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Umweltbundesamt

AUSTRIA'S INFORMATIVE INVENTORY REPORT 2003

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

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This report provides a complete and comprehensive description of the methodologies used for the compilation of Austrian's Air Emission Inventory for NO_X, SO_2, NMVOC and NH_3 as presented in Austria's 2003 submission under the Convention on Long-range Transboundary Air Pollution of the United Nations Economic Commission for Europe (UNECE/ CLRTAP).

As a party to the Convention Austria is bound to annually report data on emissions of air pollutants covered in the Convention and its Protocols. To be able to meet this reporting requirement Austria compiles an Air Emission Inventory ("Österreichische Luftschadstoffinventur – OLI") which is updated annually.

This report follows the regulations under the UNECE/CLRTAP Convention and its Protocols that define standards for national emission inventories. In 2002 the Executive Body adopted guidelines for estimating and reporting of emission data which are necessary to ensure that the transparency, consistency, comparability, completeness and accuracy of reported emissions are adequate for current CLRTAP requirements (EB.AIR/GE.1/2002/7 and its supporting addendum).

The new guidelines offer guidance on how to provide supporting documentation within the new reporting format (Nomenclature For Reporting NFR) and give information on the level of required reporting detail and on minimum and additional reporting obligations. Furthermore they ask parties to provide an Informative Inventory Report (IIR) containing detailed and complete information on the compilation of their emission inventories in order to ensure the transparency of the inventory.

This year, Austria provides the Informative Inventory Report at hand for the first time. The structure of this report follows closely the structure of Austria's National Inventory Report (NIR) submitted annually under the United Nations Framework Convention on Climate Change (UNFCCC) which includes a complete and comprehensive description of methodologies used for compilation of Austria's greenhouse gas inventory[1].

The first chapter of this report provides general information on the institutional arrangements for inventory preparation, on the inventory preparation process itself and on QA/QC activities. Chapter 2 gives information on reduction or stabilisation targets as set out in the Protocols to the Convention compared to actual trends. The third chapter presents major changes to the previous submission (emission data report 2002 under the UNECE/CLRTAP convention).

Chapters 4 to 8 include detailed information on the methodologies and assumptions used for estimating NO_X, SO_2, NMVOC and NH_3 emissions in Austria's Air Emissions Inventory and contains references and expected future methodological improvements.

The annex presents inter alia emission data for NO_X, SO_2, NMVOC and NH_3 for the year 2001 in the "New Format for Reporting - NFR" as well as trend tables for these gases and for heavy metals, POPs and particulate matter, as included in "Austria's Annual National Air Emissions Inventory 1980-2001. Submission under the Convention on Long-range Transboundary Air Pollution (CLRTAP)".

The preparation and review of Austria's National Air Emission Inventory are the responsibility of the Department of AIR EMISSIONS of the UMWELTBUNDESAMT (federal environment agency Austria).

An electronic version of the IIR 2003 as well as related data may be found on the website of the UMWELTBUNDESAMT (www.umweltbundesamt.at); further copies of this report can be ordered from the website, as well.

[1] UMWELTBUNDESAMT (2003): Austria's National Inventory Report 2003 – Submission under the United Nations Framework Convention on Climate Change; Wien.

Specific responsibilities for the IIR 2003 have been as follows:

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The authors of this report express their thanks to all experts at the UMWELTBUNDESAMT as well as from other institutions involved in the preparation of the Austrian Air Emissions Inventory for their contribution to the continuous improvement of the inventory.

The preparation of this report was financially supported by the *Federal Ministry of Agriculture, Forestry, Environment and Water Management*.

1 INTRODUCTION

1.1 Institutional Arrangement for Inventory Preparation

For the UMWELTBUNDESAMT a national air emission inventory that identifies and quantifies the main 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 serves as a basis for policies to reduce emissions.

The UMWELTBUNDESAMT has a legal responsibility for the preparation of Austrian emission inventories[2]. As Austria has to fulfil various national and international obligations, the UMWELTBUNDESAMT prepares a comprehensive Austrian Air Emission Inventory ("Österreichische Luftschadstoff-Inventur, OLI") comprising all air pollutants stipulated in the various national and international obligations. The Austrian Air Emission Inventory and all reporting obligations are the responsibility of the *Department of Air Emissions* which is part of the UMWELTBUNDESAMT.

1.1.1 Austria's Obligations

Austria has to comply with the following emission related obligations:

- Austria's obligation under the UNECE Convention on Long-range Transboundary Air Pollution (CLRTAP): 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 are (with their status of ratification)[3]:
    - The 1984 Geneva Protocol on Long-term Financing of the Cooperative Programme for Monitoring and Evaluation of the Long-range Transmission of Air Pollutants in Europe (EMEP); 40 Parties. Entered into force 28 January 1988.
    - The 1985 Helsinki Protocol on the Reduction of Sulphur Emissions or their Transboundary Fluxes by at least 30 per cent; 22 Parties. Entered into force 2 September 1987.
    - The 1988 Sofia Protocol concerning the Control of Nitrogen Oxides or their Transboundary Fluxes; 28 Parties. Entered into force 14 February 1991.
    - The 1991 Geneva Protocol concerning the Control of Emissions of Volatile Organic Compounds or their Transboundary Fluxes; 21 Parties. Entered into force 29 September 1997.
    - The 1994 Oslo Protocol on Further Reduction of Sulphur Emissions; 25 Parties. Entered into force 5 August 1998.
    - The 1998 Aarhus Protocol on Heavy Metals; 36 Signatories and 14 ratifications. Not yet in force.
    - The 1998 Aarhus Protocol on Persistent Organic Pollutants (POPs); 36 Signatories and 15 ratifications. Not yet in force.
    - The 1999 Gothenburg Protocol to Abate Acidification, Eutrophication and Ground-level Ozone; 31 Signatories and 5 ratifications. Not yet in force.

[2] "Umweltkontrollgesetz" (*environmental surveillance act*): Bundesgesetzblatt (*federal law gazette*) 152/1998.

[3] For information on reduction or stabilization targets as set out in the Protocols to CLRTAP as well as on the status of Austria fulfilling these targets see Chapter 2.1.

- Austria's annual obligations under the 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). The Austrian implementation of the European NEC-Directive[4] also entails the obligation for an national emissions inventory of the covered air pollutants.
- Austria's annual obligations under the European Council Decision 1993/389/EEC of June 24th 1993 for a Monitoring Mechanism of Community CO_2 and other Greenhouse Gas Emissions as amended by Council Decision 1999/296/EC.
- Austria's obligation under the United Nations Framework Convention on Climate Change (UNFCCC, 1992) and the Kyoto Protocol (1997).
- Obligation under the Austrian "ambient air quality law"[5] comprising the reporting of national emission data on SO_2, NO_X, NMVOC, CO, heavy metals (Pb, Cd, Hg), benzene and particulate matter.
- Austria's obligation according to Article 15 of the European IPPC Directive 1996/61/EC is to implement a European Pollutant Emission Register (EPER). Article 15 of the IPPC Directive can be associated with Article 6 of the Aarhus Convention (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 History

As there are many different obligations which are subject to continuous development, Austria's National Inventory System (NISA) has to be adapted to these changes. A brief history of the development and the activities of NISA is shown here:

- 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 country Austria participated in CORINAIR 90, which was an air emission inventory for Europe. It was part of the CORINE (Coordination d'Information Environmentale) work plan set up by the European Council of Ministers in 1985. The aim of CORINAIR 90 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 8, 1992 and subsequently submitted its instrument of ratification on February 28, 1994.
- In 1994 the first so-called Austrian Air Emission Inventory (Österreichische Luftschadstoff-Inventur, OLI) was carried out.
- In 1997 the emission data were reported for a time period (for each of the years from 1980 to 1995) for the first time.

[4] „Emissionshöchstmengengesetz- Luft *EG-L*" (*air emissions ceilings law*) Bundesgesetzblatt (*federal law gazette*) I 34/2003

[5] „Immissionsschutzgesetz-Luft *IG-L*" (*ambient air quality law*): Bundesgesetzblatt (*federal law gazette*) I 115/1997.

1.1.3 Adaptation of the National Inventory System according to the UNECE/CLRTAP Convention and its Protocols

Regulations under the UNECE/CLRTAP 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 of emission data to ensure that the transparency, consistency, comparability, completeness and accuracy of reported emissions is adequate for current CLRTAP needs (EB.AIR/GE.1/2002/7 and its supporting addendum).

Under article 8, paragraph (a) of the Convention, Parties shall exchange available information on emissions of agreed upon air pollutants annually. 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, the annual reporting obligation enfolds emission data on SO_2, NO_X, NMVOCs, NH_3, CO, TSP, PM_{10}, and $PM_{2,5}$ as well as on the heavy metals Pb, Cd and Hg and the persistent organic pollutants PAH, dioxins and furans and HCB.

Emission estimates should be prepared using the methodologies agreed upon by the Executive Body. This is in particular the EMEP/CORINAIR Guidebook as well as other internationally applied methodologies and guidelines including:

(i) The Revised 1996 Intergovernmental Panel on Climate Change (IPCC) Guidelines for National Greenhouse Gas Inventories and the IPCC Good Practice Guidance

(ii) The Integrated Pollution Prevention and Control (IPPC) European Pollutant Emission Register (EPER)

(iii) The IPPC Best Available Techniques Reference Documents

(iv) The Guidelines for Emission Inventory Reporting from the Large Combustion Plant Directive

(v) The Organization for Economic Co-operation and Development (OECD) and Pollution Release and Transfer Register (PRTR) Guidance

The emission inventory system, which is currently being adapted, will have a structure as illustrated in Figure 1.

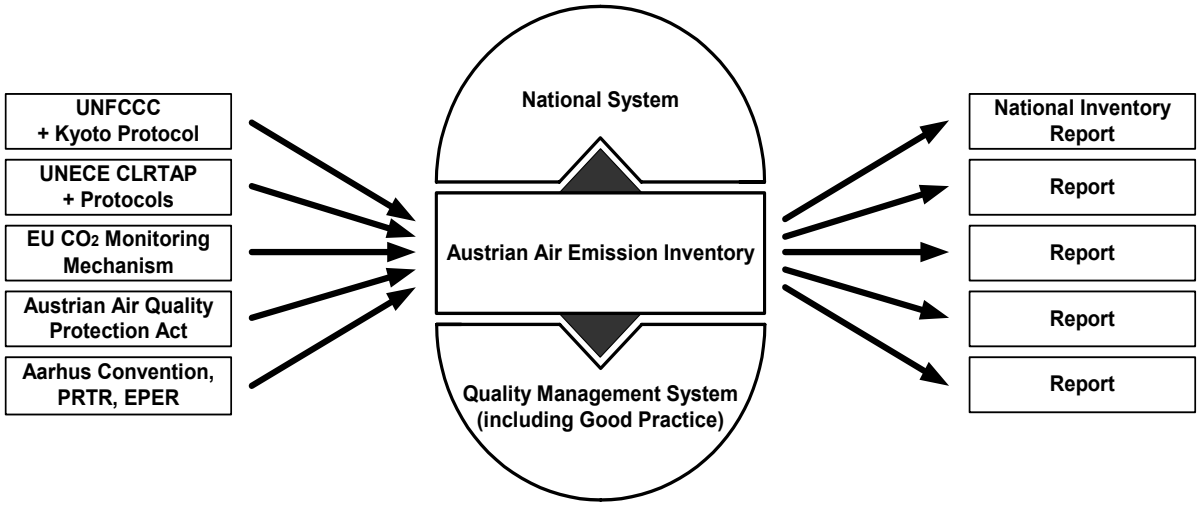

Figure 1: Structure of the future emission inventory system in Austria (NISA)

The Austrian Air Emission Inventory comprising all air pollutants stipulated by various national and international obligations will be the centre of NISA. The national system and the quality management system will be incorporated into NISA as complementary sections.

Austria is taking significant steps to ensure a high-quality emission inventory in which uncertainties are reduced as far as feasible and in which data are obtained in a transparent, consistent, complete, comparable and accurate manner.

The system will include all institutions whose data have a significant impact on emission estimates and identify their collaboration with the UMWELTBUNDESAMT. Among them are:

- Federal Provinces
- Austrian Federal Economic Chamber
- Statistics Austria
- Federal Ministry of the Environment
- Operators of installations covered by the European IPPC Directive

At the moment the UMWELTBUNDESAMT uses only published information of these institutions. The inventory of the Federal Provinces is compiled by the UMWELTBUNDESAMT applying a top down approach using the emissions of the Austrian Air Emission Inventory. One of the next steps will be to further improve the cooperation between these institutions and the UMWELTBUNDESAMT.

1.2 Inventory Preparation Process

The present Austrian air pollutant inventory for the period 1990 to 2001 was compiled according to the recommendations for inventories as set out by the Executive Body in the guidelines mentioned above.

1.2.1 The CORINAIR System

The OLI is based on the CORINAIR (CORe INventory of AIR emissions) system which has been developed by the EEA (European Environment Agency) since 1995. Austria, as many other European Countries, uses this classification and calculation method for quantifying national emissions. The CORINAIR system was designed to collect and report air emissions from to the EEA in a common format. This common European-wide database can easily be adapted to the preparation of specific inventories in accordance with the guidelines under the UNECE/CLRTAP and UNFCCC. In the following a brief description from the EEA homepage is given:

The aim is to collect, maintain, manage and publish information on emissions into the air, by means of a European air emission inventory and database system. This concerns air emissions from all sources relevant to the environmental problems of climate change, acidification, eutrophication, tropospheric ozone, air quality and dispersion of hazardous substances.

As the CORINAIR inventory is source-oriented, there is a distinction between point and area sources. Point sources are large, stationary sources of emissions that release pollutants into the atmosphere. In Austria steam boilers with more than 50 MW are categorised as large point sources. These combustion plants have to collect their data on emissions and fuel consumption monthly and report them annually. Emissions are not reported for all air pollutants addressed in the inventory, for those which are not, the Umweltbundesamt calculates emissions on the basis of the reported fuel consumption.

Fuel consumption of all considered point sources is subtracted from the total consumption of each category as obtained from national statistics. The rest is considered as area source, it is the sum of facilities or activities whose individual small amounts of emissions do not qualify them as point sources. Collectively these facilities or activities can release significant amounts of a pollutant. To estimate emissions from area sources emission factors are used. Information about the source of the emission factors used is provided below.

SNAP and SPLIT Codes

The SNAP (Selected Nomenclature for sources of Air Pollution) nomenclature is designed to estimate emissions of all kind of air pollutants. The specifications of the SNAP categories have to be revised continuously due to new reporting requirements, old versions of SNAP codes are *SNAP 90* and *SNAP 94*.

The current SNAP code version used for preparation of the Austrian Air Emission Inventory (OLI) is called *SNAP 97* which provides three levels of detail:

Level 1: 11 main categories numbered from 01 to 11.

Level 2: 76 sub categories of Level 1. Examples: 01 01, 11 25.

Level 3: 414 sub categories of Level 2. Examples: 01 01 01, 02 02 05.

Additionally the predefined SNAP categories may be expanded by so called SPLITs which are predefined by the ETC or user defined. A SPLIT code consists of three alphanumeric digits.

Fuel Codes

Fuel codes provide an additional possibility for SNAP code extension and are defined as a four digit alphanumeric code. The first three digits are based on the NAPFUE code.

OLI Source Categories

OLI source categories are used as a basis for the preparation of the emission inventory. Each OLI source category is unambiguously identified by a combination of SNAP, SPLIT and an optional Fuel Code.

For every source category a set of activity data, emission factor and emission value for each year of the inventory and for all occurring pollutants is collected.

Each source category has a NFR code for transforming the SNAP system to the NFR format.

1.2.2 Data Management

OLI needs a reliable data management to fulfil the data collecting and reporting requirements. Data collection is performed by many co-workers and the reporting requirements grow rapidly and may change over time. Data management is carried out by using MSExcel™ spreadsheets in combination with Visual Basic™ macros. The whole data is stored on a central network server which is back-uped daily for the needs of data recovery.

1.2.3 Reporting

The Austrian Air Emission Inventory currently uses the EMEP/CORINAIR calculation methods for quantifying national emissions, the results are presented in CollectER databases on the EIONET. Each database stores one year of the time series and can be read by using the CollectER V1.3 Software. The databases also include information about greenhouse gas emissions which are needed to perform Austria's reporting obligations under the UNFCCC Convention (see Chapter 1.1.1). As mentioned above, the UMWELTBUNDESAMT internally uses an expert system, as explained above. This system is more comprehensive and more flexible than the CollectER databases.

Austria's national emissions (as reported in the Austrian Air Emission Inventory) have to be transferred to the new UNECE nomenclature for reporting format (NFR) using CORINAIR standard procedures in order to comply with UNECE reporting obligations and to ensure comparability of the reported data. The NFR is a standardized format for reporting estimates of emissions, activity data, projected activity data, projected emissions and other relevant information. The source category split of NFR is consistent with the category split of the IPCC sectoral tables as applied by the UNFCCC.

Each SNAP item corresponds to a single NFR source category. In Table III A of Annex 3 of the draft guidelines for estimating and reporting emission data (EB.AIR/GE.1/2002/7) a table for corresponding allocation of all SNAP items into EMEP/NRF codes is provided.

1.3 Methodologies and Data Sources Used

The following table presents the main data sources used for activity data as well as information on who performed emission calculations:

Table 1: Main data sources for activity data and emission values

Sector	Data Sources for Activity Data	Emission Calculation
Energy	Energy Balance from STATISTIK AUSTRIA, Steam boiler database;	UMWELTBUNDESAMT, plant operators
Industry	National production statistics, import/export statistics, direct information from industry or associations of industry;	UMWELTBUNDESAMT, plant operators
Waste	Database on landfills	UMWELTBUNDESAMT
LUCF	National statistics on forests obtained from STATISTIK AUSTRIA	UMWELTBUNDESAMT
Solvent	Import/ export statistics, production statistics, consumption statistics;	Contractor: Forschungsinstitut für Energie und Umweltplanung, Wirtschaft und Marktanalysen GmbH*
Agriculture	National Studies, national agricultural statistics obtained from STATISTIK AUSTRIA;	Contractors: University of Natural Resources and Applied Life Sciences, Research Centre Seibersdorf;

* Research Institute for Energy and Environmental Planning, Economy and Market Analysis Ltd.

For the preparation of the inventory, the UMWELTBUNDESAMT prefers emission data that is reported by the operator of the source due to these data usually reflecting actual emissions more accurately than data calculated using default emission factors, as the operator has the best information about the actual circumstances. If such data is not available, national emission factors are used or, if there are no national emission factors, international emission factors are used to estimate the emissions.

If no such information is available an emission factor is multiplied with the activity data to obtain the emission data for a specific source. This method is mainly used for area sources.

The main sources for emission factors used are:

- National studies for country specific emission factors
- EMEP/CORINAIR Guidebook
- IPCC GPG
- Revised IPCC 1996 Guidelines

Main Data Suppliers

The main data suppliers for the Austrian Air Emission Inventory is STATISTIK AUSTRIA who provides the underlying energy data. The Austrian energy balances are based on several databases mainly prepared by the Ministry of Economic Affairs and Work, "Bundeslastverteiler" and STATISTIK AUSTRIA. Their methodology follows the IEA and Eurostat 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 classification.

The main data suppliers are also presented in Table 1.

Information about activity data and emissions of the industry sector is obtained from *Association of the Austrian Industries* or directly from individual plants. Activity data for some sources is obtained from STATISTIK AUSTRIA who provides statistics on production data[6]. The methodology of this statistic has 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.

Operators of steam boilers of more than 50 MW report their emissions and their activity data directly to the UMWELTBUNDESAMT. National and sometimes international studies are also used as sources of data. Operators of landfill sites report their activity data directly to UMWELTBUNDESAMT. Emissions of the years 1998-2001 are calculated on the basis of these data. Activity data needed for the calculation of non energetic emissions are based on several statistics collected by STATISTIK AUSTRIA and national and international studies.

[6] "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 2001.

1.4 Quality Assurance and Quality Control (QA/QC)

A quality management system (QMS) has been designed to ensure compliance with requirements such as transparency, accuracy, completeness, comparability and consistency.

The QMS was primarily developed to meet the strict requirement for the reporting of GHG emissions under the Kyoto Protocol. For this reason emphasis was placed on GHGs. All air pollutants are comprised by the QMS, however, in the first instance the inspection body is seeking accreditation for GHGs only.

Accreditation of the *Inspection Body for Air Emissions* is scheduled for 2004. The QMS will be fully implemented by the end of 2003. The QMS contains all relevant features of the European standard EN 45004:1995 (*General criteria for the operation of various types of bodies performing inspections*) such as strict independence, impartiality and integrity of accredited bodies and in addition complies with the QA/QC requirements of the IPCC-GPG (Good Practice Guidance by the Intergovernmental Panel on Climate Change).

Quality Management System (QMS)

Quality assurance and quality control should be integrated into every step of the inventory development process. As soon as the Kyoto Protocol enters into force, a QMS ensuring quality and credibility of GHG emission data according to IPCC-GPG will be a crucial prerequisite for participation in international emission trading. The UMWELTBUNDESAMT is committed to the implementation of a QMS based on the European standard EN 45004 and the QA/QC requirements of the IPCC-GPG.

The relevant requirements of the EN/ISO 9000 series of standards applying to the quality systems for inspection bodies are incorporated in EN 45004. EN 45004 forms part of the following series of standards covering testing, inspection, certification and accreditation:

- ISO/IEC 17025 (General requirements for the competence of testing and calibration laboratories) replacing EN 45001 (General criteria for the operation of testing laboratories)
- EN 45002 (General criteria for the assessment of testing laboratories)
- EN 45003 (General criteria for the laboratory accreditation bodies)
- EN 45004 (General criteria for the operation of various types of bodies performing inspection)
- EN 45011 (General criteria for certification bodies operating product certification)
- EN 45012 (General criteria for certification bodies operating quality system certification)
- EN 45013 (General criteria for certification bodies operating certification of personnel)
- EN 45014 (General criteria for supplier's declaration of conformity)
- EN 45020 (General terms and their definitions concerning standardisation and related activities)

The quality management system employs a process approach as illustrated in Figure 2. The UMWELTBUNDESAMT is currently implementing a QMS based on the European standard EN 45004.

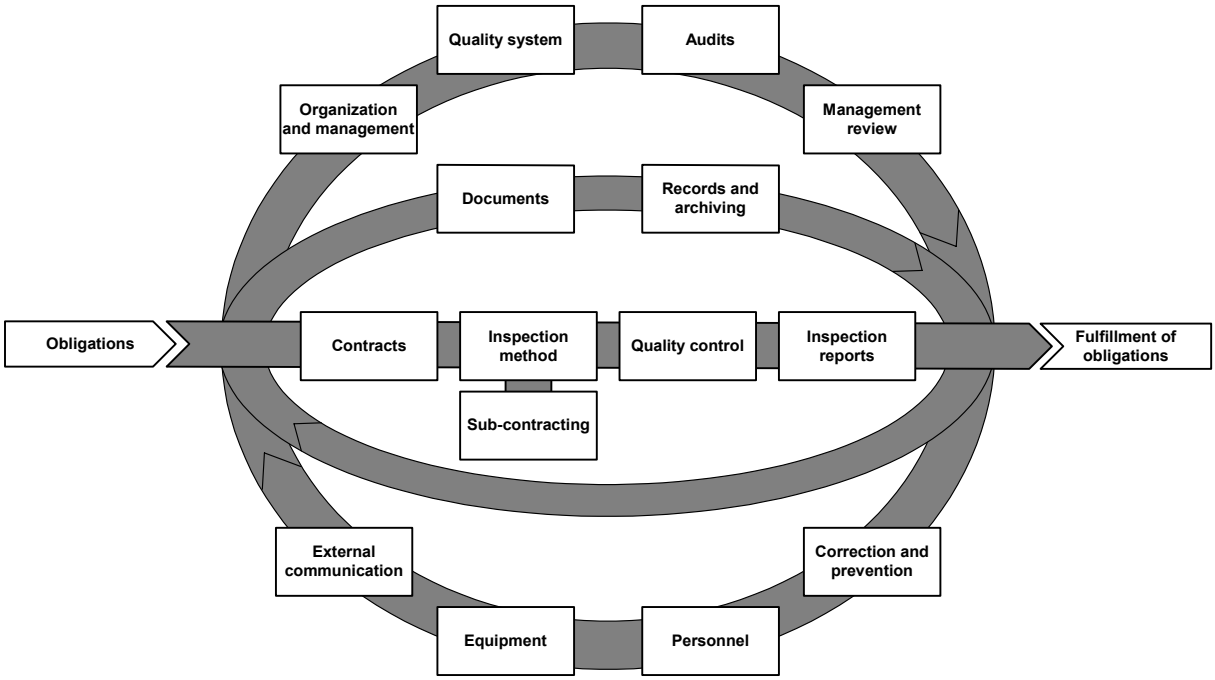

Figure 2: Process-based QMS (the outer circle corresponds to management processes, the horizontal bar to realisation processes and the inner circle to supporting processes)

The QMS is characterized by a *process approach*, referring to the application of three processes within its organisation, along with the identification and interactions of these processes and their management.

1) Management processes (outer circle)

Management Processes comprise all activities necessary for management and control of an organisation, e.g. organisation and management, quality system, audits, quality management review, corrective actions and prevention, personnel, equipment, external communication.

The most important aspect with respect to organisation and management is that it has to be ensured that the personnel is free from any commercial, financial or other pressure which might affect their judgement. Such regulations are considered fundamental in order to guarantee that emission data reflect the real emissions as truly as possible.

The staff responsible for inspection has appropriate qualifications, training, experience and a satisfactory knowledge of the requirements of the inspections to be carried out. They have the ability to make professional judgements as to conformity with general requirements using examination results and to report there-on.

Computers are used for the compilation of emission inventories. Procedures for protecting the integrity of data and for maintenance of data security have been established and implemented. Access authorisation is strictly limited for protecting the integrity of data and to ensure data confidentiality where necessary.

2) Realisation processes (horizontal bar)

Realisation processes are the department's core competences as they concern the compilation of emission inventories. The first process constitutes a contract control system which ensures that methods to be used are selected in advance, taking into account that for key source categories the most detailed method, i.e. the method with the lowest uncertainty, is the most appropriate. The inspection process consists of two steps, (i) data collection and (ii) the application of methods to estimate emissions. The UMWELTBUNDESAMT uses IPCC methods, CORINAIR methods and country specific methods. The country-specific methods have to be thoroughly documented and validated. Emission estimates are subject to quality control checks before being published in an inspection report.

The inspection body performs the majority of inspection processes. Any subcontractor performing part of the inspection is required to comply with EN 45004.

3) Supporting processes (inner circle)

Supporting processes support both management and realisation processes. They include a control system for all documents and data as well as for records and their archiving.

The quality management system is in compliance with all relevant requirements addressed in the IPCC-GPG.

Inspection bodies

The European Standard EN 45004 specifies general criteria for the competence of impartial bodies performing inspection, irrespective of the sector involved. It covers the functions of bodies whose work may include the examination of materials, products, installations, plants, processes, work procedures or services, and the determination of their conformity with requirements, as well as the subsequent reporting of results of these activities to clients and – if required – to supervisory authorities. In the case of emissions inventories, inspection concerns the examination of air emissions and covers the collection of emission data or of data which are used to estimate them, their compilation and the check of their conformity with emission reduction limits.

For this purpose a quality management system based on EN 45004 is being implemented by the Department of *Climate* of the UMWELTBUNDESAMT. The quality management system takes into account recommendations of European and international documents such as the ISO 9000 series of standards and Guide EAL-G24 (Accreditation of Inspection Bodies - Guidelines on the application of EN 45004. European Co-operation for Accreditation: 1996) as far as they are relevant for inspection bodies.

Accreditation Act

The EN 45000 series is implemented in the Austrian legislative system. The Austrian Accreditation Act ("Akkreditierungsgesetz", Federal Law Gazette 468/1992 as amended by 430/1996) regulates the accreditation of testing, inspection and certification bodies. It designates the Federal Ministry for Economic Affairs and Labour as accreditation body and defines the conditions for granting, maintaining and extending accreditation and the conditions under which accreditation may be suspended or withdrawn, partially or in total for all or part of the testing, inspection or certification body's scope of accreditation. It requires reassessment in the event of changes affecting the activity and operation of the testing, inspection or certification body, such as changes in personnel or equipment, or if analysis of a

complaint or any other information indicates that the testing, inspection or certification body no longer complies with the requirements of the accreditation body.

In Figure 3 shows the inter-relationship between the Austrian Accreditation Act, the EN 45000 series and the ISO 9000 series

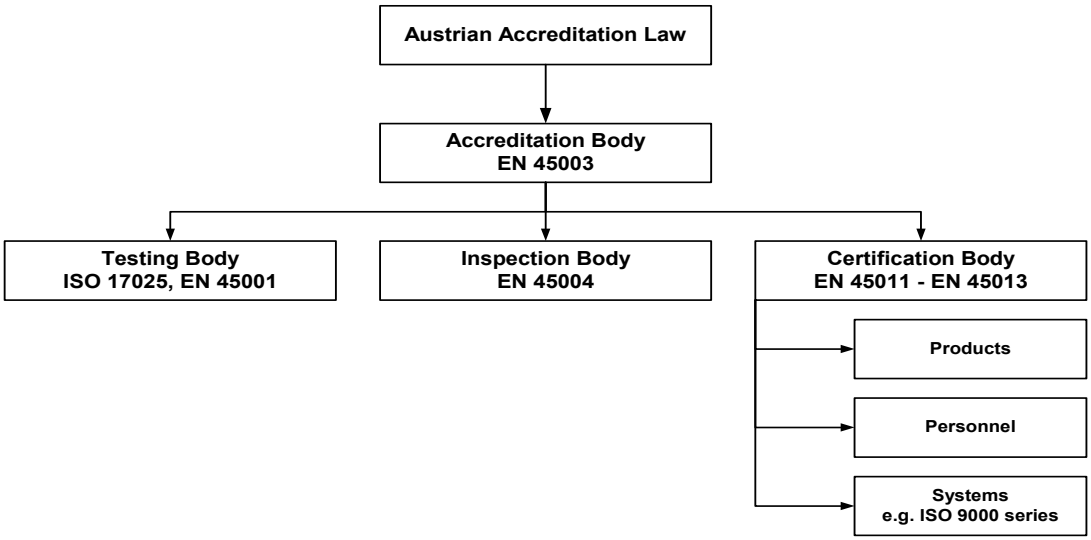

Figure 3: Inter-relationship between the Austrian Accreditation Act, the EN 45000 series and the ISO 9000 series.

The most important difference between the EN 45000 series and the ISO 9000 series is that accredited bodies under the EN 45004 have to ensure strict independence, impartiality and integrity in their activities. The personnel of the inspection body has to be free from any commercial, financial and other pressures which might affect their judgement. It has to be ensured that persons or organisations external to the inspection body cannot influence the results of inspections carried out. We feel that such a regulation is fundamental in order to guarantee that the emission data reflect the real emissions as truly as possible.

Reports issued by an accredited body may carry the federal emblem in addition to the accreditation logo. These reports are official documents.

QA/QC Activities

During the year 2003 QA/QC activities were focused on transparent documentation, adaptation of SOPs (Standard Operation Procedures) to be more practical and user friendly. SOPs comply with both IPCC and EN45004 requirements.

One of the highlights was the re-design of the key management process "Corrective and Preventive Actions" including an efficient process to establish and maintain transparency and completeness in the improvement process, while taking into account all complaints by IPCC Expert Review Teams as well as all other discrepancies discovered during the inventory compilation process.

1.5 Uncertainty Assessment

An uncertainty assessment for emissions under the NEC-directive is in progress, results will be presented in submission 2004. So far, uncertainties have been estimated for some sub sectors and for the sector AGRICULTURE (see Chapter 7).

For the greenhouse gases (CO_2, CH_4 and N_2O) a first comprehensive uncertainty analysis for the years 1990 to 1997 was performed, an overall uncertainty of 9.8% for 1990 was determined.

The planned uncertainty analysis of the NEC-gases NO_x, SO_2, NH_3 and NMVOCs will closely follow the methodology of the uncertainty analysis for the greenhouse gases [WINIWARTER & RYPDAL, 2001] as presented in Austria's National Inventory report on greenhouse gas emissions (submission 2003 under the UNFCCC convention).

When estimating uncertainty, two aspects have to be considered: systematic uncertainty and random uncertainty. Random uncertainty covers the fluctuation of a large set of measurements, which may include both the random uncertainty of the measurements and the natural variability of a parameter. A systematic error is the deviation of a result from "reality", a deviation that may be caused by a systematically flawed estimate as well as by the omission or false interpretation of certain data or statistics. The main difficulty in dealing with systematic errors is that they usually do not become apparent. Once a systematic error becomes apparent, it can be accounted for and eliminated.

The total uncertainty comprises both systematic and random uncertainty and reflects the current situation, whereas the random uncertainty can be established under ideal conditions with the inventory techniques currently available.

2 TREND IN TOTAL EMISSIONS

2.1 Emission Targets

Stabilisation or reduction targets for SO_2, NO_X, NMVOCs and POPs respectively, have been set out in the 1985 Helsinki Protocol, the 1988 Sofia Protocol, the 1991 Geneva Protocol and the 1998 Aarhus Protocol to the UNECE/CLRTAP Convention. 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 UNECE/CLRTAP Convention on the Reduction of Sulphur Emissions or their Transboundary Fluxes by at least 30 per cent entered into force in 1987. The base year to the protocol was 1984 and the reduction target should have been met by 1993.

Twenty-one ECE countries are Parties to this Protocol, all Parties have reached the reduction target. 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).

In Austria SO_2 emissions in the base year 1984 amounted to 201 Gg, by the year 1993 emissions were reduced to 58 Gg corresponding to a reduction of 71% .

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

This Protocol requires to freeze emissions of nitrogen oxides or their transboundary fluxes. The general reference year is 1987 (with the exception of the United States that chose to relate its emission target to 1978).

Taking the sum of emissions of Parties to the NO_X 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 NO_X Protocol have reached the target and stabilized emissions at 1987 (or in the case of the United States 1978) levels or reduced emissions below that level according to the latest emission data reported.

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 90ties and remained quite stable since then with only minor fluctuations.

Austrian NO_X emissions in the base year to that Protocol amounted to 223 Gg, by the year 1994 emissions were reduced to 191 Gg corresponding to a reduction of 14%. In 2001 NO_X emissions in Austria amounted to 199 Gg, which is 11% below the level of 1987.

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 (other than methane - NMVOCs) or Their Transboundary Fluxes, the second major air pollutant responsible for the formation of ground level ozone, was adopted. The protocol entered into force on 29 September 1997.

This Protocol specifies three options for emission reduction targets that have to be chosen upon signature or upon ratification. Austria opted for reduction of its emissions of non-

methane volatile organic compounds (NMVOCs) by 30% by 1999 using the year 1988 as a basis.

Austria met the reduction target: in the base year NMVOC emissions amounted to 373 Gg, in 1999 emissions were reduced by 36% to 237 Gg.

2.1.4 Protocols not yet in Force

The following three Protocols to the UNECE/CLRTAP Convention that set out reduction targets for Parties to the Convention have not yet entered into force:

- 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 will enter 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.

  The Protocol 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. It determines specific upper limits for the incineration of municipal, hazardous and medical waste. Current emission trends for POPs in Austria are given below (Chapter 2.4).

- The 1998 Aarhus Protocol on Heavy Metals:

  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. Austria has chosen 1985 as a base year. The Protocol will enter into force on 29 December 2003.

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

  The Protocol sets emission ceilings for 2010 for four pollutants: sulphur, NO_X, NMVOCs and ammonia. Parties whose emissions have a 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%, NO_X emissions by 41%, NMVOC emissions by 40% and ammonia emissions by 17% compared to 1990. The Protocol also sets tight limit values for specific emission sources and requires best available techniques to be used to keep emissions down.

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

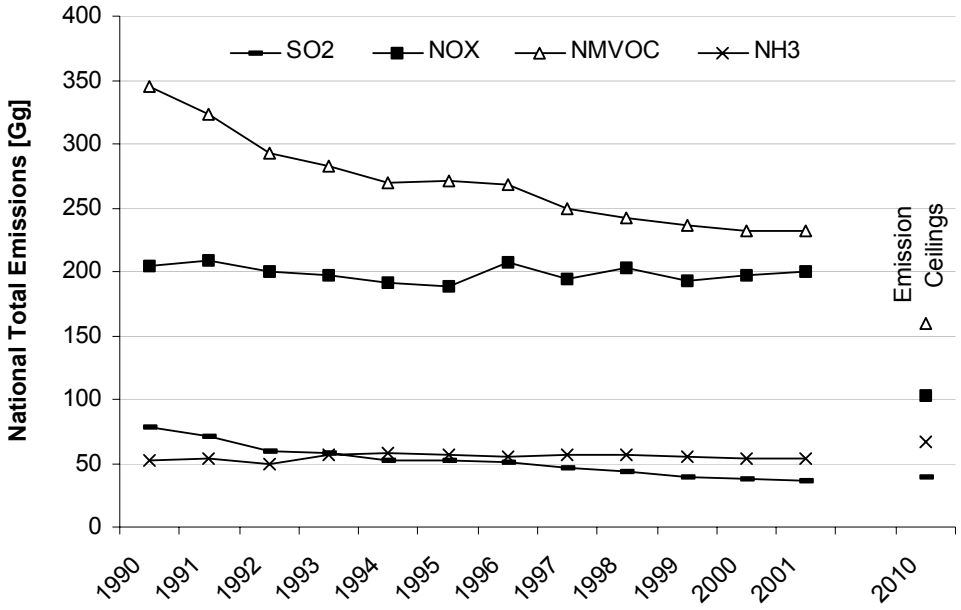

Table 2 and Figure 4 show national total emissions and trends (1990-2001) as well as emission targets[7] for air pollutants covered by the Multi- Effect Protocol.

