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# Dioxin Air Emission Inventory 1990-2004

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Thomas Capral Henriksen
Jytte Boll Illerup
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# Data sheet


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Abstract: The present Danish dioxin air emission inventory shows that the emission has been reduced from 68.6 g I-TEQ in 1990 to 22.0 g I-TEQ in 2004, or about 68% over this period. Most of the significant reductions have been achieved in the industrial sector, where emissions have been reduced from 14.67 g I-TEQ in 1990 to 0.17 g I-TEQ in 2004; a reduction of almost 99%. Lower emissions from steel and aluminium reclamation industries form the major part of the reduction within industry. Emissions from waste incineration reduced from 32.5 g I-TEQ in 1990 to 2.1 g I-TEQ in 2004; which is approx. 94%. This is due to installation of dioxin abatement equipment in incineration plants. The most important source of emission in 2004 is residential wood combustion, at 8.5 g I-TEQ, or around 40% of the total emission. In 2004, accidental fires, which are estimated to emit 6.1 g I-TEQ/year, are the second most important source, contributing with around 28% of the total emission. The present dioxin emission inventory for Denmark shows how emissions in 2004 come from sources other than waste incineration plants and industry, which were the largest sources in 1990.



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# Contents

# Preface

This report contains an update of previous dioxin emission inventories. The purpose of the work has been to prepare new Danish dioxin emission estimates including consistent time-series and to provide a single estimate for the total dioxin emission to air in Denmark as requested by international conventions.

The report is prepared by the Danish Environmental Research Institute (NERI) and funded by the Danish Environmental Protection Agency (DEPA) and NERI. The members of the steering group have been Christian Lange Fogh, Chairman (DEPA), Helle Petersen (DEPA), Thomas Capral Henriksen (NERI) and Jytte Boll Illerup, project leader (NERI).

# Summary

The purpose of this dioxin inventory has been to update previous studies on the Danish dioxin emission and add new knowledge and research. The scope of the project was, furthermore, to set up a framework against which annual updates can be made with revision of relevant emission factors and the basic activity data provided by official Danish statistics.

Especially the sections on dioxin emissions from municipal solid waste incineration and residential wood burning have been improved, with technological considerations and field measurements, in order to reduce the uncertainty surrounding two of the most important sources in the inventory.

The present Danish dioxin air emission inventory shows that the emission has been reduced from 68.6 g I-TEQ in 1990 to 22.0 g I-TEQ in 2004, or about 68% over this period. The major emission sources for 1990 were municipal waste incineration, steel reclamation and residential wood burning, while in 2004 the major sources had changed to residential wood burning and fires. Fires include landfill fires and fires in buildings and vehicles.

A large part of the significant reductions have been achieved in the industrial sector, where emissions have been reduced from 14.67 g I-TEQ in 1990 to 0.17 g I-TEQ in 2004; a reduction of almost 99%. The main reasons for the significant decrease in the emission are stricter emission regulation with required dioxin abatement in e.g. steel and aluminium reclamation industries and the total stop of steel reclamation processes in Denmark from 2002-2004.

Emissions from waste incineration reduced from 32.5 g I-TEQ in 1990 to 2.1 g I-TEQ in 2004; which is approx. 94% in spite of an increase in fuel consumption of 138% from 1990 to 2004. This was due to installation of dioxin abatement equipment and modification of the combustion process in incineration plants.

The major source in the non-industrial category is combustion of wood in the residential sector and in 2004 it was the most important source of emission, at 8.5 g I-TEQ, or around 40% of the total emission. The emission from wood use has increased by 37% from 1990 to 2004 due to a larger consumption of wood.

In 2004, accidental fires, which are estimated to emit 6.1 g I-TEQ/year, are the second most important source, contributing with around 28% of the total emission.

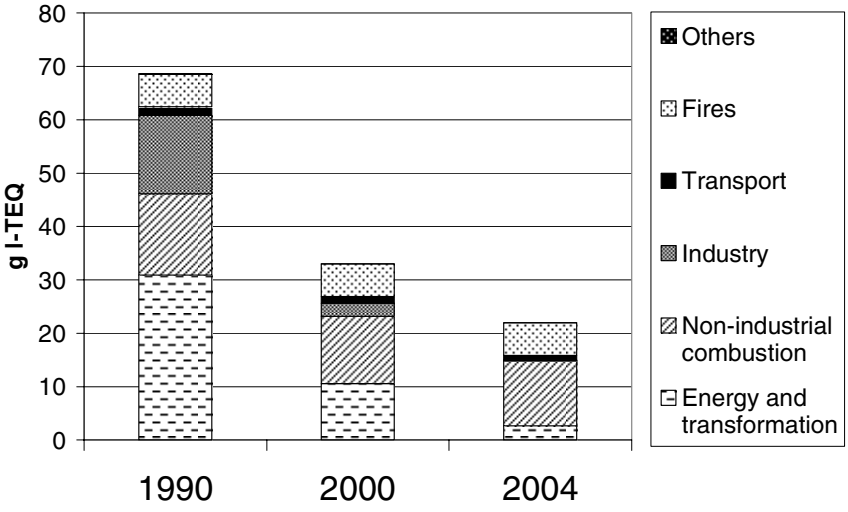



**Figure S1** Dioxin emission in 1990, 2000 and 2004, distributed according to sector. Total is 68.6 g I-TEQ for 1990, 33.0 g I-TEQ for 2000 and 22.0 g I-TEQ for 2004.

The comparison of the inventories in 1990, 2000 and 2004 in Figure S1 illustrates the large emission reduction in the energy and industrial sectors.

When reporting to international conventions, single-figure estimates are requested, and one of the tasks of the present inventory was to provide a single estimate for the total dioxin emission to air in Denmark. This does, however, not reduce the general uncertainty when estimating dioxin emissions, reflected both in the broad intervals in previous studies and the variability in measurements, as discussed in this report.

# Sammendrag

Formålet med denne emissionsopgørelse for dioxin har været at opdatere tidligere studier af den danske dioxinudledning samt at supplere opgørelsen med ny viden og forskning. Derudover har formålet med projektet været at udarbejde en metode, så opgørelsen årligt kan opdateres ved revision af relevante emissionsfaktorer og brug af officielle danske statisktikker, som for eksempel statistikker fra Energistyrelsen og Danmarks Statistik.

Særligt afsnittene omkring dioxinudledninger fra affaldsforbrænding og husholdningernes fyring med træ er forbedret med teknologiske parametre og nye målinger, for at reducere usikkerheden ved opgørelsen af to af de vigtigste dioxinkilder.

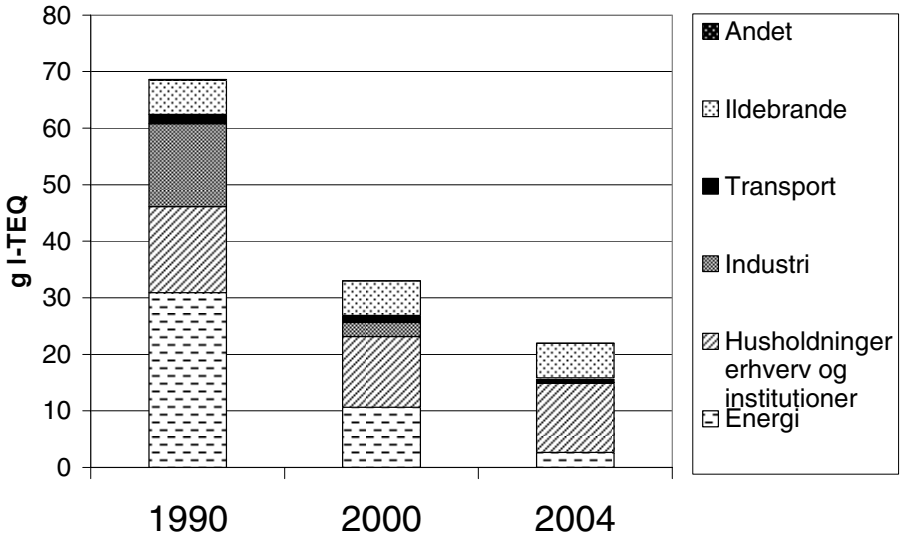
Den opdaterede danske opgørelse af dioxinudledninger til luften viser, at emissionen er reduceret fra 68,6 g I-TEQ i 1990 til 22,0 g I-TEQ i 2004, hvilket svarer til en reduktion på ca. 68 %. De største kilder i 1990 var affaldsforbrænding, genindvinding af stål og træfyring i husholdninger, mens de største kilder i 2004 er træfyring i husholdningerne og ildebrande, hvor sidst nævnte inkluderer brande på lossepladser samt i bygninger og biler.

En stor del af de betydelige reduktioner i udledningerne er opnået i industrien, hvor emissionerne er reduceret fra 14,67 g I-TEQ i 1990 til 0,17 g I-TEQ i 2004; en reduktion på næsten 99 %. Hovedårsagen til den markante reduktion er strammere miljøregulering med lavere emissionsgrænseværdier, hvilket har medført nedsættelse af dioxinudledningen fra for eksempel genindvindingen af stål og aluminium. Desuden var der et total stop for genindvendingen af stål i Danmark i perioden 2002-2004.

Emissioner fra affaldsforbrænding faldt fra 32,5 g I-TEQ i 1990 til 2,1 g I-TEQ i 2004, hvilket svarer til en reduktion på ca. 94 %, og det på trods af en stigning i den forbrændte affaldsmængden på 138 % målt i energiindhold i samme periode. Reduktionen i emissionen skyldes strengere miljøkrav, hvilket har medført installation af udstyr til dioxinrensning samt ændringer i forbrændingsprocesserne.

Den betydeligste kilde til dioxinudledning fra ikke-industrielle anlæg er husholdningers forbrænding af træ, og i 2004 er det den største kilde med en udledning på 8,5 g I-TEQ eller 40 % af den totale emission. Udledningen fra træfyring er steget med 37 % fra 1990 til 2004, som følge af et stigende forbrug af træ i husholdninger.

I 2004 er ildebrande den anden største kilde til udledning af dioxin med en estimeret emission på 6,1 g I-TEQ svarende til omkring 28 % af den samlede emission.




**Figur R1** Dioxinemission i 1990, 2000 og 2004 fordelt på sektorer. Totalerne er 68,8 g I-TEQ for 1990, 33,0 g I-TEQ for 2000 og 22,0 g I-TEQ for 2004.

Sammenligningen af opgørelserne for 1990, 2000 og 2004 i figur R1 illustrerer den store reduktion i emissionerne for energisektoren og industrien.

I rapporteringen til internationale konventioner kræves, at der kun rapporteres ét tal for hver kilde og den total emission og ikke et interval. En af opgaverne i dette arbejde har derfor været at udarbejde et enkelt estimat for hver kilde og den totale emission i Danmark. Det reducerer dog ikke den generelle usikkerhed ved emissionsopgørelsen for dioxin, hvilket også fremgår af rapporten, hvor store spredninger på dioxinmålinger er omtalt, og tidligere studiers brede intervaller for dioxinemissioner er gengivet.

# 1 Introduction

The purpose of this dioxin inventory is to update previous studies on the Danish dioxin emission and add new knowledge and research. The scope of the project is, furthermore, to set up a framework against which annual updates can be made with revision of relevant emission factors and the basic activity data provided by official Danish statistics.

Based on previous dioxin emission inventories (Hansen & Hansen, 2003; Hansen et al., 2000; Jensen, 1997; Jensen et al. 1995), the major sources for dioxin emission to the air are identified. For smaller sources a simple methodological approach is used where default emission factors from e.g. the EMEP/CORINAIR Emission Inventory Guidebook (EMEP/-CORINAIR, 2005) are used. For the sources previously identified as major sources to pollution, more detailed methodological approaches are applied in order to include a greater number of influencing factors, such as combustion technology, type of fuels, etc.

Especially the sections on dioxin emissions from municipal solid waste incineration and residential wood burning have been improved, with technological considerations and field measurements, in order to reduce the uncertainty surrounding two of the most important sources in the inventory.

In cases where the previous emission inventory is considered as the best estimate and the change in activity level between the years is insignificant, the results from the previous studies are adopted.

## 1.1 Previous inventories and the underlying framework for the current inventory

The estimated dioxin emissions to air from previous inventories are presented in Table 1.

**Table 1** Air emissions in previous inventories

| Years for which valid | Emission to air (g I-TEQ/year) | Reference | Remarks |
|---|---|---|---|
| 2000-2002 | 11-163 | Hansen & Hansen, 2003 | |
| 2000-2002 | 9-45 | Hansen & Hansen, 2003 | Well determined sources only |
| 1998-1999 | 19-170 | Hansen et al., 2000 | |
| 1995 | 38-46 | Jensen, 1997 | |

As seen in Table 1, the general uncertainty surrounding the estimates is high for dioxin inventories. Even when excluding the most uncertain sources, such as fires and residential wood combustion as in the second estimate by Hansen & Hansen (2003), the uncertainty is considerable.

When reporting to international conventions, single-figure estimates are requested, and one of the tasks of the present inventory is to provide a single estimate for the total dioxin emission to air in Denmark. This does, however, not reduce the general uncertainty when estimating dioxin emissions, reflected both in the broad intervals in previous studies and the variability in measurements, discussed at a later stage in this report.

Diffuse or multiple-point sources, comprising fires and residential wood combustion are sources associated with a high degree of uncertainty. It is difficult to estimate the emission from these sources since both activity levels and emission factors are uncertain. Hence, the uncertainty is large compared with e.g. emissions from waste incineration plants, where many measurements are taken and the activity level is relatively accurately determined.

Some of the industrial emission estimates also display large uncertainty due to the relatively few measurements taken. But since local authorities have ensured compliance with limit values after 2001, the uncertainty becomes less important than in previous inventories, in the knowledge that the general level of emissions is reduced for the relevant industries.

## 1.2 Considerations over time-series

The present inventory is prepared for the years 1990 to 2004. Distinction between emission factors for different years is made for the large sources where change in activity level, technological development or introduction of abatement have influenced the emission from 1990 to 2004. This affects the sources waste incineration, residential wood combustion, cement production, steel and aluminium reclamation.

With regard to waste incineration activities, installation of dioxin filters before 2000 was limited, but modification of the combustion process has also influenced the emission during the 1990s. These emission reduction initiatives are incorporated in the inventory for the years 1990-2004.

The largest emission reduction development within residential wood combustion relates to the increased use of wood pellets, which in general cause lower emissions than the combustion of wood logs. This development is mainly related to the period 2000-2004, which is the reason for adjusting the emission factor for these years. Use of new improved stoves and boilers which tend to emit lower levels of dioxin also reduces the emission factor during the period.

Cement production processes and the dioxin abatement technology have not changed significantly during the period of the inventory. Measurements do, however, show a development towards a lower level of emissions and, therefore, different measurements have been used for the periods for which the measurements are considered representative.

The steel and aluminium reclamation industries have been large contributors to dioxin emissions. From 2002 and onwards, the steel reclamation industry has operated with various levels of activity, including peri-

ods where production was ceased. The aluminium reclamation industry has reduced dioxin emissions since installation of dioxin filters in 2001. The development in emissions for these industries is accounted for in the inventory.

## 1.3 Structure of the report

The structure of the current report, which also reflects the methodological approach, is as follows. Chapter 1 introduces the general topics and the methodology, and contains a brief summary of the conclusions.

Chapter 2 covers dioxin emissions related to stationary combustion activities in the energy and transformation sector. An important source of dioxin emission is municipal solid waste (MSW) incineration as combined heat and power (CHP) production or district heating. Most of the emissions from MSW incineration are included in this category, but a small part of the waste treatment activity is included in the non-industrial part of the inventory. This is a consequence of the registration of some MSW incinerators as commercial, and thereby non-industrial, plants in the official energy statistics.

Emissions from stationary combustion activities in non-industrial combustion plants are dealt with in Chapter 3. A very important emission source in this category is residential wood combustion, mainly in private wood stoves and small-scale boilers. Also emissions from forestry and agriculture as well as commercial plants are dealt with in this chapter. As mentioned above, an emission from MSW incineration occurs in this part of the inventory. The activity is similar to the MSW incineration in Chapter 2, the only difference being that the incinerator is registered as a commercial plant.

Chapter 4 deals with emissions from stationary combustion in the manufacturing industry as well as process-related emissions from these industries. Some of the major process emission sources are steel and aluminium reclamation, and production of cement and mineral wool.

Chapter 5 deals with other sources, such as emissions from mobile sources in the transport sector and emissions from crematories. Emissions from accidental fires are also presented in this chapter.

Chapter 6 covers other sources and potential sources of dioxin emissions which are not included in this inventory. For example various industrial processes which have very low emission estimates. The potential source of dioxin emission from PCP-treated wood and the reason for not including this source in this inventory is also discussed in this chapter.

In Chapter 7, total emissions are summarised and the development patterns are discussed.

# 2 Dioxins from power, district heating and combined heat and power plants

In this section the dioxin emission factors for public heat and power generation plants are presented. For some sources, uncertainty surrounding the emission factors is large and selection of the most reliable factors for the dioxin emission inventory is discussed.

## 2.1 Coal-fired plants

For coal-fired public power generation, an emission factor of 33 ng I-TEQ/tonne coal was used in the previous assessment (Hansen & Hansen, 2003). This value is equal to 1.32 ng I-TEQ/GJ using a calorific value of 25 GJ/tonne coal. The result is based on measurements carried out in 1999 at "Fynsværket", which has combustion conditions similar to the vast majority of the pulverised coal combustion plants in Denmark.

German measurements (North Rhine-Westphalia State Environment Agency, 1997 and 2001) show higher emissions for coal-fired plants and the emission factors were found to be in the range 4-16 ng I-TEQ/GJ. However, measurements from Dutch coal-fired power plants show emissions between 1.5 and 3.2 pg I-TEQ/$m^3$, which give an average of 2.35 pg I-TEQ/$m^3$. (Meij & te Winkel, 2005) This emission factor can be calculated as 0.87 ng I-TEQ/GJ. Likewise, a study from power plants in Spain indicates low emission factors. Two measurements with bituminous[1] coal resulted in 0.023 and 0.106 ng I-TEQ/GJ, respectively, giving an average of 0.065 ng I-TEQ/GJ (Fernández-Martínez et al., 2004). The Dutch and Spanish measurements indicate much lower emission factors than the emission factor presented for the German conditions. The best available estimate for Denmark is considered to be the emission factor 1.32 ng I-TEQ/GJ, which is measured from a typical Danish power plant and lies between the values observed in other European countries.

## 2.2 Oil for electricity and heat generation

In the previous inventory by Hansen & Hansen (2003), an emission factor of 0.882 ng I-TEQ/GJ is used, which originates from North Rhine-Westphalia State Environment Agency (1997). This emission factor is adapted in the present study without changes since no other information sources contradicting this emission factor are found.

[1] Other measurements with sub-bituminous coal and lignite were made, but these results are not included here, because these coal standards and calorific values are not comparable with the coal used in Denmark.

## 2.3 Natural gas-fired plants

For the use of natural gas in the public electricity generating sector, the emission factor 0.02-0.03 ng I-TEQ/GJ is suggested by the European Dioxin Inventory, Stage I, Section Germany (North Rhine-Westphalia State Environment Agency, 1997). This emission factor is low, but most likely reliable for the electricity generating facilities as the contribution to the emission is expected to be low, due to very low content of Cl in natural gas. Therefore, the emission factor 0.025 ng I-TEQ/GJ is used for power generation from natural gas.

## 2.4 Orimulsion for electricity and heat generation

From 1995 to 2004 orimulsion was used as fuel for heat and electricity generation at the power station "Asnæsværket". An analysis from 1997 showed an emission factor of approximately 100 ng I-TEQ/tonne orimulsion (Hansen & Hansen, 2003). With a calorific value of 27.7 GJ/tonne, the emission factor is 3.6 ng I-TEQ/GJ. This value is used in the present inventory.

## 2.5 Municipal Solid Waste (MSW) for electricity and heat generation

An investigation of emissions from combined heat and power plants (CHP), including waste incineration plants, has contributed to estimation of emission factors for waste incineration. Dioxin emission measurements were performed at 12 Danish municipal waste incineration plants and improved dioxin emission factors were estimated based on existing emission measurements as well as on emission measurements performed within the project (dk-TEKNIK, 2003).

Based on these measurements, emission factors for municipal waste incineration plants equipped with various flue-gas cleaning systems were estimated (Nielsen & Illerup, 2003). The number of emission datasets was comprehensive and the share of national waste consumption they represented was 62%. This was due to the relatively large size of Danish waste incineration plants.

Emission factors for each of the plant categories and for plants with and without dioxin filters were estimated as fuel consumption weighted averages. The emission factors were based on full-load emission measurements and emission measurements from days with exceptional operation were included, e.g. days in which a filter bag broke.

Table 2 shows the average, minimum and maximum emission factors for the waste incineration sector as a whole and for each type of gas cleaning device (Nielsen & Illerup, 2003).

**Table 2** Estimated emission factors (ng I-TEQ/GJ)

| Plant category | Average EMF | Min. EMF | Max. EMF |
|---|---|---|---|
| Municipal waste CHP | 157 | 2 | 833 |
| - Municipal waste CHP, ESP WET | 373 | 2 | 833 |
| - Municipal waste CHP, ESP WET FB | 11 | 2 | 28 |
| - Municipal waste CHP, SD (CYK) FB | 9 | 6 | 19 |
| - Municipal waste, other | 25 | 21 | 37 |
| - Municipal waste, dioxin filter | 20 | 2 | 37 |
| - Municipal waste, without dioxin filter | 348 | 19 | 833 |

From Table 2 it is seen that plants equipped with fabric filters (FB) have a considerably lower emission of dioxin than plants only equipped with electrostatic filters (ESP) and/or cyclones (CYK). The reason for the higher emission factor for plants with wet scrubbing and ESP is that almost none of these plants are equipped with active carbon dioxin filters, while the majority of the remaining two types of waste incineration plant have dioxin filters installed. As expected, the emission factor is much lower for plants with dioxin filters than for plants without.

Previous estimates of dioxin emission from waste incineration indicated that the emission level in 1990 was around 4 ng I-TEQ/Nm$^3$ (Jensen, 1997), which equates to an emission factor of about 2 095 ng I-TEQ/GJ. Measurements from 1993 did indicate a reduction in the level to 2 ng I-TEQ/Nm$^3$ (Jensen, 1997), which corresponds to an emission factor of 1047 ng I-TEQ/GJ.

Based on the measurements carried out in 1990, 1993 and 2000, linear interpolation is made in order to estimate the emission factors for this period. As Table 3 shows, the reduction in emission factor, using this method, is substantial from 1990 to 1993 and then more modest from 1993 to 2000.

**Table 3** Interpolation of emission factor for elaboration of time-series

| | **1990** | 1991 | 1992 | **1993** | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | **2000** |
|---|---|---|---|---|---|---|---|---|---|---|---|
| ng I-TEQ/GJ | **2 095** | 1 746 | 1 396 | **1 047** | 947 | 847 | 747 | 648 | 548 | 448 | **348** |

Note: The bold figures are based on measurements.

Since 2000, all waste incineration plants have been included as point sources. Where actual measurements of dioxin emissions exist, these data are used. For the years 2000-2004 for plants where no measurements exist, the default emission factor of 348 ng I-TEQ/GJ is used for plants without dioxin abatement and 20 ng I-TEQ/GJ for plants with filters. For the plants where only a part of the plant has a dioxin filter, an emission factor weighted according to the capacity of the furnaces is used. This gives e.g. the incineration plant KARA in Roskilde a weighted emission factor of 26.6 ng I-TEQ/GJ, as one furnace has a filter and thus an estimated emission factor of 20 ng I-TEQ/GJ and the others comply with the legislative limit of 52 ng I-TEQ/GJ, according to measurements taken.

The same method gives the incineration plant REFA in Nykøbing Falster a weighted emission factor of 35.5 ng I-TEQ/GJ as the newest furnace

from 1999 has a filter and two older furnaces comply with the legislative limit value.

The implied emission factor for 2000 is close to the emission factor 348 ng I-TEQ/GJ measured at plants without dioxin abatement, although 50% of the incineration capacity had abatement technology installed at the time. The reason for this is that especially one incineration plant, "Vestforbrænding", measured a high emission of 6 g I-TEQ in 2000 prior to installation of dioxin abatement. After installation of abatement equipment in 2001, the emission fell to 4.3 g I-TEQ and 0.51 g I-TEQ in 2001 and 2002 respectively.[2]

For the years 2000 and 2004, implied emission factors are calculated and used for the small amount of waste incineration that is not included as point sources in the inventory. The implied emission factor for the years in between 2000-2004 is found by interpolation.

