umweltbundesamt

AUSTRIA'S ANNUAL AIR EMISSION INVENTORY 1980 - 2006

Submission under the UNECE Convention on Long-range Transboundary Air Pollution

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EXECUTIVE SUMMARY

As a party to the UNECE Convention on Long Range Transboundary Air Pollution (LRTAP) Austria is required to annually report data on emissions of air pollutants covered in the Convention and its Protocols: these are the main pollutants NO_x, SO_2, NMVOC, NH_3 and CO, Particulate Matter (PM), Persistent Organic Pollutants (POPs) and Heavy Metals (HM). To be able to meet this reporting requirement Austria compiles an Air Emission Inventory ("Österreichische Luftschadstoff-Inventur – OLI") which is updated annually. The preparation and review of Austria's Air Emission Inventory are the responsibility of the Department Emissions & Climate Change of the Umweltbundesamt.

The emission data presented in this report were compiled according to the guidelines for estimating and reporting emission data (EB.AIR/GE.1/2002/7), which define the format of reporting emission data (Nomenclature For Reporting – NFR) as well as standards for providing supporting documentation which should ensure the transparency of the inventory.

The complete set of tables in the NFR format, including sectoral reports, sectoral background tables and footnotes to the NFR tables, are submitted separately in digital form only. A summary of emission data is presented in the Annex to this report.

The report at hand complements the reported emission data by providing background information. It follows the template for a "minimum version" of the "Informative Inventory Report" (IIR) as elaborated by the LRTAP Convention's "Task Force on Emission Inventories and Projections" (TFEIP).

The first chapter of this report provides general information on the institutional arrangements for inventory preparation, on the inventory preparation process, methodologies and data sources used and on QA/QC activities. Furthermore it presents the key source analysis and gives information on completeness and uncertainty of emission estimates.

Chapter 2 gives information on reduction or stabilization targets as set out in the Protocols to the Convention compared to actual emission trends.

The third chapter presents major changes (so called "recalculations") related to the previous submission (emission data report 2007 under the UNECE/LRTAP Convention) which are the result of continuous improvement of Austria's Air Emission Inventory. Data presented in this report replace data reported earlier under the reporting framework of the UNECE/LRTAP Convention.

Comprehensive information on methodological issues for each sector and pollutant will be given in "Austria's Informative Inventory Report (IIR) 2008" that will be published and submitted to the UNECE in May 2008.

1 INTRODUCTION

1.1 Institutional Arrangement for Inventory Preparation

Austria, as a party to the UNECE Convention on Long-range Transboundary Air Pollution (LRTAP)[1], has to report its national emissions of air pollutants annually. The formal reporting responsibility lies with the Minister for Agriculture, Forestry, Environment and Water Management[2].

Umweltbundesamt, as the federal environment agency in Austria, has been designated as single national entity responsible for the preparation of the annual air pollutant inventory by law. The Environmental Control Act[3] regulates responsibilities of environmental control in Austria and lists the tasks of the Umweltbundesamt. One task is to provide technical expertise and the data basis for the fulfilment of the emission related reporting obligations under the UNECE LRTAP Convention. To that end, the Umweltbundesamt prepares and annually updates the Austrian air emissions inventory („Österreichische Luftschadstoff-Inventur – OLI"), which covers greenhouse gases (GHG) and emissions of other air pollutants as stipulated in the reporting obligations further explained in the following chapters.

For the Umweltbundesamt a national air emission inventory that identifies and quantifies the sources of pollutants in a consistent manner is of a high priority. Such an inventory provides a common means for comparing the relative contribution of different emission sources and hence can be a basis for policies to reduce emissions.

Within the Umweltbundesamt, the department Emissions & Climate Change is responsible for the preparation of the inventory[4] and all work related to inventory preparation.

Umweltbundesamt is an ISO 17020 accredited inspection body for Greenhouse Gas Inventories (Id. No. 241) in accordance with the Austrian Accreditation Law (AkkG)[5] by decree of the Minister of Economics and Labour (BMWA), issued on 19.01.2006, valid from 23.12.2005.[6] The requirements of EN ISO/IEC 17020 (Type A)[7] are fulfilled.

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1 http://www.unece.org/env/lrtap/

2 http://www.lebensministerium.at/

3 Umweltkontrollgesetz; Federal Law Gazette 152/1998
http://www.umweltbundesamt.at/fileadmin/site/umweltkontrolle/gesetze/ukg.pdf

4 http://www.umweltbundesamt.at/umweltschutz/luft/emissionsinventur/

5 Federal Law Gazette No. 468/1992 last amended by federal law gazette I No. 85/2002, by decree of the Minister of Economics and Labour, No. BMWA- 92.715/0036-I/12/2005, issued on 19 January, valid from 23 December 2005.
http://www.bmwa.gv.at/NR/rdonlyres/4E4C573C-4628-4B05-9DB6-D0A7C6E7EF81/216/Akkreditierungsgesetz_Englisch1.pdf

6 http://www.bmwa.gv.at/NR/rdonlyres/E956BE3D-B8A9-4922-9A2A-420182E8ED7A/22576/Akkrd.pdf

7 http://www.bmwa.gv.at/NR/rdonlyres/3F9073D6-1F51-4AB7-BBD3-687B82EC0479/0/LeitfadenL10zurAnwendungderISO17020V2.pdf

1.1.1 Austria's Obligations

Austria has to comply with the following air emission related obligations:

- Austria's obligation under the UNECE Convention on Long-range Transboundary Air Pollution (LRTAP): Austria signed the convention in 1979; since its entry into force in 1983 the Convention has been extended by eight protocols which identify specific obligations or measures to be taken by Parties. These obligations as well as information regarding the status of ratification are listed in Table 1.

Table 1: Protocols of UNECE Convention on Long-range Transboundary Air Pollution (LRTAP).

	Tools of UNECE Convention on Long-range Transboundary Air Pollution (LRTAP)	Parties	entered into force	signed/ratified by Austria
1984	Geneva Protocol on Long-term Financing of the Cooperative Programme for Monitoring and Evaluation of the Long-range Transmission of Air Pollutants in Europe (EMEP)	41	28.01.1988	16.12.1982 (r)
1985	Helsinki Protocol on the Reduction of Sulphur Emissions or their Transboundary Fluxes by at least 30 per cent	22	02.09.1987	09.07.1985 (s) 04.06.1987 (r)
1988	Sofia Protocol concerning the Control of Nitrogen Oxides or their Transboundary Fluxes	28	14.02.1991	01.11.1988 (s) 15.01.1990 (r)
1991	Geneva Protocol concerning the Control of Emissions of Volatile Organic Compounds or their Transboundary Fluxes	21	29.09.1997	19.11.1991 (s) 23.08.1994 (r)
1994	Oslo Protocol on Further Reduction of Sulphur Emissions	25	05.08.1998	14.06.1994 (s) 27.08.1998 (r)
1998	Aarhus Protocol on Heavy Metals	27	29.12.2003	24.06.1998 (s) 17.12.2003 (r)
1998	Aarhus Protocol on Persistent Organic Pollutants (POPs)	23	23.10.2003	24.06.1998 (s) 27.08.2002 (r)
1999	The 1999 Gothenburg Protocol to Abate Acidification, Eutrophication and Ground-level Ozone	18	17.05.2005	01.12.1999 (s)

Abbreviation: signed (s) / ratified (r)

Source: **http://www.unece.org/env/lrtap/welcome.html**

- Austria's annual obligations under the Directive 2001/81/EC of the European Parliament and of the Council of 23.10.2001 on national emission ceilings for certain atmospheric pollutants (NEC-Directive).[8] The Austrian implementation of the European NEC-Directive[9] also entails the obligation for a national emissions inventory of the covered air pollutants NO_x, SO_2, NMVOC and NH_3.
- Austria's annual obligations under the European Council Decision 280/2004/EC[10] "Monitoring Decision" (replacing Decision 389/1992/EEC amended by Decision 296/1999/EEC) concerning a mechanism for monitoring Community greenhouse gas emissions and for implementing the Kyoto Protocol.

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[8] http://www.umweltbundesamt.at/fileadmin/site/umweltthemen/luft/Richtlinie_2001.81.EG.pdf

[9] Emissionshöchstmengengesetz- Luft *EG-L* (*air emissions ceilings law*) BGBl, I, 34/2003
http://www.umweltbundesamt.at/fileadmin/site/umweltkontrolle/gesetze/EG-L.pdf

[10] http://europa.eu.int/eur-lex/pri/de/oj/dat/2004/l_049/l_04920040219de00010008.pdf

- Austria's obligation under the „United Nations Framework Convention on Climate Change (UNFCCC) (1992)[11] and the Kyoto Protocol (1997)[12].
- Obligation under the Austrian "ambient air quality law"[13] comprising the reporting of national emission data on SO_2, NO_x, NMVOC, CO, heavy metals (Pb, Cd, Hg), benzene and particulate matter (PM).
- Austria's obligation according to Article 15 of the European IPPC Directive 1996/61/EC[14] is to implement a European Pollutant Emission Register (EPER)[15]. Article 15 of the IPPC Directive can be associated with Article 6 of the Aarhus Convention[16] (United Nations: Aarhus 1998) which refers to the right of the public to access environmental information and to participate in the decision-making process of environmental issues.

1.1.2 National Inventory System Austria (NISA)

Regulations under the UNECE/LRTAP Convention and its Protocols define standards for the preparation of and reporting on national emission inventories. In 2002, the Executive Body adopted new guidelines for estimating and reporting emission data to ensure that the transparency, consistency, comparability, completeness and accuracy of reported emissions are adequate for current LRTAP needs (EB.AIR/GE.1/2002/7[17] and its supporting addendum).

The Austrian air emission inventory (OLI) covers all pollutants, i.e. air pollutants reported to UNECE and greenhouse gases as reported to the UNFCCC to streamline efforts and benefit from a common approach to inventory preparation in one single National Inventory System for Austria (NISA).

It is designed to comply with the (in general more stringent) standards for national emission inventories under the UNFCCC and the Kyoto Protocol and also meets all the requirements of the LRTAP Convention and other reporting obligations as presented above (chapter 1.1.1).

The "National Inventory System Austria" (NISA) includes all institutional, legal and procedural arrangements made for the preparation of emission inventories and for reporting and archiving inventory information and should ensure the quality of the inventory: timeliness, transparency, consistency, comparability, completeness and accuracy.

As there are many different obligations which are subject to continuous development, Austria's National Inventory System (NISA) has to be adapted continually to these changes. The present structure is illustrated in Figure 1.

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[11] http://unfccc.int/files/essential_background/convention/status_of_ratification/application/pdf/ratlist.pdf

[12] http://unfccc.int/files/essential_background/kyoto_protocol/application/pdf/kpstats.pdf

[13] Immissionsschutzgesetz-Luft *IG-L* (*ambient air quality law*) BGBl, I, 115/1997 http://www.umweltbundesamt.at/fileadmin/site/umweltkontrolle/gesetze/2001-IG-L.pdf

[14] http://eippcb.jrc.es/pages/Directive.htm

[15] see www.umweltbundesamt.at/eper/

[16] http://www.unece.org/env/pp/

[17] http://www.unece.org/env/eb/welcome.20.html

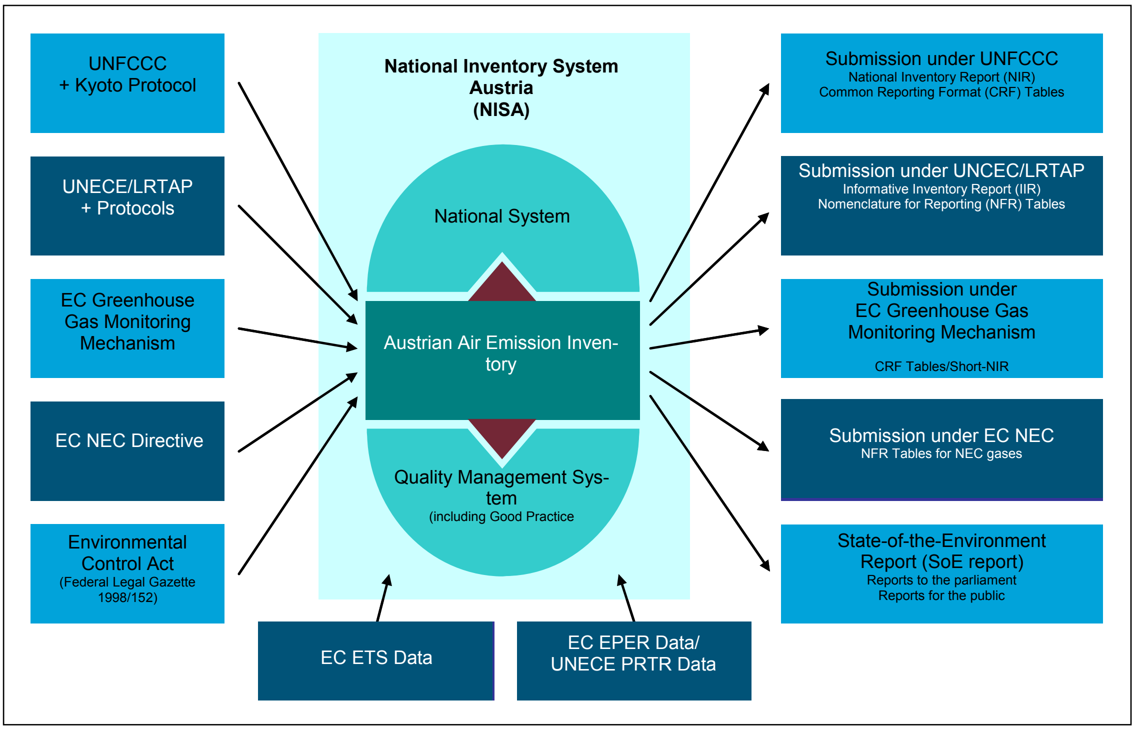

Figure 1: Structure of National Emission Inventory System Austria (NISA).

As illustrated in Figure 1 the Austrian Air Emission Inventory comprising all air pollutants stipulated by various national and international obligations is the centre of NISA. The national system as required under the Kyoto Protocol and the Quality Management System (ISO/IEC 17020) are incorporated into NISA as complementary sections.

A brief history of the development and the activities of NISA is given below:

- Austria established measurements for SO_2 under EMEP in 1978 (Cooperative Programme for Monitoring and Evaluation of the Long-range Transmission of Air Pollutants in Europe) and joined the UNECE in 1983. At that time Austria reported mainly SO_2 emissions.
- As an EFTA[18] country Austria participated in CORINAIR 90, which was an air emission inventory for Europe. It was part of the CORINE[19] work plan set up by the European Council of Ministers in 1985. The aim of CORINAIR 90[20] was to produce a complete, consistent and transparent emission inventory for the pollutants: SO_x as SO_2, NO_x as NO_2, NMVOC, CH_4, CO, CO_2, N_2O and NH_3.
- As a Party to the Convention, Austria signed the UNFCCC on June 8th, 1992 and subsequently submitted its instrument of ratification on February 28th, 1994.[21]
- In 1994 the first so-called Austrian Air Emission Inventory (OLI) was carried out.

[18] European Free Trade Association; http://www.efta.int/

[19] Coordination d'Information Environmentale

[20] http://reports.eea.eu.int/92-9167-036-7/en

[21] http://unfccc.int/parties_and_observers/parties/items/2146.php

- In 1997 emission data were reported for a time period (for each of the years from 1980 to 1995) for the first time.
- In 1998 also emissions of heavy metals, POPs and fluorinated compounds (SF_6, PFCs, HFCs) were included in the inventory.
- Inventory data for particulate matter (PM) were included in the inventory in 2001.

For more details on NISA see the report "NISA – NATIONAL INVENTORY SYSTEM AUSTRIA – Implementation Report"[22] which presents an overview of NISA and evaluates its compliance with the guidelines for national systems under Article 5, paragraph 1, of the Kyoto Protocol as specified under the Marrakesh Accord (decision 20/CP.7)[23].

1.1.3 Reporting obligation under the UNECE/LRTAP Convention and its Protocols

As a minimum requirement, each Party shall report on emissions of the substances relevant to the Protocol to which they are a Party, as required by that Protocol. Since Austria has signed all eight protocols of the UNECE/LRTAP Convention, the annual reporting obligation enfolds emission data of four groups: main pollutants, particulate matter (PM), heavy metals, and POPs. Table 2 gives the present set of components which have to be reported (minimum) and which can be reported voluntarily (additional).

Table 2: Emission Reporting Programme: YEARLY (MINIMUM and ADDITIONAL).

YEARLY	Components (Minimum and ***additional***)	Reporting years
A. National totals		
1. Main pollutants	SO_x, NO_x, NH_3, NMVOC, CO	from 1980 to 2006
2. Particulate matter	PM2,5, PM10, TSP	for 1990, 1995, and for 1999 to 2006
3. Heavy metals	Pb, Cd, Hg, *As, Cr, Cu, Ni, Se, Zn*	from 1990 to 2006
4. POPs	aldrin, chlordane, chlordecone, DDT, dieldrin, endrin, heptachlor, hexachlorobenzene (HCB), mirex, toxaphene, hexachlor-ocyclohexane (HCH), hexabromobiphenyl, polychlorinated biphenyls (PCBs), dioxins/furans (PCDD/F), polycyclic aromatic hydrocarbons (PAHs), short-chain chlorinated paraffins (SCCP), pentachlorophenol (PCP)	from 1990 to 2006
B. Sector emissions		
1. Main pollutants	SO_x, NO_x, NH_3, NMVOC, CO	from 1980 to 2006
2. Particulate matter	PM2,5, PM10, TSP	for 1990, 1995, and for 1999 to 2006
3. Heavy metals	Pb, Cd, Hg, *As, Cr, Cu, Ni, Se, Zn*	from 1990 to 2006
4. POPs	aldrin, chlordane, chlordecone, DDT, dieldrin, endrin, heptachlor, HCB, mirex, toxaphene, HCH, hexabromobiphenyl, PCBs, PCDD/F, PAHs, SCCP, PCP	from 1990 to 2006

[22] http://www.umweltbundesamt.at/fileadmin/site/publikationen/REP0004.pdf

[23] http://unfccc.int/cop7/accords_draft.pdf

Table 3: Emission Reporting Programme: 5-YEARLY (MINIMUM and ADDITIONAL as well as FOR REVIEW AND ASSESSMENT PURPOSES).

5-YEARLY: MINIMUM REPORTING		
C. Gridded data in the EMEP 50x50 km² grid		
1. National totals 2. Sector emissions	Main pollutants, PM, Pb, Cd, Hg, PAHs, HCB, dioxins/furans	1990, 1995, 2000, 2005 (PM: 2000)
D. Emissions from large point sources		
	Main pollutants, HM, PCDD/F, PAH, HCB, PM	2000, 2005
E. Historical and Projected activity data and projected national total emissions		
1. National total emissions	See table IV 2A in EB/AIR/GE.1/2002/7	2010, 2015, 2020
2. Energy consumption	See tables IV 2B, 2C in EB.AIR/GE.1/2002/7	1990, 1995, 2000, 2005, 2010, 2015 and 2020
3. Energy consumption for transport sector	See table IV 2D in EB.AIR/GE.1/2002/7	1990, 1995, 2000, 2005, 2010, 2015 and 2020
4. Agricultural activity	See table IV 2E in EB.AIR/GE.1/2002/7	1990, 1995, 2000, 2005, 2010, 2015 and 2020
5-YEARLY: ADDITIONAL REPORTING/FOR REVIEW AND ASSESSMENT PURPOSES		
VOC speciation/Height distribution/Temporal distribution Land-use data/Mercury breakdown % of toxic congeners of PCDD/F emissions Pre-1990 emissions of PAHs, HCB, PCDD/F and PCB Information on natural emissions	Parties are encouraged to review the information used for modelling at the Meteorological Synthesizing Centres available for review at http://webdab.emep.int/ and the Additional Reporting Tables	

Emission estimates should be prepared using the methodologies agreed upon by the Executive Body. These are in particular:

- EMEP/CORINAIR Emission Inventory Guidebook
  - 3rd edition October 2002 UPDATE. Technical report No 30[24]
  - 2006, Technical report No 11/2006[25]
  - 2007, Technical report No 16/2007.[26]
- EEA core set of indicators – Guide, Technical report No 1/2005[27]
- Recommendations for Revised Data Systems for Air Emission Inventories, Topic report No 12/1996[28]
- Guidance Report on preliminary assessment under EC air quality directives, Technical report No 11[29].

[24] http://reports.eea.europa.eu/EMEPCORINAIR3/en/page002.html

[25] http://reports.eea.eu.int/EMEPCORINAIR3/en

[26] http://reports.eea.europa.eu/EMEPCORINAIR5/en/page002.html

[27] http://reports.eea.eu.int/technical_report_2005_1/en

[28] http://reports.eea.eu.int/92-9167-033-2/en

[29] http://reports.eea.eu.int/TEC11a/en/tab_relations_RLR

Further other internationally applied methodologies and guidelines including:

- Integrated Pollution Prevention and Control (IPPC)[30] and European Pollutant Emission Register (EPER)[31]
- IPPC Best Available Techniques Reference Documents[32]
- Guidelines for Emission Inventory Reporting from the Large Combustion Plant Directive[33]
- Organization for Economic Co-operation and Development (OECD) and Pollution Release and Transfer Register (PRTR) Guidance[34]
- Revised 1996 Intergovernmental Panel on Climate Change (IPCC) Guidelines for National Greenhouse Gas Inventories[35] and the IPCC Good Practice Guidance[36]
- 2006 IPCC Guidelines for National Greenhouse Gas Inventories[37].

1.2 Inventory Preparation Process

The present Austrian Air Pollutant Inventory for the period 1980 to 2006 was compiled according to the recommendations for inventories as set out by the UNECE Executive Body[38] in the guidelines mentioned above.

The preparation of the inventory includes the following three stages as illustrated below.

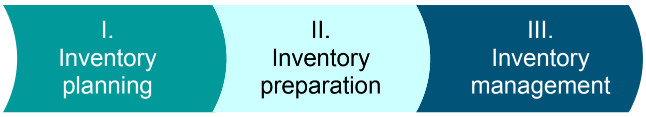

Figure 2: Three stages of inventory preparation.

I. Inventory planning

In the first stage specific responsibilities are defined and allocated: as mentioned before, the Umweltbundesamt has the overall responsibility for the national inventory, comprising greenhouse gases as well as other air pollutants.

Inventory planning also includes planning of how to distribute available resources, and thus, as resources are limited, also includes a prioritization of planned improvements. Considerations on which part of the inventory (in terms of pollutants and/or sectors) to focus efforts to improve the inventory include political or public awareness due to current environmental problems or emission reduction limits that are hard to meet. A tool to prioritize between sectors within the inven-

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30 http://eippcb.jrc.es/ and http://europa.eu.int/comm/environment/ippc/index.htm

31 http://www.eper.cec.eu.int/eper/default.asp

32 http://eippcb.jrc.es/pages/FActivities.htm

33 http://rod.eionet.eu.int/show.jsv?id=9&aid=500&mode=A

34 http://www.oecd.org/department/0,2688,en_2649_34411_1_1_1_1_1,00.html

35 http://www.ipcc-nggip.iges.or.jp/public/gl/invs1.htm

36 http://www.ipcc-nggip.iges.or.jp/public/gp/english/

37 http://www.ipcc-nggip.iges.or.jp/public/2006gl/index.htm

38 http://www.unece.org/env/eb/welcome.html

tory is the key source analysis, where efforts are focused on important sources/sectors in terms of emissions, trends or concerning the influence on the overall quality of the inventory.

In the Austrian improvement programme emphasis has been laid on the so-called NEC gases SO_x, NO_x, NMVOC, and NH_3 where continuous efforts have been taken to improve the inventory. However, in the previous year, emissions from HM, PM and POPs have been re-evaluated and updated where possible.

Within the inventory system specific responsibilities for the different emission source categories are defined ("sector experts") as well as for all activities related to the preparation of the inventory, including QA/QC, data management and reporting.

Emissions of air pollutants are estimated together with greenhouse gases in a single data base based on the CORINAIR[39] systematic, which was formerly also used as reporting format under the UNECE. This nomenclature was designed by the ETC/ACC[40] to estimate emissions of all kind of air pollutants as well as greenhouse gases.

The CORINAIR system's nomenclature is called SNAP[41], which may be expanded to adapt to national circumstances by so-called SPLIT codes, and additionally each SNAP/SPLIT category can be extended using a fuel code.

II. Inventory preparation

In the second stage, the inventory preparation process, sector experts collect activity data, emission factors and all relevant information needed for finally estimating emissions. The sector experts are also responsible for methodological choices and for contracting studies, if needed.

As the source of emission factors and/or the methodology of emission estimation for HM, POPs and PM is different compared to the "main" pollutants for a lot of source categories, emission inventories for these pollutants were prepared in studies that were contracted out; however, the incorporation into the inventory system and the update of emission calculations for subsequent years is the responsibility of the sector experts.

All data collected together with emission estimates are fed into a database (see below), where data sources are documented for future reconstruction of the inventory.

As mentioned above, the Austrian Inventory is based on the SNAP systematic, and has to be transformed into the current reporting format under the LRTAP Convention – the NFR[42] format. Additionally to actual emission data also background tables of the NFR are filled in by the sector experts, and finally QA/QC procedures as defined in the inventory planning process are carried out before the data is submitted under the UNECE/LRTAP.

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[39] CORINAIR: CORINE - CO-oRdination d'INformation Environnementale and include a project to gather and organise information on emissions into the air relevant to acid deposition; Council Decision 85/338/EEC (OJ, 1985)

[40] European Topic Centre on Air Emissions http://air-climate.eionet.europa.eu/

[41] **SNAP** (Selected Nomenclature for sources of Air Pollution) 90 or 97respectivley means the stage of development

[42] **NFR** – Nomenclature For Reporting - is a classification system developed by the UN/ECE TFEIP for the Reporting Guidelines described in eb.air.ge.1.2001.6.e.doc

III. Inventory management

For the inventory management a reliable data management to fulfil the data collecting and reporting requirements is needed. As mentioned above, data collection is performed by the different sector experts and the reporting requirements grow rapidly and may change over time.

Data management is carried out by using MS Excel™ spreadsheets in combination with Visual Basic™ macros, which is a very flexible system that can easily be adjusted to new requirements. The data is stored on a central network server which is backed up daily for the needs of data security. The inventory management also includes quality management (see Chapter 1.5) as well as documentation on QA/QC activities.

1.3 Methodologies and Data Sources Used

For large point sources the Umweltbundesamt preferably uses – after careful assessment of plausibility of this data – emission data that are reported by the "operator" of the source because these data usually reflect the actual emissions better than data calculated using general emission factors, as the operator has the best information about the actual circumstances.

If such data is not available, and for area sources, national emission factors are used or, if there are no national emission factors, international emission factors are used to estimate emissions. Where no applicable data is found, standard emission factors e.g. from the CORINAIR Guidebook are applied.

The following table presents the main data sources for activity data as well as information on who did the actual calculations.

Table 4: Main data sources for activity data and emission values.

Sector	Data Sources for Activity Data	Emission Calculation
Energy	• energy balance[43] from STATISTIK AUSTRIA[44] • EU-ETS[45] • steam boiler data base[46] administrated by UMWELTBUNDESAMT • data from industry[47] • national studies	Umweltbundesamt, plant operators
Industry	• national production statistics from STATISTIK AUSTRIA • import/export statistics from STATISTIK AUSTRIA • EU-ETS[45] • direct information from industry • direct information from associations of industry	Umweltbundesamt, plant operators
Solvent and Other Product Use	• production statistics • consumption statistics • import/export statistics } from STATISTIK AUSTRIA	Contractors: Forschungsinstitut für Energie u. Umweltplanung, Wirtschaft und Marktanalysen/Institut für industrielle Ökologie (IIÖ)[48]
Agriculture	• national agricultural statistics „Grüner Bericht"[49] from STATISTIK AUSTRIA • national report on water protection „Gewässerschutzbericht" from LEBENSMINISTERIUM[50] • national studies • direct information from agricultural association	Contractors: University of Natural Resources and Applied Life Sciences, Research Center Seibersdorf, Austria
Waste	• database on landfills administrated by UMWELTBUNDESAMT • National reports from STATISTIK AUSTRIA • sewage plant inventory administrated by UMWELTBUNDESAMT • national report on water protection „Gewässerschutz bericht" from LEBENSMINISTERIUM[50]	Umweltbundesamt

[43] compatible with requirements of the International Energy Agency (IEA Joint Questionnaires)

[44] STATISTIK AUSTRIA (2006): Energiebilanzen 1970 (1988) - 2005: Dokumentation der Methodik. Wien. http://www.statistik.at/web_de/wcmsprod/groups/gd/documents/stddok/023997.pdf#pagemode=bookmarks

[45] European Union Greenhouse Gas Emission Trading Scheme

[46] reporting obligation to § 10 (7) of LRG-K; data are used to verify the data from the national energy balance

[47] Data are used to verify the data from the national energy balance.

[48] Research Institute for Energy and Environmental Planning, Economy and Market Analysis Ltd./Institute for Industrial Ecology, Austria

[49] http://www.gruenerbericht.at/cms/index.php

[50] http://www.wassernet.at/article/articleview/20149/1/5728

1.3.1 Main Data Suppliers

STATISTIK AUSTRIA

- The main data supplier for the Austrian air emission inventory is *STATISTIK AUSTRIA*[51], which provides the underlying energy data. The Austrian energy balances are based on several databases mainly prepared by the Ministry of Economic Affairs and Labour[52], „Bundeslastverteiler" and STATISTIK AUSTRIA. Their methodology follows the International Energy Agency (IEA)[53] and Eurostat[54] conventions. The aggregates of the balances, for example transformation input and output or final energy use, are harmonised with the IEA tables as well as their sectoral breakdown which follows the NACE[55] classification.
- Activity data for some sources is obtained from STATISTIK AUSTRIA which provides statistics on production data[56]. The methodology of the statistics changed in 1996, no data is available for that year and there are some product groups that are not reported anymore in the new statistics.
- Activity data needed for the calculation of non energetic emissions are based on several statistics collected by STATISTIK AUSTRIA and national and international studies.
- Activity data for Solvent and Other Product Use are based on import/export statistics also prepared by STATISTIK AUSTRIA.