Table 2: National total emissions and trends 1990-2001 as well as emission targets for air pollutants covered by the multi- effect protocol

Year	Emissions [Gg]			
	SO_2	NO_X	NMVOC	NH_3
1990	78.68	203.88	344.78	52.27
1991	71.67	209.16	322.72	53.41
1992	59.09	200.46	293.17	49.92
1993	57.91	196.98	282.02	56.45
1994	51.63	190.63	269.97	57.53
1995	52.01	188.15	271.13	56.88
1996	51.16	206.64	268.68	55.54
1997	45.77	194.70	249.86	56.86
1998	42.99	203.00	242.49	56.14
1999	38.99	192.55	236.86	54.94
2000	38.05	196.38	231.51	53.72
2001	36.67	199.40	232.25	53.72
Trend 1990-2001	*-53%*	*-2%*	*-33%*	*+3%*
Absolute Emission Target	**39**	**103**	**159**	**66**

[7] 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 CLRTAP Protocol (103 Gg vs. 107 Gg).

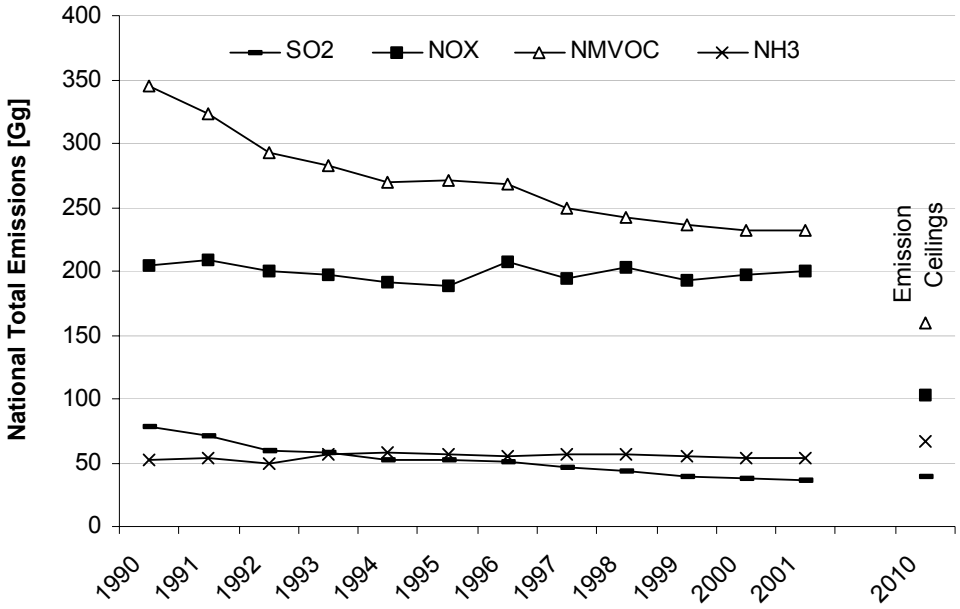

Figure 4: Emission trends and reduction targets for air pollutants covered under the Multi- Effect Protocol

SO_2 Emissions

In 1990 national total SO_2 Emissions amounted to 79 Gg; emissions decreased steadily since then and by the year 2001 emissions were reduced by 53% mainly due to lower emissions from residential heating, combustion in industries and energy industries.

As can be seen in Table 3, the main source for SO_2 emissions in Austria with a share of 87% in 1990 and 76% in 2001 result from fuel combustion activities. Within this source residential heating has the highest contribution to total SO_2 emissions (41% in 1990 and 32% in 2001).

Table 3: SO_2 emissions per NFR Category 1990 and 2001, their trend 1990-2001 and their share in total emissions

NRF Category	SO_2 Emissions [Gg]		Trend 1990-2001	Share in National Total	
	1990	2001		1990	2001
Energy	68.12	27.97	-59%	86.6%	76.3%
Fuel Combustion Activities	*66.12*	*27.81*	*-58%*	*84.0%*	*75.8%*
Fugitive Emissions from Fuels	*2.00*	*0.16*	*-92%*	*2.5%*	*0.4%*
Industrial Processes	10.49	8.64	-18%	13.3%	23.6%
Agriculture	0.00	0.00	-2%	0.0%	0.0%
Waste	0.06	0.05	-16%	0.1%	0.1%
National Total	**78.68**	**36.67**	***-53%***	**100%**	**100%**

NOTE: SO_2 emissions do not arise from NFR Categories *Solvent and Other Product Use, Land Use Change and Forestry* (LUCF) and *Other*, that's why these categories are not presented in the table.

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, which corresponds to a reduction of 50% based on 1990 emissions. Total emissions of 36.7 Gg in 2001 emissions are already below the ceiling.

NO_X Emissions

In 1990 national total NO_X Emissions amounted to 204 Gg; emissions fluctuated since then, and were only 2% below the level of 1990 in 2001 .

As can be seen in Table 3, the main source for NO_X emissions in Austria with a share of 90% in 1990 and 89% in 2001 results from fuel combustion activities. Within this source road transport has the highest contribution to total NO_X emissions, about 50% of national total emissions arise from this source.

Table 4: NO_X emissions per NFR Category 1990 and 2001, their trend 1990-2001 and their share in total emissions

NRF Category	NO_X Emissions [Gg]		Trend 1990-2001	Share in National Total	
	1990	2001		1990	2001
Energy	181.24	179.70	-1%	90%	89%
Fuel Combustion Activities	*181.24*	*179.70*	*-1%*	*90%*	*89%*
Fugitive Emissions from Fuels	*IE*	*IE*	--	--	--
Industrial Processes	17.41	14.64	-16%	7%	9%
Agriculture	5.20	5.02	-3%	3%	3%
Waste	0.04	0.03	-32%	0%	0%
National Total	**203.88**	**199.40**	**-2%**	**100%**	**100%**

NOTE: NO_X emissions do not arise from NFR Categories *Solvent and Other Product Use, Land Use Change and Forestry* (LUCF) and *Other*, that's why these categories are not presented in the table.

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 it is 103 Gg), which corresponds to a reduction of 48% based on 1990 emissions (49% for the NEC Directive). With 199 Gg in 2001, which is a reduction of 2% compared to 1990 levels, emissions in Austria are at the moment well above this ceiling.

NMVOC Emissions

In 1990 national total NMVOC Emissions amounted to 345 Gg; emissions decreased steadily since then and by the year 2001 emissions were reduced by 33%.

As can be seen in Table 3, the main source of NMVOC emissions in Austria with a share of 55% in 1990 and 49% in 2001 is *Solvent and Other Product Use*. Another important sector regarding NMVOC emissions is *Fuel Combustion Activities* with a contribution to the national total of 34% in 1990 and 43% in 2001 respectively.

Table 5: NMVOC emissions per NFR Category 1990 and 2001, their trend 1990-2001 and their share in total emissions

NRF Category	NMVOC Emissions [Gg]		Trend 1990-2001	Share in National Total	
	1990	2001		1990	2001
Energy	158.22	82.44	-48%	35.5%	45.9%
Fuel Combustion Activities	*149.44*	*78.84*	*-47%*	*33.9%*	*43.3%*
Fugitive Emissions from Fuels	*8.78*	*3.61*	*-59%*	*1.6%*	*2.5%*
Industrial Processes	16.68	20.75	24%	8.9%	4.8%
Solvent and Other Product Use	167.69	126.94	-24%	54.7%	48.6%
Agriculture	1.94	1.92	-1%	0.8%	0.6%
Waste	0.25	0.19	-24%	0.1%	0.1%
National Total	**344.78**	**232.25**	**-33%**	**100%**	**100%**

The national emission ceiling 2010 for NMVOC emissions in Austria as set out in Annex II of the Multi- Effects Protocol is 159 Gg, which corresponds to a reduction of 54% based on 1990 emissions. Assuming a linear path to the emission target, with a reduction of 33% from 1990-2001 Austria is on its path to meet the target.

NH_3 Emissions

In 1990 national total NH_3 Emissions amounted to 52 Gg; emissions fluctuated over the period from 1990 to 2001, in 2001 emissions were 3% above 1990 levels.

As can be seen in Table 3, NH_3 emissions in Austria are almost exclusively emitted by the agricultural sector. The share in national total NH_3 emissions is about 97%. Within this source manure management has the highest contribution to total NH_3 emissions (about 80%).

Table 6: NH_3 emissions per NFR Category 1990 and 2001, their trend 1990-2001 and their share in total emissions

NRF Category	NH_3 Emissions [Gg]		Trend 1990-2001	Share in National Total	
	1990	2001		1990	2001
Energy	1.27	1.50	18%	2.8%	2.4%
Fuel Combustion Activities	*1.27*	*1.50*	*18%*	*2.8%*	*2.4%*
Fugitive Emissions from Fuels	*IE*	*IE*	--	--	--
Industrial Processes	0.18	0.08	-58%	0.1%	0.4%
Agriculture	50.80	52.14	3%	97.0%	97.2%
Waste	0.01	0.01	-20%	0.0%	0.0%
National Total	**52.27**	**53.72**	**3%**	**100%**	**100%**

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, which is higher than 1990 emissions, thus the target has already been reached.

2.3 Emission Trends for Heavy Metals

Emissions of heavy metals decreased remarkably from 1985 to 2001. Emission trends for heavy metals from 1985 to 2001 are presented in Table 7. Emissions for all three priority heavy metals are well below their 1985 level, which is the obligation for Austria as a Party to the Heavy Metals Protocol as soon as it has entered into force (see Chapter 2.1.4).

Table 7: Emissions and emission trends for heavy metals 1985-2001

Emis-sions	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	Trend 1985-2001
Cd [Mg]	4.9	4.4	3.8	3.3	3.0	2.6	2.5	2.2	2.2	1.9	1.7	1.7	1.7	1.7	1.6	1.4	1.5	*-69%*
Hg [Mg]	4.3	3.9	3.3	2.8	2.6	2.5	2.4	2.0	1.9	1.6	1.6	1.5	1.5	1.4	1.3	1.2	1.2	*-73%*
Pb [Mg]	331	317	306	276	242	206	170	119	86	61	19	18	17	16	15	14	14	*-96%*

Figure 5 presents emissions of heavy metals relative to 1985 (1985=100).

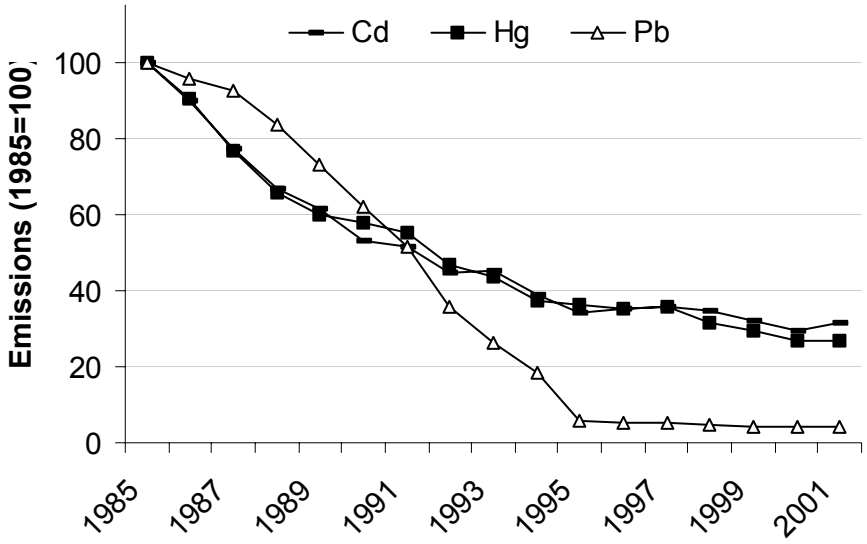

Figure 5: Emission of heavy metals 1985-2001

Cd Emissions

Cd emissions mainly arise from combustion of heavy fuel oil and wood. The sectors with the highest contribution to total emissions are residential heating, industry and energy industries.

In 1985 national total Cd emissions amounted to 4.9 Mg; emissions decreased steadily since then and by the year 2001 emissions were reduced by 69%. This reduction is due to decreasing emissions from industry and residential heating because of a decrease in the use heavy fuel oil and wood as fuel and because of improved dust abatement techniques in industry.

Hg Emissions

Hg emissions mainly arise from combustion of heavy fuel oil, wood and coal. Like Cd emissions, Hg results from the sectors with the highest contribution to total emissions which are residential heating, industry and energy industries.

In 1985 national total Hg emissions amounted to 4.3 Mg; emissions decreased steadily since then and by the year 2001 emissions were reduced by 73%. This reduction is due to decreasing emissions from industry and residential heating due to a decrease in the use of heavy fuel oil and wood as fuel and due to improved emission abatement techniques in industry.

Pb Emissions

In 1985 the main emission source for Pb emissions was road transport. From 1990 to 1995 Pb emissions from this sector decreased by 100% due to prohibition of the addition of lead to petrol. National total emissions decreased by 96% from 1985 to 2001. In addition to emission reduction in transport the industry remarkably reduced its emissions due to improved dust abatement technologies.

2.4 Emission Trends for POPs

Emissions of Persistent Organic Pollutants "POPs" decreased remarkably from 1985 to 2001. Emission trends for POPs from 1985 to 2001 are presented in Table 8. Emissions for all three POPs are well below their 1985 level, which is the obligation for Austria as a Party to the POPs Protocol after its entry into force on 23 October 2003 (see Chapter 2.1.4).

Table 8: Emissions and emission trends for POPs 1990-2001

Emis-sions	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	Trend 1985-2001
PAH [Mg]	**28.8**	**28.1**	**27.8**	**26.6**	**26.0**	**18.5**	**18.4**	**14.2**	**10.9**	**9.8**	**10.0**	**11.0**	**9.6**	**9.5**	**8.8**	**8.4**	**9.0**	*-69%*
Dioxin [g]	**188**	**187**	**189**	**175**	**166**	**160**	**134**	**75**	**67**	**56**	**58**	**59**	**59**	**55**	**51**	**50**	**52**	*-72%*
HCB [kg]	**106**	**104**	**106**	**99**	**95**	**92**	**84**	**68**	**64**	**52**	**53**	**55**	**52**	**49**	**46**	**42**	**46**	*-56%*

Figure 6 presents emissions of POPs relative to 1985 (1985=100).

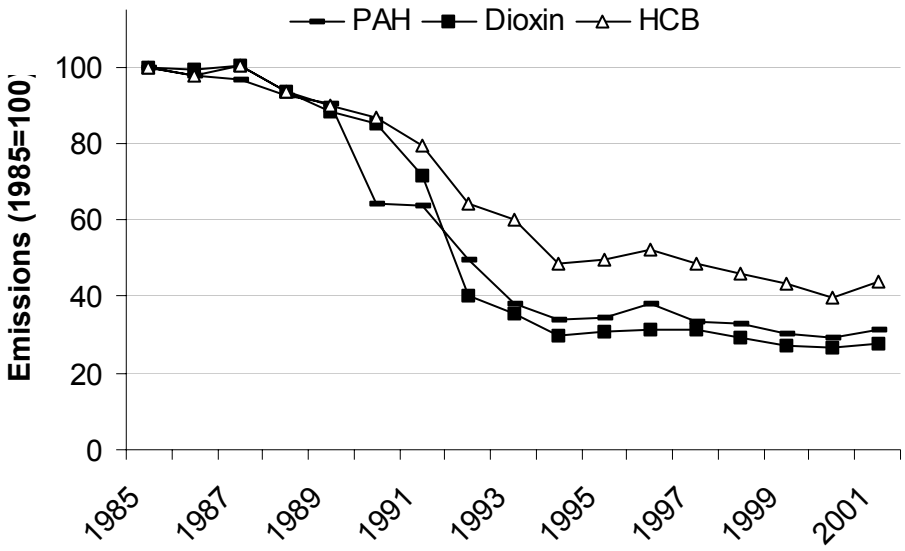

Figure 6: Emission of Persistent Organic Pollutants 1985-2001

The most important source for POPs in Austria is residential heating.

In the 80ties 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.

3 MAJOR CHANGES

3.1 Major Changes by Sector

This chapter summarizes methodological changes made to the inventory since the previous submission (submission 2002)[8]. Detailed information can be found in the sector analysis chapters of this report (Chapters 4 to 8).

1 A ENERGY

Energy Balance

Until the previous submission (submission 2002) the main data suppliers for the underlying energy source data were the Austrian Institute for Economic Research (WIFO) for the period 1980-1995 and STATISTIK AUSTRIA for the period 1996-2000.

This year STATISTIK AUSTRIA compiled a new energy balance in the IEA format based on the old WIFO energy balance and new information from industry. Inconsistencies of the old energy balance time series were eliminated. The new energy balance is in addition improved by more detailed fuel types.

Revisions of the national energy balance have a great influence on the national emission trend. In comparison to the submission from January 2002 lower energy related emissions have been estimated for the base year as well as for the whole time series.

1 A 1 a Public Electricity and Heat Production

Data on total fuel consumption has been taken from the new energy balance. In comparison with previous energy balances it reports a considerably lower consumption of fuel oil of thermoelectric power conversion (-250 000 t).

For the year 2000 the emission declarations of combustion plants >= 50 MW have been updated. Emissions of waste incineration for energy purposes reported in the previous submission under categories *6 C 1* and *1 A 5* are now reported under category *1 A 1 a*. Natural gas was so far double counted under categories *1 A 1 a* and *1 A 1 b* is now solely reported in sector *1 A 1 b*.

1 A 1 b Petroleum refining

Liquid fuel consumption of refineries has been taken from the new energy balance. Natural gas consumption which in previous submissions was considered in category *1 A 2 f* is now reported under category *1 A 1 b*.

1 A 1 c Manufacture of Solid Fuels and Other Energy Industries

Emissions from coal consumption of the mining industry which were previously included in category 1 A 2 f are now included in category 1 A 1 c.

1 A 2 Manufacturing Industries and Construction

Emissions from the different industry branches so far included under category 1 A 2 f are now reported under the corresponding categories 1 A 2 b to 1 A 2 e.

[8] Data submitted 15 February 2002

1 A 2 a Iron and steel

Energy consumption of iron and steel industry has been updated according to the new energy balance and information obtained from plant operators. Natural gas and residual fuel oil consumption which in previous submissions were considered under category *1 A 2 f* are now reported under category *1 A 2 a*.

1 A 2 f Industry-Other

In previous submissions all emissions from fuel combustion in industry except iron and steel industry were included in category *1 A 2 f*. In this submission only emissions from industry which are not considered under the categories *1 A 2 a* to *1 A 2 e* are included.

The new energy balance includes a more detailed description of fuel application increasing transparency and thus avoiding double counting of previous submissions under sector *1 A 2 f:*

Coke:

Coke so far double counted under categories *1 A 2 f* and *1 A 2 a* is now reported in sector *1 A 2 a* only.

Fuel oil:

Fuel oil so far double counted under categories *1 A 2 f* and *1 A 2 a* is now reported in sector *1 A 2 a* only.

Natural gas

Natural gas so far double counted under categories *1 A 2 f* and *1 A 2 a* is now reported in sector *1 A 2 a* only.

1 A 3 a Aviation

The following study serves as a basis for the recalculations of NO_x, SO_2 and VOC emissions:

Kalivoda M., Kudrna M.: "Air Traffic Emission Calculation for Austria 1990-2000"; on contract to the UMWELTBUNDESAMT 2002. Unpublished report.

In this new study emissions from aviation were recalculated for the time series 1990 to 2000. The study was performed to improve the accuracy of data concerning the movements and resulting emissions.

NOx, VOC and SO_2:

For the air transport class IFR (Instrument Flight Rules) the very detailed methodology from the CORINAIR guidebook in an advanced version has been used (based on the MEET model9). Emissions for VFR (Visual Flight Rules) have been calculated using average emission factors, an average fuel flow per hour and annual flight hours reported from Austrocontrol. For military flights the consumed fuel and average emission factors have been used. The calculation of the emissions of military flights does not distinguish between LTO and cruise.

The number of LTO cycles has been reported by STATISTIK AUSTRIA. The split international/national LTOs has been calculated by disaggregating the total number of movements

9 European Commission: „MEET – Methodology for calculating transport emissions and energy consumption"; DG VII, European Communities, Belgium 1999.

according to the ratio of fuel used for IFR domestic LTO and IFR international LTO (assuming an equal fuel consumption for domestic and international LTO).

Assignment of the calculated emissions to the SNAP codes:

The SNAP category "Domestic LTO" includes emissions from IFR domestic LTO, VFR and Military. The SNAP category "international LTO" corresponds to the IFR international LTO. The SNAP category "domestic cruise" corresponds with the IFR domestic cruise. The SNAP category "international cruise" corresponds with the IFR international cruise but is adjusted for reasons of conformity with national energy statistics.

Calculation for 2001:

The same emission factors and fuel allocation as in the year 2000 have been used. For the total fuel consumption, new data reported by STATISTIK AUSTRIA have been used.

1 A 3 b Road Transportation

The driving pattern of the vehicle fleet has been recalculated for the whole time series, taking into account the considerable increase of diesel vehicles share in the Austrian passenger car fleet. As a result, total fuel consumption and emissions (especially NO_x and particles) of passenger cars have increased. Emission factors for passenger cars have not been recalculated.

New data on the driving behaviour in Austria show that the number of starts per vehicle and day have changed. The cold start emissions have been recalculated.

On the basis of following study, emission factors for heavy duty vehicles (especially for EURO 2 and EURO 3 vehicles) have been revised:

Hausberger, St.: „Update of the Emission Functions for Heavy Duty Vehicles in the Handbook Emission Factors for Road Traffic"; on contract to the UMWELTBUNDESAMT, 2002; Unpublished report.

1 A 4 Other Sectors

Energy consumption and disaggregation to sub categories have been updated according to the new energy balance.

2 INDUSTRIAL PROCESSES

2 A Mineral Products : *2 A 5 Asphalt Roofing, 2 A 6 Road Paving with Asphalt*

2 D Metal Production : *Electric Furnace Steel Plants*

2 D Other Production: *2 D 1 Pulp and Paper, 2 D 1 Chipboard, 2 D 2 Food and Drink*

Activity data have been updated using updated statistical data.

4 AGRICULTURE

The previously submitted emission estimates were based on a very simple methodology using default and constant (for soils: area- based) emission factors. In 2001, UMWELTBUNDESAMT contracted the Austrian Research Center Seibersdorf and the Institute for Land-, Environment- and Energy Engineering of the University of Agriculture Vienna to develop new emission estimates for the sectors *Enteric Fermentation*, *Manure Management* and *Agricultural Soils*.

For the first time NH_3 and NO_x-emissions from fertilized and unfertilised cultures were estimated as well as VOC-emissions from agricultural vegetation. Furthermore new counting

methods resulted in changes of the activity data in the livestock categories cattle, sheep, fattening pigs and poultry.

6 WASTE

6 A 1 Solid Waste Disposal on Land - Managed Waste Disposal

From 1998 onwards all operators of landfill sites have been required to report their activity data directly to UMWELTBUNDESAMT (*Deponieverordnungsdatenbank* - Austrian disposal database). Emissions from 1998 to 2001 were recalculated on the basis of these data.

6 C Waste Incineration – Incineration of Municipal/Industrial Wastes

Emissions of waste incineration for energy purposes reported in previous submissions under category *6 C* are now reported under category *1 A 1 a*.

3.2 Recalculations per Gas

The following tables present the implication on emission trends of the methodological changes made as summarized in Chapter 3.1 and as described in detail in the sector analysis chapters of this report (Chapters 4 to 8). Changes in the use of notation keys are shown in the tables.

Table 9: Recalculation difference of NO_X emissions with respect to submission 2002

NFR Category	NO_X [Gg];										
	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Total Emissions	2.08	3.72	3.75	6.14	-3.20	5.43	25.72	10.05	21.48	10.68	12.81
1. ENERGY	3.26	4.57	6.14	7.47	-2.70	6.38	26.80	10.61	22.40	11.66	13.73
A. Fuel Combustion	3.26	4.57	6.14	7.47	-2.70	6.38	26.80	10.61	22.40	11.66	13.73
1. Energy Industries	-2.29	-2.13	-1.18	0.40	0.44	0.86	-0.44	-0.97	-1.18	0.50	0.61
a. Public Electricity and Heat Production	-3.05	-2.91	-1.91	-0.37	-0.32	0.01	-0.87	-1.49	-1.60	0.09	0.24
b. Petroleum refining	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
c. Manufacture of Solid fuels and Other Energy Industries	0.76	0.78	0.73	0.76	0.76	0.85	0.43	0.53	0.42	0.41	0.37
2. Manufacturing Industries and Construction	-5.36	-2.67	-3.02	-1.03	-1.39	-3.02	-3.79	-2.63	-3.03	-2.31	-2.54
3. Transport	19.24	18.24	18.09	16.53	7.17	16.38	35.41	18.92	28.64	15.48	17.01
a. Civil Aviation	-0.23	-0.24	-0.23	-0.20	-0.15	-0.17	-0.17	-0.15	-0.16	-0.13	-0.15
b. Road Transportation	19.01	17.98	17.78	16.14	6.75	15.93	34.95	18.45	27.85	14.44	15.71
c. Railways	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
d. Navigation	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
e. Other	0.46	0.49	0.54	0.58	0.57	0.61	0.63	0.63	0.95	1.17	1.44
4. Other Sectors	-8.34	-8.87	-7.74	-8.42	-8.92	-7.84	-4.38	-4.72	-2.03	-2.01	-1.35
5. Other	IE->NE	IE->NE	IE->NE	IE->NE	IE->NE	IE->NE	IE->NE	IE->NE	IE->NE	IE->NE	IE->NE
B. Fugitive Emissions from Fuels	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE
1. Solid Fuels	NO->IE	NO->IE	NO->IE	NO->IE	NO->IE	NO->IE	NO->IE	NO->IE	NO->IE	NO->IE	NO->IE
2. Oil and Natural Gas	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE
2. INDUSTRIAL PROCESSES	-0.02	-0.05	-0.02	-0.01	0.00	0.00	-0.02	0.08	0.08	0.08	0.18
A. Mineral Products	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Cement Production	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Lime Production	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
Other	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
B. Chemical Industry	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C. Metal Production	-0.02	-0.05	-0.02	-0.01	0.00	0.00	-0.02	0.00	0.01	0.01	0.02
D. Other Production	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.08	0.07	0.07	0.16
E. Production of Halocarbons and SF6	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
F. Consumption of Halocarbons and SF6	0->NE	0->NE	0->NE	0->NE	0->NE	0->NE	0->NE	0->NE	0->NE	0->NE	0->NE

NFR Category	NO_X [Gg];										
	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
G. Other	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
3. SOLVENT AND OTHER PRODUCT USE	NE->NO	NE->NO	NE->NO	NE->NO	NE->NO	NE->NO	NE->NO	NE->NO	NE->NO	NE->NO	NE->NO
4. AGRICULTURE	-0.98	-0.59	-1.57	-0.85	-0.29	-0.74	-0.94	-0.58	-0.82	-0.87	-0.88
A. Enteric Fermentation	5.20	5.60	4.63	5.36	5.86	5.36	5.16	5.52	5.22	5.12	5.08
B. Manure Management	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
C. Rice Cultivation	NO->NE	NO->NE	NO->NE	NO->NE	NO->NE	NO->NE	NO->NE	NO->NE	NO->NE	NO->NE	NO->NE
D. Agricultural Soils	-0.96	-0.58	-1.55	-0.83	-0.28	-0.73	-0.92	-0.56	-0.81	-0.85	-0.87
E. Prescribed Burning of Savannas	5.19	5.59	4.62	5.35	5.86	5.35	5.15	5.51	5.22	5.11	5.07
F. Field Burning of Agricultural Residues	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
G. Other	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
5. LAND-USE CHANGE AND FORESTRY	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
6. WASTE	-0.18	-0.21	-0.80	-0.48	-0.20	-0.20	-0.12	-0.07	-0.18	-0.19	-0.21
A. Solid Waste Disposal on Land	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
B. Waste-water Handling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C. Waste Incineration	-0.18	-0.21	-0.80	-0.48	-0.20	-0.20	-0.12	-0.07	-0.18	-0.19	-0.21
D. Other	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7. OTHER (PLEASE SPECIFY)	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
MEMO ITEMS:											
International Bunkers	-0.56	-0.72	-0.69	-0.37	-0.42	-0.41	-0.47	-0.46	-0.67	-0.46	-0.48
Aviation	-0.56	-0.72	-0.69	-0.37	-0.42	-0.41	-0.47	-0.46	-0.67	-0.46	-0.48
Marine	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Multilateral Operations	IE->NO	IE->NO	IE->NO	IE->NO	IE->NO	IE->NO	IE->NO	IE->NO	IE->NO	IE->NO	IE->NO

Positive values indicate that this year's estimate is higher than last year's estimate.

Table 10: Recalculation difference of SO_2 emissions with respect to submission 2002

NFR Category	SO_2 [Gg];										
	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Total Emissions	-12.06	-10.15	-3.90	-2.49	-4.69	-1.81	-1.63	-4.90	-2.78	-2.44	-2.70
1. ENERGY	-11.99	-10.04	-3.75	-2.44	-4.68	-1.79	-1.59	-4.90	-2.79	-2.42	-2.71
A. Fuel Combustion	-11.99	-10.04	-3.75	-2.44	-4.68	-1.79	-1.59	-4.90	-2.79	-2.42	-2.71
1. Energy Industries	-3.94	-4.74	-2.11	0.12	0.41	1.07	-0.47	-1.05	-0.43	0.23	0.55
a. Public Electricity and Heat Production	-3.94	-4.74	-2.11	0.12	0.41	1.07	-0.47	-1.05	-0.43	0.23	0.55
b. Petroleum refining	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
c. Manufacture of Solid fuels and Other Energy Industries	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2. Manufacturing Industries and Construction	-10.91	-4.39	-2.61	-2.55	-1.72	-3.35	-1.37	-1.99	-2.65	-1.94	-2.39
3. Transport	0.48	0.44	0.40	0.26	-0.47	0.26	0.53	0.16	0.38	0.02	0.00
a. Civil Aviation	-0.03	-0.04	-0.04	-0.03	-0.03	-0.03	0.00	0.00	0.00	0.00	0.00
b. Road Transportation	0.51	0.48	0.44	0.30	-0.43	0.30	0.53	0.16	0.38	0.01	0.00
c. Railways	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
d. Navigation	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
e. Other	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4. Other Sectors	2.38	-1.35	0.56	-0.28	-2.90	0.23	-0.28	-2.01	-0.08	-0.73	-0.87
5. Other	IE->NE	IE->NE	IE->NE	IE->NE	IE->NE	IE->NE	IE->NE	IE->NE	IE->NE	IE->NE	IE->NE
B. Fugitive Emissions from Fuels	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1. Solid Fuels	NO->IE	NO->IE	NO->IE	NO->IE	NO->IE	NO->IE	NO->IE	NO->IE	NO->IE	NO->IE	NO->IE
2. Oil and Natural Gas	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2. INDUSTRIAL PROCESSES	-0.04	-0.08	-0.04	-0.01	0.00	0.00	-0.03	0.01	0.03	0.02	0.05
A. Mineral Products	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Cement Production	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Lime Production	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
Other	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
B. Chemical Industry	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C. Metal Production	-0.04	-0.08	-0.04	-0.01	0.00	0.00	-0.03	0.01	0.03	0.02	0.05
D. Other Production	NE->IE	NE->IE	NE->IE	NE->IE	NE->IE	NE->IE	NE->IE	NE->IE	NE->IE	NE->IE	NE->IE
E. Production of Halocarbons and SF6	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
F. Consumption of Halocarbons and SF6	0->NE	0->NE	0->NE	0->NE	0->NE	0->NE	0->NE	0->NE	0->NE	0->NE	0->NE
G. Other	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
3. SOLVENT AND OTHER PRODUCT USE	NE->NO	NE->NO	NE->NO	NE->NO	NE->NO	NE->NO	NE->NO	NE->NO	NE->NO	NE->NO	NE->NO
4. AGRICULTURE	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
A. Enteric Fermentation	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
B. Manure Management	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE

NFR Category	SO_2 [Gg];										
	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
C. Rice Cultivation	NO->NE	NO->NE	NO->NE	NO->NE	NO->NE	NO->NE	NO->NE	NO->NE	NO->NE	NO->NE	NO->NE
D. Agricultural Soils	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
E. Prescribed Burning of Savannas	NO->NE	NO->NE	NO->NE	NO->NE	NO->NE	NO->NE	NO->NE	NO->NE	NO->NE	NO->NE	NO->NE
F. Field Burning of Agricultural Residues	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
G. Other	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
5. LAND-USE CHANGE AND FORESTRY	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
6. WASTE	-0.03	-0.02	-0.11	-0.03	-0.01	-0.01	-0.01	-0.01	-0.01	-0.03	-0.03
A. Solid Waste Disposal on Land	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
B. Waste-water Handling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C. Waste Incineration	-0.03	-0.02	-0.11	-0.03	-0.01	-0.01	-0.01	-0.01	-0.01	-0.03	-0.03
D. Other	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7. OTHER (PLEASE SPECIFY)	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
MEMO ITEMS:											
International Bunkers	-0.48	-0.58	-0.61	-0.57	-0.60	-0.49	0.00	0.00	-0.02	0.00	0.00
Aviation	-0.48	-0.58	-0.61	-0.57	-0.60	-0.49	0.00	0.00	-0.02	0.00	0.00
Marine	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Multilateral Operations	IE->NO	IE->NO	IE->NO	IE->NO	IE->NO	IE->NO	IE->NO	IE->NO	IE->NO	IE->NO	IE->NO

Positive values indicate that this year's estimate is higher than last year's estimate.

Table 11: Recalculation difference of NH_3 emissions with respect to submission 2002

NFR Category	NH_3 [Gg];										
	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Total Emissions	-27.59	-25.74	-26.48	-19.78	-18.31	-17.25	-17.03	-15.15	-15.62	-15.18	-13.97
1. ENERGY	-1.18	-1.47	-1.75	-1.94	-2.24	-2.35	-2.12	-2.02	-2.02	-1.88	-1.75
A. Fuel Combustion	-1.18	-1.47	-1.75	-1.94	-2.24	-2.35	-2.12	-2.02	-2.02	-1.88	-1.75
1. Energy Industries	0.04	0.03	0.06	0.10	0.10	0.09	0.09	0.08	0.08	0.07	0.07
a. Public Electricity and Heat Production	-0.03	-0.04	-0.03	-0.01	-0.01	-0.01	-0.01	-0.02	-0.02	-0.01	-0.01
b. Petroleum refining	0.07	0.06	0.09	0.10	0.10	0.09	0.10	0.10	0.10	0.08	0.08
c. Manufacture of Solid fuels and Other Energy Industries	0.01	0.01	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00
2. Manufacturing Industries and Construction	-0.01	0.02	0.00	0.06	-0.05	-0.09	-0.14	-0.10	-0.14	-0.12	-0.13
3. Transport	-1.02	-1.38	-1.68	-1.93	-2.11	-2.17	-2.02	-1.91	-1.91	-1.78	-1.65
a. Civil Aviation	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
b. Road Transportation	-1.02	-1.38	-1.69	-1.93	-2.12	-2.17	-2.02	-1.91	-1.91	-1.78	-1.65
c. Railways	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
d. Navigation	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
e. Other	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01
4. Other Sectors	-0.18	-0.14	-0.13	-0.17	-0.18	-0.18	-0.06	-0.09	-0.05	-0.06	-0.05
5. Other	IE->NE	IE->NE	IE->NE	IE->NE	IE->NE	IE->NE	IE->NE	IE->NE	IE->NE	IE->NE	IE->NE
B. Fugitive Emissions from Fuels	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE
1. Solid Fuels	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE
2. Oil and Natural Gas	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE
2. INDUSTRIAL PROCESSES	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-0.02
A. Mineral Products	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
Cement Production	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
Lime Production	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
Other	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
B. Chemical Industry	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-0.02
C. Metal Production	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
D. Other Production	NE->IE	NE->IE	NE->IE	NE->IE	NE->IE	NE->IE	NE->IE	NE->IE	NE->IE	NE->IE	NE->IE
E. Production of Halocarbons and SF6	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
F. Consumption of Halocarbons and SF6	0.002->NE	0.002->NE	0.002->NE	0.002->NE	0.002->NE	0.002->NE	0.002->NE	0.002->NE	0.002->NE	0.002->NE	0.002->NE
G. Other	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
3. SOLVENT AND OTHER PRODUCT USE	NE->NO	NE->NO	NE->NO	NE->NO	NE->NO	NE->NO	NE->NO	NE->NO	NE->NO	NE->NO	NE->NO
4. AGRICULTURE	-26.41	-24.27	-24.73	-17.83	-16.06	-14.89	-14.90	-13.13	-13.59	-13.30	-12.19
A. Enteric Fermentation	50.80	51.82	48.33	54.74	55.89	55.24	53.81	55.18	54.47	53.30	52.20
B. Manure Management	-29.90	-28.74	-27.08	-20.89	-20.70	-18.38	-17.94	-17.22	-17.01	-16.70	-15.80

NFR Category	NH_3 [Gg];										
	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
C. Rice Cultivation	NO->NE	NO->NE	NO->NE	NO->NE	NO->NE	NO->NE	NO->NE	NO->NE	NO->NE	NO->NE	NO->NE
D. Agricultural Soils	3.53	4.52	2.39	3.11	4.68	3.53	3.08	4.14	3.46	3.45	3.65
E. Prescribed Burning of Savannas	8.35	9.34	7.22	7.95	9.48	8.29	7.83	8.89	8.17	8.12	8.30
F. Field Burning of Agricultural Residues	-0.04	-0.04	-0.04	-0.04	-0.04	-0.04	-0.04	-0.04	-0.04	-0.05	-0.05
G. Other	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
5. LAND-USE CHANGE AND FORESTRY	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
6. WASTE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
A. Solid Waste Disposal on Land	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
B. Waste-water Handling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C. Waste Incineration	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
D. Other	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7. OTHER (PLEASE SPECIFY)	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
MEMO ITEMS:											
International Bunkers	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Aviation	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Marine	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Multilateral Operations	IE->NO	IE->NO	IE->NO	IE->NO	IE->NO	IE->NO	IE->NO	IE->NO	IE->NO	IE->NO	IE->NO

Positive values indicate that this year's estimate is higher than last year's estimate.