**Table 4** Waste consumption, emission factors and emissions for 1990, 2000 and 2004 and projected emission for 2006

| | 1990 | 2000 | 2004 | 2006 |
|---|---|---|---|---|
| Waste consumption (TJ) | 15 500 | 30 400 | 36 931 | 43 100 |
| Emission factor (ng I-TEQ/GJ) | 2 095 | 338 | 57 | 52 |
| Emission (g) | 32.5 | 10.3 | 2.1 | 2.2 |
| % of waste incineration capacity with dioxin filter | 0 | 50 | 91 | 100 |

From Table 4, it is seen that the amount of waste combusted in stationary combustion plants is increasing. From 1990 to 2000, consumption increased by 96% and, in the latest fuel consumption projections carried out by the Danish Energy Authority (DEA, 2005), waste consumption is expected to increase by 42% from 2000 to 2006. According to the Danish emission limit value of 0.1 ng I-TEQ/Nm$^3$ at 11% $O_2$, the emissions factor can be calculated to be 52 ng I-TEQ/GJ by the end of 2006, using the equation for MSW in Appendix A. In order to meet this requirement it will be necessary to install dioxin filters on all waste incineration plants. On average, the target has, however, already nearly been met in 2004, since many incineration plants have already installed filters which give rise to emissions below the limit value. This brings the average emission close to the limit value, although some plants still emit at levels above requirements. When all plants have abatement technology installed, the emission factor will probably be lower than required to comply with the limit value.

Despite an increase in fuel consumption of 138% from 1990 to 2004, the emission decreased by 94%. In this inventory the emission factor of 2 095 ng I-TEQ/GJ is used for 1990. For 2004, all waste incineration plants are registered as individual point sources and for the plants where dioxin emissions are reported in environmental reports, the reported emissions are used. For the remaining plants the emissions factors of 20 and 348 ng I-TEQ/GJ, estimated by Nielsen & Illerup (2003), respectively with and without dioxin abatement, are used.

[2] The emission factor for Vestforbrænding was 1 143 ng I-TEQ/GJ in 2000, 857 ng I-TEQ/GJ in 2001 and 114 ng I-TEQ/GJ in 2002.

Incineration of hospital and other medical waste is included in the inventory along with incineration of municipal solid waste, as medical waste is incinerated at the MSW incineration plants, according to information from the Danish EPA. The emission, therefore, is included in measured emissions from the MSW incinerators.

### 2.5.1 Hazardous waste incineration

"Kommunekemi" is the only Danish treatment plant for hazardous waste. Total annual emission values have been published in the environmental reports for 2002, 2003 and 2004. The value for 2004 was 1.24 mg I-TEQ (Kommunekemi, 2005). For the years 2000 and 2001, emissions are estimated from data presented by Hansen & Hansen (2003).

Kommunekemi has three kilns. Incineration of hazardous waste is carried out in two of the kilns (F3 and F4). Emission factors for this activity are listed in Table 5.

**Table 5** Emission factors for Kommunekemi's incineration kilns

| | Kiln F3 | | Kiln F4 | |
|---|---|---|---|---|
| | 2000 | 2001 | 2000 | 2001 |
| Concentration (ng I-TEQ/Nm$^3$) | 0.0142 | 0.015 | 0.028 | 0.069 |
| Emission factor (ng I-TEQ/GJ) | 7.4 | 7.9 | 14.6 | 36.1 |

Sources: Data from Hansen & Hansen (2003) and calculation formula from Nielsen & Illerup (2003).

The last kiln, F1, was used for treatment of polluted soil in 2000. The average emission of six measurements during thermal treatment was 0.35 ng/Nm$^3$ (Hansen & Hansen, 2003). The annual air flow from kiln F1 was set to be approx. 200 million m$^3$ (Hansen et al., 2000). With this annual air flow and six months treatment of polluted soil in 2000, the emission from F1 can be estimated to be 35 mg I-TEQ in 2000. In 2001, F1 was shut down for modernisation (including installation of dioxin abatement) and as a result there was no activity from the kiln in 2001.

For the years before 2000, the default emission factor for waste incineration without dioxin abatement is used. Measurements from 1995 gave an emission factor of approx. 2 000 ng I-TEQ/tonne hazardous waste (Jensen, 1997), which is approx. 190 ng I-TEQ/GJ with a calorific value of 10.5 GJ/tonne for waste. This emission factor is in the same order of magnitude as the one for MSW incineration for these years.

### 2.5.2 Use of waste oil in district heating plants

The emission from combustion of waste oil was estimated by Hansen & Hansen (2003) to be between <1-200 mg I-TEQ/year and with a best estimate of 45 mg I-TEQ/year. Most of the combusted waste oil has been re-refined and measurements by Schleicher et al. (2001) showed emission factors in the range of 29 to 36 ng I-TEQ/tonne oil under normal combustion conditions of re-refined waste oil in district heating plants. This can be calculated to an emission factor of 0.79 ng I-TEQ/GJ, using the

calorific value 41 GJ/tonne for residual oil. Hence, the emission factor for waste oil is in the same order of magnitude as for ordinary residual oil. In the present inventory, waste oil is included in the consumption of ordinary residual oil used in district heating plants.

### 2.5.3 Incineration of sewage sludge

Incineration of sewage sludge at wastewater treatment plants emits dioxin. "Lynetten" in Copenhagen is the largest plant and, therefore, is included as a point source in the inventory, emitting 1.3 mg I-TEQ in 2004. These data are from the plant's environmental report. Another contributing source is Avedøre Wastewater Treatment Plant, which in the previous Danish substance flow analysis (Hansen & Hansen, 2003) is estimated to emit 0.2 mg I-TEQ/year. Since then, dioxin abatement has been installed and the emission is set to <0.02 mg I-TEQ in 2004 (Avedøre Spildevandscenter, 2005). According to the substance flow analysis for 2002, other minor plants contributed with a total of 0.3 mg I-TEQ/year. (Hansen & Hansen, 2003). The emissions from Avedøre Wastewater Treatment Plant and the minor plants are included in the inventory as waste and have, therefore, emission factors similar to other waste incineration activities. The activity of sewage sludge incineration is registered as commercial plant activity in official statistics and, therefore, appears as a non-industrial source. Since the activity is small, this has little influence on the inventory.

## 2.6 Wood and straw for electricity and heat generation

Dioxin emissions from use of biomass in Danish CHP plants have, according to the latest measurements, been estimated to be 1 ng I-TEQ/GJ for combustion of wood and 22 ng I-TEQ/GJ for combustion of straw (Nielsen & Illerup, 2003).

Previous Danish measurements from a 6.3 MW straw-fired district heating plant showed emissions of about 1.6 ng I-TEQ/GJ for straw, using a calorific value of 14.4 GJ/tonne (Schleicher et al., 2001). The emissions from wood combustion in another district heating plant, also with a 6.3 MW boiler, were measured to be around 1.7 ng I-TEQ/GJ for wood, calculated as an average of 6 test results and a calorific value of 14.7 GJ/tonne (Schleicher et al., 2001).

The emission factors for power and CHP plants presented in Nielsen & Illerup (2003) are based on a greater number of measurements. Hence, the emission factors 1 ng I-TEQ/GJ for wood and 22 ng I-TEQ/GJ for straw are used for heat and electricity generating plants in the inventory.

## 2.7 Summary of emissions from energy sector

Table 6 summarises the emission factors used in the energy section of the inventory for 2004.

**Table 6** Summary of emission factors in energy conversion sector for 2004

| Type of Activity | Emission factor (ng I-TEQ/GJ) | Reference |
|---|---|---|
| Coal, coke and other solid fuels | 1.32 | Hansen & Hansen, 2003 |
| Fuel and gas oil, other liquid fuels, except orimulsion | 0.882 | North Rhine-Westphalia State Environment Agency, 1997 |
| Natural gas and other gaseous fuels | 0.025 | North Rhine-Westphalia State Environment Agency, 1997 |
| Orimulsion | 3.6 | Hansen & Hansen, 2003 |
| Municipal Solid Waste | 20-348 | Nielsen & Illerup, 2003 |
| Wood and wood waste | 1 | Nielsen & Illerup, 2003 |
| Straw and other agricultural waste | 22 | Nielsen & Illerup, 2003 |

For MSW, the wide span in emission factors represents the inclusion of default emission factors for plants with dioxin abatement installed and with no abatement, but for the vast majority of the activity in 2004 the emission is based on environmental reports from incineration plants. As discussed in paragraph 2.5, the emission factor for MSW has been higher in previous years.

For other fuels than MSW, the same emission factors are used for the entire period 1990-2004.

The emissions from the first category in the inventory, which is related to energy conversion including power/district heating, refineries and offshore power production, are presented in Table 7.

**Table 7** Dioxin emission from energy and transformation related combustion activities

| (g I-TEQ/year) | 1990 | 2000 | 2004 |
|---|---|---|---|
| Coal, coke and other solid fuels | 0.31 | 0.20 | 0.23 |
| Fuel and gas oil, other liquid fuels | 0.01 | 0.13 | 0.02 |
| Natural gas and other gaseous fuels | 0.00 | 0.00 | 0.00 |
| Municipal Solid Waste | 30.50 | 10.12 | 2.10 |
| Wood and wood waste | 0.00 | 0.01 | 0.02 |
| Straw and other agricultural waste | 0.09 | 0.14 | 0.27 |
| Total | 30.91 | 10.60 | 2.63 |

In 1990, the largest source of dioxin emission from the energy and transformation category was MSW incineration; minor sources were combustion of coal and straw.

The emission from energy and transformation has decreased by 91% from 1990 to 2004, which is mainly a result of decreasing emissions from waste incineration plants due to increasing installation of dioxin abatement technology and modification of the combustion process. Thus, the emissions from MSW incineration decreased by 93% from 1990 to 2004. Other sources in the energy sector have reduced the dioxin emissions. Coal combustion emitted about 1/3 less dioxin in 2004 compared with 1990 due to reduced coal consumption, while emission from straw combustion increased to three times the 1990-level in 2004 as straw is used in more power and CHP plants.

# 3 Dioxins from non-industrial combustion plants

The non-industrial plants are mainly stoves and small residential heating boilers. The other main categories for combustion plants in the non-industrial sector are commercial plants, and combustion plants in the agricultural and forestry sectors.

Two methodological approaches are used to estimate emissions; a simple method is used for all fuels other than wood, with a more detailed methodological approach being used for wood.

## 3.1 Commercial, forestry and agricultural plants

The first method is applied for combustion plants in the commercial, agricultural and forestry sectors. For these combustion plants the emission factors given in the EMEP/CORINAIR Emission Inventory Guidebook are used (Table 8).

**Table 8** Emission factors for commercial, forestry and agricultural plants

| | Solid coal fuels [1] | Gaseous fuels [2] | Liquid fuels [3] | Wood [4] |
|---|---|---|---|---|
| Emission factor (ng I-TEQ/GJ) | 300 | 2 | 10 | 400 |

[1] Raw coal, coke, etc. [2] Natural gas, LPG, etc. [3] Gas oil, fuel oil, other liquid fuels, etc. [4] Wood, peat, wood wastes, straw, etc.
Source: EMEP/CORINAIR, 2005, Section B216, Table 8.1b.

One of the most important fuels is straw combusted in agricultural boilers. The emission factors presented in the table above are supported by Danish measurements from an agricultural plant, where three test results showed emissions of 5 000, 5 600 and 9 200 ng I-TEQ/tonne straw (Schleicher et al., 2001). This can be calculated to be 458 ng I-TEQ/GJ, if the calorific value 14.4 GJ/tonne for straw is used.

For waste (MSW) incineration in commercial and institutional plants, the emission factor 348 ng I-TEQ/GJ presented in Section 2.5 is used; assuming no abatement technology. The MSW incinerators registered as commercial plants in the energy statistics are a small number municipality-owned incinerators, which combust a limited amount of the total combusted waste.

## 3.2 Residential plants

For the residential sector, a more detailed methodology is used for plants burning wood, because previous work has shown that the contribution from this source is high and the emission factors very much depend on the type of appliance used. For the other fuels, a simple methodology is

applied. The emission factors are discussed and presented in the following paragraphs.

### 3.2.1 Natural gas for residential heating

The emission factor for natural gas is suggested to be between 0.05 and 0.1 ng I-TEQ/$m^3$ gas with a typical value of 0.07 ng I-TEQ/$m^3$ (Hansen & Hansen, 2003) – a factor which is adopted from studies by Bröker et al. in 1992 and 1994 (North Rhine-Westphalia State Environment Agency, 1997). This equates to 1.88 ng I-TEQ/GJ, using the calorific value 39.94 GJ/1000 $m^3$, which can be used as representative of Danish gas quality. A German study estimated the emission factor to 1.79 ng I-TEQ/GJ for old and new residential natural gas boilers (Pfeiffer et al., 2000). The EMEP/CORINAIR Emission Inventory Guidebook from 2005 suggests using 0 as the emission factor for gaseous fuels in the simple methodology for residential sources, while with the detailed methodology the emission factor 2 ng I-TEQ/GJ for gas-fired boilers with a capacity >50 kW is suggested (EMEP/CORINAIR, 2005). This source of information has no data for boilers with lower capacity, which would have been preferable in making the inventory more detailed, as large quantities of natural gas are used for residential heating in small boilers in Denmark. Using the emission factor for medium-sized boilers of 2 ng I-TEQ/GJ, the emission is most likely not underestimated, but since it is still a low emission factor compared with other residential sources, the contribution of residential natural gas combustion to dioxin emissions remains minor.

### 3.2.2 Oil for residential heating

The emission factor suggested by The European Dioxin Inventory, Stage I, Section Germany (North Rhine-Westphalia State Environment Agency, 1997) for residential oil heating is between 0.52 and 2.34 ng I-TEQ/GJ with a typical value of 1.04 ng I-TEQ/GJ, using the calorific value 42.8 GJ/tonne for gas oil and the oil density 0.9 kg/litre. An emission factor close to this is also suggested by Pfeiffer et al. (2000), where measurements in both old and new oil heating boilers gave an average emission of 1.84 ng I-TEQ/GJ, using the calorific value 42.8 GJ/tonne for the gas oil used in the study.

The Emission Inventory Guidebook (EMEP/CORINAIR, 2005) does, however, indicate a higher emission factor of 10 ng I-TEQ/GJ for oil used for residential heating. Since many of the sources of information behind The European Dioxin Inventory, Stage I are based on tests under laboratory conditions, which is also the case for the study by Pfeiffer et al. (2000), reliance on the emission factor from the EMEP/CORINAIR Guidebook has been chosen. This may give a relatively high estimate of the dioxin emissions from oil-fired residential heating, but on the other hand may ensure that common operating conditions in households are taken into consideration.

### 3.2.3 Coal, coke and petroleum coke for residential heating

According to the official Danish Energy Statistics, the share of coal and coke products for residential heating is small and was estimated to cover

0.7% of the energy content in residentially combusted fuels in 2003 (DEA, 2004). However, uncertainty as to the exact amount is possible as private individuals import petroleum coke. But even if consumption of the fuel were twice as large, coal and coke would still not be the largest contributing factor from residential plants. The emission factor used for solid coal and coke fuels derives from the EMEP/CORINAIR Emissions Guidebook's simple methodology since demarcation according to technologies used for coal and coke firing is not considered necessary at the present activity level. The emission factor 800 ng I-TEQ/GJ will, therefore, be used for combustion of coal and coke in residential plants (EMEP/CORINAIR, 2005).

### 3.2.4 Wood for residential heating

Good overviews on previous studies of dioxin emissions from residential wood stoves and boilers are presented by Hansen & Hansen (2003) and Lavric et al. (2004). Some of the literature cited refers to tests under laboratory conditions, while recent literature states the importance of field measurements in household chimney stacks, in order to include the wide span in dioxin emissions that results from variable operating conditions.

The emission factor for dioxin from residential wood burning may, however, be associated with substantial uncertainty. This has also been underlined in previous dioxin inventories. In the Substance Flow Analysis (Hansen & Hansen, 2003), the emission factor was set to be between 1 and 50 ng I-TEQ/kg wood, which equals to between 68 and 3401 ng I-TEQ/GJ, with a calorific value for wood of 14.7 GJ/tonne.

The Danish National Environmental Research Institute (Glasius et al., 2005) has conducted field measurements that indicate relatively high and wide-ranging emission factors. Another field study of the dioxin emission from residential wood burning in Austria was made by Hübner et al. (2005) and, as presented in Table 9, the results are in accordance with those from the National Environmental Research Institute.

**Table 9** Measurements of dioxin in chimney stacks from wood burning appliances

| | Lower EMF ng I-TEQ/GJ | Upper EMF ng I-TEQ/GJ | Average EMF ng I-TEQ/GJ | Number of tests | References |
|---|---|---|---|---|---|
| Stoves <3 years | 21 | 214 | 118 | 3 | Glasius et al. 2005 + Note: A |
| Stoves >5 years | 364 | 1264 | 814 | 6 | Glasius et al. 2005 + Note: A |
| Stoves ('56 –'98) | 23 | 2300 | 839 | 10 | Hübner et al. 2005 |
| Boilers ('79 – '92) | 3 | 2600 | 492 | 10 | Hübner et al. 2005 + Note: B |

Note A: Emission factors calculated from factors in ng I-TEQ/kg wood with a calorific value of 14 MJ/kg, since air-dried wood was used in the samples. Note B: A single measurement from a pellet-fired boiler is excluded from the results for boilers. The single measurement from the pellet boiler was 2 ng I-TEQ/GJ.

The measurements in the above-mentioned studies indicate the necessity of a distinction in emission factor for old versus modern wood stoves, though the relationship is not simple. Firing with contaminated wood may increase the dioxin emission from old as well as advanced stoves significantly. On the other hand, firing in an old stove does not necessarily lead to high emissions of dioxin. Both Glasius et al. (2005) and Hüb-

ner et al. (2005) state that firing with contaminated wood, even in the past, may still cause high dioxin emissions due to ”memory-effects” in for example masonry chimneys. This may give a high emission factor together with many other influencing factors, such as operational conditions, including poor maintenance of boilers and stoves, demonstrated in a measurement by Hübner et al. (2005). Since all these influencing factors are present in a household's everyday life they must be taken into consideration when choosing an emission factor. Still, the unknown extent of firing with contaminated and semi-contaminated wood causes high uncertainty surrounding the emission factors. In the present inventory, the level of contamination of the wood is assumed to be at a low level.

The emission factors found in the studies by Glasius et al. (2005) and Hübner et al. (2005) support the suggested emission factors given in the detailed methodology as described in the Emission Inventory Guidebook (EMEP/CORINAIR, 2005). Therefore, the emission factors from the guidebook were found appropriate for elaboration of an implied emission factor based on the current distribution among technologies in residential wood burning.

Table 10 shows the estimated implied emission factor for residential wood burning appliances. Distribution according to the different technologies is based on 2002 figures (Illerup & Nielsen, 2004), while emission factors have been taken from the Emission Inventory Guidebook (EMEP/CORINAIR, 2005, Section B216).

**Table 10** Calculation of an implied emission factor for residential wood burning in 2004

| Fuel consumption distributed on technology (based on 2002-figures) | Percent | Emission factor ng I-TEQ/GJ |
|---|---|---|
| Old stoves | 45.9 % | 800 |
| New stoves | 9.2 % | 300 |
| Old boilers | 15.9 % | 500 |
| Pellet boilers | 22.9 % | 50 |
| Boilers acc. tank | 6.1 % | 50 |
| Total | 100 % | 488 |

Sources: Distribution on technology (Illerup & Nielsen, 2004); Emission factors (EMEP/CORINAIR, 2005, Section B216)

The emission factor for pellet stoves and boilers may be overestimated by the EMEP/CORINAIR Emission Inventory Guidebook since Hübner et al. (2005) measured an emission from a pellet stove as being only 2 ng I-TEQ/GJ, where the Guidebook suggests 50 ng I-TEQ/GJ. A single measurement is, however, insufficient when arguing for a reduction in the emission factor in general. A Danish study of a pellet-fired stoker boiler showed emission factors in the range between 12 and 31 ng I-TEQ/GJ (Schleicher et al., 2001 + 2002), depending on the boiler's load level and calculated with a calorific value of 17 GJ/tonne for wood pellets. The emission factor for pellet boilers of 50 ng I-TEQ/GJ, as suggested in the EMEP/CORINAIR Guidebook, is retained for pellet boilers at this time. Further studies on this emission factor may change the emission factor at a later stage.

Using the emission factors from the EMEP/CORINAIR Guidebook gives an implied emission factor for residential wood burning of 488 ng I-TEQ/GJ, which is used for the present inventory. For further discussion of the parameters used for the implied emission factor, see Illerup et al. 2005.

Different implied emission factors are used for time-series of dioxin emissions from residential wood combustion. The major contributing factor to the difference in historical emission factors is the rapid growth in the use of wood pellets. Before 1999, the share of wood pellets used in Denmark was very small. Hence, different implied emission factors for 1990 and 2000 are set up in order to reflect the change in technologies for residential heating with wood. The distribution by technology in the tables below derives from the distribution of stoves and boilers from 2002, except for the consumption of wood pellets which is based on the Danish official energy statistics. The subcategories for stoves and boilers are merged respectively to two main categories.

**Table 11** Implied emission factor for residential wood combustion in 1990

| | TJ in 1990 | Emission factor ng I-TEQ/GJ |
|---|---|---|
| Stoves | 6.313 | 800 |
| Boilers | 2.525 | 500 |
| Pellet boilers | 117 | 50 |
| Total | 8.954 | 706 |

The implied emission factor for 1990 is used for the years until 1999, since the development of pellet combustion in the period is limited. For 2000 a new implied emission factor is calculated.

**Table 12** Implied emission factor for residential wood combustion in 2000

| | TJ in 2000 | Emission factor ng I-TEQ/GJ |
|---|---|---|
| Stoves | 8.325 | 800 |
| Boilers | 3.329 | 500 |
| Pellet boilers | 2.112 | 50 |
| Total | 13.767 | 612 |

For the years 2000-2004, the implied emission factor for residential wood combustion is annually reduced equally from the emission factor 612 ng I-TEQ/GJ in 2000 to 488 ng I-TEQ/GJ in 2004, mainly as a consequence of the increase in the use of pellet boilers and new stoves during these years.

### 3.2.5 Agricultural waste (straw) for residential heating

The emission factor for small-scale residential boilers is, according to the guidebook, 500 ng I-TEQ/GJ (EMEP/CORINAIR, 2005). This factor is used in the present inventory.

### 3.2.6 Summary of emission factors for the residential sector

Table 13 gives an overview over the emission factors used for the residential sector. The emission factor for wood combustion is not constant for the period 1990-2004, as discussed in Section 3.2.4, while the emission factors for other fuels used residentially are held constant in the time-series.

**Table 13** Summary of emission factors in residential sector for 2004

| Type of Activity | Emission factor (ng I-TEQ/GJ) | Reference |
|---|---|---|
| Coal, coke and other solid fuels | 800 | (EMEP/CORINAIR, 2005, Section B216) |
| Fuel and gas oil, other liquid fuels | 10 | (EMEP/CORINAIR, 2005, Section B216) |
| Natural gas and other gaseous fuels | 2 | (EMEP/CORINAIR, 2005, Section B216) |
| Wood and wood waste | 488 | (EMEP/CORINAIR, 2005, Section B216) |
| Straw and other agricultural waste | 500 | (EMEP/CORINAIR, 2005, Section B216) |

## 3.3 Summary of emissions from the non-industrial sector

Table 14 shows the emissions from commercial, residential and agricultural plants.

**Table 14** Dioxin emission from non-industrial combustion activities

| (g I-TEQ/year) | 1990 | 2000 | 2004 |
|---|---|---|---|
| Coal, coke and other solid fuels | 2.26 | 0.78 | 0.74 |
| Fuel and gas oil, other liquid fuels | 0.66 | 0.40 | 0.33 |
| Natural gas and other gaseous fuels | 0.06 | 0.09 | 0.10 |
| Municipal Solid Waste | 1.91 | 0.05 | 0.00 |
| Wood and wood waste | 6.44 | 8.85 | 8.82 |
| Straw and other agricultural waste | 3.90 | 2.39 | 2.23 |
| Total | 15.23 | 12.55 | 12.21 |

In 1990, the major sources in the non-industrial category were combustion of wood, straw as well as coal and coke. The waste incinerators categorised as commercial plants contributed significantly to the emission in the non-industrial sector in 1990, but this emission of 1.91 g I-TEQ could as well be classified as an emission that should be added to the 30.5 g I-TEQ, which waste incineration plants, categorised in the energy sector, emitted in 1990.

The wood combustion was related to the residential sector, while combustion of straw was related to both the agricultural and residential sector. Most of the emission from coal is from energy consumption in agricultural and forestry combustion plants, while most of the emissions from coke come from residential heating appliances. The entire emission from MSW was from incineration plants in the category commercial and institutional plants.

In the non-industrial combustion sector, the contribution to the dioxin emission from coal, coke and other solid fuels has declined by 67% since 1990 due to decreasing use of these fuels. Also the contribution from straw and agricultural waste has declined by 43%, while the emission from wood use has increased by 37%. The increase in emissions from residential wood combustion is caused by a larger consumption of wood. The emission factor for 2004 is lower than in 1990, due to use of new combustion technologies such as pellet boilers and new stoves. The emission from MSW in commercial and institutional waste incineration plants has been reduced to a very low level in 2004, since only a small amount of waste is combusted in this sector and the implied emission factor for waste combustion in 2004 is lower than in 1990.

Generally, the emission from non-industrial sources has decreased by approx. 20% from 1990-2004, but if MSW incineration is counted as belonging to the energy sector, the reduction in non-industrial emissions has only been around 8%. The major driving forces for this reduction include lower use of coal products and straw; both for residential heating and in forestry and agriculture. Also, the increased use of natural gas instead of oil for residential heating contributes to the lower emission. During the period 1990 to 2004, the emission from residential wood combustion has increased from 6.3 to 8.5 g I-TEQ; keeping the overall emission reduction from non-industrial sources at a modest level.