INFORMATION FROM INDUSTRY

- Activity data and emission values for some sub categories in the industry sector are obtained from association of industries or directly from individual plants. If emission data are reported (e.g. by the plant owner) this data is – after assessment of plausibility – taken over into the inventory.

DATABASES

- Operators of steam boilers with more than 50 MW report their NO_x, SO_2, CO and TSP emissions and their activity data directly to the steam boiler data base administrated by the Umweltbundesamt (see Table 4).
- Operators of landfill sites also report their activity data directly to Umweltbundesamt. Emissions for the years 1998–2005 are calculated on the basis of these data.
- EPER: The European Pollutant Emission Register (EPER) is the first Europe-wide register for emissions from industrial facilities both to air and to water. The legal basis of EPER is Article 15 of the IPPC Directive (EPER Decision 2000/479/EG)[57], the scope is to provide information to the public[58].

  It is covering 50 pollutants including NO_x, SO_2, NMVOC, NH_3, CO, heavy metals, POPs and particulate matter (PM). However, emissions only have to be reported if they exceed certain thresholds.

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[51] www.statistik.at

[52] Bundesministerium für Wirtschaft und Arbeit (BMWA); www.bmwa.gv.at

[53] http://www.iea.org/

[54] www.europa.eu.int/comm/eurostat/

[55] Classification of Economic Activities in the European Community

[56] "Industrie und Gewerbestatistik" published by STATISTIK AUSTRIA for the years until 1995; "Konjunkturstatistik im produzierenden Bereich" published by STATISTIK AUSTRIA for the years 1997 to 2005.

[57] http://www.umweltbundesamt.at/fileadmin/site/daten/EPER/EPER_Entscheidung_EK.pdf

[58] data can be obtained from: http://www.umweltbundesamt.at/eper/

The Umweltbundesamt implemented EPER in Austria using an electronic system that enabled the facilities and the authorities to fulfil the requirements of the EPER decision electronically via the internet.

The Austrian industrial facilities had to report their annual emissions of the year 2001 or 2002 and 2004. There were about 400 facilities in Austria that had to report to EPER. As the thresholds for reporting emissions are relatively high only about 130 of them reported emissions according to the EPER Regulation. The plausibility of the reports is checked by competent authorities. The Umweltbundesamt finally checked the data for completeness and consistency with the national inventory.

However, data from EPER could not be used as data source for the national inventory. The EPER report only contains very little information beyond the emission data, the only information included is whether emissions are estimated, measured or calculated, also included is one activity value that is often not useful in the context of emissions. Additionally emission information of EPER is not complete regarding NFR sectors, and it is difficult to include this point source information when no background information (such as fuel consumption data) is available.

Thus the top-down approach of the national inventory was considered more reliable and data of EPER was not used as point source data for the national inventory but for verification purposes only.

LITERATURE

- National and sometimes international studies are also used as data suppliers (references are given in the sector analysis chapters).

Studies on HM, POPs and PM emissions

Emissions of HM and some POPs have already been estimated in the course of CORINAIR 1990 and 1994, respectively[59]. With these data and other Austrian publications as a basis comprehensive emission inventories of HM, POPs and PM for different years were prepared by contractors of the Umweltbundesamt and incorporated into the inventory system afterwards.

- WINDSPERGER, A. et. al. 1999: Entwicklung der Schwermetallemissionen – Abschätzung der Emissionen von Blei, Cadmium und Quecksilber für die Jahre 1985, 1990 und 1995 gemäß der CORINAIR-Systematik. Institut für Industrielle Ökologie und Österreichisches Forschungszentrum Seibersdorf. Wien. (Nicht veröffentlicht).

  Development of Heavy Metal Emissions – Estimation of emissions of Lead, Cadmium and Mercury for the years 1985, 1990 and 1995 according to the CORINAIR-systematics. Department for industrial ecology *and Austrian Research Centers Seibersdorf. Vienna. (not published).*

- Österreichische Emissionsinventur für Cadmium, Quecksilber und Blei.

  Austrian emission inventory for Cd, Hg and Pb 1995-2000 prepared by FTU – Forschungsgesellschaft Technischer Umweltschutz GmbH. Vienna November 2001 (not published).

- HÜBNER, C. 2001: Österreichische Emissionsinventur für POPs 1985–1999. FTU – Forschungsgesellschaft Technischer Umweltschutz GmbH. Werkvertrag des Umweltbundesamt, IB-650. Wien. (Nicht veröffentlicht).

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[59] ORTHOFER, R. (1996); HÜBNER, C. (1996); HÜBNER, C. & WURST, F. (1997); HÜBNER, C. (2000)

Austrian emission inventory for POPs 1985–1999. Prepared by FTU – Research Center Technical environment protection (Ltd.). Study commissioned by Umweltbundesamt IB-650. Vienna. (not published).

- WINIWARTER, W.; TRENKER, C.; HÖFLINGER, W. 2001: Österreichische Emissionsinventur für Staub. Österreichisches Forschungszentrum Seibersdorf. Wien.

  Austrian emission inventory for PM. Austrian Research Centers Seibersdorf. Vienna.

- WINIWARTER, W.; SCHMID-STEJSKAL, H. & WINDSPERGER, A. (2007): Aktualisierung und Verbesserung der österreischen Luftschadstoffinventur für Schwebstaub. Systems research – Austrian Research Centers &Institut für Industrielle Ökologie. Wien.

  Updating and Improvement of the Austrian Air Emission Inventory (OLI) for PM. Systems research – Austrian Research Centers & Department for industrial ecology. Vienna.

1.3.2 Summary of methodologies applied for estimating emissions

In Table 5 a summary of methodologies applied for estimating emissions is given.

The following abbreviations are used:

- D DEFAULT
- L Literature
- CS COUNTRY SPECIFIC
- PS PLANT SPECIFIC

Dark shaded cells indicate that no such emissions arise from this source; light shaded cells (green) indicate key sources.

Table 5: Summary of methodologies applied for estimating emissions.

NFR	Description	SO_2	NO_x	NMVOC	NH_3	CO	Cd	Hg	Pb	PAH	Diox	HCB	TSP	PM10	PM2.5
1 A 1 a	Public Electricity and Heat Production	PS, CS	PS, CS	CS	CS	PS, CS	D/CS	D/CS	D/CS	L/CS	L/CS	L/CS	PS, CS	PS, CS	PS, CS
1 A 1 b	Petroleum refining	PS	PS		CS	PS	CS	CS	CS	L/CS	L/CS	CS	PS	PS	PS
1 A 1 c	Manufac.of Solid fuels a. Oth. Energy Ind.		CS	CS	CS	CS					L/CS	CS	CS	CS	CS
1 A 2 mobile	Other mobile in industry	CS	CS	CS	CS	CS	CS	CS	CS	L/CS	L/CS	CS	CS	CS	CS
1 A 2 stat (l)	Manuf. Ind. & Constr. stationary LIQUID	PS, CS	PS, CS	PS, CS	CS	PS, CS	D/CS	D/CS	D/CS	L/CS	L/CS	CS	PS, CS	PS, CS	PS, CS
1 A 3 a	Civil Aviation	CS	CS	CS	CS	CS	CS	CS	CS				CS	CS	CS
1 A 3 b 1	R.T., Passenger cars	CS	CS	CS	CS	CS	CS	CS	CS	L/CS	L/CS	CS	CS	CS	CS
1 A 3 b 2	R.T., Light duty vehicles	CS	CS	CS	CS	CS	CS	CS	CS	L/CS	L/CS	CS	CS	CS	CS
1 A 3 b 3	R.T., Heavy duty vehicles	CS	CS	CS	CS	CS	CS	CS	CS	L/CS	L/CS	CS	CS	CS	CS
1 A 3 b 4	R.T., Mopeds & Motorcycles		CS	CS	CS	CS	CS	CS	CS	L/CS	L/CS	CS			
1 A 3 b 5	R.T., Gasoline evaporation			CS											
1 A 3 b 6	R.T., Automobile tyre and break wear						L						CS	CS	CS
1 A 3 c	Railways	CS	CS	CS	CS	CS	D/CS	D/CS	D/CS	L/CS	L/CS	CS	CS	CS	CS
1 A 3 d	Navigation	CS	CS	CS	CS	CS	CS	CS	CS	L/CS	L/CS	CS	CS	CS	CS
1 A 3 e	Other	NA	CS	CS	CS	CS						CS	CS	CS	CS
1 A 4 mob	Other Sectors –mobile	CS	CS	CS	CS	CS	CS	CS	CS	L/CS	L/CS	CS	CS	CS	CS
1 A 4 stat (b)	Other Sectors stationary BIOMASS	CS	CS	CS	CS	CS	D/CS	D/CS	D/CS	L/CS	L/CS	CS	CS	CS	CS
1 A 5	Other	CS	CS	CS	CS	CS	CS	CS	CS	L/CS	L/CS	CS	CS	CS	CS

NFR	Description	SO_2	NO_x	NMVOC	NH_3	CO	Cd	Hg	Pb	PAH	Diox	HCB	TSP	PM10	PM2.5
1 B	FUGITIVE EMISSIONS FROM FUELS	PS		D, PS									CS	CS	CS
2 A	MINERAL PRODUCTS					L							CS	CS	CS
2 B	CHEMICAL INDUSTRY	CS	CS	CS	PS	CS	CS	CS	CS				CS	CS	CS
2 C	METAL PRODUCTION	CS	CS	CS		CS	CS	CS	CS	CS	CS	CS	CS	CS	CS
2 D	OTHER PRODUCTION		CS	L		CS				CS	CS	CS	CS	CS	CS
2 G	OTHER				CS										
3	SOLVEN & OTHER PRODUCT USE			CS			PS		CS						
4 B 1	Cattle				CS										
4 B 3	Sheep				D										
4 B 4	Goats				D										
4 B 6	Horses				D										
4 B 8	Swine				CS										
4 B 9	Poultry				D										
4 B-13	Other				D										
4 D	AGRICULTURAL SOILS		D	D	D								L	L	L
4 F	FIELD BURNING OF AGRIC. RESIDUES	CS	CS	CS	D	CS	CS	CS	CS	CS	CS	CS			
4 G	Agriculture – Other												D	D	D
6	WASTE	CS	CS	CS	CS	CS	CS	CS	CS	CS	CS	CS	CS	CS	CS

1.4 Key Source Analysis

To help prioritising efforts in inventory preparation, the identification of key sources is a helpful tool. A key source is a source within an inventory which has a strong influence on the total inventory's properties such as the absolute emission level, the trend of emissions or the quality of the inventory regarding its certainty or uncertainty.

As stated in the "Good Practice Guidance for LRTAP Emission Inventories" (see Part B of the EMEP/CORINAIR Emission Inventory Guidebook, 3rd edition), the choice of parameter which is considered key also depends on the application of the inventory: for compliance assessments the trend is essential, whereas in the case that emission reporting obligations are formulated as emission ceilings, the emission level uncertainty is relevant.

However, quantitative uncertainties for the current inventory have not been assessed (for further information see Chapter 1.6). A simplified approach is to only analyse absolute emission levels, and according to the GPG for GHG inventories this quantitative approach is a so-called Tier 1 analysis, the "level assessment"[60].

In a first step, a level assessment for all pollutants reported to the LRTAP convention was performed and reported in this report. For the next years also a qualitative approach for the gases covered by the multi-effects protocol is planned ("Tier 2 analysis"). In this approach sources are identified whose uncertainty of emission levels has a significant effect on the total inventories uncertainty. As for these pollutants absolute emission ceilings have to be met, the uncertainty of reported emissions is – as mentioned above – essential.

Level Assessment

For the level assessment the contribution from each source (fraction of total emission) is listed and ranked until 95% of the total emission is accounted for. The analysis was made for the last year of the inventory (2006).

However, in a first step the source categories have to be aggregated according to applied methodologies: sources estimated using the same methodology and the same source of activity data and emission factors are aggregated.

Identification of Source Categories

This is an important step in terms of correlation of input data, which could otherwise falsify results of a key source analysis which usually assumes that input data are not dependent on each other.

A very detailed analysis e.g. on the level of detail given in the NFR might result in many categories with the same source of (correlating) input data, whereas on the other hand a high level of aggregation could mask some information. That's why the identification of source categories for the key source analysis was made in two steps:

After an initial analysis at a high level of aggregation further splits were made for categories that contributed significantly to total emissions of one pollutant, but only if the methodologies for the sub-sources are not the same (e.g. Solvent and Other Product Use the methodology for NMVOC emissions uses the same input data for all sub-sources, and the input data are dependant on each other, which is why no further dissaggregation was made).

For reasons of transparency, the same level of aggregation for all pollutants was used.

In the following the rationale for the aggregation per sector is given:

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[60] The so-called "trend assessment" is also a Tier 1 approach using not the absolute emission value but the trend of emissions as key parameter

1 A Combustion Activities

1 A Combustion Activities is the most important sector for emissions reported to UNECE. To account for this fact and help prioritising efforts this sector was analysed in greater detail.

As methodologies for mobile and stationary sources are generally different, this split was used for all sub categories. Furthermore, for mobile sources the different means of transport were considered separately, and additionally the sub category road transport was further disaggregated as it is an important source for many pollutants.

For stationary sources a split following the third level of the NFR was used (1 A 2, 1 A 4), and additionally a fuel split was made, except for 1 A 1 Energy Industries where the disaggregation followed NFR level four with no fuel split and 1 A 5 where no further split was made as this category is of minor importance in terms of emission levels.

The following figure explains the disaggregation used for 1 A Combustion Activities.

1 A Combustion Activities	1 A 1 Energy Industries	1 A 1 a Public Electricity and Heat Production		
		1 A 1 b Petroleum refining		
		1 A 1 c Manufacture of Solid fuels and Other Energy Industries		
	1 A 2 Manufacturing Industries and Constructions		● Stationary sources	● Liquid Fuels ● Solid Fuels ● Gaseous Fuels ● Biomass ● Other
			● Mobile sources	
	1 A 3 Transport	1 A 3 a Civil Aviation		
		1 A 3 b Road Transport	● Passenger Cars ● Light Duty Vehicles ● Heavy Duty Vehicles ● Mopeds & Motorcycles ● Gasoline Evaporation ● Automobile Tyre and Breakwear	
		1 A 3 c Railways		
		1 A 3 d Navigation		
		1 A 3 e Other		
	1 A 4 Other Sectors		● Stationary sources	● Liquid Fuels ● Solid Fuels ● Gaseous Fuels ● Biomass ● Other
			● Mobile sources	
	1 A 5 Other			

Figure 3: Disaggregation used for 1 A Combustion Activities.

1 B Fugitive Emissions

No further disaggregation as emission data has the same source for all sub categories.

2 Industrial Processes

Level two of the NFR was used (2 A/2 B/2 C/2 D) as emission data has the same source for most sub categories or, in the case of 2 C Metal Production, one sub-source is clearly dominating.

3 Solvent and Other Product Use

No further disaggregation as one model was used for all NMVOC emissions and considering other pollutants only HM emissions arise from one sub category.

4 Agriculture

Level two of the NFR was used (4 B/4 D/4 F); only the sub category 4 B was further disaggregated as this is an important source for NH_3 and the methodology is different for the animal categories.

6 Waste

No further disaggregation was used as this category is of minor importance concerning emissions of pollutants reported to the UNECE.

The applied aggregation resulted in 44 source categories (not including categories that are not relevant for Austria).

Results of the Level Assessment

As the analysis was made for all different pollutants reported to the UNECE and as these pollutants differ in their way of formation, most of the identified categories are key for one pollutant or more: as in last year's analysis, 33 key sources were identified. The results of the analysis are presented in Table 6.

However, compared to last year's analysis, two additional key sources were identified, and two sources identified in last year's analysis were not identified in this year's analysis (this is due to recalculations, for explanations for recalculations please refer to Chapter 3):

- Additional sources
  - 6 Waste
  - 1 A 3 b 4 Road Traffic: Mopeds & Motorcycles
- Sources identified in last year's analysis but not in this year's
  - 1 A 3 c Railways
  - 1 A 4 Other Sectors stationary – other.

Table 6: Level Assessment for the year 2006.

Level Assessment 2007		**SO_2**	**NO_x**	**NMVOC**	**NH_3**	**CO**	**Cd**	**Hg**	**Pb**
					[%]				
1 A 1 a	Public Electricity and Heat Production	14.61	4.66	0.41	0.40	0.52	9.22	19.79	10.28
1 A 1 b	Petroleum refining	12.97	1.51		0.15	0.06	15.35	1.06	2.05
1 A 1 c	Manufacture of Solid fuels and Other Energy Industries	0.00	0.66	0.00	0.02	0.01	0.00	0.00	0.00
1 A 2 mobile	Other mobile in industry	2.04	5.74	1.14	0.01	0.86	3.70	0.01	0.00
1 A 2 stat (l)	Manuf. Ind. and Constr. stationary LIQUID	8.57	1.17	0.07	0.09	0.57	5.44	5.14	4.11
1 A 2 stat (s)	Manuf. Ind. and Constr. stationary SOLID	20.29	2.68	0.28	0.00	18.56	0.15	9.33	0.33
1 A 2 stat (g)	Manuf. Ind. and Constr. stationary GASEOUS	0.33	3.47	0.03	0.17	0.52	0.00	0.00	0.00
1 A 2 stat (b)	Manuf. Ind. and Constr. stationary BIOMASS	3.16	1.57	0.08	0.17	0.33	3.41	3.21	3.34
1 A 2 stat (s)	Manuf. Ind. and Constr. stationary OTHER	1.80	1.09	0.19	0.00	0.65	4.74	8.53	14.13
1 A 3 a	Civil Aviation	0.25	0.34	0.16	0.00	0.36	0.01	0.00	0.00
1 A 3 b 1	R.T., Passenger cars	0.24	18.52	6.25	3.45	24.21	0.31	0.12	0.07
1 A 3 b 2	R.T., Light duty vehicles	0.04	2.65	0.39	0.08	1.12	0.04	0.02	0.00
1 A 3 b 3	R.T., Heavy duty vehicles	0.19	36.33	2.61	0.09	1.97	0.19	0.07	0.02
1 A 3 b 4	R.T., Mopeds & Motorcycles		0.19	1.09	0.00	2.73	0.00	0.00	0.00
1 A 3 b 5	R.T., Gasoline evaporation			2.05					
1 A 3 b 7	R.T., Automobile road abrasion						7.59		
1 A 3 c	Railways	0.20	0.60	0.10	0.00	0.05	0.01	0.02	0.01
1 A 3 d	Navigation	0.05	0.20	0.36	0.00	0.37	0.00	0.00	0.00

Level Assessment 2007		SO_2	NO_x	NMVOC	NH_3	CO	Cd	Hg	Pb
					[%]				
1 A 3 e	Other		0.54	0.00		0.01			
1 A 4 mob	Other Sectors - mobile	0.18	7.85	4.57	0.01	4.90	0.16	0.01	0.00
1 A 4 stat (l)	Other Sectors stationary LIQUID	16.08	1.96	0.05	0.38	0.82	0.27	0.07	0.02
1 A 4 stat (s)	Other Sectors stationary SOLID	10.54	0.24	1.03	0.00	3.13	3.60	6.07	3.56
1 A 4 stat (g)	Other Sectors stationary GASEOUS	0.00	1.23	0.01	0.12	0.38			
1 A 4 stat (b)	Other Sectors stationary BIOMASS	2.93	3.62	18.13	0.58	33.78	25.35	14.04	14.87
1 A 4 stat (o)	Other Sectors stationary OTHER	0.33	0.03	0.02	0.00	0.02	0.39	0.14	0.26
1 A 5	Other	0.14	0.09	0.03		0.10			
1 B	FUGITIVE EMISSIONS FROM FUELS	0.59		1.82					
2 A	MINERAL PRODUCTS					1.25			
2 B	CHEMICAL INDUSTRY	2.69	0.20	0.77	0.11	1.42	0.06	0.01	0.01
2 C	METAL PRODUCTION	1.60	0.05	0.27		0.34	19.70	30.31	46.81
2 D	OTHER PRODUCTION		0.48	1.71		0.10			
2 G	OTHER				0.00				
3	SOLVENT AND OTHER PRODUCT USE			55.31					
4 B 1	Cattle				55.92				
4 B 2	Buffalo								
4 B 3	Sheep				1.21				
4 B 4	Goats				0.21				
4 B 6	Horses				1.11				
4 B 7	Mules and Asses								
4 B 8	Swine				14.19				
4 B 9	Poultry				7.88				

Level Assessment 2007		SO_2	NO_x	NMVOC	NH_3	CO	Cd	Hg	Pb
		[%]							
4 B-13	Other				0.16				
4 D	AGRICULTURAL SOILS		2.30	0.98	11.85				
4 F	FIELD BURNING OF AGRICULTURAL RESIDUES	0.00	0.01	0.06	0.06	0.13	0.16	0.03	0.08
4 G	OTHER								
6	WASTE	0.20	0.02	0.05	1.59	0.75	0.13	2.01	0.06

Level Assessment 2007		PAH	Diox	HCB	TSP	PM10	PM2.5
		%					
1 A 1 a	Public Electricity and Heat Production	0.16	1.80	0.80	1.53	2.42	3.90
1 A 1 b	Petroleum refining	0.03	0.05	0.01	0.13	0.22	0.35
1 A 1 c	Manufacture of Solid fuels and Other Energy Industries	0.00	0.00	0.00	0.10	0.17	0.32
1 A 2 mobile	Other mobile in industry	1.19	0.21	0.04	4.27	6.01	9.36
1 A 2 stat (l)	Manuf. Ind. and Constr. stationary LIQUID	0.04	0.62	0.13			
1 A 2 stat (s)	Manuf. Ind. and Constr. stationary SOLID	0.06	0.39	0.05			
1 A 2 stat (g)	Manuf. Ind. and Constr. stationary GASEOUS	0.02	1.16	0.23			
1 A 2 stat (b)	Manuf. Ind. and Constr. stationary BIOMASS	0.56	2.98	0.48			
1 A 2 stat (s)	Manuf. Ind. and Constr. stationary OTHER	0.26	6.50	2.55			
1 A 3 a	Civil Aviation				0.10	0.17	0.33

Level Assessment 2007		PAH	Diox	HCB	TSP	PM10	PM2.5
				%			
1 A 3 b 1	R.T., Passenger cars	7.70	0.96	0.19	2.69	4.65	8.90
1 A 3 b 2	R.T., Light duty vehicles	1.76	0.23	0.05	0.58	1.00	1.92
1 A 3 b 3	R.T., Heavy duty vehicles	7.89	1.38	0.28	2.45	4.23	8.11
1 A 3 b 4	R.T., Mopeds & Motorcycles	0.59	0.01	0.00			
1 A 3 b 5	R.T., Gasoline evaporation						
1 A 3 b 7	R.T., Automobile road abrasion				13.53	7.78	4.48
1 A 3 c	Railways	0.17	0.04	0.01	2.15	1.33	0.94
1 A 3 d	Navigation	0.05	0.02	0.00	0.04	0.07	0.14
1 A 3 e	Other				0.01	0.01	0.01
1 A 4 mob	Other Sectors - mobile	1.81	0.43	0.09	15.88	24.92	43.42
1 A 4 stat (l)	Other Sectors stationary LIQUID	0.30	0.34	0.03			
1 A 4 stat (s)	Other Sectors stationary SOLID	3.04	6.02	7.59			
1 A 4 stat (g)	Other Sectors stationary GASEOUS	0.03	0.41	0.04			
1 A 4 stat (b)	Other Sectors stationary BIOMASS	69.34	64.32	78.13			
1 A 4 stat (o)	Other Sectors stationary OTHER	0.22	0.50	0.42			
1 A 5	Other				0.06	0.10	0.19
1 B	FUGITIVE EMISSIONS FROM FUELS				0.79	0.64	0.39
2 A	MINERAL PRODUCTS				35.05	28.81	6.59
2 B	CHEMICAL INDUSTRY				0.64	0.64	0.65
2 C	METAL PRODUCTION	2.09	10.60	8.67	1.89	2.30	1.93
2 D	OTHER PRODUCTION	0.42	0.30	0.06	1.36	0.94	0.72
2 G	OTHER						
3	SOLVENT AND OTHER PRODUCT USE				0.59	1.01	1.94

Level Assessment 2007		PAH	Diox	HCB	TSP	PM10	PM2.5
					%		
4 B 1	Cattle						
4 B 2	Buffalo						
4 B 3	Sheep						
4 B 4	Goats						
4 B 6	Horses						
4 B 7	Mules and Asses						
4 B 8	Swine						
4 B 9	Poultry						
4 B-13	Other						
4 D	AGRICULTURAL SOILS				14.67	11.40	4.86
4 F	FIELD BURNING OF AGRICULTURAL RESIDUES	2.26	0.33	0.07			
4 G	OTHER				1.25	0.97	0.41
6	WASTE	0.00	0.38	0.08	0.25	0.21	0.13

Keys sources are listed in bold, highlighted boxes show for which pollutants the category is key. The given percentage is the contribution of the category to national total emissions, blank fields indicate that no such emissions occur from this source.

1.5 Quality Assurance and Quality Control (QA/QC)

A quality management system (QMS) has been designed to contribute to the objectives of *good practice guidance (GPG)*, namely to improve transparency, consistency, comparability, completeness and confidence in national inventories of emissions estimates.

The QMS was primarily developed to meet the requirement of reporting greenhouse gas emissions under the Kyoto Protocol. For this reason the emphasis was placed on greenhouse gases. All air pollutants are covered by the QMS; however, in the first instance the inspection body applied to accreditation for greenhouse gases only.

The *Department of Air Emissions* of the Umweltbundesamt has decided to implement a QMS based on the International Standard ISO 17020 *General Criteria for the operation of various types of bodies performing inspections*[61]. Consequently the QMS contains all relevant features of international standard such as strict independence, impartiality and integrity of accredited bodies. Furthermore the QMS ensures the fulfilment of requirements as stipulated in Chapter 8 of the IPCC-GPG[62].

The QMS was fully implemented by the end of 2003, and the accreditation audit of the *Department for Air Emissions* as inspection body took place in autumn 2005. In January 2006, the official notification concerning the accreditation for greenhouse gases of the *Department for Air Emissions* was received.[63/64]

QA/QC Activities

QA/QC activities for non-GHG focus on Tier 1 and Tier 2 quality control procedures, they follow largely the procedures described in the LRTAP GPG. Also Tier 1 Quality Assurance procedures are performed, however they are not made by a third party but as a so-called 2nd party audit (e.g. the data manager who is not directly involved in the preparation of the inventory of the different sectors is performing checks as listed below).

QA/QC activities are performed at all stages of inventory preparation, they include during

- inventory preparation/ data collection (performed by sector experts):
  - checking if applied methodology is applicable or if any comments have been made e.g. by the review team, incorporating last year's planned improvements
  - transparent and comprehensible documenting and archiving that allows reproduction of the inventory
- data processing (performed by data manager):
  - electronic checks to screen for incomplete estimates and calculation errors
  - visual checks to screen for time series consistency
- preparation of inventory report (performed by sector experts):
  - check for transcription errors by comparison of data in reporting format with data/information in the inventory database.
  - check for plausibility of estimates by comparison with previous estimates using automatically produced data sheets showing recalculation differences

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[61] The International Standard ISO 17020 has replaced the European Standard EN 45004.

[62] Good Practice Guidance by the Intergovernmental Panel on Climate Change

[63] Akkreditierungsbescheid (certificate of accreditation) GZ BMWA-92.715/0036-I/12/2005

[64] For more information see Austria's National Inventory Report 2007 - Submission under the UNFCCC

1.6 Uncertainty Assessment

So far, no quantitative uncertainty assessment for any of the pollutants or pollutant groups relevant for this report has been made. For GHGs a comprehensive uncertainty assessment has already been performed.[64]

However, the quality of estimates for all relevant pollutants has been rated using qualitative indicators as suggested in Chapter "GPG for LRTAP emission inventories" of the EMEP/CORINAIR Guidebook. The definition of the ratings is given in Table 7, the ratings for the emission estimates are presented in Table 9.

Table 7: Definitions of qualitative rating.

Rating	Definition	Typical Error Range
A	An estimate based on a large number of measurements made at a large number of facilities that fully represent the sector	10 to 30%
B	An estimate based on a large number of measurements made at a large number of facilities that represent a large part of the sector	20 to 60%
C	An estimate based on a number of measurements made at a small number of representative facilities, or an engineering judgement based on a number of relevant facts	50 to 150%
D	An estimate based on single measurements, or an engineering calculation derived from a number of relevant	100 to 300%
E	An estimate based on an engineering calculation derived from assumptions only	order of magnitude

Source: Chapter "GPG for LRTAP emission inventories" of the EMEP/CORINAIR Guidebook

Furthermore, for HM and POPs qualitative „quality indicators" have been assigned to each emission value, and based on these values, a „semi-quantitative" value for the overall uncertainty of the HM and POPs emission inventory was calculated. As uncertainties for HM and POP emissions are generally relatively high (related to uncertainties to e.g. main pollutants or CO_2) and often difficult to determine, this „semi-quantitative" approach is considered to be a good approximation.

First, the main influences on the uncertainty of emission data were identified and the criteria were graded for every emission source:

- Influence on the uncertainty mainly related to the emission factor
  - (i) data availability (1 = representative sample, 2–4 = fair/medium/poor data availability, 5 = no measured data/indirect estimation);
  - (ii) the variation of the emission values (difference of measured or reported values: 10^1 = 1, …, 10^5 or more = 5).
- Influence on the uncertainty mainly related to the activity data
  - (iii) the homogeneity of emitters (1 = similar, …, 3 = different);
  - (iv) quality of activity data (1 = good, …, 3 = poor).

