A3d)	[kg]	24	24	30	37	45	49	48	45	52	45	41	37	35	35	28
Benzo(g,h,i) perylene	Civil Aviation int. (1A3a)	[kg]	0	0	0	0	0	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	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	0	0	0	0	0
indeno(1,2,3-c,d) pyrene	Road (1A3b)	[kg]	45	47	47	46	47	47	47	48	48	48	48	48	49	51	54
indeno(1,2,3-c,d) pyrene	Railways (1A3c)	[kg]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
indeno(1,2,3-c,d) pyrene	Navigation (1A3d)	[kg]	4	4	5	6	6	7	8	7	5	4	4	4	5	5	5
indeno(1,2,3-c,d) pyrene	Residential (1A4b)	[kg]	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1
indeno(1,2,3-c,d) pyrene	Ag./for./fish. (1A4c)	[kg]	17	17	17	15	14	14	14	14	14	14	14	13	13	13	11
indeno(1,2,3-c,d) pyrene	Military (1A5)	[kg]	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
indeno(1,2,3-c,d) pyrene	Navigation int. (1A3d)	[kg]	19	20	24	30	36	39	39	36	42	36	34	30	29	29	23
indeno(1,2,3-c,d) pyrene	Civil Aviation int. (1A3a)	[kg]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Annex 17: Uncertainty estimates

Uncertainty estimation, SO_2

Source category	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 Gg SO2	Input data Gg SO2	Input data %	Input data %	%	%	%	%	%	%	%
Road Transportation	SO2	5766	378	2	50	50,040	4,788	-0,068364163	0,0241	-3,4182081	0,068255932	3,41888954
Other mobile sources	SO2	9914	3576	10	50	50,990	46,111	0,068184454	0,2281	3,40922272	3,225560913	4,69329764
Total	SO2	15679,52	3954,59				2149,184					33,7158484
Total uncertainties					**Overall uncertainty in the year (%):**		**46,359**			**Trend uncertainty (%):**		**5,807**

Uncertainty estimation, NO_x

Source category	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 Nox	Gg Nox	%	%	%	%	%	%	%	%	%
Road Transportation	Nox	102091	59085	2	50	50,040	28,499	-0,057091096	0,3795	-2,8545548	1,073426639	3,04970949
Other mobile sources	Nox	53594	44661	10	100	100,499	43,263	0,057268328	0,2869	5,72683279	4,056877395	7,01818124
Total	Nox	155685,74	103745,58				2683,860					58,5555959
Total uncertainties					**Overall uncertainty in the year (%):**		**51,806**			**Trend uncertainty (%):**		**7,652**

Uncertainty estimation, NMVOC

Source category	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 Gg NMVOC	Input data Gg NMVOC	Input data %	Input data %	%	%	%	%	%	%	%
Road Transportation	NMVOC	79517	26477	2	50	50,040	32,010	-0,084888781	0,2785	-4,2444391	0,78765442	4,31690425
Other mobile sources	NMVOC	15562	14913	10	100	100,499	36,210	0,085458855	0,1569	8,54588555	2,218197767	8,82907476
Total	NMVOC	95078,32	41390,27				2335,834					96,5882234
Total uncertainties					**Overall uncertainty in the year (%):**		**48,330**			**Trend uncertainty (%):**		**9,828**

Uncertainty estimation, CO

Source category	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 Gg CO	Input data Gg CO	Input data %	Input data %	%	%	%	%	%	%	%
Road Transportation	CO	448826	232650	2	50	50,040	30,499	-0,106244358	0,4004	-5,3122179	1,132535152	5,43160151
Other mobile sources	CO	132202	149058	10	100	100,499	39,245	0,10682201	0,2565	10,682201	3,628058696	11,2814993
Total	CO	581027,96	381708,72				2470,377					156,774522
						nn						
Total uncertainties					**Overall uncertainty in the year (%):**		**49,703**			**Trend uncertainty (%):**		**12,521**

Uncertainty estimation, NH_3

Source category	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 Gg NH3	Input data Gg NH3	Input data %	Input data %	%	%	%	%	%	%	%
Road Transportation	NH3	70	2443	2	1000	1000,002	997,165	2,468823893	31,9313	2468,82389	90,31521594	2470,47531
Other mobile sources	NH3	6	7	10	1000	1000,050	2,837	-2,489513577	0,0908	-2489,5136	1,284640473	2489,51391
Total	NH3	76,51	2450,01				994346,626					12300927,8
Total uncertainties					**Overall uncertainty in the year (%):**		**997,169**			**Trend uncertainty (%):**		**3507**

Uncertainty estimation, TSP

Source category	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 Gg TSP	Input data Gg TSP	Input data %	Input data %	%	%	%	%	%	%	%
Road Transportation	TSP	5255	3214	2	50	50,040	25,434	-0,06344501	0,3652	-3,1722505	1,033028224	3,3362135
Other mobile sources	TSP	3546	3110	10	100	100,499	49,419	0,063567704	0,3534	6,35677044	4,997171271	8,08580554