# 4 Dioxins from industrial plants

In general, the emission factors from the public power sector are adopted for industrial combustion facilities in Denmark due to the many similarities between the facilities. Since the combustion activity in the industrial sector is mostly natural gas, the emission of dioxin from combustion is quite low.

Where more detailed knowledge of actual emissions from larger industrial point sources exists, this information is used instead of the default emission factors.

## 4.1 High-temperature industrial processes

There are a few potential sources of dioxin emissions from high temperature processes and these sources are estimated to contribute to the overall emission on a limited scale only. These sources include (with emission factors from Hansen & Hansen 2003 in brackets) manufacturing of clay-based insulation materials (0.018 ng I-TEQ/kg produced material), tiles and bricks based on clay (0.018 ng I-TEQ/kg produced material) and lime production (0.02 ng I-TEQ/kg material).

### 4.1.1 Production of insulation materials

Hansen & Hansen (2003) estimates an emission of approx. 0.02-0.32 g I-TEQ/year for other materials produced in high temperature processes. These sources cover production of insulation materials such as glass wool and stone wool as well as production of glass, china and ceramics.

The production of mineral wools is included in the inventory for 2004. The company Rockwool has calculated emissions of 0.026 g I-TEQ for their production site in Doense. For their production in Vamdrup they have calculated emissions of 0.031 g I-TEQ (Lambertsen, 2006). These calculations, based on measurements, are made for 2005, but are also considered valid for 2004 due to little change in production quantities and methods. At the present time, no exact knowledge of the dioxin emission from mineral wool production exists for before 2004. The level is, however, expected to be higher historically, since one further production unit was in operation prior to 2002 and installation of high temperature burners was conducted during the 1990s. This part of the inventory may be improved at a later stage, as and when more information becomes available.

### 4.1.2 Production of cement

The only cement producer in Denmark is Aalborg Portland, which has one large and six smaller kilns. Measurements have been made regularly since 1999, but uncertainty is high as measurements are only performed a few times per year and, moreover, the results of the measurements

vary significantly. Some measurements are even below the detection limit. For these measurements, the detection limit is used for calculation of the emissions.

In 2004, six measurements (two from the large kiln and four from the small kilns) were made which, on average, gave a dioxin emission of 22 ng I-TEQ/tonne produced cement (Thomsen, 2006). This emission factor is used for the 2004 inventory and gave, with a production of 2 861 000 tonnes, an emission of 0.0629 g I-TEQ.

During the period 1999 to 2002, nine measurements on the large kiln and a single measurement on one small kiln were made. These measurements showed emission levels around 5 ng I-TEQ/tonne produced cement. This level was used as the emission factor for the years in this period.

In 1995, one single measurement was made on the large kiln, which showed an emission of 500 ng I-TEQ/tonne produced cement. (Thomsen, 2006). This measurement is used as an emission factor for the year 1995 and the earlier years back to 1990. A production of 1 620 000 tonnes in 1990 resulted in an emission of 0.82 g I-TEQ.

For the years 1996 to 1998, a linear interpolation between the known measurements in 1995 and 1999 is made for the emission factors.

## 4.2 Steel reclamation

Activity in the steel reclamation industry has varied greatly over recent years. Production ceased in 2002, but by the end of January 2005 steel reclamation in the electric steel furnace had started again with an annual production target of 400 000 - 600 000 tonnes. However, production in the electric steel furnace closed down again in December 2005. Thus, in 2003 and 2004, there was no dioxin emission from steel reclamation. Before 2002, however, there have been emissions from this process each year within the timeframe, back to 1990.

The Emission Inventory Guidebook (EMEP/CORINAIR, 2005) suggests emission factors for steel reclamation within a broad range (Table 15).

**Table 15** Emission factors for electric steel furnaces

| Emission factor (µg I-TEQ/Mg) | Data quality | Abatement type | Fuel type | Country |
|---|---|---|---|---|
| 5[3] | E | *Unknown* | *Unknown* | Belgium |
| 6 | E | *Unknown* | *Unknown* | France |
| 0.15-1.8 | C | Fabric filter | *Unknown* | Germany |
| 0.068-0.23 | C | ESP | *Unknown* | Germany |
| 2 | E | Semi-abated | *Unknown* | Netherlands |
| 20 | E | Semi-abated | PVC cont. | Netherlands |
| 0.7 | E | *Unknown* | No $Cl_2$ | UK |
| 10 | E | *Unknown* | High $Cl_2$ | UK |
| 0.2-8.6[4] | E | *Unknown* | *Unknown* | Sweden |
| 11 | E | *Unknown* | *Unknown* | Switzerland |

Source: http://reports.eea.eu.int/EMEPCORINAIR4/en/B427vs3.3.pdf

Two previous measurements from the Danish steel reclamation process from 2001 showed dioxin emissions corresponding to 0.3 and 1.0 µg I-TEQ/tonne manufactured steel (Hansen & Hansen, 2003). No measurements have been made since 2001, as there was no production in electric steel furnaces from 2002 to 2004 and the production in 2005 was generally very unstable – with the result that the frequency of the measurement has been limited, according to the local authorities. In the present inventory, the emission factors for the years prior to 2002 are estimated as an average of the two measurements conducted in 2001.

The input to the electric steel furnace in 2000 was about 806 000 tonnes (Det Danske Stålvalseværk, 2001) and, using an emission factor of 0.65 µg I-TEQ/tonne, the estimated emission is 0.52 g I-TEQ. The estimate agrees well with the estimate of 0.1-2.4 g I-TEQ/year from the substance flow analysis (Hansen & Hansen, 2003).

The emission from steel reclamation was estimated to be 12 g N-TEQ and 7.5 g I-TEQ in 1990 and 1995, respectively (Jensen, 1997). For the time-series, the emission is linearly interpolated between the estimates 12 g N-TEQ in 1990, 7.5 g I-TEQ in 1995 and 0.52 g I-TEQ in 2000. For the years 2001 and 2002 the emission is set to 0.52 g I-TEQ.

## 4.3 Aluminium reclamation

In Denmark, only one company performs aluminium reclamation. The company is Stena Aluminium; before 2001 it was named Gotthard Aluminium and, before a fusion in 1990, it was part of Kolding Metalværk (Kolding Metal Works). Dioxin abatement technology was installed by the end of 2000 in order to comply with stricter regulations.

[3] Value based on data from Sweden and the Netherlands; the range is 0.1-50 µg I-TEQ/Mg.

[4] ng N-TEQ/Mg

From January 2001, the emission limit value from flue gas from industrial plants has been 0.1 ng I-TEQ/Nm$^3$, unless special technical or financial circumstances justify a limit of 0.2 ng I-TEQ/Nm$^3$ (Danish EPA, 2001). In the current case, the local authority has been in dialogue with the company and demanded installation of dioxin abatement technology to comply with the limit value of 0.1 ng I-TEQ/Nm$^3$ and measurements have shown this to be feasible (www.vejleamt.dk). In this inventory, an emission concentration equal to the legal value is used for 2004.

In 2000, the annual production of aluminium of approx. 30 000 tonnes resulted in a yearly emission of 30 mg I-TEQ/year, assuming compliance with the legislative limit value of 0.1 ng I-TEQ/Nm$^3$ after installation of dioxin abatement (Hansen & Hansen, 2003). The emission factor was estimated to 1 µg I-TEQ/tonne aluminium produced. Production in 2004, according to Statistics Denmark, was about 20 200 tonnes. Using the emission factor of 0.001 mg I-TEQ/tonne for the inventory, the emission in 2004 is 0.02 g I-TEQ. This emission factor is used for the years after installation of dioxin abatement.

For the years 1990 to 2000, the estimated emission is assumed to be 1.74 g I-TEQ/year, as the mean value for the estimated range 0.17-3.3 g I-TEQ/year given in Hansen et al. (2000).

The uncertainty surrounding the emissions for the years prior to 2000 is, however, very high and measurements made before abatement technology was installed by the end of 2000 showed concentrations of 183, 113 and 14 ng I-TEQ/Nm$^3$,. Assuming the same ratio between concentration in air flow and the emission, as used above, the average emission factor would be 1.0 mg I-TEQ/tonne aluminium. With a production of about 30 000 tonnes in 2000 the emission would be 30 g I-TEQ. This high uncertainty surrounding emissions for the years before 2000 is also discussed in the substance flow analysis from 2003 (Hansen & Hansen, 2003), which states that the worst case dioxin emission before installation of abatement technology would be around 60 g I-TEQ/year.

## 4.4 Summary of emissions from industrial sector

Table 16 presents the emissions in 1990 and 2004 for industrial activities.

**Table 16** Dioxin emission from industrial combustion and process activities

| (g I-TEQ/year) | 1990 | 2000 | 2004 |
|---|---|---|---|
| Coal, coke and other solid fuels | 0.02 | 0.03 | 0.01 |
| Fuel and gas oil, other liquid fuels | 0.02 | 0.03 | 0.01 |
| Natural gas and other gaseous fuels | 0.00 | 0.02 | 0.00 |
| Municipal Solid Waste | 0.06 | 0.09 | 0.00 |
| Wood and wood waste | 0.01 | 0.00 | 0.00 |
| Process emissions | 14.56 | 2.29 | 0.15 |
| - Aluminium reclamation | 1.74 | 1.74 | 0.02 |
| - Steel reclamation | 12.00 | 0.52 | NA |
| - Cement production | 0.81 | 0.01 | 0.06 |
| - Mineral wool | NE | NE | 0.06 |
| - Lime, tiles, bricks production | 0.01 | 0.01 | 0.01 |
| Total | 14.67 | 2.46 | 0.17 |

In the industrial sector, steel reclamation was the activity with the largest emission in 1990. Industrial combustion activity does, in general, cause relatively low emissions, as large quantities of the fuels used are natural gas, which has a low emission factor.

Due to stricter emission regulation with required dioxin abatement in the steel and aluminium reclamation industries and the total stop of steel reclamation processes in Denmark from 2002-2004.the emissions from these sources are reduced significantly. This has made the manufacture of cement and mineral wool into the largest industrial sources of dioxin emissions in 2004 and reduced the total industrial dioxin emission by more than 98% compared with 1990.

# 5 Dioxins from other sources

## 5.1 Transport sector

The dioxin emission from road transport in 2004 can be estimated to be 0.22 g I-TEQ, relating mainly to passenger cars. Emissions from other mobile sources, including railways, aviation and maritime traffic, are estimated to be 0.61 g I-TEQ. The largest source is use of bunkers in international navigation. The emission factors for this part of the inventory are adopted from the EMEP/CORINAIR Emission Inventory Guidebook 2005 and used for the entire period. Future work for this sector will be to document and improve the emissions estimates and also investigate the influence of additives in leaded petrol from 1990 and onwards, until their phase-out.

## 5.2 Crematories

The substance flow analysis from 2003 estimated the dioxin emission from crematories to be between 6 and 70 mg I-TEQ/year (90% confidence level) with a best estimate of 38 mg I-TEQ/year (Hansen & Hansen, 2003). This estimate is considered valid for the present inventory. The estimate was based on measurements giving various results, but with an annual activity of about 40 000 cremations this corresponds to an average emission factor of 950 ng I-TEQ/cremation. According to the measurements referred to in the substance flow analysis, this is in the upper end of the measurements for cremations.

## 5.3 Accidental fires

### 5.3.1 Fires in buildings and vehicles

The substance flow analysis set the emission from accidental fires to be between 0.5 and 20 g I-TEQ/year (Hansen & Hansen, 2003). This estimate relies on the previous estimate from Hansen (2000) and is considered the best estimate. Based on the assumption of 13 000 small fires, 3 000 medium fires and 650 large fires each year, and on the population size and the average content of PVC in Danish homes, the emission from accidental fires in buildings in Denmark is estimated to be 5.3 g I-TEQ/year (Schleicher & Jensen, 2004).

Accidental fires in vehicles are, with 1 000 fires each year, estimated to give rise to a dioxin emission of 0.05 g I-TEQ/year (Schleicher & Jensen, 2004: 27).

### 5.3.2 Municipal landfill fires

The previous estimate of the emission of dioxins to air from landfills is 0.25-10 g I-TEQ/year. This estimate is based on the assumption of 5 000-10 000 tonnes of waste being burned in landfill fires each year and that the emission factor is between 50 and 1 000 ng I-TEQ/kg waste (Hansen & Hansen, 2003). The variance heavily depends on PVC-content, but waste at Danish landfill sites does not normally contain PVC. Measurements by Hedman (2005) show emissions between 16-65 ng I-TEQ/kg from backyard burning of waste without PVC. The emission does increase significantly with rising content of PVC. This relation was verified by Lemieux et al. (2003), who found household waste without PVC to emit between 2 and 28 ng I-TEQ/kg, rising to between 179 and 242 ng I-TEQ/kg with 1% PVC-content and between 3 543 and 6 655 ng I-TEQ/kg with 7.5% PVC-content. Since waste at Danish landfill sites does not contain PVC under normal circumstances, an emission factor of 50 ng I-TEQ/kg waste can be used.

In 2004, there were several deposits of waste of a size of approximately 25 000 tonnes, on average, awaiting available incineration capacity. According to the Danish EPA, few landfill fires at such storage sites have occurred annually over the last 5-10 years (Hansen, 2006). The sizes of the fires vary, but most fires are of a limited size. Larger, longer-term landfill fires, like the one in 2000 at a landfill near Esbjerg where about 75% of 25 000 tonnes of waste was combusted during a week-long fire, are very seldom and must be considered as an extraordinary event. Assuming three annual fires, each burning 5 000 tonnes or 20% of a 25 000 tonne deposit, and an average emission factor of 50 ng I-TEQ/kg waste, the emission can be estimated at 0.75 g I-TEQ/year. Although there is uncertainty surrounding the extent of the fires and the actual emissions, this estimate is considered valid for the years 1990-2004.

## 5.4 Summary of emissions from other sources

Table 17 shows the emissions from crematories and fires ad well as transport, i.e. road transport and the other transport modes of rail, navigation and aviation.

**Table 17** Dioxin emission from other sources

| (g I-TEQ/year) | 1990 | 2000 | 2004 |
|---|---|---|---|
| Transport | 1.64 | 1.26 | 0.83 |
| - Road transport | 0.87 | 0.34 | 0.22 |
| - Rail, Navigation and Aviation | 0.77 | 0.92 | 0.61 |
| Crematories | 0.038 | 0.038 | 0.038 |
| Fires in buildings and vehicles | 5.35 | 5.35 | 5.35 |
| Landfill fires | 0.75 | 0.75 | 0.75 |

For crematories, landfill fires and fires in buildings and vehicles, the emission estimates are used for the period as a whole. For transport, change in the activity level influences the emission.

In 1990, the emissions from road transport slightly exceeded the emissions from other sources of transport, i.e. rail, navigation and aviation. For road transport, the fuel contributing the most was petrol. The emission factor for petrol will be revised in future inventories, as there may be some uncertainty with regard to the influence of additives in leaded petrol in the present inventory. Regarding the other transport sources, the greatest emission stems from the use of bunkers in navigation.

The emission from the transport sector has decreased by 49 % from 1990 to 2004 and most of the reduction is from road transport, due to increasing use of catalyst cars.

# 6 Potential emissions not included in the inventory

This chapter discusses potential sources of emission which are considered insignificant due to very low emissions. These sources will be discussed briefly but not presented along with the inventory in the last chapter.

## 6.1 Pentachlorophenol (PCP)-treated wood

In previous work (Hansen & Hansen, 2003), the dioxin emission estimate for PCP-treated wood was very uncertain and was calculated to be in the range of 0.5 to 26 g I-TEQ/year. The two largest sources were assumed to be evaporation of dioxin from PCP-treated wood used for construction and single-use wood pallets for transport purposes. According to a new estimate by Jensen (2006), dioxin emissions from PCP-treated wood can, however, be considered to be negligible. The arguments here are that PCP preservation does not contain substances than can cause emission of dioxin and that the evaporation rate of dioxin from PCP-treated construction wood is much lower than assumed in Hansen & Hansen (2003).

## 6.2 Chemicals

The previous estimate of dioxin emission to air from chemical industrial activities is very uncertain. Potential sources within the manufacturing industry are production of pesticides and pharmaceuticals, where the best estimate for pesticides was set to 0.001-0.007 g I-TEQ/year. Both sources are generally considered marginal in the total inventory (Hansen & Hansen, 2003). Thus, these sources are not taken into further consideration in the present inventory.

## 6.3 Feedstuffs

The emissions from feedstuff production are generally estimated to be low from the potential sources, which in the substance flow analysis (Hansen & Hansen, 2003) are fish oil and meal (0.02 g I-TEQ/year), meat and bone meal (<0.01 g I-TEQ/year) and green feed drying (0.004-0.04 g I-TEQ/year).

## 6.4 Other industrial processes

The emission from other industrial processes, which are not included in the discussion of industrial activities, is set to be <0.04 g I-TEQ/year (Hansen & Hansen, 2003). This emission, which is not included in the in-

ventory, covers activities such as asphalt preparation, spray drying, coal tar production and vitamin manufacturing.

## 6.5 Cable scrap treatment

Until 2002, there was one plant carrying out cable scrap reclamation in Denmark, so there is no emission for 2004. In 2000, the plant was estimated to emit 0.00004-0.001 g I-TEQ/year (Hansen & Hansen, 2003).

## 6.6 Shredder plants

There are six shredder plants in Denmark, which treat metal scrap. Two measurements of dioxin emission to air were made for a shredder plant in 2001 and 2000, which gave an estimate of the total emission from shredder plants of between <0.001 and 0.015 g I-TEQ/year. This relatively low estimate replaces an even lower total estimate of 0.0005 to 0.004 g I-TEQ/year based on measurements in 1999 (Hansen & Hansen, 2003). In general, all estimates indicate low emissions from this source.

## 6.7 Metal Manufacturing

Two contributing activities within metal manufacturing are metal casting, emitting <0.001-0.01 g I-TEQ/year, and hot-dip galvanising, emitting 0.02-0.44 g I-TEQ/year (Hansen & Hansen, 2003). The contribution from metal casting is insignificant, while hot-dip galvanising previously has been estimated to contribute more. According to the Danish EPA, all organic material is removed in today's processes prior to galvanising, so the process no longer leads to dioxin formation.

## 6.8 Charcoal used in garden grills

Schleicher et al. (2001) measured emission factors for charcoal cooking between 6 and 15 ng I-TEQ/kg charcoal. The source is not included in the present inventory, since the use of charcoal is not included in official energy statistics. But an annual import of charcoal of 17 000 tonnes and an assumption that this quantity is equal to the actual consumption used for grilling, the emission would be estimated to be between 0.102 and 0.255 g I-TEQ/year. Inclusion of the source in the inventory can be considered at a later stage.

## 6.9 Smoking of tobacco

Smoking of tobacco is not included in the present inventory since the contribution is expected to be very low. With 8 178 million cigarettes sold in 2004 (Statistics Denmark, 2005) and an emission factor of 0.1 pg I-TEQ/cigarette (UNEP, 2005), the emission is estimated to be 0.0008 g I-TEQ/year.

## 6.10 Fireworks

No data are available for fireworks.

# 7 Conclusions – dioxin inventory for 1990 to 2004

This chapter summarises the emission distributed by sector and fuel for the years 1990, 2000 and 2004. More detailed data for these years are available in Appendices B, C, D and E. Furthermore, time-series are presented in tables at the end of the present chapter.

## 7.1 Comparison and overview

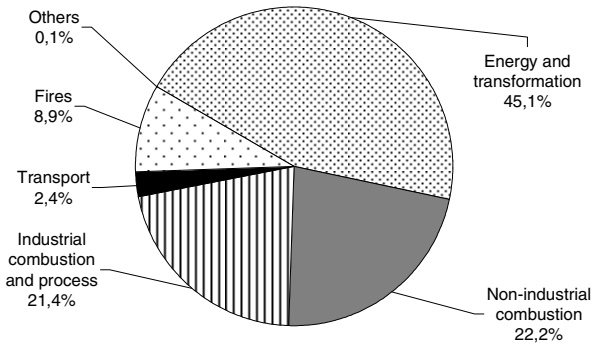



**Figure 1** Distribution of dioxin emission in 1990. The total emission is estimated 68.6 g I-TEQ

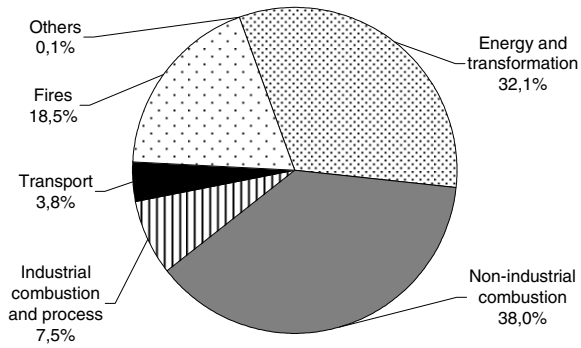



**Figure 2** Distribution of dioxin emission in 2000. The total emission is estimated 33.0 g I-TEQ

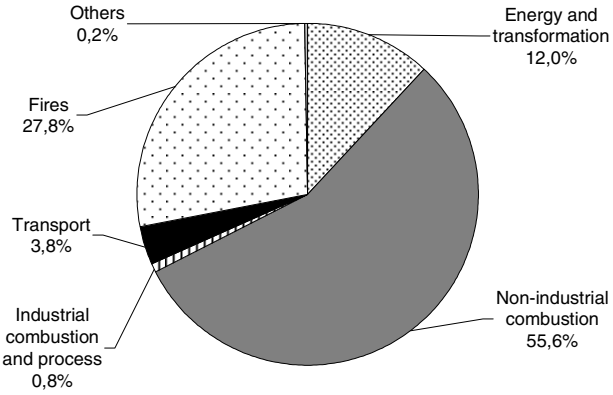



**Figure 3** Distribution of dioxin emission in 2004. The total emission is estimated 22.0 g I-TEQ

The major emission sources for 1990 were municipal waste incineration, steel reclamation and residential wood burning, while in 2004 the major sources had changed to residential wood burning and fires. Fires include landfill fires and fires in buildings and vehicles.

The relative contribution to the dioxin emission from the energy and transformation sector has decreased from around 45% to 12% of the total emission from 1990-2004, mainly due to decreasing emissions from waste incineration plants. The emission from waste incineration plants categorised as commercial or institutional plants, and therefore included

in the non-industrial sector, could be added to the energy sector, where most incineration plants are included. Adding MSW incinerators included as non-industrial sources to the energy sector would give shares in the region of 48% in 1990 and 12% in 2004, as these incinerators emitted 2.8% of the total emission in 1990 and close to nothing in 2004.

The emission from industrial activities has decreased significantly from 14.67 g I-TEQ in 1990 to 0.17 g I-TEQ in 2004. This has also reduced the relative contribution from industry in the inventory to less than 1% of the total emission - in 1990 it was around 21% of the emission. The main reasons for the significant decrease in the emission are stricter emission regulation with required dioxin abatement in e.g. steel and aluminium reclamation industries and the total stop of steel reclamation processes in Denmark from 2002-2004.

The non-industrial sector - where the residential sector is the most important - has reduced its emissions by approx. 20 % from 1990 to 2004. However, as the emission reduction for especially the industrial sector, but also for the energy and transport sectors, has been larger than for non-industrial activities, the share of emissions from non-industrial sources has grown from around 22% to over 55% of the total emission. As mentioned above, 2.8% of the emission in 1990 was from waste incineration plants categorised as non-industrial sources in official statistics, which is why one can argue, that non-industrial sources contributed with around 19% to the total emission in 1990 rather than 22%.

The relative contribution from fires has increased from around 9% to nearly 28% from 1990 to 2004, although the emission is assumed to be constant over the period. But, as regulation has lowered emissions from the large point sources, such as waste incineration plants and industries, the importance of the diffuse and multiple-point sources has increased. Hence, accidental fires and residential wood use contribute relatively more in 2004.

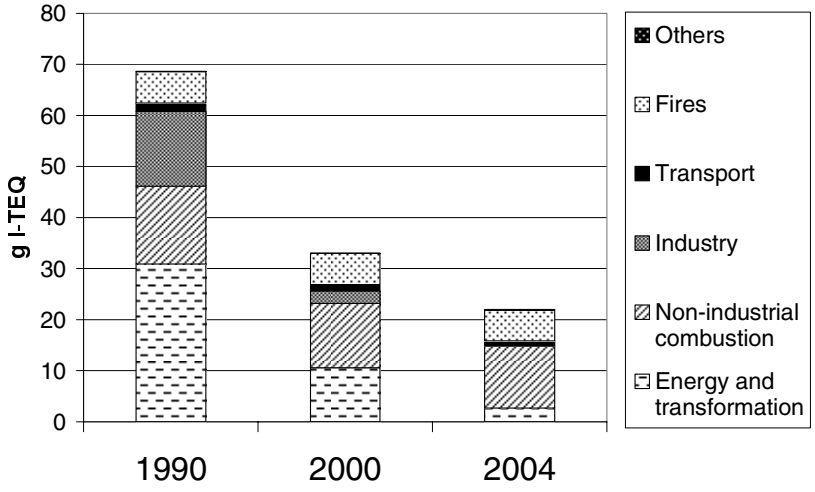



**Figure 4** Dioxin emission in 1990, 2000 and 2004, distributed according to sector. Total is 68.6 g I-TEQ for 1990, 33.0 g I-TEQ for 2000 and 22.0 g I-TEQ for 2004.