Table 12: Recalculation difference of NMVOC emissions with respect to submission 2002

NFR Category	NMVOC [Gg];										
	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Total Emissions	-14.89	-6.97	-2.96	-3.92	-4.48	-4.58	3.33	-10.50	-8.12	-8.21	-7.19
1. ENERGY	-13.54	-5.71	-1.48	-2.43	-3.08	-2.92	5.00	-8.77	-5.97	-6.36	-4.87
A. Fuel Combustion	-13.54	-5.71	-1.48	-2.43	-3.08	-2.92	5.00	-8.77	-5.97	-6.36	-4.87
1. Energy Industries	0.05	0.04	0.13	0.19	0.20	0.22	0.27	0.26	0.27	0.23	0.33
a. Public Electricity and Heat Production	0.04	0.04	0.13	0.19	0.20	0.22	0.27	0.26	0.27	0.23	0.33
b. Petroleum refining	NE->IE	NE->IE	NE->IE	NE->IE	NE->IE	NE->IE	NE->IE	NE->IE	NE->IE	NE->IE	NE->IE
c. Manufacture of Solid fuels and Other Energy Industries	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2. Manufacturing Industries and Construction	-0.54	-0.40	-0.41	-0.38	0.39	0.44	0.40	0.48	0.57	0.63	0.68
3. Transport	-16.35	-19.44	-14.71	-11.45	-9.92	-8.10	-5.18	-5.30	-3.20	-4.18	-3.70
a. Civil Aviation	-0.03	-0.04	-0.04	-0.04	-0.03	-0.04	-0.02	-0.01	0.00	0.00	0.00
b. Road Transportation	-16.33	-19.41	-14.68	-11.42	-9.89	-8.06	-5.16	-5.29	-3.21	-4.19	-3.71
c. Railways	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
d. Navigation	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
e. Other	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4. Other Sectors	3.31	14.10	13.50	9.21	6.25	4.52	9.51	-4.21	-3.61	-3.05	-2.18
5. Other	IE->NE	IE->NE	IE->NE	IE->NE	IE->NE	IE->NE	IE->NE	IE->NE	IE->NE	IE->NE	IE->NE
B. Fugitive Emissions from Fuels	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1. Solid Fuels	NO->IE	NO->IE	NO->IE	NO->IE	NO->IE	NO->IE	NO->IE	NO->IE	NO->IE	NO->IE	NO->IE
2. Oil and Natural Gas	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2. INDUSTRIAL PROCESSES	-0.06	0.06	-0.02	0.00	0.03	-0.26	-0.27	-0.39	-0.79	-0.54	-0.92
A. Mineral Products	0.00	0.00	0.00	0.00	0.00	-0.12	-0.12	-0.34	-0.94	-0.68	-1.11
Cement Production	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Lime Production	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
Other	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
B. Chemical Industry	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C. Metal Production	0.00	-0.01	0.00	0.00	0.00	-0.17	-0.18	-0.20	-0.21	-0.22	-0.25
D. Other Production	-0.05	0.07	-0.02	0.00	0.03	0.03	0.03	0.15	0.36	0.36	0.44
E. Production of Halocarbons and SF6	1.89	2.01	1.89	1.86	1.89	1.93	1.92	1.96	2.18	2.18	2.19
F. Consumption of Halocarbons and SF6	1.89	2.01	1.89	1.86	1.89	1.93	1.92	1.96	2.18	2.18	2.19
G. Other	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
3. SOLVENT AND OTHER PRODUCT USE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4. AGRICULTURE	-1.20	-1.21	-1.26	-1.29	-1.22	-1.20	-1.21	-1.13	-1.16	-1.11	-1.19
A. Enteric Fermentation	1.94	1.93	1.87	1.84	1.90	1.91	1.89	1.97	1.93	1.97	1.87
B. Manure Management	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE

NFR Category	NMVOC [Gg];										
	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
C. Rice Cultivation	NO->NE	NO->NE	NO->NE	NO->NE	NO->NE	NO->NE	NO->NE	NO->NE	NO->NE	NO->NE	NO->NE
D. Agricultural Soils	-0.80	-0.81	-0.86	-0.89	-0.82	-0.80	-0.81	-0.72	-0.75	-0.71	-0.79
E. Prescribed Burning of Savannas	1.72	1.71	1.65	1.62	1.68	1.69	1.67	1.75	1.71	1.75	1.66
F. Field Burning of Agricultural Residues	-0.40	-0.40	-0.40	-0.40	-0.40	-0.40	-0.40	-0.41	-0.41	-0.41	-0.41
G. Other	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
5. LAND-USE CHANGE AND FORESTRY	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
6. WASTE	-0.10	-0.11	-0.19	-0.20	-0.21	-0.20	-0.19	-0.20	-0.20	-0.20	-0.21
A. Solid Waste Disposal on Land	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-0.01
B. Waste-water Handling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C. Waste Incineration	-0.10	-0.11	-0.19	-0.20	-0.21	-0.20	-0.19	-0.20	-0.20	-0.20	-0.21
D. Other	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7. OTHER (PLEASE SPECIFY)	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
MEMO ITEMS:											
International Bunkers	-0.02	-0.01	0.01	0.04	0.05	0.06	0.10	0.15	0.17	0.18	0.17
Aviation	-0.02	-0.01	0.01	0.04	0.05	0.06	0.10	0.15	0.17	0.18	0.17
Marine	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Multilateral Operations	IE->NO	IE->NO	IE->NO	IE->NO	IE->NO	IE->NO	IE->NO	IE->NO	IE->NO	IE->NO	IE->NO

Positive values indicate that this year's estimate is higher than last year's estimate.

4 ENERGY (CRF SECTOR 1)

Sector *1 Energy* considers emissions originating from fuel combustion activities (Category *1 A 1* to *1 A 5*) as well as fugitive emissions from fuels (Category *1 B 1* to *1 B 2*).

4.1 Fuel Combustion Activities (NFR Source Categories 1 A 1 to 1 A 5)

The category *Fuel Combustion Activities* comprises all emissions arising from stationary fuel combustion in energy industries, manufacturing industries, residential heating, the commercial and agricultural/forestry sector, all kind of mobile sources such as road transport, air traffic, railways, shipping as well as off-road machinery in agriculture, forestry, industry, military and households.

Fuel combustion is the main source for SO_2 and NO_X emissions and a minor source for NH_3 emissions in Austria. Road transport and biomass combustion in households are important sources for NMVOC emissions. In 2001 the share in national total anthropogenic emissions of this category is 75.8 % of SO_2, 90.1% of NO_X, 33.9 % of NMVOC and 2.8% of NH_3.

4.1.1 Emission Trends

SO_2, NO_X, NMVOC and NH_3 emissions from fuel combustion activities for the period from 1990 to 2001 are presented in Table 13.

Table 13: Emissions from Fuel Combustion Activities 1A1 to 1A5 and trends 1990-2001

Year	Emissions [Gg]			
	SO_2	NO_X	NMVOC	NH_3
1990	66.12	181.24	149.44	1.27
1991	61.04	186.05	152.69	1.41
1992	49.11	178.97	139.26	1.42
1993	47.49	174.48	133.29	1.53
1994	41.55	167.90	123.14	1.50
1995	42.08	166.96	119.20	1.54
1996	40.63	186.12	118.14	1.62
1997	36.03	173.84	91.36	1.57
1998	34.11	182.85	88.05	1.57
1999	30.19	172.52	82.98	1.52
2000	29.67	176.67	78.02	1.41
2001	27.81	179.70	78.84	1.50
Trend 1990-2001	-58%	-1%	-47%	18%
Share in National Total 1990	84%	89%	43%	2%
Share in National Total 2001	76%	90%	34%	3%

The following Figure 7 shows the emission trends 1990-2001 of total fuel combustion activities.

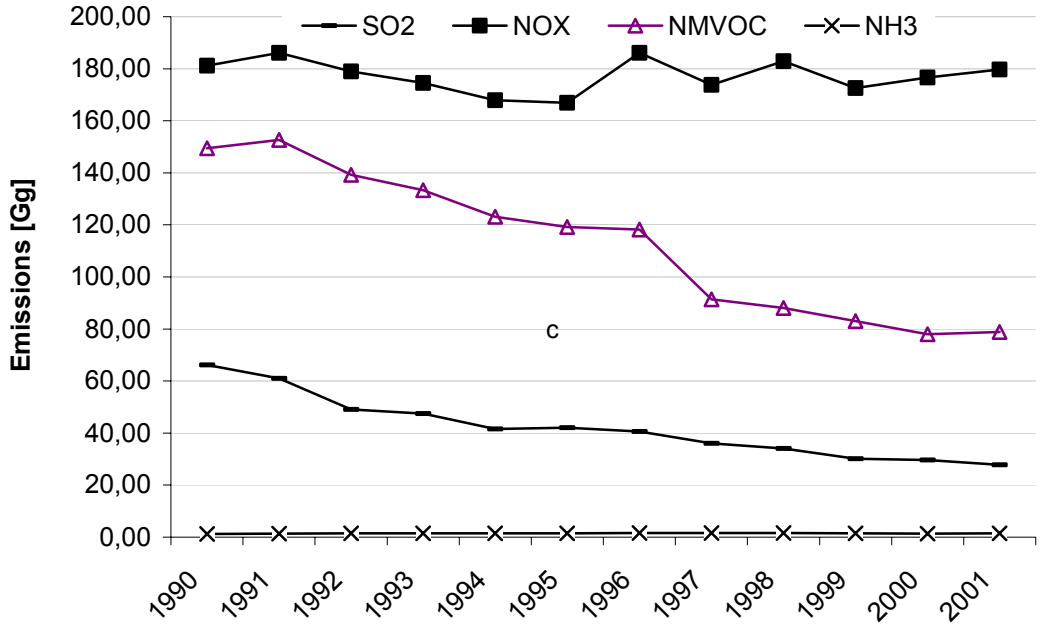

Figure 7: Emissions from Fuel Combustion Activities 1A1 to 1A5, 1990-2001

SO_2 Emissions

The main source for SO_2 emissions of the fuel combustion sector in 2001 is the sector *1 A 4 Other* (small combustion, mainly households) with a share of 38%, followed by *1 A 1 Energy Industries* with a share of 28%, *1 A 2 Manufacturing Industries* with a share of 22% and *1 A 3 Transport* with a share of 11% .

Total SO_2 emissions from fuel combustion activities decreased continuously since 1990. The driving forces for this trend are the desulphurisation of petroleum products and the decreasing usage of coal in residential heating. The increasing SO_2 emissions of refinery production driven.

Table 14 shows the emission trend of each sub category, comments to notation keys are given in Table 18 and the relevant sub chapters of the methodological description.

Table 14: SO_2 emissions per NFR Category 1990 and 2001, their trend 1990-2001 and their share in total emissions of Fuel Combustion Activities 1A1 to 1A5.

NRF Category	SO_2 Emissions [Gg]		Trend 1990-2001	Share in 1A1 to 1A5	
	1990	2001		1990	2001
FUEL COMBUSTION ACTIVITIES	**66.12**	**27.81**	**-58%**	**100%**	**100%**
1 A 1 Energy Industries	**13.50**	**7.82**	**-42%**	**20%**	**28%**
1 A 1 a Public Electricity and Heat Production	11.25	4.21	-63%	17%	15%
1 A 1 b Petroleum refining	2.25	3.62	61%	3%	13%
1 A 1 c Manufacture of Solid fuels and Other Energy Industries	NO	NO	-	-	-
1 A 2 Manufacturing Industries and Construction	**15.65**	**6.22**	**-60%**	**24%**	**22%**
1 A 2 a Iron and Steel	0.03	0.29	819%	0%	1%
1 A 2 b Non-ferrous Metals	0.12	0.17	36%	0%	1%
1 A 2 c Chemicals	1.27	1.01	-20%	2%	4%
1 A 2 d Pulp, Paper and Print	3.88	0.89	-77%	6%	3%
1 A 2 e Food Processing, Beverages and Tobacco	2.29	0.36	-84%	3%	1%
1 A 2 f Other	8.06	3.50	-57%	12%	13%
1 A 3 Transport	**4.37**	**3.15**	**-28%**	**7%**	**11%**
1 A 3 a Civil Aviation	0.02	0.04	94%	0%	0%
1 A 3 a 2 Civil Aviation (Domestic)	0.02	0.04	94%	0%	0%
1 A 3 a 2 i Civil Aviation (Domestic, LTO)	0.01	0.02	41%	0%	0%
1 A 3 a ii Civil Aviation (Domestic, Cruise)	0.00	0.02	267%	0%	0%
1 A 3 b Road Transportation	4.05	3.00	-26%	6%	11%
1 A 3 b i R.T., Passenger cars	2.36	1.88	-21%	4%	7%
1 A 3 b ii R.T., Light duty vehicles	0.30	0.32	9%	0%	1%
1 A 3 b iii R.T., Heavy duty vehicles	1.38	0.79	-43%	2%	3%

NRF Category	SO_2 Emissions [Gg]		Trend 1990-2001	Share in 1A1 to 1A5	
	1990	2001		1990	2001
1 A 3 b iv R.T., Mopeds & Motorcycles	0.01	0.01	100%	0%	0%
1 A 3 b v R.T., Gasoline evaporation	NO	NO	-	-	-
1 A 3 b vi R.T., Automobile tyre and break wear	NO	NO	-	-	-
1 A 3 b vii R.T., Automobile road abrasion	NO	NO	-	-	-
1 A 3 c Railways	0.26	0.10	-63%	0%	0%
1 A 3 d Navigation	0.04	0.02	-50%	0%	0%
1 A 3 d ii National Navigation	0.04	0.02	-50%	0%	0%
1 A 3 e Other	NO	NO	-	-	-
1 A 3 e i Pipeline compressors	NO	NO	-	-	-
1 A 3 e ii Other mobile sources and machinery	NO	NO	-	-	-
1 A 4 Other Sectors	**32.61**	**10.63**	**-67%**	**49%**	**38%**
1 A 4 a Commercial/Institutional	3.15	0.80	-75%	5%	3%
1 A 4 b Residential	26.92	8.99	-67%	41%	32%
1 A 4 b i Residential plants	26.86	8.97	-67%	41%	32%
1 A 4 b ii Houshold and gardening (mobile)	0.06	0.02	-67%	0%	0%
1 A 4 c Agriculture/Forestry/Fisheries	2.54	0.84	-67%	4%	3%
1 A 4 c i Stationary	1.59	0.47	-70%	2%	2%
1 A 4 c ii Off road Vehicles and Other Machinery	0.94	0.37	-61%	1%	1%
1 A 4 c iii National Fishing	NO	NO	-	-	-
1 A 5 Other	**IE**	**IE**	**-**	**-**	**-**
1 A 5 a Other, Stationary (including Military)	IE	IE	-	-	-
1 A 5 b Other, Mobile (including Military)	IE	IE	-	-	-
Memo items					
1 A 3 a i International Aviation	0.28	0.51	82%	-	-
1 A 3 d i International Navigation	NO	NO	-	-	-

NO_X Emissions

The main source for NO_X emissions of the fuel combustion sector in 2001 are *1 A 3 Transport* with a share of 56% followed by the sector *1 A 4 Other* (small combustion, mainly households) with a share of 22%, *1 A 2 Manufacturing Industries* with 14% and *1 A 1 Energy Industries* with 7%.

Total NO_X emissions from fuel combustion activities slightly fluctuated since 1990. The -21% decrease of NO_X emissions from *1 A 1 Energy Industries* and -13% decrease of *1 A 2 Manufacturing Industries* are mainly driven by additionally applied control techniques (Low-NO_X burner, NO_X-removal). In the transport sector the -40% decrease of emissions from passenger cars is compensated by the 85% increase of emissions from heavy duty vehicles. The 18% increase of category *1 A 4 Other* is mainly driven by the 37% increase of off-road vehicles in agriculture and forestry.

Table 15 shows the emission trend of each sub category, comments to notation keys are given in Table 18 and the relevant sub chapters of the methodology description.

Table 15: NO_X emissions per NFR Category 1990 and 2001, their trend 1990-2001 and their share in total emissions of Fuel Combustion Activities 1A1 to 1A5.

NRF Category	NO_X Emissions [Gg]		Trend 1990-2001	Share in 1A1 to 1A5	
	1990	2001		1990	2001
FUEL COMBUSTION ACTIVITIES	181.24	179.70	-1%	100%	100%
1 A 1 Energy Industries	16.51	13.04	-21%	9%	7%
1 A 1 a Public Electricity and Heat Production	11.39	9.27	-19%	6%	5%
1 A 1 b Petroleum refining	4.32	3.30	-23%	2%	2%
1 A 1 c Manufacture of Solid fuels and Other Energy Industries	0.80	0.46	-42%	0%	0%
1 A 2 Manufacturing Industries and Construction	28.57	24.84	-13%	16%	14%
1 A 2 a Iron and Steel	0.11	0.34	220%	0%	0%
1 A 2 b Non-ferrous Metals	0.19	0.19	1%	0%	0%
1 A 2 c Chemicals	1.75	1.07	-39%	1%	1%
1 A 2 d Pulp, Paper and Print	4.63	3.90	-16%	3%	2%
1 A 2 e Food Processing, Beverages and Tobacco	1.72	0.67	-61%	1%	0%
1 A 2 f Other	20.18	18.67	-7%	11%	10%
1 A 3 Transport	101.99	101.46	-1%	56%	56%
1 A 3 a Civil Aviation	0.13	0.32	152%	0%	0%
1 A 3 a 2 Civil Aviation (Domestic)	0.13	0.32	152%	0%	0%
1 A 3 a 2 i Civil Aviation (Domestic, LTO)	0.09	0.13	49%	0%	0%
1 A 3 a ii Civil Aviation (Domestic, Cruise)	0.04	0.19	374%	0%	0%
1 A 3 b Road Transportation	98.93	97.14	-2%	55%	54%
1 A 3 b i R.T., Passenger cars	69.84	42.11	-40%	39%	23%

NRF Category	NO_X Emissions [Gg]		Trend 1990-2001	Share in 1A1 to 1A5	
	1990	2001		1990	2001
1 A 3 b ii R.T., Light duty vehicles	2.31	5.29	129%	1%	3%
1 A 3 b iii R.T., Heavy duty vehicles	26.55	49.17	85%	15%	27%
1 A 3 b iv R.T., Mopeds & Motorcycles	0.20	0.54	170%	0%	0%
1 A 3 b v R.T., Gasoline evaporation	NO	NO	-	-	-
1 A 3 b vi R.T., Automobile tyre and break wear	NO	NO	-	-	-
1 A 3 b vii R.T., Automobile road abrasion	NO	NO	-	-	-
1 A 3 c Railways	1.95	1.69	-13%	1%	1%
1 A 3 d Navigation	0.52	0.57	10%	0%	0%
1 A 3 d ii National Navigation	0.52	0.57	10%	0%	0%
1 A 3 e Other	0.46	1.74	281%	0%	1%
1 A 3 e i Pipeline compressors	0.46	1.74	281%	0%	1%
1 A 3 e ii Other mobile sources and machinery	NO	NO	-	-	-
1 A 4 Other Sectors	34.17	40.35	18%	19%	22%
1 A 4 a Commercial/Institutional	2.35	1.61	-31%	1%	1%
1 A 4 b Residential	14.27	15.53	9%	8%	9%
1 A 4 b i Residential plants	13.20	14.65	11%	7%	8%
1 A 4 b ii Houshold and gardening (mobile)	1.07	0.89	-17%	1%	0%
1 A 4 c Agriculture/Forestry/Fisheries	17.55	23.21	32%	10%	13%
1 A 4 c i Stationary	1.35	1.06	-21%	1%	1%
1 A 4 c ii Off road Vehicles and Other Machinery	16.20	22.15	37%	9%	12%
1 A 4 c iii National Fishing	NO	NO	-	-	-
1 A 5 Other	IE	IE	-	-	-
1 A 5 a Other, Stationary (including Military)	IE	IE	-	-	-
1 A 5 b Other, Mobile (including Military)	IE	IE	-	-	-
Memo items					
1 A 3 a i International Aviation	2.77	5.16	86%	2%	3%
1 A 3 d i International Navigation	NO	NO	-	-	-

NMVOC Emissions

The main source for NMVOC emissions of the fuel combustion sector in 2001 is the sector *1 A 4 Other* (small combustion, mainly households) with a share of 56%, followed by *1 A 3 Transport* with a share of 38%. *1 A 2 Manufacturing Industries* with a share of 5% and *1 A 1 Energy Industries* with a share of 1% are minor sources of NMVOC.

Total NMVOC emissions from fuel combustion activities decreased continuously since 1990. The main reasons for this trend are the -71% decrease of combustion related emissions from passenger cars and the -68% decrease of gasoline evaporation of mobile sources. The -33% decrease of *1 A 4 Other* is mainly driven by the improved efficiency of biomass heatings in households.

Table 16 shows the emission trend of each sub category, comments to notation keys are given in Table 18 and the relevant sub chapters of the methodology description.

Table 16: NMVOC emissions per NFR Category 1990 and 2001, their trend 1990-2001 and their share in total emissions of Fuel Combustion Activities 1A1 to 1A5.

NRF Category	NMVOC Emissions [Gg]		Trend 1990-2001	Share in 1A1 to 1A5	
	1990	2001		1990	2001
FUEL COMBUSTION ACTIVITIES	149.44	78.84	-47%	100%	100%
1 A 1 Energy Industries	0.41	0.69	70%	0%	1%
1 A 1 a Public Electricity and Heat Production	0.41	0.69	70%	0%	1%
1 A 1 b Petroleum refining	IE	IE	-	-	-
1 A 1 c Manufacture of Solid fuels and Other Energy Industries	0.00	0.00	-42%	0%	0%
1 A 2 Manufacturing Industries and Construction	3.58	3.63	1%	2%	5%
1 A 2 a Iron and Steel	0.00	0.00	338%	0%	0%
1 A 2 b Non-ferrous Metals	0.00	0.00	72%	0%	0%
1 A 2 c Chemicals	0.12	0.09	-23%	0%	0%
1 A 2 d Pulp, Paper and Print	0.59	0.68	15%	0%	1%
1 A 2 e Food Processing, Beverages and Tobacco	0.03	0.01	-64%	0%	0%
1 A 2 f Other	2.84	2.85	0%	2%	4%
1 A 3 Transport	79.10	30.33	-62%	53%	38%
1 A 3 a Civil Aviation	0.04	0.07	79%	0%	0%
1 A 3 a 2 Civil Aviation (Domestic)	0.04	0.07	79%	0%	0%
1 A 3 a 2 i Civil Aviation (Domestic, LTO)	0.02	0.05	137%	0%	0%
1 A 3 a ii Civil Aviation (Domestic, Cruise)	0.02	0.02	13%	0%	0%
1 A 3 b Road Transportation	78.02	29.34	-62%	52%	37%
1 A 3 b i R.T., Passenger cars	47.73	14.06	-71%	32%	18%
1 A 3 b ii R.T., Light duty vehicles	0.90	0.80	-11%	1%	1%

NRF Category	NMVOC Emissions [Gg]		Trend 1990-2001	Share in 1A1 to 1A5	
	1990	2001		1990	2001
1 A 3 b iii R.T., Heavy duty vehicles	2.33	2.76	19%	2%	4%
1 A 3 b iv R.T., Mopeds & Motorcycles	7.04	5.28	-25%	5%	7%
1 A 3 b v R.T., Gasoline evaporation	20.02	6.44	-68%	13%	8%
1 A 3 b vi R.T., Automobile tyre and break wear	NO	NO	-	-	-
1 A 3 b vii R.T., Automobile road abrasion	NO	NO	-	-	-
1 A 3 c Railways	0.31	0.24	-23%	0%	0%
1 A 3 d Navigation	0.73	0.68	-6%	0%	1%
1 A 3 d ii National Navigation	0.73	0.68	-6%	0%	1%
1 A 3 e Other	0.00	0.01	281%	0%	0%
1 A 3 e i Pipeline compressors	0.00	0.01	281%	0%	0%
1 A 3 e ii Other mobile sources and machinery	NO	NO	-	-	-
1 A 4 Other Sectors	66.36	44.18	-33%	44%	56%
1 A 4 a Commercial/Institutional	0.54	0.66	21%	0%	1%
1 A 4 b Residential	57.52	32.74	-43%	38%	42%
1 A 4 b i Residential plants	51.15	26.99	-47%	34%	34%
1 A 4 b ii Houshold and gardening (mobile)	6.37	5.76	-10%	4%	7%
1 A 4 c Agriculture/Forestry/Fisheries	8.29	10.78	30%	6%	14%
1 A 4 c i Stationary	0.37	2.00	438%	0%	3%
1 A 4 c ii Off road Vehicles and Other Machinery	7.92	8.78	11%	5%	11%
1 A 4 c iii National Fishing	NO	NO	-	-	-
1 A 5 Other	IE	IE	-	-	-
1 A 5 a Other, Stationary (including Military)	IE	IE	-	-	-
1 A 5 b Other, Mobile (including Military)	IE	IE	-	-	-
Memo items					
1 A 3 a i International Aviation	0.30	0.65	116%	0%	1%
1 A 3 d i International Navigation	NO	NO	-	-	-

NH_3 Emissions

The main source for NH_3 emissions of the fuel combustion sector in 2001 is the small combustion sector *1 A 4* with a share of 49%, followed by *1 A 3 Transport* with a share of 21%, *1 A 1 Energy Industries* with a share of 17% and *1 A 2 Manufacturing Industries* with 14%.

Total NH_3 emissions from fuel combustion activities are slightly fluctuating over time depending on the yearly changing fuel consumption mix. The main sources of NH3 from fuel combustion activities are biomass and gas oil heatings in households.

Table 17 shows the emission trend of each sub category, comments to notation keys are given in Table 18 and the relevant sub chapters of the methodology description.

Table 17: NH_3 emissions per NFR Category 1990 and 2001, their trend 1990-2001 and their share in total emissions of Fuel Combustion Activities 1A1 to 1A5.

NRF Category	NH_3 Emissions [Gg]		Trend 1990-2001	Share in 1A1 to 1A5	
	1990	2001		1990	2001
FUEL COMBUSTION ACTIVITIES	1.274	1.501	18%	100%	100%
1 A 1 Energy Industries	0.185	0.250	35%	15%	17%
1 A 1 a Public Electricity and Heat Production	0.113	0.163	44%	9%	11%
1 A 1 b Petroleum refining	0.066	0.084	26%	5%	6%
1 A 1 c Manufacture of Solid fuels and Other Energy Industries	0.005	0.003	-42%	0%	0%
1 A 2 Manufacturing Industries and Construction	0.189	0.207	9%	15%	14%
1 A 2 a Iron and Steel	0.011	0.020	80%	1%	1%
1 A 2 b Non-ferrous Metals	0.002	0.003	60%	0%	0%
1 A 2 c Chemicals	0.025	0.016	-34%	2%	1%
1 A 2 d Pulp, Paper and Print	0.045	0.054	20%	4%	4%
1 A 2 e Food Processing, Beverages and Tobacco	0.018	0.014	-24%	1%	1%
1 A 2 f Other	0.087	0.099	13%	7%	7%
1 A 3 Transport	0.277	0.321	16%	22%	21%
1 A 3 a Civil Aviation	0.000	0.000	56%	0%	0%
1 A 3 a 2 Civil Aviation (Domestic)	0.000	0.000	56%	0%	0%
1 A 3 a 2 i Civil Aviation (Domestic, LTO)	0.000	0.000	18%	0%	0%
1 A 3 a ii Civil Aviation (Domestic, Cruise)	0.000	0.000	265%	0%	0%
1 A 3 b Road Transportation	0.271	0.307	13%	21%	20%
1 A 3 b i R.T., Passenger cars	0.231	0.250	8%	18%	17%
1 A 3 b ii R.T., Light duty vehicles	0.004	0.006	43%	0%	0%
1 A 3 b iii R.T., Heavy duty vehicles	0.017	0.020	18%	1%	1%
1 A 3 b iv R.T., Mopeds & Motorcycles	0.019	0.032	68%	1%	2%

NRF Category	NH_3 Emissions [Gg]		Trend 1990-2001	Share in 1A1 to 1A5	
	1990	2001		1990	2001
1 A 3 b v R.T., Gasoline evaporation	NO	NO	-	-	-
1 A 3 b vi R.T., Automobile tyre and break wear	NO	NO	-	-	-
1 A 3 b vii R.T., Automobile road abrasion	NO	NO	-	-	-
1 A 3 c Railways	0.002	0.002	-23%	0%	0%
1 A 3 d Navigation	0.000	0.000	-1%	0%	0%
1 A 3 d ii National Navigation	0.000	0.000	-1%	0%	0%
1 A 3 e Other	0.003	0.012	281%	0%	1%
1 A 3 e i Pipeline compressors	0.003	0.012	281%	0%	1%
1 A 3 e ii Other mobile sources and machinery	NO	NO	-	-	-
1 A 4 Other Sectors	0.623	0.724	16%	49%	48%
1 A 4 a Commercial/Institutional	0.059	0.054	-8%	5%	4%
1 A 4 b Residential	0.515	0.622	21%	40%	41%
1 A 4 b i Residential plants	0.515	0.622	21%	40%	41%
1 A 4 b ii Houshold and gardening (mobile)	0.000	0.000	-18%	0%	0%
1 A 4 c Agriculture/Forestry/Fisheries	0.049	0.048	-2%	4%	3%
1 A 4 c i Stationary	0.042	0.039	-6%	3%	3%
1 A 4 c ii Off road Vehicles and Other Machinery	0.007	0.009	20%	1%	1%
1 A 4 c iii National Fishing	NO	NO	-	-	-
1 A 5 Other	IE	IE	-	-	-
1 A 5 a Other, Stationary (including Military)	IE	IE	-	-	-
1 A 5 b Other, Mobile (including Military)	IE	IE	-	-	-
Memo items					
1 A 3 a i International Aviation	0.002	0.003	81%	0%	0%
1 A 3 d i International Navigation	NO	NO	-	-	-

4.1.2 General Methodology for stationary sources of NFR categories 1 A 1 to 1 A 5

CORINAIR methodology is applied: the fuel consumption of each subcategory is multiplied with a fuel and technology dependent emission factor for NO_X, SO_2, NMVOC and NH_3.

In contrast to the standard methodology, emissions due to combustion activities of Category *2 C 1 Iron and Steel Production* are not included in category *1 A Fuel Combustion Activities* where they should be included according to the CORINAIR guidelines. Instead, they are reported together with process-specific emissions under category *2 Industrial Processes.* This is also the case for emissions from fuel combustion in cement industry which are not reported under category *1 A 2 f* but included in category *2 A 1 Cement Production.*

One reason for reporting combustion-related emissions as mentioned above in Category *2 Industrial Processes* is that this corresponds with industry reporting, seeing principal difficulties in splitting emissions from complex processes into several categories.

Emission factors

Emission factors for combustion plants are expressed as kg/TJ. It should be noted that emission factors are sometimes dependent on the fuel category, e.g. "hard coal" is a group of different hard coal types with different characteristics.

Emission factors may vary over time for the following reasons:

- The chemical characteristics of a fuel category varies, e.g. sulphur content in residual oil.
- The mix of fuels in the fuel category changes over time. If the different fuels of a fuel category have different calorific values and their share in the fuel category changes, the calorific value of the fuel category might change over time. If emission factors are measured in the unit kg/t the transformation to kg/TJ induces a different emission factor.
- The technology of a combustion plant, which burns a specific fuel, changes over time.

Stationary sources

Country specific emission factors are used which are taken from national studies [BMWA-EB, 1990], [BMWA-EB, 1996] and [UMWELTBUNDESAMT, 2001]. In these studies emission factors are provided for the years 1987, 1995 and 1996 were determined by measurements in Austrian plants. NH_3 emission factors are taken from a national study [UMWELTBUNDESAMT, 1990] and the CORINAIR Guidebook B112. Details are included in the relevant chapters.

NH_3

Emission factors are constant for the whole time series.

SO_2, NO_X, NMVOC

For the years 1990 to 1994 emission factors are linearly interpolated by using the emission factors from 1987 and 1995 taken from the studies mentioned above. From 1997 onwards the emission factor of 1996 is used.

In the national studies only emission factors for VOC are cited. NMVOC emission factors are calculated by subtracting the share of CH_4 from VOC emission factors.

Activity data

If the energy balance is based on mass or volume units the fuel quantities must be converted into energy units [TJ] by multiplying with the corresponding net calorific value (NCV), which is

provided by STATISTIK AUSTRIA along with the energy balance (see Annex 1). The fuel quantities of each subcategory are taken from the energy balance as presented in Annex 1. Detailed activity data used for calculation of emission data (in more detail than energy balance data) is presented in Chapter 4.6.

Not all categories of the gross inland fuel consumption are combusted or relevant for the inventory:

- emissions from international bunker fuels are not included in the National Total but reported separately as Memo Item.
- transformation and distribution losses and transformations of fuels to other fuels (like hard coal to coke oven coke or internal refinery processes which have been added to the transformation sector of the energy balance) is not considered for calculation of emissions.
- non-energy use is also not considered for calculation of emissions in Sector *1 A Energy*. However, from these fuels fugitive emissions might occur, these emissions are considered in Sector 3 *Solvents*. Emissions from fuel used as a feedstock are considered in Sector 2 *Industrial Processes*.

4.1.3 Recalculations

Recalculations are mainly driven by the revision of the energy balance as described in chapter 3 *Major Changes*. More detailed information on changes made with respect to last year's submission is provided in the corresponding subchapters.

4.1.4 Completeness

Table 18 gives an overview of the NFR categories included in this chapter and presents the transformation matrix from SNAP categories. It also provides information on the status of emission estimates of all subcategories. A "✓" indicates that emissions from this subcategory have been estimated.

Table 18: Overview of subcategories of Category 1 A Fuel Combustion: transformation into SNAP Codes and status of estimation

NFR Category	SNAP	Status			
		NO_X	SO_2	NMVOC	NH_3
1 A 1 Energy Industries					
1 A 1 a Public Electricity and Heat Production	0101 Public power 0102 District heating plants	✓	✓	✓	✓
1 A 1 b Petroleum refining	0103 Petroleum refining plants	✓	✓	IE[(a)]	✓
1 A 1 c Manufacture of Solid fuels and Other Energy Industries	010503 Oil/Gas Extraction plants	✓	✓	✓	✓
1 A 2 Manufacturing Industries					
1 A 2 a Iron and Steel	0301 Comb. In boilers, gas turbines and stationary engines (Iron and Steel Industry) 030301 Sinter and palletising plants 030326 Processes with Contact-Other(Iron and Steel Industry)	✓ IE[(1)]	✓ IE[(1)]	✓ IE[(1)]	✓ NE[(1)]
1 A 2 b Non-ferrous Metals	0301 Comb. In boilers, gas turbines and stationary engines(Non-ferrous Metals Industry)	✓	✓	✓	✓

NFR Category	SNAP	Status			
		NO_X	SO_2	NMVOC	NH_3
1 A 2 c Chemicals	0301 Comb. in boilers, gas turbines and stationary engines (Chemical Industry)	✓	✓	✓	✓
1 A 2 d Pulp, Paper and Print	0301 Comb. in boilers, gas turbines and stationary engines (Pulp, Paper and Print Industry)	✓	✓	✓	✓
1 A 2 e Food Processing, Beverages and Tobacco	0301 Comb. in boilers, gas turbines and stationary engines (Food Processing, Beverages and Tobacco Industry)	✓	✓	✓	✓
1 A 2 f Other	0301 Comb. in boilers, gas turbines and stationary engines (Other Industry+ Electricity and Heat Production in Industry) 030311 Cement Industry 030317 Other Glass 030319 Bricks and Tiles 0808 Other Mobile Sources and Machinery-Industry	✓ IE(2)	✓ IE(2)	✓ IE(2)	✓ IE(2)
1 A 3 Transport					
1 A 3 a ii Civil Aviation (Domestic)	080501 Domestic airport traffic (LTO cycles - <1000 m) 080503 Domestic cruise traffic (>1000 m)	✓	✓	✓	✓
1 A 3 b Road Transportation	0701 Passenger cars 0702 Light duty vehicles < 3.5 t 0703 Heavy duty vehicles > 3.5 t and buses 0704 Mopeds and Motorcycles < 50 cm3 0705 Motorcycles > 50 cm3 0706 Gasoline evaporation from vehicles 0801 Other Mobile Sources and Machinery-Military	✓	✓	✓	✓
1 A 3 c Railways	0802 Other Mobile Sources and Machinery-Railways	✓	✓	✓	✓
1 A 3 d ii National Navigation	0803 Other Mobile Sources and Machinery-Inland waterways	✓	✓	✓	✓
1 A 4 e Other					
1 A 3 e i Pipeline Compressors	010506 Pipeline Compressors	✓	✓	✓	✓
1 A 3 e ii Other mobile sources and machinery	0810 Other Mobile Sources and Machinery-Other off-road	NO	NO	NO	NO
1 A 4 Other Sectors					
1 A 4 a Commercial/Institutional	0201 Commercial and institutional plants	✓	✓	✓	✓
1 A 4 b Residential					
1 A 4 b i Residential Plants	0202 Residential plants	✓	✓	✓	✓
1 A 4 b ii Houshold and gardening (mobile)	0809 Other Mobile Sources and Machinery-Household and gardening	✓	✓	✓	✓
1 A 4 c Agriculture/Forestry/Fisheries					
1 A 4 c i Stationary	0203 Plants in agriculture, forestry and aquaculture	✓	✓	✓	✓

NFR Category	SNAP	Status			
		NO_X	SO_2	NMVOC	NH_3
1 A 4 c ii Off-road Vehicles and Other Machinery	0806 Other Mobile Sources and Machinery-Agriculture 0807 Other Mobile Sources and Machinery-Forestry	✓	✓	✓	✓
1A 4 c iii National Fishing	080403 National fishing	NO	NO	NO	NO
1 A 5 Other					
1 A 5 a Other, Stationary		NO	NO	NO	NO
1 A 5 b Other, Mobile (Including military)	0801 Military	IE(3)	IE(3)	IE(3)	IE(3)
Memo Items					
1 A 3 a i International Aviation	080502 International airport traffic (LTO cycles - <1000 m) 080504 International cruise traffic (>1000 m)	✓	✓	✓	✓
1 A 3 d i International Navigation	080404 International sea traffic (international bunkers)	NO	NO	NO	NO

(a) NMVOC emissions from petroleum refinery are included in category *1 B 2 a iv Oil Refining/ Storage.*

(1) Emissions from two iron and steel plants are included in *2 C Metal Production*. NH_3 emissions from this two plants are not estimated.
(2) Emissions from fuel combustion in cement industry are included in *2 A 1 Cement Production.* NH_3 emissions from cement industry are not estimated.
(3) Emissions from Military Road Transportation are included in *1 A 3 b Road Transportation.* Emissions from Military Aviation are included in *1 A 3 a Civil Aviation.*

4.2 Energy Industries (NFR Source Category 1 A 1)

4.2.1 Public Electricity and Heat Production (1 A 1 a)

4.2.1.1 Source Category Description

Category *1 A 1 a Public Electricity and Heat Production* comprises emissions from fuel combustion in public power and heat plants. Emissions from waste incineration plants which produce public district heating and/or power are also considered in this source category. Emissions from industry autoproducers are included in category *1 A 2 f*.