An arithmetic mean of the different grades was calculated; as the first two criteria have a higher impact on the uncertainty of the emission value, there were five grades were to choose from compared to three grades for the other two criteria. Thus the arithmetic mean is more dependent on the more important criteria. This resulted in a single quality indicator for each emission value.

To estimate the overall inventory uncertainty the quality indicators of the different emission sources were weighted according to the share in total emissions and the mean was calculated; This resulted in a single quality indicator for the overall inventory (for total emissions of one pollutant).

Statistically it can be deduced that an increase of the quality indicator by a value of 1 corresponds to a decrease in the quality and thus a increase in the variation by a factor of 2.

Finally, to calculate the variation of total emissions ("uncertainty") from of the weighted quality indicator the following assumption was made: as emission values are usually asymmetrically distributed, the „true" value (the value used for the inventory) reflects the geometrical mean value of the distribution. Using this assumption the variation of total emissions can be calculated using the following formula:

$$\frac{x}{\sqrt{2\exp(QI)}} \leq x \leq x \bullet \sqrt{2\exp(QI)}$$

QI…weighed quality indicator

x…"true" emission value (value used in the inventory)

The following table presents the results for HM and POPs. For POP emissions a factor of about 3 was determined, and a factor of about 2 for HM emissions.

Table 8: Variation of total emissions ("uncertainty") of HM and POP emissions.

Uncertainty[65]	**1999**			**2000**	
	Emission [kg]	**Variation**		**Emission [t]**	**Variation**
Dioxin/Furan	0.18	0.08–0.4	Cd	0.97	0.5–2.1
HCB	47	20–130	Hg	0.88	0.5–1.7
PAHs	28 000	10 000–80 000	Pb	12.4	6.0–26

[65] The analysis was performed in 2001 for emission data of 1999 for POPs and 2000 for HM. As emissions have been recalculated since then the presented emission values differ slightly from values reported now.

Table 9: Quality of emission estimates.

NFR	Description	SO_2	NO_x	NMVOC	NH_3	CO	Cd	Hg	Pb	PAH	Diox	HCB	TSP	PM10	PM2.5
1 A 1 a	**Public Electricity and Heat Production**	A	A	D	E	A	C	C	C	C	C	C	B	C	C
1 A 1 b	**Petroleum refining**	A	A		E	A	C	C	C	D	D	D	A	B	B
1 A 1 c	Manufacture of Solid fuels & Other Energy Ind.		B	D	E	D					D	D	B	B	B
1 A 2 mobile	**Other mobile in industry**	A	B	B	C	B	C	C	C	D	D	D	B	B	B
1 A 2 stat (l)	**Manuf. Ind. and Constr. stationary LIQUID**	A	B	D	E	C	C	B	C	C	E	D	C	C	C
1 A 3 a	Civil Aviation	A	B	B	C	B	B	B	B				B	B	B
1 A 3 b 1	**R.T., Passenger cars**	A	B	B	C	B	B	B	C	C	D	D	B	B	B
1 A 3 b 2	**R.T., Light duty vehicles**	A	B	B	C	B	B	B	C	C	D	D	B	B	B
1 A 3 b 3	**R.T., Heavy duty vehicles**	A	B	B	C	B	B	B	C	C	D	D	B	B	B
1 A 3 b 4	**R.T., Mopeds & Motorcycles**		B	B	C	B	B	B	C	D	D	D			
1 A 3 b 5	**R.T., Gasoline evaporation**			B											
1 A 3 b 6	**R.T., Automobile tyre and break wear**						C	C	C				C	C	C
1 A 3 c	**Railways**	A	B	B	C	B	B	B	C	D	D	D	B	B	B
1 A 3 d	Navigation	A	B	B	C	B	B	B	C	D	D	D	B	B	B
1 A 3 e	Other		A	D	E	C						D	C	C	C
1 A 4 mob	**Other Sectors – mobile**	A	B	B	C	B	C	C	C	D	D	D	B	B	B
1 A 4 stat (b)	**Other Sectors stationary BIOMASS**	A	B	C	E	C	C	C	D	D	E	D	C	C	C
1 A 5	Other	B	C	C	D	C	C	C	C	D	D	D	C	C	C

NFR	Description	SO_2	NO_x	NMVOC	NH_3	CO	Cd	Hg	Pb	PAH	Diox	HCB	TSP	PM10	PM2.5
1 B	**FUGITIVE EMISSIONS FROM FUELS**	A		**A**									D	D	D
2 A	**MINERAL PRODUCTS**					**C**							**D**	**D**	**D**
2 B	**CHEMICAL INDUSTRY**	**B**	B	**D**	A	**D**	A	A	B				A	A	A
2 C	**METAL PRODUCTION**	**C**	B	C		B	**B**	**B**	**C**	**C**	**C**	**C**	**B**	**B**	**B**
2 D	**OTHER PRODUCTION**		B	**B**		B				E	E	E	D	D	D
2 G	OTHER				E										
3	**SOLVENT AND OTHER PRODUCT USE**			**A**			B		B						
4 B 1	**Cattle**				**B**										
4 B 3	**Sheep**				**B**										
4 B 4	Goats				B										
4 B 6	Horses				B										
4 B 8	**Swine**				**B**										
4 B 9	**Poultry**				**B**										
4 B-13	Other				B										
4 D	**AGRICULTURAL SOILS**		**B**	E	**B**								**D**	**D**	**D**
4 F	**FIELD BURNING OF AGRIC. RESIDUES**	E	E	E	E	E	E	E	E	**E**	E	E			
4 G	**Agriculture – Other**												**D**	**D**	**D**
6	**WASTE**	D	D	C	C	**C**	B	B	B	D	D	B	D	D	D

Abbreviations: see Table 7;
(dark shaded cells indicate that no such emissions arise from this source, light shaded cells (green) indicate that source is a key source for this pollutant)

1.7 Completeness

The inventory is complete with regard to reported gases, reported years and reported emissions from all sources, and also complete in terms of geographic coverage.

Geographic Coverage

The geographic coverage is complete. There is no territory in Austria not covered by the inventory.

However, if fuel prices vary considerably in neighbouring countries, fuel sold within the territory of a Party is used outside its territory (so-called 'fuel export'). Austria has experienced a considerable amount of 'fuel export' in the last few years.

In the 2002 UNECE Emission Reporting Guidelines, Parties are given the choice of whether to report emissions on the basis of fuel used or fuel sold to the final consumer but should clearly state the basis of their calculations in their submissions.

In reports to the UNECE/LRTAP, emissions from mobile sources are reported on the basis of fuel sold. Emissions from 'fuel export' are therefore included in the Austrian Total.[66]

Gases, Reporting Years

In accordance with the Austrian obligation, all relevant pollutants mentioned in Table 2 (minimum reporting programme) are covered by the Austrian inventory and are reported for the years 1980–2006 for the main pollutants, from 1985 onwards for POPs and HMs and for the years 1990, 1995 and from 2000 onwards for PM.

Sources

Notation keys are used according to the Guidelines for Estimating and Reporting Emission Data under LRTAP (UNECE 2003 – see Table 10)[67] to indicate where emissions are not occurring in Austria, where emissions have not been estimated or have been included elsewhere as suggested by EMEP/CORINAIR. The main reason for different allocations to categories are the allocation in national statistics, insufficient information on the national statistics, national methods, and the impossibility to disaggregate emission declarations; explanations for each the case is given in the NFR-Table IV 1 F1–F4.

[66] For more information, see UMWELTBUNDESAMT (2007): Austria's National Air Emission Inventory 1990–2005: Submission under Directive 2001/81/EC on national emission ceilings for certain atmospheric pollutants. Vienna. http://www.umweltbundesamt.at/fileadmin/site/publikationen/REP0058.pdf

[67] AIR POLLUTION STUDIES No. 15

Table 10: Notation keys used in the NFR.

Abbreviation	Meaning	Objective
NO	not occurring	for emissions by sources of compounds that do not occur for a particular compound or source category within a country;
NA	not applicable	is used for activities in a given source category which are believed not to result in significant emissions of a specific compound;
NE	not estimated	for existing emissions by sources of compounds that have not been estimated; Where "NE" is used in an inventory the Party should indicate why emissions could not be estimated.
IE	included elsewhere	for emissions by sources of compounds that are estimated but included elsewhere in the inventory instead of in the expected source category; Where "IE" is used in an inventory, the Party should indicate where in the inventory the emissions from the displaced source category have been included and the Party should give the reasons for this inclusion deviating from the expected category.
C	confidential	for emissions by sources of compounds which could lead to the disclosure of confidential information; Where "C" is used in an inventory, reference should be made to the Protocol provision that authorizes such practice.
NR	not relevant	According to Para. 9 in the Emission Guidelines, Emission inventory reporting should cover all years from 1980 onwards, if data are available. However, "NR" (Not Relevant) is introduced to ease the reporting where emissions are not strictly required by the different Protocols. E.g. for some Parties emissions of NMVOC prior to 1988.

2 TREND IN TOTAL EMISSIONS

2.1 Emission Targets

Stabilisation or reduction targets for SO_2, NO_x, NMVOC, NH_3, heavy metals and POPs respectively, have been set out in the different protocols of UNECE/LRTAP Convention mentioned in Chapter 1.1.3 and listed in Table 1. Information on these targets as well as on the status of Austria fulfilling these targets is provided below.

2.1.1 The 1985 Helsinki Protocol on the Reduction of Sulphur Emissions or their Transboundary Fluxes

The Protocol to the Convention on LRTAP on the Reduction of Sulphur Emissions or their Transboundary Fluxes by at least 30 per cent was entered into force in 1987. [68] Twenty-one ECE countries are Parties to this Protocol, which aims at abating one of the major air pollutants. As a result of this Protocol, substantial cuts in sulphur emissions have been recorded in Europe: Taken as a whole, the 21 Parties to the 1985 Sulphur Protocol reduced 1980 sulphur emissions by more than 50% by 1993 (using the latest available figure, where no data were available for 1993). Also individually, based on the latest available data, all Parties to the Protocol have reached the reduction target. Eleven Parties have achieved reductions of at least 60%. Given the target year 1993 for the 1985 Sulphur Protocol, it can be concluded that all Parties to that Protocol have reached the target of reducing emissions by at least 30%.

In Austria, SO_2 emissions in the base year 1980 amouned to 345 Gg, by the year 1993 emissions were reduced to 53 Gg corresponding to a reduction of 84%. In 2006, SO_2 emissions in Austria amounted to 28 Gg, which is a decrease by 92% compared to 1980. This reduction could be archieved mainly due to lower emissions from residential heating, combustion in industries and energy industries.

2.1.2 The 1988 Sofia Protocol concerning the Control of Emissions of Nitrogen Oxides or their Transboundary Fluxes

In 1988 the Protocol concerning the Control of Emissions of Nitrogen Oxides or their Transboundary Fluxes was adopted in Sofia (Bulgaria).[69] This Protocol requires as a first step, to freeze emissions of nitrogen oxides or their transboundary fluxes. The general reference year is 1987[70].

Taking the sum of emissions of Parties to the NOx Protocol in 1994, or a previous year, where no recent data are available, also a reduction of 9% compared to 1987 can be noted. Nineteen of the 25 Parties to the 1988 NOx Protocol have reached the target and stabilized emissions at 1987[71] levels or reduced emissions below that level according to the latest emission data reported.

The second step to the NOx Protocol requires the application of an effects-based approach. Applying the multi-pollutant, multi-effect critical load approach, a new instrument being prepared at present should provide for further reduction of emissions of nitrogen compounds, including

[68] http://www.unece.org/env/lrtap/sulf_h1.htm

[69] http://www.unece.org/env/lrtap/nitr_h1.htm

[70] with the exception of the United States that chose to relate its emission target to 1978

[71] or in the case of the United States 1978

ammonia, and volatile organic compounds, in view of their contribution to photochemical pollution, acidification and eutrophication, and their effects on human health, the environment and materials, by addressing all significant emission sources.

The collection of scientific and technical information as a basis for a further reduction in nitrogen oxides and ammonia, considering their acidifying as well as nitrifying effects, is under way.

Austria was successful in fulfilling the stabilisation target set out in the Protocol: NO_x emissions decreased steadily from the base year 1987 until the mid-1990s and remained largely stable with only minor fluctuations until 1999. However, since then emissions have been increasing again, in 2001 emissions even slightly exceeded 1987 levels. The main reason for the increase of NO_x emissions are strongly increasing emissions from heavy duty vehicles, which is mainly caused by 'fuel tourism'.

Austrian NO_x emissions in the base year under this Protocol amounted to 214 Gg, by the year 1995 emissions were reduced to 181 Gg corresponding to a reduction of 16%. In 2006, NO_x emissions in Austria amounted to 225 Gg, which is a decrease by 5% compared to 1987.[72]

2.1.3 The 1991 Geneva Protocol concerning the Control of Emissions of Volatile Organic Compounds or their Transboundary Fluxes

In November 1991, the Protocol to the Convention on Long-range Transboundary Air Pollution on the Control of Emissions of Volatile Organic Compounds (VOCs, i.e. hydrocarbons) or Their Transboundary Fluxes, the second major air pollutant responsible for the formation of ground level ozone, was adopted. It has entered into force on 29 September 1997.[73]

This Protocol specifies three options for emission reduction targets that have to be chosen upon signature or upon ratification:

(i) 30% reduction in emissions of volatile organic compounds (VOCs) by 1999 using a year between 1984 and 1990 as a basis;[74]

(ii) The same reduction as for (i) within a Tropospheric Ozone Management Area (TOMA) specified in annex I to the Protocol and ensuring that by 1999 total national emissions do not exceed 1988 levels;[75]

(iii) Finally, where emissions in 1988 did not exceed certain specified levels, Parties may opt for a stabilization at that level of emission by 1999.[76]

Austria met the reduction target: in the base year NMVOC emissions amounted to 350 Gg, in 1999 emissions were reduced by 49% to 178 Gg. From 1999 to 2006 a further reduction of 4% (172 Gg) can be noted.

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[72] Please note that emissions from mobile sources are calculated based on fuel sold, which for the last few years is considerably higher than fuel used: emissions for 2006 based on fuel used amount to 173 Gg, which is about 23% less (see Chapter 1.7 Completeness for more information regarding 'fuel tourism', Austria's emissions based on fuel used – thus excluding 'fuel tourism' – are presented in Table 1 in the Annex).

[73] http://www.unece.org/env/lrtap/vola_h1.htm

[74] This option has been chosen by Austria, Belgium, Estonia, Finland, France, Germany, Netherlands, Portugal, Spain, Sweden and the United Kingdom with 1988 as base year, by Denmark with 1985, by Liechtenstein, Switzerland and the United States with 1984, and by Czech Republic, Italy, Luxembourg, Monaco and Slovakia with 1990 as base year

[75] Annex I specifies TOMAs in Norway (base year 1989) and Canada (base year 1988)

[76] This has been chosen by Bulgaria, Greece, and Hungary

2.1.4 The 1998 Aarhus Protocol on Heavy Metals

The Executive Body adopted the Protocol on Heavy Metals on 24 June 1998 in Aarhus (Denmark).[77] It targets three particularly harmful metals: cadmium, lead and mercury. According to one of the basic obligations, Parties will have to reduce their emissions for these three metals below their levels in 1990 (or an alternative year between 1985 and 1995). The Protocol entered into force on 29th December 2003.

The Protocol aims to cut emissions from industrial sources (iron and steel industry, non-ferrous metal industry), combustion processes (power generation, road transport) and waste incineration. It lays down stringent limit values for emissions from stationary sources and suggests best available techniques (BAT) for these sources, such as special filters or scrubbers for combustion sources or mercury-free processes. The Protocol requires Parties to phase out leaded petrol. It also introduces measures to lower heavy metal emissions from other products, such as mercury in batteries, and proposes the introduction of management measures for other mercury-containing products, such as electrical components (thermostats, switches), measuring devices (thermometers, manometers, barometers), fluorescent lamps, dental amalgam, pesticides and paint.

Austria has chosen 1985 as a base year and current emissions are well below the level of the base year (see Chapter 2.4).

2.1.5 The 1998 Aarhus Protocol on Persistent Organic Pollutants (POPs)

The Executive Body adopted the Protocol on Persistent Organic Pollutants on 24 June 1998 in Aarhus (Denmark). It entered into force on 23 October 2003. It focuses on a list of 16 substances that have been singled out according to agreed risk criteria. The substances comprise eleven pesticides, two industrial chemicals and three by-products/contaminants. The ultimate objective is to eliminate any discharges, emissions and losses of POPs. The Protocol bans the production and use of some products outright (aldrin, chlordane, chlordecone, dieldrin, endrin, hexabromobiphenyl, mirex and toxaphene). Others are scheduled for elimination at a later stage (DDT, heptachlor, hexaclorobenzene, PCBs). Finally, the Protocol severely restricts the use of DDT, HCH (including lindane) and PCBs.

The Protocol includes provisions for dealing with the wastes of products that will be banned. It also obliges Parties to reduce their emissions of dioxins, furans, PAHs and HCB below their levels in 1990 (or an alternative year between 1985 and 1995). For the incineration of municipal, hazardous and medical waste, it lays down specific limit values.

Austria has chosen 1985 as a base year and current emissions are well below the level of the base year (see Chapter 2.5).

2.1.6 The 1999 Gothenburg Protocol to Abate Acidification, Eutrophication and Ground-level Ozone "Multi-Effect Protocol"

The Executive Body adopted the Protocol to Abate Acidification, Eutrophication and Ground-level Ozone in Gothenburg (Sweden) on 30 November 1999.

The Protocol sets emission ceilings for 2010 for four pollutants: sulphur, NOx, VOCs and ammonia. These ceilings were negotiated on the basis of scientific assessments of pollution ef-

[77] http://www.unece.org/env/lrtap/hm_h1.htm

fects and abatement options. Parties whose emissions have a more severe environmental or health impact and whose emissions are relatively cheap to reduce will have to make the biggest cuts. Once the Protocol is fully implemented, Europe's sulphur emissions should be cut by at least 63%, its NOx emissions by 41%, its VOC emissions by 40% and its ammonia emissions by 17% compared to 1990.

The Protocol also sets tight limit values for specific emission sources (e.g. combustion plant, electricity production, dry cleaning, cars and lorries) and requires best available techniques to be used to keep emissions down. VOC emissions from such products as paints or aerosols will also have to be cut. Finally, farmers will have to take specific measures to control ammonia emissions. Guidance documents adopted together with the Protocol provide a wide range of abatement techniques and economic instruments for the reduction of emissions in the relevant sectors, including transport.

It has been estimated that once the Protocol is implemented, the area in Europe with excessive levels of acidification will shrink from 93 million hectares in 1990 to 15 million hectares. That with excessive levels of eutrophication will fall from 165 million hectares in 1990 to 108 million hectares. The number of days with excessive ozone levels will be halved. Consequently, it is estimated that life-years lost as a result of the chronic effects of ozone exposure will be about 2,300,000 lower in 2010 than in 1990, and there will be approximately 47,500 fewer premature deaths resulting from ozone and particulate matter in the air. The exposure of vegetation to excessive ozone levels will be 44% down on 1990.

Information on emission trends of pollutants covered by this protocol is given in Chapter 2.2.

2.2 Emission Trends for Air Pollutants covered by the Multi- Effect Protocol as well as CO

Table 11 show national total emissions and trends (1990–2006) as well as emission targets[78] for air pollutants covered by the Multi-Effect Protocol.

Please note that emissions from mobile sources are calculated based on fuel sold in Austria, thus national total emissions include 'fuel tourism'.[79]

Table 11: National total emissions and trends 1990–2006 as well as emission targets for air pollutants covered by the Multi-Effect Protocol and CO.

Year	Emission [Gg]				
	SO_2	NO_x	NMVOC	NH_3	CO
1990	74.33	192.41	283.18	71.05	1 444.11
1991	71.42	202.65	275.20	73.62	1 513.92
1992	55.03	191.89	250.43	72.06	1 481.31
1993	53.38	186.24	249.27	72.80	1 448.57
1994	47.61	180.70	231.16	73.99	1 379.37
1995	46.85	181.40	229.35	75.35	1 267.33
1996	44.61	203.81	221.54	73.11	1 246.13

[78] For NO_x the National Emission Ceilings Directive (NEC Directive) of the European Union, who also signed the Multi-Effect Protocol, sets a tighter emission target for Austria than the LRTAP Protocol (103 Gg vs. 107 Gg).

[79] see Chapter 1.7 Completeness for more information regarding 'fuel tourism'; Austria's emissions based on fuel used – thus excluding 'fuel tourism' – are presented in the Annex.

Year	Emission [Gg]				
	SO_2	NO_x	NMVOC	NH_3	CO
1997	40.16	193.03	206.62	72.87	1 154.95
1998	35.57	208.09	191.80	72.98	1 109.26
1999	33.79	198.89	178.44	71.13	1 034.38
2000	31.62	205.35	177.11	69.14	959.09
2001	32.70	215.03	188.25	68.77	930.36
2002	31.64	224.58	188.79	67.62	898.57
2003	32.44	235.54	183.01	67.27	900.10
2004	26.93	233.29	176.02	66.46	857.50
2005	26.65	236.97	163.65	65.95	823.41
2006	28.46	225.16	171.63	65.81	785.35
Trend 1990–2006	**-62%**	**17%**	**-39%**	**-7%**	**-46%**
Absolute Emission Target 2010	**39.00**	**107.00**	**159.00**	**66.00**	**-**

2.2.1 SO_2 Emissions

In 1990, national total SO_2 emissions amounted to 74 Gg; emissions have decreased steadily since then and by the year 2006 emissions were reduced by 62% mainly due to lower emissions from residential heating, combustion in industries and energy industries.

As shown in Table 12, the main source for SO_2 emissions in Austria with a share of 94% in 1990 and 95% in 2006 is Category *1 A Fuel Combustion Activities*. Within this source residential heating has the highest contribution to total SO_2 emissions. SO_2 emissions have decreased steadily mainly due to lower emissions from residential heating, combustion in industries and energy industries, mainly caused by a switch-over from high sulfur fuels (like coal and heavy oil) to fuels with lower sulfur content, and the implementation of desulfurizsation units. The peak of SO_2 emissions in 2004 in Sector *Agriculture* (< 0.1% to national total) is due to a larger area of stubble fields burnt that year.

The 2010 national emission ceiling for SO_2 emissions in Austria as set out in Annex II of the Multi-Effects Protocol is 39 Gg (see Table 11) In 2006 Austrian total SO2 emissions (28 Gg) were well below the ceiling.

Table 12: SO_2 emissions per NFR Category 1990 and 2006, their trend 1990–2006 and their share in total emissions.

NFR Category		SO_2 Emissions [Gg]		Trend	Share in National Total	
		1990	2006	1990–2006	1990	2006
1	Energy	72.03	27.18	-62%	97%	96%
1 A	*Fuel Combustion Activities*	*70.03*	*27.01*	*-61%*	*94%*	*95%*
1 B	*Fugitive Emissions from Fuels*	*2.00*	*0.17*	*-92%*	*3%*	*1%*
2	Industrial Processes	2.22	1.22	-45%	3%	4%
3	Solvent and Other Product Use	NA	NA			
4	Agriculture	<0.01	<0.01	-16%	<1%	<1%
6	Waste	0.07	0.06	-20%	<1%	<1%
	National Total	74.33	28.46	-62%	100%	100%

2.2.2 NO_x Emissions

In 1990, national total NO_x emissions amounted to 192 Gg; emissions were slightly decreasing until the mid-1990 but have been increasing again in the last years: in 2006, they were about 17% above the level of 1990.

As can be seen in Table 13, the main source for NO_x emissions in Austria with a share of 94% in 1990 and 97% in 2006 is *Fuel Combustion Activities.* Within this source *road transport*, with about 59% of national total emissions, has the highest contribution to total NO_x emissions.

The 2010 national emission ceiling for NO_x emissions in Austria as set out in Annex II of the Multi-Effects Protocol is 107 Gg (in the European National Emissions Ceiling Directive the national emission ceiling is 103 Gg). With 225 Gg NO_x emissions in 2006 emissions in Austria are at the moment well above this ceiling – see Table 11.

Please note that emissions from mobile sources are calculated based on fuel sold, which for the last few years is considerably higher than fuel used: emissions for 2006 based on fuel used amount to 173 Gg, which is about 23% less, but still well above the NEC ceilling.[80,66]

Table 13: NO_x emissions per NFR Category 1990 and 2006, their trend 1990–2006 and their share in total emissions.

NFR Category	NO_x Emissions [Gg]		Trend	Share in National Total	
	1990	2006	1990–2006	1990	2006
1 Energy	181.43	218.27	20%	94%	97%
1 A Fuel Combustion Activities	*181.43*	*218.27*	*20%*	*94%*	*97%*
1 B Fugitive Emissions from Fuels	*IE*	*IE*			
2 Industrial Processes	4.80	1.63	-66%	2%	1%
3 Solvent and Other Product Use	NA	NA			
4 Agriculture	6.09	5.21	-14%	3%	2%
6 Waste	0.10	0.05	-50%	<1%	<1%
National Total	192.41	225.16	17%	100%	100%

[80] see Chapter 1.7 Completeness for more information regarding 'fuel tourism'; Austria's emissions based on fuel used – thus excluding 'fuel tourism' - are presented in Table 1 in the Annex.

2.2.3 NMVOC Emissions

In 1990 national total NMVOC emissions amounted to 283 Gg; emissions have decreased steadily since then and by the year 2006 emissions were reduced by 39%.

As can be seen in Table 14, the main sources of NMVOC emissions in Austria are *Fuel Combustion Activities* with a share of 50% in 1990 and 39% in 2006, and *Solvent and Other Product Use* with a contribution to the national total of 41% in 1990 and 55% in 2006 respectively.

NMVOC emissions decreased considerably in both main sectors: the reduction in the energy sector is due to decreasing emissions from road transport due to low emission combustion and also from residential heating, which is due to the replacement of ineffective heating systems.

The reduction in Sector Solvent and Other Product Use is due to legal abatement measures such exhaust systems and aftertreatment.

The national emission ceiling 2010 for NMVOC emissions in Austria as set out in Annex II of the Multi-Effects Protocol is 159 Gg (see Table 11). In 2006 Austria's NMVOC emissions amounted to 172 Gg, and thus Austria is 8% above this target.

Table 14: NMVOC emissions per NFR Category 1990 and 2006, their trend 1990–2006 and their share in total emissions.

NFR Category		NMVOC Emissions [Gg]		Trend	Share in National Total	
		1990	2006	1990–2006	1990	2006
1	Energy	153.12	70.12	-54%	54%	41%
1 A	Fuel Combustion Activities	*140.91*	*66.99*	*-52%*	*50%*	*39%*
1 B	Fugitive Emissions from Fuels	*12.22*	*3.12*	*-74%*	*4%*	*2%*
2	Industrial Processes	11.10	4.73	-57%	4%	3%
3	Solvent and Other Product Use	116.95	94.92	-19%	41%	55%
4	Agriculture	1.85	1.79	-3%	1%	1%
6	Waste	0.16	0.08	-50%	<1%	<1%
	National Total	**283.18**	**171.63**	**-39%**	**100%**	**100%**

2.2.4 NH_3 Emissions

In 1990, national total NH_3 emissions amounted to 71 Gg; emissions have slightly decreased over the period from 1990 to 2006, in 2006 emissions were 7% below 1990 levels.

As can be seen in Table 15, NH_3 emissions in Austria are almost exclusively emitted by the agricultural sector. The share in national total NH_3 emissions is about 93% for 2006. Within this source manure management – cattle has the highest contribution to total NH_3 emissions: the share in national total emissions of manure management of cattle was 56% in 2006.

The national emission ceiling 2010 for NH_3 emissions in Austria as set out in Annex II of the Multi-Effects Protocol is 66 Gg (see Table 11). In 2006 Austrian total NH_3 emissions (66 Gg) were just below this ceiling.

Table 15: NH_3 emissions per NFR Category 1990 and 2006, their trend 1990–2006 and their share in total emissions.

NFR Category		NH_3 Emissions [Gg]		Trend	Share in National Total	
		1990	2006	1990–2006	1990	2006
1	Energy	4.28	3.76	-12%	6%	6%
1 A	*Fuel Combustion Activities*	*4.28*	*3.76*	*-12%*	*6%*	*6%*
1 B	*Fugitive Emissions from Fuels*	*IE*	*IE*			
2	Industrial Processes	0.27	0.07	-72%	<1%	<1%
3	Solvent and Other Product Use	NA	NA			
4	Agriculture	66.12	60.93	-8%	93%	93%
6	Waste	0.38	1.04	177%	1%	2%
	National Total	**71.05**	**65.81**	**-7%**	**100%**	**100%**

2.2.5 Carbon monoxide (CO) Emissions

CO is a colourless and odourless gas, formed when carbon in fuel is not burned completely. It is a component of motor vehicle exhaust, other sources of CO emissions include industrial processes, non-transportation fuel combustion, and natural sources such as wildfires. Peak CO concentrations typically occur during the colder months of the year when CO automotive emissions are greater and night-time inversion conditions are more frequent.

In 1990 national total CO emissions amounted to 1 444 Gg; emissions have considerably decreased over the period from 1990 to 2006, in 2006 emissions were 46% below 1990 levels.

As can be seen in Table 16, CO emissions in Austria are almost exclusively emitted by the energy sector, and more specifically, fuel combustion activities. The share in national total CO emissions is about 96% for 2006. Emissions decreased mainly due to decreasing emissions from road transport and residential heating, which is due to the switch-over to improved technologies. The peak of CO emissions in 2004 of Sector *Agriculture* (contribution <1% to national total) is due to a larger area of stubble fields burnt that year.

Table 16: CO emissions per NFR Category 1990 and 2006, their trend 1990–2006 and their share in total emissions.