The comparison of the inventories in 1990, 2000 and 2004 in Figure 4 and Table 18 illustrates the large emission reduction in the energy and industrial sectors. More detailed information on emissions within the subcategories can be found in Appendices B, C, D and E.

**Table 18** Inventory for 1990, 2000 and 2004

| Emission (g I-TEQ) | 1990 | 2000 | 2004 |
|---|---|---|---|
| Energy and transformation | 30.91 | 10.60 | 2.63 |
| Coal, coke and other solid fuels | 0.31 | 0.20 | 0.23 |
| Fuel and gas oil, other liquid fuels | 0.01 | 0.13 | 0.02 |
| Natural gas and other gaseous fuels | 0.00 | 0.00 | 0.00 |
| Municipal Solid Waste | 30.50 | 10.12 | 2.10 |
| Wood and wood waste | 0.00 | 0.01 | 0.02 |
| Straw and other agricultural waste | 0.09 | 0.14 | 0.27 |
| Non-industrial combustion | 15.23 | 12.55 | 12.21 |
| Coal, coke and other solid fuels | 2.26 | 0.78 | 0.74 |
| Fuel and gas oil, other liquid fuels | 0.66 | 0.40 | 0.33 |
| Natural gas and other gaseous fuels | 0.06 | 0.09 | 0.10 |
| Municipal Solid Waste | 1.91 | 0.05 | 0.00 |
| Wood and wood waste | 6.44 | 8.85 | 8.82 |
| Straw and other agricultural waste | 3.90 | 2.39 | 2.23 |
| Industrial combustion and process | 14.67 | 2.46 | 0.17 |
| Coal, coke and other solid fuels | 0.02 | 0.03 | 0.01 |
| Fuel and gas oil, other liquid fuels | 0.02 | 0.03 | 0.01 |
| Natural gas and other gaseous fuels | 0.00 | 0.02 | 0.00 |
| Municipal Solid Waste | 0.06 | 0.09 | 0.00 |
| Wood and wood waste | 0.01 | 0.00 | 0.00 |
| Process emissions | 14.56 | 2.29 | 0.15 |
| - aluminium reclamation | 1.74 | 1.74 | 0.02 |
| - steel reclamation | 12.00 | 0.52 | NA |
| - cement production | 0.81 | 0.01 | 0.06 |
| - mineral wool | NE | NE | 0.06 |
| - lime, tiles, bricks production | 0.01 | 0.01 | 0.01 |
| Transport | 1.64 | 1.26 | 0.83 |
| Road transport | 0.87 | 0.34 | 0.22 |
| Rail, Navigation and Aviation | 0.77 | 0.92 | 0.61 |
| Fires | 6.10 | 6.10 | 6.10 |
| Others | 0.04 | 0.04 | 0.04 |
| Total | 68.6 | 33.0 | 22.0 |

## 7.2 Time-series and development in emission

**Table 19** Time-series for emissions 1990 – 2004

| | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0101 Public power | 2,40 | 6,67 | 8,18 | 9,25 | 9,64 | 10,91 | 12,17 | 11,56 | 8,67 | 7,80 | 10,21 | 9,48 | 6,66 | 8,06 | 2,23 |
| 0102 District heating plants | 28,52 | 21,30 | 15,61 | 10,40 | 8,97 | 7,93 | 6,32 | 5,68 | 4,51 | 1,39 | 0,39 | 0,60 | 0,69 | 0,54 | 0,40 |
| 0103 Petroleum refining plants | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 |
| 0105 Coal mining, oil / gas extraction, pipeline c | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 |
| 0201 Commercial and institutional plants (t) | 2,19 | 2,01 | 1,75 | 1,40 | 1,39 | 1,35 | 1,24 | 1,09 | 0,70 | 1,02 | 0,43 | 0,36 | 0,34 | 0,44 | 0,34 |
| 0202 Residential plants | 10,62 | 12,04 | 12,17 | 12,86 | 12,07 | 11,81 | 12,16 | 12,08 | 10,93 | 11,01 | 10,84 | 11,52 | 10,93 | 11,32 | 10,69 |
| 0203 Plants in agriculture, forestry and aquacultu | 2,42 | 2,49 | 2,24 | 2,11 | 1,93 | 1,77 | 1,59 | 1,60 | 1,49 | 1,32 | 1,28 | 1,26 | 1,14 | 1,23 | 1,18 |
| 0301 Comb. in boilers, gas turbines and stationary | 0,09 | 0,09 | 0,09 | 0,07 | 0,05 | 0,05 | 0,05 | 0,04 | 0,04 | 0,04 | 0,02 | 0,02 | 0,02 | 0,02 | 0,02 |
| 0303 Processes with contact | 2,56 | 2,81 | 2,93 | 2,94 | 2,95 | 2,98 | 2,73 | 2,52 | 2,20 | 1,82 | 1,90 | 0,21 | 0,38 | 0,30 | 0,14 |
| 0402 Processes in iron and steel industries and co | 12,00 | 11,10 | 10,20 | 9,30 | 8,40 | 7,50 | 6,10 | 4,70 | 3,31 | 1,92 | 0,52 | 0,52 | 0,52 | 0,00 | 0,00 |
| 0406 Processes in wood, paper pulp, food, drink | 0,01 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,01 | 0,00 | 0,00 | 0,00 | 0,01 |
| 0604 Other use of solvents and related activities | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 |
| 0701 Passenger cars (r) | 0,79 | 0,78 | 0,76 | 0,70 | 0,62 | 0,57 | 0,51 | 0,44 | 0,37 | 0,31 | 0,26 | 0,22 | 0,19 | 0,17 | 0,14 |
| 0702 Light duty vehicles < 3.5 t (r) | 0,04 | 0,04 | 0,04 | 0,04 | 0,04 | 0,04 | 0,04 | 0,03 | 0,03 | 0,03 | 0,03 | 0,03 | 0,02 | 0,02 | 0,02 |
| 0703 Heavy duty vehicles > 3.5 t and buses (r) | 0,04 | 0,04 | 0,04 | 0,03 | 0,04 | 0,04 | 0,04 | 0,04 | 0,04 | 0,04 | 0,04 | 0,04 | 0,04 | 0,04 | 0,04 |
| 0705 Motorcycles > 50 cm3 | 0,01 | 0,01 | 0,01 | 0,01 | 0,01 | 0,01 | 0,01 | 0,01 | 0,01 | 0,01 | 0,01 | 0,02 | 0,02 | 0,02 | 0,02 |
| 0801 Military | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 |
| 0802 Railways | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 |
| 0803 Inland waterways | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 |
| 0804 Maritime activities | 0,73 | 0,69 | 0,70 | 0,92 | 1,00 | 1,04 | 1,00 | 0,92 | 0,90 | 0,86 | 0,88 | 0,76 | 0,66 | 0,68 | 0,57 |
| 0805 Air traffic | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 |
| 0806 Agriculture | 0,02 | 0,01 | 0,01 | 0,01 | 0,01 | 0,01 | 0,01 | 0,01 | 0,01 | 0,01 | 0,01 | 0,01 | 0,01 | 0,01 | 0,01 |
| 0807 Forestry | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 |
| 0808 Industry | 0,01 | 0,01 | 0,01 | 0,01 | 0,01 | 0,01 | 0,01 | 0,01 | 0,01 | 0,01 | 0,01 | 0,01 | 0,01 | 0,01 | 0,01 |
| 0809 Household and gardening | 0,01 | 0,01 | 0,01 | 0,01 | 0,01 | 0,01 | 0,01 | 0,01 | 0,01 | 0,01 | 0,01 | 0,01 | 0,02 | 0,02 | 0,02 |
| 0902 Waste incineration | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 |
| 0910 Other waste treatment | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 |
| 0909 Cremation | 0,04 | 0,04 | 0,04 | 0,04 | 0,04 | 0,04 | 0,04 | 0,04 | 0,04 | 0,04 | 0,04 | 0,04 | 0,04 | 0,04 | 0,04 |
| Fires | 6,10 | 6,10 | 6,10 | 6,10 | 6,10 | 6,10 | 6,10 | 6,10 | 6,10 | 6,10 | 6,10 | 6,10 | 6,10 | 6,10 | 6,10 |
| **Total** | **68,6** | **66,2** | **60,9** | **56,2** | **53,3** | **52,2** | **50,1** | **46,9** | **39,4** | **33,7** | **33,0** | **31,2** | **27,8** | **29,0** | **22,0** |

Note: The numbers in the categories refer to the SNAP-categorisation, which is used in the NERI database for the emission inventories. The categories 01-04 are all stationary sources, while the categories 07 and 08 are related to mobile sources and, thus, most of the categories relate to transport.

Table 19 shows the reduction in dioxin emission during the period 1990-2004. Significant reductions are related to waste incineration and the steel reclamation industry. For waste incineration, it can also be seen that more waste incineration plants have shifted from production of heat only to production of power as well.

As for the rest of the inventory, the time-series have considerable uncertainty attached to the interpolations between the years. The interpolations are made where no measured data have been available, which has been the case for most of the years 1990-2000 for waste incineration, as discussed in Section 2.5. But also for years where the inventory relies on measurements, uncertainty is featured. With few measurements taken each year, the uncertainty can be high. For example, the slight increase in the total emission from 2002 to 2003 and the following rapid reduction from 2003 to 2004 can, to some extent, be related to very high emission estimates for two incineration plants in particular, "Måbjergværket" and "Frederikshavn", in 2003 and much lower measurements in 2004 after installation of dioxin abatement. For these plants, default emission factors for plants without abatement technology were used before 2003, since no site-specific measurements were available, and this may have lead to a minor underestimate.

As presented in previous paragraphs, the reduction within industrial sources has been considerable during the period. The almost linear slope in the reduction seen in Table 19 is to some extent a consequence of the interpolation made between measurements, which reflects a trend rather than a stepwise reduction from year to year.

Another interesting point in the inventory is the stable emission level from residential plants of which the most emission comes from wood combustion. The mechanisms ensuring this status quo are an increasing consumption of wood and a slightly decreasing emission factor, due to measurements that indicate the possibility of lower emission levels from wood stoves and boilers with modern combustion principles.

Overall, the emission of dioxin to air has reduced by nearly 68% from 1990 to 2004.

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# Appendix A – Calorific values and equations

**Table A1** Calorific values for fuels

| | Calorific value; normal moisture content (GJ/ton; for gas GJ/1000m$^3$) | Calorific value; dry (GJ/ton) | References |
|---|---|---|---|
| Coal | 25 | | DEA, 2004 |
| - Bituminous coal in Spanish study | 22.61-27.00 | | Fernandez-Martínez et al., 2004 |
| Natural gas | 39.94 | | DEA, 2004 |
| - Natural gas in German study | 36.1 | | Pfeiffer et al., 2000 |
| Residual oil | 41.0 | | DEA, 2004 |
| Orimulsion | 27.7 | | DEA, 2004 |
| Gas oil | 42.8 | | DEA, 2004 |
| MSW | 10.5 | | DEA, 2004 |
| Wood | 14.7 | 19.0 | Videncenter, 2000 |
| Wood pellets | 17.5 | | Videncenter, 2000 |
| Straw | 14.4 | 18.2 | Videncenter, 2000 |
| Charcoal | 29.7 | | Videncenter, 2000 |

## Relation between air volume and fuel quantity on coal-fired plants

$$Nm^3{}_{dryfluegas} / kg_{fuel} = \frac{130}{21 - \%O_2}$$

$$Nm^3{}_{wetfluegas} / kg_{fuel} = 0{,}54 + \frac{131}{21 - \%O_2}$$

where $\%O_2$ is measured in volume. (Danish EPA, 2001)

## Emission factor equation for natural gas

$$Emissionfactor_{g/GJ} = \frac{Emissionfactor_{mg/m^3} \times 0.237586 \times 21}{21 - \%O_2}$$

where the constant is calculated from the Danish natural gas quality in 2002 by Danish Gas Technology Centre. (Nielsen & Illerup, 2003)

### Emission factor equation for MSW

$$Emissionfactor_{g/GJ} = \frac{Emissionfactor_{mg/m^3} \times 0.249429 \times 21}{21 - \%O_2}$$

with a calorific value of 10.5 GJ/ton, a flue gas volume of 5500 $m^3$ at 11 $\%O_2$ per ton MSW. (Nielsen & Illerup, 2003)

### Emission factor equation for wood

$$Emissionfactor_{g/GJ} = \frac{Emissionfactor_{mg/m^3} \times 0.272379 \times 21}{21 - \%O_2}$$

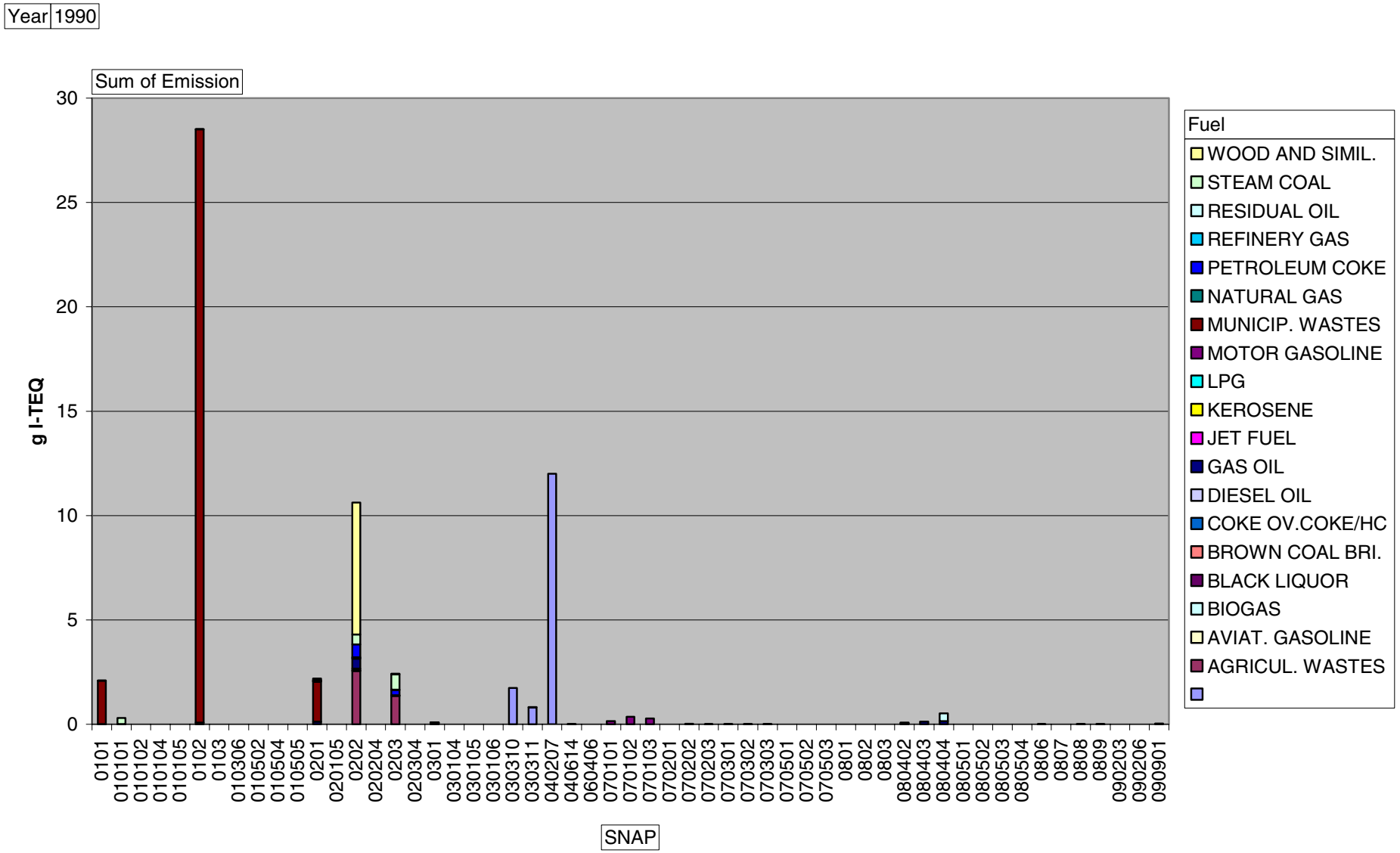
where moisture content in fuel is 45%. (Nielsen & Illerup, 2003)

### Emission factor equation for straw

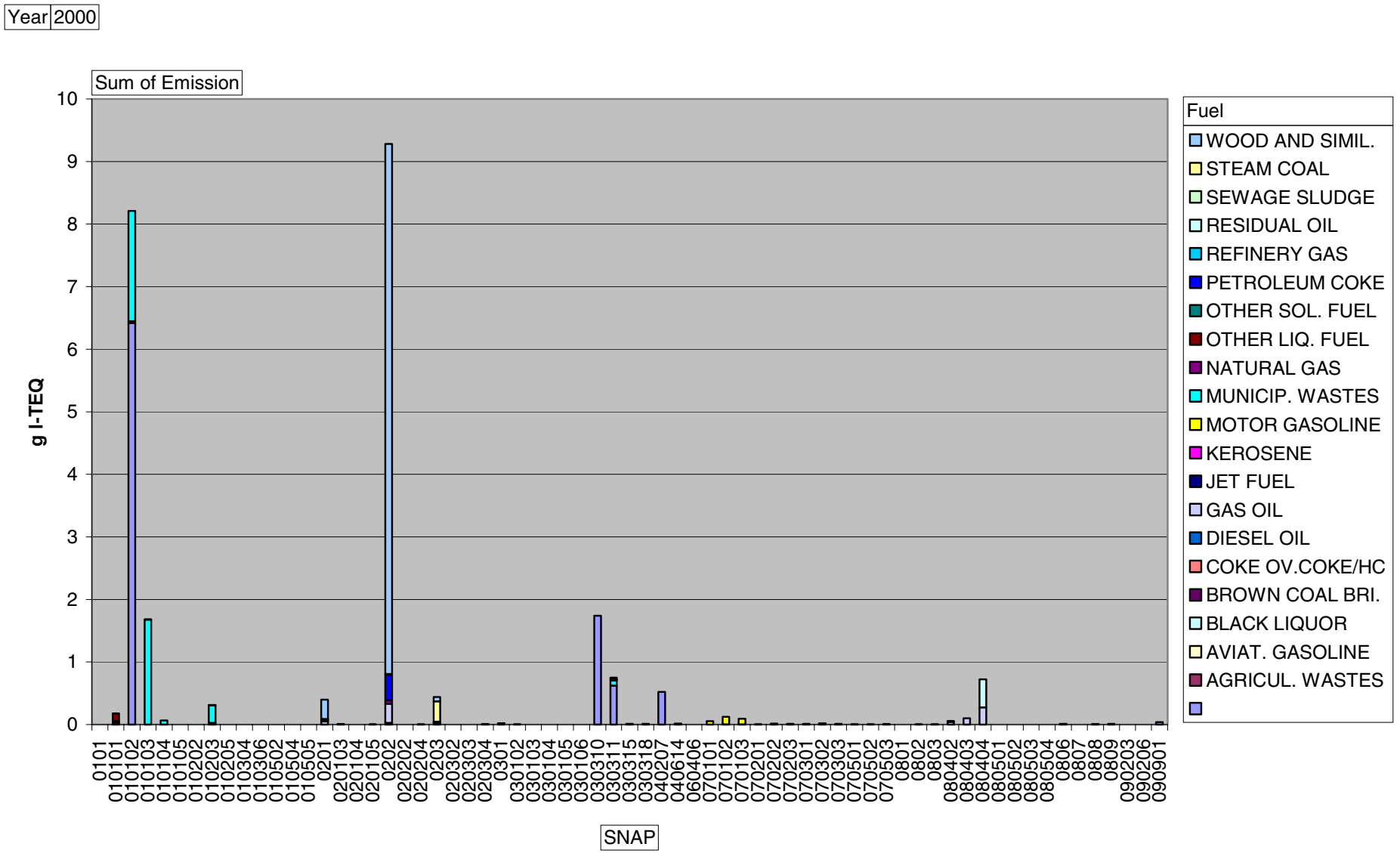
$$Emissionfactor_{g/GJ} = \frac{Emissionfactor_{mg/m^3} \times 0.259719 \times 21}{21 - \%O_2}$$

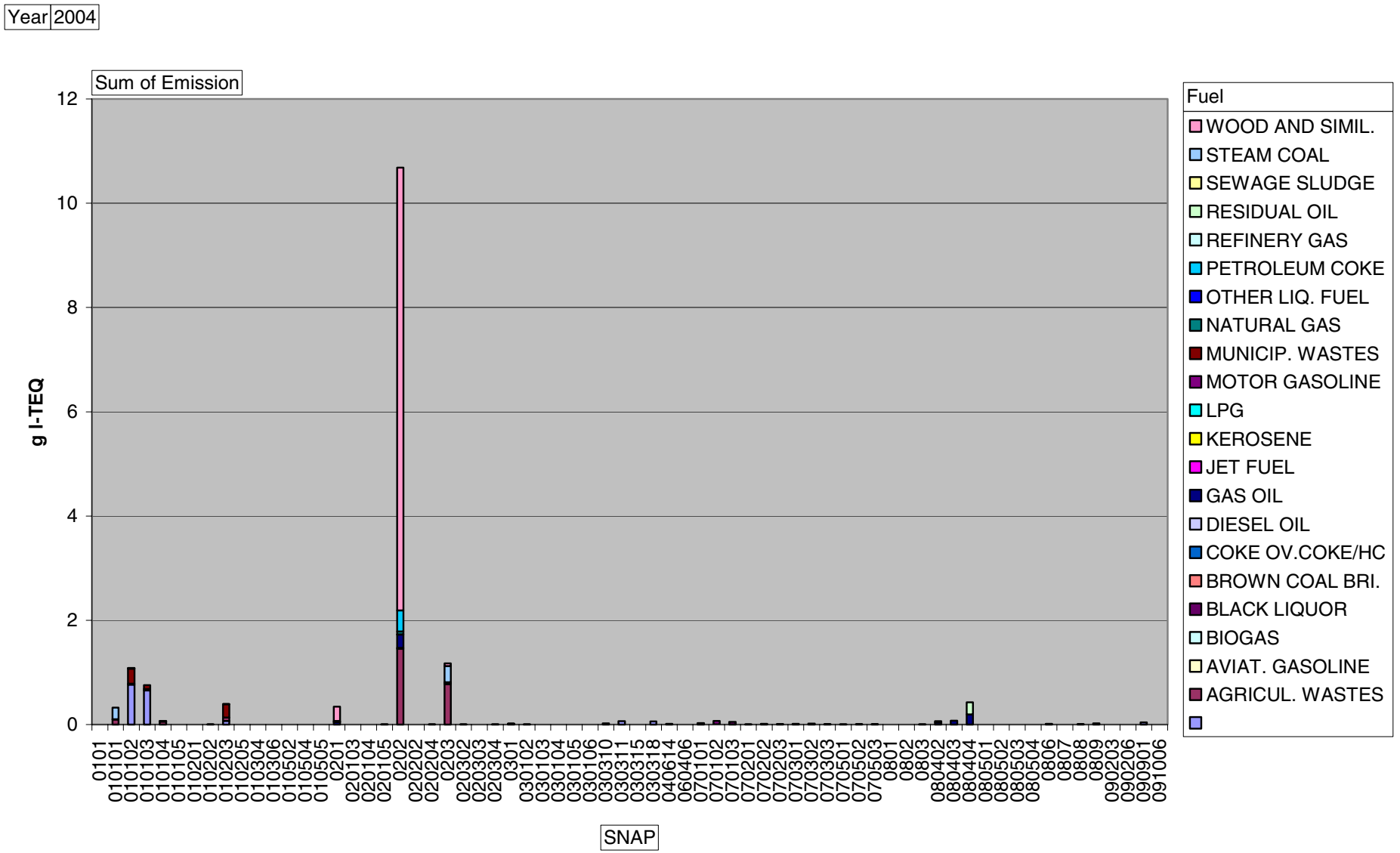
where moisture content in fuel is 15%. (Nielsen & Illerup, 2003)

# Appendix B – Charts over emission on fuel and SNAP category




Note: The categories above refer to SNAP-code categorisation. Brief definitions of the SNAP-codes can be found in appendix C, D and E.