While total fuel consumption increased from 141 PJ in 1990 to 167 PJ in 2001, the SO_2 and NO_X emissions decreased due to fuel switches and the implementation of abatement techniques. The increase of NO_X emission from 1999 to 2001 is mainly driven by an increase of coal consumption within this period.

Table 19: Emission trends of category 1 A 1 a Energy Industries

Year	SO_2 [Gg]	NO_X [Gg]	NMVOC [Gg]	NH_3 [Gg]	Fuel Consumtion (PJ)
1990	11.25	11.39	0.41	0.11	141
1991	10.48	9.24	0.46	0.12	150
1992	5.19	8.94	0.41	0.11	117
1993	6.66	7.86	0.43	0.14	120
1994	4.71	6.81	0.40	0.14	125
1995	5.95	8.06	0.40	0.14	139
1996	4.33	7.27	0.44	0.16	159
1997	5.37	7.88	0.45	0.16	155
1998	3.58	6.85	0.45	0.18	149
1999	3.98	7.42	0.43	0.17	150
2000	3.69	7.96	0.49	0.13	138
2001	4.21	9.27	0.69	0.16	167
Trend	*-63%*	*-19%*	*70%*	*44%*	*19%*

4.2.1.2 Methodological Issues

In a first step large point sources are considered. UMWELTBUNDESAMT is operating a database to store plant specific data, called "*Dampfkesseldatenbank"* (DKDB) which includes data on fuel consumption, NO_X, SO_X, CO and PM emissions from boilers with a thermal capacity greater than 3 MW for all years from 1990. These data are used to generate a sectoral split of the categories *Public Power* and *District Heating*, with further distinction between the two categories ≥ *300 MW* and ≥ *50 MW to 300 MW* of thermal capacity. Currently 41 plants are considered with this approach. Table 20 shows the trends of the reported NO_X and SO_2 emissions and fuel consumption.

Table 20: Trends of reported emissions and fuel consumption of 1 A 1 a point sources.

	SO_2 [Gg]	NO_X [Gg]	Fuel Consumtion (PJ)
1990	10.85	10.46	133
1991	9.56	8.00	139
1992	4.83	7.79	106
1993	4.38	5.18	100
1994	2.71	4.52	107
1995	3.03	5.20	116
1996	3.50	4.84	117
1997	4.26	5.00	101
1998	2.83	4.64	109
1999	3.31	4.84	97
2000	3.20	5.18	79
2001	2.82	5.17	76
Trend	*-74%*	*-51%*	*-43%*

The fuel consumption of all considered point sources is subtracted from the total consumption of this category which is taken from the energy balance. The rest is considered as area source.

Emissions of plants < 50 MW are calculated by multiplying emission factors with the corresponding activity data (see Chapter 4.1.2).

For point sources >= 50 MW plant specific emission and activity data was used.

Emission factors

Emission factors are summarized in chapter 4.6.

NH_3

For NH_3 emission factors from [UMWELTBUNDESAMT, 1990] are used.

NMVOC

Sources of VOC emission factors are cited in chapter 0

General Methodology.

VOC emission factors are divided into NMVOC and CH_4 emission factors as shown in Table 21. The split follows closely [STANZEL et. al, 1995].

Table 21: Share of NMVOC emissions in VOC emissions for 1 A 1 a.

	Solid Fossile	Liquid Fossile	Natural Gas	Biomass
Electricity plants	90%	80%	25%	75%
District Heating plants	Hard coal 70% Brown Coal 80%	80%	30%	75%

NO_X and SO_2

For plants < 50 MW emission factors of the studies cited in Chapter 4.1.2 are used.

Plants >= 50 MW are considered as point sources. These are grouped according to the four SNAP categories:

- SNAP 010101 Public Power >= 300 MW thermal capacity.
- SNAP 010102 Public Power >= 50 MW < 300 MW thermal capacity.
- SNAP 010201 District Heating >= 300 MW thermal capacity.
- SNAP 010202 District Heating >= 50 MW < 300 MW thermal capacity.

For each group implied emission factors (IEF) from plant specific emission data as obtained from plant operators were calculated. The implied emission factors are used to report emissions per fuel group as needed for the CRF-format of the UNFCCC that has to be consistent with the UNECE/CLRTAP submission. Implied emission factors are in addition used to trace control efficiency over time series and to compare different inventories.

Activity data

Detailed activity data is provided in chapter 4.6.

Fuel consumption in the public electricity sector varies strongly over time. The most important reason for this variation is the fact that in Austria up to 70% of the power needed is produced by hydroelectric power plants. If production of electricity by hydropower is low, production from thermal power plants is high and vice versa.

Fuel consumption is taken from the energy balance prepared by STATISTIK AUSTRIA (see Annex 1). Total fuel consumption minus consumption of point sources >= 50 MW is taken as activity data for plants smaller than 50 MW.

Solid Fossil Fuels

In this category solid fossil fuels are combusted by public power and district heating plants with a thermal capacity greater than 50 MW. From 1990 onwards emissions from all point sources >=50 MW were reported annually and are therefore considered in the inventory. There are, however, two reasons why not all emissions of solid fuels are reported as point sources in this category:

- Fuel consumption of the energy balance for this category is greater than the sum of all point sources.
- Point source data is not complete.

If any of the two cases occur the distribution of the remaining solid fuels to one of the area source categories is done using information of previous years.

4.2.1.3 Recalculation

Recalculation is mainly driven by the revision of the energy balance as cited in chapter 3 *Major Changes*. Table 22 shows the change of emissions due to recalculation.

Table 22: Recalculation difference with respect to previous submission for 1 A 1 a Energy Industries.

	SO_2^* [Gg]	NO_X^* [Gg]	NMVOC* [Gg]	NH_3^* [Gg]
1990	-3.94	-3.05	0.04	-0.03
1991	-4.74	-2.91	0.04	-0.04
1992	-2.11	-1.91	0.13	-0.03
1993	0.12	-0.37	0.19	-0.01
1994	0.41	-0.32	0.20	-0.01
1995	1.07	0.01	0.22	-0.01
1996	-0.47	-0.87	0.27	-0.01
1997	-1.05	-1.49	0.26	-0.02
1998	-0.43	-1.60	0.27	-0.02
1999	0.23	0.09	0.23	-0.01
2000	0.55	0.24	0.33	-0.01

* Negative numbers indicate less emissions compared to previous submission

4.2.2 Petroleum Refining (1 A 1 b)

4.2.2.1 Source Category Description

Category *1 A 1 b Petroleum Refining* enfolds SO_2, NO_X and NH_3 emissions from fuel combustion of one petroleum refining plant. NMVOC emissions from fuel combustion are included in category *1 B 2 a iv Oil Refining/ Storage* together with fugitive NMVOC emissions.

SO_2 emissions increased since 1990 due to higher fuel consumption; NO_X emissions decreased.

Table 23: Emission trends of category 1 A 1 b Petroleum Refining

	SO_2 [Gg]	NO_X [Gg]	NMVOC [Gg]	NH_3 [Gg]	Fuel Consumtion (PJ)
1990	2.25	4.32	IE	0.07	30
1991	2.11	4.32	IE	0.06	28
1992	2.85	4.19	IE	0.09	37
1993	3.42	3.40	IE	0.10	42
1994	3.03	3.41	IE	0.10	43
1995	2.98	3.38	IE	0.09	41
1996	3.49	3.48	IE	0.10	42
1997	3.66	3.47	IE	0.10	41
1998	3.80	3.36	IE	0.10	41
1999	3.55	3.25	IE	0.08	37
2000	3.44	3.07	IE	0.08	35
2001	3.62	3.30	IE	0.08	36
Trend	*61%*	*-23%*	-	*26%*	*20%*

4.2.2.2 Methodological Issues

Since 1994 the refinery plant directly reports NO_X and SO_2 emissions to UMWELTBUNDESAMT. For the years 1990 to 1993 emission values are taken from the DKDB. NH_3 emissions for each fuel type are calculated by multiplying fuel consumption with an emission factor.

Emission factors

NO_X and SO_2

For NO_X and SO_2 emission factors for combustion in industrial boilers taken from the studies quoted in Chapter 4.1.2 were applied.

From the reported emission data and activity data implied emission factors were calculated.

NH_3

NH_3 emission factors are taken from [UMWELTBUNDESAMT, 1990].

Activity data

Fuel consumption of refinery is reported in the energy balance as *Energy Sector-Inputs to Oil Refineries* and *Refinery Fuel* respectively.

4.2.2.3 Recalculation

NH_3 emissions that were not included in last year's submission are now estimated.

4.2.3 Manufacture of Solid Fuels and Other Energy Industries (1 A 1 c)

4.2.3.1 Source Category Description

Category *1 A 1 c Manufacture of Solid Fuels and Other Energy Industries* enfolds NO_X, NMVOC and NH_3 emissions from natural gas combustion in the oil and gas extraction sector. The decrease of emissions is driven by a decrease of fuel consumption.

Table 24: Emission trends of category 1 A 1 c Manufacture of Solid Fuels and Other Energy Industries

	SO_2 [Gg]	NO_X [Gg]	NMVOC [Gg]	NH_3 [Gg]	Fuel Consumtion (PJ)
1990	NO	0.80	0.00	0.01	5
1991	NO	0.81	0.00	0.01	5
1992	NO	0.75	0.00	0.01	5
1993	NO	0.79	0.00	0.01	5
1994	NO	0.78	0.00	0.01	5
1995	NO	0.86	0.00	0.01	6
1996	NO	0.45	0.00	0.00	3
1997	NO	0.56	0.00	0.00	4
1998	NO	0.45	0.00	0.00	3
1999	NO	0.45	0.00	0.00	3

2000	NO	0.40	0.00	0.00	3
2001	NO	0.46	0.00	0.00	3
Trend	-	*-42%*	*-42%*	*-42%*	*-42%*

4.2.3.2 Methodological Issues

CORINAIR methodology is applied: fuel consumption is multiplied with a fuel and technology dependant emission factor for NO_X, NMVOC and NH_3.

Emission factors

Emission factors are provided in chapter 4.6. *Activity Data and Emissions Factors.* Unabated emission factors of industrial boilers were applied. Sources of emission factors are cited in chapter 4.1.2.

Activity data

Natural gas consumption is reported in the energy balance as *Energy Sector-Oil and Gas Extraction*.

4.2.3.3 Recalculation

Recalculation is mainly driven by the revision of the energy balance as cited in chapter 3 *Major Changes*. In the last submission abated NO_X emission factors from *Public Power Plants* were used (year 1990: 109 kg NO_X/TJ; year 2000: 41 kg NO_X /TJ). As no information about installed control technologies is available for this sector an unabated NO_X emission factor of 150 kg NO_X /TJ was applied. Table 25 shows the change of emissions due to recalculation.

Table 25: Recalculation difference with respect to previous submission for 1 A 1 c Manufacture of Solid Fuels and Other Energy Industries.

	NO_X^* [Gg]	NMVOC* [Gg]	NH_3^* [Gg]
1990	0.76	0.003	0.005
1991	0.78	0.003	0.005
1992	0.73	0.002	0.005
1993	0.76	0.002	0.005
1994	0.76	0.002	0.005
1995	0.85	0.003	0.005
1996	0.43	0.001	0.002
1997	0.53	0.001	0.003
1998	0.42	0.001	0.002
1999	0.41	0.001	0.002
2000	0.37	0.001	0.002

* Negative numbers indicate less emissions compared to previous submission

4.2.3.4 Planned Improvements

It is planned to request activity data and NO_X emission factors from oil/gas extraction industry.

4.3 Manufacturing Industries and Construction (NFR Source Category 1 A 2)

Category *1 A 2 Manufacturing Industries and Construction* comprises emissions from stationary fuel combustion as well as from off-road activities in industry.

Table 26: Emission trends of category 1 A 2 Manufacturing Industries and Construction.

	SO_2 [Gg]	NO_X [Gg]	NMVOC [Gg]	NH_3 [Gg]
1990	15.65	28.57	3.58	0.19
1991	14.31	28.83	3.74	0.20
1992	11.29	28.41	3.84	0.20
1993	9.62	28.16	3.75	0.23
1994	8.57	28.27	3.83	0.24
1995	9.06	27.35	3.88	0.24
1996	10.55	27.89	3.86	0.24
1997	11.12	30.68	3.94	0.28
1998	11.35	29.81	3.89	0.24
1999	7.93	28.14	3.88	0.24
2000	9.16	28.52	3.87	0.23
2001	6.22	24.84	3.63	0.21
Trend	*-60%*	*-13%*	*1%*	*9%*

4.3.1 Iron and Steel (1 A 2 a)

4.3.1.1 Source Category Description

Category *1 A 2 a Iron and Steel* comprises emissions from fuel combustion in iron and steel industry except those reported under category *2 C 1 Iron and Steel Production*, where emissions from two sites operated by the same company are considered. This company accounts for more than 90% of total steel production in Austria and is the only operator of blast furnaces. The reason for reporting emissions from these sites in the Industrial Processes sector is that also process specific emissions are included.

The increase of emissions from *1 A 2 a Iron and Steel* is driven by the increase of fuel consumption.

Table 27: Emission trends of category 1 A 2 a Iron and Steel.

	SO_2 [Gg]	NO_X [Gg]	NMVOC [Gg]	NH_3 [Gg]	Fuel Consumtion (PJ)*
1990	0.03	0.11	0.001	0.01	0.9
1991	0.05	0.10	0.001	0.01	0.9
1992	0.06	0.09	0.001	0.01	0.9
1993	0.10	0.09	0.002	0.01	0.9
1994	0.11	0.09	0.002	0.01	1.0
1995	0.12	0.09	0.002	0.01	1.1
1996	0.13	0.10	0.003	0.01	1.3
1997	0.42	0.49	0.006	0.02	5.1
1998	0.37	0.44	0.005	0.02	4.6
1999	0.32	0.34	0.005	0.02	3.4
2000	0.36	0.51	0.007	0.02	7.0
2001	0.29	0.34	0.004	0.02	3.6
Trend	*819%*	*220%*	*338%*	*80%*	*298%*

* Fuel consumption of the two iron & steel plants of which emissions are reported under *2 C Metal Production* is not included.

4.3.1.2 Methodological Issues

CORINAIR methodology is applied: fuel consumption is multiplied with a fuel and technology dependant emission factor.

Emission factors

Emission factors are provided in chapter *4.6 Activity Data and Emission Factors*, emission factors of industrial boilers were applied. Sources of emission factors are cited in Chapter 4.1.2.

Activity data

To avoid double counting of emissions the fuel consumption of the two iron & steel sites that are reported in category *2 C Metal Production* is subtracted from total fuel consumption for this category taken from the energy balance (see Annex 1).

Activity data of the two iron and steel sites is not reported over the whole time series. The data gaps are filled by means of a model and additional information from STATISTIK AUSTRIA.

Recalculation

Double counting of emissions from natural gas and fuel oil consumption of the two iron and steel cites whose emissions are reported in *2 C Metal Production* was corrected.

Planned Improvements

Request historical activity data of the two iron and steel sites from plant operators.

4.3.2 Non-Ferrous Metals (1 A 2 b)

4.3.2.1 Source Category Description

Category *1 A 2 b Non-Ferrous Metals* comprises emissions from fuel combustion in non ferrous metal industry.

The increase of emissions is driven by the increase of fuel consumption.

Table 28: Emission trends of category 1 A 2 b Non-Ferrous Metals.

	SO_2 [Gg]	NO_X [Gg]	NMVOC [Gg]	NH_3 [Gg]	Fuel Consumtion (PJ)
1990	0.12	0.19	0.002	0.002	1.9
1991	0.09	0.16	0.002	0.002	1.8
1992	0.10	0.18	0.003	0.002	2.1
1993	0.04	0.16	0.002	0.003	2.3
1994	0.06	0.15	0.002	0.003	2.6
1995	0.07	0.14	0.002	0.003	2.7
1996	0.14	0.16	0.004	0.003	2.7
1997	0.18	0.21	0.004	0.004	3.3
1998	0.22	0.22	0.005	0.004	3.2
1999	0.14	0.18	0.003	0.003	3.0
2000	0.21	0.22	0.005	0.004	3.4
2001	0.17	0.19	0.004	0.003	3.0
Trend	*36%*	*1%*	*72%*	*60%*	*58%*

4.3.2.2 Methodological Issues

CORINAIR methodology is applied: fuel consumption is multiplied with a fuel and technology dependant emission factor.

Emission factors

Emission factors are provided in chapter *4.6 Activity Data and Emission Factors,* emission factors of industrial boilers were applied. Sources of emission factors are cited in Chapter 4.1.2.

Activity data

Fuel consumption is taken from the energy balance (see Annex 1).

4.3.2.3 Planned Improvements

At present default emission factors for industrial boilers are used. It is planned to investigate emissions and fuel consumption of process furnaces.

4.3.3 Chemicals (1 A 2 c)

4.3.3.1 Source Category Description

Category *1 A 2 c Chemicals* enfolds emissions from fuel combustion in chemical industry including emissions from refinery gas which is delivered from the only Austrian petroleum refinery to a petrochemical plant.

Whereas fuel consumption in 2001 is equal to 1990 emissions decreased.

Table 29: Emission trends of category 1 A 2 c Chemicals.

	SO_2 [Gg]	NO_X [Gg]	NMVOC [Gg]	NH_3 [Gg]	Fuel Consumtion (PJ)
1990	1.27	1.75	0.12	0.02	14
1991	1.07	1.59	0.12	0.02	14
1992	1.24	1.66	0.12	0.03	14
1993	1.13	1.34	0.07	0.02	13
1994	1.22	1.28	0.10	0.02	13
1995	1.33	1.25	0.11	0.02	14
1996	1.41	1.27	0.08	0.02	14
1997	1.94	1.65	0.11	0.03	17
1998	1.90	1.52	0.10	0.02	16
1999	1.37	1.40	0.09	0.03	16
2000	1.62	1.35	0.10	0.02	16
2001	1.01	1.07	0.09	0.02	14
Trend	*-20%*	*-39%*	*-23%*	*-34%*	*0%*

4.3.3.2 Methodological Issues

CORINAIR methodology is applied: fuel consumption is multiplied with a fuel and technology dependant emission factor.

Emission factors

Emission factors are provided in chapter *4.6 Activity Data and Emission Factors*, emission factors of industrial boilers were applied. Sources of emission factors are cited in Chapter 4.1.2.

Activity data

Fuel consumption is taken from the energy balance (see Annex 1).

4.3.4 Pulp, Paper and Print (1 A 2 d)

4.3.4.1 Source Category Description

Category *1 A 2 d Pulp, Paper and Print* comprises emissions from fuel combustion in pulp, paper and print industry. Emissions from combustion of black liquor for autoproduction of heat and electricity are reported in category *1 A 2 f Other.*

Fuel consumption increased since 1990 but NO_X and SO_2 emissions decreased due to the implementation of measures and fuel switches.

Table 30: Emission trends of category 1 A 2 d Pulp, Paper and Print.

	SO_2 [Gg]	NO_X [Gg]	NMVOC [Gg]	NH_3 [Gg]	Fuel Consumtion (PJ)
1990	3.88	4.63	0.59	0.05	37
1991	4.44	4.61	0.59	0.04	37
1992	2.21	4.16	0.56	0.05	35
1993	1.91	4.23	0.55	0.05	35
1994	1.80	3.83	0.53	0.04	32
1995	1.56	3.51	0.56	0.04	32
1996	1.49	3.10	0.52	0.03	30
1997	1.68	4.12	0.60	0.04	40
1998	1.33	4.29	0.56	0.06	41
1999	1.00	3.76	0.61	0.05	40
2000	1.02	4.35	0.73	0.05	46
2001	0.89	3.90	0.68	0.05	42
Trend	*-77%*	*-16%*	*15%*	*20%*	*15%*

4.3.4.2 Methodological Issues

NO_X, NMVOC and NH_3

CORINAIR methodology is applied: fuel consumption is multiplied with a fuel and technology dependant emission factor.

SO_2

SO_2 emissions for the year 1990 are taken from [UMWELTBUNDESAMT, 1993], for the year 1993 from [WINDSPERGER et al., 1997], for the year 1999 personal information from Austropapier (the Austrian Association of Paper Industry) was provided, for the years 2000 and 2001 emissions were taken from [Austropapier, 2002]. Emissions for the years in between were linearly interpolated.

From the reported emission data and the activity data of the energy balance implied emission factors were calculated.

Following the allocation of the energy balance, a share of emissions from combustion of black liquor is reported under category *1 A 2 f Other.*

Emission factors

Emission factors are provided in chapter *4.6 Activity Data and Emission Factors*, emission factors of industrial boilers were applied. Sources of emission factors are cited in Chapter 4.1.2.

Activity data

Fuel consumption is taken from the energy balance (see Annex 1.

4.3.4.3 Planned Improvements

It is planned to reallocate emissions of heat and electricity autoproduction in paper and pulp industry from category *1 A 2 f Other* to category *1 A 2 d Pulp, Paper and Print* and to adjust NO_X emissions to the value reported by Austropapier.

4.3.5 Food Processing, Beverages and Tobacco (1 A 2 e)

4.3.5.1 Source Category Description

Category *1 A 2 e Food Processing, Beverages and Tobacco* comprises emissions from fuel combustion in food processing, beverages and tobacco industry.

While fuel consumption is quite stable emissions decreased due to a decrease of liquid fuel consumption and due to the implementation of measures.

Table 31: Emission trends of category 1 A 2 e Food Processing, Beverages and Tobacco.

	SO_2 [Gg]	NO_X [Gg]	NMVOC [Gg]	NH_3 [Gg]	Fuel Consumtion (PJ)
1990	2.29	1.72	0.03	0.02	12
1991	1.41	1.48	0.02	0.02	13
1992	1.20	1.41	0.03	0.02	12
1993	0.73	1.12	0.02	0.02	12
1994	0.54	0.97	0.01	0.02	12
1995	0.62	0.89	0.02	0.02	13
1996	0.58	0.78	0.02	0.02	11
1997	0.51	0.79	0.01	0.02	12
1998	0.71	0.86	0.02	0.02	12
1999	0.31	0.64	0.01	0.01	11
2000	0.56	0.80	0.02	0.02	12
2001	0.36	0.67	0.01	0.01	11
Trend	*-84%*	*-61%*	*-64%*	*-24%*	*-11%*

4.3.5.2 Methodological Issues

CORINAIR methodology is applied: fuel consumption is multiplied with a fuel and technology dependant emission factor.

Emission factors

Emission factors are provided in chapter *4.6 Activity Data and Emission factors*, emission factors of industrial boilers were applied. Sources of emission factors are cited in Chapter 4.1.2.

Activity data

Fuel consumption is taken from the energy balance (see Annex 1).

4.3.6 Manufacturing Industries and Construction – Other (1 A 2 f)

4.3.6.1 Source Category Description

Category *1 A 2 f Other* comprises emissions from fuel combustion in industry which are not reported under categories *1 A 2 a, 1 A 2 b, 1 A 2 c, 1 A 2 d* and *1 A 2 e*. It also includes emissions from all industrial auto producer plants as well as emissions from off-road machinery of total industry. It does not include emissions of cement industry which are reported under category *2 A 1 Cement Production*.

Table 32: Emission trends of category 1 A 2 f Other.

	SO_2 [Gg]	NO_X [Gg]	NMVOC [Gg]	NH_3 [Gg]
1990	8.06	20.18	2.84	0.09
1991	7.24	20.89	3.01	0.10
1992	6.47	20.92	3.13	0.10
1993	5.71	21.22	3.10	0.13
1994	4.84	21.94	3.19	0.15
1995	5.34	21.48	3.18	0.14
1996	6.81	22.48	3.24	0.15
1997	6.38	23.42	3.20	0.17
1998	6.82	22.49	3.20	0.13
1999	4.78	21.82	3.16	0.13
2000	5.39	21.28	3.01	0.12
2001	3.50	18.67	2.85	0.10
Trend	*-57%*	*-7%*	*0%*	*13%*

4.3.6.2 1 A 2 f Manufacturing Industries and Construction - Other - stationary sources

Table 33 shows emission trends of stationary sources of category *1 A 2 f Other-stationary sources.* While fuel consumption increased the SO_2 and NO_X emissions decreased due to the implementation of measures.

Table 33: Emission trends of category 1 A 2 f Other-Stationary Sources.

	SO_2 [Gg]	NO_X [Gg]	NMVOC [Gg]	NH_3 [Gg]	Fuel Consumtion (PJ)*
1990	7.40	8.38	0.68	0.08	66
1991	6.54	8.37	0.72	0.09	73
1992	5.74	8.00	0.76	0.09	74
1993	4.99	8.46	0.75	0.13	88
1994	4.20	8.20	0.82	0.14	99
1995	5.11	7.73	0.84	0.14	101
1996	6.58	8.68	0.95	0.15	107
1997	6.14	8.75	0.90	0.16	104
1998	6.57	8.14	0.95	0.12	96
1999	4.55	7.49	0.93	0.13	95
2000	5.16	7.01	0.79	0.12	85
2001	3.26	5.61	0.74	0.10	74
Trend	*-56%*	*-33%*	*8%*	*13%*	*12%*

* Fuel consumption of cement industry of which emissions are reported under *2 A 1 Cement Production* is not included.

Methodology

CORINAIR methodology is applied: fuel consumption is multiplied with a fuel and technology dependant emission factor.

Emission factors

Emission factors are provided in chapter *4.6 Activity Data and Emissions Factors, e*mission factors of industrial boilers were applied. Sources of emission factors are cited in Chapter 4.1.2.

Activity data

To avoid double counting of emissions fuel consumption of cement industry is subtracted from total fuel consumption for this category as taken from the energy balance (see Annex 1).

Cement Industry

Activity data for the period from 1990 to 1999 were taken from studies [HACKEL et al., 1995/1997/2001]. They are based upon information from companies and thus represent plant specific data. For 2000 and 2001 activity data of 1999 was used.

Planned Improvements

It is planned to also include emissions from *2 A 1 Cement Production* in Category *1 A 2 f Other.*

4.3.6.3 1 A 2 f Manufacturing Industries and Construction - Other - mobile sources

Most mobile sources of the industry are among the building industry. Within the industry sector there are different vehicles, which can be summarized to the following groups:

- vehicles with diesel engine > 80 kW
- vehicles with diesel engine < 80 kW
- vehicles with 4-stroke-petrol engine
- vehicles with 2-stroke-petrol engine

Emissions from this category are presented in the following table.

Table 34: Emissions from off-road – Industry 1990-2001 [Gg]

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
NO_x	11.80	12.52	12.92	12.76	13.74	13.75	13.80	14.67	14.35	14.33	14.27	13.06
SO_2	0.66	0.70	0.73	0.72	0.64	0.23	0.23	0.24	0.25	0.23	0.23	0.24
NH_3	0.003	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.003
NMVOC	2.16	2.29	2.37	2.35	2.37	2.34	2.29	2.30	2.25	2.23	2.22	2.11

NO_x-emission increased slightly due to an increase of traffic in this category. However, the implied emission factor decreased. For NMVOC, NH_3 and especially SO_2 the downward trend was stronger resulting in an overall decreasing trend.

Methodology

In 2001 a study on off road emissions in Austria was finished [PISCHINGER, 2000]. The study was prepared to improve the poor data quality in this sector. The following categories were taken into account:

- 1 A 2 f Industry
- 1 A 3 b Military Activities
- 1 A 3 c Railways
- 1 A 3 d Navigation
- 1 A 4 b Household and Gardening
- 1 A 4 c Agriculture and Forestry

Depending on the engine's fuel consumption the ratio power of the engine was calculated, emissions were calculated by multiplying ratio power and emission factors. To improve data quality the influence of the vehicle age on the operating time was taken into account.

With this method all relevant effects on engine emissions could be covered:

- Emissions according to the engine type
- Emissions according to the effective engine performance
- Emissions according to the engine age
- Emissions depending on the engine operating time
- Engine operating time according to the engine age

Due to the high fuel consumption by the off road sector the ratio of fuel consumption between the on- and off road transport sector was recalculated.

Emission factors for NO_x, NMVOC and NH_3 were defined for four categories of engine type depending on the year of construction. They are listed in Table 35 to Table 38. The emission factors present fuel consumption and emissions according to the engine power output. Total emissions are calculated by multiplying emission factors with average motor capacity and activity data. With this bottom-up method national total fuel consumption and total emissions are calculated. Calculated total fuel consumption of off road traffic is summed up with total fuel consumption of road transport and is compared with national total sold fuel; due to uncertainties of the bottom-up method the values differ by about 5%. To be consistent with the national energy balance, activity data in the bottom-up approaches for both road transport and off- road traffic is adjusted so that finally the calculated total fuel consumption equals to the figure of fuel sold in the national energy balance.

Table 35: Emission Factors for diesel engines > 80 kW [g/kWh]

Year	Fuel	NO_x	NH_3	NMVOC
	[g/kWh]			
1993	282	13.0	0.00300	1.95
1997	273	14.4	0.00240	1.56
2000	265	9.2	0.00195	1.27

Table 36: Emission Factors for diesel engines < 80 kW [g/kWh]

Year	Fuel	NO_x	NH_3	NMVOC
	[g/kWh]			
1993	296	13.0	0.00600	3.90
1997	287	14.4	0.00450	2.93
2000	278	9.2	0.00390	2.54

Table 37: Emission Factors for 4-stroke-petrol engines [g/kWh]

Year	Fuel	NO_x	NH_3	NMVOC
	[g/kWh]			
1993	550	5.0	0.00194	42.84
1997	520	5.5	0.00172	38.08
2000	500	5.5	0.00159	35.22

Table 38: Emission Factors for 2-stroke-petrol engines [g/kWh]

Year	Fuel	NO_x	NH_3	NMVOC
	[g/kWh]			
1993	700	1.5	0.00168	297.0
1997	675	1.5	0.00151	267.3
2000	655	1.5	0.00134	237.6

Emission factors for SO_2 are based on the "Handbook of Emission Factors" [HAUSBERGER & KELLER, 1998]. They take into account analysis about the sulphur content of the fuel, which has been part of the inquiry of the yearly fuel quality monitory system.

Activity data

Activity data, vehicle stock and specific fuel consumption for vehicles and machinery were taken from:

- STATISTIK AUSTRIA
- Questionnaire to vehicle and machinery user
- Information from vehicle and machinery manufacturer
- Interviews with experts
- Expert judgment

Activities as well as the implied emission factors (national total emissions divided by total fuel consumption in GWh) for *off-road - industry* are presented in the following table.

Table 39: Implied emission factors and activities for off-road - industry 1990-2001

Year	IEF NO_X [kg/GWh]	IEF SO_2 [kg/GWh]	IEF NH_3 [kg/GWh]	IEF NMVOC [kg/GWh]	Activity [GWh]
1990	3 829.21	215.22	1.10	700.75	3 081
1991	3 828.96	215.22	1.10	701.50	3 271
1992	3 828.24	215.20	1.10	703.32	3 374
1993	3 827.96	215.20	1.10	704.15	3 334
1994	3 932.90	182.48	1.07	678.36	3 494
1995	3 947.78	67.36	1.06	672.18	3 484
1996	3 985.91	67.37	1.05	661.70	3 463
1997	4 076.02	67.39	1.02	639.20	3 599
1998	3 862.24	67.40	0.97	605.64	3 715
1999	3 741.46	59.00	0.94	581.47	3 829
2000	3 598.98	59.01	0.91	558.99	3 965
2001	3 269.92	59.01	0.86	527.90	3 995

4.4 Transport (NFR Source Category 1 A 3)

4.4.1 1 A 3 a Civil Aviation

As can be seen in Table 40, emissions from NFR Category Civil Aviation almost doubled within the period from 1990-2001 due to an increase in civil aviation by 170%, the NO_x-emissions tripled. However, emission factors decreased over this period.

Table 40: Emissions from Civil Aviation total 1990-2001 [Gg]

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
NO_x	0.13	0.15	0.17	0.20	0.22	0.23	0.26	0.28	0.31	0.32	0.33	0.32
SO_2	0.02	0.02	0.02	0.03	0.03	0.03	0.03	0.03	0.04	0.04	0.04	0.04
NH_3	0.0002	0.0002	0.0002	0.0003	0.0003	0.0002	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003
NMVOC	0.04	0.04	0.03	0.03	0.03	0.02	0.04	0.05	0.07	0.07	0.07	0.07

Table 41: Emissions from Civil Aviation national, LTO (including military and VFR) 1990-2001 [Gg]

		1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
NO_x	total	0.09	0.09	0.09	0.10	0.11	0.09	0.11	0.11	0.13	0.13	0.13	0.13
	IFR	*0.03*	*0.03*	*0.03*	*0.04*	*0.04*	*0.04*	*0.05*	*0.05*	*0.06*	*0.06*	*0.06*	*0.06*
	Mili-tary	*0.05*	*0.05*	*0.05*	*0.06*	*0.06*	*0.05*	*0.06*	*0.05*	*0.06*	*0.06*	*0.07*	*0.06*
	VFR	*0.01*	*0.01*	*0.01*	*0.01*	*0.01*	*0.01*	*0.01*	*0.01*	*0.01*	*0.01*	*0.01*	*0.01*
SO_2	total	0.01	0.02	0.01	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
	IFR	*0.003*	*0.003*	*0.004*	*0.004*	*0.004*	*0.004*	*0.005*	*0.006*	*0.007*	*0.007*	*0.007*	*0.007*
	Mili-tary	*0.010*	*0.011*	*0.010*	*0.012*	*0.013*	*0.010*	*0.012*	*0.011*	*0.013*	*0.013*	*0.014*	*0.013*
	VFR	*0.001*	*0.001*	*0.001*	*0.001*	*0.001*	*0.001*	*0.001*	*0.001*	*0.001*	*0.001*	*0.001*	*0.001*
NH_3		0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002
NMVOC		0.02	0.02	0.02	0.02	0.02	0.02	0.03	0.04	0.05	0.05	0.05	0.05

Table 42: Emissions from Civil Aviation national, cruise 1990-2001 [Gg]

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
NO_x	0.04	0.06	0.08	0.10	0.11	0.13	0.15	0.17	0.18	0.19	0.20	0.19
SO_2	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.02	0.02
NH_3	0.0000	0.0000	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
NMVOC	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.02	0.02	0.02

4.4.1.1 Methodological Issues

Emission estimates for **NO_x and SO_2** were taken from a study commissioned by the UMWELTBUNDESAMT that was finished in 2002 [KALIVODA et. al, 2002]. Emissions for the year 2001 have been calculated using implied emission factors and fuel allocation obtained from the values for the year 2000.

For the air transport class IFR (Instrument Flight Rules) the very detailed methodology from the CORINAIR guidebook in an advanced version (based on the [MEET, 1999] model) has been used. It is based on air traffic movement data[10] (flight distance and destination per aircraft type), aircraft/ engine performance data and emission factors.