NFR Category		CO Emissions [Gg]		Trend	Share in National Total	
		1990	2006	1990–2006	1990	2006
1	Energy	1 385.17	754.06	-46%	96%	96%
1 A	*Fuel Combustion Activities*	*1 385.17*	*754.06*	*-46%*	*96%*	*96%*
1 B	*Fugitive Emissions from Fuels*	*IE*	*IE*			
2	Industrial Processes	46.37	24.37	-47%	3%	3%
3	Solvent and Other Product Use	NA	NA			
4	Agriculture	1.20	1.01	-16%	<1%	<1%
6	Waste	11.37	5.91	-48%	1%	1%
	National Total	**1 444.11**	**785.35**	**-46%**	**100%**	**100%**

2.3 Emission Trends for Particulate matter (PM)

Dust is a complex mixture consisting of both directly emitted and secondarily formed components of both natural and anthropogenic origin (e.g. dust, geological material, abraded particles and biological material) and has a rather inhomogeneous composition of sulphate, nitrate, ammonium, organic carbon, heavy metals, PAH and dioxins/ furans. PM is either formed during industrial production and combustion processes as well as during mechanical processes such as abrasion of surface materials and generation of fugitive dust or by secondary formation from SO_2, NO_x, NMVOC or NH_3.

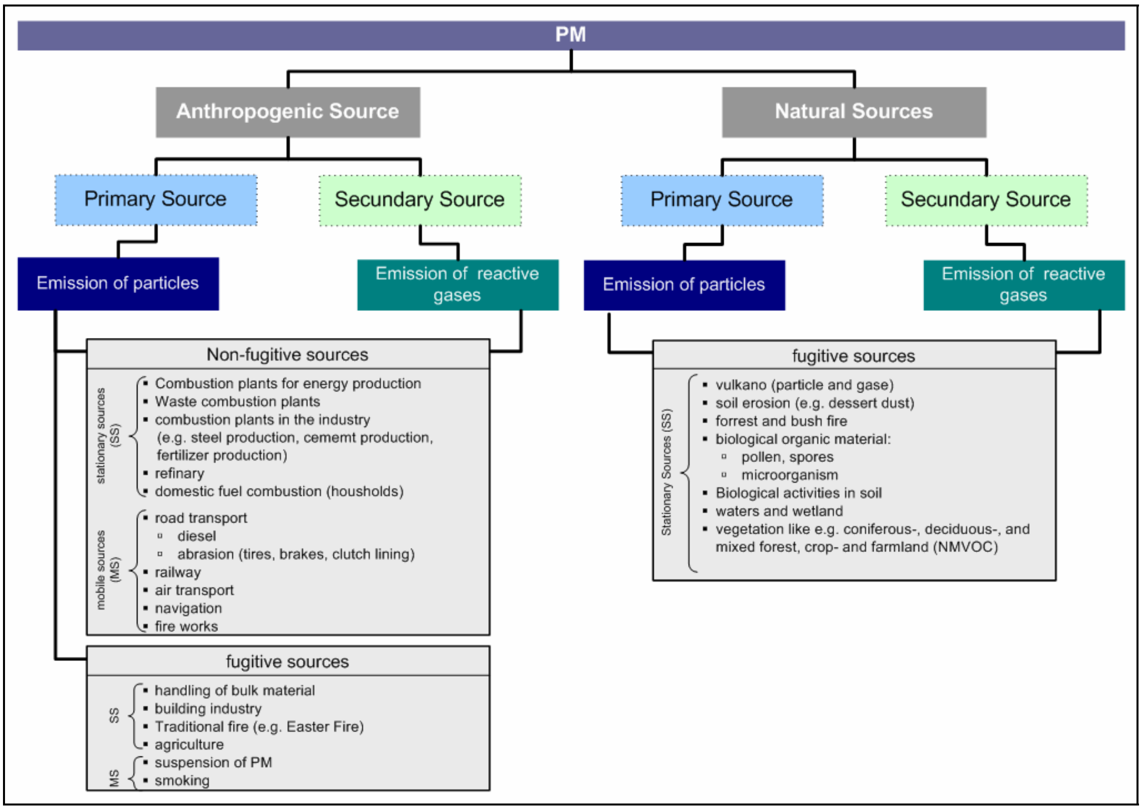

Figure 4: Schematic classification of PM sources

PM does not only have effects on the chemical composition and reactivity of the atmosphere but also affects human and animal health and welfare. When breathed in, a particle-loaded atmosphere impacts on the respiratory tract. The observable effects are dependent on the particle size, that's why for legislative issues particulate matter (PM) is classified according to its size (see Figure 5).

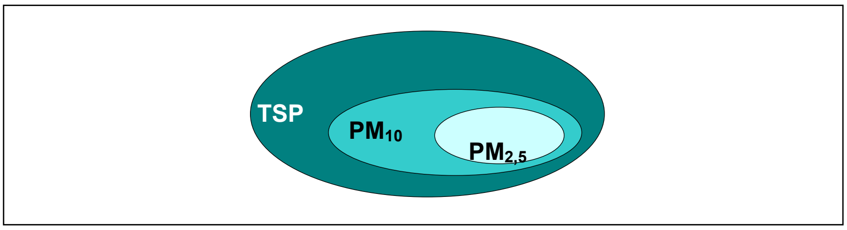

Figure 5: Distribution of TSP, PM10 and PM2,5 (schematic).

TSP emissions in Austria derive from industrial processes, road transport, agriculture and small heating installations. Fine particles often have a seasonal pattern: Whereas PM2.5 values are typically higher in the season when sulfates are more readily formed from SO_2 emissions from power plants, PM10 concentrations tend to be higher in the fourth calendar quarter because fine particle nitrates are more readily formed in cooler weather, and wood stove and fireplace use produces more carbon.

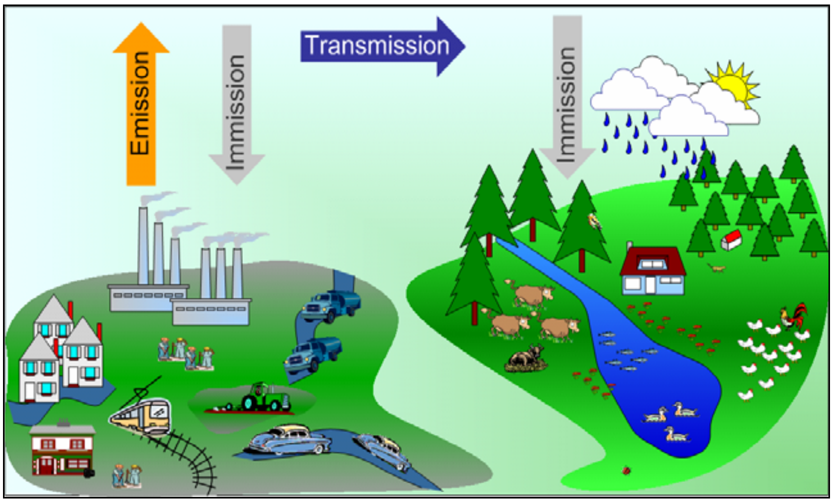

Figure 6: Interrelation of emission, transmission and immission.

Particulate matter (PM) emissions remained quite stable over the period 1990 to 2006: TSP emission increased by 9 %, PM10 emission were about the same level as 1990, and PM2.5 emissions decreased by 8 % over the period 1990 to 2006. Emission trends for PM from 1990 to 2006 are presented in Table 17 and Figure 7, and the emissions of PM are presented relative to 1990. Apart from industry and traffic, private households and the agricultural sector are considerable contributors to emissions of PM. The explanation for these trends is given in the following chapters.

Table 17: National total emissions and emission trends for particulate matter (PM) 1990–2006.

Year	**Emissions [Mg]**		
	TSP	**PM10**	**PM2.5**
1990	68 609	42 974	25 830
1995	71 593	43 442	25 212
1999	70 249	42 585	24 799
2000	74 069	43 925	24 487
2001	73 960	44 142	25 002
2002	73 643	43 547	24 533
2003	73 895	43 806	24 879
2004	74 382	43 702	24 425
2005	73 225	43 056	24 288
2006	75 030	43 465	23 740
Trend 1990–2006	***9 %***	***1 %***	***-8 %***

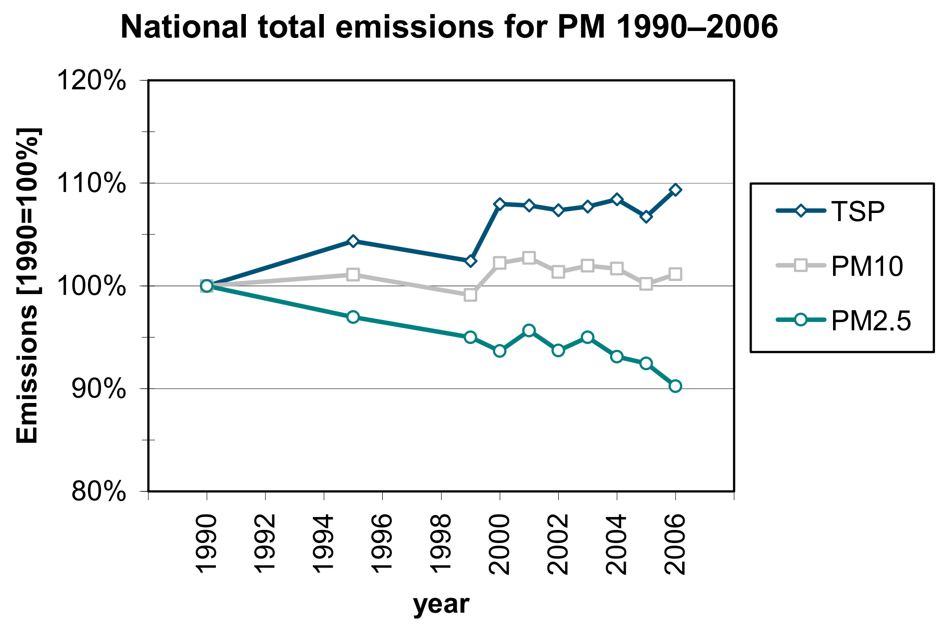

Figure 7: National total emissions for PM 1990–2006.

2.3.1 PM10 Emissions

PM10 is the fraction of suspended particulate matter in the air with d_{ae} less than or equal to a 10 µm, which are collected with 50 % efficiency by a PM10 sampling device. These particles are small enough to be breathable and could be deposited in lungs, which may cause deteriorated lung functions.

PM10 emissions and emission trends in Austria

National total PM10 emissions amounted to 43.0 Gg in 1990 and were almost on the same level as 2006 (emissions in 2006 amounted to 43.5 Gg – see Table 18).

As shown in Table 18 the main source for PM10 emissions in Austria are combustion processes in the energy sector with a share of 53 % in national total emissions in 2006. These emissions are mainly due to fuel combustion activities in the sector:

- "*Other Sectors*" including fuel combustion in commercial and institutional building, households and in the area of agriculture and fishery (47 % of emissions of *Sector 1 A*[81])
  - in *Households* (residential plants) (32 % of emissions of *Sector 1 A*); small combustion plants and households oven and stove are main sources of PM10
  - in *Agriculture and Forestry* (12 % of emissions of *Sector 1 A*); *Off Road Vehicles* and *Other Machinery* are important sources of PM10

[81] Sector 1 A: fuel combustion activities

- Transport activities including mechanical abrasion from road surfaces, and re-suspended dust from roads (36 % of emissions of *Sector 1 A*)
  - *Automobile Road Abrasion* (15 % of emissions of Sector 1 A) is an important PM10 source
  - Road transport activities with *Passenger cars* (9 % of *Sector 1 A*) and *Heavy duty vehicles* (8 % of emissions of *Sector 1 A*) represents the majority of PM sources
- *Manufacturing Industries and Construction* (11% of emissions of *Sector 1 A*) and *Energy Industries* (5 % of emissions of *Sector 1 A*)

The *Sector Industrial Processes* has a share of 33 % in national total PM10 emissions. Whithin this sector

- the subssector *Mineral products* is responsible for about 88 % of the PM10 emission. The handling of bulk materials like mineral products and the activities in the field of civil engineering represents the majority of PM10 sources.
- The activities in the Iron and Steel Production are responsible for about 7 % of PM10 emissions of *Sector Industrial Processes.*

Another source for PM 10 emissions in Austria with a share of about 12 % is the agricultural sector (livestock husbandry and cultivation).

The sectors *Fugitive Emissions from Fuels, Solvent and Other Product Use* and *Waste* are minor PM10 sources.

As presented in Figure 8 and Table 18, the emissions of PM10 are on the same level as in 1990. However, the achievements made by several appropriate measures in the sector *Energy* (NFR 1A) are:

- *Energy Industrie* and *Manufacturing Industries and Construction* by
  - application of abatement techniques such as flue gas collection and flue gas cleaning systems (already in the 1980)
  - installation of energy- and resource-saving production processes (already in the 1980)
  - substitution from high-emission fuels to low-emission (low-ash) fuels. (already in the 1980)
  - raising awareness for environmental production

  The increase of PM10 emissions in the last decade is mainly due to the enourmous increase in energy consumption. Another reason of increasing PM10 emissions is the application of CO_2-neutral fuels such as biomass (wood, pellets,…) in district-heating plants. These fuels belong even with modern technology more to the group of high-emission fuels regarding PM.
- *Other Sector*, which includes commercial, institutional and residential combustion plants by
  - substitution of old installation with modern technology
  - installation of energy-saving combustion plants
  - connection to the district-heating networks or other public energy- and heating networks
  - substitution from high-emission fuels to low-emission (low-ash) fuels.
  - raising awareness for energy sawing and environmental task

- All the above mentioned measures are most completely compensated by enormous increasing PM10 emission of the sector *Transportation* due to increased transport activities of both individual transport (passanger cars) and road/highway transport with heavy duty vehicles. These activities induce of course increasing PM emission from automobile tyre and brake wear as well as mechanical abrasion from road surfaces, and re-suspended dust from roads.

In the Sector *Industrial Processes* (NFR 2) generally an increasing emission trend of 10 % in PM 10 emission can be noted for the period 1990 to 2006 whereas

- especially in the iron and steel industry (*Metal production* (NFR2 C)) enourmous efforts were made in reducing PM 10 emission by introducing low-PM technologies, abatement techniques, flue gas collection and flue gas cleaning system etc.
- also in the *Chemical Industry* (NFR 2B) efforts were made in reducing PM 10 emission due to protective enclosure process lines and bulk materials.

The increase in PM10 emission in the sector *Industrial processes* (NFR 2) is a result of extensive activities in the sector *Mineral products* due to manifold construction activities.

In the Sector *Solvent and Other Product Use (NFR 3)*, which includes fireworks and smoking of tobacco an increasing emission trend of 8 % in PM 10 emission can be noted for the period 1990 to 2006.

In sector NFR 4 *Agriculture* PM10 emissions decreased slightly by about 4 %.

- Tillage operations and harvesting activities *(Agricultural Soils* (NFR 4 D)) are the main sources for PM emissions. The decrease in agricultural production (soil cultivation, harvesting, etc.) is responsible for the decrease of 3 % in PM10 emissions over the period 1990 to 2006.
- A comparatively small amount of the agricultural PM10 emissions result from animal husbandry (NFR 4 G), where a decreasing trend of 14 % can be noted.

Within the source NFR 6 *Waste* the subcategory NFR 6 A *Solid Waste Disposal on Land* is the only source, except for 1990 where 6 C contribute to PM. PM10 emissions increase by about 30 % in the period 1990 to 2006 due to underlying activity data. The increase of activity data and PM emission were mainly in the period 1998 to 2006.

Table 18: PM10 emissions per NFR Category 1990 and 2006, their trend 1990–2006 and their share in total emissions.

NFR Category		PM10 Emissions [Mg]		Trend	Share in National Total	
		1990	2006	1990–2006	1990	2006
1	Energy	23 962	23 340	-3%	56%	54%
1 A	Fuel Combustion Activities	23 658	23 062	-3%	55%	53%
1 A 1	*Energy Industries*	*997*	*1 219*	*22%*	*2%*	*3%*
1 A 2	*Manufacturing Industries and Construction*	*3 791*	*2 610*	*-31%*	*9%*	*6%*
1 A 3	*Transport*	*5 364*	*8 362*	*56%*	*12%*	*19%*
1 A 4	*Other Sectors*	*13 490*	*10 828*	*-20%*	*31%*	*25%*
1 A 5	*Other*	*16*	*44*	*185%*	*<1%*	*<1%*
1 B	Fugitive Emissions from Fuels	305	278	-9%	1%	1%

	NFR Category	PM10 Emissions [Mg]		Trend	Share in National Total	
		1990	2006	1990–2006	1990	2006
2	Industrial Processes	12 920	14 206	10%	30%	33%
2 A	Mineral Products	7 425	12 520	69%	17%	29%
2 B	Chemical Industry	565	280	-51%	1%	1%
2 C	Metal Production	4 561	998	-78%	11%	2%
2 D	Other Production	369	408	11%	1%	1%
3	Solvent and Other Product Use	407	439	8%	1%	1%
4	Agriculture	5 604	5 375	-4%	13%	12%
4 D	Agricultural Soils	5 110	4 952	-3%	12%	11%
4 G	Other	494	422	-14%	1%	1%
6	Waste	70	90	30%	<1%	<1%
	Total Emissions	**42 963**	**43 450**	**1%**		

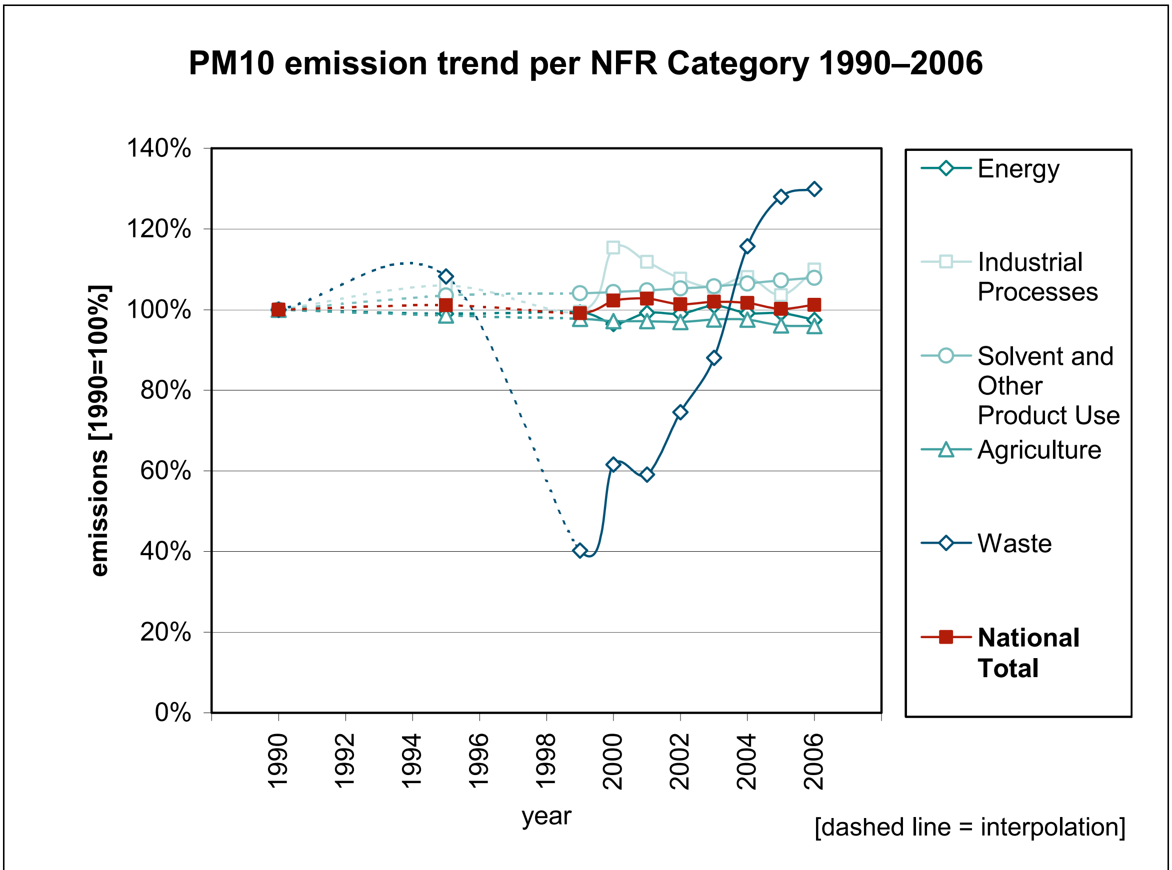

Figure 8: PM10 emission trend per NFR Category 1990–2006.

2.3.2 PM2.5 Emissions

The size fraction PM2.5 refers to particles with a d_{ae} less than or equal to 2.5 µm that are collected by measuring devices with 50 % collection efficiency. Exposure to considerable amounts of PM2.5 can cause respiratory and circulatory complaints in sensitive individuals. PM2.5 also causes reductions in visibility and solar radiation due to enhanced scattering of light. Furthermore, aerosol precursors such as ammonia (the source of which is mainly agriculture) form PM2.5 as secondary particles through chemical reactions in the atmosphere.

PM2.5 emissions and emission trends in Austria

National total PM2.5 emissions amounted to 25 Gg in 1990 and have decreased steadily so that by the year 2006 emissions were reduced by 10 % (to 23 Gg).

As it is shown in Table 19 PM2.5 emissions in Austria mainly arose from combustion processes in the energy sector with a share of 82 % in the total emissions in 2006. Besides the sources already mentioned in the context of TSP and PM10, PM2.5 emissions resulted on a big scale from power plants with flue gas cleaning systems, which filter larger particles. The industrial processes sector had a share of 10 % and the agricultural sector had a share of 5 % in national total emissions.

In general the reduction of PM2.5 emission is due to the installation of flue gas collection and modern flue gas cleaning technologies in several branches.

Table 19: PM2.5 emissions per NFR Category 1990 and 2006, their trend 1990–2006 and their share in total emissions.

	NFR Category	**PM2.5 Emissions [Mg]**		**Trend**	**Share in National Total**	
		1990	**2006**	**1990–2006**	**1990**	**2006**
1	Energy	19 942	18 764	-6%	79%	83%
1 A	Fuel Combustion Activities	19 847	18 676	-6%	79%	82%
1 A 1	*Energy Industries*	*850*	*1 037*	*22%*	*3%*	*5%*
1 A 2	*Manufacturing Industries and Construction*	*3 291*	*2 122*	*-36%*	*13%*	*9%*
1 A 3	*Transport*	*3 398*	*5 630*	*66%*	*14%*	*25%*
1 A 4	*Other Sectors*	*12 292*	*9 844*	*-20%*	*49%*	*43%*
1 A 5	*Other*	*15*	*44*	*191%*	*<1%*	*<1%*
1 B	Fugitive Emissions from Fuels	95	87	-8%	<1%	<1%
2	Industrial Processes	3 505	2 241	-36%	14%	10%
2 A	Mineral Products	990	1 493	51%	4%	7%
2 B	Chemical Industry	302	148	-51%	1%	1%
2 C	Metal Production	2 066	437	-79%	8%	2%
2 D	Other Production	148	163	11%	1%	1%
3	Solvent and Other Product Use	407	439	8%	2%	2%
4	Agriculture	1 245	1 194	-4%	5%	5%
4 D	Agricultural Soils	1 136	1 101	-3%	5%	5%
4 G	Other	110	94	-14%	<1%	<1%
6	Waste	23	28	25%	<1%	<1%
	Total Emissions	**25 122**	**22 667**	**-10%**		

2.3.3 Total suspended particulate matter (TSP) Emissions

Total suspended particulate matter (TSP) refers to the entire range of ambient air matter that can be collected, from the sub-micron level up to 100 µm in aerodynamic diameter (d_{ae}). Particles with a d_{ae} larger than 100 µm will not remain in air for a significant length of time. TSP remains in the air for relatively short periods of time and are therefore generally not carried long distances. As a result TSP tend to be a local rather than a regional problem, occurring close to industrial sources, such as metal processing plants and mining operations, along roads because of the re-suspension, and close to stables and agricultural crop land.

TSP emissions and emission trends in Austria

National total TSP emissions amounted to 69 Gg in 1990 and mounted to 75 Gg in 2006, which is an increase of about 9 % (Table 20). TSP emissions in Austria derive from industrial processes, road transport, agriculture and small heating installations.

Table 20: TSP emissions per NFR Category 1990 and 2006, their trend 1990–2006 and their share in total emissions.

	NFR Category	TSP Emissions [Mg]		Trend	Share in National Total	
		1990	2006	1990–2006	1990	2006
1	Energy	31 812	33 224	4%	46%	44%
1 A	Fuel Combustion Activities	31 165	32 635	5%	45%	44%
1 A 1	*Energy Industries*	*1 054*	*1 317*	*25%*	*2%*	*2%*
1 A 2	*Manufacturing Industries and Construction*	*4 342*	*3 199*	*-26%*	*6%*	*4%*
1 A 3	*Transport*	*10 981*	*16 164*	*47%*	*16%*	*22%*
1 A 4	*Other Sectors*	*14 772*	*11 910*	*-19%*	*22%*	*16%*
1 A 5	*Other*	*16*	*45*	*176%*	*<1%*	*<1%*
1 B	Fugitive Emissions from Fuels	647	589	-9%	1%	1%
2	Industrial Processes	23 769	29 202	23%	35%	39%
2 A	Mineral Products	15 455	26 286	70%	23%	35%
2 B	Chemical Industry	958	477	-50%	1%	1%
2 C	Metal Production	6 435	1 418	-78%	9%	2%
2 D	Other Production	922	1 020	11%	1%	1%
3	Solvent and Other Product Use	407	439	8%	1%	1%
4	Agriculture	12 453	11 944	-4%	18%	16%
4 D	Agricultural Soils	11 355	11 005	-3%	17%	15%
4 G	Other	1 098	939	-14%	2%	1%
6	Waste	145	191	31%	<1%	<1%
0	**Total Emissions**	**68 587**	**75 001**	**9%**		

As shown in Table 20 the main source for TSP emissions in Austria with a share of 44 % were

- combustion processes in the energy sector (mainly small combustion plants, oven or stoves fired with wood or coke in households
- PM emission from automobile tyre and brake wear as well as mechanical abrasion from road surfaces, and re-suspended dust from roads.

In the energy sector neither an overall reducing nor an increasing trend could be noted (slight increase of 5 %). The emissions within the energy sector are very inhomogeneous: the decrease of TSP emission in especially the manufacturing industries and construction branch, is completely compensated by enormously increasing TSP emission from transportation activities.

The second main sector for TSP emission is the Sector *Industrial Processes* with a share of 39 %. The increasing TSP emissions in this sector are due to intensive activities in mineral production and the construction branch.

The sector NFR 4 *Agriculture* has a contribution to the national total TSP emission of 16 % in 2006. A slight decreasing trend of 3 % can be noted due to dreasing activities.

2.4 Reassessment of the Austrian Air Emission Inventory (OLI) for Particulate matter (PM)

The Austrian Air Emission Inventory (OLI) for Particulate matter (PM) was reassessed within the scope of an external study [82] based on

- a previous quantitative estimate[83],
- the official Austrian emission inventory (OLI), and
- recent studies on the quantification of PM emissions.

In the course of the reassessment new emission sources were included, activity data and emission factors updated and methodologies improved.

The main conclusions of the study are that

- TSP emissions in Austria mainly arise from industrial processes, road transport, agriculture and small heating installations.
- Smaller size fractions (PM10, and especially PM2.5) are dominated by combustion emissions – PM2.5 emissions mainly arise from small heating installations, road transport and off-road transport".
- For small heating installations, increases in firewood consumptions - which are usually not very efficient in terms of emissions, thus resulting in higher PM emissions - have been more than counterbalanced by the introduction of efficient burners over the last decade, so overall emissions have decreased.

Furthermore, the concept of "potential emissions" was developed to describe a situation where huge discrepancies between reported amounts of material available for atmospheric release and their actual atmospheric occurrence are evident. The "potential emissions" are to be seen as upper boundaries to possible release fluxes, but require confirmation from atmospheric measurements before being accepted to the inventory – including them would easily double overall PM emissions (total suspended particles, TSP). Potential emissions occur for fugitive emissions, dominating overall emissions and the large size fractions.

[82] WINIWARTER, W.; SCHMID-STEJSKAL, H. & WINDSPERGER, A. (2007): Aktualisierung und Verbesserung der österreichischen Luftschadstoffinventur für Schwebstaub. Systems research – Austrian Research Centers &Institut für Industrielle Ökologie. Wien.

[83] WINIWARTER, W.; TRENKER, C.; HÖFLINGER, W. 2001: Österreichische Emissionsinventur für Staub. Österreichisches Forschungszentrum Seibersdorf. Wien.

Other conclusions of the study were:

- Further improvement of the inventory would require first of all additional measurements, for those sources where potential emissions may play a role. Combustion emission estimates would strongly benefit from better activity estimates, specifically concerning the quantity of wood burnt in modern installations.
- The most promising abatement option is the phase-out of outdated technology. This includes old Diesel engines used in "other transport", as well as old, inefficient equipment to burn wood. Possible measures in limestone quarries could help reduce fugitive emissions.

Even though there are high uncertainties concerning PM emissions not only in terms of absolute emissions, but also regading the time and place/spot of emissions (PM emissions often are a temporal and local problem), the inventory data proved to be helpful in explaing source patterns of immission measurements in Austrian cities. From this follows that further attention with regard to off-city sources (like those from industrial processes) are necessary.

2.5 Emission Trends for Heavy Metals

In general emissions of heavy metals decreased remarkably from 1985 to 2006. Emission trends for heavy metals from 1985 to 2006 are presented in Table 21. Emissions for all three priority heavy metals (Cd, Pb, Hg) are well below their 1985 level, which is the obligation for Austria as a Party to the Heavy Metals Protocol (see Chapter 2.1.4).

Table 21: National total emissions and emission trends for heavy metals 1985–2006.