Year 2000
Sum of Emission
g I-TEQ
10
9
8
7
6
5
4
3
2
1
0
0101
010101
010102
010103
010104
010105
010202
010203
010205
010304
010306
010502
010504
010505
0201
020103
020104
020105
0202
020202
020204
0203
020302
020303
020304
0301
030102
030103
030104
030105
030106
030310
030311
030315
030318
040207
040614
060406
070101
070102
070103
070201
070202
070203
070301
070302
070303
070501
070502
070503
0801
0802
0803
080402
080403
080404
080501
080502
080503
080504
0806
0807
0808
0809
090203
090206
090901
SNAP
Fuel
WOOD AND SIMIL.
STEAM COAL
SEWAGE SLUDGE
RESIDUAL OIL
REFINERY GAS
PETROLEUM COKE
OTHER SOL. FUEL
OTHER LIQ. FUEL
NATURAL GAS
MUNICIP. WASTES
MOTOR GASOLINE
KEROSENE
JET FUEL
GAS OIL
DIESEL OIL
COKE OV.COKE/HC
BROWN COAL BRI.
BLACK LIQUOR
AVIAT. GASOLINE
AGRICUL. WASTES


Year 2004
Sum of Emission
g I-TEQ
12
10
8
6
4
2
0
0101
010101
010102
010103
010104
010105
010201
010202
010203
010205
010304
010306
010502
010504
010505
0201
020103
020104
020105
0202
020204
020203
020302
020303
020304
0301
030102
030103
030104
030105
030106
030310
030311
030315
030318
040614
060406
070101
070102
070103
070201
070202
070203
070301
070302
070303
070501
070502
070503
0801
0802
0803
080402
080403
080404
080501
080502
080503
080504
0806
0807
0808
0809
090203
090206
090901
091006
SNAP
Fuel
WOOD AND SIMIL.
STEAM COAL
SEWAGE SLUDGE
RESIDUAL OIL
REFINERY GAS
PETROLEUM COKE
OTHER LIQ. FUEL
NATURAL GAS
MUNICIP. WASTES
MOTOR GASOLINE
LPG
KEROSENE
JET FUEL
GAS OIL
DIESEL OIL
COKE OV.COKE/HC
BROWN COAL BRI.
BLACK LIQUOR
BIOGAS
AVIAT. GASOLINE
AGRICUL. WASTES

# Appendix C – Total dioxin emission inventory for 1990. (g I-TEQ)

| snap_id | snap_gr_name | snapsg_name | snap_name | fuel_gr_abbr | SumOfEmission | uni_abbr |
|---|---|---|---|---|---|---|
| 0101 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | Public power | | COAL | 0.01125048 | g |
| 0101 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | Public power | | MUNICIP. WASTES | 2.07405000 | g |
| 0101 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | Public power | | STRAW | 0.01053800 | g |
| 0101 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | Public power | | RESIDUAL OIL | 0.00068340 | g |
| 0101 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | Public power | | GAS OIL | 0.00021095 | g |
| 0101 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | Public power | | BIOGAS | 0.00000353 | g |
| 010101 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | Public power | Combustion plants >= 300 MW (boilers) | COAL | 0.00000000 | g |
| 010101 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | Public power | Combustion plants >= 300 MW (boilers) | COAL | 0.29011087 | g |
| 010101 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | Public power | Combustion plants >= 300 MW (boilers) | RESIDUAL OIL | 0.00593619 | g |
| 010101 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | Public power | Combustion plants >= 300 MW (boilers) | NATURAL GAS | 0.00010013 | g |
| 010102 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | Public power | Combustion plants >= 50 and < 300 MW (boilers) | COAL | 0.00000000 | g |
| 010102 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | Public power | Combustion plants >= 50 and < 300 MW (boilers) | COAL | 0.00279702 | g |
| 010102 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | Public power | Combustion plants >= 50 and < 300 MW (boilers) | STRAW | 0.00000000 | g |
| 010102 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | Public power | Combustion plants >= 50 and < 300 MW (boilers) | RESIDUAL OIL | 0.00000000 | g |
| 010102 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | Public power | Combustion plants >= 50 and < 300 MW (boilers) | RESIDUAL OIL | 0.00003728 | g |
| 010102 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | Public power | Combustion plants >= 50 and < 300 MW (boilers) | GAS OIL | 0.00000000 | g |

| | | | | | | |
|---|---|---|---|---|---|---|
| 010102 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | Public power | Combustion plants >= 50 and < 300 MW (boilers) | NATURAL GAS | 0.00000000 | g |
| 010102 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | Public power | Combustion plants >= 50 and < 300 MW (boilers) | BIOGAS | 0.00000000 | g |
| 010104 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | Public power | Gas turbines | GAS OIL | 0.00003880 | g |
| 010104 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | Public power | Gas turbines | NATURAL GAS | 0.00004648 | g |
| 010105 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | Public power | Stationary engines | RESIDUAL OIL | 0.00000823 | g |
| 010105 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | Public power | Stationary engines | GAS OIL | 0.00001486 | g |
| 010105 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | Public power | Stationary engines | NATURAL GAS | 0.00001694 | g |
| 010105 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | Public power | Stationary engines | BIOGAS | 0.00000237 | g |
| 0102 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | District heating plants | | COAL | 0.00794244 | g |
| 0102 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | District heating plants | | WOOD AND SIMIL. | 0.00321700 | g |
| 0102 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | District heating plants | | MUNICIP. WASTES | 28.42286500 | g |
| 0102 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | District heating plants | | STRAW | 0.07752800 | g |
| 0102 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | District heating plants | | RESIDUAL OIL | 0.00176929 | g |
| 0102 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | District heating plants | | GAS OIL | 0.00171196 | g |
| 0102 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | District heating plants | | FISH & RAPE OIL | 0.00065621 | g |
| 0102 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | District heating plants | | NATURAL GAS | 0.00027583 | g |
| 0102 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | District heating plants | | LPG | 0.00000023 | g |
| 0102 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | District heating plants | | BIOGAS | 0.00000075 | g |

| | | | | | | |
|---|---|---|---|---|---|---|
| 0103 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | Petroleum refining plants | | REFINERY GAS | 0.00001145 | g |
| 010306 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | Petroleum refining plants | Process furnaces | RESIDUAL OIL | 0.00115472 | g |
| 010306 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | Petroleum refining plants | Process furnaces | REFINERY GAS | 0.00033800 | g |
| 010502 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | Coal mining, oil / gas extraction, pipeline c | Combustion plants >= 50 and < 300 MW (boilers) | NATURAL GAS | 0.00000000 | g |
| 010504 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | Coal mining, oil / gas extraction, pipeline c | Gas turbines | NATURAL GAS | 0.00023706 | g |
| 010505 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | Coal mining, oil / gas extraction, pipeline c | Stationary engines | NATURAL GAS | 0.00000004 | g |
| 010505 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | Coal mining, oil / gas extraction, pipeline c | Stationary engines | BIOGAS | 0.00000017 | g |
| 0201 | NON-INDUSTRIAL COMBUSTION PLANTS | Commercial and institutional plants (t) | | COAL | 0.02626170 | g |
| 0201 | NON-INDUSTRIAL COMBUSTION PLANTS | Commercial and institutional plants (t) | | BROWN COAL BRI. | 0.00030750 | g |
| 0201 | NON-INDUSTRIAL COMBUSTION PLANTS | Commercial and institutional plants (t) | | PETROLEUM COKE | 0.01860690 | g |
| 0201 | NON-INDUSTRIAL COMBUSTION PLANTS | Commercial and institutional plants (t) | | WOOD AND SIMIL. | 0.08179520 | g |
| 0201 | NON-INDUSTRIAL COMBUSTION PLANTS | Commercial and institutional plants (t) | | MUNICIP. WASTES | 1.91483000 | g |
| 0201 | NON-INDUSTRIAL COMBUSTION PLANTS | Commercial and institutional plants (t) | | RESIDUAL OIL | 0.01070494 | g |
| 0201 | NON-INDUSTRIAL COMBUSTION PLANTS | Commercial and institutional plants (t) | | GAS OIL | 0.11794783 | g |
| 0201 | NON-INDUSTRIAL COMBUSTION PLANTS | Commercial and institutional plants (t) | | KEROSENE | 0.00569083 | g |
| 0201 | NON-INDUSTRIAL COMBUSTION PLANTS | Commercial and institutional plants (t) | | NATURAL GAS | 0.01275259 | g |
| 0201 | NON-INDUSTRIAL COMBUSTION PLANTS | Commercial and institutional plants (t) | | LPG | 0.00016551 | g |
| 0201 | NON-INDUSTRIAL COMBUSTION PLANTS | Commercial and institutional plants (t) | | BIOGAS | 0.00039814 | g |

| | | | | | | |
|---|---|---|---|---|---|---|
| 020105 | NON-INDUSTRIAL COMBUSTION PLANTS | Commercial and institutional plants (t) | Stationary engines | NATURAL GAS | 0.00009197 | g |
| 020105 | NON-INDUSTRIAL COMBUSTION PLANTS | Commercial and institutional plants (t) | Stationary engines | BIOGAS | 0.00054096 | g |
| 0202 | NON-INDUSTRIAL COMBUSTION PLANTS | Residential plants | | COAL | 0.47124080 | g |
| 0202 | NON-INDUSTRIAL COMBUSTION PLANTS | Residential plants | | BROWN COAL BRI. | 0.04048000 | g |
| 0202 | NON-INDUSTRIAL COMBUSTION PLANTS | Residential plants | | COKE OV.COKE/HC | 0.08527520 | g |
| 0202 | NON-INDUSTRIAL COMBUSTION PLANTS | Residential plants | | PETROLEUM COKE | 0.60870160 | g |
| 0202 | NON-INDUSTRIAL COMBUSTION PLANTS | Residential plants | | WOOD AND SIMIL. | 6.32182899 | g |
| 0202 | NON-INDUSTRIAL COMBUSTION PLANTS | Residential plants | | STRAW | 2.54344500 | g |
| 0202 | NON-INDUSTRIAL COMBUSTION PLANTS | Residential plants | | RESIDUAL OIL | 0.00216927 | g |
| 0202 | NON-INDUSTRIAL COMBUSTION PLANTS | Residential plants | | GAS OIL | 0.46463224 | g |
| 0202 | NON-INDUSTRIAL COMBUSTION PLANTS | Residential plants | | KEROSENE | 0.04404777 | g |
| 0202 | NON-INDUSTRIAL COMBUSTION PLANTS | Residential plants | | NATURAL GAS | 0.03472426 | g |
| 0202 | NON-INDUSTRIAL COMBUSTION PLANTS | Residential plants | | LPG | 0.00133933 | g |
| 020204 | NON-INDUSTRIAL COMBUSTION PLANTS | Residential plants | Stationary engines | NATURAL GAS | 0.00000000 | g |
| 0203 | NON-INDUSTRIAL COMBUSTION PLANTS | Plants in agriculture, forestry and aquacultu | | COAL | 0.73736670 | g |
| 0203 | NON-INDUSTRIAL COMBUSTION PLANTS | Plants in agriculture, forestry and aquacultu | | BROWN COAL BRI. | 0.01797960 | g |
| 0203 | NON-INDUSTRIAL COMBUSTION PLANTS | Plants in agriculture, forestry and aquacultu | | PETROLEUM COKE | 0.25113720 | g |
| 0203 | NON-INDUSTRIAL COMBUSTION PLANTS | Plants in agriculture, forestry and aquacultu | | WOOD AND SIMIL. | 0.03486000 | g |

| | | | | | | |
|---|---|---|---|---|---|---|
| 0203 | NON-INDUSTRIAL COMBUSTION PLANTS | Plants in agriculture, forestry and aquacultu | | STRAW | 1.35650400 | g |
| 0203 | NON-INDUSTRIAL COMBUSTION PLANTS | Plants in agriculture, forestry and aquacultu | | RESIDUAL OIL | 0.01223716 | g |
| 0203 | NON-INDUSTRIAL COMBUSTION PLANTS | Plants in agriculture, forestry and aquacultu | | GAS OIL | 0.00406220 | g |
| 0203 | NON-INDUSTRIAL COMBUSTION PLANTS | Plants in agriculture, forestry and aquacultu | | KEROSENE | 0.00042526 | g |
| 0203 | NON-INDUSTRIAL COMBUSTION PLANTS | Plants in agriculture, forestry and aquacultu | | NATURAL GAS | 0.00444400 | g |
| 0203 | NON-INDUSTRIAL COMBUSTION PLANTS | Plants in agriculture, forestry and aquacultu | | LPG | 0.00051709 | g |
| 020304 | NON-INDUSTRIAL COMBUSTION PLANTS | Plants in agriculture, forestry and aquacultu | Stationary engines | NATURAL GAS | 0.00020845 | g |
| 020304 | NON-INDUSTRIAL COMBUSTION PLANTS | Plants in agriculture, forestry and aquacultu | Stationary engines | BIOGAS | 0.00001929 | g |
| 0301 | COMBUSTION IN MANUFACTURING INDUSTRY | Comb. in boilers, gas turbines and stationary | | COAL | 0.01168240 | g |
| 0301 | COMBUSTION IN MANUFACTURING INDUSTRY | Comb. in boilers, gas turbines and stationary | | BROWN COAL BRI. | 0.00000577 | g |
| 0301 | COMBUSTION IN MANUFACTURING INDUSTRY | Comb. in boilers, gas turbines and stationary | | COKE OV.COKE/HC | 0.00154350 | g |
| 0301 | COMBUSTION IN MANUFACTURING INDUSTRY | Comb. in boilers, gas turbines and stationary | | PETROLEUM COKE | 0.00039633 | g |
| 0301 | COMBUSTION IN MANUFACTURING INDUSTRY | Comb. in boilers, gas turbines and stationary | | WOOD AND SIMIL. | 0.00578374 | g |
| 0301 | COMBUSTION IN MANUFACTURING INDUSTRY | Comb. in boilers, gas turbines and stationary | | MUNICIP. WASTES | 0.05872914 | g |
| 0301 | COMBUSTION IN MANUFACTURING INDUSTRY | Comb. in boilers, gas turbines and stationary | | RESIDUAL OIL | 0.01457821 | g |
| 0301 | COMBUSTION IN MANUFACTURING INDUSTRY | Comb. in boilers, gas turbines and stationary | | GAS OIL | 0.00047446 | g |
| 0301 | COMBUSTION IN MANUFACTURING INDUSTRY | Comb. in boilers, gas turbines and stationary | | KEROSENE | 0.00006142 | g |
| 0301 | COMBUSTION IN MANUFACTURING INDUSTRY | Comb. in boilers, gas turbines and stationary | | NATURAL GAS | 0.00055255 | g |

| | | | | | | |
|---|---|---|---|---|---|---|
| 0301 | COMBUSTION IN MANUFACTURING INDUSTRY | Comb. in boilers, gas turbines and stationary | | LPG | 0.00003940 | g |
| 0301 | COMBUSTION IN MANUFACTURING INDUSTRY | Comb. in boilers, gas turbines and stationary | | REFINERY GAS | 0.00000477 | g |
| 0301 | COMBUSTION IN MANUFACTURING INDUSTRY | Comb. in boilers, gas turbines and stationary | | BIOGAS | 0.00000000 | g |
| 030104 | COMBUSTION IN MANUFACTURING INDUSTRY | Comb. in boilers, gas turbines and stationary | Gas turbines | NATURAL GAS | 0.00000000 | g |
| 030104 | COMBUSTION IN MANUFACTURING INDUSTRY | Comb. in boilers, gas turbines and stationary | Gas turbines | NATURAL GAS | 0.00001266 | g |
| 030105 | COMBUSTION IN MANUFACTURING INDUSTRY | Comb. in boilers, gas turbines and stationary | Stationary engines | NATURAL GAS | 0.00000000 | g |
| 030106 | COMBUSTION IN MANUFACTURING INDUSTRY | Comb. in boilers, gas turbines and stationary | Other stationary equipment (n) | GAS OIL | 0.00000538 | g |
| 030106 | COMBUSTION IN MANUFACTURING INDUSTRY | Comb. in boilers, gas turbines and stationary | Other stationary equipment (n) | NATURAL GAS | 0.00000340 | g |
| 030310 | COMBUSTION IN MANUFACTURING INDUSTRY | Processes with contact | Secondary aluminium production | | 1.74000000 | g |
| 030311 | COMBUSTION IN MANUFACTURING INDUSTRY | Processes with contact | Cement (f) | | 0.80998800 | g |
| 030311 | COMBUSTION IN MANUFACTURING INDUSTRY | Processes with contact | Cement (f) | COAL | 0.00662491 | g |
| 030311 | COMBUSTION IN MANUFACTURING INDUSTRY | Processes with contact | Cement (f) | PETROLEUM COKE | 0.00329901 | g |
| 030311 | COMBUSTION IN MANUFACTURING INDUSTRY | Processes with contact | Cement (f) | RESIDUAL OIL | 0.00155484 | g |
| 040207 | PRODUCTION PROCESSES | Processes in iron and steel industries and co | Electric furnace steel plant | | 12.00000000 | g |
| 040614 | PRODUCTION PROCESSES | Processes in wood, paper pulp, food, drink an | Lime (decarbonizing) | | 0.01399500 | g |
| 060406 | SOLVENT AND OTHER PRODUCT USE | Other use of solvents and related activities | Preservation of wood | | 0.00000000 | g |
| 070101 | ROAD TRANSPORT | Passenger cars (r) | Highway driving | DIESEL OIL | 0.00071982 | g |
| 070101 | ROAD TRANSPORT | Passenger cars (r) | Highway driving | MOTOR GASOLINE | 0.14699805 | g |

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| 070102 | ROAD TRANSPORT | Passenger cars (r) | Rural driving | DIESEL OIL | 0.00174271 | g |
| 070102 | ROAD TRANSPORT | Passenger cars (r) | Rural driving | MOTOR GASOLINE | 0.35598552 | g |
| 070103 | ROAD TRANSPORT | Passenger cars (r) | Urban driving | DIESEL OIL | 0.00135986 | g |
| 070103 | ROAD TRANSPORT | Passenger cars (r) | Urban driving | MOTOR GASOLINE | 0.27986118 | g |
| 070201 | ROAD TRANSPORT | Light duty vehicles < 3.5 t (r) | Highway driving | DIESEL OIL | 0.00142334 | g |
| 070201 | ROAD TRANSPORT | Light duty vehicles < 3.5 t (r) | Highway driving | MOTOR GASOLINE | 0.00406364 | g |
| 070202 | ROAD TRANSPORT | Light duty vehicles < 3.5 t (r) | Rural driving | DIESEL OIL | 0.00474447 | g |
| 070202 | ROAD TRANSPORT | Light duty vehicles < 3.5 t (r) | Rural driving | MOTOR GASOLINE | 0.01354546 | g |
| 070203 | ROAD TRANSPORT | Light duty vehicles < 3.5 t (r) | Urban driving | DIESEL OIL | 0.00339542 | g |
| 070203 | ROAD TRANSPORT | Light duty vehicles < 3.5 t (r) | Urban driving | MOTOR GASOLINE | 0.00977239 | g |
| 070301 | ROAD TRANSPORT | Heavy duty vehicles > 3.5 t and buses (r) | Highway driving | DIESEL OIL | 0.00934510 | g |
| 070302 | ROAD TRANSPORT | Heavy duty vehicles > 3.5 t and buses (r) | Rural driving | DIESEL OIL | 0.01597713 | g |
| 070303 | ROAD TRANSPORT | Heavy duty vehicles > 3.5 t and buses (r) | Urban driving | DIESEL OIL | 0.00998499 | g |
| 070501 | ROAD TRANSPORT | Motorcycles > 50 cm3 | Highway driving | MOTOR GASOLINE | 0.00113459 | g |
| 070502 | ROAD TRANSPORT | Motorcycles > 50 cm3 | Rural driving | MOTOR GASOLINE | 0.00316064 | g |
| 070503 | ROAD TRANSPORT | Motorcycles > 50 cm3 | Urban driving | MOTOR GASOLINE | 0.00380897 | g |
| 0801 | OTHER MOBILE SOURCES AND MACHINERY | Military | | DIESEL OIL | 0.00010358 | g |
| 0801 | OTHER MOBILE SOURCES AND MACHINERY | Military | | JET FUEL | 0.00000000 | g |

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|---|---|---|---|---|---|---|
| 0801 | OTHER MOBILE SOURCES AND MACHINERY | Military | | MOTOR GASOLINE | 0.00000618 | g |
| 0801 | OTHER MOBILE SOURCES AND MACHINERY | Military | | AVIAT. GASOLINE | 0.00002510 | g |
| 0802 | OTHER MOBILE SOURCES AND MACHINERY | Railways | | DIESEL OIL | 0.00279118 | g |
| 0802 | OTHER MOBILE SOURCES AND MACHINERY | Railways | | MOTOR GASOLINE | 0.00000000 | g |
| 0803 | OTHER MOBILE SOURCES AND MACHINERY | Inland waterways | | DIESEL OIL | 0.00038151 | g |
| 0803 | OTHER MOBILE SOURCES AND MACHINERY | Inland waterways | | MOTOR GASOLINE | 0.00221174 | g |
| 080402 | OTHER MOBILE SOURCES AND MACHINERY | Maritime activities | National sea traffic within EMEP area | RESIDUAL OIL | 0.04777259 | g |
| 080402 | OTHER MOBILE SOURCES AND MACHINERY | Maritime activities | National sea traffic within EMEP area | GAS OIL | 0.03341648 | g |
| 080403 | OTHER MOBILE SOURCES AND MACHINERY | Maritime activities | National fishing | RESIDUAL OIL | 0.00383042 | g |
| 080403 | OTHER MOBILE SOURCES AND MACHINERY | Maritime activities | National fishing | GAS OIL | 0.12071422 | g |
| 080403 | OTHER MOBILE SOURCES AND MACHINERY | Maritime activities | National fishing | MOTOR GASOLINE | 0.00000000 | g |
| 080404 | OTHER MOBILE SOURCES AND MACHINERY | Maritime activities | International sea traffic (international bunkers)(h) | RESIDUAL OIL | 0.38305199 | g |
| 080404 | OTHER MOBILE SOURCES AND MACHINERY | Maritime activities | International sea traffic (international bunkers)(h) | GAS OIL | 0.13970841 | g |
| 080501 | OTHER MOBILE SOURCES AND MACHINERY | Air traffic | Domestic airport traffic (LTO cycles - <1000 m) | JET FUEL | 0.00000000 | g |
| 080501 | OTHER MOBILE SOURCES AND MACHINERY | Air traffic | Domestic airport traffic (LTO cycles - <1000 m) | JET FUEL | 0.00000000 | g |
| 080501 | OTHER MOBILE SOURCES AND MACHINERY | Air traffic | Domestic airport traffic (LTO cycles - <1000 m) | AVIAT. GASOLINE | 0.00053605 | g |
| 080501 | OTHER MOBILE SOURCES AND MACHINERY | Air traffic | Domestic airport traffic (LTO cycles - <1000 m) | AVIAT. GASOLINE | 0.00004414 | g |
| 080502 | OTHER MOBILE SOURCES AND MACHINERY | Air traffic | International airport traffic (LTO cycles - <1000 m) | JET FUEL | 0.00000000 | g |

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| 080502 | OTHER MOBILE SOURCES AND MA-CHINERY | Air traffic | International airport traffic (LTO cycles - <1000 m) | JET FUEL | 0.00000000 | g |
| 080502 | OTHER MOBILE SOURCES AND MA-CHINERY | Air traffic | International airport traffic (LTO cycles - <1000 m) | AVIAT. GASOLINE | 0.00015660 | g |
| 080502 | OTHER MOBILE SOURCES AND MA-CHINERY | Air traffic | International airport traffic (LTO cycles - <1000 m) | AVIAT. GASOLINE | 0.00002867 | g |
| 080503 | OTHER MOBILE SOURCES AND MA-CHINERY | Air traffic | Domestic cruise traffic (>1000 m) | JET FUEL | 0.00000000 | g |
| 080503 | OTHER MOBILE SOURCES AND MA-CHINERY | Air traffic | Domestic cruise traffic (>1000 m) | JET FUEL | 0.00000000 | g |
| 080504 | OTHER MOBILE SOURCES AND MA-CHINERY | Air traffic | International cruise traffic (>1000 m)(i) | JET FUEL | 0.00000000 | g |
| 080504 | OTHER MOBILE SOURCES AND MA-CHINERY | Air traffic | International cruise traffic (>1000 m)(i) | JET FUEL | 0.00000000 | g |
| 0806 | OTHER MOBILE SOURCES AND MA-CHINERY | Agriculture | | DIESEL OIL | 0.01169068 | g |
| 0806 | OTHER MOBILE SOURCES AND MA-CHINERY | Agriculture | | MOTOR GASOLINE | 0.00362071 | g |
| 0807 | OTHER MOBILE SOURCES AND MA-CHINERY | Forestry | | DIESEL OIL | 0.00010300 | g |
| 0807 | OTHER MOBILE SOURCES AND MA-CHINERY | Forestry | | MOTOR GASOLINE | 0.00174394 | g |
| 0808 | OTHER MOBILE SOURCES AND MA-CHINERY | Industry | | DIESEL OIL | 0.00719912 | g |
| 0808 | OTHER MOBILE SOURCES AND MA-CHINERY | Industry | | MOTOR GASOLINE | 0.00089502 | g |
| 0809 | OTHER MOBILE SOURCES AND MA-CHINERY | Household and gardening | | MOTOR GASOLINE | 0.00962202 | g |
| 090203 | WASTE TREATMENT AND DISPOSAL | Waste incineration | Flaring in oil refinery | REFINERY GAS | 0.00001029 | g |
| 090206 | WASTE TREATMENT AND DISPOSAL | Waste incineration | Flaring in gas and oil extraction | NATURAL GAS | 0.00010545 | g |
| 090901 | WASTE TREATMENT AND DISPOSAL | Cremation | Incineration of corpses | | 0.03800000 | g |