Fuel consumptions for the different transport modes IFR national LTO, IFR international LTO, IFR national cruise and IFR international cruise as obtained from the MEET model were summed up to a total fuel consumption figure. This value was compared by the UMWELTBUNDESAMT with the total amount of kerosene sold in Austria of the national energy balance: a difference was observed (lower fuel consumption in the energy balance). Therefore the fuel consumption of IFR international cruise was adjusted so that the total fuel consumption of the calculations according to the MEET model is consistent with national fuel sales figures from the energy balance. The reason for choosing IFR international cruise for this adjustment is that this mode is assumed to hold the highest uncertainty.

Only IFR national LTO and IFR national cruise is considered in *1 A 3 a Civil Aviation*, IFR international LTO and IFR international cruise is considered in *I B Av International Bunkers Aviation*.

For calculation of NO_x and SO_2 emissions VFR and military flights were considered as well.

Fuel consumption for VFR flights were directly obtained from the energy balance, as total fuel consumption for this flight mode is represented by the total amount of aviation gasoline sold in Austria.

NMVOC
VOC emissions for IFR have been calculated like NO_x and SO_2. According to the CORINAIR guidebook 90.4% of VOC of the LTO-IFR are assumed to be NMVOC.

NH_3 emissions were calculated using the fuel consumptions as obtained in the study.

Emission factors are taken from the ICAO Engine Exhaust Emissions Databank [BALASHOW & SMITH, 1995].

Fuel consumptions for *1 A 3 a Civil Aviation* as obtained from the MEET model (or from the energy balance for VFR) presented in Table 43.

[10] This data is also used for the split national/ international aviation.

Table 43: Fuel consumptions for 1 A 3 a Civil Aviation 1990-2001

Year	IFR national LTO	IFR national cruise	Military	VFR
	Kerosene [Mg]			Gasoline [Mg]
1990	3 164	4 508	10 439	2 487
1991	3 417	5 929	11 102	2 563
1992	3 670	7 351	10 019	2 641
1993	3 924	8 773	11 840	2 722
1994	4 177	10 195	12 527	2 805
1995	4 430	11 616	9 672	2 241
1996	5 128	12 877	11 689	2 153
1997	5 827	14 137	11 119	2 417
1998	6 525	15 398	12 809	2 602
1999	6 697	16 279	12 551	2 771
2000	6 868	17 161	13 613	2 039
2001	6 621	16 544	13 124	2 039

Table 44: Implied emission factors and activities for Civil Aviation Domestic – LTO, differentiated by IFR, Military and VFR, and for Civil Aviation Domestic – Cruise 1990-2001

Year	IEF NO_X [Mg/Mg]				IEF SO_2 [Mg/Mg]			
	LTO			Cruise	LTO			Cruise
	IFR	Military	VFR		IFR	Military	VFR	
1990	0.009	0.005	0.003	0.009	0.001	0.001	0.0004	0.001
1991	0.009	0.005	0.003	0.010	0.001	0.001	0.0004	0.001
1992	0.009	0.005	0.003	0.011	0.001	0.001	0.0004	0.001
1993	0.009	0.005	0.003	0.011	0.001	0.001	0.0004	0.001
1994	0.009	0.005	0.003	0.011	0.001	0.001	0.0004	0.001
1995	0.009	0.005	0.003	0.011	0.001	0.001	0.0004	0.001
1996	0.009	0.005	0.003	0.012	0.001	0.001	0.0004	0.001
1997	0.009	0.005	0.003	0.012	0.001	0.001	0.0004	0.001
1998	0.009	0.005	0.003	0.012	0.001	0.001	0.0004	0.001
1999	0.009	0.005	0.003	0.012	0.001	0.001	0.0004	0.001
2000	0.009	0.005	0.003	0.012	0.001	0.001	0.0004	0.001
2001	0.009	0.005	0.003	0.012	0.001	0.001	0.0004	0.001

Table 45: Implied emission factors and activities for Civil Aviation total 1990-2001

Year	IEF NO_X [kg/GWh]	IEF SO_2 [kg/GWh]	IEF NH_3 [kg/GWh]	IEF NMVOC [kg/GWh]	Activity [GWh]
1990	1 527.77	230.44	2.38	466.54	83
1991	1 495.17	212.82	2.14	353.44	101
1992	1 401.41	185.69	1.87	274.60	120
1993	1 427.32	185.95	1.82	215.42	138
1994	1 417.84	179.70	1.73	171.09	157
1995	1 367.65	160.74	1.47	143.04	166
1996	1 438.01	169.79	1.49	210.68	181
1997	1 410.66	161.59	1.44	263.03	199
1998	1 443.74	165.87	1.46	307.91	216
1999	1 400.54	160.49	1.43	302.90	229
2000	1 440.06	166.94	1.38	312.12	231
2001	1 435.52	166.44	1.39	310.92	224

Table 46: Implied emission factors and activities for Civil Aviation national, LTO (including military and VFR) 1990-2001

Year	IEF NO_X [kg/GWh]	IEF SO_2 [kg/GWh]	IEF NH_3 [kg/GWh]	IEF NMVOC [kg/GWh]	Activity [GWh]
1990	3 019.47	511.23	5.83	717.72	29
1991	3 125.84	528.58	5.95	673.52	30
1992	2 946.70	486.50	5.66	631.64	31
1993	3 155.06	527.87	5.95	579.12	32
1994	3 241.42	542.00	6.05	541.76	33
1995	3 555.58	570.41	6.22	652.78	26
1996	4 329.99	699.54	7.10	1066.75	25
1997	4 017.30	631.31	6.64	1295.52	29
1998	4 228.94	667.05	6.89	1524.32	31
1999	3 972.21	625.86	6.61	1492.32	33
2000	5 548.39	889.22	8.40	2110.48	24
2001	5 358.62	858.56	8.19	2034.66	24

Table 47: Implied emission factors and activities for Civil Aviation national, cruise 1990-2001

Year	IEF NO_X [kg/GWh]	IEF SO_2 [kg/GWh]	IEF NH_3 [kg/GWh]	IEF NMVOC [kg/GWh]	Activity [GWh]
1990	742.39	82.61	0.57	334.29	55
1991	822.56	82.58	0.57	221.41	72
1992	871.61	82.56	0.57	152.20	89
1993	904.76	82.54	0.57	105.41	106
1994	928.75	82.53	0.57	71.68	123
1995	953.36	83.17	0.57	46.52	140
1996	964.22	83.00	0.57	70.43	155
1997	974.27	82.95	0.57	90.17	170
1998	982.90	82.94	0.57	106.64	186
1999	971.97	82.93	0.57	104.69	196
2000	962.17	82.93	0.57	102.93	207
2001	962.17	82.93	0.57	102.93	199

4.4.1.2 Planned Improvements

This year for calculation of SO_2 and NO_x emissions also military aviation was considered. Emissions from military aviation will be reallocated to *1 A 5 Other*.

4.4.2 1 A 3 b Road Transport

Road Transport is the main emission source for NO_x, SO_2, NMVOC and NH_3 emissions of the transport sector: about 95 to 97% of the NO_x, SO_2, and NH_3 , and 70% of the NMVOC emissions of the transport sector originate from that source. Total Road Transport activity increased by 46% from 1990 to 2001. However, due to decreasing emission factors SO_2, NMVOC and NO_X emissions were below 1990 levels in 2001.

The sector includes emissions from passenger cars, light duty vehicles, heavy duty vehicles and busses, mopeds and motorcycles as well as gasoline evaporation from vehicles and automobile tyre and brake wear.

Technical improvements and a stricter legislation led to a reduction of emissions per vehicles or per mileage, respectively. On the other hand a steady increase of transport activity is observed.

The road transport sector is one of the main sources of NO_X emissions in Austria. Around 48% of national total NO_X emissions are driven by road transport. NO_X emissions from road transport are dominated by road freight transport with heavy duty vehicles (with a share of about 51% in total road transport emissions) and passenger car transport (43% from total road transport emissions).

Table 48: NO_x emissions from Road Transport 1990-2001 [Gg]

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Passenger Cars	69.84	72.45	65.41	60.22	58.42	54.37	48.58	45.80	47.09	43.39	41.90	42.11
Light duty vehicles	2.31	2.56	2.69	2.94	2.76	2.89	4.96	3.82	4.74	4.23	4.89	5.29
Heavy duty vehicles	26.55	28.76	30.21	32.87	29.93	30.57	51.67	39.17	47.36	41.47	46.15	49.17
Mopeds & Motorcycles	0.20	0.23	0.24	0.25	0.27	0.30	0.31	0.34	0.41	0.44	0.48	0.54
Total Road Transport	**98.93**	**104.03**	**98.57**	**96.31**	**91.42**	**88.15**	**105.55**	**89.16**	**99.63**	**89.56**	**93.45**	**97.14**

For SO_2, NMVOC and NH_3 emissions passenger cars are the main source.

SO_2 and NH_3 emissions reached a maximum in 1994 and have steadily decreased since then: SO_2 emissions in 2001 were 26% below 1990 levels whereas NH_3 emissions were still 15% above emissions in 1990.

NMVOC emissions have constantly decreased since 1990, in 2001 emissions were 61% below the 1990 level.

Table 49: SO_2 emissions from road transport 1990-2001 [Gg]

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Passenger Cars	2.36	2.73	2.81	2.94	3.27	3.02	1.42	1.50	1.72	1.76	1.70	1.88
Light duty vehicles	0.30	0.36	0.41	0.47	0.47	0.44	0.30	0.24	0.30	0.28	0.29	0.32
Heavy duty vehicles	1.38	1.52	1.62	1.79	1.67	1.48	0.92	0.70	0.85	0.74	0.72	0.79
Mopeds & Motorcycles	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Total Road Transport	**4.05**	**4.62**	**4.85**	**5.21**	**5.41**	**4.94**	**2.64**	**2.44**	**2.88**	**2.78**	**2.71**	**3.00**

Table 50: NH_3 emissions from road transport 1990-2001 [Gg]

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Passenger Cars	0.23	0.29	0.32	0.34	0.35	0.34	0.31	0.29	0.30	0.27	0.26	0.25
Light duty vehicles	0.00	0.00	0.00	0.01	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01
Heavy duty vehicles	0.02	0.02	0.02	0.02	0.02	0.02	0.03	0.02	0.02	0.02	0.02	0.02
Mopeds & Motorcycles	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.03	0.03	0.03	0.03
Total Road Transport	**0.27**	**0.33**	**0.36**	**0.38**	**0.40**	**0.39**	**0.37**	**0.34**	**0.36**	**0.33**	**0.31**	**0.31**

Table 51: NMVOC emissions from road transport 1990-2001 [Gg]

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Passenger Cars	45.46	44.53	38.68	34.07	30.45	26.45	22.42	19.73	18.39	15.86	14.12	13.01
Light duty vehicles	0.87	0.90	0.88	0.90	0.78	0.76	1.19	0.83	0.92	0.74	0.77	0.77
Heavy duty vehicles	2.27	2.36	2.41	2.56	2.32	2.37	3.74	2.65	2.99	2.45	2.58	2.70
Mopeds & Motorcycles	6.57	6.81	6.12	5.62	5.43	5.12	4.72	4.60	4.94	4.71	4.73	4.91
gasoline evaporation	20.02	19.11	17.89	16.99	15.68	14.29	12.83	11.41	10.07	8.75	7.40	6.44
Total Road Transport	**78.02**	**76.64**	**68.72**	**62.73**	**57.13**	**51.24**	**46.95**	**41.08**	**39.18**	**34.18**	**31.16**	**29.34**

4.4.2.1 Methodological Issues

Mobile combustion is differentiated into the categories Passenger Cars, Light Duty Vehicles, Heavy Duty Vehicles and Buses, Mopeds and Motorcycles and Military Activities.

In order to apply the CORINAIR methodology a split of the fuel consumption of different vehicle categories is required. Calculations of emissions from mobile combustion except emissions from military activities are based on the GLOBEMI study [HAUSBERGER, 1998].

For road transportation, energy consumption and emissions of the different categories are calculated by multiplying the yearly road performance (km/vehicle and year) and the specific energy use with emission factors (g/km, g/kWh, g/kg fuel). Emission factors are based on the "Handbook of Emission Factors" [HAUSBERGER, KELLER, 1998]. The emissions from cold starts are calculated separately – taking into account temperature, interception periods and driving distances.

Activity data

Calculation of the activity data is based on the GLOBEMI study [HAUSBERGER, 1998]. Information on the number of new vehicles is published yearly by STATISTIK AUSTRIA. Information on the yearly road performance of the vehicles is supplied by the Austrian automobile clubs throughout the annual vehicle inspection system.

Different road performance for different street categories depending on the engine type, vehicle size and vehicle age is taken into account. The extrapolation of the yearly vehicle stock- and performance share (by vehicle age, motor type and vehicle size) is based on a dynamic, vehicle specific drop out- and road performance function.

Based on the GLOBEMI model total fuel consumption and total emissions for road transport are calculated with a bottom-up approach. Calculated total fuel consumption of road transport is summed up with total fuel consumption of off road traffic and is compared with national total sold fuel: due to uncertainties of the bottom up method the values differ by about 5%. To be consistent with the national energy balance, activity data in the bottom-up approach is adjusted so that finally the calculated total fuel consumption equals the figure of fuel sold in the national energy balance.

Table 52: Implied emission factors and activities for road transport 1990-2001

Year	IEF NO_X [kg/GWh]	IEF SO_2 [kg/GWh]	IEF NH_3 [kg/GWh]	IEF NMVOC [kg/GWh]	Activity [GWh]
1990	2 145.40	87.82	5.88	1 691.88	46 114.50
1991	2 024.38	89.92	6.49	1 491.46	51 389.13
1992	1 928.42	94.83	7.05	1 344.52	51 111.93
1993	1 866.50	100.92	7.42	1 215.75	51 596.78
1994	1 760.16	104.20	7.66	1 100.05	51 937.58
1995	1 687.31	94.54	7.38	980.83	52 243.23
1996	1 807.07	45.27	6.32	803.80	58 409.01
1997	1 638.22	44.89	6.32	754.92	54 422.77
1998	1 613.28	46.62	5.80	634.42	61 756.79

Year	IEF NO_X [kg/GWh]	IEF SO_2 [kg/GWh]	IEF NH_3 [kg/GWh]	IEF NMVOC [kg/GWh]	Activity [GWh]
1999	1 520.28	47.19	5.53	580.15	58 911.87
2000	1 502.43	43.60	5.03	500.90	62 202.45
2001	1 447.30	44.64	4.58	437.13	67 117.30

Military

Emission estimates for military activities were taken from [PISCHINGER, 2000]. Information on the fleet composition was taken from official data presented in the internet as no other data was available. Also no information on the road performance of military vehicles was available, that's why emission estimates only present rough estimations, which were obtained making the following assumptions: for passenger cars and motorcycles the yearly road performance as calculated for civil cars was used. For tanks and other special military vehicles the emission factors for diesel engines > 80kW was used (see Table 35; for these vehicles a power of 300 kW was assumed). The yearly road performance for such vehicles was estimated to be 30 h / year (as a lot of vehicles are old and many are assumed not to be in actual use anymore).

Table 53: Emissions from military 1990-2001 [Gg]

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
NO_x	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
SO_2	0.0017	0.0017	0.0017	0.0017	0.0015	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
NH_3	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001
NMVOC	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.003	0.003	0.003

Activities used for estimating the emissions and the implied emission factors are presented in the following table.

Table 54: Emission factors and activities for military 1990-2001

Year	IEF NO_X [kg/ GWh]	IEF SO_2 [kg/ GWh]	IEF NH_3 [kg/ GWh]	IEF NMVOC [kg/ GWh]	Activity [GWh]
1990	3 900.01	216.25	1.25	515.33	8
1991	3 900.01	216.25	1.25	515.33	8
1992	3 900.01	216.25	1.25	515.33	8
1993	3 900.01	216.25	1.25	515.33	8
1994	3 904.86	183.80	1.25	514.25	8
1995	3 981.73	67.83	1.26	500.65	8
1996	4 052.34	68.11	1.26	486.66	8
1997	4 122.01	67.12	1.27	475.06	8
1998	4 182.00	67.41	1.27	460.97	8

Year	IEF NO_X [kg/ GWh]	IEF SO_2 [kg/ GWh]	IEF NH_3 [kg/ GWh]	IEF NMVOC [kg/ GWh]	Activity [GWh]
1999	4 073.65	58.95	1.28	439.43	8
2000	3 938.21	59.32	1.29	422.11	8
2001	3 773.64	59.67	1.30	406.98	8

4.4.2.2 Planned Improvements

For the category *1 A 3 b* the following improvements are planned:

- improve and widen the underlying data sources for emission factors
- validate database with emission factors based on real driving cycles

4.4.3 1 A 3 c Railways

Only diesel and coal engines are taken into account, emissions driven by power plants due to production of electricity for electric engines are not included to avoid double counting of emissions.

Table 55: Emissions from railways 1990-2001 [Gg]

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
NO_x	1.95	2.03	2.00	1.92	1.91	1.75	1.56	1.53	1.49	1.83	1.81	1.69
SO_2	0.26	0.25	0.26	0.24	0.24	0.22	0.15	0.11	0.10	0.11	0.10	0.10
NH_3	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002
NMVOC	0.31	0.31	0.30	0.29	0.29	0.26	0.23	0.22	0.21	0.26	0.25	0.24

Emissions from Railways fluctuated over the period from 1990-2001. They reached a maximum in 1991; afterwards the trend was decreasing until 2001. In the year 2001 all emissions were below 1990 levels. In contrast to the other transport sectors the activity of railways decreased within the observed period by 16%.

The applied methodology is described in the subchapter on mobile sources of *1 A 2 f* (see Chapter 4.2.2.9). Activities used for estimating the emissions and implied emission factors are presented in the following table.

Table 56: Emission factors and activities for railways 1990-2001

Year	IEF NO_X [kg/GWh]	IEF SO_2 [kg/GWh]	IEF NH_3 [kg/GWh]	IEF NMVOC [kg/GWh]	Activity [GWh]
1990	3 014.86	403.05	3.36	473.14	646
1991	3 032.00	380.05	3.31	465.93	670
1992	2 985.36	387.67	3.24	455.95	668
1993	2 941.93	375.15	3.15	444.31	652
1994	2 898.06	371.17	3.08	433.73	657
1995	2 855.86	356.25	3.02	425.96	613

Year	IEF NO_X [kg/GWh]	IEF SO_2 [kg/GWh]	IEF NH_3 [kg/GWh]	IEF NMVOC [kg/GWh]	Activity [GWh]
1996	2 811.20	277.94	2.97	418.05	554
1997	2 776.51	194.88	2.84	400.28	553
1998	2 735.32	184.38	2.77	389.88	544
1999	2 719.52	163.00	2.72	383.58	672
2000	2 699.83	153.02	2.68	378.10	670
2001	2 679.77	151.64	2.65	373.61	632

4.4.4 1 A 3 d Navigation

Navigation is mainly freight traffic. NO_X and SO_2 emissions from this category fluctuated over the period from 1990 to 1997, since 1997 emissions are quite stable.

NH_3 and NMVOC emissions were constant with only minor fluctuations over the period from 1990 to 2001.

Table 57: emissions from navigation 1990-2001 [Gg]

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
NO_x	0.52	0.47	0.45	0.45	0.54	0.52	0.51	0.59	0.58	0.58	0.58	0.57
SO_2	0.04	0.03	0.03	0.03	0.04	0.03	0.01	0.02	0.02	0.02	0.02	0.02
NH_3	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
NMVOC	0.73	0.72	0.72	0.72	0.73	0.72	0.72	0.72	0.71	0.70	0.69	0.68

The applied methodology is described in the subchapter on mobile sources of *1 A 2 f* (see Chapter 4.2.2.9). Activities used for estimating the emissions and the implied emission factors are presented in the following table.

Table 58: Emission factors and activities for navigation 1990-2001

Year	IEF NO_X [kg/GWh]	IEF SO_2 [kg/GWh]	IEF NH_3 [kg/GWh]	IEF NMVOC [kg/GWh]	Activity [GWh]
1990	2 680.56	182.18	0.42	3 739.66	195
1991	2 648.68	178.66	0.41	4 085.83	177
1992	2 600.66	177.85	0.40	4 160.95	173
1993	2 566.76	178.15	0.39	4 126.08	175
1994	2 602.28	183.34	0.39	3 495.76	208
1995	2 555.49	151.89	0.38	3 567.53	202
1996	2 521.08	72.80	0.37	3 537.10	202
1997	2 530.84	74.34	0.37	3 098.84	232
1998	2 497.19	74.45	0.36	3 038.98	234

Year	IEF NO_X [kg/GWh]	IEF SO_2 [kg/GWh]	IEF NH_3 [kg/GWh]	IEF NMVOC [kg/GWh]	Activity [GWh]
1999	2 463.89	74.34	0.35	2 977.79	236
2000	2 430.78	74.48	0.34	2 917.67	237
2001	2 396.65	74.63	0.34	2 857.03	239

4.4.5 Other Transportation (1 A 3 e)

4.4.5.1 Source Category Description

Category *1 A 3 e Other Transportation* comprises emissions from pipeline transport (compressors). Fuel consumption and emissions increased by 281% since 1990.

Table 59: Emission trends of category 1 A 3 e Other Transportation.

	SO_2 [Gg]	NO_X [Gg]	NMVOC [Gg]	NH_3 [Gg]	Fuel Consumtion (PJ)
1990	NO	0.46	0.002	0.003	3.0
1991	NO	0.49	0.002	0.003	3.3
1992	NO	0.54	0.002	0.004	3.6
1993	NO	0.58	0.002	0.004	3.9
1994	NO	0.57	0.002	0.004	3.8
1995	NO	0.61	0.002	0.004	4.1
1996	NO	0.63	0.002	0.004	4.2
1997	NO	0.63	0.002	0.004	4.2
1998	NO	0.95	0.003	0.006	6.3
1999	NO	1.17	0.004	0.008	7.8
2000	NO	1.44	0.005	0.010	9.6
2001	NO	1.74	0.006	0.012	11.6
Trend	-	*281%*	*281%*	*281%*	*281%*

4.4.5.2 Methodological Issues

CORINAIR methodology is applied: fuel consumption is multiplied with a fuel and technology dependant emission factor.

Emission factors are provided in chapter 4.6. Unabated emission factors of industrial boilers were applied. Sources of emission factors are cited in Chapter 4.1.2.

Fuel consumption is taken from the energy balance (see Annex 1).

4.4.5.3 Planned Improvements

It is planned to ask industry to report NO_X emissions and activity data to verify the high increase of natural gas consumption since 1990.

4.5 Other Sectors (NFR Source Category 1 A 4)

Category *1 A 4 Other sectors* comprises emissions from stationary fuel combustion in the small combustion sector. It also includes emissions from mobile sources in households and gardening including snow cats and skidoos as well as mobile sources in agriculture and forestry.

Table 60: Emission trends of category 1 A 4 Other Sectors..

	SO_2 [Gg]	NO_X [Gg]	NMVOC [Gg]	NH_3 [Gg]
1990	32.61	34.17	66.36	0.62
1991	29.21	35.68	70.77	0.69
1992	24.62	34.96	65.22	0.65
1993	22.28	34.82	65.34	0.66
1994	19.52	33.97	60.73	0.61
1995	18.87	36.05	62.67	0.67
1996	19.41	38.52	65.91	0.74
1997	13.27	39.07	44.90	0.68
1998	12.35	39.42	43.54	0.68
1999	11.78	39.80	43.46	0.68
2000	10.51	39.11	41.47	0.63
2001	10.63	40.35	44.18	0.72
Trend	*-67%*	*18%*	*-33%*	*16%*

4.5.1 Other Sectors - Stationary Combustion (1 A 4 a, 1 A 4 b i and 1 A 4 c i)

4.5.1.1 Source Category Description

Categories *1 A 4 a Commercial / Institutional, 1 A 4 b i Residential plants* and *1 A 4 c i Agriculture / Forestry / Fishing-Stationary* enfold emissions from stationary fuel combustion in the small combustion sector.

Fuel consumption of stationary sources increased for the commercial and residential sector and decreased for the agricultural sector.

Table 61: Fuel consumption trends of 1 A 4 Other Sectors - Stationary Combustion.

Fuel Consumption [PJ]	1 A 4 Stationary	1 A 4 a Commercial	1 A 4 b i Residential	1 A 4 c i Agriculture
1990	231	27	191	13
1991	258	33	212	13
1992	247	39	197	11
1993	248	39	200	10
1994	228	33	186	8
1995	251	42	200	9

1996	277	47	220	10
1997	252	35	209	8
1998	251	35	207	9
1999	253	33	211	9
2000	239	29	201	9
2001	266	32	224	10
Trend	*15%*	*18%*	*17%*	*-20%*

NO_X emissions of the commercial sector decreased due to a fuel switch from liquid fuels to natural gas and due to the decrease of coal consumption. Total NO_X emissions of the residential sector increased mainly due to the increase of biomass and natural gas consumption although NO_X emissions from coal combustion and liquid fuels decreased strongly. In the agricultural sector NO_X emissions from combustion of liquid and solid fuels decreased while NO_X emissions from natural gas and biomass combustion increased.

Table 62: NO_X emission trends of 1 A 4 Stationary Combustion.

NO_X [Gg]	1 A 4 Stationary	1 A 4 a Commercial	1 A 4 b i Residential	1 A 4 c i Agriculture
1990	16.89	2.35	13.20	1.35
1991	17.99	2.38	14.33	1.28
1992	16.66	2.50	12.99	1.17
1993	15.97	2.38	12.65	0.94
1994	14.47	2.17	11.54	0.76
1995	15.79	2.65	12.31	0.83
1996	17.19	2.92	13.35	0.92
1997	16.61	1.80	13.96	0.86
1998	16.36	1.76	13.72	0.88
1999	16.48	1.62	13.91	0.94
2000	15.58	1.50	13.16	0.93
2001	17.31	1.61	14.65	1.06
Trend	*3%*	*-31%*	*11%*	*-21%*

SO_2 emissions of all sectors decreased due to a strong decrease of coal combustion and the decreased sulphur content of gas oil.

Table 63: SO_2 emission trends of 1 A 4 Stationary Combustion.

SO_2 [Gg]	1 A 4 Stationary	1 A 4 a Commercial	1 A 4 b i Residential	1 A 4 c i Agriculture
1990	31.61	3.15	26.86	1.59
1991	28.19	2.57	24.54	1.09
1992	23.56	2.05	20.57	0.95
1993	21.19	1.98	18.49	0.73
1994	18.57	1.72	16.28	0.57
1995	18.51	1.60	16.32	0.60
1996	19.03	1.86	16.54	0.63
1997	12.88	1.36	11.08	0.44
1998	11.94	1.23	10.28	0.43
1999	11.41	1.01	9.95	0.45
2000	10.13	0.77	8.93	0.43
2001	10.24	0.80	8.97	0.47
Trend	*-68%*	*-75%*	*-67%*	*-70%*

NMVOC emissions decreased due to the decrease of coal consumption and due to the switch of combustion of biomass in stoves and apartment heatings to central heatings. The dip of total NMVOC emissions from 1996 to 1997 is due a new emission factor that has become available that has been applied.

Table 64: NMVOC emission trends of 1 A 4 Stationary Combustion.

NMVOC [Gg]	1 A 4 Stationary	1 A 4 a Commercial	1 A 4 b i Residential	1 A 4 c i Agriculture
1990	52.06	0.54	51.15	0.37
1991	56.36	0.66	55.28	0.41
1992	50.51	0.42	49.72	0.37
1993	50.59	0.50	49.71	0.38
1994	45.62	0.47	44.80	0.34
1995	47.68	0.42	46.89	0.37
1996	50.73	0.42	49.91	0.40
1997	29.74	0.81	27.25	1.68
1998	28.54	0.63	26.22	1.69
1999	28.57	0.62	26.15	1.79
2000	26.69	0.67	24.27	1.75
2001	29.64	0.66	26.99	2.00
Trend	*-43%*	*21%*	*-47%*	*438%*

NH_3 emissions decreased for the commercial and agricultural sector due to the decrease of liquid fuel and coal consumption. NH_3 emissions of the residential sector increased due to the increase of biomass, natural gas and liquid fuel consumption.

Table 65: NH_3 emission trends of 1 A 4 Stationary Combustion.

NH_3 [Gg]	1 A 4 Stationary	1 A 4 a Commercial	1 A 4 b i Residential	1 A 4 c i Agriculture
1990	0.62	0.06	0.51	0.04
1991	0.68	0.06	0.57	0.04
1992	0.64	0.07	0.54	0.04
1993	0.65	0.07	0.55	0.03
1994	0.60	0.06	0.51	0.03
1995	0.66	0.07	0.56	0.03
1996	0.74	0.09	0.61	0.04
1997	0.67	0.06	0.58	0.03
1998	0.67	0.06	0.57	0.03
1999	0.67	0.05	0.58	0.03
2000	0.62	0.04	0.55	0.03
2001	0.71	0.05	0.62	0.04
Trend	16%	-8%	21%	-6%

4.5.1.2 Methodological Issues

CORINAIR simple methodology was applied.

Three technology-dependent subcategories (heating types) were considered in this category:

1. Central Heatings (CH)
2. Apartment Heatings (AH)
3. Stoves (ST)

1 A 4 a Commercial/Institutional; 1 A 4 b i Agriculture/Forestry/Fishing

There is no information on the kind of devices within this categories. It is thus assumed that the whole fuel consumption (according to the energy balance) is combusted in devices similar to central heatings (and the emission factors for central heatings was applied).

1 A 4 b i Residential

For category *1 A 4 b Residential* the disaggregation of the fuel consumption to each of the heating types is performed by the means of building- and habitation-statistics which were surveyed for the years 1991 and 2000 by STATISTIK AUSTRIA.

Table 66: Split of heating types of category 1 A 4 b i Residential.

	Natural Gas			Fuel Oil, LPG	Gas oil			Hard Coal (+ Briquettes)		
	CH	AH	ST	CH	CH	AH	ST	CH	AH	ST
1990	22.6%	38.4%	39.1%	100%	75.0%	10.0%	15.0%	60.6%	9.4%	30.0%
1991	26.0%	36.4%	37.6%	100%	75.0%	10.0%	15.0%	62.3%	8.8%	29.0%
1992	28.6%	37.8%	33.5%	100%	76.2%	9.4%	14.4%	62.0%	8.8%	29.3%
1993	31.3%	39.2%	29.5%	100%	77.3%	8.9%	13.8%	61.6%	8.7%	29.6%
1994	33.9%	40.6%	25.4%	100%	78.5%	8.3%	13.3%	61.3%	8.7%	30.0%
1995	36.6%	42.1%	21.4%	100%	79.6%	7.7%	12.7%	61.0%	8.7%	30.3%
1996	39.2%	43.5%	17.3%	100%	80.8%	7.2%	12.1%	60.7%	8.7%	30.6%
1997	41.9%	44.9%	13.2%	100%	81.9%	6.6%	11.5%	60.4%	8.7%	30.9%
1998	44.5%	46.3%	9.2%	100%	83.1%	6.0%	10.9%	60.0%	8.7%	31.3%
1999	47.1%	47.7%	5.1%	100%	84.2%	5.4%	10.4%	59.7%	8.7%	31.6%
2000	47.1%	47.7%	5.1%	100%	84.2%	5.4%	10.4%	59.7%	8.7%	31.6%
2001	47.1%	47.7%	5.1%	100%	84.2%	5.4%	10.4%	59.7%	8.7%	31.6%

Table 67: Split of heating types of category 1 A 4 b i Residential.

	Brown Coal			Brown Coal Briquettes			Coke		
	CH	AH	ST	CH	AH	ST	CH	AH	ST
1990	60.6%	9.4%	30.0%	60.6%	9.4%	30.0%	60.6%	9.4%	30.0%
1991	62.3%	8.8%	29.0%	62.3%	8.8%	29.0%	62.3%	8.8%	29.0%
1992	60.4%	10.0%	29.6%	57.8%	8.9%	33.3%	63.9%	8.6%	27.5%
1993	58.5%	11.3%	30.2%	53.3%	9.1%	37.6%	65.6%	8.5%	26.0%
1994	56.6%	12.5%	30.9%	48.7%	9.3%	42.0%	67.3%	8.3%	24.5%
1995	54.7%	13.7%	31.5%	44.2%	9.4%	46.3%	68.9%	8.1%	22.9%
1996	52.8%	15.0%	32.2%	39.7%	9.6%	50.7%	70.6%	8.0%	21.4%
1997	51.0%	16.2%	32.8%	35.2%	9.8%	55.0%	72.2%	7.8%	19.9%
1998	49.1%	17.5%	33.4%	30.7%	10.0%	59.3%	73.9%	7.7%	18.4%
1999	47.2%	18.7%	34.1%	26.2%	10.1%	63.7%	75.6%	7.5%	16.9%
2000	47.2%	18.7%	34.1%	26.2%	10.1%	63.7%	75.6%	7.5%	16.9%
2001	47.2%	18.7%	34.1%	26.2%	10.1%	63.7%	75.6%	7.5%	16.9%

Table 68: Split of heating types of category 1 A 4 b i Residential.

	Fuel Wood			Wood Wastes		
	CH	AH	ST	CH	AH	ST
1990	61.3%	7.3%	31.4%	61.3%	7.3%	31.4%
1991	62.9%	6.1%	31.0%	62.9%	6.1%	31.0%
1992	63.5%	6.4%	30.1%	66.2%	5.8%	28.0%
1993	64.1%	6.6%	29.3%	69.5%	5.4%	25.1%
1994	64.7%	6.8%	28.5%	72.8%	5.1%	22.1%
1995	65.3%	7.1%	27.6%	76.1%	4.7%	19.1%
1996	65.9%	7.3%	26.8%	79.4%	4.4%	16.2%
1997	66.5%	7.5%	26.0%	82.8%	4.0%	13.2%
1998	67.1%	7.8%	25.1%	86.1%	3.7%	10.3%
1999	67.7%	8.0%	24.3%	89.4%	3.3%	7.3%
2000	67.7%	8.0%	24.3%	89.4%	3.3%	7.3%
2001	67.7%	8.0%	24.3%	89.4%	3.3%	7.3%

Emission factors

Country specific emission factors are used which are taken from the national studies [BMWA-EB, 1990], [BMWA-EB, 1996] and [UMWELTBUNDESAMT, 2001]. In these studies emission factors are provided for the years 1987, 1995 and 1996 which were determined by measurements of emissions of typical Austrian small combustion devices. For the years 1990 to 1994 emission factors were interpolated using the values of 1987 and 1995. From 1997 onwards the emission factors from 1996 were applied.

Emission factors are provided in chapter 4.6.

In some cases only VOC emission factors are provided in the studies, NMVOC emission factors are determined assuming that a certain percentage of VOC emissions is methane as listed in Table 69. The split follows closely [STANZEL et. al, 1995].

Table 69: Share of CH_4 and NMVOC in VOC for small combustion devices.

	CH_4	NMVOC	VOC
Coal	25%	75%	100%
Gas oil; Petroleum	20%	80%	100%
Residual Fuel Oil	25%	75%	100%
Natural Gas; LPG	80%	20%	100%
Biomass	25%	75%	100%

Activity data

Fuel consumption is taken from the energy balance (see Annex 1).

4.5.1.3 Recalculation

Activity data changed due to a revision of the energy balance (see Chapter 3 Major Changes). The fuel consumption of the small combustion sector is now based on model assumptions by means of heating degree days and statistical surveys called "Mikrozensus".

The split of total fuel consumption of category *1 A 4 b i Residential* into the three heating types was updated for the years 1992 to 2001 due to new statistical information.

4.5.1.4 Planned Improvements

It is planned to consider new technologies like pellet heatings and *fuel value technique devices* ("Brennwert-Technologie") in the calculation model and to obtain more specific information about the heating devices and fuel consumption of the commercial/institutional and agricultural sector.

4.5.2 1 A 4 b Household and gardening – mobile sources

In addition to vehicles used in household and gardening this category contains ski slope machineries and snow vehicles.

NH_3 and NMVOC emissions from this category slightly decreased over the period from 1990 to 2001, NOx and especially SO_2 emissions decreased to a greater extend due to decreasing emission factors.

Table 70: Emissions from off-road – household and gardening 1990-2001 [Gg]

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
NO_x	1.07	1.07	1.09	1.10	1.13	1.16	1.15	1.15	1.03	1.01	1.00	0.89
SO_2	0.06	0.06	0.06	0.06	0.05	0.02	0.02	0.02	0.02	0.02	0.02	0.02
NH_3	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0002	0.0002
NMVOC	6.37	6.40	6.43	6.45	6.43	6.36	6.29	6.21	6.10	5.98	5.87	5.76

The applied methodology is described in the subchapter on mobile sources of *1 A 2 f* (see Chapter 4.3.6).

Activities used for estimating emissions and the implied emission factors are presented in the following table.

Table 71: Emission factors and activities for off-road – household and gardening 1990-2001

Year	IEF NO_X [kg/GWh]	IEF SO_2 [kg/GWh]	IEF NH_3 [kg/GWh]	IEF NMVOC [kg/GWh]	Activity [GWh]
1990	2 013.16	106.69	0.53	11 968.46	532
1991	2 011.67	106.58	0.52	11 978.06	534
1992	2 020.02	107.08	0.54	11 928.29	539
1993	2 026.59	107.45	0.53	11 889.32	543
1994	2 093.05	91.81	0.50	11 935.14	539
1995	2 148.63	39.90	0.50	11 738.63	542
1996	2 142.13	39.83	0.50	11 683.83	538

Year	IEF NO_X [kg/GWh]	IEF SO_2 [kg/GWh]	IEF NH_3 [kg/GWh]	IEF NMVOC [kg/GWh]	Activity [GWh]
1997	2 154.79	39.74	0.51	11 625.82	534
1998	1 953.51	39.56	0.47	11 552.85	528
1999	1 928.25	35.74	0.48	11 371.69	526
2000	1 904.84	35.73	0.46	11 169.58	526
2001	1 701.03	35.57	0.44	11 063.61	520

4.5.3 1 A 4 c Agriculture and forestry – mobile sources

NO_X emissions from this category increased following the increase in activity data. SO_2 emissions decreased by about 60% in the period from 1990 to 2001 due to decreasing emission factors. NH_3 and NMVOC emissions remained quite constant with only minor fluctuations over this period.