Total	TSP	8800,85	6324,15		3089,085		76,5105717
Total uncertainties				**Overall uncertainty in the year (%):**	**55,580**	**Trend uncertainty (%):**	**8,747**

Uncertainty estimation, Arsenic

Source category	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	Arsenic	0	0	2	1000	1000,002	0,000	0	0,0000	0	0	0
Other mobile sources	Arsenic	62	32	10	1000	1000,050	1000,050	0	0,5205	0	7,36056672	7,36056672
Total	Arsenic	62,04	32,29				1000100,000					54,1779424

Total uncertainties	**Overall uncertainty in the year (%):**	**1000,050**		**Trend uncertainty (%):**	**7,361**

Uncertainty estimation, Cadmium

Source category	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	29	38	2	1000	1000,002	752,837	0,106869182	0,8553	106,869182	2,4191589	106,896559
Other mobile sources	Cadmium	15	12	10	1000	1000,050	247,177	-0,107206059	0,2808	-107,20606	3,971180747	107,279585
Total	Cadmium	44,23	50,25				627860,281					22935,7836
Total uncertainties					**Overall uncertainty in the year (%):**		**792,376**			**Trend uncertainty (%):**		**151,446**

Uncertainty estimation, Chromium

Source category	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	146	189	2	1000	1000,002	750,964	0,1098472	0,8487	109,8472	2,400508233	109,873426
Other mobile sources	Chromium	77	63	10	1000	1000,050	249,050	-0,110182459	0,2815	-110,18246	3,980330975	110,25433
Total	Chromium	222,88	251,89				625973,033					24228,1871
Total uncertainties					**Overall uncertainty in the year (%):**		**791,185**			**Trend uncertainty (%):**		**155,654**

Uncertainty estimation, Copper

Source category	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	4950	6432	2	1000	1000,002	803,800	0,063780076	0,9757	63,7800761	2,759671202	63,8397516
Other mobile sources	Copper	1642	1570	10	1000	1000,050	196,211	-0,064099279	0,2382	-64,099279	3,36807917	64,1877052
Total	Copper	6592,65	8002,49				684593,573					8195,57538
Total uncertainties					**Overall uncertainty in the year (%):**		**827,402**			**Trend uncertainty (%):**		**90,529**

Uncertainty estimation, Mercury

Source category	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	0	0	2	1000	1000,002	0,000	0	0,0000	0	0	0
Other mobile sources	Mercury	17	12	10	1000	1000,050	1000,050	0	0,7278	0	10,29279693	10,2927969
Total	Mercury	16,9	12,3				1000100,000					105,941669
Total uncertainties					**Overall uncertainty in the year (%):**		**1000,050**			**Trend uncertainty (%):**		**10,293**

Uncertainty estimation, Nickel

Source category	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	204	265	2	1000	1000,002	166,111	0,051527218	0,0852	51,5272178	0,240840835	51,5277806
Other mobile sources	Nickel	2907	1330	10	1000	1000,050	833,931	-0,051083618	0,4275	-51,083618	6,045209527	51,4400678
Total	Nickel	3110,39	1594,42				723033,963					5301,19275

Total uncertainties					**Overall uncertainty in the year (%):**		**850,314**				**Trend uncertainty (%):**	**72,809**

Uncertainty estimation, Lead

Source category	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	96828	54	2	1000	1000,002	36,831	-0,012648062	0,0005	-12,648062	0,001482585	12,6480624
Other mobile sources	Lead	6859	1421	10	1000	1000,050	963,217	0,012757738	0,0137	12,7577375	0,193854412	12,7592102
Total	Lead	103687,18	1475,65				929143,400					322,770928

Total uncertainties					**Overall uncertainty in the year (%):**		**963,921**				**Trend uncertainty (%):**	**17,966**

Uncertainty estimation, Selenium

Source category	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	29	38	2	1000	1000,002	346,176	0,106007035	0,2779	106,007035	0,786008948	106,009949
Other mobile sources	Selenium	107	71	10	1000	1000,050	653,858	-0,105405067	0,5249	-105,40507	7,422725265	105,666101
Total	Selenium	136,13	109,28				547367,512					22403,4342
Total uncertainties					**Overall uncertainty in the year (%):**		**739,843**			**Trend uncertainty (%):**		**149,678**

Uncertainty estimation, Zinc

Source category	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	2912	3784	2	1000	1000,002	781,662	0,079402014	0,9282	79,4020143	2,625370703	79,4454054
Other mobile sources	Zinc	1165	1057	10	1000	1000,050	218,351	-0,079741388	0,2593	-79,741388	3,666707036	79,8256457
Total	Zinc	4076,4	4840,66				658671,854					12683,7062
Total uncertainties					**Overall uncertainty in the year (%):**		**811,586**			**Trend uncertainty (%):**		**112,622**