Year	Emissions [Mg]		
	Cd	Hg	Pb
1985	3.10	3.74	326.79
1986	2.70	3.32	313.03
1987	2.21	2.84	302.13
1988	1.94	2.45	272.20
1989	1.74	2.24	239.34
1990	1.58	2.14	207.35
1991	1.53	2.04	171.75
1992	1.25	1.64	119.83
1993	1.16	1.39	86.20
1994	1.06	1.18	59.66
1995	0.97	1.20	16.07
1996	0.99	1.16	15.50
1997	0.97	1.13	14.49
1998	0.90	0.95	12.99
1999	0.98	0.94	12.50
2000	0.95	0.89	11.96
2001	0.98	0.95	12.10
2002	1.00	0.94	12.46
2003	1.03	0.98	12.68
2004	1.03	0.94	13.07
2005	1.10	1.00	13.71
2006	1.12	1.02	14.12
Trend 1985–2006	**-64%**	**-73%**	**-96%**

2.5.1 Cadmium (Cd) Emissions

Cadmium (Cd) has been ubiquitously distributed in the natural environment for millions of years. It occurs in the earth's crust with a content estimated to be between 0.08 and 0.5 ppm.[84] Unlike some other heavy metals, such as lead or mercury, which have been used since ancient times, Cd has been refined and utilized only since 100 years, but it was already discovered in 1817. The production and consumption of Cd has risen distinctly only since the 1940's. The primary uses are electroplated cadmium coatings, nickel-cadmium storage batteries, pigments, and stabiliz-

[84] Ullmann's Encyclopedia of Industrial Chemistry (2003): Cadmium and Cadmium Compounds. Wiley-VCH Verlag

ers for plastics. Publicity about the toxicity of cadmium has affected the consumption significantly.

For human beings Cd does not have a biological function unlike many other elements. The smoking (of tobacco) stands for an important exposure to Cd: smokers generally have about twice as high cadmium concentrations in the renal cortex compared to non-smokers. For the non-smoking population food is an important source of exposure because Cd is accumulated in the human and animal bodies due to its long half-life. Cd compounds and complexes are classified as an unambiguous carcinogenic working material.

Cadmium emissions and emission trends in Austria

National total Cd emissions amounted to 3.1 Mg in 1985, and amounted to 1.58 Mg in 1990; since then emissions have decreased steadily and by the year 2006 emissions were reduced by 64% (1.12 Mg).

As shown in Table 22 the main source for Cd emissions in Austria with a share of 80% is the energy sector. These emissions mainly arise from combustion of heavy fuel oil, wood and wood waste as well as black liqour. The sub sectors with the highest contribution to Cd emissions from the energy sector are residential plants with 21%, petroleum refining with 15%, road transportation with 8% and pulp, paper and print with 8% in 2006. The industrial processes sector contributed about 20% to national total Cd emission.

The overall reduction from 1985 to 2006 is mainly due to decreasing emissions from the industrial processes and energy sector because of a decrease in the use of heavy fuel oil and improved or newly installed flue gas abatement techniques. The significantly emission reduction in the Sector *Solvent and Other Product Use* results from the ban of Cd in paint.

Cd emissions are increasing again in the last few years, which is due to the growing activities in the industrial processes sector and energy sector. The increasing Cd-emission in the energy sector were due increasing use of wood and wooden litter in small combustion plants, the combustion of heavy fuel oil and residues from the petroleum processing in the refinery as well as the thermal utilisation of industrial residues and residential waste. The use of hard coal has increased also. Another reason is the continuously growing activity in the transport sector, especially of heavy duty vehicles.

Table 22: Cd emissions per NFR Category 1985 and 2006, their trend 1985–2006 and their share in total emissions.

NFR Category		Cd Emissions [Mg]			Trend		Share in National Total		
		1985	1990	2006	1985–2006	1990–2006	1985	1990	2006
1	Energy	2.08	1.06	0.90	-57%	-15%	67%	67%	80%
1 A	*Fuel Combustion Activities*	2.08	1.06	0.90	-57%	-15%	67%	67%	80%
1 B	*Fugitive Emissions f. Fuels*	NA	NA	NA					
2	Industrial Processes	0.84	0.46	0.22	-73%	-51%	27%	29%	20%
3	Solvent a. Other Product Use	<0.01	<0.01	NA			<1%	<1%	
4	Agriculture	0.04	<0.01	<0.01	-96%	-16%	1%	<1%	<1%
6	Waste	0.14	0.06	<0.01	-99%	-98%	4%	4%	<1%
	National Total	3.10	1.58	1.12	-64%	-29%	100%	100%	100%

2.5.2 Mercury (Hg) Emissions

Mercury (Hg) has been ubiquitously distributed in the natural environment for millions of years. It occurs in the earth's crust with a content estimated to be about $4 \cdot 10^{-5}$%.[85] Because of its special properties, mercury has had a number of uses for a long time: the conventional application is the thermometer, barometer, and hydrometer; other important areas of use are the lighting industry and for electrical components. Mercury forms alloys with a large number of metals, these alloys also have a wide range of applications.

Mercury emissions and emission trends in Austria

In 1985 national total Hg emissions amounted to 3.7 Mg and amounted to 2.1 Mg in 1990; emissions have decreased steadily and by the year 2006 emissions were reduced by 73%.

As it is shown in Table 23 Hg emissions mainly arise from the energy sector by combustion processes with a share of 68% of the total emissions in 2006. These emissions are composed of emissions from combustion of coal, heavy fuel oil and waste in manufacturing idustries and construction, the combustion of wood, wood waste and coal in residential plants and combustion of coal and heavy fuel oil in public electricity and heat production.

Process related emissions in the sector industrial processes (especially metal industries) account for about 30% of national total Hg emissions in 2006. Hg emissions mainly arise from the same sub-sectors as Cd emissions, which are residential heating, industry and energy industries.

The overall reduction of about 73% for the period 1985 to 2006 was due to decreasing emissions from the industrial processes sector and residential heating due to a decrease in the use of heavy fuel oil and wood as fuel and also due to improved emission abatement techniques in industry. Several bans in different industrial sub-sectors as well in the agriculture sector lead to the sharp fall of total Hg emission in Austria.

Table 23: Hg emissions per NFR Category 1985 and 2006, their trend 1985–2006 and their share in total emissions.

NFR Category		Hg Emissions [Mg]			Trend		Share in National Total		
		1985	**1990**	**2006**	**1985–2006**	**1990–2006**	**1985**	**1990**	**2006**
1	Energy	2.98	1.56	0.69	-77%	-56%	80%	73%	68%
1 A	*Fuel Combustion Activities*	2.98	1.56	0.69	-77%	-56%	80%	73%	68%
1 B	*Fugitive Emissions f. Fuels*	NA	NA	NA					
2	Industrial Processes	0.67	0.53	0.31	-54%	-41%	18%	25%	30%
3	Solvent a. Other Product Use	NA	NA	NA					
4	Agriculture	0.01	<0.01	<0.01	-96%	-16%	<1%	<1%	<1%
6	Waste	0.09	0.05	0.02	-76%	-62%	2%	3%	2%
	National Total	**3.74**	**2.14**	**1.02**	**-73%**	**-52%**			

[85] Ullmann's Encyclopedia of Industrial Chemistry Copyright (2003): Mercury and Mercury Compounds.

2.5.3 Lead (Pb) Emissions

In the past, automotive sources were the major contributor of lead emissions to the atmosphere. Due to Austrian regulatory efforts to reduce the content of lead in gasoline the contribution of air emissions of lead from the transportation sector has drastically declined over the past two decades. Today, industrial processes, primarily metals processing, are the major sources of lead emissions. The highest air concentrations of lead are usually found in the vicinity of smelters and battery manufacturers. Exposure to lead occurs mainly through inhalation of air and ingestion of lead in food, water, soil, or dust. It accumulates in the blood, bones, and soft tissues and can adversely affect the kidneys, liver, nervous system, and other organs. Lead can also be deposited on the leaves of plants, which pose a hazard to grazing animals and humans through ingestion via food chain.

Lead emissions and emission trends in Austria

In 1985 national total Pb emissions amounted to 327 Mg and to 207 Mg in 1990; emissions have decreased steadily and by the year 2006 emissions were reduced by 96% (14 Mg).

As it is shown in Table 23 today's Pb emissions mainly arise from the energy sector by combustion processes with a share of about 53% of the Austrian Pb emissions. In 1985 the main emission source for Pb emissions with a share of about 79% was the sector energy especially the sub-sector *road transport*. From 1990 to 1995 Pb emissions from this sector decreased by 100% due to prohibition of the addition of lead to petrol.

In addition to emission reduction in the energy sector the sector industrial proesses reduced its emissions remarkably due to improved dust abatement technologies. The significantly emission reduction in the sector solvent and other product use results from the ban of Pb in this production field or products.

Table 24: Pb emissions per NFR Category 1985 and 2006, their trend 1985–2006 and their share in total emissions.

NFR Category		Pb Emissions [Mg]			Trend		Share in National Total		
		1985	1990	2006	1985–2006	1990–2006	1985	1990	2006
1	Energy	258.20	174.17	7.49	-97%	-96%	79%	84%	53%
1 A	*Fuel Combustion Activities*	258.20	174.17	7.49	-97%	-96%	79%	84%	53%
1 B	*Fugitive Emissions f. Fuels*	NA	NA	NA					
2	Industrial Processes	62.45	32.09	6.61	-89%	-79%	19%	15%	47%
3	Solvent a. Other Product Use	0.06	0.07	NA			<1%	<1%	
4	Agriculture	0.23	0.01	0.01	-95%	-16%	<1%	<1%	<1%
6	Waste	5.85	1.02	0.01	-100%	-99%	2%	<1%	<1%
	National Total	**326.79**	**207.35**	**14.12**	**-96%**	**-93%**			

2.6 Emission Trends for POPs

Emissions of Persistent Organic Pollutants (POPs) decreased remarkably from 1985 to 2006. As can be seen in Table 25, emissions for all three POPs are well below their 1985 level, which is the obligation for Austria as a Party to the POPs Protocol (see Chapter 1.1.1).

The most important source for POPs in Austria is residential heating. In the 80s industry and waste incineration were still important sources regarding POP emissions. Due to legal regulations concerning air quality emissions from industry and waste incineration decreased remarkably from 1990 to 1993, which is the main reason for the overall decrease in national total POP emissions.

Table 25: Emissions and emission trends for POPs 1985–2006.

Year	Emission		
	PAH [Mg]	Dioxin [g]	HCB [kg]
1985	27.05	187.13	106.31
1986	26.32	186.04	103.76
1987	26.23	187.93	106.55
1988	24.65	173.21	97.96
1989	24.26	164.27	94.72
1990	17.30	160.27	91.77
1991	17.89	134.99	84.44
1992	13.33	76.47	69.51
1993	10.12	66.77	63.84
1994	9.28	56.06	51.79
1995	9.62	58.27	52.93
1996	10.72	59.64	55.64
1997	9.29	59.33	51.78
1998	8.94	56.15	49.01
1999	8.80	53.59	47.56
2000	8.21	51.99	44.15
2001	8.89	54.35	47.35
2002	8.71	42.57	45.02
2003	9.04	43.31	45.60
2004	8.99	42.75	43.86
2005	9.19	44.65	45.58
2006	8.73	43.69	43.10
Trend 1985–2006	***-68%***	***-77%***	***-59%***

2.6.1 Polycyclic Aromatic Hydrocarbons (PAH) Emissions

The polycyclic aromatic hydrocarbons (PAH) are molecules built up of benzene rings which resemble fragments of single layers of graphite. PAHs are a group of approximately 100 compounds. Most PAHs in the environment arise from incomplete burning of carbon-containing materials like oil, wood, garbage or coal. Fires are able to produce fine PAH particles, they bind to ash particles and sometimes move long distances through the air. Thus PAHs have been ubiquitously distributed in the natural environment since thousands of years.

Out all different compounds of the pollutant group of PAHs, the four compounds benz(a)pyren, benzo(b)fluoranthen, benzo(k)fluoranthen and indeno(1,2,3-cd)pyren are used as indicators for the purposes of emission inventories, which has been specified in the UNECE POPs Protocol mentioned above.

PAH emissions and emission trends in Austria

In 1985 national total PAH emissions amounted to about 27 Mg and amounted to about 17 Mg in 1990; emissions have decreased steadily and by the year 2006 emissions were reduced by about 68% (to 9 Mg in 2006).

In 1985 the main emission sources for PAH emissions were the Sectors Energy (44%), Industrial processes (29%) and Agriculture (26%). In 2006 the main source regarding PAH emissions is *Energy* with a share in the national total of 95%. From 1985 to 2006 PAH emissions from Agriculture decreased remarkably by 97% due to prohibition of open field burning, PAH emissions from the sector Industrial processes decreased by 97% due to the shut down of primary aluminium production in Austria, which was a main source for PAH emissions.

Table 26: PAH emissions per NFR Category 1985 and 2006, their trend 1985–2006 and their share in total emissions.

NFR Category		PAH Emissions [Mg]			Trend		Share in National Total		
		1985	1990	2006	1985–2006	1990–2006	1985	1990	2006
1	Energy	11.95	9.47	8.31	-30%	-12%	44%	55%	95%
1 A	*Fuel Combustion Activities*	11.95	9.47	8.31	-30%	-12%	44%	55%	95%
1 B	*Fugitive Emissions from Fuels*	NA	NA	NA					
2	Industrial Processes	7.88	7.44	0.22	-97%	-97%	29%	43%	3%
3	Solvent a. Other Product Use	0.15	0.15	NA		1%	1%		
4	Agriculture	7.07	0.24	0.20	-97%	-18%	26%	1%	2%
6	Waste	0.00	0.00	0.00	-91%	-89%	<1%	<1%	<1%
	National Total	**27.05**	**17.30**	**8.73**	**-68%**	**-50%**			

2.6.2 Dioxins and Furan

Dioxins form a family of toxic chlorinated organic compounds that share certain chemical structures and biological characteristics. Several hundred of these compounds exist and are members of three closely related families: the chlorinated dibenzo(p)dioxins (CDDs), chlorinated dibenzofurans (CDFs) and certain polychlorinated biphenyls (PCBs). Dioxins bio-accumulate in humans and wildlife due to their fat solubility and 17 of these compounds are especially toxic.

Dioxins are formed as a result of combustion processes such as commercial or municipal waste incineration and from burning fuels like wood, coal or oil as a main source of dioxins. Dioxins can also be formed when household trash is burned and as a result of natural processes such as forest fires. Dioxins enter the environment also through the production and use of organochlorinated compounds: chlorine bleaching of pulp and paper, certain types of chemical manufacturing and processing, and other industrial processes are able to create small quantities of dioxins. Cigarette smoke also contains small amounts of dioxins.

Thanks to stringent legislation and modern technology dioxin emissions due to combustion and incineration as well as due to chemical manufacturing and processes have been reduced dramatically. Nowadays domestic combustion as well as thermal processes in metals extraction and processing have become more significant.

Dioxin/Furan emissions and emission trends in Austria

In 1985 national total dioxin/furan emissions amounted to about 187 g and amounted to about 160 g in 1990; emissions have decreased steadily and by the year 2006 emissions were reduced by about 77% (to 44 g in 2006).

In 1985 the main sources for dioxin/furan emissions were the Sectors *Energy* (59%) and *Industrial Processes* (especially iron and steel production)(27%). In 2006 the main sector regarding dioxin/furan emissions is *Energy* with a share in National Total of 88%.

From 1985 to 2006 PAH emissions from the sectors *Waste* and *Solvents and Other Product Use* decreased by almost 100% due to stringent legislation and modern technology. The dioxin emissions of the sectors *Agriculture* and *Industrial processes* decreased by 97% and 91%, respectivley, due to prohibition of open field burning and improved emission abatement technologies in iron and steel industries.

Table 27: Dioxin emissions per NFR Category 1985 and 2006, their trend 1985–2006 and their share in total emissions.

NFR Category		**Dioxin Emissions [g]**			**Trend**		**Share in National Total**		
		1985	**1990**	**2006**	**1985–2006**	**1990–2006**	**1985**	**1990**	**2006**
1	Energy	109.69	101.84	38.62	-65%	-62%	59%	64%	88%
1 A	*Fuel Combustion Activities*	*109.69*	*101.84*	*38.62*	*-65%*	*-62%*	*59%*	*64%*	*88%*
1 B	*Fugitive Emissions from Fuels*	*NA*	*NA*	*NA*					
2	Industrial Processes	51.30	39.00	4.76	-91%	-88%	27%	24%	11%
3	Solvent & Other Product Use	5.19	1.06	NA			3%	1%	-
4	Agriculture	5.05	0.18	0.15	-97%	-18%	3%	<1%	<1%
6	Waste	15.90	18.19	0.17	-99%	-99%	8%	11%	<1%
	National Total	**187.13**	**160.27**	**43.69**	**-77%**	**-73%**			

2.6.3 Hexachlorobenzene (HCB) Emissions

Hexachlorobenzene (HCB) has been widely employed as a fungicide on seeds, especially against the fungal disease 'bunt' that affects some cereal crops. The marketing and use of hexachlorobenzene as a plant protection product was banned in the European Union in 1988.

As there is no more hexachlorobenzene production in the EU, the only man-made releases of hexachlorobenzene are as unintentional by-product; it is emitted from the same chemical and thermal processes as Dioxins/Furans and formed via a similar mechanism.

It is released to the environment as an unintentional by-product in chemical industry (production of several chlorinated hydrocarbons such as drugs, pesticides or solvents) and in metal industries and is formed in combustion processes in the presence of chlorine.

HCB emissions and emission trends in Austria

In 1985 national total HCB emissions amounted to about 106 g and amounted to about 92 g in 1990; emissions have decreased steadily and by the year 2006 emissions were reduced by about 597% (to 43 g in 2006).

In 1985 the two main sources for HCB emissions were the sectors *Energy* (78%) and *Industrial processes* (12%). In 2006 the main sector of HCB emissions is *Energy* with a share in National Total of 91%.

From 1985 to 2006 HCB emissions from the sectors *Waste* and *Agriculture* as well as *Solvents and Other Products Use* decreased remarkably by 94% and more due to stringent legislation and modern technology. HCB emissions of the sectors *Industrial processes* and *Energy* decreased by 72% or 53% respectively due to improved dust abatement technologies. National total emissions decreased by 59% in the period from 1985 to 2006.

Table 28: Hexachlorbenzene (HCB) emissions per NFR Category 1985 and 2006, their trend 1985–2006 and their share in total emissions.

NFR Category		HCB Emissions [g]			Trend		Share in National Total		
		1985	1990	2006	1985–2006	1990–2006	1985	1990	2006
1	Energy	83.21	72.57	39.27	-53%	-46%	78%	79%	91%
1 A	*Fuel Combustion Activities*	*83.21*	*72.57*	*39.27*	*-53%*	*-46%*	*78%*	*79%*	*91%*
1 B	*Fugitive Emissions from Fuels*	*NA*	*NA*	*NA*					
2	Industrial Processes	13.27	9.71	3.76	-72%	-61%	12%	11%	9%
3	Solvent and Other Product Use	7.71	9.05	NA			7%	10%	
4	Agriculture	1.01	0.04	0.03	-97%	-18%	1%	<1%	<1%
6	Waste	1.11	0.39	0.03	-97%	-91%	1%	<1%	<1%
0	**National Total**	106.31	91.77	43.10	-59%	-53%	100%	100%	100%

3 MAJOR CHANGES

3.1 Relation to data reported earlier

As a result of the continuous improvement of Austria's National Air Emission Inventory, emissions of some sources have been recalculated based on updated data or revised methodologies, thus emission data for 1990 to 2005 submitted this year differ from data reported previously.

The figures presented in this report replace data reported earlier by the Umweltbundesamt under the reporting framework of the UNECE/LRTAP Convention and NEC Directive of the European Union.

Explanations for recalculations per sector are given in Chapter 3.3.

The main recalculation concerning all sectors was the reassessment of the Austrian Air Emission Inventory (OLI) for PM within the scope an external study [82]. Explanations for the recalcaulations per sector are given below.

Table 29: Recalculation difference of Austria's PM emissions compared to the previous submission.

	TSP	PM10	PM2.5
1990	-25%	-10%	-10%
2000	-17%	-4%	-7%
2005	-20%	-5%	-7%

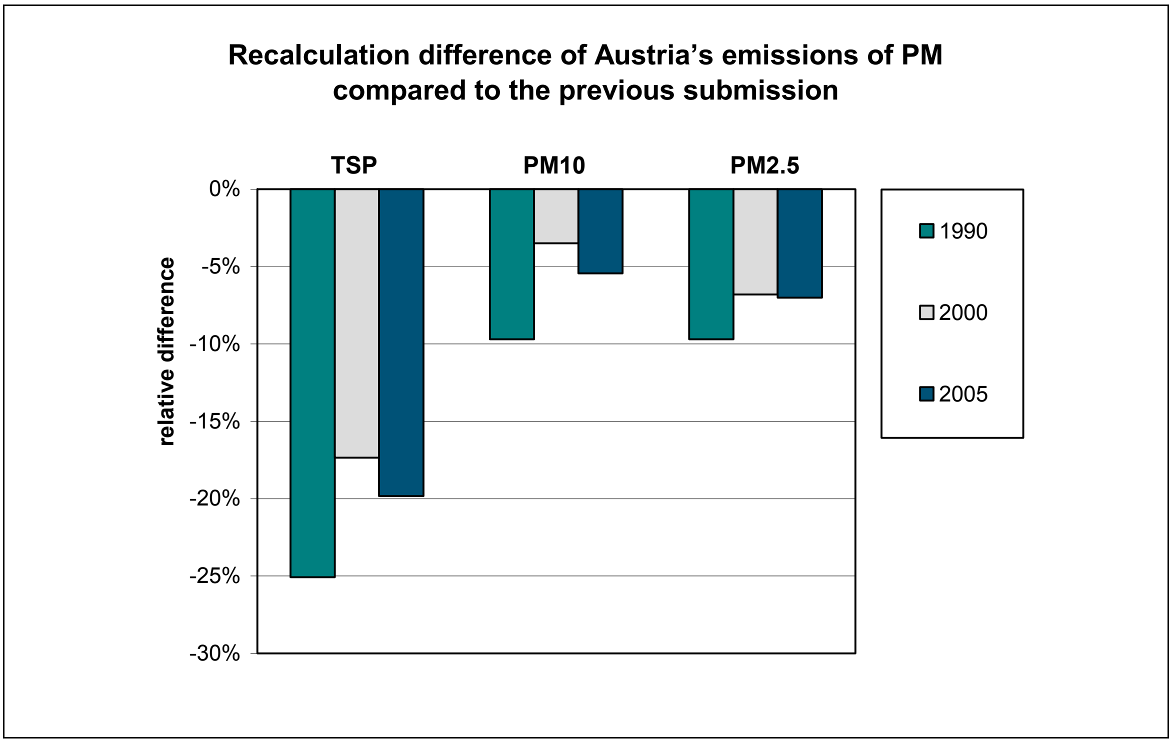

Figure 9: Recalculation difference of Austria's emissions of PM compared to the previous submission.

3.2 Explanations and Justifications for Recalculations

Compiling an emission inventory includes data collecting, data transfer and data processing. Data has to be collected from different sources, for instance

- national statistics
- associations
- plant operators
- studies
- personal information
- other publications.

The provided data must be transferred from different data formats and units into a unique electronic format to be processed further. The calculation of emissions by applying methodologies on the collected data and the final computing of time series into a predefined format (NFR) are further steps in the preparation of the final submission. Finally the submission must be delivered in due time. Even though a QA/QC system gives assistance so that potential error sources are minimized it is necessary to make some revisions – so called recalculations – under the following circumstances:

- An emission source was not considered in the previous inventory.
- A source/data supplier has delivered new data because previous data were preliminary data only (by estimation, extrapolation) or the methodology has been improved.
- Occurrence of errors in data transfer or processing: wrong data, unit-conversion, software errors, et al.
- Methodological changes: a new methodology must be applied to fulfil the reporting requirements because one of the following reasons:
  - to decrease uncertainties;
  - an emission source becomes a key source;
  - consistent input data needed for applying the methodology is no longer accessible;
  - input data for more detailed methodology is now available;
  - methodology is no longer appropriate.

3.3 Major Changes by Sector

This chapter describes the methodological changes by sector made to the inventory since the previous submission.

3.3.1 Major Changes SECTOR 1 ENERGY

Fuel Combustion (1A)

Changes in Allocation

From 2002 to 2005 sinter magnesite plants have been shifted from category *1 A 2 b Non Ferrous Metals* to category *1 A 2 f Other Industry.*

Update of activity data and NCVs

Update of activity data and NCVs are following the updates of the IEA compliant energy balance compiled by the federal statistics authority STATISTIK AUSTRIA.

Energy balance update and corrections:

Correction of residual fuel oil NCVs from 1995 to 2005 (e.g. +2% in 1999, +1% in 2005).

Correction of hard coal NCVs from 1999 to 2001 and from 2004 to 2005 (e.g -4.5% in 2000; -0.2% in 2005).

Correction of brown coal NCVs from 1999 to 2001 and for 2005 (e.g +0.2% in 1999; +3.9% in 2001).

Correction of petrol coke and 'other oil products' NCVs 1994 to 1996 (+0.2%).

Correction of NCVs affects fuel consumption calculation (conversion of tonnes or cubic meters to TJ) and therefore leads to changes in emissions alculation for the respecity fuels and periods as mentioned above.

Update of activity data (in 'tonnes' or 'cubic metres' per category) mainly affects the period 1999 to 2004. Transformation input has been revised to improve the compliance between transformation input and electricity and heat production (more reliable efficiencies). National fossil fuel consumption are not affected by this update but consumption and emissions have been shifted between categories 1.A.1 (public energy plants) and 1.A.2 (auto producers plants) and/or between final energy consumption and transformation input.

1 A 3 b Transport – Road Transportation:

Update of statistical energy data, particularly the biodiesel consumption.

1 A 3 e Other Transportation - pipeline compressors:

Update of 2004 natural gas consumption according to the updated national energy balance.

1 A 4 a Commercial/Institutional and *1 A 4 b Residential*

New sources like charcoal production, barbecue, bonfire, open firepits are incorporated.

1 A 4 Other Sectors – Mobile Sources:

Update of statistical energy data for railways (coal, diesel, electricity) up to 2000.

Improvements of methodologies and emission factors:

1 A 1 a Public Electricity and Heat Production:

Gap-filling of missing NO_X emission declarations by means of EPER data (GUD Leopoldau 2000 to 2006).

Update of NH_3 emissions factor of coal plants according to actual measurements.

1.A.2.a Iron and Steel

Update of 2005 SO_2 emissions according to new information from industry (VOEST).

1.A.2.d Pulp and Paper

Update of 2005 PM emissions according to a report published by the Austrian paper manufacturing industry.

1 A 2 f Cement Production:

Update of emissions 2003-2005 according to a study of the Austrian cement manufacturing industry.

1.A.2.f Other Industry

PM emissions from cement and limestone kilns are now included under NFR 2 A 1 and 2 A 2.

1 A 4 b Residential:

Update of heating type split from 2001 onwards by means of 2004 houshold census data. This affects calculation of CO, NMVOC, NOX (and POPs) emissions from residential heatings.

Fuel consumption of new biomass-, gas- and oil-heatings have been revised from the year 2000 onwards by means of boiler sales statistics. This affects calculation of CO, NMVOC, NO_X, (PM and POPs) emissions from residential heatings.

1 A 3 b Road Transport:

All emission factors for passenger cars, light goods vehicles and motorcycles have been updated. The source of the new emission factors is the EU project ARTEMIS (Assessment and Reliability of Transport Emission Models and Inventory Systems). In ARTEMIS a new set of real world driving cycles was developed (CADC, Common ARTEMIS Driving Cycle; http://www.trl.co.uk/artemis/introduction.htm). This CADC results, for most exhaust gas components, in clearly different emission factors compared to the former ones (UMWELTBUNDESAMT 2004: Handbook Emission Factors for Road Transport (HBEFA); Version 2.1**.** www.hbefa.net). In the majority of cases the emission levels are significantly higher, primarily for NOx.

Furthermore a new transport model has been implemented. New data with reference to vehicle-kilometres, ton-kilometres and passenger-kilometres was used. The current figures show for 2005 approximately 8% more vehicle kilometres in Austria than the former set of traffic activity data.

All these changes in the traffic numbers and in the emission factors clearly show effects on the total transport-related emissions set out in the inventory (for the whole time series).

<u>*New estimates for Offroad-Abrasion*</u>

1 A 5 b Military

1 A 4 c 2 Agriculture (off-site)

1 A 4 c 2 Forestry

1 A 2 f Industry

FUGITIVE EMISSIONS (1 B)

Update of activity data:

1 B 2 Fugitive emissions from fuels:

Activity data for 2005 were updated due to updated energy statistics and updated information on the gas distribution network.