Table 72: emissions from off-road – agriculture and forestry 1990-2001 [Gg]

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
NO_x	16.20	16.61	17.21	17.75	18.37	19.10	20.18	21.31	22.03	22.30	22.53	22.15
SO_2	0.94	0.97	1.00	1.03	0.90	0.34	0.36	0.37	0.39	0.35	0.36	0.37
NH_3	0.007	0.008	0.008	0.008	0.008	0.008	0.008	0.009	0.009	0.009	0.009	0.009
NMVOC	7.92	8.02	8.28	8.29	8.69	8.63	8.89	8.95	8.90	8.91	8.91	8.78

The applied methodology is described in the subchapter on mobile sources of *1 A 2 f* (see Chapter 4.3.6). Activities used for estimating the emissions and the implied emission factors are presented in the following table.

Table 73: Emission factors and activities for off-road – agriculture and forestry 1990-2001

Year	IEF NO_X [kg/GWh]	IEF SO_2 [kg/GWh]	IEF NH_3 [kg/ GWh]	IEF NMVOC [kg/ GWh]	Activity [GWh]
1990	3 606.75	209.60	1.63	1 762.67	4 492.8
1991	3 609.95	209.80	1.63	1 742.20	4 601.3
1992	3 612.02	209.94	1.63	1 737.00	4 765.2
1993	3 617.95	210.29	1.64	1 690.86	4 905.6
1994	3 636.02	178.22	1.62	1 719.65	5 052.8
1995	3 684.43	66.12	1.59	1 664.09	5 184.2
1996	3 730.95	66.14	1.56	1 643.90	5 408.2
1997	3 781.95	66.22	1.53	1 588.03	5 633.4
1998	3 771.76	66.30	1.50	1 524.11	5 840.7
1999	3 692.61	58.11	1.46	1 475.10	6 040.2
2000	3 622.20	58.15	1.43	1 432.55	6 219.5
2001	3 524.55	58.17	1.40	1 396.04	6 285.9

4.6 Activity Data and Emission Factors

Activity Data is taken from the National Energy Balance, which is presented in Annex 1.

The National Energy Balance

The new time series is consistent to the IEA-questionnaire format and has been submitted to the IEA in November 2002. There are four different IEA questionnaires for each of: oil, natural gas, coal and renewable fuels. Table 74 shows the unified categories of the IEA questionnaires and the corresponding NFR categories to which the fuel consumption is assigned to.

Table 74: IEA-Questionnaires and their correspondence to NFR categories.

IEA-Category*	Comments	SNAP	NFR-Category
Production			
Imports			
Exports			
Bunkers	No activity.		
Stock Changes			
Refinery Fuel		0103	1 A 1 b Petroleum Refining
Transformation Sector, of which:			
Public Electricity plants	Plant specific data are considered.	0101 0102	1 A 1 a Public Electricity and Heat Production
Public CHP plants			
Public Heat plants			
Auto Producer Electricity plants		0301	1 A 2 Manufacturing Industries and Construction
Auto Producer CHP plants		0301	1 A 2 Manufacturing Industries and Construction
Auto Producer Heat plants		0301	1 A 2 Manufacturing Industries and Construction
Coke Ovens	Transformation from *Coking Coal* to *Coke Oven Coke* .		
Blast furnaces	Coke Oven Coke only.	030326	1 A 2 a Iron and Steel
Gas Works	Transformation of *Other Oil Products* to *Gas Works Gas* .		
Petrochemical Industry	No activity.		
Patent Fuel Plants	No activity.		
Not Elsewhere Specified	No activity.		
Energy Sector, of which:			
Coal Mines	No activity.		
Oil and Gas Extraction		0105	1 A 1 c Manufacture of Solid fuels and Other Energy Industries
Inputs to oil refineries		0103	1 A 1 b Petroleum Refining

IEA-Category*	Comments	SNAP	NFR-Category
Coke Ovens	*Coke Oven Gas* and *Blast Furnace Gas* only.	0301	1 A 2 a Iron and Steel
Blast furnaces	*Coke Oven Coke* only.	030326	1 A 2 a Iron and Steel
Gas Works	*Natural Gas* only.	0101	1 A 1 a Public Electricity and Heat Production
Electricity, CHP and Heat Plants		0101	1 A 1 a Public Electricity and Heat Production
Liquefaction Plants	No activity.		
Not Elsewhere Specified	No activity.		
Distribution Losses	Includes statistical differences and therefore it may be less than zero.		
Final Energy Consumption			
Total Transport, of which:			
Domestic Air Transport	Division to SNAP categories is performed by means of studies.	07 08 0201	1 A 2 f Manuf. Ind. and Constr. -Other 1 A 3 Transport 1 A 4 b Residential 1 A 4 c Agriculture/ Forestry/ Fisheries
Road			
Rail			
Inland Waterways			
Pipeline Transport	*Natural Gas* only	010506	1 A 3 e Transport-Other
Non Specified	*Other biofuels* only.	0201	1 A 4 a Commercial/ Institutional
Total Industry, of which:			
Iron and Steel		0301 030301	1 A 2 a Iron and Steel
Chemical (incl.Petro-Chemical)		0301	1 A 2 c Chemicals
Non ferrous Metals		0301	1 A 2 b Non-ferrous Metals
Non metallic Mineral Products		0301 030311 030317 030319	1 A 2 f Manuf. Ind. and Constr. -Other
Transportation Equipment		0301	1 A 2 f Manuf. Ind. and Constr. -Other
Machinery		0301	1 A 2 f Manuf. Ind. and Constr. -Other
Mining and Quarrying		0301	1 A 2 f Manuf. Ind. and Constr. -Other
Food, Beverages and Tobacco		0301	1 A 2 e Food Processing, Beverages and Tobacco
Pulp, Paper and Printing		0301	1 A 2 d Pulp, Paper and Print
Wood and Wood Products		0301	1 A 2 f Manuf. Ind. and Constr. -Other
Construction		0301	1 A 2 f Manuf. Ind. and Constr. -Other
Textiles and Leather		0301	1 A 2 f Manuf. Ind. and Constr. -Other

IEA-Category*	Comments	SNAP	NFR-Category
Non Specified		0301	1 A 2 f Manuf. Ind. and Constr. -Other
Total Other sectors, of which:			
Commercial and Public Services		0201	1 A 4 a Commercial/ Institutional
Residential		0202	1 A 4 b Residential
Agriculture		0203	1 A 4 c Agriculture/Forestry/ Fisheries
Non Specified	No activity.		

*Sector names may differ to original IEA questionnaire naming convention.

Fuels and Fuel Categories

The units used in the national fuel statistics are: *ton* for solid or liquid fuels and *cubic meter* for gaseous fuels. To convert these units into the caloric unit *Joule* the calorific value of each fuel category has to be quantified. These calorific values are specified in the unit *Joule per Mass or Volume Unit,* e.g. MJ/kg, MJ/m³ gas.

Each fuel has chemical and physical characteristics which influence its burning performance e.g. calorific value or carbon and sulphur content. Fuel categories are formed to pool fuels of the same characteristics in fuel groups, limitations are given by the fuel categories of the energy balance. A list of the fuel categories and their correspondence to NFR-fuel categories (Reporting tables IV 2B) is shown in Table 75.

Table 75: Fuel categories used for the inventory and correspondence to NFR fuel categories

Inventory Fuel Category		IEA Fuel Category		NFR Fuel Category
Code (1)	Category	Category	Net Calorific Value(2)	
102 A	Hard Coal	Bituminous Coal and Anthracite	28.00	Hard Coal
104 A	Hard Coal Briquettes	Patent Fuel	31.00	Hard Coal
105 A	Brown Coal	Lignite/Brown Coal	9.82	Brown Coal
106 A	Brown Coal Briquettes	BKB/PB	19.30	Brown Coal
107 A	Coke	Coke Oven Coke	28.20	Hard Coal
113 A	Peat	Peat	8.80	Brown Coal
304 A	Coke Oven Gas	Coke Oven Gas	17.52	Derived Gases
305 A	Blast Furnace Gas	Blast Furnace Gas	3.50	Derived Gases
203 B	Light Fuel Oil Sulphur Content < 0,2 %	Residual Fuel Oil	41.50	Heavy Fuel Oil
203 C	Medium Fuel Oil Sulphur Content < 0,4%	Residual Fuel Oil	41.50	Heavy Fuel Oil
203 D	Heavy Fuel Oil Sulphur Content >= 1%	Residual Fuel Oil	41.50	Heavy Fuel Oil
204 A	Gasoil	Heating and other Gasoil	42.80	Other Liquid Fuels
205 0	Diesel	Transport Diesel	42.80	Other Liquid Fuels

Inventory Fuel Category		IEA Fuel Category		NFR Fuel Category
Code (1)	Category	Category	Net Calorific Value(2)	
206 A	Petroleum	Other Kerosene	43.41	Other Liquid Fuels
206 B	Kerosene	Kerosene Type Jet Fuel	43.41	Other Liquid Fuels
207 A	Aviation Gasoline	Gasoline Type Jet Fuel	42.50	Other Liquid Fuels
208 0	Motor Gasoline	Motor Gasoline	42.50	Other Liquid Fuels
224 A	Other Petroleum Products	Other Products	43.49	Other Liquid Fuels
303 A	Liquified Petroleum Gas (LPG)	LPG	46.00	Other Liquid Fuels
308 A	Refinery Gas	Refinery Gas	49.00	Other Liquid Fuels
301 A	Natural Gas	Natural Gas	35.85	Natural Gas
114 B	Municipal Waste	Municipal Solid Waste	8.70	Other Solid Fuels
114 C	Hazardous Waste	Industrial Wastes	8.70	Other Solid Fuels
115 A	Industrial Waste	Industrial Wastes	8.70	Other Solid Fuels
111 A	Fuel Wood	*Wood/Wood wastes/Other Solid Wastes, of which:* Wood	14.35	Biomass
116 A	Wood Wastes	*Wood/Wood wastes/Other Solid Wastes, of which:* Other vegetal materials and waste (including straw, sawdust, wood chips)	8.70	Biomass
118 A	Sewage Sludge	Industrial Wastes	8.70	Biomass
215 A	Black Liquor	*Wood/Wood wastes/Other Solid Wastes, of which:* Black Liquor	8.70	Biomass
309 A	Biogas	Biogas	23.40	Biomass
309 B	Sewage Sludge Gas	Sewage Sludge Gas	27.00	Biomass
310 A	Gas from Waste Disposal Site	Landfill Gas	25.00	Biomass

(1) First three digits are based on CORINAIR / NAPFUE 94–Code
(2) Units: [MJ / kg] or [MJ / m^3 Gas] respectively, for the Year 2001

The following tables provide detailed activity data and emission factors for stationary fuel combustion. Descriptions of SNAP codes are given in Table 74 and in chapter 4.1.4 *Completeness*.

Table 76: Activity data [TJ]

Fuel	SNAP	1990	1995	1998	1999	2000	2001
1 A 1 a Public Electricity and Heat Production - Point Sources							
Light Fuel Oil	010101	2	10	0	0	0	0
Light Fuel Oil	010201	1	5	5	0	0	6
Light Fuel Oil	010202	0	0	5	4	233	218
Medium Fuel Oil	010101	0	0	0	0	0	0
Medium Fuel Oil	010202	291	113	141	85	0	0
Heavy Fuel Oil	010101	7 428	5 887	12 509	10 737	3 407	1 837
Heavy Fuel Oil	010102	1 252	524	111	256	64	61
Heavy Fuel Oil	010201	237	60	101	74	67	89
Heavy Fuel Oil	010202	6 595	5 961	4 611	4 406	5 061	3 348
Gas oil	010201	0	0	1	7	2	2
Hard Coal	010101	28 041	18 690	17 429	13 869	23 255	23 776
Hard Coal	010102	735	1 941	3 287	2 924	5 674	7 199
Hard Coal	010201	9 229	8 798	6 471	7 788	9 984	10 295
Hard Coal	010202	64	21	0	0	0	0
Lignite and brown coal	010101	16 676	12 709	7 468	13 883	11 330	11 289
Lignite and brown coal	010102	5 399	2 302	0	0	0	0
Lignite and brown coal	010202	725	16	13	6	0	0
Brown Coal Briquettes	010202	93	0	0	0	0	0
Natural Gas	010101	42 323	42 000	39 418	30 060	5 111	1 080
Natural Gas	010102	9 544	2 906	2 156	388	138	320
Natural Gas	010201	542	1 013	1 494	903	623	623
Natural Gas	010202	1 672	7 746	7 327	6 335	6 111	6 604
Fuel Wood	010101	0	0	0	20	17	40
Fuel Wood	010102	0	0	16	0	23	33
Sewage Sludge	010202	0	558	594	149	700	688
Municipal Solid Waste	010202	2 425	3 672	4 782	5 015	6 093	7 705
Hazardous Waste	010101	0	0	0	0	3	40
Hazardous Waste	010102	0	0	0	0	45	167
Hazardous Waste	010201	0	0	0	0	0	11
Hazardous Waste	010202	0	656	749	187	613	613
1 A 1 a Public Electricity and Heat Production - Area Sources							
Light Fuel Oil	010101	0	0	0	0	0	0
Light Fuel Oil	010103	113	153	234	223	112	153
Light Fuel Oil	010201	0	0	0	0	0	0
Light Fuel Oil	010202	0	0	0	0	0	0
Light Fuel Oil	010203	341	1 250	1 900	1 119	893	903
Medium Fuel Oil	010101	0	0	0	0	0	0
Medium Fuel Oil	010202	0	0	0	0	0	0
Medium Fuel Oil	010203	0	0	0	0	0	0
Heavy Fuel Oil	010101	0	0	0	0	0	0
Heavy Fuel Oil	010102	0	0	0	0	0	0

Fuel	SNAP	1990	1995	1998	1999	2000	2001
Heavy Fuel Oil	010103	0	5 276	8 148	7 990	3 741	11 058
Heavy Fuel Oil	010201	0	0	0	0	0	0
Heavy Fuel Oil	010202	0	0	0	0	0	0
Heavy Fuel Oil	010203	0	0	0	0	0	0
Gas oil	010103	4	82	7	16	1	780
Gas oil	010201	0	0	0	0	0	0
Gas oil	010203	0	0	100	0	0	0
Diesel	010105	0	214	40	86	0	2
Diesel	010205	0	43	0	0	0	0
Liquified Petroleum Gas	010203	51	161	58	33	4	4
Hard Coal	010101	0	0	0	0	0	0
Hard Coal	010102	0	0	0	0	0	0
Hard Coal	010103	376	458	1 291	241	206	4 478
Hard Coal	010201	0	0	0	0	0	0
Hard Coal	010202	0	0	0	0	0	0
Lignite and brown coal	010101	0	0	0	0	0	0
Lignite and brown coal	010102	0	0	0	0	0	0
Lignite and brown coal	010103	0	468	0	0	421	2 921
Lignite and brown coal	010202	0	0	0	0	0	0
Lignite and brown coal	010203	0	86	0	0	0	0
Brown Coal Briquettes	010103	131	0	0	0	0	0
Brown Coal Briquettes	010202	0	0	0	0	0	0
Brown Coal Briquettes	010203	2	0	0	0	0	0
Natural Gas	010101	0	0	0	0	0	0
Natural Gas	010102	0	0	0	0	0	0
Natural Gas	010103	71	8 231	22 035	36 182	46 271	61 754
Natural Gas	010201	0	0	0	0	0	0
Natural Gas	010202	0	0	0	0	0	0
Natural Gas	010203	4 462	2 754	0	217	0	0
Municipal Solid Waste	010202	0	0	0	0	0	0
Municipal Solid Waste	010203	0	0	0	318	474	595
Hazardous Waste	010101	0	0	0	0	0	0
Hazardous Waste	010102	0	0	0	0	0	0
Hazardous Waste	010201	0	0	0	0	0	0
Hazardous Waste	010202	0	0	0	0	0	0
Industrial Waste	010203	0	0	0	133	134	134
Fuel Wood	010101	0	0	0	0	0	0
Fuel Wood	010102	0	0	0	0	0	0
Fuel Wood	010203	0	0	193	0	0	0
Wood Waste	010103	0	73	125	98	86	813
Wood Waste	010203	2 045	4 332	5 904	6 453	7 010	7 566
Sewage Sludge	010202	0	0	0	0	0	0
Biogas	010103	0	0	0	13	20	20
Sewage Sludge Gas	010103	0	10	50	17	39	49
Sewage Sludge Gas	010203	0	0	2	0	0	0
Landfill Gas	010103	0	29	30	25	20	67
1 A 1 b Petroleum Refining							

Fuel	SNAP	1990	1995	1998	1999	2000	2001
Heavy Fuel Oil	010301	3 304	5 607	2 533	869	1 498	293
Gasoil	010301	0	10	92	269	3	3
Diesel	010301	0	41	54	12	11	12
Petroleum	010301	0	0	0	0	0	43
Jet Gasoline	010301	0	0	0	0	0	43
Other Petroleum Products	010301	0	11 633	13 884	11 421	11 180	12 074
Liquefied Petroleum Gas	010301	360	901	68	106	939	0
Refinery Gas	010301	18 276	14 938	17 045	16 578	15 210	16 012
Natural Gas	010301	8 045	7 606	7 305	7 339	6 356	7 380
1 A 1 c Manufacture of Solid Fuels and Other Energy Industries							
Hard Coal	010503	0	0	0	0	0	0
Natural Gas	010503	5 339	5 746	2 989	3 017	2 665	3 099
1 A 2 a Iron and Steel							
Light Fuel Oil	030103	0	0	2 639	1 884	2 074	1 972
Light Fuel Oil	030326	0	2 846	2 533	1 809	1 991	1 893
Heavy Fuel Oil	030103	0	0	0	0	0	0
Heavy Fuel Oil	030326	3 627	2 846	5 173	3 693	4 065	3 864
Gas oil	030103	0	0	0	0	0	0
Petroleum	030103	0	0	0	0	0	0
Liquefied Petroleum Gas	030103	213	163	686	684	694	596
Hard Coal	030103	0	0	0	0	0	0
Lignite and brown coal	030103	0	0	0	0	0	0
Coke	030103	64	250	255	300	348	226
Coke	030301	6 544	4 791	4 422	4 790	5 606	5 606
Coke	030301	6 544	4 791	4 422	4 790	5 606	5 606
Coke Oven Gas	030103	13 117	10 906	12 166	12 220	10 466	5 111
Blast Furnace Gas	030103	16 175	17 564	18 608	17 313	19 491	20 275
Natural Gas	030103	634	666	1 022	541	3 885	827
Natural Gas	030326	9 960	10 475	13 155	13 271	11 693	12 996
Wood Waste	030103	0	0	0	0	0	0
1 A 2 b Non Ferrous Metals							
Light Fuel Oil	030103	7	166	161	275	154	265
Medium Fuel Oil	030103	13	27	19	8	4	3
Heavy Fuel Oil	030103	128	67	297	57	216	87
Gas oil	030103	1	0	5	5	1	5
Petroleum	030103	0	0	1	1	0	0
Liquefied Petroleum Gas	030103	383	286	254	253	257	221
Hard Coal	030103	0	0	0	0	0	0
Coke	030103	33	46	157	185	216	212
Natural Gas	030103	1 361	2 134	2 301	2 242	2 528	2 243
1 A 2 c Chemicals							
Light Fuel Oil	030103	44	601	362	619	346	597
Medium Fuel Oil	030103	80	99	42	17	10	8
Heavy Fuel Oil	030103	808	243	668	128	486	196
Gas oil	030103	1	9	12	10	3	10
Liquefied Petroleum Gas	030103	0	0	5	5	5	5
Refinery Gas	030103	0	0	0	113	98	73

Fuel	SNAP	1990	1995	1998	1999	2000	2001
Hard Coal	030103	160	1 251	1 953	1 231	1 507	635
Lignite and brown coal	030103	0	0	0	0	0	0
Brown Coal Briquettes	030103	0	0	0	0	0	0
Coke	030103	60	84	316	372	435	426
Natural Gas	030103	7 762	8 176	9 839	9 586	10 812	9 593
Fuel Wood	030103	0	0	0	0	0	0
Wood Waste	030103	2 898	1 722	1 575	2 616	765	877
Industrial Waste	030103	2 288	1 933	1 273	1 265	1 629	1 707
1 A 2 d Pulp, Paper and Print							
Light Fuel Oil	030103	1 262	960	925	1 320	1 453	1 381
Heavy Fuel Oil	030103	3 787	2 879	2 774	1 320	1 453	1 381
Gas oil	030103	0	0	4	3	1	3
Petroleum	030103	0	0	0	0	0	0
Liquefied Petroleum Gas	030103	43	41	56	55	56	48
Hard Coal	030103	36	1 193	3 170	1 998	2 445	1 030
Lignite and brown coal	030103	1 461	1 213	415	852	242	187
Brown Coal Briquettes	030103	833	267	1	1	2	1
Coke	030103	0	0	0	0	0	0
Natural Gas	030103	12 948	9 695	16 393	15 972	18 014	15 983
Fuel Wood	030103	9	0	1	0	0	1
Wood Waste	030103	3 662	3 911	5 842	4 376	5 287	6 061
Black Liquor	030103	12 540	12 125	11 562	13 616	16 864	15 921
Biogas	030103	0	0	0	17	41	56
Industrial Waste	030103	0	0	13	14	16	17
1 A 2 e Food Processing, Beverages and Tobacco							
Light Fuel Oil	030103	147	2 010	758	1 298	726	1 251
Medium Fuel Oil	030103	270	331	88	36	21	16
Heavy Fuel Oil	030103	2 721	814	1 400	269	1 018	410
Gas oil	030103	6	47	56	46	15	46
Petroleum	030103	0	0	1	1	0	0
Liquefied Petroleum Gas	030103	170	122	112	112	113	97
Hard Coal	030103	0	0	0	0	0	0
Lignite and brown coal	030103	17	0	0	0	0	0
Brown Coal Briquettes	030103	13	0	1	1	1	0
Coke	030103	22	30	110	130	152	149
Natural Gas	030103	8 939	9 333	9 370	9 129	10 297	9 136
Fuel Wood	030103	121	93	8	8	7	9
Wood Waste	030103	10	9	1	0	0	0
Biogas	030103	0	0	0	15	8	0
Industrial Waste	030103	0	0	6	6	7	7
1 A 2 f Industry - Electricity and Heat Autoproducers							
Light Fuel Oil	030103	0	3 858	3 903	3 678	2 357	1 208
Heavy Fuel Oil	030103	391	3 858	3 903	3 678	2 357	1 208
Gas oil	030103	0	0	2	14	6	10
Hard Coal	030103	1 335	402	1 218	929	1 391	1 078
Lignite and brown coal	030103	491	1 036	74	0	227	227
Natural Gas	030103	16 123	31 817	29 060	29 645	21 892	19 778

Fuel	SNAP	1990	1995	1998	1999	2000	2001
Wood Waste	030103	405	4 459	1 063	5 122	4 440	2 045
Black Liquor	030103	5 260	9 267	11 354	10 003	7 197	7 317
Biogas	030103	0	35	27	114	159	122
Sewage Sludge Gas	030103	0	609	663	696	703	772
Landfill Gas	030103	0	117	490	499	438	1 275
Industrial Waste	030103	2 531	953	808	2 329	574	203
1 A 2 f Industry - Other							
Light Fuel Oil	030103	228	5 125	5 575	5 838	4 455	5 868
Medium Fuel Oil	030103	519	597	267	110	64	49
Heavy Fuel Oil	030103	4 862	841	3 671	198	2 499	632
Gas oil	030103	49	271	447	372	117	372
Petroleum	030103	0	0	5	5	2	0
Liquefied Petroleum Gas	030103	2 192	2 324	1 929	1 710	1 736	1 479
Hard Coal	030103	0	226	1 123	7	624	4
Lignite and brown coal	030103	25	0	0	1	0	0
Brown Coal Briquettes	030103	0	0	0	0	0	0
Coke	030103	130	84	412	484	566	555
Natural Gas	030103	21 844	25 772	21 619	20 867	24 386	20 886
Fuel Wood	030103	530	981	142	119	87	76
Wood Waste	030103	2 676	1 067	1 125	918	1 109	1 271
Industrial Waste	030103	46	158	464	505	574	589
1 A 2 f Cement Industry							
Light Fuel Oil	030311	17	2 277	845	1 054	978	1 019
Medium Fuel Oil	030311	8	1	3	1	1	1
Heavy Fuel Oil	030311	3 946	956	1 036	739	814	774
Hard Coal	030311	5 574	4 341	4 461	3 684	3 684	3 684
Lignite and brown coal	030311	255	92	43	104	105	105
Natural Gas	030311	824	357	417	444	444	444
Industrial Waste	030311	705	863	1 157	1 379	1 379	1 379
1 A 2 f Glass Industry							
Heavy Fuel Oil	030317	268	40	40	40	40	40
Liquefied Petroleum Gas	030317	148	84	84	84	84	84
Natural Gas	030317	2 973	2 894	2 894	2 894	2 894	2 894
1 A 2 f Bricks and Tiles Industry							
Light Fuel Oil	030319	41	50	50	50	50	50
Heavy Fuel Oil	030319	870	588	588	588	588	588
Natural Gas	030319	2 242	3 317	3 317	3 317	3 317	3 317
1 A 3 e Other Transportation - Pipeline Compressors							
Natural Gas	010506	3 045	4 092	6 344	7 807	9 627	11 596
1 A 4 a Commercial/Institutional							
Light Fuel Oil	020103	9 881	7 277	1 515	1 220	1 358	1 314
Medium Fuel Oil	020103	2 802	1 180	371	126	124	94
Gas oil	020103	1 110	3 814	10 128	8 443	2 647	8 442
Petroleum	020103	766	210	726	693	258	44
Liquefied Petroleum Gas	020103	1 563	2 992	1 305	1 515	1 538	1 321
Hard Coal	020103	351	232	327	203	264	34

Fuel	SNAP	1990	1995	1998	1999	2000	2001
Hard Coal Briquettes	020103	0	0	25	25	23	4
Lignite and brown coal	020103	95	49	31	35	15	11
Brown Coal Briquettes	020103	108	119	221	206	252	90
Coke	020103	378	237	158	155	140	159
Natural Gas	020103	7 765	23 148	18 652	18 172	20 496	18 185
Fuel Wood	020103	1 332	1 168	486	477	434	506
Wood Waste	020103	844	930	766	865	1 001	1 131
Landfill Gas	020103	0	49	7	0	0	0
Industrial Waste	020103	230	650	580	631	717	736
1 A 4 b i Residential - Central Heatings							
Light Fuel Oil	020202	19 291	7 846	6 480	7 174	7 120	8 058
Gas oil	020202	38 842	52 947	58 391	59 265	55 188	62 545
Liquefied Petroleum Gas	020202	756	1 208	1 820	1 999	2 032	2 299
Hard Coal	020202	2 990	2 336	1 694	1 487	1 297	137
Hard Coal Briquettes	020202	0	0	60	59	54	8
Lignite and brown coal	020202	1 293	565	261	213	155	140
Brown Coal Briquettes	020202	2 745	1 244	519	462	397	453
Coke	020202	9 990	7 127	5 077	4 839	4 184	4 742
Natural Gas	020202	7 410	16 114	23 983	26 772	26 965	30 061
Fuel Wood	020202	35 258	39 995	40 408	40 506	37 477	42 355
Wood Waste	020202	338	866	1 891	2 843	3 241	3 906
1 A 4 b i Residential - Apartment Heatings							
Gas oil	020202	5 179	5 135	4 226	3 830	3 566	4 042
Hard Coal	020202	463	334	245	216	188	20
Hard Coal Briquettes	020202	0	0	9	9	8	1
Lignite and brown coal	020202	200	142	93	84	61	56
Brown Coal Briquettes	020202	425	266	168	179	154	175
Coke	020202	1 547	842	527	482	416	472
Natural Gas	020202	12 591	18 537	24 964	27 110	27 305	30 440
Fuel Wood	020202	4 201	4 327	4 682	4 793	4 435	5 012
Wood Waste	020202	40	54	80	105	120	144
1 A 4 b i Residential - Stoves							
Gas oil	020205	7 768	8 432	7 688	7 288	6 787	7 691
Hard Coal	020205	1 482	1 160	882	786	686	72
Hard Coal Briquettes	020205	0	0	31	31	29	4
Lignite and brown coal	020205	641	326	178	154	112	101
Brown Coal Briquettes	020205	1 360	1 303	1 003	1 122	965	1 101
Coke	020205	4 950	2 373	1 267	1 084	938	1 063
Peat	020205	9	9	9	9	9	9
Natural Gas	020205	12 827	9 415	4 953	2 914	2 935	3 272
Fuel Wood	020205	18 041	16 929	15 148	14 554	13 466	15 218
1 A 4 c i Agriculture/Forestry/Fisheries							
Light Fuel Oil	020302	7 838	3 188	2 633	2 915	2 893	3 274
Gas oil	020302	38	50	50	50	46	61
Liquefied Petroleum Gas	020302	77	124	186	205	208	235
Hard Coal	020302	63	58	39	33	27	3
Brown Coal Briquettes	020302	200	124	75	78	67	76

Fuel	SNAP	1990	1995	1998	1999	2000	2001
Coke	020302	335	210	140	130	113	128
Natural Gas	020302	355	476	583	614	619	690
Fuel Wood	020302	3 625	3 861	3 797	3 773	3 491	3 945
Wood Waste	020302	371	624	1 051	1 397	1 587	1 876

Table 77: NO_X emission factors [kg/TJ]

SNAP	All years	1990	1995	1998	1999	2000	2001
Hard Coal and Hard Coal Briquettes							
010101. 10102		58.88	52.00	50.00	50.00	50.00	50.00
010103		170.00	170.00	50.00	50.00	50.00	50.00
010201. 10202		108.75	190.00	62.00	62.00	62.00	62.00
010503. 030103	250.00						
02 xx xx Apartment and Central Heatings		190.00	190.00	78.00	78.00	78.00	78.00
02 xx xx Stoves		110.00	110.00	132.00	132.00	132.00	132.00
030311	IE						
Brown Coal							
010101. 010102		162.00	82.00	77.00	77.00	77.00	77.00
010103		170.00	170.00	77.00	77.00	77.00	77.00
010202		101.25	170.00	77.00	77.00	77.00	77.00
010203	170.00						
02 xx xx Central Heatings		170.00	170.00	78.00	78.00	78.00	78.00
02 xx xx Apartment Heatings		80.00	80.00	78.00	78.00	78.00	78.00
02 xx xx Stoves		70.00	70.00	132.00	132.00	132.00	132.00
030103	170.00						
030311	IE						
Brown Coal Briquettes							
010103		170.00	170.00	77.00	77.00	77.00	77.00
010202		101.25	170.00	77.00	77.00	77.00	77.00
010203	170.00						
02 xx xx Apartment and Central Heatings		140.00	140.00	78.00	78.00	78.00	78.00
02 xx xx Stoves		30.00	30.00	132.00	132.00	132.00	132.00
030103	170.00						
Coke Oven Coke							
02 xx xx Apartment and Central Heatings		140.00	140.00	78.00	78.00	78.00	78.00
02 xx xx Stoves		110.00	110.00	132.00	132.00	132.00	132.00
030103	220.00						
030301. 030326	IE						
Fuel Wood							
010101. 010102. 010203	85.00						
02 xx xx Central		85.00	85.00	107.00	107.00	107.00	107.00

SNAP	All years	1990	1995	1998	1999	2000	2001
Heatings							
02 xx xx Apart-ment Heatings		40.00	40.00	107.00	107.00	107.00	107.00
02 xx xx Stoves		40.00	40.00	106.00	106.00	106.00	106.00
030103	110.00						
Peat							
020205	70.00						
Municipal Solid Waste. Hazardous Waste. Industrial Waste. Sewage Sludge. Black Liquor							
010101	100.00						
010202. 010203	100.00						
020103	100.00						
030103	100.00						
Wood Waste							
010103. 010203	143.00						
02 xx xx Central Heatings		85.00	85.00	107.00	107.00	107.00	107.00
02 xx xx Apart-ment Heatings		40.00	40.00	107.00	107.00	107.00	107.00
02 xx xx Stoves		40.00	40.00	106.00	106.00	106.00	106.00
030103	143.00						
Light Fuel Oil							
010101. 010201. 010202		98.75	130.00	42.00	42.00	42.00	42.00
010103. 010203		118.00	118.00	159.40	159.40	159.40	159.40
02 xx xx	115.00						
030103. 030319	118.00						
030311	IE						
030326	IE						
Medium Fuel Oil							
010101. 010202		133.75	140.00	76.00	76.00	76.00	76.00
010203		138.00	118.00	159.40	159.40	159.40	159.40
020103		138.00	118.00	118.00	118.00	118.00	118.00
030103		138.00	118.00	118.00	118.00	118.00	118.00
030311	IE						
Heavy Fuel Oil							
010101. 010102		85.50	28.00	26.00	26.00	26.00	26.00
010103		235.00	235.00	26.00	26.00	26.00	26.00
010201. 010202		156.25	200.00	100.00	100.00	100.00	100.00
010203		235.00	235.00	317.40	317.40	317.40	317.40
010301		156.77	92.73	90.94	100.70	97.41	105.38
030103. 030317. 030319	235.00						
030311	IE						
030326	IE						
Gas oil							
010103. 010201. 010203	65.00						

SNAP	All years	1990	1995	1998	1999	2000	2001
010301		156.77	92.73	90.94	100.70	97.41	105.38
02 xx xx Apartment and Central Heatings	42.00						
02 xx xx Stoves	19.00						
030103	65.00						
Diesel							
010105. 010205. 030105	700.00						
Petroleum. Jet Gasoline							
010301		156.77	92.73	90.94	100.70	97.41	105.38
020103	42.00						
030103	118.00						
Other Petroleum Products							
010301		156.77	92.73	90.94	100.70	97.41	105.38
Natural Gas							
010101. 010102		57.50	35.00	30.00	30.00	30.00	30.00
010103		109.13	41.00	30.00	30.00	30.00	30.00
010201. 010202		43.75	50.00	25.00	25.00	25.00	25.00
010203. 010301		109.13	41.00	41.00	41.00	41.00	41.00
010503. 010506	150.00						
02 xx xx Central Heatings		41.50	44.00	42.00	42.00	42.00	42.00
02 xx xx Apartment Heatings		38.75	45.00	43.00	43.00	43.00	43.00
02 xx xx Stoves		37.88	51.00	51.00	51.00	51.00	51.00
030103. 030317. 030319		109.13	41.00	41.00	41.00	41.00	41.00
030311	IE						
030326	IE						
Liquefied Petroleum Gas							
010203		109.13	41.00	41.00	41.00	41.00	41.00
010301		156.77	92.73	90.94	100.70	97.41	105.38
02 xx xx		41.50	44.00	42.00	42.00	42.00	42.00
030103		109.13	41.00	41.00	41.00	41.00	41.00
Coke Oven Gas. Blast Furnace Gas							
030103	IE						
Refinery Gas							
010301. 030103		156.77	92.73	90.94	100.70	97.41	105.38
Biogas. Sewage Sludge Gas. Landfill Gas							
010103. 010203	150.00						
020103	150.00						
030103	150.00						

Table 78: SO_2 emission factors [kg/TJ]

SNAP	All years	1990	1995	1998	1999	2000	2001
Hard Coal and Hard Coal Briquettes							
010101. 10102		52.38	48.00	57.00	57.00	57.00	57.00
010103		600.00	600.00	57.00	57.00	57.00	57.00
010201. 10202		640.00	640.00	40.00	40.00	40.00	40.00
010503. 030103	600.00						
02 xx xx Apartment and Central Heatings		640.00	640.00	543.00	543.00	543.00	543.00
02 xx xx Stoves		640.00	640.00	340.00	340.00	340.00	340.00
030311	IE						
Brown Coal							
010101. 010102		114.88	73.00	89.00	89.00	89.00	89.00
010103. 010203		630.00	630.00	89.00	89.00	89.00	89.00
010202		530.00	530.00	89.00	89.00	89.00	89.00
02 xx xx Central and Apartment Heatings		530.00	530.00	543.00	543.00	543.00	543.00
02 xx xx Stoves		530.00	530.00	340.00	340.00	340.00	340.00
030103	630.00						
030311	IE						
Brown Coal Briquettes							
010103		630.00	630.00	89.00	89.00	89.00	89.00
010202. 010203		630.00	630.00	89.00	89.00	89.00	89.00
02 xx xx Apartment and Central Heatings		600.00	600.00	543.00	543.00	543.00	543.00
02 xx xx Stoves		600.00	600.00	340.00	340.00	340.00	340.00
030103	630.00						
030103 Paper and Pulp Industry		327.39	180.19	133.58	120.14	110.10	121.21
Coke Oven Coke							
02 xx xx Apartment and Central Heatings		700.00	700.00	543.00	543.00	543.00	543.00
02 xx xx Stoves		700.00	700.00	340.00	340.00	340.00	340.00
030103	500.00						
030103 Paper and Pulp Industry		432.40	237.98	176.42	158.67	145.41	160.09
030301. 030326	IE						
Fuel Wood							
010101. 010102. 010203	11.00						
02 xx xx	11.00						
030103 Paper and Pulp Industry		37.06	20.40	15.12	13.60	12.46	13.72
030103	11.00						
Peat							