# Appendix D – Total dioxin emission inventory for 2000. (g I-TEQ)

| snap_id | snap_gr_name | snapsg_name | snap_name | fuel_gr_abbr | SumOfEmission | uni_abbr |
|---|---|---|---|---|---|---|
| 0101 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | Public power | | RESIDUAL OIL | 0.00000000 | g |
| 0101 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | Public power | | GAS OIL | 0.00000000 | g |
| 0101 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | Public power | | NATURAL GAS | 0.00000036 | g |
| 010101 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | Public power | Combustion plants >= 300 MW (boilers) | COAL | 0.00000000 | g |
| 010101 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | Public power | Combustion plants >= 300 MW (boilers) | COAL | 0.19392307 | g |
| 010101 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | Public power | Combustion plants >= 300 MW (boilers) | MUNICIP. WASTES | 0.02461722 | g |
| 010101 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | Public power | Combustion plants >= 300 MW (boilers) | STRAW | 0.02463120 | g |
| 010101 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | Public power | Combustion plants >= 300 MW (boilers) | RESIDUAL OIL | 0.00000000 | g |
| 010101 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | Public power | Combustion plants >= 300 MW (boilers) | RESIDUAL OIL | 0.00346480 | g |
| 010101 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | Public power | Combustion plants >= 300 MW (boilers) | GAS OIL | 0.00000000 | g |
| 010101 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | Public power | Combustion plants >= 300 MW (boilers) | GAS OIL | 0.00011960 | g |
| 010101 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | Public power | Combustion plants >= 300 MW (boilers) | ORIMULSION | 0.12293345 | g |
| 010101 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | Public power | Combustion plants >= 300 MW (boilers) | NATURAL GAS | 0.00058854 | g |
| 010102 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | Public power | Combustion plants >= 50 and < 300 MW (boilers) | | 6.46647000 | g |
| 010102 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | Public power | Combustion plants >= 50 and < 300 MW (boilers) | COAL | 0.00000000 | g |
| 010102 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | Public power | Combustion plants >= 50 and < 300 MW (boilers) | COAL | 0.00821680 | g |

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| 010102 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | Public power | Combustion plants >= 50 and < 300 MW (boilers) | WOOD AND SIMIL. | 0.00155411 | g |
| 010102 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | Public power | Combustion plants >= 50 and < 300 MW (boilers) | WOOD AND SIMIL. | 0.00072071 | g |
| 010102 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | Public power | Combustion plants >= 50 and < 300 MW (boilers) | MUNICIP. WASTES | 0.00000000 | g |
| 010102 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | Public power | Combustion plants >= 50 and < 300 MW (boilers) | MUNICIP. WASTES | 1.57040390 | g |
| 010102 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | Public power | Combustion plants >= 50 and < 300 MW (boilers) | STRAW | 0.00000000 | g |
| 010102 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | Public power | Combustion plants >= 50 and < 300 MW (boilers) | STRAW | 0.02920920 | g |
| 010102 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | Public power | Combustion plants >= 50 and < 300 MW (boilers) | RESIDUAL OIL | 0.00000000 | g |
| 010102 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | Public power | Combustion plants >= 50 and < 300 MW (boilers) | RESIDUAL OIL | 0.00021580 | g |
| 010102 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | Public power | Combustion plants >= 50 and < 300 MW (boilers) | GAS OIL | 0.00000000 | g |
| 010102 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | Public power | Combustion plants >= 50 and < 300 MW (boilers) | GAS OIL | 0.00019092 | g |
| 010102 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | Public power | Combustion plants >= 50 and < 300 MW (boilers) | NATURAL GAS | 0.00000333 | g |
| 010102 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | Public power | Combustion plants >= 50 and < 300 MW (boilers) | NATURAL GAS | 0.00003621 | g |
| 010102 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | Public power | Combustion plants >= 50 and < 300 MW (boilers) | BIOGAS | 0.00000063 | g |
| 010103 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | Public power | Combustion plants < 50 MW (boilers) | | 0.00013000 | g |
| 010103 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | Public power | Combustion plants < 50 MW (boilers) | COAL | 0.00004683 | g |
| 010103 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | Public power | Combustion plants < 50 MW (boilers) | WOOD AND SIMIL. | 0.00066982 | g |
| 010103 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | Public power | Combustion plants < 50 MW (boilers) | MUNICIP. WASTES | 0.00000000 | g |
| 010103 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | Public power | Combustion plants < 50 MW (boilers) | MUNICIP. WASTES | 1.67882041 | g |

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| 010103 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | Public power | Combustion plants < 50 MW (boilers) | STRAW | 0.01408748 | g |
| 010103 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | Public power | Combustion plants < 50 MW (boilers) | RESIDUAL OIL | 0.00009578 | g |
| 010103 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | Public power | Combustion plants < 50 MW (boilers) | GAS OIL | 0.00000000 | g |
| 010103 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | Public power | Combustion plants < 50 MW (boilers) | NATURAL GAS | 0.00001610 | g |
| 010103 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | Public power | Combustion plants < 50 MW (boilers) | NATURAL GAS | 0.00000100 | g |
| 010103 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | Public power | Combustion plants < 50 MW (boilers) | BIOGAS | 0.00000337 | g |
| 010104 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | Public power | Gas turbines | MUNICIP. WASTES | 0.00000000 | g |
| 010104 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | Public power | Gas turbines | MUNICIP. WASTES | 0.06546508 | g |
| 010104 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | Public power | Gas turbines | RESIDUAL OIL | 0.00010348 | g |
| 010104 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | Public power | Gas turbines | GAS OIL | 0.00002535 | g |
| 010104 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | Public power | Gas turbines | GAS OIL | 0.00006566 | g |
| 010104 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | Public power | Gas turbines | NATURAL GAS | 0.00007623 | g |
| 010104 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | Public power | Gas turbines | NATURAL GAS | 0.00049811 | g |
| 010105 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | Public power | Stationary engines | WOOD AND SIMIL. | 0.00005347 | g |
| 010105 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | Public power | Stationary engines | MUNICIP. WASTES | 0.00000000 | g |
| 010105 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | Public power | Stationary engines | RESIDUAL OIL | 0.00001518 | g |
| 010105 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | Public power | Stationary engines | GAS OIL | 0.00005995 | g |
| 010105 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | Public power | Stationary engines | GAS OIL | 0.00000067 | g |

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| 010105 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | Public power | Stationary engines | NATURAL GAS | 0.00064100 | g |
| 010105 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | Public power | Stationary engines | BIOGAS | 0.00003872 | g |
| 010202 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | District heating plants | Combustion plants >= 50 and < 300 MW (boilers) | COAL | 0.00000049 | g |
| 010202 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | District heating plants | Combustion plants >= 50 and < 300 MW (boilers) | WOOD AND SIMIL. | 0.00017994 | g |
| 010202 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | District heating plants | Combustion plants >= 50 and < 300 MW (boilers) | STRAW | 0.00331122 | g |
| 010202 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | District heating plants | Combustion plants >= 50 and < 300 MW (boilers) | RESIDUAL OIL | 0.00005180 | g |
| 010202 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | District heating plants | Combustion plants >= 50 and < 300 MW (boilers) | GAS OIL | 0.00061231 | g |
| 010202 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | District heating plants | Combustion plants >= 50 and < 300 MW (boilers) | NATURAL GAS | 0.00000544 | g |
| 010203 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | District heating plants | Combustion plants < 50 MW (boilers) | | 0.02736000 | g |
| 010203 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | District heating plants | Combustion plants < 50 MW (boilers) | COAL | 0.00000469 | g |
| 010203 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | District heating plants | Combustion plants < 50 MW (boilers) | WOOD AND SIMIL. | 0.00384538 | g |
| 010203 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | District heating plants | Combustion plants < 50 MW (boilers) | WOOD AND SIMIL. | 0.00003684 | g |
| 010203 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | District heating plants | Combustion plants < 50 MW (boilers) | MUNICIP. WASTES | 0.00000000 | g |
| 010203 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | District heating plants | Combustion plants < 50 MW (boilers) | MUNICIP. WASTES | 0.28370282 | g |
| 010203 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | District heating plants | Combustion plants < 50 MW (boilers) | STRAW | 0.07239399 | g |
| 010203 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | District heating plants | Combustion plants < 50 MW (boilers) | RESIDUAL OIL | 0.00054463 | g |
| 010203 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | District heating plants | Combustion plants < 50 MW (boilers) | RESIDUAL OIL | 0.00000688 | g |
| 010203 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | District heating plants | Combustion plants < 50 MW (boilers) | GAS OIL | 0.00020561 | g |

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| 010203 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | District heating plants | Combustion plants < 50 MW (boilers) | FISH & RAPE OIL | 0.00004313 | g |
| 010203 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | District heating plants | Combustion plants < 50 MW (boilers) | NATURAL GAS | 0.00003568 | g |
| 010203 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | District heating plants | Combustion plants < 50 MW (boilers) | LPG | 0.00000001 | g |
| 010203 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | District heating plants | Combustion plants < 50 MW (boilers) | BIOGAS | 0.00000054 | g |
| 010205 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | District heating plants | Stationary engines | GAS OIL | 0.00000000 | g |
| 010205 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | District heating plants | Stationary engines | NATURAL GAS | 0.00000509 | g |
| 010304 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | Petroleum refining plants | Gas turbines | REFINERY GAS | 0.00003768 | g |
| 010306 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | Petroleum refining plants | Process furnaces | RESIDUAL OIL | 0.00000000 | g |
| 010306 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | Petroleum refining plants | Process furnaces | RESIDUAL OIL | 0.00116688 | g |
| 010306 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | Petroleum refining plants | Process furnaces | REFINERY GAS | 0.00017099 | g |
| 010502 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | Coal mining, oil / gas extraction, pipeline c | Combustion plants >= 50 and < 300 MW (boilers) | NATURAL GAS | 0.00000000 | g |
| 010502 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | Coal mining, oil / gas extraction, pipeline c | Combustion plants >= 50 and < 300 MW (boilers) | NATURAL GAS | 0.00000851 | g |
| 010504 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | Coal mining, oil / gas extraction, pipeline c | Gas turbines | NATURAL GAS | 0.00062539 | g |
| 010505 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | Coal mining, oil / gas extraction, pipeline c | Stationary engines | NATURAL GAS | 0.00000035 | g |
| 010505 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | Coal mining, oil / gas extraction, pipeline c | Stationary engines | BIOGAS | 0.00000081 | g |
| 0201 | NON-INDUSTRIAL COMBUSTION PLANTS | Commercial and institutional plants (t) | | PETROLEUM COKE | 0.00362100 | g |
| 0201 | NON-INDUSTRIAL COMBUSTION PLANTS | Commercial and institutional plants (t) | | WOOD AND SIMIL. | 0.31037040 | g |
| 0201 | NON-INDUSTRIAL COMBUSTION PLANTS | Commercial and institutional plants (t) | | MUNICIP. WASTES | 0.04165656 | g |

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| 0201 | NON-INDUSTRIAL COMBUSTION PLANTS | Commercial and institutional plants (t) | | RESIDUAL OIL | 0.00343022 | g |
| 0201 | NON-INDUSTRIAL COMBUSTION PLANTS | Commercial and institutional plants (t) | | GAS OIL | 0.04957566 | g |
| 0201 | NON-INDUSTRIAL COMBUSTION PLANTS | Commercial and institutional plants (t) | | KEROSENE | 0.00063008 | g |
| 0201 | NON-INDUSTRIAL COMBUSTION PLANTS | Commercial and institutional plants (t) | | NATURAL GAS | 0.01446785 | g |
| 0201 | NON-INDUSTRIAL COMBUSTION PLANTS | Commercial and institutional plants (t) | | LPG | 0.00024324 | g |
| 0201 | NON-INDUSTRIAL COMBUSTION PLANTS | Commercial and institutional plants (t) | | BIOGAS | 0.00062181 | g |
| 020103 | NON-INDUSTRIAL COMBUSTION PLANTS | Commercial and institutional plants (t) | Combustion plants < 50 MW (boilers) | MUNICIP. WASTES | 0.00000000 | g |
| 020103 | NON-INDUSTRIAL COMBUSTION PLANTS | Commercial and institutional plants (t) | Combustion plants < 50 MW (boilers) | MUNICIP. WASTES | 0.00479196 | g |
| 020103 | NON-INDUSTRIAL COMBUSTION PLANTS | Commercial and institutional plants (t) | Combustion plants < 50 MW (boilers) | GAS OIL | 0.00000000 | g |
| 020103 | NON-INDUSTRIAL COMBUSTION PLANTS | Commercial and institutional plants (t) | Combustion plants < 50 MW (boilers) | GAS OIL | 0.00071306 | g |
| 020103 | NON-INDUSTRIAL COMBUSTION PLANTS | Commercial and institutional plants (t) | Combustion plants < 50 MW (boilers) | NATURAL GAS | 0.00008642 | g |
| 020103 | NON-INDUSTRIAL COMBUSTION PLANTS | Commercial and institutional plants (t) | Combustion plants < 50 MW (boilers) | BIOGAS | 0.00000000 | g |
| 020104 | NON-INDUSTRIAL COMBUSTION PLANTS | Commercial and institutional plants (t) | Stationary gas turbines | NATURAL GAS | 0.00004667 | g |
| 020105 | NON-INDUSTRIAL COMBUSTION PLANTS | Commercial and institutional plants (t) | Stationary engines | GAS OIL | 0.00001277 | g |
| 020105 | NON-INDUSTRIAL COMBUSTION PLANTS | Commercial and institutional plants (t) | Stationary engines | NATURAL GAS | 0.00206626 | g |
| 020105 | NON-INDUSTRIAL COMBUSTION PLANTS | Commercial and institutional plants (t) | Stationary engines | BIOGAS | 0.00101302 | g |
| 0202 | NON-INDUSTRIAL COMBUSTION PLANTS | Residential plants | | COAL | 0.01155360 | g |
| 0202 | NON-INDUSTRIAL COMBUSTION PLANTS | Residential plants | | BROWN COAL BRI. | 0.02059840 | g |

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| 0202 | NON-INDUSTRIAL COMBUSTION PLANTS | Residential plants | | COKE OV.COKE/HC | 0.00400800 | g |
| 0202 | NON-INDUSTRIAL COMBUSTION PLANTS | Residential plants | | PETROLEUM COKE | 0.41055200 | g |
| 0202 | NON-INDUSTRIAL COMBUSTION PLANTS | Residential plants | | WOOD AND SIMIL. | 8.47469754 | g |
| 0202 | NON-INDUSTRIAL COMBUSTION PLANTS | Residential plants | | STRAW | 1.55577750 | g |
| 0202 | NON-INDUSTRIAL COMBUSTION PLANTS | Residential plants | | RESIDUAL OIL | 0.00035611 | g |
| 0202 | NON-INDUSTRIAL COMBUSTION PLANTS | Residential plants | | GAS OIL | 0.30275667 | g |
| 0202 | NON-INDUSTRIAL COMBUSTION PLANTS | Residential plants | | KEROSENE | 0.00091190 | g |
| 0202 | NON-INDUSTRIAL COMBUSTION PLANTS | Residential plants | | NATURAL GAS | 0.05513783 | g |
| 0202 | NON-INDUSTRIAL COMBUSTION PLANTS | Residential plants | | LPG | 0.00130199 | g |
| 020202 | NON-INDUSTRIAL COMBUSTION PLANTS | Residential plants | Combustion plants < 50 MW (boilers) | NATURAL GAS | 0.00011064 | g |
| 020204 | NON-INDUSTRIAL COMBUSTION PLANTS | Residential plants | Stationary engines | NATURAL GAS | 0.00287835 | g |
| 0203 | NON-INDUSTRIAL COMBUSTION PLANTS | Plants in agriculture, forestry and aquacultu | | COAL | 0.32376360 | g |
| 0203 | NON-INDUSTRIAL COMBUSTION PLANTS | Plants in agriculture, forestry and aquacultu | | PETROLEUM COKE | 0.00184620 | g |
| 0203 | NON-INDUSTRIAL COMBUSTION PLANTS | Plants in agriculture, forestry and aquacultu | | WOOD AND SIMIL. | 0.06803720 | g |
| 0203 | NON-INDUSTRIAL COMBUSTION PLANTS | Plants in agriculture, forestry and aquacultu | | STRAW | 0.82974800 | g |
| 0203 | NON-INDUSTRIAL COMBUSTION PLANTS | Plants in agriculture, forestry and aquacultu | | RESIDUAL OIL | 0.01778526 | g |
| 0203 | NON-INDUSTRIAL COMBUSTION PLANTS | Plants in agriculture, forestry and aquacultu | | GAS OIL | 0.02156378 | g |
| 0203 | NON-INDUSTRIAL COMBUSTION PLANTS | Plants in agriculture, forestry and aquacultu | | KEROSENE | 0.00008213 | g |

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|---|---|---|---|---|---|---|
| 0203 | NON-INDUSTRIAL COMBUSTION PLANTS | Plants in agriculture, forestry and aquacultu | | NATURAL GAS | 0.00476775 | g |
| 0203 | NON-INDUSTRIAL COMBUSTION PLANTS | Plants in agriculture, forestry and aquacultu | | LPG | 0.00018666 | g |
| 0203 | NON-INDUSTRIAL COMBUSTION PLANTS | Plants in agriculture, forestry and aquacultu | | BIOGAS | 0.00015297 | g |
| 020302 | NON-INDUSTRIAL COMBUSTION PLANTS | Plants in agriculture, forestry and aquacultu | Combustion plants < 50 MW (boilers) | STRAW | 0.00232000 | g |
| 020302 | NON-INDUSTRIAL COMBUSTION PLANTS | Plants in agriculture, forestry and aquacultu | Combustion plants < 50 MW (boilers) | RESIDUAL OIL | 0.00003269 | g |
| 020303 | NON-INDUSTRIAL COMBUSTION PLANTS | Plants in agriculture, forestry and aquacultu | Stationary gas turbines | NATURAL GAS | 0.00012381 | g |
| 020304 | NON-INDUSTRIAL COMBUSTION PLANTS | Plants in agriculture, forestry and aquacultu | Stationary engines | WOOD AND SIMIL. | 0.00008640 | g |
| 020304 | NON-INDUSTRIAL COMBUSTION PLANTS | Plants in agriculture, forestry and aquacultu | Stationary engines | RESIDUAL OIL | 0.00004017 | g |
| 020304 | NON-INDUSTRIAL COMBUSTION PLANTS | Plants in agriculture, forestry and aquacultu | Stationary engines | GAS OIL | 0.00004774 | g |
| 020304 | NON-INDUSTRIAL COMBUSTION PLANTS | Plants in agriculture, forestry and aquacultu | Stationary engines | FISH & RAPE OIL | 0.00000146 | g |
| 020304 | NON-INDUSTRIAL COMBUSTION PLANTS | Plants in agriculture, forestry and aquacultu | Stationary engines | NATURAL GAS | 0.00621884 | g |
| 020304 | NON-INDUSTRIAL COMBUSTION PLANTS | Plants in agriculture, forestry and aquacultu | Stationary engines | BIOGAS | 0.00015308 | g |
| 0301 | COMBUSTION IN MANUFACTURING INDUSTRY | Comb. in boilers, gas turbines and stationary | | COAL | 0.00484069 | g |
| 0301 | COMBUSTION IN MANUFACTURING INDUSTRY | Comb. in boilers, gas turbines and stationary | | COKE OV.COKE/HC | 0.00031449 | g |
| 0301 | COMBUSTION IN MANUFACTURING INDUSTRY | Comb. in boilers, gas turbines and stationary | | PETROLEUM COKE | 0.00037676 | g |
| 0301 | COMBUSTION IN MANUFACTURING INDUSTRY | Comb. in boilers, gas turbines and stationary | | WOOD AND SIMIL. | 0.00445017 | g |
| 0301 | COMBUSTION IN MANUFACTURING INDUSTRY | Comb. in boilers, gas turbines and stationary | | RESIDUAL OIL | 0.00649411 | g |
| 0301 | COMBUSTION IN MANUFACTURING INDUSTRY | Comb. in boilers, gas turbines and stationary | | GAS OIL | 0.00192665 | g |

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|---|---|---|---|---|---|---|
| 0301 | COMBUSTION IN MANUFACTURING INDUSTRY | Comb. in boilers, gas turbines and stationary | | KEROSENE | 0.00000000 | g |
| 0301 | COMBUSTION IN MANUFACTURING INDUSTRY | Comb. in boilers, gas turbines and stationary | | NATURAL GAS | 0.00070384 | g |
| 0301 | COMBUSTION IN MANUFACTURING INDUSTRY | Comb. in boilers, gas turbines and stationary | | NATURAL GAS | 0.00001135 | g |
| 0301 | COMBUSTION IN MANUFACTURING INDUSTRY | Comb. in boilers, gas turbines and stationary | | LPG | 0.00002544 | g |
| 0301 | COMBUSTION IN MANUFACTURING INDUSTRY | Comb. in boilers, gas turbines and stationary | | BIOGAS | 0.00000081 | g |
| 030102 | COMBUSTION IN MANUFACTURING INDUSTRY | Comb. in boilers, gas turbines and stationary | Combustion plants >= 50 and < 300 MW (boilers) | COAL | 0.00140366 | g |
| 030102 | COMBUSTION IN MANUFACTURING INDUSTRY | Comb. in boilers, gas turbines and stationary | Combustion plants >= 50 and < 300 MW (boilers) | WOOD AND SIMIL. | 0.00000096 | g |
| 030102 | COMBUSTION IN MANUFACTURING INDUSTRY | Comb. in boilers, gas turbines and stationary | Combustion plants >= 50 and < 300 MW (boilers) | RESIDUAL OIL | 0.00037861 | g |
| 030102 | COMBUSTION IN MANUFACTURING INDUSTRY | Comb. in boilers, gas turbines and stationary | Combustion plants >= 50 and < 300 MW (boilers) | RESIDUAL OIL | 0.00025122 | g |
| 030102 | COMBUSTION IN MANUFACTURING INDUSTRY | Comb. in boilers, gas turbines and stationary | Combustion plants >= 50 and < 300 MW (boilers) | GAS OIL | 0.00000277 | g |
| 030102 | COMBUSTION IN MANUFACTURING INDUSTRY | Comb. in boilers, gas turbines and stationary | Combustion plants >= 50 and < 300 MW (boilers) | NATURAL GAS | 0.00006726 | g |
| 030102 | COMBUSTION IN MANUFACTURING INDUSTRY | Comb. in boilers, gas turbines and stationary | Combustion plants >= 50 and < 300 MW (boilers) | BIOGAS | 0.00000000 | g |
| 030103 | COMBUSTION IN MANUFACTURING INDUSTRY | Comb. in boilers, gas turbines and stationary | Combustion plants < 50 MW (boilers) | WOOD AND SIMIL. | 0.00043954 | g |
| 030103 | COMBUSTION IN MANUFACTURING INDUSTRY | Comb. in boilers, gas turbines and stationary | Combustion plants < 50 MW (boilers) | RESIDUAL OIL | 0.00012381 | g |
| 030103 | COMBUSTION IN MANUFACTURING INDUSTRY | Comb. in boilers, gas turbines and stationary | Combustion plants < 50 MW (boilers) | GAS OIL | 0.00007242 | g |
| 030103 | COMBUSTION IN MANUFACTURING INDUSTRY | Comb. in boilers, gas turbines and stationary | Combustion plants < 50 MW (boilers) | NATURAL GAS | 0.00000291 | g |
| 030104 | COMBUSTION IN MANUFACTURING INDUSTRY | Comb. in boilers, gas turbines and stationary | Gas turbines | RESIDUAL OIL | 0.00000000 | g |
| 030104 | COMBUSTION IN MANUFACTURING INDUSTRY | Comb. in boilers, gas turbines and stationary | Gas turbines | GAS OIL | 0.00000004 | g |

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| 030104 | COMBUSTION IN MANUFACTURING INDUSTRY | Comb. in boilers, gas turbines and stationary | Gas turbines | NATURAL GAS | 0.00008595 | g |
| 030104 | COMBUSTION IN MANUFACTURING INDUSTRY | Comb. in boilers, gas turbines and stationary | Gas turbines | NATURAL GAS | 0.00008296 | g |
| 030105 | COMBUSTION IN MANUFACTURING INDUSTRY | Comb. in boilers, gas turbines and stationary | Stationary engines | STRAW | 0.00000849 | g |
| 030105 | COMBUSTION IN MANUFACTURING INDUSTRY | Comb. in boilers, gas turbines and stationary | Stationary engines | GAS OIL | 0.00000009 | g |
| 030105 | COMBUSTION IN MANUFACTURING INDUSTRY | Comb. in boilers, gas turbines and stationary | Stationary engines | NATURAL GAS | 0.00003891 | g |
| 030105 | COMBUSTION IN MANUFACTURING INDUSTRY | Comb. in boilers, gas turbines and stationary | Stationary engines | BIOGAS | 0.00000004 | g |
| 030106 | COMBUSTION IN MANUFACTURING INDUSTRY | Comb. in boilers, gas turbines and stationary | Other stationary equipments (n) | GAS OIL | 0.00000712 | g |
| 030106 | COMBUSTION IN MANUFACTURING INDUSTRY | Comb. in boilers, gas turbines and stationary | Other stationary equipments (n) | NATURAL GAS | 0.00000127 | g |
| 030310 | COMBUSTION IN MANUFACTURING INDUSTRY | Processes with contact | Secondary aluminium production | | 1.74000000 | g |
| 030311 | COMBUSTION IN MANUFACTURING INDUSTRY | Processes with contact | Cement (f) | | 0.01306361 | g |
| 030311 | COMBUSTION IN MANUFACTURING INDUSTRY | Processes with contact | Cement (f) | COAL | 0.02283219 | g |
| 030311 | COMBUSTION IN MANUFACTURING INDUSTRY | Processes with contact | Cement (f) | PETROLEUM COKE | 0.00000000 | g |
| 030311 | COMBUSTION IN MANUFACTURING INDUSTRY | Processes with contact | Cement (f) | MUNICIP. WASTES | 0.07932158 | g |
| 030311 | COMBUSTION IN MANUFACTURING INDUSTRY | Processes with contact | Cement (f) | SEWAGE SLUDGE | 0.00630543 | g |
| 030311 | COMBUSTION IN MANUFACTURING INDUSTRY | Processes with contact | Cement (f) | RESIDUAL OIL | 0.01975362 | g |
| 030315 | COMBUSTION IN MANUFACTURING INDUSTRY | Processes with contact | Container glass (f) | GAS OIL | 0.00001931 | g |
| 030315 | COMBUSTION IN MANUFACTURING INDUSTRY | Processes with contact | Container glass (f) | NATURAL GAS | 0.01134312 | g |
| 030318 | COMBUSTION IN MANUFACTURING INDUSTRY | Processes with contact | Mineral wool (except binding) | COKE OV.COKE/HC | 0.00377568 | g |