Table 30: Recalculation difference of Austria's PM emissions compared to the previous submission in Sector 1

	1990			2000			2005		
	Δ %	OLI 2006	OLI 2007	Δ %	OLI 2006	OLI 2007	Δ %	OLI 2006	OLI 2007
PM2.5 [Mg]									
1A	*-6%*	21 041	19 847	*-2%*	19 172	18 859	*-1%*	19 413	19 146
1A1	*9%*	780	850	*10%*	521	572	*13%*	752	847
1A2	*-2%*	3 357	3 291	*0%*	2 601	2 605	*-6%*	2 146	2 021
1A3	*-40%*	5 622	3 398	*-20%*	6 866	5 471	*-18%*	7 453	6 090
1A4	*9%*	11 268	12 292	*11%*	9 166	10 194	*12%*	9 020	10 145
1A5	*1%*	15	15	*1%*	17	18	*0%*	42	42
1B	=	95	95	*0%*	82	82	*0%*	91	91
PM10 [Mg]									
1A	*-1%*	23 920	23 658	*4%*	21 934	22 842	*5%*	22 326	23 459
1A1	*8%*	926	997	*8%*	619	666	*11%*	893	993
1A2	*3%*	3 668	3 791	*8%*	2 846	3 061	*3%*	2 396	2 477
1A3	*-23%*	6 985	5 364	*-6%*	8 464	7 946	*-4%*	9 131	8 792
1A4	*9%*	12 326	13 490	*12%*	9 988	11 150	*13%*	9 864	11 154
1A5	*4%*	15	16	*3%*	17	18	*1%*	42	43
1B		305	305	*0%*	263	263	*0%*	290	289
TSP [Mg]									
1A	*-3%*	31 984	31 165	*2%*	31 060	31 540	*3%*	31 962	32 924
1A1	*7%*	982	1 054	*7%*	668	713	*11%*	964	1 069
1A2	*12%*	3 871	4 342	*20%*	3 013	3 601	*18%*	2 569	3 038
1A3	*-20%*	13 738	10 981	*-9%*	16 552	15 016	*-7%*	17 680	16 513
1A4	*10%*	13 378	14 772	*13%*	10 809	12 192	*14%*	10 708	12 260
1A5	*9%*	15	16	*8%*	17	19	*3%*	42	43
1B		647	647	*0%*	556	558	*0%*	614	612

3.3.2 Major Changes SECTOR 2 INDUSTRIAL PROCESSES

Update of activity data:

2 D 1 Other Production – Pulp and Paper (chipboard production):

Activity data for 2005 has been updated.

2 D 2 Other Production – Food and Drink (Bread, Wine, Beer and Spirits):

Activity data for 2005 has been updated.

Improvements of methodologies and emission factors:

2 Industrial Processes

Updating methodology and emission factors for handling bulk materials according VDI guidelines 3790

2 A 1 Cement Production and *2 A 2 Lime Production*

PM emissions from cement and limestone kilns from 1 A 2 f Other Industry are now included under 2 A 1 and 2 A 2

2 A 7 *Construction and demolition*

Updating methodology and emission factors for handling bulk materials according CEIP-MEIP (2002)

Table 31: Recalculation difference of Austria's PM emissions compared to the previous submission in Sector 2

	1990			2000			2005		
	∆ %	OLI 2006	OLI 2007	∆ %	OLI 2006	OLI 2007	∆ %	OLI 2006	OLI 2007
PM2.5 [Mg]									
2	*-32%*	5 189	3 505	*-41%*	5 018	2 938	*-48%*	4 444	2 329
2A	*-63%*	2 681	990	*-62%*	3 613	1 377	*-63%*	3 606	1 331
2B	*-32%*	441	302	*0%*	138	138	*0%*	141	141
2C	=	2 066	2 066	=	1 267	1 267	=	697	697
2D	*29418%*	1	148	*51828%*	0	156	*53384%*	0	160
PM10 [Mg]									
2	*-7%*	13 846	12 920	*1%*	14 814	14 901	*-1%*	13 452	13 383
2A	*-14%*	8 624	7 425	*-3%*	11 614	11 312	*-4%*	11 578	11 110
2B	*-14%*	660	565	*0%*	262	262	*0%*	267	267
2C	=	4 561	4 561	=	2 937	2 937	=	1 605	1 605
2D	*33430%*	1	369	*43190%*	1	390	*44486%*	1	401
TSP [Mg]									
2	*-6%*	25 170	23 769	*2%*	28 743	29 341	*1%*	26 734	27 069
2A	*-13%*	17 789	15 455	*-2%*	24 103	23 730	*-3%*	23 990	23 324
2B	*1%*	945	958	=	447	447	=	456	456
2C	=	6 435	6 435	=	4 190	4 190	=	2 286	2 286
2D	*41787%*	2	922	*51146%*	2	974	*52681%*	2	1 003

3.3.3 Major Changes SECTOR 3 SOLVENT USE

Improvements of methodologies and emission factors:

3 D 4:

New sources like fireworks and tobacco are incorporated.

3.3.4 Major Changes SECTOR 4 AGRICULTURE

Improvements of methodologies and emission factors

4 D PM emissions from Soil Cultivation and Harvesting

Emission calculation and emissions factors based on Öttl & Funk (2007) and Hinz (2007)

Incorporating a climate factor

4 G Particle emissions from animal husbandry:

Update of PM emission factors according to RAINS-Model (Lükewille et al., 2001) and Klimont et al. (2001)

Table 32: Recalculation difference of Austria's PM emissions compared to the previous submission in Sector 4

	1990			2000			2005		
	Δ %	OLI 2006	OLI 2007	Δ %	OLI 2006	OLI 2007	Δ %	OLI 2006	OLI 2007
PM2.5 [Mg]									
4	-45%	2 256	1 245	-39%	1 989	1 210	-44%	2 144	1 197
4D	-23%	1 465	1 136	-11%	1 251	1 114	-19%	1 355	1 102
4G	-86%	791	110	-87%	738	96	-88%	789	95
PM10 [Mg]									
4	-41%	9 440	5 604	-36%	8 457	5 445	-43%	9 379	5 385
4D	-18%	6 209	5 110	-7%	5 361	5 012	-14%	5 767	4 959
4G	-85%	3 231	494	-86%	3 096	434	-88%	3 611	426
TSP [Mg]									
4	-63%	33 603	12 453	-58%	29 145	12 100	-62%	31 841	11 966
4D	-62%	29 725	11 355	-56%	25 430	11 137	-60%	27 508	11 020
4G	-72%	3 877	1 098	-74%	3 715	964	-78%	4 333	946

3.3.5 Major Changes SECTOR 6 WASTE

Update of activity data

6 A 1 Managed waste disposal on land:

Activity data (1998 to 2005) has been updated. According to the Austrian Landfill Ordinance, the operators of landfill sites have to report their activity data annually. Based on reports received after the due date and updates, the amount of deposited waste changed (<10 %) compared to the previous submission.

According to the recommendation of the ERT, the double counting of deposited waste due to the clean-up of former waste deposit sites was corrected and resulted in lower amounts of deposited waste in 2002 and 2003.

6 D Other:

Sewage sludge is no longer considered a separate waste fraction for composting as it can be assumed that it is already accounted for in the waste fraction undergoing mechanical-biological treatment. Emissions from mechanical-biological treatment are considered in this source category.

Activity data for mechanical-biological treatment have been updated for the years 2003-2005, as new data were available.

Activity data for separately collected bio-waste were updated from 2001-2005, because new data from the waste Management Concepts and Plans of the nine Federal Provinces (Bundesländer) were available.

Improvements of methodologies and emission factors

6 A 1 Managed waste disposal on land:

Emission factors were updated.

Table 33: Recalculation difference of Austria's PM emissions compared to the previous submission in Sector 6

	1990			2000			2005		
	Δ %	OLI 2006	OLI 2007	Δ %	OLI 2006	OLI 2007	Δ %	OLI 2006	OLI 2007
PM2.5 [Mg]									
6	-13%	26	23	-19%	17	13	2%	27	28
PM10 [Mg]									
6	-13%	80	70	-19%	53	43	2%	87	89
TSP [Mg]									
6	-13%	168	145	-19%	112	91	2%	184	188

3.4 Recalculations per Gas

The following tables present the implication on emission trends of the methodological changes made as summarized in Chapter 3.3. Changes in the use of notation keys are also shown in the tables[86].

3.4.1 Recalculation difference of particle matter emissions with respect to submission 2006

In the following the recalculation difference of particle matter emissions with respect to submission 2006 is depicted in the following Table.

[86] a "=" in the field for relative difference indicates that reported emissions do not differ from the previous submission; blank fields indicate that no such emissions occur from this sector;

Detailed explanations are provided in chapters 3.1 and 3.3.

Table 34: Recalculation difference of PM emissions in general with respect to submission 2006.

		Relative difference			Absolute difference [Mg]					
		1990 Δ %	2000 Δ %	2005 Δ %	1990	1995	2002	2003	2004	2005
TSP										
1	Energy	*-3%*	*2%*	*3%*	-820	-348	333	648	703	960
2	Industrial Processes	*-6%*	*2%*	*1%*	-1401	-65	-163	-269	478	335
3	Solvent & Other Product Use	*NEW*	*NEW*	*NEW*	407	421	428	430	433	436
4	Agriculture	*-63%*	*-58%*	*-62%*	-21149	-17052	-18566	-16212	-21856	-19876
6	Waste	*-13%*	*-19%*	*2%*	-22	-25	-17	-25	-21	4
0	**Total Emissions**	***-25%***	***-17%***	***-20%***	**-22986**	**-17068**	**-17985**	**-15428**	**-20264**	**-18140**
PM10										
1	Energy	*-1%*	*4%*	*5%*	-263	142	762	977	983	1 132
2	Industrial Processes	*-7%*	*1%*	*-1%*	-926	-209	-306	-353	0	-68
3	Solvent & Other Product Use	*NEW*	*NEW*	*NEW*	407	421	428	430	433	436
4	Agriculture	*-41%*	*-36%*	*-43%*	-3 837	-3 205	-3 401	-3 170	-4 298	-3 994
6	Waste	*-13%*	*-19%*	*2%*	-11	-12	-8	-12	-10	2
0	**Total Emissions**	***-10%***	***-4%***	***-5%***	**-4 629**	**-2 862**	**-2 525**	**-2 128**	**-2 892**	**-2 491**
PM2.5										
1	Energy	*-6%*	*-2%*	*-1%*	-1 194	-946	-481	-336	-381	-267
2	Industrial Processes	*-32%*	*-41%*	*-48%*	-1 683	-1 878	-2 240	-2 209	-2 189	-2 115
3	Solvent & Other Product Use	*NEW*	*NEW*	*NEW*	407	421	428	430	433	436
4	Agriculture	*-45%*	*-39%*	*-44%*	-1 011	-806	-850	-748	-1 035	-947
6	Waste	*-13%*	*-19%*	*2%*	-3	-4	-3	-4	-3	1
0	**Total Emissions**	***-12%***	***-10%***	***-11%***	**-3 484**	**-3 212**	**-3 145**	**-2 867**	**-3 175**	**-2 892**

4 ABBREVIATIONS

AMA .... Agrarmarkt Austria

BAWP .... Bundes-Abfallwirtschaftsplan (Federal Waste Management Plan)

BMLFUW .... Bundesministerium für Land- und Forstwirtschaft, Umwelt und Wasserwirtschaft (Federal Ministry for Agriculture, Forestry, Environment and Water Management)

BMUJF .... Bundesministerium für Umwelt, Jugend und Familie (Federal Ministry for Environment, Youth and Family (before 2000, now domain of Environment: BMLFUW))

BUWAL .... Bundesamt für Umwelt, Wald und Landschaft. Bern (The Swiss Agency for the Environment, Forests and Landscape (SAEFL), Bern)

CORINAIR .... Core Inventory Air

CORINE................ Coordination d´information Environmentale

CRF .... Common Reporting Format

DKDB.................... Dampfkesseldatenbank (Austrian annual steam boiler inventory)

EC......................... European Community

EEA....................... European Environment Agency

EIONET .... European Environment Information and Observation NETwork

EMEP.................... Cooperative Programme for Monitoring and Evaluation of the Long-range Transmission of Air Pollutants in Europe

ETS....................... Emission Trading System

EPER.................... European Pollutant Emission Register

GLOBEMI .... Globale Modellbildung für Emissions- und Verbrauchsszenarien im Verkehrssektor ((Global Modelling for Emission- and Fuel consumption Scenarios of the Transport Sector) see (HAUSBERGER. 1998))

GPG...................... Good Practice Guidance (of the IPCC)

HM .... Heavy Metals

IEA........................ International Energy Agency

IEF .... Implied emission factor

IFR........................ Instrument Flight Rules

IIR .... Informative Inventory Report

IPCC .... Intergovernmental Panel on Climate Change

LTO....................... Landing/Take-Off cycle

MEET.................... MEET (1999): MEET – Methodology for calculating transport emissions and energy consumption. European Commission, DG VII, Belgium.

NACE.................... Nomenclature des activites economiques de la Communaute Europeenne

NAPFUE .... Nomenclature for Air Pollution Fuels

NEC .... National Emissions Ceiling (Directive 2001/81/EC of The European Parliament And Of The Council of 23 October 2001 on national emission ceilings for certain atmospheric pollutants – NEC Directive)

NFR .... Nomenclature for Reporting (Format of Reporting under the UNECE/LRTAP Convention)

NIR........................ National Inventory Report (Submission under the United Nations Framework Convention on Climate Change)

NISA .... National Inventory System Austria

OECD .... Organisation for Economic Co-operation and Development

OLI .... Österreichische Luftschadstoff InventurAustrian Air Emission Inventory

PHARE .... Phare is the acronym of the Programme's original name: 'Poland and Hungary: Action for the Restructuring of the Economy'. It covers now 14 partner countries: Albania, Bosnia and Herzegovina, Bulgaria, Croatia, the Czech Republic, Estonia, the Former Yugoslav Republic of Macedonia (FYROM), Hungary, Latvia, Lithuania, Poland, Romania, Slovakia and Slovenia, (However, Croatia was suspended from the Phare Programme in July 1995.)

PM .... Particular Matter

POP .... Persistent Organic Pollutants

PRTR .... Pollution Release and Transfer Register

QA/QC .... Quality Assurance/Quality Control

QMS...................... Quality Management System

RWA .... Raiffeisen Ware Austria (see www.rwa.at)

SNAP .... Selected Nomenclature on Air Pollutants

TAN....................... Total ammoniacal nitrogen

Umweltbundesamt.. Umweltbundesamt (Federal Environment Agency)

UNECE/LRTAP..... United Nations Economic Commission for Europe.Convention on Long-range Transboundary Air Pollution

UNFCCC............... United Nations Framework Convention on Climate Change

VFR....................... Visual Flight Rules

WIFO .... Wirtschaftsforschungsinstitut (Austrian Institute for Economic Research)

ANNEX

NFR for 2006

TABLE IV 1: National sector emissions: Main pollutants, particulate matter, heavy metals and persistent organic pollutants
Version 2004-1

COUNTRY: AT (as ISO2 code)
DATE: 14.0 (as DD.MM.YYYY)
YEAR: ### (as YYYY, year of Emissions)

Yearly minimum reporting

		NFR sectors to be reported to LRTAP	A = Allowable Aggre	Main Pollutants: NOx	CO	NMVOC	SOx	NH3	Particulate Matter: TSP	PM10	PM2.5	Priority Heavy Metals: Pb	Cd	Hg
				Gg NO2	Gg	Gg	Gg SO2	Gg	Gg	Gg	Gg	Mg	Mg	Mg
1 A 1 a	(a)	**1 A 1 a Public Electricity and Heat Production**		10.50	4.11	0.70	4.16	0.26	1.14	1.05	0.88	1.45	0.10	0.20
1 A 1 b	(a)	**1 A 1 b Petroleum refining**		3.39	0.46	IE	3.69	0.10	0.10	0.09	0.08	0.29	0.17	0.01
1 A 1 c	(a)	**1 A 1 c Manufacture of Solid Fuels and Other Energy Industries**		1.48	0.10	0.00	NA	0.01	0.07	0.07	0.07	0.00	0.00	0.00
1 A 2	(a)	**1 A 2 Manufacturing Industries and Construction**	A	35.37	168.71	3.06	10.29	0.29	3.20	2.61	2.12	3.09	0.20	0.27
1 A 2 a	(a)	1 A 2 a Iron and Steel		5.23	148.00	0.33	5.76	0.05	0.06	0.06	0.07	0.20	0.00	0.00
1 A 2 b	(a)	1 A 2 b Non-ferrous Metals		0.21	0.04	0.00	0.10	0.00	0.01	0.01	0.01	1.05	0.02	0.01
1 A 2 c	(a)	1 A 2 c Chemicals		1.20	1.29	0.16	0.44	0.03	0.41	0.37	0.31	0.38	0.01	0.01
1 A 2 d	(a)	1 A 2 d Pulp, Paper and Print		5.12	2.01	0.25	1.17	0.07	0.27	0.25	0.20	0.77	0.09	0.07
1 A 2 e	(a)	1 A 2 e Food Processing, Beverages and Tobacco		0.78	0.13	0.01	0.24	0.02	0.04	0.04	0.03	0.01	0.00	0.00
1 A 2 f	(a)	1 A 2 f Other (Please specify in a covering note)		22.83	17.24	2.30	2.58	0.12	2.40	1.89	1.50	0.69	0.07	0.18
1 A 3 a ii (i)		**1 A 3 a ii (i) Civil Aviation (Domestic, LTO)**		0.19	2.64	0.22	0.02	0.00	0.02	0.02	0.02	0.00	0.00	0.00
1 A 3 a ii (ii)		**1 A 3 a ii (ii) Civil Aviation (Domestic, Cruise)**		0.57	0.17	0.06	0.05	0.00	0.05	0.05	0.05	0.00	0.00	0.00
1 A 3 b	(a)	**1 A 3 b Road Transportation**	A	129.92	236.80	21.25	0.13	2.38	14.44	7.67	5.31	0.01	0.09	0.00
1 A 3 b i		1 A 3 b i R.T., Passenger cars		41.71	190.10	10.72	0.07	2.27	2.02	2.02	2.02	0.01	0.00	0.00
1 A 3 b ii		1 A 3 b ii R.T., Light duty vehicles		5.97	8.81	0.67	0.01	0.05	0.44	0.44	0.44	0.00	0.00	0.00
1 A 3 b iii		1 A 3 b iii R.T., Heavy duty vehicles		81.81	15.47	4.48	0.05	0.06	1.84	1.84	1.84	0.00	0.00	0.00
1 A 3 b iv		1 A 3 b iv R.T., Mopeds & Motorcycles		0.43	21.42	1.06	NA	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1 A 3 b v		1 A 3 b v R.T., Gasoline evaporation		NA	NA	3.52	NA	NA	NA	NA	NA	NA	NA	NA
1 A 3 b vi		1 A 3 b vi R.T., Automobile tyre and brake wear		IE	IE	IE	IE	IE	IE	IE	IE	IE	0.00	IE
1 A 3 b vii		1 A 3 b vii R.T., Automobile road abrasion		NA	NA	NA	NA	NA	10.15	3.38	1.01	NA	0.09	NA
1 A 3 c	(a)	**1 A 3 c Railways**		1.36	0.36	0.17	0.06	0.00	1.81	0.58	0.21	0.00	0.00	0.00
1 A 3 d ii		**1 A 3 d ii National Navigation**		0.45	2.88	0.62	0.01	0.00	0.03	0.03	0.03	0.00	0.00	0.00
1 A 3 e	(a)	**1 A 3 e Other (Please specify in a covering note)**	A	1.22	0.08	0.00	NA	0.01	0.00	0.00	0.00	NA	NA	NA
1 A 3 e i		1 A 3 e i Pipeline compressors		1.22	0.08	0.00	NA	0.01	0.00	0.00	0.00	NA	NA	NA
1 A 3 e ii		1 A 3 e ii Other mobile sources and machinery		NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
1 A 4 a	(a)	**1 A 4 a Commercial / Institutional**		2.79	13.04	1.34	1.73	0.12	0.56	0.52	0.48	0.33	0.04	0.02
1 A 4 b	(a)	**1 A 4 b Residential**	A	12.98	285.14	31.95	6.49	0.55	8.31	7.57	6.83	2.14	0.24	0.18
1 A 4 b i		1 A 4 b i Residential plants		12.21	267.52	29.56	6.49	0.55	8.17	7.43	6.69	2.14	0.24	0.18
1 A 4 b ii		1 A 4 b ii Household and gardening (mobile)		0.77	17.62	2.39	0.00	0.00	0.15	0.15	0.15	0.00	0.00	0.00
1 A 4 c	(a)	**1 A 4 c Agriculture / Forestry / Fishing**	A	17.85	39.83	7.57	0.33	0.05	3.03	2.73	2.53	0.16	0.05	0.01
1 A 4 c i		1 A 4 c i Stationary		0.96	18.94	2.11	0.28	0.04	0.56	0.50	0.45	0.16	0.05	0.01
1 A 4 c ii		1 A 4 c ii Off-road Vehicles and Other Machinery		16.90	20.89	5.45	0.05	0.01	2.47	2.23	2.08	0.00	0.00	0.00
1A 4 c iii		1A 4 c iii National Fishing		NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
1 A 5 a	(a)	**1 A 5 a Other, Stationary (including Military)**		IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE
1 A 5 b	(a)	**1 A 5 b Other, Mobile (Including military)**		0.21	0.75	0.05	0.04	0.00	0.05	0.04	0.04	0.00	0.00	0.00
1B1	(a)	**1B1 Fugitive Emissions from Solid Fuels**	A	NA	NA	NA	NA	NA	0.59	0.28	0.09	NA	NA	NA
1 B 1 a	(a)	1 B 1 a Coal Mining and Handling		NA	NA	NA	NA	NA	0.59	0.28	0.09	NA	NA	NA
1 B 1 b	(a)	1 B 1 b Solid fuel transformation		IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE
1 B 1 c	(a)	1 B 1 c Other (Please specify in a covering note)		NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
1 B 2	(a)	**1 B 2 Oil and natural gas**	A	IE	IE	3.12	0.17	IE	IE	IE	IE	IE	IE	IE
1 B 2 a	(a)	**1 B 2 a Oil**		NA	NA	2.06	NA	NA	NA	NA	NA	NA	NA	NA
1 B 2 a i	(a)	1 B 2 a i Exploration Production, Transport		NA	NA	0.91	NA	NA	NA	NA	NA	NA	NA	NA
1 B 2 a iv	(a)	1 B 2 a iv Refining / Storage		NA	NA	0.95	NA	NA	NA	NA	NA	NA	NA	NA
1 B 2 a v	(a)	1 B 2 a v Distribution of oil products		NA	NA	1.00	NA	NA	NA	NA	NA	NA	NA	NA
1 B 2 a vi	(a)	1 B 2 a vi Other		NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
1 B 2 b	(a)	1 B 2 b Natural gas		NA	NA	0.26	0.17	NA	NA	NA	NA	NA	NA	NA
1 B 2 c	(a)	1 B 2 c Venting and flaring		IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE

Yearly minimum reporting (continued) / *Additional reporting*

	Persistent Organic Pollutants (POPs) Annex I (1): Aldrin	Chlordane	Chlordecone	Dieldrin	Endrin	Heptachlor	Hexabromo-	Mirex	Toxaphene	POPs Annex II (2): HCH	DDT	PCB	POPs Annex III (3): DIOX	PAH: benzo(a)	benzo(b)	benzo(k)	Indeno(1,2,3-	total	HCB	Other Heavy Metals: As	Cr	Cu	Ni	Se	Zn	Other POPs (4): PCP	SCCP
	kg	kg	kg	kg	kg	kg	kg	kg	kg	kg	kg	kg	g I-Teq	Mg	Mg	Mg	Mg	Mg	kg	Mg	Mg	Mg	Mg	Mg	Mg	kg	kg
1 A 1 a	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	0.79	NR	NR	NR	NR	0.01	0.34	NR	NR	NR	NR	NR	NR	NR	NR
1 A 1 b	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	0.02	NR	NR	NR	NR	0.00	0.00	NR	NR	NR	NR	NR	NR	NR	NR
1 A 1 c	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	0.00	NR	NR	NR	NR	0.00	0.00	NR	NR	NR	NR	NR	NR	NR	NR
1 A 2	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	5.18	NR	NR	NR	NR	0.19	1.50	NR	NR	NR	NR	NR	NR	NR	NR
1 A 2 a	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	0.04	NR	NR	NR	NR	0.00	0.01	NR	NR	NR	NR	NR	NR	NR	NR
1 A 2 b	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	2.22	NR	NR	NR	NR	0.00	1.00	NR	NR	NR	NR	NR	NR	NR	NR
1 A 2 c	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	0.58	NR	NR	NR	NR	0.02	0.09	NR	NR	NR	NR	NR	NR	NR	NR
1 A 2 d	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	0.63	NR	NR	NR	NR	0.00	0.13	NR	NR	NR	NR	NR	NR	NR	NR
1 A 2 e	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	0.04	NR	NR	NR	NR	0.00	0.01	NR	NR	NR	NR	NR	NR	NR	NR
1 A 2 f	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	1.67	NR	NR	NR	NR	0.16	0.27	NR	NR	NR	NR	NR	NR	NR	NR
1 A 3 a ii (i)	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NE	NR	NR	NR	NR	NE	NE	NR	NR	NR	NR	NR	NR	NR	NR
1 A 3 a ii (ii)	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NE	NR	NR	NR	NR	NE	NE	NR	NR	NR	NR	NR	NR	NR	NR
1 A 3 b	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	1.13	NR	NR	NR	NR	1.57	0.23	NR	NR	NR	NR	NR	NR	NR	NR
1 A 3 b i	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	0.42	NR	NR	NR	NR	0.67	0.08	NR	NR	NR	NR	NR	NR	NR	NR
1 A 3 b ii	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	0.10	NR	NR	NR	NR	0.15	0.02	NR	NR	NR	NR	NR	NR	NR	NR
1 A 3 b iii	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	0.60	NR	NR	NR	NR	0.69	0.12	NR	NR	NR	NR	NR	NR	NR	NR
1 A 3 b iv	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	0.01	NR	NR	NR	NR	0.05	0.00	NR	NR	NR	NR	NR	NR	NR	NR
1 A 3 b v	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	IE	NR	NR	NR	NR	NA	NA	NR	NR	NR	NR	NR	NR	NR	NR
1 A 3 b vi	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	IE	NR	NR	NR	NR	IE	IE	NR	NR	NR	NR	NR	NR	NR	NR
1 A 3 b vii	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NA	NR	NR	NR	NR	NA	NA	NR	NR	NR	NR	NR	NR	NR	NR
1 A 3 c	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	0.02	NR	NR	NR	NR	0.01	0.00	NR	NR	NR	NR	NR	NR	NR	NR
1 A 3 d ii	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	0.01	NR	NR	NR	NR	0.00	0.00	NR	NR	NR	NR	NR	NR	NR	NR
1 A 3 e	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	0.00	NR	NR	NR	NR	NA	0.00	NR	NR	NR	NR	NR	NR	NR	NR
1 A 3 e i	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	0.00	NR	NR	NR	NR	NA	0.00	NR	NR	NR	NR	NR	NR	NR	NR
1 A 3 e ii	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NO	NR	NR	NR	NR	NO	NO	NR	NR	NR	NR	NR	NR	NR	NR
1 A 4 a	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	2.21	NR	NR	NR	NR	0.16	1.37	NR	NR	NR	NR	NR	NR	NR	NR
1 A 4 b	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	27.08	NR	NR	NR	NR	5.78	32.46	NR	NR	NR	NR	NR	NR	NR	NR
1 A 4 b i	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	27.03	NR	NR	NR	NR	5.75	32.45	NR	NR	NR	NR	NR	NR	NR	NR
1 A 4 b ii	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	0.05	NR	NR	NR	NR	0.03	0.01	NR	NR	NR	NR	NR	NR	NR	NR
1 A 4 c	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	2.18	NR	NR	NR	NR	0.58	3.36	NR	NR	NR	NR	NR	NR	NR	NR
1 A 4 c i	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	2.05	NR	NR	NR	NR	0.45	3.33	NR	NR	NR	NR	NR	NR	NR	NR
1 A 4 c ii	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	0.13	NR	NR	NR	NR	0.13	0.03	NR	NR	NR	NR	NR	NR	NR	NR
1A 4 c iii	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NO	NR	NR	NR	NR	NO	NO	NR	NR	NR	NR	NR	NR	NR	NR
1 A 5 a	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	IE	NR	NR	NR	NR	IE	IE	NR	NR	NR	NR	NR	NR	NR	NR
1 A 5 b	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	0.00	NR	NR	NR	NR	0.00	0.00	NR	NR	NR	NR	NR	NR	NR	NR
1B1	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NA	NR	NR	NR	NR	NA	NA	NR	NR	NR	NR	NR	NR	NR	NR
1 B 1 a	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NA	NR	NR	NR	NR	NA	NA	NR	NR	NR	NR	NR	NR	NR	NR
1 B 1 b	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	IE	NR	NR	NR	NR	IE	IE	NR	NR	NR	NR	NR	NR	NR	NR
1 B 1 c	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NO	NR	NR	NR	NR	NO	NO	NR	NR	NR	NR	NR	NR	NR	NR
1 B 2	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	IE	NR	NR	NR	NR	IE	IE	NR	NR	NR	NR	NR	NR	NR	NR
1 B 2 a	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NA	NR	NR	NR	NR	NA	NA	NR	NR	NR	NR	NR	NR	NR	NR
1 B 2 a i	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NA	NR	NR	NR	NR	NA	NA	NR	NR	NR	NR	NR	NR	NR	NR
1 B 2 a iv	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NA	NR	NR	NR	NR	NA	NA	NR	NR	NR	NR	NR	NR	NR	NR
1 B 2 a v	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NA	NR	NR	NR	NR	NA	NA	NR	NR	NR	NR	NR	NR	NR	NR
1 B 2 a vi	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NE	NR	NR	NR	NR	NE	NE	NR	NR	NR	NR	NR	NR	NR	NR
1 B 2 b	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NA	NR	NR	NR	NR	NA	NA	NR	NR	NR	NR	NR	NR	NR	NR
1 B 2 c	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	IE	NR	NR	NR	NR	IE	IE	NR	NR	NR	NR	NR	NR	NR	NR