SNAP	All years	1990	1995	1998	1999	2000	2001
020205	530.00						
Municipal Solid Waste. Hazardous Waste. Industrial Waste. Sewage Sludge. Black Liquor							
010101	130.00						
0102 xx	130.00						
020103							
030103 Paper and Pulp Industry		80.30	44.20	32.76	29.47	27.00	29.73
030103	130.00						
Wood Waste							
010103. 010203	11.00						
02 xx xx	11.00						
030103 Paper and Pulp Industry		37.06	20.40	15.12	13.60	12.46	13.72
030103	60.00						
Light Fuel Oil							
010101. 010201. 010202		147.00	90.00	92.00	92.00	92.00	92.00
010103. 010203		150.00	92.00	92.00	92.00	92.00	92.00
02 xx xx		147.00	90.00	90.00	90.00	90.00	90.00
030103. 030319		150.00	92.00	92.00	92.00	92.00	92.00
030103 Paper and Pulp Industry		92.66	31.28	23.19	20.85	19.11	21.04
030311	IE						
030326	IE						
Medium Fuel Oil							
010101. 010202. 010203		235.20	180.00	196.00	196.00	196.00	196.00
020103		294.00	196.00	196.00	196.00	196.00	196.00
030103		294.00	293.00	293.00	293.00	293.00	293.00
030311	IE						
Heavy Fuel Oil							
010101. 010102		237.60	42.00	50.00	50.00	50.00	50.00
010103		792.00	398.00	50.00	50.00	50.00	50.00
010201. 010202		792.00	450.00	127.00	127.00	127.00	127.00
010203		792.00	398.00	398.00	398.00	398.00	398.00
010301		102.66	90.07	112.69	121.38	119.31	127.00
030103. 030317. 030319		792.00	398.00	398.00	398.00	398.00	398.00
030103 Paper and Pulp Industry		489.22	135.31	100.31	90.22	82.68	91.02
030311	IE						
030326	IE						
Gas oil							
010103. 010201. 010203		93.33	45.00	45.00	45.00	45.00	45.00

SNAP	All years	1990	1995	1998	1999	2000	2001
010301		102.66	90.07	112.69	121.38	119.31	127.00
02 xx xx		93.33	45.00	45.00	45.00	45.00	45.00
030103		93.33	45.00	45.00	45.00	45.00	45.00
030103 Paper and Pulp Industry		57.65	15.30	11.34	10.20	9.35	10.29
Diesel							
010105. 010205. 030105		58.72	60.65	18.76	18.76	18.76	18.76
Petroleum. Jet Gasoline							
010301		102.66	90.07	112.69	121.38	119.31	127.00
020103		147.00	90.00	90.00	90.00	90.00	90.00
030103		150.00	92.00	92.00	92.00	92.00	92.00
030103 Paper and Pulp Industry		92.66	31.28	23.19	20.85	19.11	21.04
Other Petroleum Products							
010301		102.66	90.07	112.69	121.38	119.31	127.00
Natural Gas							
All SNAPs	0.00						
Liquefied Petroleum Gas							
All SNAPs	0.00						
Coke Oven Gas. Blast Furnace Gas							
030103	IE						
Refinery Gas							
010301. 030103		102.66	90.07	112.69	121.38	119.31	127.00
Biogas. Sewage Sludge Gas. Landfill Gas							
All SNAPs	0.00						

Table 79: NMVOC emission factors [kg/TJ]

SNAP	All years	1990	1995	1998	1999	2000	2001
Hard Coal and Hard Coal Briquettes							
010101. 10102. 010103	0.90						
010201. 10202		15.25	5.00	0.70	0.70	0.70	0.70
010503. 030103	15.00						
02 xx xx Apart-ment and Central Heatings		700.00	700.00	218.00	218.00	218.00	218.00
02 xx xx Stoves		1 100.00	1 100.00	251.00	251.00	251.00	251.00
030311	IE						
Brown Coal							
010101. 010102		1.46	0.90	0.90	0.90	0.90	0.90
010103	23.00						
010202		26.13	19.00	0.80	0.80	0.80	0.80
010203	23.00						

SNAP	All years	1990	1995	1998	1999	2000	2001
02 xx xx Central and Apartment Heatings		830.00	830.00	218.00	218.00	218.00	218.00
02 xx xx Stoves		900.00	900.00	251.00	251.00	251.00	251.00
030103	23.00						
030311	IE						
Brown Coal Briquettes							
010103	23.00						
010202		26.13	19.00	0.80	0.80	0.80	0.80
010203	23.00						
02 xx xx Apartment and Central Heatings		300.00	300.00	218.00	218.00	218.00	218.00
02 xx xx Stoves		530.00	530.00	251.00	251.00	251.00	251.00
030103	23.00						
Coke Oven Coke							
02 xx xx Apartment and Central Heatings		49.00	49.00	218.00	218.00	218.00	218.00
02 xx xx Stoves		83.00	83.00	251.00	251.00	251.00	251.00
030103	8.00						
030301. 030326	IE						
Fuel Wood							
010101. 010102. 010203	64.00						
02 xx xx Apartment and Central Heatings		980.00	980.00	336.00	336.00	336.00	336.00
02 xx xx Stoves		2 000.00	2 000.00	494.00	494.00	494.00	494.00
030103	5.00						
Peat							
020205	900.00						
Municipal Solid Waste. Hazardous Waste. Industrial Waste. Sewage Sludge. Black Liquor							
All SNAPs	38.00						
Wood Waste							
010103. 010203	5.00						
02 xx xx Central Heatings		64.00	64.00	336.00	336.00	336.00	336.00
02 xx xx Apartment Heatings		980.00	980.00	336.00	336.00	336.00	336.00
02 xx xx Stoves		2 000.00	2 000.00	494.00	494.00	494.00	494.00
030103	5.00						
Light Fuel Oil							
010101. 010201. 010202		7.08	5.00	5.00	5.00	5.00	5.00
010103. 010203	0.80						
02 xx xx	0.75						
030103. 030319	0.80						
030311	IE						

SNAP	All years	1990	1995	1998	1999	2000	2001
030326	IE						
Medium Fuel Oil							
010101. 010202		7.08	5.00	5.00	5.00	5.00	5.00
010203	8.00						
020103	8.00						
030103	8.00						
030311	IE						
Heavy Fuel Oil							
010101. 010102	2.40						
010103	8.00						
010201. 010202		7.08	5.00	5.00	5.00	5.00	5.00
010203	8.00						
010301	IE						
030103. 030317. 030319	8.00						
030311	IE						
030326	IE						
Gas oil							
010103. 010201. 010203	4.80						
010301	IE						
02 xx xx Apart-ment and Central Heatings	0.80						
02 xx xx Stoves	1.50						
030103	4.80						
Diesel							
010105. 010205. 030105	0.80						
Petroleum. Jet Gasoline							
010301	IE						
020103	4.80						
030103	4.80						
Other Petroleum Products							
010301	IE						
Natural Gas							
010101. 010102	0.06						
010103	0.50						
010201. 010202		0.98	0.40	0.50	0.50	0.50	0.50
010203	0.50						
010301	IE						
010503. 010506	0.50						
02 xx xx Apart-ment and Central Heatings		0.70	0.20	0.20	0.20	0.20	0.20
02 xx xx Stoves		1.33	0.20	0.20	0.20	0.20	0.20
030103. 030317. 030319	0.50						
030311	IE						

SNAP	All years	1990	1995	1998	1999	2000	2001
030326	IE						
Liquefied Petroleum Gas							
010203	0.50						
010301	IE						
02 xx xx	0.50						
030103	0.50						
Coke Oven Gas. Blast Furnace Gas							
030103	IE						
Refinery Gas							
010301. 030103	IE						
Biogas. Sewage Sludge Gas. Landfill Gas							
010103. 010203	0.50						
020103	0.50						
030103	0.50						

Table 80: NH_3 emission factors (applied for the years 1990-2001, all sectors) [kg/TJ]

Fuel	Emission Factor
Hard Coal and Hard Coal Briquettes	0.01
Brown Coal	0.02
Brown Coal Briquettes	0.02
Coke Oven Coke	0.02
Fuel Wood	5.00
Peat	0.02
Municipal Solid Waste. Hazardous Waste. Industrial Waste. Sewage Sludge. Black Liquor	0.02
Wood Waste	5.00
Light Fuel Oil	2.68
Medium Fuel Oil	2.68
Heavy Fuel Oil	2.68
Gas Oil	2.68
Diesel	2.68
Petroleum. Jet Gasoline	2.68
Other Petroleum Products	2.68
Natural Gas	1.00
Liquefied Petroleum Gas	1.00
Coke Oven Gas. Blast Furnace Gas	NE
Refinery Gas	2.68
Biogas. Sewage Sludge Gas. Landfill Gas	1.00

4.7 Fugitive Emissions (NFR Source Category 1 B)

NMVOC emissions from this category are only a minor source of NMVOC emissions in Austria: in 1990 the contribution to national total emissions was 1.6%, in the year 2001 it was 2.5%. Fugitive NMVOC emissions decreased: in 2001, they were 59% below 1990 levels.

This category is also a minor source regarding SO_2 emissions, which originate from the first treatment of sour gas. The contribution in the year 1990 was 0.4%, in 2001 these emissions contributed 2.5% to national total SO_2 emissions. SO_2 emissions from NFR Category 1 B decreased by 92% between 1990 and 2001.

4.7.1 Completeness

Table 81 gives an overview of the NFR categories included in this chapter and presents the transformation matrix from SNAP categories. It also provides information on the status of emission estimates of all subcategories. A "✓" indicates that emissions from this subcategory have been estimated.

Table 81: Overview of subcategories of Category 1 B Fugitive Emissions: transformation into SNAP codes and status of estimation

NFR Category	SNAP	Status			
		NO_X	SO_2	NH_3	NMVOC
1 B 1 a Coal Mining and Handling	050102 Underground mining 050101 Open cast mining	NO			NE
1 B 2 a Oil					
i Exploration	0502 Extraction, 1st treatment and loading of liquid fossil fuels	NO			NE
ii Production					
iii Transport	050502 Transports and Depots	NO			✓
vi Refining/ Storage	0401 Processes in Petroleum Industries 050501 Refinery Dispatch Station	NO			✓
v Distribution of oil products	0504 Liquid fuel distribution (Except Petrol distribution) 050503 Petrol distribution – Service Stations	NO			✓
1 B 2 b Natural Gas	0503 Extraction, 1st treatment and loading of gaseous fossil fuels 050601 Pipelines 050602 Distribution Networks	NO	✓	NO	✓
1 B 2 c Venting/Flaring		NE	NO	NO	NE

4.7.2 Methodological issues

4.7.2.1 1 B 2 a Oil

In this category NMVOC emissions of transport and distribution of oil products as well as from oil refining are considered. The most important sources of this sector are the refinery dispatch station with a contribution of 45% to total NMVOC emissions of NFR Category *1 B Fugitive Emissions* and oil refining with a contribution of 38% in 2001.

Emissions from depots and from refuelling of cars decreased remarkably (93% and 81% respectively) due to installation of gas recovery units.

Emissions were reported directly from "Fachverband Mineralöl" (Austrian association of oil industry). Activity data were taken from national statistics. From emission and activity data an implied emission factor was calculated.

Emissions, activity data and implied emission factors are presented in Table 82 and Table 83.

Table 82: Emissions, activity data and implied emission factors for emissions from NFR Category 1 B 2 a Fugitive Emissions from Oil – Transport and Depots and Distribution

Year	Refinery Dispatch Station		Transport and Depots		Service Stations		Petrol
	NMVOC [Gg]	IEF [g/Mg]	NMVOC [Gg]	IEF [g/Mg]	NMVOC [Gg]	IEF [g/Mg]	Activity [Gg]
1990	1.06	413	2.20	861	1.63	637	2 554
1991	1.19	427	2.49	889	1.84	658	2 796
1992	1.17	438	2.44	912	1.81	675	2 676
1993	1.18	460	2.46	958	1.82	709	2 568
1994	1.20	478	2.50	995	1.85	736	2 513
1995	0.82	341	2.37	986	1.59	662	2 402
1996	0.81	365	1.82	819	1.26	567	2 218
1997	0.80	381	1.79	851	0.76	362	2 105
1998	2.25	1021	0.12	53	0.54	244	2 204
1999	1.61	785	0.11	53	0.43	209	2 047
2000	1.61	811	0.19	94	0.36	180	1 980
2001	1.61	805	0.15	75	0.31	155	1 994
Trend 1990-2001	52%	95%	-93%	-91%	-81%	-76%	-22%

Table 83: Emissions, activity data and implied emission factors for emissions from NFR Category 1 B 2 a Fugitive Emissions – Oil Refining

Year	NMVOC Emissions [Gg]	IEF [g/Mg]	Crude Oil Refined [Gg]
1990	3.78	472	7 993
1991	4.00	472	8 463
1992	4.18	472	8 856
1993	4.09	472	8 659
1994	1.50	167	8 957
1995	1.50	172	8 721
1996	1.50	165	9 100
1997	1.50	155	9 656
1998	1.50	155	9 707
1999	1.39	152	9 123
2000	1.39	159	8 720

Year	NMVOC Emissions [Gg]	IEF [g/Mg]	Crude Oil Refined [Gg]
2001	1.38	156	8 855
Trend 1990-2001	*-63%*	*-67%*	*11%*

4.7.2.2 1 B 2 b Natural Gas

In this category SO_2 emissions from the first treatment of sour gas and NMVOC emissions from gas distribution networks are considered.

SO_2 emissions from the 1st treatment of sour gas are reported directly by the operator of the only sour gas treatment plant in Austria.

NMVOC emissions from gas distribution networks were calculated by applying an emission factor of 19 656 g/ m³ gas distributed [ORTHOFER, R. 1991]. Gas consumption figures were taken from national statistics.

Table 84: Emissions, activity data and implied emission factors for emissions from NFR Category 1 B 2 b Fugitive Emissions – Natural Gas

Year	Gas Distribution		Gas Extraction/ 1st treatment		
	NMVOC Emissions [Gg]	Gas consumption [Mm³]	SO_2 Emissions [Gg]	IEF [g/Mg]	Natural Gas [1000m³]
1990	0.12	6 090	2.00	8 062	248 090
1991	0.13	6 439	1.30	4 547	285 901
1992	0.12	6 323	2.00	5 600	357 135
1993	0.13	6 668	2.10	6 529	321 653
1994	0.13	6 859	1.28	3 521	363 582
1995	0.15	7 488	1.53	3 772	405 638
1996	0.16	7 971	1.20	8 776	136 737
1997	0.15	7 682	0.07	165	406 177
1998	0.16	7 887	0.04	114	367 195
1999	0.16	8 059	0.14	406	352 318
2000	0.15	7 791	0.15	405	358 357
2001	0.16	8 200	0.16	402	393 492
Trend 1990-2001	*+35%*	*+35%*	*-92%*	*-95%*	*+59%*

5 INDUSTRIAL PROCESSES (NFR SECTOR 2)

This chapter includes details on methodologies used for estimating emissions of SO_2, NO_X, NH_3 and NMVOCs as well as references of activity data and emission factors reported under NFR Category *2 Industrial Processes* for the period from 1990 to 2001 in the NFR.

Emissions from this category comprise emissions from the following sub categories: *Mineral Products*, *Chemical Industry*, *Metal Production* and *Other Production* (*Chipboard* and *Food and Drink)*.

Except for *2 C 1 Iron and Steel Production* and *2 A 1 Cement Production*, where all emissions are reported in Sector *2 Industry*, only process related emissions are considered in this Sector, emissions due to fuel combustion in manufacturing industries are allocated in NFR Category *1 A 2 Fuel Combustion - Manufacturing Industries and Construction* (see Chapter 3).

Some categories in this sector are not applicable for Austria as there is no such production. For some categories emissions have not been estimated (NE) or are included elsewhere (IE). A summary of these categories is given in Table 90.

5.1 Sector Overview

5.1.1 Emission Trends

SO_2, NO_X, NMVOC and NH_3 emissions from NFR Category *2 Industry* for the period from 1990 to 2001 are presented in Table 85 and Figure 8.

Table 85: Emissions from NFR Category 2 Industry and trends 1990-2001

Year	Emissions [Gg]			
	SO_2	NO_X	NMVOC	NH_3
1990	10.49	17.41	16.68	0.18
1991	9.27	17.48	18.17	0.17
1992	7.95	16.84	19.69	0.16
1993	8.28	17.11	21.18	0.17
1994	8.76	16.84	21.56	0.13
1995	8.35	15.81	21.24	0.10
1996	9.28	15.33	21.26	0.09
1997	9.62	15.32	21.22	0.10
1998	8.78	14.90	20.81	0.10
1999	8.60	14.88	21.09	0.12
2000	8.17	14.60	20.79	0.10
2001	8.64	14.64	20.75	0.08
Trend 1990-2001	*-18%*	*-16%*	*24%*	*-58%*
Share in National Total 1990	*23.6%*	*7%*	*8.9%*	*0.1%*
Share in National Total 2001	*13.3%*	*9%*	*4.8%*	*0.4%*

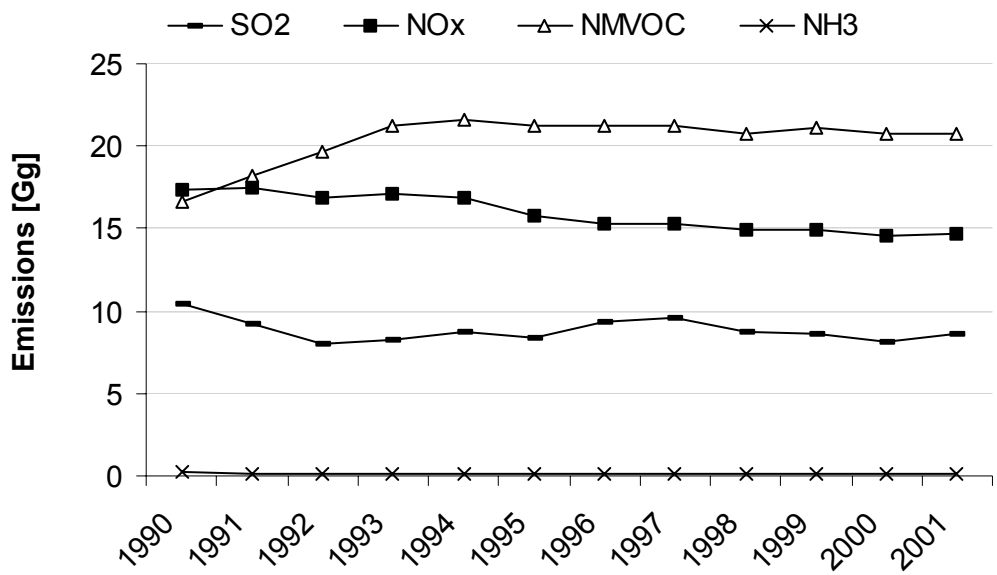

Figure 8: Emissions from NFR Category 2 Industry 1990-2001

SO_2 Emissions

SO_2 emissions from NFR Category *2 Industry* fluctuated over the period from 1990 to 2001. As can be seen in Table 3, in 1990 emissions amounted to 11 Gg, in 2001 they were 18% lower (9 Gg). The main source for SO_2 emissions in the industrial processes sector is metal production with a contribution of over 60%.

Table 86: SO_2 emissions per NFR Category 1990 and 2001, their trend 1990-2001 and their share in total emissions of the industry sector.

NRF Category	SO_2 Emissions [Gg]		Trend 1990-2001	Share in *2 Industry*	
	1990	2001		1990	2001
2 Industrial Processes	10.49	8.64	***-18%***	100%	100%
2 A Mineral Products	1.10	0.18	***-84%***	*2%*	*10%*
2 B Chemical Products	2.68	3.19	***19%***	*37%*	*26%*
2 C Metal Production	6.70	5.28	***-21%***	*61%*	*64%*

NO_X Emissions

As can be seen in Figure 8, NO_X emissions from the industrial processes sector decreased steadily over the period from 1990 to 2001. In 1990 they amounted to 17 Gg, in the year 2001 they were 16% below 1990 levels (15 Gg). The main sources for NO_X emissions of NFR Category *2 Industry* are *2 A Mineral Products* with a contribution of around 40% and *2 B Chemical Products* and *2 C Metal Production* both with a contribution of about 30%. Category *2 D Other Production* (Chipboard Production) is only a minor source within this sector.

Table 87: NO_X emissions per NFR Category 1990 and 2001, their trend 1990-2001 and their share in total emissions of the industry sector.

NRF Category	NO_X Emissions [Gg]		Trend 1990-2001	Share in *2 Industry*	
	1990	2001		1990	2001
2 Industrial Processes	17.41	14.64	***-16%***	100%	100%
2 A Mineral Products	7.64	5.24	***-31%***	36%	44%
2 B Chemical Products	4.07	4.40	***8%***	30%	23%
2 C Metal Production	5.14	4.27	***-17%***	29%	30%
2 D Other Production	0.55	0.74	***35%***	5%	3%

NMVOC Emissions

The trend regarding NMVOC emissions from *2 Industrial Processes* shows increasing emissions: in the period from 1990 to 2001 emissions increased by 24%, mainly due to increasing emissions from chemical industry, which is the main contributor to NMVOC emissions from industrial processes (see Table 3).

Table 88: NMVOC emissions per NFR Category 1990 and 2001, their trend 1990-2001 and their share in total emissions of the industry sector.

NRF Category	NMVOC Emissions [Gg]		Trend 1990-2001	Share in *2 Industry*	
	1990	2001		1990	2001
2 Industrial Processes	16.68	20.75	***24%***	100%	100%
2 A Mineral Products	5.52	5.17	***-6%***	25%	33%
2 B Chemical Products	8.29	12.34	***49%***	59%	50%
2 C Metal Production	0.59	0.51	***-13%***	2%	4%
2 D Other Production	2.29	2.74	***19%***	13%	14%

NH_3 Emissions

NH_3 emissions from industrial processes exclusively arise from NFR Category *2 B Chemical Products*. This sector is only a minor source of NH_3 emissions with a contribution to national total emissions of 0.4% in 1990 and 0.1% in 2001 respectively.

The trend concerning NH_3 emissions from industry is decreasing emissions: in the period from 1990 to 2001 emissions decreased by 58% (see Table 85).

5.1.2 Methodology

The general method for estimating emissions for the industrial processes sector involves multiplying production data for each process by an emission factor per unit of production (CORINAIR simple methodology).

In some categories emission and production data were reported directly by industry or associations of industries and thus represent plant specific data.

5.1.3 Quality Assurance and Quality Control (QA/QC)

For the Austrian Inventory there is an internal quality management system, for further information see Chapter 1.6.

Concerning measurement and documentation of emission data there are also specific regulations in the Austrian legislation as presented in Table 89. This legislation also addresses verification. Some plants that are reporting emission data have quality management systems implemented according to the ISO 9000–series or to similar systems.

Table 89: Austrian legislation with specific regulations concerning measurement and documentation of emission data

IPCC Source Category	Austrian legislation
2 A 1	BGBl 1993/ 63 Verordnung für Anlagen zur Zementerzeugung
2 A 7	BGBl 1994/ 498 Verordnung für Anlagen zur Glaserzeugung
2 C 1	BGBl 1994/ 447 Verordnung für Gießereien
2 C 1	BGBl II 1997/ 160 Verordnung für Anlagen zur Erzeugung von Eisen und Stahl
2 C 1	BGBl II 1997/ 163 Verordnung für Anlagen zum Sintern von Eisenerzen
2 A / 2 B /2 C / 2 D	BGBl II 1997/ 331 Feuerungsanlagen-Verordnung
2 C 2 / 2 C 3 / 2 C 5	BGBl II 1998/ 1 Verordnung zur Erzeugung von Nichteisenmetallen
2 A / 2 B /2 C / 2 D	BGBl 1988/ 380 Luftreinhaltegesetz für Kesselanlagen
2 A / 2 B /2 C / 2 D	BGBl 1989/ 19 Luftreinhalteverordnung für Kesselanlagen

Extracts of the applicable paragraphs are provided in Annex 3.

5.1.4 Recalculations

Information on changes made with respect to last year's submission is provided in Chapter 3 *Methodological Changes,* details are provided in the corresponding subchapters of this chapter (e.g. Chapter 0).

5.1.5 Completeness

Table 90 gives an overview of the NFR categories included in this chapter and presents the transformation matrix from SNAP categories. It also provides information on the status of emission estimates of all subcategories. A "✓" indicates that emissions from this subcategory have been estimated.

Table 90: Overview of subcategories of Category 1 A Fuel Combustion: transformation into SNAP Codes and status of estimation

NFR Category	SNAP	Status			
		NO_X	SO_2	NH_3	NMVOC
2 A Mineral Products					
2 A 1 Cement Production	040612 Cement (decarbonising)	✓	✓	NE	✓
2 A 2 Lime Production	040614 Lime (decarbonising)	NO			
2 A 3 Limestone and Dolomite Use	040618 Limestone and Dolomite Use	NO			
2 A 4 Soda Ash Production and Use	040619 Soda Ash Production and Use	NO			
2 A 5 Asphalt Roofing	040610 Roof covering with asphalt materials	NO			✓
2 A 6 Road Paving with Asphalt	040611 Road paving with asphalt	NO			✓
2 A 7 Other	040613 Glass (decarbonising)	✓	NE	NE	✓
2 B Chemical Industry					
2 B 1 Ammonia Production	040403 Ammonia			✓	
2 B 2 Nitric Acid Production	040402 Nitric acid	IE			
2 B 3 Adipic Acid Production	040521 Adipic acid	NO			
2 B 4 Carbide Production	040412 Calcium carbide production	NE			
2 B 5 Other	040401 Sulphuric Acid 040405 Ammonium Nitrate 040407 NPK Fertilizers 040408 Urea 040416 Processes in Inorganic Chemistry - Other 040527 Processes in Organic Chemistry - Other	✓	✓	✓	✓
2 C Metal Production	040201 Coke oven 040202 Blast furnace charging 040203 Pig iron tapping 040206 Basic oxygen furnace steel plant 040209 Sinter and palletising plants 040210 Other: Cast Iron	✓	✓	--	✓
	040207 Electric furnace steel plant	✓	✓	--	✓
	040208 Rolling mills	--	--	--	✓
	040309 Processes in non-ferrous metal industries – Other - Cast	✓	✓	--	✓
2 D Other Production					
2 D 1 Pulp and Paper	040601 Chipboard 040602 Paper pulp (Kraft process) 040603 Paper pulp (Acid Sulphite process) 040604 Paper pulp (Neutral Sulphite Semi-Chemical process)	✓			✓
2 D 2 Food and Drink	040605 Bread 040606 Wine 040607 Beer 040608 Spirits	NO	NO	NO	✓
2 G Other		**NE**			

5.2 Mineral Products (CRF Source Category 2 A)

5.2.1 Cement Production (2 A 1)

5.2.1.1 Source Category Description

All emissions from cement production are reported in *2 A 1* (thus emissions due to combustion that should be reported in *1 A 2* are included in this category as well). SO_2, NO_X and NMVOC emissions from cement production mainly arise from combustion activities.

Cement production is an important NO_X source of NFR Category *2 Industry*. In the year 2001 emissions from this source amounted to 3.96 Gg, that are 27% of total NO_X emissions from this category. In the year 1990 37% of the NO_X emissions from all production processes arose from cement production.

In the period from 1990-2001 SO_2 emissions from this category decreased remarkably by 84%, NO_X emissions were 39% below 1990 levels, there was only a slight decrease (8%) regarding NMVOC emissions over the same period.

Table 91: NO_X , SO_2 and NMVOC emissions from 2 A 1 Cement Production 1990-2001

Year	Emissions [Gg]		
	SO_2	NO_X	NMVOC
1990	1.10	6.49	0.24
1991	1.06	6.30	0.23
1992	1.03	6.50	0.23
1993	0.93	6.32	0.24
1994	1.09	6.24	0.21
1995	0.77	4.92	0.16
1996	1.24	4.71	0.20
1997	1.30	4.44	0.25
1998	0.41	3.90	0.18
1999	0.18	3.96	0.22
2000	0.18	3.96	0.22
2001	0.18	3.96	0.22
Trend 1990-2001	*-84%*	*-39%*	*-8%*

5.2.1.2 Methodological Issues

Activity and emission data for the period from 1990 to 1999 were taken from studies [HACKEL et al., 1995/1997/2001]. They are based upon information provided by companies and thus represent plant specific data. For 2000 the activity data for cement was obtained from the *Association of the Cement Industry*, for 2001 the value of 2000 was used due to lack of more up-to-date activity data. Emissions for 2000 and 2001 were calculated using the implied emission factor of 1999.

Implied emission factors were calculated from activity and emission data, they are presented in Table 92.

Table 92: Implied emission factors and activity data for emissions from cement production

Year	IEF SO_2 [g/Mg]	IEF NO_X [g/Mg]	IEF NMVOC [g/Mg]	Activity [Mg]
1990	235	1 386	50	4 679 409
1991	220	1 308	48	4 821 480
1992	214	1 347	49	4 822 304
1993	191	1 300	50	4 858 012
1994	228	1 310	43	4 762 651
1995	202	1 283	43	3 839 415
1996	327	1 247	52	3 779 074
1997	334	1 136	64	3 909 083
1998	112	1 064	50	3 668 076
1999	48	1 082	60	3 658 102
2000	49	1 105	61	3 580 570
2001	49	1 105	61	3 580 570
Trend 1990-2001	*-79%*	*-20%*	*21%*	*-23%*

5.2.1.3 Planned Improvements

Activity data for 2000 and 2001 will be updated as soon as new data becomes available.

Emissions from cement production are split into process- and combustion specific emissions. Only CO_2 emissions from decarbonising are considered as process emissions, all others are considered as emissions due to combustion. All emissions due to combustion (thus also including NO_X emissions) will be reallocated from *2 Industry* to *1 A 2 Combustion in Manufacturing Industries* in next year's submission.

5.2.2 Asphalt Roofing (2 A 5)

5.2.2.1 Source Category Description

In this category NMVOC emissions from the production and laying of asphalt roofing are considered. NMVOC emissions of this category are an important NMVOC source from NFR Category *2 Industry*: in 2001 23% of all industrial process NMVOC emissions, compared to 30% in 1990, originated from this category.

Table 93 presents NMVOC emissions arising from asphalt roofing. As can be seen in the table, NMVOC emissions reached a maximum in 1994. In 2001 emissions from this category were 7% below the level of the base year. As a constant emission factor was used for estimating these emissions, the emissions followed the changes in production of roofing paper.

5.2.2.2 Methodological Issues

NMVOC emissions from asphalt roofing were calculated by multiplying an emission factor of 180 g NMVOC /m² produced asphalt roofing [BUWAL, 1995] with activity data (roofing paper produced). The consumption of bitumen was assumed to be 1.2 kg/m² of asphalt roofing.

Activity data were taken from national statistics (STATISTIK AUSTRIA). For 1996 and 2001 no activity value was available from these statistics, that's why the value of the year before was used for these years.

Table 93 presents activity data for asphalt roofing as well as emissions from this category for the period from 1990 to 2001.

Table 93: Activity data (Roofing Paper produced) and NMVOC emissions for Asphalt Roofing 1990-2001

Year	Roofing Paper [m²]	NMVOC emissions [Gg]
1990	27 945 000	5.03
1991	28 007 000	5.04
1992	29 311 000	5.28
1993	30 731 000	5.53
1994	31 745 000	5.71
1995	31 229 000	5.62
1996	31 229 000	5.62
1997	29 976 436	5.40
1998	27 060 715	4.87
1999	26 616 092	4.79
2000	26 020 734	4.68
2001	26 020 734	4.68
Trend 1990-2001	*-7%*	*-7%*

5.2.2.3 Recalculation

Activity data from the years 1997 to 2000 were updated using statistical data because in the last submission the value of 1995 was used for these years. Table 94 presents the recalculation difference resulting from this update of activity data.

Table 94: Recalculation Difference with respect to last year's submission for NMVOC emissions from Asphalt Roofing

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Difference [Gg]	0	0	0	0	0	0	0	-0.23	-0.75	-0.83	-0.94

5.2.3 Road Paving with Asphalt (2 A 6)

5.2.3.1 Source Category Description

In this category NMVOC emissions from road paving with asphalt are considered. This source only contributes 1% to total NMVOC emissions from NFR Category *2 Industry*.

Table 93 presents NMVOC emissions arising from road paving with asphalt. As can be seen in the table, in 2001 emissions from this category were 7% above the level of the base year. As a constant emission factor was used for estimating these emissions, the emissions followed the changes in production of roofing paper.

5.2.3.2 Methodological Issues

Emissions were calculated by applying an emission factor of 600 g NMVOC per t asphalt used for road paving [BUWAL, 1995].

Activity data was taken from national statistics (STATISTIK AUSTRIA). For 1996 and 2001 no activity data was available from these statistics, for this reason the value of the year before was used for these years.

Table 93 presents activity data as well as emissions from this category for the period from 1990 to 2001.

Table 95: Activity data (asphalt used for road paving) and NMVOC emissions for NFR Category 2 A 6 Road Paving with Asphalt 1990-2001

Year	Asphalt [t]	NMVOC emissions [Gg]
1990	402 727	0.24
1991	434 305	0.26
1992	568 206	0.34
1993	490 422	0.29
1994	714 808	0.43
1995	522 418	0.31
1996	522 418	0.31
1997	522 943	0.31
1998	405 200	0.24
1999	969 000	0.58
2000	429 292	0.26
2001	429 292	0.26
Trend 1990-2001	*7%*	*7%*

5.2.3.3 Recalculation

Activity data from the years 1995 to 2000 was updated using statistical data because in the last submission the value of 1994 was used for these years. Table 94 presents the recalculation difference resulting from this update of activity data.

Table 96: Recalculation Difference with respect to last year's submission for NMVOC emissions from Asphalt Roofing

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Difference [Gg]	0	0	0	0	0	-0.12	-0.12	-0.12	-0.19	0.15	-0.17

5.2.4 Mineral Products - Other (2 A 7)

5.2.4.1 Source Category Description

Emissions from the production of glass are considered in this category.

In the year 2001 9% of total NO_x emissions from NFR Category *2 Industry* arose from glass production. It is also a minor source for NMVOC emissions, in 1990 NO_x only contributed 0.04% to total NMVOC emissions from industrial processes. As a constant emission factor was used for estimating these emissions, the emissions followed the changes in production of glass.

5.2.4.2 Methodological Issues

Emissions were calculated by applying a national emission factor on production data (activity values).

The applied emission factors of 2 900 g NO_x/Mg glass produced and 20 g NMVOC/Mg glass produced were calculated from emission and production data obtained from a glass production company. These emission factors were applied to total glass production figures in Austria.

Activity data for the year 1990 was taken from STATISTIK AUSTRIA, for the other years the production figures were reported by associations of industries (glass industry).

Table 97: Activity data for emissions from NFR Category 2 A 7 Other – Glass Production

Year	Emissions [Gg]		Activity [Mg]
	NO_x	NMVOC	
1990	1.16	0.008	398 515
1991	1.33	0.009	458 666
1992	1.18	0.008	405 863
1993	1.18	0.008	406 222
1994	1.26	0.009	434 873
1995	1.26	0.009	435 094
1996	1.26	0.009	435 094 (1)
1997	1.18	0.008	405 760
1998	1.18	0.008	405 760 (2)
1999	1.29	0.009	445 069

Year	Emissions [Gg]		Activity [Mg]
	NO_x	NMVOC	
2000	1.09	0.008	375 348
2001	1.28	0.009	440 865
Trend 1990-2001	*11%*	*11%*	*11%*

NOTE: (1) value from 1995 was used for 1996 also
(2) value from 1997 was used for 1998 also

5.3 Chemical Products (NFR Source Category 2 B)

5.3.1 Ammonia and Nitric Acid Production (2 B 1 and 2 B 2)

5.3.1.1 Source Category Description

Ammonia (NH_3) is produced by catalytic steam reforming of natural gas or other light hydrocarbons (e.g. liquefied petroleum gas, naphtha). Nitric acid (HNO_3) is manufactured via the reaction of ammonia (NH_3) whereas in a first step NH_3 reacts with air to NO and NO_2 and is then transformed with water to HNO_3. Both processes are minor sources of NH_3: emissions from the production of ammonia contributed 8% to total NH_3 emissions from industrial processes. The contribution of emissions from nitric acid production was only 0.4%.

In Austria there is only one producer of ammonia and nitric acid.

5.3.1.2 Methodological Issues

Activity data since 1990 and emission data from 1994 onwards were reported directly to the UMWELTBUNDESAMT by the only producer in Austria and thus represent plant specific data. From emission and activity data an implied emission factor was calculated (see Table 98). The implied emission factor that was calculated from activity and emission data from 1994 was applied to calculate emissions of the years 1990 to 1993 as no emission data was available for these years.