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| 030318 | COMBUSTION IN MANUFACTURING INDUSTRY | Processes with contact | Mineral wool (except binding) | NATURAL GAS | 0.00648158 | g |
| 040207 | PRODUCTION PROCESSES | Processes in iron and steel industries and co | Electric furnace steel plant | | 0.52000000 | g |
| 040614 | PRODUCTION PROCESSES | Processes in wood, paper pulp, food, drink an | Lime (decarbonizing) | | 0.01491151 | g |
| 060406 | SOLVENT AND OTHER PRODUCT USE | Other use of solvents and related activities | Preservation of wood | | 0.00000000 | g |
| 070101 | ROAD TRANSPORT | Passenger cars (r) | Highway driving | DIESEL OIL | 0.00118561 | g |
| 070101 | ROAD TRANSPORT | Passenger cars (r) | Highway driving | MOTOR GASOLINE | 0.04871876 | g |
| 070102 | ROAD TRANSPORT | Passenger cars (r) | Rural driving | DIESEL OIL | 0.00287563 | g |
| 070102 | ROAD TRANSPORT | Passenger cars (r) | Rural driving | MOTOR GASOLINE | 0.11789886 | g |
| 070103 | ROAD TRANSPORT | Passenger cars (r) | Urban driving | DIESEL OIL | 0.00218237 | g |
| 070103 | ROAD TRANSPORT | Passenger cars (r) | Urban driving | MOTOR GASOLINE | 0.08973879 | g |
| 070201 | ROAD TRANSPORT | Light duty vehicles < 3.5 t (r) | Highway driving | DIESEL OIL | 0.00161787 | g |
| 070201 | ROAD TRANSPORT | Light duty vehicles < 3.5 t (r) | Highway driving | MOTOR GASOLINE | 0.00244846 | g |
| 070202 | ROAD TRANSPORT | Light duty vehicles < 3.5 t (r) | Rural driving | DIESEL OIL | 0.00539291 | g |
| 070202 | ROAD TRANSPORT | Light duty vehicles < 3.5 t (r) | Rural driving | MOTOR GASOLINE | 0.00816154 | g |
| 070203 | ROAD TRANSPORT | Light duty vehicles < 3.5 t (r) | Urban driving | DIESEL OIL | 0.00377504 | g |
| 070203 | ROAD TRANSPORT | Light duty vehicles < 3.5 t (r) | Urban driving | MOTOR GASOLINE | 0.00571308 | g |
| 070301 | ROAD TRANSPORT | Heavy duty vehicles > 3.5 t and buses (r) | Highway driving | DIESEL OIL | 0.01097248 | g |
| 070302 | ROAD TRANSPORT | Heavy duty vehicles > 3.5 t and buses (r) | Rural driving | DIESEL OIL | 0.01745482 | g |

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| 070303 | ROAD TRANSPORT | Heavy duty vehicles > 3.5 t and buses (r) | Urban driving | DIESEL OIL | 0.01029564 | g |
| 070501 | ROAD TRANSPORT | Motorcycles > 50 cm3 | Highway driving | MOTOR GASOLINE | 0.00197644 | g |
| 070502 | ROAD TRANSPORT | Motorcycles > 50 cm3 | Rural driving | MOTOR GASOLINE | 0.00550439 | g |
| 070503 | ROAD TRANSPORT | Motorcycles > 50 cm3 | Urban driving | MOTOR GASOLINE | 0.00664393 | g |
| 0801 | OTHER MOBILE SOURCES AND MACHINERY | Military | | DIESEL OIL | 0.00026475 | g |
| 0801 | OTHER MOBILE SOURCES AND MACHINERY | Military | | JET FUEL | 0.00000000 | g |
| 0801 | OTHER MOBILE SOURCES AND MACHINERY | Military | | MOTOR GASOLINE | 0.00000614 | g |
| 0801 | OTHER MOBILE SOURCES AND MACHINERY | Military | | AVIAT. GASOLINE | 0.00004543 | g |
| 0802 | OTHER MOBILE SOURCES AND MACHINERY | Railways | | DIESEL OIL | 0.00221411 | g |
| 0802 | OTHER MOBILE SOURCES AND MACHINERY | Railways | | MOTOR GASOLINE | 0.00000000 | g |
| 0803 | OTHER MOBILE SOURCES AND MACHINERY | Inland waterways | | DIESEL OIL | 0.00062476 | g |
| 0803 | OTHER MOBILE SOURCES AND MACHINERY | Inland waterways | | MOTOR GASOLINE | 0.00220302 | g |
| 080402 | OTHER MOBILE SOURCES AND MACHINERY | Maritime activities | National sea traffic within EMEP area | RESIDUAL OIL | 0.02024818 | g |
| 080402 | OTHER MOBILE SOURCES AND MACHINERY | Maritime activities | National sea traffic within EMEP area | GAS OIL | 0.04043897 | g |
| 080403 | OTHER MOBILE SOURCES AND MACHINERY | Maritime activities | National fishing | GAS OIL | 0.10022713 | g |
| 080403 | OTHER MOBILE SOURCES AND MACHINERY | Maritime activities | National fishing | MOTOR GASOLINE | 0.00000000 | g |
| 080404 | OTHER MOBILE SOURCES AND MACHINERY | Maritime activities | International sea traffic (international bunkers)(h) | RESIDUAL OIL | 0.44507858 | g |
| 080404 | OTHER MOBILE SOURCES AND MACHINERY | Maritime activities | International sea traffic (international bunkers)(h) | GAS OIL | 0.27469683 | g |

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| 080501 | OTHER MOBILE SOURCES AND MA-CHINERY | Air traffic | Domestic airport traffic (LTO cycles - <1000 m) | JET FUEL | 0.00000000 | g |
| 080501 | OTHER MOBILE SOURCES AND MA-CHINERY | Air traffic | Domestic airport traffic (LTO cycles - <1000 m) | JET FUEL | 0.00000000 | g |
| 080501 | OTHER MOBILE SOURCES AND MA-CHINERY | Air traffic | Domestic airport traffic (LTO cycles - <1000 m) | AVIAT. GASOLINE | 0.00051376 | g |
| 080501 | OTHER MOBILE SOURCES AND MA-CHINERY | Air traffic | Domestic airport traffic (LTO cycles - <1000 m) | AVIAT. GASOLINE | 0.00000417 | g |
| 080502 | OTHER MOBILE SOURCES AND MA-CHINERY | Air traffic | International airport traffic (LTO cycles - <1000 m) | JET FUEL | 0.00000000 | g |
| 080502 | OTHER MOBILE SOURCES AND MA-CHINERY | Air traffic | International airport traffic (LTO cycles - <1000 m) | JET FUEL | 0.00000000 | g |
| 080502 | OTHER MOBILE SOURCES AND MA-CHINERY | Air traffic | International airport traffic (LTO cycles - <1000 m) | AVIAT. GASOLINE | 0.00003844 | g |
| 080502 | OTHER MOBILE SOURCES AND MA-CHINERY | Air traffic | International airport traffic (LTO cycles - <1000 m) | AVIAT. GASOLINE | 0.00000603 | g |
| 080503 | OTHER MOBILE SOURCES AND MA-CHINERY | Air traffic | Domestic cruise traffic (>1000 m) | JET FUEL | 0.00000000 | g |
| 080503 | OTHER MOBILE SOURCES AND MA-CHINERY | Air traffic | Domestic cruise traffic (>1000 m) | JET FUEL | 0.00000000 | g |
| 080504 | OTHER MOBILE SOURCES AND MA-CHINERY | Air traffic | International cruise traffic (>1000 m)(i) | JET FUEL | 0.00000000 | g |
| 080504 | OTHER MOBILE SOURCES AND MA-CHINERY | Air traffic | International cruise traffic (>1000 m)(i) | JET FUEL | 0.00000000 | g |
| 0806 | OTHER MOBILE SOURCES AND MA-CHINERY | Agriculture | | DIESEL OIL | 0.00984491 | g |
| 0806 | OTHER MOBILE SOURCES AND MA-CHINERY | Agriculture | | MOTOR GASOLINE | 0.00193130 | g |
| 0807 | OTHER MOBILE SOURCES AND MA-CHINERY | Forestry | | DIESEL OIL | 0.00011013 | g |
| 0807 | OTHER MOBILE SOURCES AND MA-CHINERY | Forestry | | MOTOR GASOLINE | 0.00073656 | g |
| 0808 | OTHER MOBILE SOURCES AND MA-CHINERY | Industry | | DIESEL OIL | 0.00773985 | g |
| 0808 | OTHER MOBILE SOURCES AND MA-CHINERY | Industry | | MOTOR GASOLINE | 0.00085439 | g |

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| 0809 | OTHER MOBILE SOURCES AND MACHINERY | Household and gardening | | MOTOR GASOLINE | 0.01185026 | g |
| 090203 | WASTE TREATMENT AND DISPOSAL | Waste incineration | Flaring in oil refinery | REFINERY GAS | 0.00000783 | g |
| 090206 | WASTE TREATMENT AND DISPOSAL | Waste incineration | Flaring in gas and oil extraction | NATURAL GAS | 0.00025105 | g |
| 090206 | WASTE TREATMENT AND DISPOSAL | Waste incineration | Flaring in gas and oil extraction | NATURAL GAS | 0.00000073 | g |
| 090901 | WASTE TREATMENT AND DISPOSAL | Cremation | Incineration of corpses | | 0.03800000 | g |
| 091006 | WASTE TREATMENT AND DISPOSAL | Other waste treatment | Biogas production | BIOGAS | 0.00000102 | g |

# Appendix E – Total dioxin emission inventory for 2004. (g I-TEQ)

| snap_id | snap_gr_name | snapsg_name | snap_name | fuel_gr_abbr | SumOfEmission | uni_abbr |
|---|---|---|---|---|---|---|
| 0101 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | Public power | | RESIDUAL OIL | 0.00000000 | g |
| 0101 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | Public power | | GAS OIL | 0.00000000 | g |
| 0101 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | Public power | | NATURAL GAS | 0.00000004 | g |
| 010101 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | Public power | Combustion plants >= 300 MW (boilers) | COAL | 0.00000000 | g |
| 010101 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | Public power | Combustion plants >= 300 MW (boilers) | COAL | 0.22166876 | g |
| 010101 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | Public power | Combustion plants >= 300 MW (boilers) | WOOD AND SIMIL. | 0.00023138 | g |
| 010101 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | Public power | Combustion plants >= 300 MW (boilers) | STRAW | 0.09606133 | g |
| 010101 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | Public power | Combustion plants >= 300 MW (boilers) | RESIDUAL OIL | 0.00000000 | g |
| 010101 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | Public power | Combustion plants >= 300 MW (boilers) | RESIDUAL OIL | 0.00491978 | g |
| 010101 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | Public power | Combustion plants >= 300 MW (boilers) | GAS OIL | 0.00002040 | g |
| 010101 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | Public power | Combustion plants >= 300 MW (boilers) | GAS OIL | 0.00017377 | g |
| 010101 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | Public power | Combustion plants >= 300 MW (boilers) | ORIMULSION | 0.00000000 | g |
| 010101 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | Public power | Combustion plants >= 300 MW (boilers) | ORIMULSION | 0.00006739 | g |
| 010101 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | Public power | Combustion plants >= 300 MW (boilers) | NATURAL GAS | 0.00000000 | g |
| 010101 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | Public power | Combustion plants >= 300 MW (boilers) | NATURAL GAS | 0.00048218 | g |
| 010102 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | Public power | Combustion plants >= 50 and < 300 MW (boilers) | | 0.76426000 | g |

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| 010102 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | Public power | Combustion plants >= 50 and < 300 MW (boilers) | COAL | 0.00000000 | g |
| 010102 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | Public power | Combustion plants >= 50 and < 300 MW (boilers) | COAL | 0.00595518 | g |
| 010102 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | Public power | Combustion plants >= 50 and < 300 MW (boilers) | PETROLEUM COKE | 0.00000941 | g |
| 010102 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | Public power | Combustion plants >= 50 and < 300 MW (boilers) | WOOD AND SIMIL. | 0.00208185 | g |
| 010102 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | Public power | Combustion plants >= 50 and < 300 MW (boilers) | WOOD AND SIMIL. | 0.00317552 | g |
| 010102 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | Public power | Combustion plants >= 50 and < 300 MW (boilers) | MUNICIP. WASTES | 0.00000000 | g |
| 010102 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | Public power | Combustion plants >= 50 and < 300 MW (boilers) | MUNICIP. WASTES | 0.29005960 | g |
| 010102 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | Public power | Combustion plants >= 50 and < 300 MW (boilers) | STRAW | 0.00000000 | g |
| 010102 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | Public power | Combustion plants >= 50 and < 300 MW (boilers) | STRAW | 0.01954082 | g |
| 010102 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | Public power | Combustion plants >= 50 and < 300 MW (boilers) | RESIDUAL OIL | 0.00000000 | g |
| 010102 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | Public power | Combustion plants >= 50 and < 300 MW (boilers) | RESIDUAL OIL | 0.00037061 | g |
| 010102 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | Public power | Combustion plants >= 50 and < 300 MW (boilers) | GAS OIL | 0.00000000 | g |
| 010102 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | Public power | Combustion plants >= 50 and < 300 MW (boilers) | GAS OIL | 0.00006780 | g |
| 010102 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | Public power | Combustion plants >= 50 and < 300 MW (boilers) | FISH & RAPE OIL | 0.00000046 | g |
| 010102 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | Public power | Combustion plants >= 50 and < 300 MW (boilers) | NATURAL GAS | 0.00000568 | g |
| 010102 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | Public power | Combustion plants >= 50 and < 300 MW (boilers) | NATURAL GAS | 0.00002856 | g |
| 010102 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | Public power | Combustion plants >= 50 and < 300 MW (boilers) | BIOGAS | 0.00000000 | g |
| 010103 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | Public power | Combustion plants < 50 MW (boilers) | | 0.65168000 | g |

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| 010103 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | Public power | Combustion plants < 50 MW (boilers) | COAL | 0.00003120 | g |
| 010103 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | Public power | Combustion plants < 50 MW (boilers) | WOOD AND SIMIL. | 0.00105829 | g |
| 010103 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | Public power | Combustion plants < 50 MW (boilers) | MUNICIP. WASTES | 0.00000000 | g |
| 010103 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | Public power | Combustion plants < 50 MW (boilers) | MUNICIP. WASTES | 0.07234392 | g |
| 010103 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | Public power | Combustion plants < 50 MW (boilers) | STRAW | 0.02924856 | g |
| 010103 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | Public power | Combustion plants < 50 MW (boilers) | RESIDUAL OIL | 0.00001513 | g |
| 010103 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | Public power | Combustion plants < 50 MW (boilers) | GAS OIL | 0.00001220 | g |
| 010103 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | Public power | Combustion plants < 50 MW (boilers) | FISH & RAPE OIL | 0.00004813 | g |
| 010103 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | Public power | Combustion plants < 50 MW (boilers) | NATURAL GAS | 0.00001992 | g |
| 010103 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | Public power | Combustion plants < 50 MW (boilers) | NATURAL GAS | 0.00000099 | g |
| 010103 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | Public power | Combustion plants < 50 MW (boilers) | BIOGAS | 0.00000196 | g |
| 010104 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | Public power | Gas turbines | WOOD AND SIMIL. | 0.00000497 | g |
| 010104 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | Public power | Gas turbines | WOOD AND SIMIL. | 0.00448306 | g |
| 010104 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | Public power | Gas turbines | MUNICIP. WASTES | 0.00000000 | g |
| 010104 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | Public power | Gas turbines | STRAW | 0.01352982 | g |
| 010104 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | Public power | Gas turbines | STRAW | 0.04096105 | g |
| 010104 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | Public power | Gas turbines | RESIDUAL OIL | 0.00008581 | g |
| 010104 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | Public power | Gas turbines | RESIDUAL OIL | 0.00651547 | g |

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| 010104 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | Public power | Gas turbines | GAS OIL | 0.00003529 | g |
| 010104 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | Public power | Gas turbines | GAS OIL | 0.00003579 | g |
| 010104 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | Public power | Gas turbines | NATURAL GAS | 0.00006301 | g |
| 010104 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | Public power | Gas turbines | NATURAL GAS | 0.00070482 | g |
| 010105 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | Public power | Stationary engines | WOOD AND SIMIL. | 0.00000000 | g |
| 010105 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | Public power | Stationary engines | MUNICIP. WASTES | 0.00000000 | g |
| 010105 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | Public power | Stationary engines | RESIDUAL OIL | 0.00000148 | g |
| 010105 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | Public power | Stationary engines | GAS OIL | 0.00009126 | g |
| 010105 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | Public power | Stationary engines | GAS OIL | 0.00000304 | g |
| 010105 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | Public power | Stationary engines | FISH & RAPE OIL | 0.00000160 | g |
| 010105 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | Public power | Stationary engines | NATURAL GAS | 0.00065953 | g |
| 010105 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | Public power | Stationary engines | NATURAL GAS | 0.00000027 | g |
| 010105 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | Public power | Stationary engines | BIOGAS | 0.00003588 | g |
| 010201 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | District heating plants | Combustion plants >= 300 MW (boilers) | GAS OIL | 0.00008172 | g |
| 010202 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | District heating plants | Combustion plants >= 50 and < 300 MW (boilers) | COAL | 0.00000084 | g |
| 010202 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | District heating plants | Combustion plants >= 50 and < 300 MW (boilers) | WOOD AND SIMIL. | 0.00062037 | g |
| 010202 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | District heating plants | Combustion plants >= 50 and < 300 MW (boilers) | STRAW | 0.00209911 | g |
| 010202 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | District heating plants | Combustion plants >= 50 and < 300 MW (boilers) | RESIDUAL OIL | 0.00003036 | g |

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| 010202 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | District heating plants | Combustion plants >= 50 and < 300 MW (boilers) | GAS OIL | 0.00036942 | g |
| 010202 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | District heating plants | Combustion plants >= 50 and < 300 MW (boilers) | FISH & RAPE OIL | 0.00000411 | g |
| 010202 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | District heating plants | Combustion plants >= 50 and < 300 MW (boilers) | NATURAL GAS | 0.00001071 | g |
| 010203 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | District heating plants | Combustion plants < 50 MW (boilers) | | 0.06511000 | g |
| 010203 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | District heating plants | Combustion plants < 50 MW (boilers) | COAL | 0.00000000 | g |
| 010203 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | District heating plants | Combustion plants < 50 MW (boilers) | WOOD AND SIMIL. | 0.00479837 | g |
| 010203 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | District heating plants | Combustion plants < 50 MW (boilers) | MUNICIP. WASTES | 0.00000000 | g |
| 010203 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | District heating plants | Combustion plants < 50 MW (boilers) | MUNICIP. WASTES | 0.25566800 | g |
| 010203 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | District heating plants | Combustion plants < 50 MW (boilers) | STRAW | 0.06615411 | g |
| 010203 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | District heating plants | Combustion plants < 50 MW (boilers) | RESIDUAL OIL | 0.00016517 | g |
| 010203 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | District heating plants | Combustion plants < 50 MW (boilers) | RESIDUAL OIL | 0.00001845 | g |
| 010203 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | District heating plants | Combustion plants < 50 MW (boilers) | GAS OIL | 0.00043442 | g |
| 010203 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | District heating plants | Combustion plants < 50 MW (boilers) | FISH & RAPE OIL | 0.00051939 | g |
| 010203 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | District heating plants | Combustion plants < 50 MW (boilers) | NATURAL GAS | 0.00004029 | g |
| 010203 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | District heating plants | Combustion plants < 50 MW (boilers) | LPG | 0.00000000 | g |
| 010203 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | District heating plants | Combustion plants < 50 MW (boilers) | BIOGAS | 0.00000059 | g |
| 010205 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | District heating plants | Stationary engines | GAS OIL | 0.00000478 | g |
| 010205 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | District heating plants | Stationary engines | NATURAL GAS | 0.00001185 | g |

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| 010205 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | District heating plants | Stationary engines | BIOGAS | 0.00000091 | g |
| 010304 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | Petroleum refining plants | Gas turbines | REFINERY GAS | 0.00003386 | g |
| 010306 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | Petroleum refining plants | Process furnaces | RESIDUAL OIL | 0.00000000 | g |
| 010306 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | Petroleum refining plants | Process furnaces | RESIDUAL OIL | 0.00094518 | g |
| 010306 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | Petroleum refining plants | Process furnaces | GAS OIL | 0.00000835 | g |
| 010306 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | Petroleum refining plants | Process furnaces | REFINERY GAS | 0.00019717 | g |
| 010502 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | Coal mining, oil / gas extraction, pipeline c | Combustion plants >= 50 and < 300 MW (boilers) | NATURAL GAS | 0.00000000 | g |
| 010502 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | Coal mining, oil / gas extraction, pipeline c | Combustion plants >= 50 and < 300 MW (boilers) | NATURAL GAS | 0.00000901 | g |
| 010504 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | Coal mining, oil / gas extraction, pipeline c | Gas turbines | NATURAL GAS | 0.00067672 | g |
| 010505 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | Coal mining, oil / gas extraction, pipeline c | Stationary engines | GAS OIL | 0.00000010 | g |
| 010505 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | Coal mining, oil / gas extraction, pipeline c | Stationary engines | NATURAL GAS | 0.00000031 | g |
| 010505 | COMBUSTION IN ENERGY AND TRANS-FORMATION INDUS | Coal mining, oil / gas extraction, pipeline c | Stationary engines | BIOGAS | 0.00000153 | g |
| 0201 | NON-INDUSTRIAL COMBUSTION PLANTS | Commercial and institutional plants (t) | | COAL | 0.00038940 | g |
| 0201 | NON-INDUSTRIAL COMBUSTION PLANTS | Commercial and institutional plants (t) | | PETROLEUM COKE | 0.00000000 | g |
| 0201 | NON-INDUSTRIAL COMBUSTION PLANTS | Commercial and institutional plants (t) | | WOOD AND SIMIL. | 0.27238120 | g |
| 0201 | NON-INDUSTRIAL COMBUSTION PLANTS | Commercial and institutional plants (t) | | MUNICIP. WASTES | 0.00189515 | g |
| 0201 | NON-INDUSTRIAL COMBUSTION PLANTS | Commercial and institutional plants (t) | | RESIDUAL OIL | 0.00107544 | g |
| 0201 | NON-INDUSTRIAL COMBUSTION PLANTS | Commercial and institutional plants (t) | | GAS OIL | 0.04411382 | g |