2 A	(a)	2 A MINERAL PRODUCTS (b)	A	NA	9.78	IE	NA	NA	26.29	12.52	1.49	NA	NA	NA	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NA	NR	NR	NR	NR	NA	NA	NR	NR	NR	NR	NR	NR	NR	NR
2 A 1	(a)	2 A 1 Cement Production		NA	NA	NA	NA	NA	0.10	0.09	0.08	NA	NA	NA	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NA	NR	NR	NR	NR	NA	NA	NR	NR	NR	NR	NR	NR	NR	NR
2 A 2	(a)	2 A 2 Lime Production		NA	NA	NA	NA	NA	0.10	0.09	0.06	NA	NA	NA	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NA	NR	NR	NR	NR	NA	NA	NR	NR	NR	NR	NR	NR	NR	NR
2 A 3	(a)	2 A 3 Limestone and Dolomite Use		NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NO	NR	NR	NR	NR	NO	NO	NR	NR	NR	NR	NR	NR	NR	NR
2 A 4	(a)	2 A 4 Soda Ash Production and use		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NA	NR	NR	NR	NR	NA	NA	NR	NR	NR	NR	NR	NR	NR	NR
2 A 5	(a)	2 A 5 Asphalt Roofing		NA	9.78	IE	NA	NA	NA	NA	NA	NA	NA	NA	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NA	NR	NR	NR	NR	NA	NA	NR	NR	NR	NR	NR	NR	NR	NR
2 A 6	(a)	2 A 6 Road Paving with Asphalt		NA	NA	IE	NA	NA	NA	NA	NA	NA	NA	NA	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NA	NR	NR	NR	NR	NA	NA	NR	NR	NR	NR	NR	NR	NR	NR
2 A 7	(a)	2 A 7 Other including Non Fuel Mining & Construction (Please specify in a covering note)		NA	NA	NA	NA	NA	26.09	12.36	1.35	NA	NA	NA	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NA	NR	NR	NR	NR	NA	NA	NR	NR	NR	NR	NR	NR	NR	NR
2 B	(a)	2 B CHEMICAL INDUSTRY	A	0.45	11.14	1.32	0.77	0.07	0.48	0.28	0.15	0.00	0.00	0.00	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NA	NR	NR	NR	NR	NA	NA	NR	NR	NR	NR	NR	NR	NR	NR
2 B 1	(a)	2 B 1 Ammonia Production		0.22	0.08	IE	NA	0.01	NA	NA	NA	NA	NA	NA	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NA	NR	NR	NR	NR	NA	NA	NR	NR	NR	NR	NR	NR	NR	NR
2 B 2	(a)	2 B 2 Nitric Acid Production		0.17	NA	NA	NA	0.00	NA	NA	NA	NA	NA	NA	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NA	NR	NR	NR	NR	NA	NA	NR	NR	NR	NR	NR	NR	NR	NR
2 B 3	(a)	2 B 3 Adipic Acid Production		NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NO	NR	NR	NR	NR	NO	NO	NR	NR	NR	NR	NR	NR	NR	NR
2 B 4	(a)	2 B 4 Carbide Production		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NA	NR	NR	NR	NR	NA	NA	NR	NR	NR	NR	NR	NR	NR	NR
2 B 5	(a)	2 B 5 Other (Please specify in a covering note)		0.07	11.07	1.32	0.77	0.06	0.48	0.28	0.15	0.00	0.00	0.00	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NA	NR	NR	NR	NR	NA	NA	NR	NR	NR	NR	NR	NR	NR	NR
2 C	(a)	2 C METAL PRODUCTION		0.11	2.67	0.47	0.45	IE	1.42	1.00	0.44	6.61	0.22	0.31	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	4.63	NR	NR	NR	NR	0.18	3.74	NR	NR	NR	NR	NR	NR	NR	NR
2 D	(a)	2 D OTHER PRODUCTION (b)	A	1.07	0.78	2.94	NA	NA	1.02	0.41	0.16	NA	NA	NA	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	0.13	NR	NR	NR	NR	0.04	0.03	NR	NR	NR	NR	NR	NR	NR	NR
2 D 1	(a)	2 D 1 Pulp and Paper		1.07	0.78	0.79	NA	NA	0.35	0.14	0.06	NA	NA	NA	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NA	NR	NR	NR	NR	NA	NA	NR	NR	NR	NR	NR	NR	NR	NR
2 D 2	(a)	2 D 2 Food and Drink		NA	NA	2.15	NA	NA	0.00	0.00	0.00	NA	NA	NA	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	0.13	NR	NR	NR	NR	0.04	0.03	NR	NR	NR	NR	NR	NR	NR	NR
2 G	(a)	2 G OTHER (Please specify in a covering note)		NA	NA	NA	NA	0.00	NA	NA	NA	NA	NA	NA	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NA	NR	NR	NR	NR	NA	NA	NR	NR	NR	NR	NR	NR	NR	NR
3 A	(a)	3 A PAINT APPLICATION		NA	NA	27.25	NA	NA	NA	NA	NA	NA	NA	NA	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NA	NR	NR	NR	NR	NA	NA	NR	NR	NR	NR	NR	NR	NR	NR
3 B	(a)	3 B DEGREASING AND DRY CLEANING		NA	NA	11.80	NA	NA	NA	NA	NA	NA	NA	NA	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NA	NR	NR	NR	NR	NA	NA	NR	NR	NR	NR	NR	NR	NR	NR
3 C	(a)	3 C CHEMICAL PRODUCTS, MANUFACTURE AND PROCESSING		NA	NA	11.37	NA	NA	NA	NA	NA	NA	NA	NA	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NA	NR	NR	NR	NR	NA	NA	NR	NR	NR	NR	NR	NR	NR	NR
3 D	(a)	3 D OTHER including products containing HMs and POPs (Please specify in a covering note)		NA	NA	44.51	NA	NA	0.44	0.44	0.44	NA	NA	NA	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NE	NR	NR	NR	NR	NE	NE	NR	NR	NR	NR	NR	NR	NR	NR
4 B	(a)	4 B MANURE MANAGEMENT (c)	A	NA	NA	NA	NA	53.09	NA	NA	NA	NA	NA	NA	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NA	NR	NR	NR	NR	NA	NA	NR	NR	NR	NR	NR	NR	NR	NR
4 B 1	(a)	4 B 1 Cattle		NA	NA	NA	NA	36.80	NA	NA	NA	NA	NA	NA	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NA	NR	NR	NR	NR	NA	NA	NR	NR	NR	NR	NR	NR	NR	NR
4 B 1 a	(a)	4 B 1 a Dairy		NA	NA	NA	NA	14.27	NA	NA	NA	NA	NA	NA	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NA	NR	NR	NR	NR	NA	NA	NR	NR	NR	NR	NR	NR	NR	NR
4 B 1 b	(a)	4 B 1 b Non-Dairy		NA	NA	NA	NA	22.53	NA	NA	NA	NA	NA	NA	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NA	NR	NR	NR	NR	NA	NA	NR	NR	NR	NR	NR	NR	NR	NR
4 B 2	(a)	4 B 2 Buffalo		NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NO	NR	NR	NR	NR	NO	NO	NR	NR	NR	NR	NR	NR	NR	NR
4 B 3	(a)	4 B 3 Sheep		NA	NA	NA	NA	0.80	NA	NA	NA	NA	NA	NA	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NA	NR	NR	NR	NR	NA	NA	NR	NR	NR	NR	NR	NR	NR	NR
4 B 4	(a)	4 B 4 Goats		NA	NA	NA	NA	0.14	NA	NA	NA	NA	NA	NA	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NA	NR	NR	NR	NR	NA	NA	NR	NR	NR	NR	NR	NR	NR	NR
4 B 5	(a)	4 B 5 Camels and Llamas		NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NO	NR	NR	NR	NR	NO	NO	NR	NR	NR	NR	NR	NR	NR	NR
4 B 6	(a)	4 B 6 Horses		NA	NA	NA	NA	0.73	NA	NA	NA	NA	NA	NA	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NA	NR	NR	NR	NR	NA	NA	NR	NR	NR	NR	NR	NR	NR	NR
4 B 7	(a)	4 B 7 Mules and Asses		IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	IE	NR	NR	NR	NR	IE	IE	NR	NR	NR	NR	NR	NR	NR	NR
4 B 8	(a)	4 B 8 Swine		NA	NA	NA	NA	9.34	NA	NA	NA	NA	NA	NA	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NA	NR	NR	NR	NR	NA	NA	NR	NR	NR	NR	NR	NR	NR	NR
4 B 9	(a)	4 B 9 Poultry		NA	NA	NA	NA	5.18	NA	NA	NA	NA	NA	NA	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NA	NR	NR	NR	NR	NA	NA	NR	NR	NR	NR	NR	NR	NR	NR
4 B 13	(a)	4 B 13 Other		NA	NA	NA	NA	0.11	NA	NA	NA	NA	NA	NA	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NA	NR	NR	NR	NR	NA	NA	NR	NR	NR	NR	NR	NR	NR	NR
4 C	(a)	4 C RICE CULTIVATION		NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NO	NR	NR	NR	NR	NO	NO	NR	NR	NR	NR	NR	NR	NR	NR
4 D 1	(a)	4 D 1 Direct Soil Emission		5.18	NA	1.67	NA	7.80	11.01	4.95	1.10	NA	NA	NA	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NA	NR	NR	NR	NR	NA	NA	NR	NR	NR	NR	NR	NR	NR	NR
4 F	(a)	4 F FIELD BURNING OF AGRICULTURAL WASTES		0.03	1.01	0.11	0.00	0.04	NE	NE	NE	0.01	0.00	0.00	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	0.15	NR	NR	NR	NR	0.20	0.03	NR	NR	NR	NR	NR	NR	NR	NR
4 G	(a)	4 G OTHER (d)		NA	NA	NA	NA	NA	0.94	0.42	0.09	NA	NA	NA	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NA	NR	NR	NR	NR	NA	NA	NR	NR	NR	NR	NR	NR	NR	NR
5 B	(a)	5 B FOREST AND GRASSLAND CONVERSION		NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NE	NR	NR	NR	NR	NE	NE	NR	NR	NR	NR	NR	NR	NR	NR
6 A	(a)	6 A SOLID WASTE DISPOSAL ON LAND		NA	5.90	0.08	NA	0.00	0.19	0.09	0.03	0.00	0.00	0.00	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NA	NR	NR	NR	NR	NA	NA	NR	NR	NR	NR	NR	NR	NR	NR
6 B	(a)	6 B WASTE WATER HANDLING		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NA	NR	NR	NR	NR	NA	NA	NR	NR	NR	NR	NR	NR	NR	NR
6 C	(a)	6 C WASTE INCINERATION (e)		0.05	0.01	0.00	0.06	0.00	NE	NE	NE	0.01	0.00	0.02	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	0.17	NR	NR	NR	NR	0.00	0.03	NR	NR	NR	NR	NR	NR	NR	NR
6 D	(a)	6 D OTHER WASTE (f)		NA	NA	NA	NA	1.04	NA	NA	NA	NA	NA	NA	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NA	NR	NR	NR	NR	NA	NA	NR	NR	NR	NR	NR	NR	NR	NR
7	(a)	7 OTHER		NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NO	NR	NR	NR	NR	NO	NO	NR	NR	NR	NR	NR	NR	NR	NR
NATIONAL TOTAL	(g)	National Total for the entire territory (2002 Guidelines)		225.16	785.35	171.63	28.46	65.81	75.00	43.45	22.67	14.12	1.12	1.02	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	43.88	NR	NR	NR	NR	8.73	43.10	NR	NR	NR	NR	NR	NR	NR	NR
Memo Items. NOT TO BE INCLUDED IN NATIONAL TOTALS IF NOT OTHERWISE STATED																																									
SNAP NATIONAL	(g)	National Total for the entire territory (1997 Guidelines)		225.16	785.35	171.63	28.46	65.81	75.00	43.45	22.67	14.12	1.12	1.02	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	43.88	NR	NR	NR	NR	8.73	43.10	NR	NR	NR	NR	NR	NR	NR	NR
GRID TOTAL	(h)	National Total for the EMEP grid domain		225.16	785.35	171.63	28.46	65.81	75.00	43.45	22.67	14.12	1.12	1.02	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	43.88	NR	NR	NR	NR	8.73	43.10	NR	NR	NR	NR	NR	NR	NR	NR
1 A 3 a i (i)	(a)	International Aviation (LTO)		0.88	0.83	0.32	0.07	0.00	0.07	0.07	0.07	0.00	0.00	0.00	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NE	NR	NR	NR	NR	NE	NE	NR	NR	NR	NR	NR	NR	NR	NR
1 A 3 a i (ii)	(a)	International Aviation (Cruise)		4.90	0.96	0.43	0.51	0.00	0.55	0.55	0.55	0.00	0.00	0.00	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NE	NR	NR	NR	NR	NE	NE	NR	NR	NR	NR	NR	NR	NR	NR
1 A 3 d i (i)	(a)	International maritime Navigation		NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NO	NR	NR	NR	NR	NO	NO	NR	NR	NR	NR	NR	NR	NR	NR
1 A 3 d i (ii)	(a)	International inland waterways (Included in NEC totals only)		NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NO	NR	NR	NR	NR	NO	NO	NR	NR	NR	NR	NR	NR	NR	NR
5 E	(a)	5 E Other		0.97	NA	124.62	NA	NA	NA	NA	NA	NA	NA	NA	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NA	NR	NR	NR	NR	NA	NA	NR	NR	NR	NR	NR	NR	NR	NR
X		X (11 08 Volcanoes)		NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NO	NR	NR	NR	NR	NO	NO	NR	NR	NR	NR	NR	NR	NR	NR

(a) Sectors already reported to UNFCCC for NO_x, CO, NMVOC, SO_2.
(b) Including Product handling.
(c) Including NH3 from Enteric Fermentation.
(d) Including PM sources.
(e) Excludes waste incineration for energy (this is included in 1 A 1).
(f) Includes accidental fires.
(g) National Total refers to the territory declared upon ratification of the relevant Protocol of the Convention.
(h) EMEP grid domain is defined in the Emission Reporting Guidelines (ECE/EB.AIR/80/Annex V)

Note 1: Main Pollutants should cover the time span from 1980 to latest year.
HM should cover the time span from 1990 to latest year.
POPs should cover the time span from 1990 to the latest year.
PM should cover the time span from 2000 to latest year.

Note 2: The A=Allowable Aggregation illustrates the level of aggregation that can be used if more detailed information is not available.
Grey cells show which sectors can be aggregated into the sector marked A. Black cells occur when two possible levels of aggregation are possible.

Notes 3:
(1): The POPs listed in annex I to the Protocol on POPs are substances scheduled for elimination; DDT and PCBs are also listed in annex I;
(2): The POPs listed in annex II to the Protocol on POPs are substances scheduled for restrictions on use;
(3): The POPs listed in annex III to the Protocol on POPs are substances referred to in article 3, para. 5 (a), of the Protocol. Polycyclic aromatic hydrocarbons (PAHs): For the purpose of the emission inventories, the following four indicator compounds should be used: benzo(b)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene and indeno(1,2,3-cd)pyrene. HCB is also included in annex I to the Protocol as a substance for elimination.
(4): See article 8 of the Protocol (Research, development and monitoring; reporting voluntary).

Footnotes to NFR

FOOTNOTES IV 1: National sector emissions: Main pollutants, particulate matter (PM), heavy metals (HM) and persistent organic pollutants (POP).

Table IV 1 F1: Definition of Notation Keys
See: Chapter 1

Table 1 F2: Explanation to the Notation key NE

NFR code	Substance(s)	Reason for reporting NE
1.A.3.a i	DIOX, PAH, HCB	No measurements or emission factors available
1.A.3.a ii	DIOX, PAH, HCB	No measurements or emission factors available
1.A.3.e i	DIOX	No measurements or emission factors available. However, DIOX emissions from this category seem to be negligible (NA could be reported alternatively)
1.B.2.a.vi	all	No other emission sources from 1.B.2.a are known
4.F	TSP, PM10, PM2.5	No sufficient information
6.C	TSP, PM10, PM2.5	No sufficient information

Table IV 1 F3: Explanation to the Notation key IE

NFR code	Substance(s)	Included in NFR code
1.A.1.b	NMVOC	1 B 2 a iv
1.B.1.b	all	1 A 2 a
1 B 2 c	all	1 B 2 a i
2 A 5	NMVOC	3
2 A 6	NMVOC	3
2 B 1	NMVOC	2 B 5
2 C	NH_3	1 A 2 a
4 B 7 Mules and Asses	NH_3	4 B 6 Horses
4 D 1 ii Animal waste applied to soil	NH_3	4 B 1 to 4 B13
4 D 2 pasture range and paddock	NO_x, NH_3, TSP, PM10, PM2.5	4 D 1

Table IV 1 F4: Sub-sources accounted for in reporting codes „other“

NFR code	Sub-source description	Substance(s) reported
1A2f		NO_x, SO_2, CO, NMVOC, NH_3, TSP, PM10, PM2.5, PAH, HCB, DIOX, Cd, Hg, Pb
1A3 e	1 A 3 e i Pipeline compressors	NO_x, CO, NMVOC, NH_3, TSP, PM10, PM2.5, PAH, HCB
1A5a		
1A5b		
1B1 c		none
1B2 a vi		none
2 A 7	diffuse emissions from construction, mining and food production	TSP, PM10, PM2.5
2 B 5	emissions from other organic and inorganic chemical industries	NO_x, CO, NMVOC, SO_x, NH_3, TSP, PM10, PM2.5, Pb, Cd, Hg
2 G	emissions from use of NH3 as refrigerant	NH_3
3 D		
4 B 13	wild animals, mainly deer (pasture)	NH_3
4 G	particle emissions from animal husbandry	TSP, PM10, PM2.5
6 D		
7		
5E		

Table IV 1 F5: Basis for estimating emissions from mobile sources. Please tick off with X.

NFR code	Description	Fuel sold	Fuel used	Comment
1 A 3 a i (i)	International Aviation (LTO)	x		
1 A 3 a i (ii)	International Aviation (Cruise)	x		
1 A 3 a ii (i)	1 A 3 a ii Civil Aviation (Domestic, LTO)	x		
1 A 3 a ii (ii)	1 A 3 a ii Civil Aviation (Domestic, Cruise)	x		
1A3b	Road transport	x		
1A3c	Railways	x		
1A3di (i)	International maritime Navigation			
1A3di (ii)	International inland waterways (Included in NEC totals only)			
1A3dii	National Navigation	x		
1A4ci	Agriculture	x		
1A4cii	Off-road Vehicles and Other Machinery	x		
1A4ciii	National Fishing	x		
1 A 5 b	Other, Mobile (Including military)	x		

Austria's emissions for SO_2, NO_x, NMVOC and NH_3 according to the submission under NEC directive

The following table presents Austria's emissions based on fuel used – thus excluding 'fuel tourism'[87] – as submitted under Directive 2001/81/EC.

Table A-1: Austria's emissions 1990–2006 without 'fuel tourism' according to Directive 2001/81/EC, Article 8 (1).

	SO_2 [Gg]	NO_x [Gg]	NMVOC [Gg]	NH_3 [Gg]
1990	74.73	200.06	283.52	71.04
1991	71.44	199.90	272.14	73.21
1992	55.08	192.10	249.61	71.91
1993	53.29	184.92	249.65	72.89
1994	47.72	183.56	233.00	74.38
1995	46.79	180.96	231.25	75.83
1996	44.19	180.98	223.16	73.84
1997	40.04	185.67	209.22	73.69
1998	35.14	182.57	191.73	73.31
1999	33.54	182.30	179.47	71.66
2000	31.25	178.78	177.25	69.54
2001	32.20	179.61	187.01	68.86
2002	31.06	178.54	185.53	67.20
2003	31.76	179.73	178.68	66.62
2004	26.88	176.92	171.72	65.81
2005	26.60	175.62	159.34	65.36
2006	28.42	173.11	168.00	65.32
Ceilings 2010	39.00	103.00	159.00	66.00

[87] For information regarding fuel tourism please refer to Chapter 1.7 Completeness

Emission Trends per Sector

Table A-2: Emission trends for SO_2 [Gg] 1980–2006.

	NFR-Sectors										
year	1	1 A	1 B	2	3	4	5	6	7		
	ENERGY	FUEL COMBUSTION ACTIVITIES	FUGITIVE EMISSIONS FROM FUELS	INDUSTRIAL PROCESSES	SOLVENT AND OTHER PRODUCT USE	AGRICULTURE	LAND USE CHANGE AND FORESTRY	WASTE	OTHER	NATIONAL TOTAL	International Bunkers
1980	331.16	328.60	2.56	13.14	NA	0.04	NE	0.41	NO	345	0.12
1981	289.21	287.31	1.89	13.02	NA	0.04	NE	0.41	NO	302.67	0.13
1982	275.06	273.31	1.75	12.89	NA	0.04	NE	0.41	NO	288.41	0.12
1983	200.36	198.77	1.59	12.77	NA	0.04	NE	0.41	NO	213.59	0.15
1984	183.50	181.83	1.67	12.65	NA	0.04	NE	0.41	NO	196.60	0.20
1985	167.29	165.76	1.53	12.07	NA	0.05	NE	0.41	NO	179.81	0.21
1986	148.72	147.26	1.46	11.28	NA	0.04	NE	0.41	NO	160.46	0.19
1987	127.63	126.11	1.52	10.28	NA	0.04	NE	0.41	NO	138.37	0.21
1988	99.09	97.44	1.65	3.92	NA	0.05	NE	0.22	NO	103.28	0.23
1989	89.24	87.52	1.73	3.31	NA	0.05	NE	0.14	NO	92.74	0.28
1990	72.03	70.03	2.00	2.22	NA	0.00	NE	0.07	NO	74.33	0.28
1991	69.46	68.16	1.30	1.90	NA	0.00	NE	0.06	NO	71.42	0.32
1992	53.32	51.32	2.00	1.67	NA	0.00	NE	0.04	NO	55.03	0.34
1993	51.92	49.82	2.10	1.42	NA	0.00	NE	0.04	NO	53	0.36
1994	46.14	44.86	1.28	1.42	NA	0.00	NE	0.05	NO	47.61	0.38
1995	45.43	43.90	1.53	1.37	NA	0.00	NE	0.05	NO	46.85	0.42
1996	43.27	42.07	1.20	1.29	NA	0.00	NE	0.05	NO	44.61	0.47
1997	38.84	38.78	0.07	1.27	NA	0.00	NE	0.05	NO	40.16	0.48
1998	34.33	34.29	0.04	1.18	NA	0.00	NE	0.05	NO	35.57	0.50
1999	32.62	32.47	0.14	1.12	NA	0.00	NE	0.06	NO	33.79	0.49
2000	30.47	30.33	0.15	1.09	NA	0.00	NE	0.06	NO	31.62	0.53
2001	31.43	31.27	0.16	1.21	NA	0.00	NE	0.06	NO	32.70	0.52
2002	30.37	30.24	0.14	1.21	NA	0.00	NE	0.06	NO	31.64	0.48
2003	31.17	31.02	0.15	1.21	NA	0.00	NE	0.06	NO	32.44	0.41

	NFR-Sectors										
year	1	1 A	1 B	2	3	4	5	6	7		
	ENERGY	FUEL COMBUSTION ACTIVITIES	FUGITIVE EMISSIONS FROM FUELS	INDUSTRIAL PROCESSES	SOLVENT AND OTHER PRODUCT USE	AGRICULTURE	LAND USE CHANGE AND FORESTRY	WASTE	OTHER	NATIONAL TOTAL	International Bunkers
2004	25.66	25.51	0.14	1.22	NA	0.00	NE	0.06	NO	26.93	0.49
2005	25.37	25.24	0.13	1.22	NA	0.00	NE	0.06	NO	26.65	0.55
2006	27.18	27.01	0.17	1.22	NA	0.00	NE	0.06	NO	28.46	0.57

Table A-3: Emission trends for NO_x [Gg] 1980–2006.

	NFR-Sectors										
year	1	1 A	1 B	2	3	4	5	6	7		
	ENERGY	FUEL COMBUSTION ACTIVITIES	FUGITIVE EMISSIONS FROM FUELS	INDUSTRIAL PROCESSES	SOLVENT AND OTHER PRODUCT USE	AGRICULTURE	LAND USE CHANGE AND FORESTRY	WASTE	OTHER	NATIONAL TOTAL	International Bunkers
1980	214.36	214.36	IE	13.98	NA	6.66	NE	0.25	NO	235.26	1.15
1981	203.26	203.26	IE	12.71	NA	6.63	NE	0.25	NO	222.85	1.25
1982	201.14	201.14	IE	11.45	NA	6.80	NE	0.25	NO	219.65	1.15
1983	204.00	204.00	IE	10.27	NA	6.91	NE	0.25	NO	221.44	1.44
1984	206.17	206.17	IE	9.07	NA	7.04	NE	0.25	NO	222.53	1.94
1985	211.53	211.53	IE	7.88	NA	7.06	NE	0.25	NO	226.73	2.11
1986	205.07	205.07	IE	6.68	NA	6.95	NE	0.25	NO	218.95	1.87
1987	201.76	201.76	IE	5.49	NA	7.19	NE	0.25	NO	214.70	2.07
1988	196.90	196.90	IE	5.27	NA	7.14	NE	0.17	NO	209.48	2.28
1989	191.68	191.68	IE	4.99	NA	6.92	NE	0.13	NO	203.73	2.79
1990	181.43	181.43	IE	4.80	NA	6.09	NE	0.10	NO	192.41	2.77
1991	191.77	191.77	IE	4.48	NA	6.31	NE	0.09	NO	202.65	3.12
1992	181.32	181.32	IE	4.55	NA	5.95	NE	0.06	NO	191.89	3.40
1993	178.50	178.50	IE	1.98	NA	5.71	NE	0.05	NO	186.24	3.61
1994	172.61	172.61	IE	1.92	NA	6.12	NE	0.04	NO	180.70	3.77
1995	173.72	173.72	IE	1.46	NA	6.18	NE	0.05	NO	181.40	4.23
1996	196.48	196.48	IE	1.42	NA	5.86	NE	0.05	NO	203.81	4.66
1997	185.57	185.57	IE	1.50	NA	5.91	NE	0.05	NO	193.03	4.85

	NFR-Sectors										
year	**1**	**1 A**	**1 B**	**2**	**3**	**4**	**5**	**6**	**7**		
	ENERGY	**FUEL COMBUSTION ACTIVITIES**	**FUGITIVE EMISSIONS FROM FUELS**	**INDUSTRIAL PROCESSES**	**SOLVENT AND OTHER PRODUCT USE**	**AGRICULTURE**	**LAND USE CHANGE AND FORESTRY**	**WASTE**	**OTHER**	**NATIONAL TOTAL**	**International Bunkers**
1998	200.67	200.67	IE	1.46	NA	5.91	NE	0.05	NO	208.09	5.01
1999	191.64	191.64	IE	1.44	NA	5.76	NE	0.05	NO	198.89	4.92
2000	198.16	198.16	IE	1.54	NA	5.60	NE	0.05	NO	205.35	5.36
2001	207.84	207.84	IE	1.57	NA	5.57	NE	0.05	NO	215.03	5.21
2002	217.39	217.39	IE	1.63	NA	5.50	NE	0.05	NO	224.58	4.88
2003	228.75	228.75	IE	1.34	NA	5.40	NE	0.05	NO	235.54	4.17
2004	226.71	226.71	IE	1.28	NA	5.26	NE	0.05	NO	233.29	4.90
2005	229.95	229.95	IE	1.75	NA	5.22	NE	0.05	NO	236.97	5.53
2006	218.27	218.27	IE	1.63	NA	5.21	NE	0.05	NO	225.16	5.79

Table A-4: Emission trends for NMVOC [Gg] 1980–2006.

	NFR-Sectors										
year	**1**	**1 A**	**1 B**	**2**	**3**	**4**	**5**	**6**	**7**		
	ENERGY	**FUEL COMBUSTION ACTIVITIES**	**FUGITIVE EMISSIONS FROM FUELS**	**INDUSTRIAL PROCESSES**	**SOLVENT AND OTHER PRODUCT USE**	**AGRICULTURE**	**LAND USE CHANGE AND FORESTRY**	**WASTE**	**OTHER**	**NATIONAL TOTAL**	**International Bunkers**
1980	170.95	158.21	12.74	17.73	210.53	4.55	NE	0.16	NO	403.93	0.13
1981	173.43	161.18	12.24	17.12	187.39	4.48	NE	0.16	NO	382.57	0.14
1982	173.49	161.96	11.53	16.76	184.22	4.60	NE	0.16	NO	379.24	0.13
1983	175.19	163.83	11.35	16.24	181.11	4.51	NE	0.16	NO	377.21	0.16
1984	180.27	168.77	11.50	15.73	178.05	4.57	NE	0.16	NO	378.79	0.22
1985	180.14	168.62	11.52	15.21	172.82	4.61	NE	0.16	NO	372.94	0.24
1986	174.88	163.28	11.60	14.83	171.65	4.52	NE	0.16	NO	366.03	0.21
1987	172.30	160.55	11.76	14.36	170.50	4.54	NE	0.16	NO	361.86	0.23
1988	161.26	149.59	11.67	14.57	169.36	4.66	NE	0.16	NO	350.00	0.26
1989	157.46	145.56	11.91	14.54	148.42	4.61	NE	0.16	NO	325.20	0.32
1990	153.12	140.91	12.22	11.10	116.95	1.85	NE	0.16	NO	283.18	0.31

	NFR-Sectors										
year	1	1 A	1 B	2	3	4	5	6	7		
	ENERGY	FUEL COMBUSTION ACTIVITIES	FUGITIVE EMISSIONS FROM FUELS	INDUSTRIAL PROCESSES	SOLVENT AND OTHER PRODUCT USE	AGRICULTURE	LAND USE CHANGE AND FORESTRY	WASTE	OTHER	NATIONAL TOTAL	International Bunkers
1991	160.54	147.38	13.16	12.58	100.08	1.84	NE	0.16	NO	275.20	0.35
1992	152.39	139.26	13.12	13.78	82.33	1.78	NE	0.15	NO	250.43	0.38
1993	149.88	137.03	12.86	15.05	82.43	1.75	NE	0.15	NO	249.27	0.41
1994	138.58	128.32	10.26	13.57	77.06	1.81	NE	0.14	NO	231.16	0.44
1995	133.70	124.88	8.83	11.95	81.75	1.82	NE	0.13	NO	229.35	0.48
1996	131.19	123.28	7.90	10.37	78.07	1.80	NE	0.12	NO	221.54	0.57
1997	112.62	105.26	7.37	9.06	82.93	1.88	NE	0.12	NO	206.62	0.63
1998	106.59	100.74	5.85	7.71	75.54	1.84	NE	0.11	NO	191.80	0.69
1999	100.46	95.32	5.13	6.04	69.96	1.88	NE	0.11	NO	178	0.67
2000	92.52	87.36	5.16	4.96	77.74	1.78	NE	0.10	NO	177.11	0.70
2001	89.55	86.23	3.31	4.38	92.36	1.86	NE	0.10	NO	188.25	0.68
2002	85.37	81.89	3.47	4.57	96.90	1.85	NE	0.10	NO	188.79	0.64
2003	83.37	79.93	3.44	4.26	93.55	1.73	NE	0.10	NO	183.01	0.54
2004	77.73	74.46	3.27	4.40	91.83	1.97	NE	0.09	NO	176.02	0.64
2005	75.19	72.10	3.09	4.71	81.80	1.86	NE	0.09	NO	163.65	0.72
2006	70.12	66.99	3.12	4.73	94.92	1.79	NE	0.08	NO	171.63	0.75

Table A-5: Emission trends for NH_3 [Gg] 1980–2006.