Uncertainty estimation, Dioxins

Source category	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	538,463	-0,085523979	0,1892	-85,523979	0,535107834	85,5256533
Other mobile sources	Dioxins	0	0	10	1000	1000,050	461,562	0,086008338	0,1622	86,0083384	2,29331929	86,0389074
Total	Dioxins	1,11	0,39				502981,041					14717,331
Total uncertainties					**Overall uncertainty in the year (%):**		**709,212**			**Trend uncertainty (%):**		**121,315**

Uncertainty estimation, Flouranthene

Source category	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	823	655	2	1000	1000,002	743,092	-0,015172032	0,6065	-15,172032	1,715521328	15,2687118
Other mobile sources	Flouranthene	257	226	10	1000	1000,050	256,922	0,01525129	0,2097	15,2512899	2,965539969	15,5369325
Total	Flouranthene	1079,9	881,44				618195,133					474,529832
Total uncertainties					**Overall uncertainty in the year (%):**		**786,254**			**Trend uncertainty (%):**		**21,784**

Uncertainty estimation, Benzo(b) flouranthene

Source category	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(b) flouranthene	66	64	2	1000	1000,002	736,460	0,026710282	0,6870	26,7102818	1,943131267	26,7808684
Other mobile sources	Benzo(b) flouranthene	27	23	10	1000	1000,050	263,555	-0,026820872	0,2458	-26,820872	3,476748307	27,0452756
Total	Benzo(b) flouranthene	92,62	86,4				611834,202					1448,66185
Total uncertainties					**Overall uncertainty in the year (%):**		**782,198**			**Trend uncertainty (%):**		**38,061**

Uncertainty estimation, Benzo(k) flouranthene

Source category	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	65	72	2	1000	1000,002	799,736	0,050553323	0,8361	50,5533228	2,364723686	50,6085997
Other mobile sources	Benzo(k) flouranthene	21	18	10	1000	1000,050	200,276	-0,050806484	0,2094	-50,806484	2,960820191	50,8926839
Total	Benzo(k) flouranthene	86,31	90,23				679687,526					5151,29564
Total uncertainties					**Overall uncertainty in the year (%):**		**824,432**			**Trend uncertainty (%):**		**71,773**

Uncertainty estimation, Benzo(a) pyrene

Source category	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	47	49	2	1000	1000,002	840,852	0,023329729	0,8388	23,329729	2,372543766	23,450058
Other mobile sources	Benzo(a) pyrene	11	9	10	1000	1000,050	159,158	-0,023477497	0,1588	-23,477497	2,245286487	23,5846172
Total	Benzo(a) pyrene	58,01	57,87				732363,053					1106,13939
Total uncertainties					**Overall uncertainty in the year (%):**		**855,782**			**Trend uncertainty (%):**		**33,259**

Uncertainty estimation, Benzo(g,h,i) perylene

Source category	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	100	93	2	1000	1000,002	753,599	0,017871073	0,6809	17,8710733	1,925974993	17,9745553
Other mobile sources	Benzo(g,h,i) perylene	36	30	10	1000	1000,050	246,415	-0,017954372	0,2226	-17,954372	3,148665404	18,2283722
Total	Benzo(g,h,i) perylene	136,9	123,7				628631,639					655,358192
Total uncertainties					**Overall uncertainty in the year (%):**		**792,863**			**Trend uncertainty (%):**		**25,600**

Uncertainty estimation, indeno(1,2,3-c,d) pyrene

Source category	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) pyrene	45	54	2	1000	1000,002	724,555	0,079885942	0,7679	79,8859423	2,171936652	79,9154621
Other mobile sources	indeno(1,2,3-c,d) pyrene	24	20	10	1000	1000,050	275,460	-0,080122671	0,2919	-80,122671	4,128424329	80,228962
Total	indeno(1,2,3-c,d) pyrene	69,71	73,88				600858,083					12823,1674
Total uncertainties					**Overall uncertainty in the year (%):**		**775,150**			**Trend uncertainty (%):**		**113,239**

NERI **National Environmental Research Institute**
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This report explains the parts of the Danish inventories related to road transport and other mobile sources. Emission results for CO2, CH4, N2O, SO_2, NO_x, NMVOC, CO, particulate matter (PM), heavy metals, dioxins and PAH are shown from 1985 to 2004. In this period the fuel use and CO_2 emissions for road transport have increased by 48%. The emission decreases for PM (exhaust only), CO, NO_x and NMVOC are 35, 58, 34 and 66% respectively, due to the introduction of vehicles complying with gradually stricter emission standards. A N_2O emission increase of 301% is related to the high emissions from gasoline catalyst cars. For other mobile sources the fuel use and CO_2 emissions have decreased by 15% from 1985 to 2004. The PM, NO_x and NMVOC emission declines are 46, 14 and 10%, respectively. For SO_2 the emission drop is 74% from 1985 to 2004, due to gradually lower fuel sulphur contents. For CO the 1985 and 2004 emissions are the same. Uncertainties for the emissions and trends have been estimated.

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