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| 0201 | NON-INDUSTRIAL COMBUSTION PLANTS | Commercial and institutional plants (t) | | KEROSENE | 0.00076734 | g |
| 0201 | NON-INDUSTRIAL COMBUSTION PLANTS | Commercial and institutional plants (t) | | NATURAL GAS | 0.01788504 | g |
| 0201 | NON-INDUSTRIAL COMBUSTION PLANTS | Commercial and institutional plants (t) | | LPG | 0.00042976 | g |
| 0201 | NON-INDUSTRIAL COMBUSTION PLANTS | Commercial and institutional plants (t) | | BIOGAS | 0.00102091 | g |
| 020103 | NON-INDUSTRIAL COMBUSTION PLANTS | Commercial and institutional plants (t) | Combustion plants < 50 MW (boilers) | | 0.00130000 | g |
| 020103 | NON-INDUSTRIAL COMBUSTION PLANTS | Commercial and institutional plants (t) | Combustion plants < 50 MW (boilers) | MUNICIP. WASTES | 0.00000000 | g |
| 020103 | NON-INDUSTRIAL COMBUSTION PLANTS | Commercial and institutional plants (t) | Combustion plants < 50 MW (boilers) | GAS OIL | 0.00000000 | g |
| 020103 | NON-INDUSTRIAL COMBUSTION PLANTS | Commercial and institutional plants (t) | Combustion plants < 50 MW (boilers) | NATURAL GAS | 0.00010089 | g |
| 020103 | NON-INDUSTRIAL COMBUSTION PLANTS | Commercial and institutional plants (t) | Combustion plants < 50 MW (boilers) | BIOGAS | 0.00000000 | g |
| 020104 | NON-INDUSTRIAL COMBUSTION PLANTS | Commercial and institutional plants (t) | Stationary gas turbines | NATURAL GAS | 0.00004414 | g |
| 020105 | NON-INDUSTRIAL COMBUSTION PLANTS | Commercial and institutional plants (t) | Stationary engines | WOOD AND SIMIL. | 0.00004400 | g |
| 020105 | NON-INDUSTRIAL COMBUSTION PLANTS | Commercial and institutional plants (t) | Stationary engines | GAS OIL | 0.00000756 | g |
| 020105 | NON-INDUSTRIAL COMBUSTION PLANTS | Commercial and institutional plants (t) | Stationary engines | NATURAL GAS | 0.00206602 | g |
| 020105 | NON-INDUSTRIAL COMBUSTION PLANTS | Commercial and institutional plants (t) | Stationary engines | LPG | 0.00000004 | g |
| 020105 | NON-INDUSTRIAL COMBUSTION PLANTS | Commercial and institutional plants (t) | Stationary engines | BIOGAS | 0.00103430 | g |
| 0202 | NON-INDUSTRIAL COMBUSTION PLANTS | Residential plants | | COAL | 0.00023360 | g |
| 0202 | NON-INDUSTRIAL COMBUSTION PLANTS | Residential plants | | BROWN COAL BRI. | 0.00000000 | g |
| 0202 | NON-INDUSTRIAL COMBUSTION PLANTS | Residential plants | | COKE OV.COKE/HC | 0.02128320 | g |

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| 0202 | NON-INDUSTRIAL COMBUSTION PLANTS | Residential plants | | PETROLEUM COKE | 0.40192000 | g |
| 0202 | NON-INDUSTRIAL COMBUSTION PLANTS | Residential plants | | WOOD AND SIMIL. | 8.49571254 | g |
| 0202 | NON-INDUSTRIAL COMBUSTION PLANTS | Residential plants | | STRAW | 1.45072500 | g |
| 0202 | NON-INDUSTRIAL COMBUSTION PLANTS | Residential plants | | RESIDUAL OIL | 0.00044417 | g |
| 0202 | NON-INDUSTRIAL COMBUSTION PLANTS | Residential plants | | GAS OIL | 0.25290533 | g |
| 0202 | NON-INDUSTRIAL COMBUSTION PLANTS | Residential plants | | KEROSENE | 0.00110525 | g |
| 0202 | NON-INDUSTRIAL COMBUSTION PLANTS | Residential plants | | NATURAL GAS | 0.05971742 | g |
| 0202 | NON-INDUSTRIAL COMBUSTION PLANTS | Residential plants | | LPG | 0.00130150 | g |
| 020202 | NON-INDUSTRIAL COMBUSTION PLANTS | Residential plants | Combustion plants < 50 MW (boilers) | NATURAL GAS | 0.00012738 | g |
| 020204 | NON-INDUSTRIAL COMBUSTION PLANTS | Residential plants | Stationary engines | NATURAL GAS | 0.00295106 | g |
| 0203 | NON-INDUSTRIAL COMBUSTION PLANTS | Plants in agriculture, forestry and aquacultu | | COAL | 0.31187040 | g |
| 0203 | NON-INDUSTRIAL COMBUSTION PLANTS | Plants in agriculture, forestry and aquacultu | | PETROLEUM COKE | 0.00000000 | g |
| 0203 | NON-INDUSTRIAL COMBUSTION PLANTS | Plants in agriculture, forestry and aquacultu | | WOOD AND SIMIL. | 0.05107200 | g |
| 0203 | NON-INDUSTRIAL COMBUSTION PLANTS | Plants in agriculture, forestry and aquacultu | | STRAW | 0.77372000 | g |
| 0203 | NON-INDUSTRIAL COMBUSTION PLANTS | Plants in agriculture, forestry and aquacultu | | RESIDUAL OIL | 0.00720074 | g |
| 0203 | NON-INDUSTRIAL COMBUSTION PLANTS | Plants in agriculture, forestry and aquacultu | | GAS OIL | 0.02374846 | g |
| 0203 | NON-INDUSTRIAL COMBUSTION PLANTS | Plants in agriculture, forestry and aquacultu | | KEROSENE | 0.00007482 | g |
| 0203 | NON-INDUSTRIAL COMBUSTION PLANTS | Plants in agriculture, forestry and aquacultu | | NATURAL GAS | 0.00451318 | g |

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| 0203 | NON-INDUSTRIAL COMBUSTION PLANTS | Plants in agriculture, forestry and aquacultu | | LPG | 0.00010693 | g |
| 0203 | NON-INDUSTRIAL COMBUSTION PLANTS | Plants in agriculture, forestry and aquacultu | | BIOGAS | 0.00053637 | g |
| 020302 | NON-INDUSTRIAL COMBUSTION PLANTS | Plants in agriculture, forestry and aquacultu | Combustion plants < 50 MW (boilers) | STRAW | 0.00232000 | g |
| 020302 | NON-INDUSTRIAL COMBUSTION PLANTS | Plants in agriculture, forestry and aquacultu | Combustion plants < 50 MW (boilers) | RESIDUAL OIL | 0.00005265 | g |
| 020303 | NON-INDUSTRIAL COMBUSTION PLANTS | Plants in agriculture, forestry and aquacultu | Stationary gas turbines | NATURAL GAS | 0.00010761 | g |
| 020304 | NON-INDUSTRIAL COMBUSTION PLANTS | Plants in agriculture, forestry and aquacultu | Stationary engines | RESIDUAL OIL | 0.00000000 | g |
| 020304 | NON-INDUSTRIAL COMBUSTION PLANTS | Plants in agriculture, forestry and aquacultu | Stationary engines | GAS OIL | 0.00000000 | g |
| 020304 | NON-INDUSTRIAL COMBUSTION PLANTS | Plants in agriculture, forestry and aquacultu | Stationary engines | FISH & RAPE OIL | 0.00000000 | g |
| 020304 | NON-INDUSTRIAL COMBUSTION PLANTS | Plants in agriculture, forestry and aquacultu | Stationary engines | NATURAL GAS | 0.00572719 | g |
| 020304 | NON-INDUSTRIAL COMBUSTION PLANTS | Plants in agriculture, forestry and aquacultu | Stationary engines | BIOGAS | 0.00082268 | g |
| 0301 | COMBUSTION IN MANUFACTURING INDUSTRY | Comb. in boilers, gas turbines and stationary | | COAL | 0.00493135 | g |
| 0301 | COMBUSTION IN MANUFACTURING INDUSTRY | Comb. in boilers, gas turbines and stationary | | COKE OV.COKE/HC | 0.00039881 | g |
| 0301 | COMBUSTION IN MANUFACTURING INDUSTRY | Comb. in boilers, gas turbines and stationary | | PETROLEUM COKE | 0.00023845 | g |
| 0301 | COMBUSTION IN MANUFACTURING INDUSTRY | Comb. in boilers, gas turbines and stationary | | WOOD AND SIMIL. | 0.00353093 | g |
| 0301 | COMBUSTION IN MANUFACTURING INDUSTRY | Comb. in boilers, gas turbines and stationary | | RESIDUAL OIL | 0.00450908 | g |
| 0301 | COMBUSTION IN MANUFACTURING INDUSTRY | Comb. in boilers, gas turbines and stationary | | GAS OIL | 0.00260815 | g |
| 0301 | COMBUSTION IN MANUFACTURING INDUSTRY | Comb. in boilers, gas turbines and stationary | | KEROSENE | 0.00001750 | g |
| 0301 | COMBUSTION IN MANUFACTURING INDUSTRY | Comb. in boilers, gas turbines and stationary | | NATURAL GAS | 0.00067613 | g |

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| 0301 | COMBUSTION IN MANUFACTURING INDUSTRY | Comb. in boilers, gas turbines and stationary | | NATURAL GAS | 0.00001197 | g |
| 0301 | COMBUSTION IN MANUFACTURING INDUSTRY | Comb. in boilers, gas turbines and stationary | | LPG | 0.00001873 | g |
| 0301 | COMBUSTION IN MANUFACTURING INDUSTRY | Comb. in boilers, gas turbines and stationary | | BIOGAS | 0.00000114 | g |
| 030102 | COMBUSTION IN MANUFACTURING INDUSTRY | Comb. in boilers, gas turbines and stationary | Combustion plants >= 50 and < 300 MW (boilers) | COAL | 0.00197832 | g |
| 030102 | COMBUSTION IN MANUFACTURING INDUSTRY | Comb. in boilers, gas turbines and stationary | Combustion plants >= 50 and < 300 MW (boilers) | WOOD AND SIMIL. | 0.00000000 | g |
| 030102 | COMBUSTION IN MANUFACTURING INDUSTRY | Comb. in boilers, gas turbines and stationary | Combustion plants >= 50 and < 300 MW (boilers) | MUNICIP. WASTES | 0.00000000 | g |
| 030102 | COMBUSTION IN MANUFACTURING INDUSTRY | Comb. in boilers, gas turbines and stationary | Combustion plants >= 50 and < 300 MW (boilers) | RESIDUAL OIL | 0.00000000 | g |
| 030102 | COMBUSTION IN MANUFACTURING INDUSTRY | Comb. in boilers, gas turbines and stationary | Combustion plants >= 50 and < 300 MW (boilers) | RESIDUAL OIL | 0.00149069 | g |
| 030102 | COMBUSTION IN MANUFACTURING INDUSTRY | Comb. in boilers, gas turbines and stationary | Combustion plants >= 50 and < 300 MW (boilers) | GAS OIL | 0.00000000 | g |
| 030102 | COMBUSTION IN MANUFACTURING INDUSTRY | Comb. in boilers, gas turbines and stationary | Combustion plants >= 50 and < 300 MW (boilers) | GAS OIL | 0.00000250 | g |
| 030102 | COMBUSTION IN MANUFACTURING INDUSTRY | Comb. in boilers, gas turbines and stationary | Combustion plants >= 50 and < 300 MW (boilers) | NATURAL GAS | 0.00005739 | g |
| 030102 | COMBUSTION IN MANUFACTURING INDUSTRY | Comb. in boilers, gas turbines and stationary | Combustion plants >= 50 and < 300 MW (boilers) | BIOGAS | 0.00000000 | g |
| 030103 | COMBUSTION IN MANUFACTURING INDUSTRY | Comb. in boilers, gas turbines and stationary | Combustion plants < 50 MW (boilers) | WOOD AND SIMIL. | 0.00034217 | g |
| 030103 | COMBUSTION IN MANUFACTURING INDUSTRY | Comb. in boilers, gas turbines and stationary | Combustion plants < 50 MW (boilers) | RESIDUAL OIL | 0.00000000 | g |
| 030103 | COMBUSTION IN MANUFACTURING INDUSTRY | Comb. in boilers, gas turbines and stationary | Combustion plants < 50 MW (boilers) | GAS OIL | 0.00000000 | g |
| 030103 | COMBUSTION IN MANUFACTURING INDUSTRY | Comb. in boilers, gas turbines and stationary | Combustion plants < 50 MW (boilers) | NATURAL GAS | 0.00000311 | g |
| 030104 | COMBUSTION IN MANUFACTURING INDUSTRY | Comb. in boilers, gas turbines and stationary | Gas turbines | RESIDUAL OIL | 0.00000000 | g |
| 030104 | COMBUSTION IN MANUFACTURING INDUSTRY | Comb. in boilers, gas turbines and stationary | Gas turbines | GAS OIL | 0.00000000 | g |

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| 030104 | COMBUSTION IN MANUFACTURING INDUSTRY | Comb. in boilers, gas turbines and stationary | Gas turbines | GAS OIL | 0.00000000 | g |
| 030104 | COMBUSTION IN MANUFACTURING INDUSTRY | Comb. in boilers, gas turbines and stationary | Gas turbines | NATURAL GAS | 0.00010983 | g |
| 030104 | COMBUSTION IN MANUFACTURING INDUSTRY | Comb. in boilers, gas turbines and stationary | Gas turbines | NATURAL GAS | 0.00005598 | g |
| 030105 | COMBUSTION IN MANUFACTURING INDUSTRY | Comb. in boilers, gas turbines and stationary | Stationary engines | STRAW | 0.00000000 | g |
| 030105 | COMBUSTION IN MANUFACTURING INDUSTRY | Comb. in boilers, gas turbines and stationary | Stationary engines | RESIDUAL OIL | 0.00000027 | g |
| 030105 | COMBUSTION IN MANUFACTURING INDUSTRY | Comb. in boilers, gas turbines and stationary | Stationary engines | GAS OIL | 0.00000000 | g |
| 030105 | COMBUSTION IN MANUFACTURING INDUSTRY | Comb. in boilers, gas turbines and stationary | Stationary engines | FISH & RAPE OIL | 0.00000000 | g |
| 030105 | COMBUSTION IN MANUFACTURING INDUSTRY | Comb. in boilers, gas turbines and stationary | Stationary engines | NATURAL GAS | 0.00003926 | g |
| 030105 | COMBUSTION IN MANUFACTURING INDUSTRY | Comb. in boilers, gas turbines and stationary | Stationary engines | BIOGAS | 0.00000042 | g |
| 030106 | COMBUSTION IN MANUFACTURING INDUSTRY | Comb. in boilers, gas turbines and stationary | Other stationary equipments (n) | GAS OIL | 0.00000769 | g |
| 030106 | COMBUSTION IN MANUFACTURING INDUSTRY | Comb. in boilers, gas turbines and stationary | Other stationary equipments (n) | NATURAL GAS | 0.00000055 | g |
| 030310 | COMBUSTION IN MANUFACTURING INDUSTRY | Processes with contact | Secondary aluminium production | | 0.02020200 | g |
| 030311 | COMBUSTION IN MANUFACTURING INDUSTRY | Processes with contact | Cement (f) | | 0.06295236 | g |
| 030311 | COMBUSTION IN MANUFACTURING INDUSTRY | Processes with contact | Cement (f) | COAL | 0.00000000 | g |
| 030311 | COMBUSTION IN MANUFACTURING INDUSTRY | Processes with contact | Cement (f) | PETROLEUM COKE | 0.00000000 | g |
| 030311 | COMBUSTION IN MANUFACTURING INDUSTRY | Processes with contact | Cement (f) | MUNICIP. WASTES | 0.00000000 | g |
| 030311 | COMBUSTION IN MANUFACTURING INDUSTRY | Processes with contact | Cement (f) | SEWAGE SLUDGE | 0.00000000 | g |
| 030311 | COMBUSTION IN MANUFACTURING INDUSTRY | Processes with contact | Cement (f) | RESIDUAL OIL | 0.00000000 | g |

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| 030315 | COMBUSTION IN MANUFACTURING INDUSTRY | Processes with contact | Container glass (f) | GAS OIL | 0.00000335 | g |
| 030315 | COMBUSTION IN MANUFACTURING INDUSTRY | Processes with contact | Container glass (f) | NATURAL GAS | 0.00002278 | g |
| 030318 | COMBUSTION IN MANUFACTURING INDUSTRY | Processes with contact | Mineral wool (except binding) | | 0.05700000 | g |
| 030318 | COMBUSTION IN MANUFACTURING INDUSTRY | Processes with contact | Mineral wool (except binding) | NATURAL GAS | 0.00000160 | g |
| 040614 | PRODUCTION PROCESSES | Processes in wood, paper pulp, food, drink an | Lime (decarbonizing) | | 0.01327666 | g |
| 060406 | SOLVENT AND OTHER PRODUCT USE | Other use of solvents and related activities | Preservation of wood | | 0.00000000 | g |
| 070101 | ROAD TRANSPORT | Passenger cars (r) | Highway driving | DIESEL OIL | 0.00000000 | g |
| 070101 | ROAD TRANSPORT | Passenger cars (r) | Highway driving | MOTOR GASOLINE | 0.02466739 | g |
| 070102 | ROAD TRANSPORT | Passenger cars (r) | Rural driving | DIESEL OIL | 0.00466079 | g |
| 070102 | ROAD TRANSPORT | Passenger cars (r) | Rural driving | MOTOR GASOLINE | 0.05968771 | g |
| 070103 | ROAD TRANSPORT | Passenger cars (r) | Urban driving | DIESEL OIL | 0.00348803 | g |
| 070103 | ROAD TRANSPORT | Passenger cars (r) | Urban driving | MOTOR GASOLINE | 0.04483797 | g |
| 070201 | ROAD TRANSPORT | Light duty vehicles < 3.5 t (r) | Highway driving | DIESEL OIL | 0.00215845 | g |
| 070201 | ROAD TRANSPORT | Light duty vehicles < 3.5 t (r) | Highway driving | MOTOR GASOLINE | 0.00123127 | g |
| 070202 | ROAD TRANSPORT | Light duty vehicles < 3.5 t (r) | Rural driving | DIESEL OIL | 0.00719488 | g |
| 070202 | ROAD TRANSPORT | Light duty vehicles < 3.5 t (r) | Rural driving | MOTOR GASOLINE | 0.00410423 | g |
| 070203 | ROAD TRANSPORT | Light duty vehicles < 3.5 t (r) | Urban driving | DIESEL OIL | 0.00498443 | g |
| 070203 | ROAD TRANSPORT | Light duty vehicles < 3.5 t (r) | Urban driving | MOTOR GASOLINE | 0.00283347 | g |

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|---|---|---|---|---|---|---|
| 070301 | ROAD TRANSPORT | Heavy duty vehicles > 3.5 t and buses (r) | Highway driving | DIESEL OIL | 0.01175918 | g |
| 070302 | ROAD TRANSPORT | Heavy duty vehicles > 3.5 t and buses (r) | Rural driving | DIESEL OIL | 0.01827998 | g |
| 070303 | ROAD TRANSPORT | Heavy duty vehicles > 3.5 t and buses (r) | Urban driving | DIESEL OIL | 0.01064644 | g |
| 070501 | ROAD TRANSPORT | Motorcycles > 50 cm3 | Highway driving | MOTOR GASOLINE | 0.00265870 | g |
| 070502 | ROAD TRANSPORT | Motorcycles > 50 cm3 | Rural driving | MOTOR GASOLINE | 0.00739948 | g |
| 070503 | ROAD TRANSPORT | Motorcycles > 50 cm3 | Urban driving | MOTOR GASOLINE | 0.00895525 | g |
| 0801 | OTHER MOBILE SOURCES AND MACHINERY | Military | | DIESEL OIL | 0.00100448 | g |
| 0801 | OTHER MOBILE SOURCES AND MACHINERY | Military | | JET FUEL | 0.00000000 | g |
| 0801 | OTHER MOBILE SOURCES AND MACHINERY | Military | | MOTOR GASOLINE | 0.00004908 | g |
| 0801 | OTHER MOBILE SOURCES AND MACHINERY | Military | | AVIAT. GASOLINE | 0.00003288 | g |
| 0802 | OTHER MOBILE SOURCES AND MACHINERY | Railways | | DIESEL OIL | 0.00210118 | g |
| 0803 | OTHER MOBILE SOURCES AND MACHINERY | Inland waterways | | DIESEL OIL | 0.00071236 | g |
| 0803 | OTHER MOBILE SOURCES AND MACHINERY | Inland waterways | | MOTOR GASOLINE | 0.00206433 | g |
| 080402 | OTHER MOBILE SOURCES AND MACHINERY | Maritime activities | National sea traffic within EMEP area | RESIDUAL OIL | 0.02240463 | g |
| 080402 | OTHER MOBILE SOURCES AND MACHINERY | Maritime activities | National sea traffic within EMEP area | GAS OIL | 0.04159560 | g |
| 080403 | OTHER MOBILE SOURCES AND MACHINERY | Maritime activities | National fishing | RESIDUAL OIL | 0.00046806 | g |
| 080403 | OTHER MOBILE SOURCES AND MACHINERY | Maritime activities | National fishing | GAS OIL | 0.07608434 | g |
| 080403 | OTHER MOBILE SOURCES AND MACHINERY | Maritime activities | National fishing | MOTOR GASOLINE | 0.00000000 | g |

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|---|---|---|---|---|---|---|
| 080404 | OTHER MOBILE SOURCES AND MA-CHINERY | Maritime activities | International sea traffic (international bun-kers)(h) | RESIDUAL OIL | 0.23214022 | g |
| 080404 | OTHER MOBILE SOURCES AND MA-CHINERY | Maritime activities | International sea traffic (international bun-kers)(h) | GAS OIL | 0.19398645 | g |
| 080501 | OTHER MOBILE SOURCES AND MA-CHINERY | Air traffic | Domestic airport traffic (LTO cycles - <1000 m) | JET FUEL | 0.00000000 | g |
| 080501 | OTHER MOBILE SOURCES AND MA-CHINERY | Air traffic | Domestic airport traffic (LTO cycles - <1000 m) | JET FUEL | 0.00000000 | g |
| 080501 | OTHER MOBILE SOURCES AND MA-CHINERY | Air traffic | Domestic airport traffic (LTO cycles - <1000 m) | AVIAT. GASOLINE | 0.00048930 | g |
| 080501 | OTHER MOBILE SOURCES AND MA-CHINERY | Air traffic | Domestic airport traffic (LTO cycles - <1000 m) | AVIAT. GASOLINE | 0.00000397 | g |
| 080502 | OTHER MOBILE SOURCES AND MA-CHINERY | Air traffic | International airport traffic (LTO cycles - <1000 m) | JET FUEL | 0.00000000 | g |
| 080502 | OTHER MOBILE SOURCES AND MA-CHINERY | Air traffic | International airport traffic (LTO cycles - <1000 m) | JET FUEL | 0.00000000 | g |
| 080502 | OTHER MOBILE SOURCES AND MA-CHINERY | Air traffic | International airport traffic (LTO cycles - <1000 m) | AVIAT. GASOLINE | 0.00003612 | g |
| 080502 | OTHER MOBILE SOURCES AND MA-CHINERY | Air traffic | International airport traffic (LTO cycles - <1000 m) | AVIAT. GASOLINE | 0.00000575 | g |
| 080503 | OTHER MOBILE SOURCES AND MA-CHINERY | Air traffic | Domestic cruise traffic (>1000 m) | JET FUEL | 0.00000000 | g |
| 080503 | OTHER MOBILE SOURCES AND MA-CHINERY | Air traffic | Domestic cruise traffic (>1000 m) | JET FUEL | 0.00000000 | g |
| 080504 | OTHER MOBILE SOURCES AND MA-CHINERY | Air traffic | International cruise traffic (>1000 m)(i) | JET FUEL | 0.00000000 | g |
| 080504 | OTHER MOBILE SOURCES AND MA-CHINERY | Air traffic | International cruise traffic (>1000 m)(i) | JET FUEL | 0.00000000 | g |
| 0806 | OTHER MOBILE SOURCES AND MA-CHINERY | Agriculture | | DIESEL OIL | 0.00955278 | g |
| 0806 | OTHER MOBILE SOURCES AND MA-CHINERY | Agriculture | | MOTOR GASOLINE | 0.00159098 | g |
| 0807 | OTHER MOBILE SOURCES AND MA-CHINERY | Forestry | | DIESEL OIL | 0.00011312 | g |
| 0807 | OTHER MOBILE SOURCES AND MA-CHINERY | Forestry | | MOTOR GASOLINE | 0.00039661 | g |

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|---|---|---|---|---|---|---|
| 0808 | OTHER MOBILE SOURCES AND MACHINERY | Industry | | DIESEL OIL | 0.00798189 | g |
| 0808 | OTHER MOBILE SOURCES AND MACHINERY | Industry | | MOTOR GASOLINE | 0.00085439 | g |
| 0809 | OTHER MOBILE SOURCES AND MACHINERY | Household and gardening | | MOTOR GASOLINE | 0.02082792 | g |
| 090203 | WASTE TREATMENT AND DISPOSAL | Waste incineration | Flaring in oil refinery | REFINERY GAS | 0.00000737 | g |
| 090206 | WASTE TREATMENT AND DISPOSAL | Waste incineration | Flaring in gas and oil extraction | NATURAL GAS | 0.00025750 | g |

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The present Danish dioxin air emission inventory shows that the emission has been reduced from 68.6 g I-TEQ in 1990 to 22.0 g I-TEQ in 2004, or about 68% over this period. Most of the significant reductions have been achieved in the industrial sector, where emissions have been reduced from 14.67 g I-TEQ in 1990 to 0.17 g I-TEQ in 2004; a reduction of almost 99%. Lower emissions from steel and aluminium reclamation industries form the major part of the reduction within industry. Emissions from waste incineration reduced from 32.5 g I-TEQ in 1990 to 2.1 g I-TEQ in 2004; which is approx. 94%. This is due to installation of dioxin abatement equipment in incineration plants. The most important source of emission in 2004 is residential wood combus-tion, at 8.5 g I-TEQ, or around 40% of the total emission. In 2004, accidental fires, which are es-timated to emit 6.1 g I-TEQ/year, are the second most important source, contributing with around 28% of the total emission. The present dioxin emission inventory for Denmark shows how emissions in 2004 come from sources other than waste incineration plants and industry, which were the largest sources in 1990.

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