	NFR-Sectors										
year	1	1 A	1 B	2	3	4	5	6	7		
	ENERGY	FUEL COMBUSTION ACTIVITIES	FUGITIVE EMISSIONS FROM FUELS	INDUSTRIAL PROCESSES	SOLVENT AND OTHER PRODUCT USE	AGRICULTURE	LAND USE CHANGE AND FORESTRY	WASTE	OTHER	NATIONAL TOTAL	International Bunkers
1980	1.39	1.39	IE	0.31	NA	62.09	NE	0.01	NO	63.79	0.001
1981	1.30	1.30	IE	0.30	NA	62.88	NE	0.01	NO	64.48	0.001
1982	1.28	1.28	IE	0.29	NA	63.42	NE	0.01	NO	65.00	0.001
1983	1.25	1.25	IE	0.28	NA	64.86	NE	0.01	NO	66.39	0.001

	NFR-Sectors										
year	1	1 A	1 B	2	3	4	5	6	7		
	ENERGY	FUEL COMBUSTION ACTIVITIES	FUGITIVE EMISSIONS FROM FUELS	INDUSTRIAL PROCESSES	SOLVENT AND OTHER PRODUCT USE	AGRICULTURE	LAND USE CHANGE AND FORESTRY	WASTE	OTHER	NATIONAL TOTAL	International Bunkers
1984	1.28	1.28	IE	0.29	NA	65.51	NE	0.01	NO	67.08	0.001
1985	1.32	1.32	IE	0.28	NA	65.14	NE	0.01	NO	66.75	0.001
1986	1.34	1.34	IE	0.26	NA	64.47	NE	0.01	NO	66.08	0.001
1987	1.33	1.33	IE	0.26	NA	64.76	NE	0.01	NO	66.36	0.001
1988	2.18	2.18	IE	0.28	NA	63.39	NE	0.01	NO	65.86	0.002
1989	3.29	3.29	IE	0.27	NA	63.54	NE	0.01	NO	67.10	0.002
1990	4.28	4.28	IE	0.27	NA	66.12	NE	0.38	NO	71.05	0.002
1991	5.85	5.85	IE	0.51	NA	66.87	NE	0.39	NO	73.62	0.002
1992	6.67	6.67	IE	0.37	NA	64.57	NE	0.45	NO	72.06	0.002
1993	7.45	7.45	IE	0.22	NA	64.59	NE	0.54	NO	72.80	0.002
1994	7.66	7.66	IE	0.17	NA	65.55	NE	0.62	NO	73.99	0.003
1995	7.49	7.49	IE	0.10	NA	67.12	NE	0.64	NO	75.35	0.003
1996	7.01	7.01	IE	0.10	NA	65.33	NE	0.67	NO	73.11	0.003
1997	6.52	6.52	IE	0.10	NA	65.60	NE	0.65	NO	72.87	0.003
1998	6.55	6.55	IE	0.10	NA	65.66	NE	0.67	NO	72.98	0.003
1999	5.92	5.92	IE	0.12	NA	64.39	NE	0.71	NO	71.13	0.003
2000	5.42	5.42	IE	0.10	NA	62.90	NE	0.72	NO	69.14	0.004
2001	5.28	5.28	IE	0.08	NA	62.68	NE	0.73	NO	68.77	0.004
2002	5.23	5.23	IE	0.06	NA	61.59	NE	0.75	NO	67.62	0.003
2003	5.05	5.05	IE	0.08	NA	61.38	NE	0.76	NO	67.27	0.003
2004	4.55	4.55	IE	0.06	NA	60.90	NE	0.95	NO	66.46	0.003
2005	4.17	4.17	IE	0.07	NA	60.67	NE	1.04	NO	65.95	0.004
2006	3.76	3.76	IE	0.07	NA	60.93	NE	1.04	NO	65.81	0.004

Table A-6: Emission trends for CO [Gg] 1980–2006.

	NFR-Sectors										
year	1	1 A	1 B	2	3	4	5	6	7		
	ENERGY	FUEL COMBUSTION ACTIVITIES	FUGITIVE EMISSIONS FROM FUELS	INDUSTRIAL PROCESSES	SOLVENT AND OTHER PRODUCT USE	AGRICULTURE	LAND USE CHANGE AND FORESTRY	WASTE	OTHER	NATIONAL TOTAL	International Bunkers
1980	1 681.4	1 681.4	IE	52.8	NA	31.1	NE	10.7	NO	1 776.1	0.3
1981	1 675.1	1 675.1	IE	50.7	NA	28.6	NE	10.8	NO	1 765.1	0.4
1982	1 684.3	1 684.3	IE	48.3	NA	32.9	NE	10.8	NO	1 776.3	0.4
1983	1 673.8	1 673.8	IE	47.9	NA	32.8	NE	10.8	NO	1 765.2	0.4
1984	1 724.9	1 724.9	IE	48.1	NA	35.1	NE	10.8	NO	1 818.8	0.6
1985	1 699.4	1 699.4	IE	46.7	NA	36.3	NE	10.7	NO	1 793.2	0.6
1986	1 639.2	1 639.2	IE	44.7	NA	33.2	NE	10.6	NO	1 727.7	0.6
1987	1 577.4	1 577.4	IE	44.9	NA	34.2	NE	10.6	NO	1 667.2	0.6
1988	1 502.0	1 502.0	IE	45.9	NA	38.2	NE	10.9	NO	1 597.0	0.7
1989	1 487.6	1 487.6	IE	46.3	NA	36.4	NE	11.3	NO	1 581.5	0.9
1990	1 385.2	1 385.2	IE	46.4	NA	1.2	NE	11.4	NO	1 444.1	0.8
1991	1 459.7	1 459.7	IE	41.7	NA	1.2	NE	11.3	NO	1 513.9	0.9
1992	1 424.2	1 424.2	IE	45.0	NA	1.1	NE	11.0	NO	1 481.3	1.0
1993	1 389.4	1 389.4	IE	47.2	NA	1.1	NE	10.9	NO	1 448.6	1.1
1994	1 319.3	1 319.3	IE	48.6	NA	1.2	NE	10.3	NO	1 379.4	1.1
1995	1 211.4	1 211.4	IE	45.1	NA	1.2	NE	9.7	NO	1 267.3	1.3
1996	1 196.3	1 196.3	IE	39.4	NA	1.2	NE	9.2	NO	1 246.1	1.4
1997	1 106.7	1 106.7	IE	38.3	NA	1.2	NE	8.7	NO	1 154.9	1.5
1998	1 064.8	1 064.8	IE	34.9	NA	1.2	NE	8.4	NO	1 109.3	1.6
1999	994.5	994.5	IE	30.6	NA	1.2	NE	8.1	NO	1 034.4	1.6
2000	922.8	922.8	IE	27.4	NA	1.1	NE	7.7	NO	959.1	1.7
2001	897.5	897.5	IE	24.2	NA	1.2	NE	7.4	NO	930.4	1.6
2002	866.2	866.2	IE	23.9	NA	1.2	NE	7.3	NO	898.6	1.5
2003	868.0	868.0	IE	23.6	NA	1.1	NE	7.4	NO	900.1	1.3
2004	825.0	825.0	IE	23.9	NA	1.7	NE	6.9	NO	857.5	1.5
2005	791.7	791.7	IE	24.2	NA	1.1	NE	6.4	NO	823.4	1.7
2006	754.1	754.1	IE	24.4	NA	1.0	NE	5.9	NO	785.4	1.8

Table A-7: Emission trends for Cd [Mg] 1985–2006.

	NFR-Sectors										
year	**1**	**1 A**	**1 B**	**2**	**3**	**4**	**5**	**6**	**7**		
	ENERGY	**FUEL COMBUSTION ACTIVITIES**	**FUGITIVE EMISSIONS FROM FUELS**	**INDUSTRIAL PROCESSES**	**SOLVENT AND OTHER PRODUCT USE**	**AGRICULTURE**	**LAND USE CHANGE AND FORESTRY**	**WASTE**	**OTHER**	**NATIONAL TOTAL**	**International Bunkers**
1985	2.08	2.08	NA	0.84	0.00	0.04	NE	0.14	NO	3.10	0.00
1986	1.82	1.82	NA	0.71	0.00	0.04	NE	0.12	NO	2.70	0.00
1987	1.41	1.41	NA	0.65	0.00	0.04	NE	0.10	NO	2.21	0.00
1988	1.19	1.19	NA	0.62	0.00	0.05	NE	0.08	NO	1.94	0.00
1989	1.06	1.06	NA	0.58	0.00	0.04	NE	0.06	NO	1.74	0.00
1990	1.06	1.06	NA	0.46	0.00	0.00	NE	0.06	NO	1.58	0.00
1991	1.09	1.09	NA	0.38	0.00	0.00	NE	0.05	NO	1.53	0.00
1992	0.97	0.97	NA	0.26	0.00	0.00	NE	0.01	NO	1.25	0.00
1993	0.94	0.94	NA	0.22	0.00	0.00	NE	0.00	NO	1.16	0.00
1994	0.88	0.88	NA	0.18	0.00	0.00	NE	0.00	NO	1.06	0.00
1995	0.81	0.81	NA	0.16	0.00	0.00	NE	0.00	NO	0.97	0.00
1996	0.84	0.84	NA	0.15	0.00	0.00	NE	0.00	NO	0.99	0.00
1997	0.80	0.80	NA	0.16	0.00	0.00	NE	0.00	NO	0.97	0.00
1998	0.74	0.74	NA	0.16	0.00	0.00	NE	0.00	NO	0.90	0.00
1999	0.80	0.80	NA	0.17	0.00	0.00	NE	0.00	NO	0.98	0.00
2000	0.76	0.76	NA	0.18	0.00	0.00	NE	0.00	NO	0.95	0.00
2001	0.80	0.80	NA	0.18	0.00	0.00	NE	0.00	NO	0.98	0.00
2002	0.80	0.80	NA	0.19	0.00	0.00	NE	0.00	NO	1.00	0.00
2003	0.83	0.83	NA	0.19	0.00	0.00	NE	0.00	NO	1.03	0.00
2004	0.83	0.83	NA	0.20	0.00	0.00	NE	0.00	NO	1.03	0.00
2005	0.88	0.88	NA	0.22	0.00	0.00	NE	0.00	NO	1.10	0.00
2006	0.90	0.90	NA	0.22	NA	0.00	NE	0.00	NO	1.12	0.00

Table A-8: Emission trends for Hg [Mg] 1985–2006.

	NFR-Sectors										
year	**1**	**1 A**	**1 B**	**2**	**3**	**4**	**5**	**6**	**7**		
	ENERGY	**FUEL COMBUSTION ACTIVITIES**	**FUGITIVE EMISSIONS FROM FUELS**	**INDUSTRIAL PROCESSES**	**SOLVENT AND OTHER PRODUCT USE**	**AGRICULTURE**	**LAND USE CHANGE AND FORESTRY**	**WASTE**	**OTHER**	**NATIONAL TOTAL**	**International Bunkers**
1985	2.98	2.98	NA	0.67	NA	0.01	NE	0.09	NO	3.74	0.00
1986	2.60	2.60	NA	0.63	NA	0.01	NE	0.08	NO	3.32	0.00
1987	2.16	2.16	NA	0.61	NA	0.01	NE	0.07	NO	2.84	0.00
1988	1.78	1.78	NA	0.59	NA	0.01	NE	0.06	NO	2.45	0.00
1989	1.59	1.59	NA	0.58	NA	0.01	NE	0.06	NO	2.24	0.00
1990	1.56	1.56	NA	0.53	NA	0.00	NE	0.05	NO	2.14	0.00
1991	1.50	1.50	NA	0.49	NA	0.00	NE	0.05	NO	2.04	0.00
1992	1.18	1.18	NA	0.44	NA	0.00	NE	0.02	NO	1.64	0.00
1993	0.96	0.96	NA	0.41	NA	0.00	NE	0.02	NO	1.39	0.00
1994	0.76	0.76	NA	0.40	NA	0.00	NE	0.02	NO	1.18	0.00
1995	0.71	0.71	NA	0.47	NA	0.00	NE	0.02	NO	1.20	0.00
1996	0.71	0.71	NA	0.43	NA	0.00	NE	0.02	NO	1.16	0.00
1997	0.68	0.68	NA	0.43	NA	0.00	NE	0.02	NO	1.13	0.00
1998	0.60	0.60	NA	0.33	NA	0.00	NE	0.01	NO	0.95	0.00
1999	0.65	0.65	NA	0.28	NA	0.00	NE	0.01	NO	0.94	0.00
2000	0.64	0.64	NA	0.24	NA	0.00	NE	0.01	NO	0.89	0.00
2001	0.70	0.70	NA	0.24	NA	0.00	NE	0.01	NO	0.95	0.00
2002	0.66	0.66	NA	0.26	NA	0.00	NE	0.01	NO	0.94	0.00
2003	0.70	0.70	NA	0.26	NA	0.00	NE	0.01	NO	0.98	0.00
2004	0.65	0.65	NA	0.27	NA	0.00	NE	0.02	NO	0.94	0.00
2005	0.67	0.67	NA	0.30	NA	0.00	NE	0.02	NO	1.00	0.00
2006	0.69	0.69	NA	0.31	NA	0.00	NE	0.02	NO	1.02	0.00

Table A-9: Emission trends for Pb [Mg] 1985–2006.

	NFR-Sectors										
year	1	1 A	1 B	2	3	4	5	6	7		
	ENERGY	FUEL COMBUSTION ACTIVITIES	FUGITIVE EMISSIONS FROM FUELS	INDUSTRIAL PROCESSES	SOLVENT AND OTHER PRODUCT USE	AGRICULTURE	LAND USE CHANGE AND FORESTRY	WASTE	OTHER	NATIONAL TOTAL	International Bunkers
1985	258.20	258.20	NA	62.45	0.06	0.23	NE	5.85	NO	326.79	0.00
1986	255.11	255.11	NA	52.38	0.06	0.21	NE	5.27	NO	313.03	0.00
1987	249.29	249.29	NA	47.85	0.06	0.22	NE	4.69	NO	302.13	0.00
1988	224.14	224.14	NA	45.16	0.07	0.24	NE	2.59	NO	272.20	0.00
1989	195.66	195.66	NA	41.74	0.07	0.23	NE	1.64	NO	239.34	0.00
1990	174.17	174.17	NA	32.09	0.07	0.01	NE	1.02	NO	207.35	0.00
1991	143.81	143.81	NA	27.09	0.06	0.01	NE	0.78	NO	171.75	0.00
1992	100.67	100.67	NA	18.61	0.06	0.01	NE	0.49	NO	119.83	0.00
1993	70.61	70.61	NA	15.15	0.05	0.01	NE	0.38	NO	86.20	0.00
1994	47.31	47.31	NA	12.03	0.05	0.01	NE	0.27	NO	59.66	0.00
1995	11.33	11.33	NA	4.68	0.04	0.01	NE	0.01	NO	16.07	0.00
1996	11.18	11.18	NA	4.26	0.04	0.01	NE	0.01	NO	15.50	0.00
1997	9.64	9.64	NA	4.79	0.04	0.01	NE	0.01	NO	14.49	0.00
1998	8.23	8.23	NA	4.70	0.04	0.01	NE	0.01	NO	12.99	0.00
1999	7.53	7.53	NA	4.91	0.04	0.01	NE	0.01	NO	12.50	0.00
2000	6.42	6.42	NA	5.48	0.04	0.01	NE	0.01	NO	11.96	0.00
2001	6.70	6.70	NA	5.35	0.03	0.01	NE	0.01	NO	12.10	0.00
2002	6.76	6.76	NA	5.65	0.03	0.01	NE	0.01	NO	12.46	0.00
2003	6.95	6.95	NA	5.68	0.03	0.01	NE	0.01	NO	12.68	0.00
2004	7.12	7.12	NA	5.90	0.03	0.01	NE	0.01	NO	13.07	0.00
2005	7.16	7.16	NA	6.49	0.03	0.01	NE	0.01	NO	13.71	0.00
2006	7.49	7.49	NA	6.61	NA	0.01	NE	0.01	NO	14.12	0.00

Table A-10: Emission trends for PAH [Mg] 1985–2006.

NFR-Sectors												
year	**1**	**1 A**	**1 B**	**2**	**3**	**4**	**5**	**6**	**7**			
	ENERGY	**FUEL COMBUSTION ACTIVITIES**	**FUGITIVE EMISSIONS FROM FUELS**	**INDUSTRIAL PROCESSES**	**SOLVENT AND OTHER PRODUCT USE**	**AGRICULTURE**	**LAND USE CHANGE AND FORESTRY**	**WASTE**	**OTHER**	**NATIONAL TOTAL**	**International Bunkers**	
1985	11.95	11.95	NA	7.88	0.15	7.07	NE	0.00	NO	27.05	NE	
1986	11.29	11.29	NA	7.82	0.15	7.06	NE	0.00	NO	26.32	NE	
1987	11.11	11.11	NA	7.91	0.15	7.06	NE	0.00	NO	26.23	NE	
1988	9.97	9.97	NA	7.46	0.15	7.06	NE	0.00	NO	24.65	NE	
1989	9.48	9.48	NA	7.57	0.15	7.06	NE	0.00	NO	24.26	NE	
1990	9.47	9.47	NA	7.44	0.15	0.24	NE	0.00	NO	17.30	NE	
1991	10.32	10.32	NA	7.18	0.15	0.24	NE	0.00	NO	17.89	NE	
1992	9.40	9.40	NA	3.59	0.11	0.24	NE	0.00	NO	13.33	NE	
1993	9.28	9.28	NA	0.52	0.07	0.24	NE	0.00	NO	10.12	NE	
1994	8.40	8.40	NA	0.59	0.06	0.24	NE	0.00	NO	9.28	NE	
1995	8.85	8.85	NA	0.49	0.04	0.24	NE	0.00	NO	9.62	NE	
1996	9.57	9.57	NA	0.90	0.02	0.24	NE	0.00	NO	10.72	NE	
1997	8.58	8.58	NA	0.47	0.01	0.23	NE	0.00	NO	9.29	NE	
1998	8.30	8.30	NA	0.41	NE	0.23	NE	0.00	NO	8.94	NE	
1999	8.32	8.32	NA	0.25	NE	0.23	NE	0.00	NO	8.80	NE	
2000	7.78	7.78	NA	0.19	NE	0.23	NE	0.00	NO	8.21	NE	
2001	8.47	8.47	NA	0.18	NE	0.23	NE	0.00	NO	8.89	NE	
2002	8.29	8.29	NA	0.19	NE	0.23	NE	0.00	NO	8.71	NE	
2003	8.62	8.62	NA	0.19	NE	0.23	NE	0.00	NO	9.04	NE	
2004	8.50	8.50	NA	0.20	NE	0.29	NE	0.00	NO	8.99	NE	
2005	8.77	8.77	NA	0.22	NE	0.21	NE	0.00	NO	9.19	NE	
2006	8.31	8.31	NA	0.22	NE	0.20	NE	0.00	NO	8.73	NE	

Table A-11: Emission trends for Dioxin [g] 1985–2006.

	NFR-Sectors										
year	**1**	**1 A**	**1 B**	**2**	**3**	**4**	**5**	**6**	**7**		
	ENERGY	**FUEL COMBUSTION ACTIVITIES**	**FUGITIVE EMISSIONS FROM FUELS**	**INDUSTRIAL PROCESSES**	**SOLVENT AND OTHER PRODUCT USE**	**AGRICULTURE**	**LAND USE CHANGE AND FORESTRY**	**WASTE**	**OTHER**	**NATIONAL TOTAL**	**International Bunkers**
1985	109.69	109.69	NA	51.30	5.19	5.05	NE	15.90	NO	187.13	NE
1986	107.87	107.87	NA	51.02	6.20	5.05	NE	15.89	NO	186.04	NE
1987	115.94	115.94	NA	50.81	0.24	5.05	NE	15.89	NO	187.93	NE
1988	110.02	110.02	NA	41.60	1.06	5.05	NE	15.48	NO	173.21	NE
1989	101.74	101.74	NA	41.13	1.06	5.05	NE	15.29	NO	164.27	NE
1990	101.84	101.84	NA	39.00	1.06	0.18	NE	18.19	NO	160.27	NE
1991	80.87	80.87	NA	35.15	1.04	0.18	NE	17.75	NO	134.99	NE
1992	53.86	53.86	NA	21.89	0.02	0.18	NE	0.53	NO	76.47	NE
1993	49.34	49.34	NA	17.01	0.02	0.18	NE	0.22	NO	66.77	NE
1994	44.54	44.54	NA	11.26	NE	0.18	NE	0.08	NO	56.06	NE
1995	45.79	45.79	NA	12.23	NE	0.18	NE	0.08	NO	58.27	NE
1996	48.22	48.22	NA	11.17	NE	0.18	NE	0.08	NO	59.64	NE
1997	46.92	46.92	NA	12.15	NE	0.17	NE	0.08	NO	59.33	NE
1998	44.45	44.45	NA	11.45	NE	0.17	NE	0.08	NO	56.15	NE
1999	40.74	40.74	NA	12.60	NE	0.17	NE	0.08	NO	53.59	NE
2000	37.69	37.69	NA	14.05	NE	0.17	NE	0.08	NO	51.99	NE
2001	40.55	40.55	NA	13.55	NE	0.17	NE	0.08	NO	54.35	NE
2002	39.08	39.08	NA	3.24	NE	0.17	NE	0.08	NO	42.57	NE
2003	40.04	40.04	NA	2.98	NE	0.17	NE	0.12	NO	43.31	NE
2004	39.08	39.08	NA	3.30	NE	0.21	NE	0.16	NO	42.75	NE
2005	40.31	40.31	NA	4.02	NE	0.15	NE	0.17	NO	44.65	NE
2006	38.62	38.62	NA	4.76	NE	0.15	NE	0.17	NO	43.69	NE

Table A-12: Emission trends for HCB [kg] 1985–2006.

	NFR-Sectors										
year	1	1 A	1 B	2	3	4	5	6	7		
	ENERGY	FUEL COMBUSTION ACTIVITIES	FUGITIVE EMISSIONS FROM FUELS	INDUSTRIAL PROCESSES	SOLVENT AND OTHER PRODUCT USE	AGRICULTURE	LAND USE CHANGE AND FORESTRY	WASTE	OTHER	NATIONAL TOTAL	International Bunkers
1985	83.21	83.21	NA	13.27	7.71	1.01	NE	1.11	NO	106.31	NE
1986	80.31	80.31	NA	13.21	8.12	1.01	NE	1.11	NO	103.76	NE
1987	83.14	83.14	NA	13.18	8.11	1.01	NE	1.11	NO	106.55	NE
1988	76.86	76.86	NA	11.16	8.22	1.01	NE	0.70	NO	97.96	NE
1989	72.79	72.79	NA	11.06	9.34	1.01	NE	0.52	NO	94.72	NE
1990	72.57	72.57	NA	9.71	9.05	0.04	NE	0.39	NO	91.77	NE
1991	69.71	69.71	NA	8.03	6.39	0.04	NE	0.28	NO	84.44	NE
1992	56.94	56.94	NA	4.94	7.49	0.04	NE	0.11	NO	69.51	NE
1993	53.58	53.58	NA	3.70	6.47	0.04	NE	0.04	NO	63.84	NE
1994	48.04	48.04	NA	2.45	1.25	0.04	NE	0.02	NO	51.79	NE
1995	50.20	50.20	NA	2.67	0.00	0.04	NE	0.02	NO	52.93	NE
1996	53.15	53.15	NA	2.44	0.00	0.04	NE	0.02	NO	55.64	NE
1997	49.07	49.07	NA	2.65	0.00	0.03	NE	0.02	NO	51.78	NE
1998	46.45	46.45	NA	2.50	0.00	0.03	NE	0.02	NO	49.01	NE
1999	44.75	44.75	NA	2.76	0.00	0.03	NE	0.02	NO	47.56	NE
2000	41.02	41.02	NA	3.07	0.00	0.03	NE	0.02	NO	44.15	NE
2001	44.32	44.32	NA	2.98	0.00	0.03	NE	0.02	NO	47.35	NE
2002	41.80	41.80	NA	3.17	NE	0.03	NE	0.02	NO	45.02	NE
2003	42.36	42.36	NA	3.18	NE	0.03	NE	0.02	NO	45.60	NE
2004	40.48	40.48	NA	3.30	NE	0.04	NE	0.03	NO	43.86	NE
2005	41.82	41.82	NA	3.69	NE	0.03	NE	0.03	NO	45.58	NE
2006	39.27	39.27	NA	3.76	NE	0.03	NE	0.03	NO	43.10	NE

Table A-13: Emission trends for TSP [Mg] 1990–2006.

	NFR-Sectors											
year	**1**	**1 A**	**1 B**	**2**	**3**	**4**	**5**	**6**	**7**		
	ENERGY	**FUEL COMBUSTION ACTIVITIES**	**FUGITIVE EMISSIONS FROM FUELS**	**INDUSTRIAL PROCESSES**	**SOLVENT AND OTHER PRODUCT USE**	**AGRICULTURE**	**LAND USE CHANGE AND FORESTRY**	**WASTE**	**OTHER**	**NATIONAL TOTAL**	**International Bunkers**
1990	31 812	31 165	647	23 769	407	12 453	NE	145	NO	68 587	307
1995	32 200	31 655	545	26 514	421	12 274	NE	159	NO	71 568	456
1999	32 714	32 215	500	24 874	424	12 169	NE	59	NO	70 240	530
2000	32 098	31 540	558	29 341	425	12 100	NE	91	NO	74 055	576
2001	32 929	32 343	585	28 406	426	12 099	NE	87	NO	73 946	560
2002	33 010	32 412	599	28 009	428	12 069	NE	110	NO	73 626	524
2003	33 726	33 084	642	27 436	430	12 153	NE	130	NO	73 875	448
2004	33 402	32 797	605	28 211	433	12 139	NE	170	NO	74 355	526
2005	33 536	32 924	612	27 069	436	11 966	NE	188	NO	73 196	595
2006	33 224	32 635	589	29 202	439	11 944	NE	191	NO	75 001	622

Table A-14: Emission trends for PM 10 [Mg] 1990–2006.

	NFR-Sectors										
year	**1**	**1 A**	**1 B**	**2**	**3**	**4**	**5**	**6**	**7**		
	ENERGY	**FUEL COMBUSTION ACTIVITIES**	**FUGITIVE EMISSIONS FROM FUELS**	**INDUSTRIAL PROCESSES**	**SOLVENT AND OTHER PRODUCT USE**	**AGRICULTURE**	**LAND USE CHANGE AND FORESTRY**	**WASTE**	**OTHER**	**NATIONAL TOTAL**	**International Bunkers**
1990	23 962	23 658	305	12 920	407	5 604	NE	70	NO	42 963	307
1995	23 717	23 460	257	13 693	421	5 523	NE	75	NO	43 430	456
1999	23 798	23 563	236	12 855	424	5 476	NE	28	NO	42 581	530
2000	23 105	22 842	263	14 901	425	5 445	NE	43	NO	43 918	576
2001	23 771	23 495	276	14 453	426	5 444	NE	41	NO	44 136	560
2002	23 717	23 435	282	13 911	428	5 431	NE	52	NO	43 539	524
2003	24 200	23 898	303	13 636	430	5 469	NE	61	NO	43 797	448
2004	23 744	23 459	285	13 969	433	5 463	NE	81	NO	43 690	526
2005	23 748	23 459	289	13 383	436	5 385	NE	89	NO	43 042	595
2006	23 340	23 062	278	14 206	439	5 375	NE	90	NO	43 450	622

Table A-15: Emission trends for PM 2.5 [Mg] 1990–2006.

	NFR-Sectors										
year	1	1 A	1 B	2	3	4	5	6	7		
	ENERGY	FUEL COMBUSTION ACTIVITIES	FUGITIVE EMISSIONS FROM FUELS	INDUSTRIAL PROCESSES	SOLVENT AND OTHER PRODUCT USE	AGRICULTURE	LAND USE CHANGE AND FORESTRY	WASTE	OTHER	NATIONAL TOTAL	International Bunkers
1990	19 942	19 847	95	3 505	407	1 245	NE	23	NO	25 122	307
1995	19 662	19 582	80	3 020	421	1 227	NE	24	NO	24 354	456
1999	19 618	19 544	74	2 597	424	1 217	NE	9	NO	23 864	530
2000	18 942	18 859	82	2 938	425	1 210	NE	13	NO	23 528	576
2001	19 511	19 424	86	2 870	426	1 210	NE	13	NO	24 030	560
2002	19 418	19 329	88	2 470	428	1 207	NE	16	NO	23 540	524
2003	19 770	19 675	95	2 430	430	1 215	NE	19	NO	23 865	448
2004	19 282	19 192	90	2 433	433	1 214	NE	25	NO	23 387	526
2005	19 237	19 146	91	2 329	436	1 197	NE	28	NO	23 227	595
2006	18 764	18 676	87	2 241	439	1 194	NE	28	NO	22 667	622