Table 98: Activity data, emissions and implied emission factors for NH_3 emissions from Ammonia and Nitric Acid Production (NFR Categories 2 B 1 and 2 B 2) 1990–2001

Year	Ammonia Production			Nitric Acid Production		
	Production [t]	Emission [Gg]	IEF [g/t]	Production [t]	Emission [Gg]	IEF [g/t]
1990	461 000	0.0074	16.00	530 000	0.0014	2.60
1991	475 000	0.0076	16.00	535 000	0.0014	2.60
1992	432 000	0.0069	16.00	485 000	0.0013	2.60
1993	469 000	0.0075	16.00	513 000	0.0013	2.60
1994	444 000	0.0071	16.00	502 000	0.0013	2.59
1995	473 000	0.0107	22.62	484 000	0.0001	0.21
1996	484 772	0.0123	25.37	495 738	0.0002	0.40
1997	479 698	0.0109	22.72	489 375	0.0019	3.88
1998	484 449	0.0042	8.67	504 977	0.0003	0.59
1999	490 493	0.0085	17.33	512 798	0.0002	0.39
2000	482 333	0.0070	14.51	533 715	0.0004	0.75
2001	448 176	0.0060	13.39	510 800	0.0005	0.98
Trend 1990-2001	-3%	*-19%*	*-16%*	*-4%*	*-64%*	-62%

The emission factors vary depending on the plant utilization and on how often the production process was interrupted, e.g. because of change of the catalyst.

5.3.2 Chemical Products - Other (2 B 5)

5.3.2.1 Source Category Description

This category includes NH_3 emissions from the production of ammonium nitrate, fertilizers and urea as well as SO_2 and NO_X emissions from inorganic chemical processes (reported as a sum) and NMVOC emissions from organic chemical processes (also reported as a sum).

The production of fertilizers is the most important NH_3 source of this category as well as of the overall industrial processes sector: in 2001 73% of all emissions from NFR Category *2 Industry* originated from fertilizer production.

Processes in inorganic chemical industries are an important NO_x source of the industrial processes sector, in 2001 this category contributed 30% to total emissions from NFR Category *2 Industry*. This source is also important regarding SO_2 emissions: 37% of the SO_2 emissions from the industrial processes sector originated from this source.

In the year 2001 NMVOC emissions from organic chemical industries contributed 59% to total emission from the industrial processes sector.

Emissions from this category are presented in the following table:

Table 99: Emissions from NFR Category 2 B 5 1990–2001

	NH_3 Emissions from the Production of [Gg]				SO_2 Emissions [Gg]	NO_x Emissions [Gg]	NMVOC Emissions [Gg]
Year	Ammonium Nitrate	Fertilizer	Urea	Total NH_3 Emissions	Processes in Inorganic Chemical Industries		Organic Chemistry
1990	0.0011	0.13	0.04	0.17	2.68	4.07	8.29
1991	0.0011	0.12	0.04	0.17	2.85	4.18	9.64
1992	0.0011	0.11	0.04	0.15	3.02	4.29	10.99
1993	0.0011	0.12	0.04	0.16	3.19	4.40	12.34
1994	0.0003	0.07	0.05	0.12	3.19	4.40	12.34
1995	0.0009	0.04	0.05	0.09	3.19	4.40	12.34
1996	0.0004	0.05	0.03	0.08	3.19	4.40	12.34
1997	0.0003	0.06	0.03	0.09	3.19	4.40	12.34
1998	0.0003	0.06	0.04	0.10	3.19	4.40	12.34
1999	0.0003	0.07	0.03	0.11	3.19	4.40	12.34
2000	0.0002	0.07	0.02	0.09	3.19	4.40	12.34
2001	0.0003	0.06	0.01	0.07	3.19	4.40	12.34
Trend 1990-2001	*-73%*	*-58%*	*-63%*	*-59%*	*+19%*	*+8%*	*+49%*

5.3.2.2 Methodological Issues

Ammonium nitrate and urea production

For ammonium nitrate and urea production activity data since 1990 and emission data from 1994 onwards were reported directly to the UMWELTBUNDESAMT by the only producer in Austria and thus represent plant specific data.

An implied emission factor was calculated from emission and activity data (see Table 98). The implied emission factor that was calculated from activity and emission data of 1994 was applied to calculate emissions of the years 1990 to 1993 as no emission data was available for these years.

Fertilizer production

For fertilizer production activity data from 1990 to 1994 was taken from national production statistics[11] (STATISTK AUSTRIA), emission and activity data from 1995 onwards was reported by the main producer in Austria. For the years 1990 to 1993 emissions were estimated with information on emissions of the main producer and extrapolation to total production. The emission estimate for 1994 was obtained by applying the average emission factor of 1995-1999.

Table 100: Activity data and implied emission factors for NH_3 emissions from ammonia nitrate, fertilizers and urea production (NFR Category 2 B 5) 1990–2001

	Ammonium Nitrate Production		Fertiliser Production		Urea Production	
Year	Production [t]	IEF [g/t]	Production [t]	IEF [g/t]	Production [t]	IEF [g/t]
1990	15 500	72.39	1 388 621	97.00	282 000	137.00
1991	15 500	72.39	1 273 467	97.00	295 000	137.00
1992	15 500	72.39	1 182 595	97.00	259 000	137.00
1993	15 500	72.39	1 250 804	97.00	305 000	137.00
1994	15 500	19.35	1 222 578	58.85	360 000	137.00
1995	12 432	72.39	916 265	40.60	393 000	121.37
1996	14 457	27.67	940 313	54.88	417 705	72.78
1997	13 718	21.87	924 856	64.77	392 017	71.17
1998	13 993	21.44	977 212	58.74	395 288	98.16
1999	14 514	20.67	988 662	75.25	408 386	81.05
2000	15 510	12.89	1 022 983	71.56	390 185	44.59
2001	14 697	20.41	959 698	58.56	367 218	39.21
Trend 1990-2001	*-5%*	*-72%*	*-31%*	*-40%*	*-30%*	*-71%*

[11] This results in an inconsistency of the time series, as activity data taken from national statistics represent total production in Austria, whereas the data obtained from the largest Austrian producer covers only the production of this producer. It is planned to prepare a consistent time series.

Processes in inorganic and organic chemical industries

All SO_2, NO_X and NMVOC process emissions from chemical industries (both organic and inorganic) are reported together as a total in category *2 B 5 Other*.

Activity data until 1992 were taken from STATISTIK AUSTRIA. In the year 1994 a study commissioned by associations of industries was published [WINDSPERGER & TURI, 1997]. The activity figures for the year 1993 included in this study was used for all years afterwards, as no more up to date activity data is available.

Emission data was taken from the same study [WINDSPERGER & TURI,1997], it was obtained from direct inquiries in industry.

From activity and emission data an emission factor was calculated. Both activity data and implied emission factors are presented in Table 101.

Table 101: Implied emission factors and activity data for process emissions from chemical industries

Year	Processes in Organic Chemical Industries		Processes in Inorganic Chemical Industries		
	IEF NMVOC [g/Mg]	Activity [Mg]	IEF SO_2 [g/Mg]	IEF NO_X [g/Mg]	Activity [Mg]
1990	7 330	1 130 265	2 784	4 225	963 824
1991	9 355	1 030 030	3 206	4 701	889 430
1992	11 537	952 298	3 338	4 743	904 561
1993	13 405	920 317	3 729	5 147	854 909
1994	11 565	1 066 788	3 509	4 842	908 640
1995	10 333	1 193 928	3 509	4 842	908 640
1996	11 565	1 066 788	3 509	4 842	908 640
1997	11 565	1 066 788	3 509	4 842	908 640
1998	11 565	1 066 788	3 509	4 842	908 640
1999	11 565	1 066 788	3 509	4 842	908 640
2000	11 565	1 066 788	3 509	4 842	908 640
2001	11 565	1 066 788	3 509	4 842	908 640
Trend 1990-2001	*+58%*	*-6%*	*+26%*	*+15%*	*-6%*

5.3.2.3 Planned Improvements

A new study on process NO_X emissions will become available in 2003, the findings presented in this study will be taken into account to update emission and activity data for emissions from chemical industry.

5.4 Metal Production (NFR Source Category 2 C)

In this category emissions from iron and steel production and casting as well as process emissions from non-ferrous metal production and casting are considered.

The following table presents total emissions from this category.

Table 102: Emissions from NFR Category 2 C Metal Production

Year	Emissions [Gg]		
	SO_2	NOx	NMVOC
1990	6.70	5.15	0.59
1991	5.36	5.09	0.56
1992	3.90	4.32	0.54
1993	4.16	4.68	0.51
1994	4.48	4.38	0.56
1995	4.39	4.64	0.44
1996	4.86	4.38	0.43
1997	5.13	4.64	0.46
1998	5.18	4.78	0.50
1999	5.23	4.59	0.50
2000	4.81	4.42	0.56
2001	5.28	4.28	0.51
Trend 1990-2001	*-21%*	*-17%*	*-13%*

5.4.1 Iron and Steel

In Austria iron and steel production is concentrated at two integrated sites operated by the same company. About 90% of total iron and steel production in Austria is produced at these two sites in blast furnaces, the rest is produced in electric furnace steel plants.

Emissions from iron cast are also included in this category.

5.4.1.1 Blast Furnaces

The operator of the only blast furnaces in Austria reports total emissions without distinguishing between different processes. Thus all emissions (both emissions due to combustion and process emissions) from *Coke oven*, *Pig Iron Tapping, Basic Oxygen Furnace Steel Plants*, *Rolling Mills (except NMVOC process emissions)*, *Sinter and Palletising Plants* are included in this category.

Emission and activity data were reported directly to UMWELTBUNDESAMT, thus representing plant specific data. An implied emission factor was calculated from the reported emission and activity data as presented in Table 103. Activity data (metal production) as reported by the company is also presented in Table 103.

Table 103: Emissions, implied emission factors and activity data for Iron and Steel Production 1990-2001

Year	Emissions [Gg]			IEF [g/Mg]			Activity [Mg]
	SO_2	NO_x	NMVOC	SO_2	NO_x	NMVOC	
1990	6.05	4.97	0.07	1 542	1 267	17	3 922 000
1991	4.75	4.94	0.06	1 220	1 267	14	3 896 000
1992	3.25	4.14	0.05	904	1 153	13	3 592 000
1993	3.48	4.50	0.05	933	1 203	14	3 736 000
1994	3.79	4.18	0.06	957	1 054	16	3 964 000
1995	3.69	4.44	0.06	816	980	13	4 529 000
1996	4.20	4.20	0.06	1 040	1 039	15	4 041 000
1997	4.43	4.43	0.07	942	943	15	4 700 205
1998	4.46	4.55	0.07	947	967	15	4 707 370
1999	4.52	4.37	0.07	952	920	15	4 751 994
2000	4.06	4.18	0.09	789	812	17	5 150 174
2001	4.53	4.04	0.09	887	791	18	5 107 717
Trend 1990-2001	*-25%*	*-19%*	*34%*	*-42%*	*-38%*	*3%*	*30%*

5.4.1.2 Electric Furnace Steel Plant

Estimation of emissions from electric furnace steel plants was carried out by multiplying an emission factor with production data.

The emission factors of 590 g SO_2 /Mg electric steel produced

330 g NO_x / Mg electric steel produced

60 g NMVOC /Mg electric steel produced

were taken from a study published by the Austrian chamber of commerce, section industry [WINDSPERGER & TURI, 1997]. For NMVOC emissions it was assumed that total VOC emissions as presented in the study are composed of 10% CH_4 and 90% NMVOC (expert judgement UMWELTBUNDESAMT).

Activity data were obtained from the *Association of Mining and Steel Industries* and thus represent plant specific data.

Table 104 presents activity data for electric steel production for the period from 1990 to 2001. As a constant emission factor was used for estimating these emissions, the emissions followed the changes in electric steel production.

Table 104: Activity data and emissions from Electric Steel Production 1990-2001

Year	Production [t]	Emissions [Gg]		
	Electric steel	SO_2	NO_X	NMVOC
1990	370 107	0.22	0.12	0.02
1991	290 324	0.17	0.10	0.02
1992	360 620	0.21	0.12	0.02
1993	410 769	0.24	0.14	0.02
1994	430 949	0.25	0.14	0.03
1995	453 645	0.27	0.15	0.03
1996	396 200	0.23	0.13	0.02
1997	465 578	0.27	0.15	0.03
1998	502 913	0.30	0.17	0.03
1999	485 929	0.29	0.16	0.03
2000	540 539	0.32	0.18	0.03
2001	545 695	0.32	0.18	0.03
Trend 1990-2001	*47%*	*47%*	*47%*	*47%*

Recalculation

There is a difference in the emission values reported last year compared to the ones reported this year because a new time series of activity data was used (previously the value of 1994 was used for all years, now values for all reporting years have been collected).

Table 105: Recalculation difference of emissions from electric furnace steel plants compared to last year's submission

Year	Recalculation Difference [Gg]		
	SO_2	NOx	NMVOC
1990	-0.04	-0.02	-0.004
1991	-0.08	-0.05	-0.008
1992	-0.04	-0.02	-0.004
1993	-0.01	-0.01	-0.001
1994	0.00	0.00	0.000
1995	0.01	0.01	0.001
1996	-0.02	-0.01	-0.002
1997	0.02	0.01	0.002
1998	0.04	0.02	0.004
1999	0.03	0.02	0.003
2000	0.06	0.04	0.007

5.4.1.3 Rolling Mills

The emission factor for VOC emissions from rolling mills was reported directly by industry and thus represents plant specific data. It was assumed that VOC emissions are composed of 10% CH_4 and 90% NMVOC (expert judgement UMWELTBUNDESAMT) resulting in an emission factor of 0.9 g NMVOC/ Mg steel produced.

The activity data were plant specific data and were directly reported by the iron and steel industry.

Table 106 presents activity data (steel produced) as well as NMVOC emissions arising from rolling mills for the period from 1990 to 2001. As a constant emission factor was used for estimating these emissions, the emissions followed the changes in production of steel.

Table 106: Activity data and NMVOC emissions from Rolling Mills 1990-2001

Year	Steel Produced [t]	NMVOC emissions [Gg]
1990	3 922 000	0.0035
1991	3 896 000	0.0035
1992	3 592 000	0.0032
1993	3 736 000	0.0034
1994	3 964 000	0.0036
1995	4 529 000	0.0041
1996	4 041 000	0.0036
1997	4 700 205	0.0042
1998	4 707 370	0.0042
1999	4 751 994	0.0043
2000	5 150 174	0.0046
2001	5 107 717	0.0046
Trend 1990-2001	*+30%*	*+30%*

5.4.1.4 Iron Cast

Activity data were obtained from "Fachverband der Gießereiindustrie Österreichs" (association of the Austrian foundry industry). The applied emission factors were taken from a study commissioned by the same association [FACHVERBAND DER GIEßEREIINDUSTRIE].

Table 107: Emissions, implied emission factors and activity data for cast iron 1990-2001

Year	Emissions [Gg]			Emission Factors [g/Mg]			Activity [Mg]
	SO_2	NOx	NMVOC	SO_2	NOx	NMVOC	
1990	0.03	0.03	0.29	170	170	1 450	196 844
1991	0.03	0.03	0.28	170	170	1 450	191 401
1992	0.03	0.03	0.26	170	170	1 450	176 643
1993	0.03	0.03	0.23	170	170	1 450	155 186
1994	0.03	0.03	0.23	170	170	1 450	158 102
1995	0.02	0.03	0.22	140	160	1 260	176 486
1996	0.02	0.03	0.21	140	160	1 260	166 659
1997	0.02	0.03	0.21	140	160	1 260	169 957
1998	0.03	0.03	0.24	140	160	1 260	190 045
1999	0.03	0.03	0.23	140	160	1 260	181 701
2000	0.03	0.03	0.24	140	160	1 260	191 420
2001	0.03	0.03	0.23	130	151	1 180	192 386
Trend 1990-2001	*-25%*	*-13%*	*-20%*	*-24%*	*-11%*	*-19%*	*-2%*

5.4.2 Non-ferrous Metals

In this category process emissions from non-ferrous metal production as well as from non-ferrous metal cast (light metal cast and heavy metal cast) are considered.

NMVOC emissions from non-ferrous metals only contribute 0.7% to the sector total in 2001. SO_2 emissions from non-ferrous metals contribute 5% to total SO_2 emissions from NFR Category *2 Industry*, the source of these emissions is almost exclusively non- ferrous metal production, the contribution of light and heavy metal cast is only about 0.01% for both categories.

5.4.2.1 Non- ferrous Metals Production

Emission estimates for emissions from Non-ferrous Metal Production were taken from a study [WINDSPERGER & TURI, 1997] and was used for all years: 0.4 Gg SO_2 and 0.01 Gg NMVOC.

5.4.2.2 Non- ferrous Metals Casting

Activity data were obtained from "Fachverband der Gießereiindustrie Österreichs" (association of the Austrian foundry industry). The applied emission factors as presented below were taken from a study commissioned by the same association [FACHVERBAND DER GIEßEREIINDUSTRIE].

Table 108: Emissions, implied emission factors and activity data for light metal cast 1990-2001

Year	Emissions [Gg]			Emission Factors [g/Mg]			Activity [Mg]
	SO_2	NOx	NMVOC	SO_2	NOx	NMVOC	
1990	0.006	0.015	0.187	120	330	4 040	46 316
1991	0.006	0.015	0.187	120	330	4 040	46 252
1992	0.006	0.016	0.192	120	330	4 040	47 434
1993	0.005	0.015	0.180	120	330	4 040	44 626
1994	0.006	0.017	0.213	120	330	4 040	52 786
1995	0.001	0.014	0.104	10	230	1 740	59 834
1996	0.001	0.015	0.112	10	230	1 740	64 462
1997	0.001	0.016	0.124	10	230	1 740	71 001
1998	0.001	0.018	0.136	10	230	1 740	78 174
1999	0.001	0.018	0.139	10	230	1 740	80 105
2000	0.001	0.021	0.161	10	230	1 740	92 695
2001	0.001	0.017	0.129	10	170	1 289	100 061
Trend 1990-2001	*-82%*	*11%*	*-31%*	*-92%*	*-49%*	*-68%*	*116%*

Table 109: Emissions, implied emission factors and activity data for heavy metal cast 1990-2001

Year	Emissions [Gg]			Emission Factors [g/Mg]			Activity [Mg]
	SO_2	NOx	NMVOC	SO_2	NOx	NMVOC	
1990	0.0009	0.0009	0.0118	100	100	1 390	8 525
1991	0.0009	0.0009	0.0125	100	100	1 390	8 957
1992	0.0010	0.0010	0.0134	100	100	1 390	9 624
1993	0.0010	0.0010	0.0135	100	100	1 390	9 733
1994	0.0011	0.0011	0.0150	100	100	1 390	10 758
1995	0.0008	0.0008	0.0123	80	80	1 180	10 384
1996	0.0009	0.0009	0.0132	80	80	1 180	11 204
1997	0.0010	0.0010	0.0141	80	80	1 180	11 955
1998	0.0010	0.0010	0.0144	80	80	1 180	12 214
1999	0.0010	0.0010	0.0146	80	80	1 180	12 334
2000	0.0011	0.0011	0.0156	80	80	1 180	13 214
2001	0.0011	0.0011	0.0157	80	80	1 180	13 285
Trend 1990-2001	*25%*	*25%*	*32%*	*-20%*	*-20%*	*-15%*	*56%*

5.5 Other Production (NFR Source Category 2 D)

5.5.1 Pulp and Paper (2 D 1)

5.5.1.1 Source Category Description

As emissions from pulp and paper production mainly arise from combustion activities, they are included in *1 A 2 Combustion in Manufacturing Industries*.

In this category emissions from chipboard production are considered. NO_X emissions from chipboard production mainly arise from combustion activities. It is also a source for NMVOC emissions.

NO_X emissions from this category amounted to 0.74 Gg in the year 2001, that are 5% of total NO_X emissions from production processes (compared to 3% in 1990). As a constant emission factor was used for estimating these emissions, the emissions followed the changes in production of chipboards.

NMVOC emissions from this source contributed 3% to the sectoral total emissions in 2001, compared to 2% in 1990.

5.5.1.2 Methodological Issues

Emissions were calculated by applying a national emission factor on production data (activity data).

Activity data were taken from STATISTIK AUSTRIA. The values of 1995, 1998 and 2000 were also used for the year after because no data is available for these years. The applied emission factors were taken from a study [WURST et al., 1994], the values of 492 g NO_x /Mg product and 361 g NMVOC / Mg chipboard produced is a mean value of values obtained by inquiries of different companies producing chipboards.

Table 110: Activity data and emissions from Electric Steel Production 1990–2001

Year	Production [t]	Emissions [Gg]	
	Chipboard	NOx	NMVOC
1990	1 121 786	0.55	0.40
1991	1 182 574	0.58	0.43
1992	1 152 004	0.57	0.42
1993	1 115 349	0.55	0.40
1994	1 167 307	0.57	0.42
1995	1 194 262	0.59	0.43
1996	1 194 262	0.59	0.43
1997	1 353 000	0.67	0.49
1998	1 332 015	0.66	0.48
1999	1 332 015	0.66	0.48
2000	1 509 673	0.74	0.54
2001	1 509 673	0.74	0.54
Trend 1990-2001	*35%*	*35%*	*35%*

5.5.1.3 Planned Improvements

In chipboard production gas and wood dust are used as fuels. As wood dust accumulates as waste material during chipboard production it is not reported as a fuel in the energy balance, where fuel gas is reported and included in the fuel input of SNAP Category 03 *Combustion in Production Processes*.

As the used emission factor from SNAP Category 040601 Chipboard Production refers to all emissions from chipboard production but emissions due combustion of fuel gas in chipboard production are also included in SNAP 03, these emissions are counted double. However, it is not possible to separate emissions due to combustion of wood dust from gas as no detailed fuel input figures for chipboard production are available. Further investigation of this subject is planned and if possible the double count will be eliminated.

5.5.1.4 Recalculation

Activity data for the years 1997 onwards have been updated using statistical data. Previously the value of 1995 was used for all years after.

Table 111: Recalculation Difference with respect to last year's submission for emissions from Chipboard Production 1990-2001

Year	Recalculation Difference [Gg]	
	NOx	NMVOC
1990	0.00	0.00
1991	0.00	0.00
1992	0.00	0.00
1993	0.00	0.00
1994	0.00	0.00
1995	0.00	0.00
1996	0.00	0.00
1997	0.08	0.06
1998	0.07	0.05
1999	0.07	0.05
2000	0.16	0.11

5.5.2 Food and Drink (2 D 2)

5.5.2.1 Source Category Description

This category includes NMVOC emissions from the production of bread, wine, sprits and beer.

Table 112 presents NMVOC emissions from *Food and Drink Production* for the period from 1990 to 2001. As a constant emission factor was used for estimating these emissions, the emissions followed the changes in production of food and drink.

Table 112: NMVOC emissions from Food and Drink Production 1990–2001

Year	NMVOC Emissions [Gg]				
	Bread	Wine	Beer	Spirits	Total
1990	0.91	0.21	0.20	0.58	1.89
1991	0.93	0.20	0.20	0.68	2.01
1992	0.97	0.17	0.20	0.55	1.89
1993	0.98	0.12	0.20	0.56	1.86
1994	1.02	0.17	0.20	0.50	1.89
1995	1.01	0.14	0.19	0.58	1.93
1996	1.01	0.14	0.19	0.58	1.92
1997	1.08	0.12	0.19	0.58	1.96
1998	1.25	0.18	0.18	0.58	2.18
1999	1.24	0.18	0.18	0.58	2.18
2000	1.28	0.15	0.17	0.58	2.19
2001	1.28	0.15	0.17	0.58	2.19
Trend 1990-2001	*+42%*	*-26%*	*-11%*	*+0%*	*+16%*

As can be seen in the table, NMVOC emissions varied during the period, but the overall trend was decreasing NMVOC emissions. From 1990 to 2001 NMVOC emissions from this category increased by 16%.

5.5.2.2 Methodological Issues

Emissions were calculated by multiplying the annual production with an emission factor.

The following emission factors were applied:

Bread: 4 200 kg_{NMVOC}/Mg_{bread}

Wine: 65 kg_{NMVOC}/hl_{wine}

Beer: 20 kg_{NMVOC}/hl_{beer}

Spirits: 2 000 kg_{NMVOC}/hl_{spirit}

All emission factors were taken from [BUWAL, 1995] because of the very similar structures and standards of industry in Austria and Switzerland.

Activity data was taken from national statistics (STATISTIK AUSTRIA), for the year 2001 no activity data was available, that's why the value of 2000 was also used for 2001. Table 113 presents activity data for bread, wine, beer and spirits production for the period from 1990 to 2001.

Table 113: Activity data of Food and Drink Production 1990–2001

Year	Spirits [hl]	Beer [hl]	Wine [hl]	Bread [t]
1990	289 134	9 799 090	3 166 290	215 992
1991	338 189	9 971 470	3 093 259	221 149
1992	274 182	10 176 200	2 588 215	229 858
1993	279 831	9 788 520	1 865 479	233 729
1994	249 777	9 934 764	2 646 635	241 691
1995	289 676	9 473 950	2 228 969	241 601
1996	289 676	9 370 693	2 110 332	241 601
1997	289 676	9 303 437	1 801 747	256 055
1998	289 676	8 836 673	2 703 170	296 695
1999	289 676	8 884 269	2 803 383	294 843
2000	289 676	8 725 404	2 338 410	305 845
2001	289 676	8 725 404	2 338 410	305 845

5.5.2.3 Recalculations

Activity data has been updated using statistical data:
For bread previously the value of 1994 was used for all years, now values for all reporting years have been collected.
Also for spirits the whole time series was recalculated, however due to a change of the methodology in the national statistics the last activity value available is the one of 1995. This value was also used for the years onwards.
For wine activity data since 1998 has been updated, for beer the values of 1990, 1991, 1994, 1999 and 2000.
The recalculation difference with respect to last year's submission resulting from these changes are presented in Table 114 (negative numbers indicate that emissions reported this year are lower compared to those reported last year).

Table 114: Recalculation Difference compared to last year's submission for NMVOC emissions from Food and Drink Production 1990–2001

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Difference [Gg]	-0.05	0.07	-0.02	0	0.03	0.03	0.03	0.09	0.31	0.31	0.32

6 SOLVENT AND OTHER PRODUCT USE (NFR SECTOR 3)

6.1 Sector Overview

This chapter describes the methodology used for calculating NMVOC emissions from solvent use in Austria. Solvents are chemical compounds, which are used to dissolve substances as paint, glues, ink, rubber, plastic, pesticides or for cleaning purposes (degreasing). After application of these substances or other procedures of solvent use most of the solvent is released into air. Because solvents consist mainly of NMVOC, solvent use is a major source for anthropogenic NMVOC emissions in Austria. Once released into the atmosphere NMVOCs react with reactive molecules (mainly HO-radicals) or high energetic light to finally form CO_2.

Emission Trends

In the year 2001 this category had a contribution of 58% to Austria's National Total NMVOC emissions. The trend of NMVOC emissions from 1990 to 2001 shows a decrease of 24% for this sector (see Table 115) due to change in activity data.

Table 115: NMVOC Emissions in Austria from 1990-2001 by subcategory

	NMVOC Emissions [Gg]											
	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
3	**167.69**	**140.03**	**122.39**	**115.79**	**115.96**	**122.13**	**121.63**	**130.10**	**126.94**	**126.94**	**126.94**	**126.94**
3 A	14.21	14.75	14.99	13.13	13.15	13.85	13.79	14.76	14.40	14.40	14.40	14.40
3 B	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
3 C	15.99	16.64	16.82	15.16	15.19	15.99	15.93	16.89	16.48	16.48	16.48	16.48
3 D	137.50	108.64	90.58	87.50	87.63	92.29	91.92	98.44	96.06	96.06	96.06	96.06

Note: Estimates of 1998 were used for the years after as preliminary estimate (will be updated for next submission).

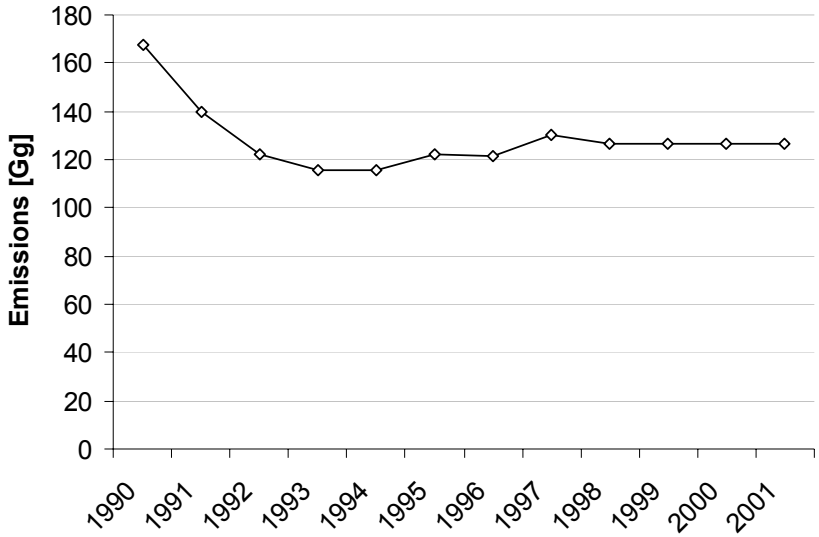

Figure 9: NMVOC Emissions from Category 3 Solvents in Austria from 1990-2001

Quality Assurance and Quality Control (QA/QC)

For the Austrian Inventory there is an internal quality management system, comprising the whole emission inventory (see Chapter 1.3.).

Inquiries from industry show inconsistencies with the statistical data – see *Planned Improvements* at the end of this chapter and in chapter 6.3.

Recalculations

No recalculations were done in this category.

Completeness

Table 116 gives an overview of the SNAP categories included in this chapter and also provides information on the status of emission estimates of all subcategories. A "✓" indicates that emissions from this subcategory have been estimated.

Table 116: Overview of subcategories of Category 3 Solvent and Other Product Use: transformation into SNAP Codes and status of estimation

NFR Category		SNAP	Status			
			NO_X	SO_2	NH_3	NMVOC
3 A	PAINT APPLICATION					
		060102 Paint application: car repairing	NO	NO	NO	✓
		060107 Paint application: wood	NO	NO	NO	✓
		060108 Other industrial paint application	NO	NO	NO	✓
		060109 Other non industrial paint application	NO	NO	NO	✓
		060102 Paint application: car repairing	NO	NO	NO	✓
3 B	DEGREASING AND DRY CLEANING		NO	NO	NO	NO
3 C	CHEMICAL PRODUCTS, MANUFACTURE AND PROCESSING					
		060307 Paints manufacturing	NO	NO	NO	IE
		060312 Textile finishing	NO	NO	NO	✓
3 D	OTHER					
		060501 Anaesthesia	NO	NO	NO	✓
		060505 Fire Extinguishers	NO	NO	NO	NE
		060506 Aerosol Cans	NO	NO	NO	✓
		060508 Other	NO	NO	NO	✓
		060403 Printing industry	NO	NO	NO	✓
		060405 Application of glues and adhesives	NO	NO	NO	✓

6.2 Methodological Issues

Estimation of NMVOC emissions include the following steps:

Step 1: Estimation of the consumption of each product group of the statistical data set.

Step 2: Estimation of the solvent content of each product group of the statistical data set.

Step 3: Estimation of the NMVOC content of solvents.

Emission factors

The NMVOC content of each of the substances is estimated by expert judgement. It is assumed to be on average 85% for all solvents.

Activity data

Steps 1–2 of the above mentioned methodology are performed by using a national study [SCHÖRNER & SCHÖNSTEIN, 1999] As there is no standard IPCC methodology in the GPG for calculating emissions from solvent use a revised version of the CORINAIR detailed methodology is applied.

CORINAIR detailed methodology:

> *This method is based on a mass balance per solvent. The sum of all solvent mass balances equals the NMVOC emission due to solvent use. In formula the solvent mass balance is:*
>
> *consumption = production + import - export - destruction/disposal - hold-up*

The simplified formula without consideration of destruction/disposal and hold-up is:

> consumption = production + import - export

The data used to perform step 1 are from STATISTIK AUSTRIA. The number of solvent containing substances is 83 organic compounds in 65 product categories. Each compound or product category has a specific solvent content, which has to be estimated by expert judgement. Unfortunately statistical data are not consistent because of different categories of the production- and import/export-statistics. Changes in the meaning of product categories lead to further inconsistencies of time series.

It has to be noted that a sectoral approach of the category *Solvent and Other Product Use* is difficult when using the top down methodology. For the sectoral approach some additional information from industry and manufacturers is gathered, which is also used for verification purposes.

Table 117 shows the total solvent use and respective NMVOC emissions.

Table 117: Total solvent consumption and NMVOC emissions from Solvent Use 1990-2001

Year	Solvent Consumption [Gg]	NMVOC Emissions [Gg]
1990	197.29	167.69
1991	164.75	140.03
1992	143.99	122.39
1993	136.22	115.79
1994	136.42	115.96

1995	143.68	122.13
1996	143.10	121.63
1997	153.05	130.10
1998	149.34	126.94
1999 (1)	149.34	126.94
2000 (1)	149.34	126.94
2001 (1)	149.34	126.94

(1) Preliminary estimate: Value of 1998

6.3 Planned Improvements

New data will become available in 2003 from a study which combines the actual top down with a bottom up approach based on inquiries of industry and manufacturers.

7 AGRICULTURE (NFR SECTOR 4)

7.1 Sector Overview

This chapter includes information on the estimation of NH_3, NO_X and NMVOC emissions of the sector *Agriculture* in Austria corresponding to the data reported in Category 4 of the NFR Format. It describes the calculations of source categories *4 B Manure Management, 4 D Agricultural Soils* and *4 F Field Burning of Agricultural Wastes.*

An inventory improvement program has been launched in 2001. Key issues of the implemented improvements of this sector are described in the corresponding *Recalculations* chapters of each subchapter.

To give an overview of Austria's farm structure some information is provided below (according to the 1999 Farm Structure Survey – full survey) [GRÜNER BERICHT 1999, (2001)]:

Agriculture in Austria is small- structured: about 217 500 farms are managed, 41% of these farms manage less than 10 ha cultivated area each. More than 85 000 holdings are classified as situated in less favoured areas. Mountainous areas account for 70% of Austria's federal territory, which is the highest share of all EU countries.

The agricultural area comprises 3.4 million hectares corresponding to ~ 41% of the total territory (forestry ~46%, other area ~13%). The shares of the different agricultural activities are as follows:

- 41% arable land
- 27% grassland (meadows mown several times and seeded grassland)
- 30% extensive grassland (meadows mown once a year, litter meadows, rough pastures, Alpine pastures and mountain meadows)
- 2% other types of agricultural land-use (vineyards, orchards, house gardens, vine and tree nurseries)

7.1.1 Emission Trends

Emission trends per gas

In the year 2001 the sector *Agriculture* contributed 97.0% to Austria's NH_3 emissions. The trend from 1990 to 2001 shows an increase of 2.6%. The share of this sector's NO_X emissions is 2.5%. From 1990 to 2001 NO_X from Agriculture decreased by 3.4%. In 2001 NMVOC emissions contributed 0.8% to Austria's total emissions and decreased by 0.8% in the reported period.

Table 118: Emissions and trends from 1990-2001, Sector 4 Agriculture

Gas	Emissions [Gg]												Trend 1990-2001
	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	
NH_3	50.80	51.82	48.33	54.74	55.89	55.24	53.81	55.18	54.47	53.30	52.20	52.14	2.6%
NO_X	5.20	5.60	4.63	5.36	5.86	5.36	5.16	5.52	5.22	5.12	5.08	5.02	-3.4%
NMVOC	1.94	1.93	1.87	1.84	1.90	1.91	1.89	1.97	1.93	1.97	1.87	1.92	-0.8%

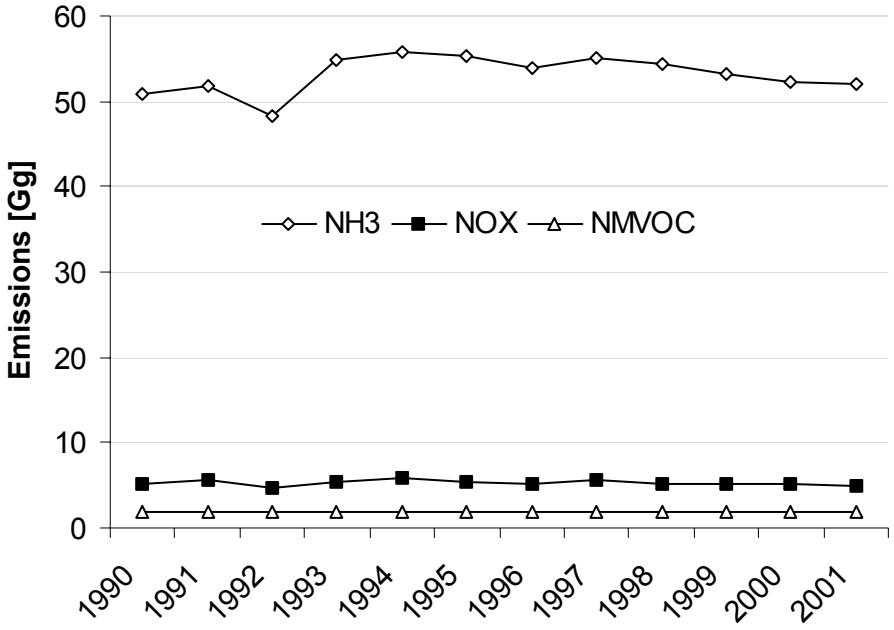

Figure 10: Emissions from NFR Category 4 Agriculture 1990-2001

Emission trends per sector

Table 119 presents emissions and their trends 1990-2001 from sector *Agriculture* by gas and source categories as well as the contribution to the national total emissions.

Table 119: Emissions and trend 1990-2001 from sector Agriculture by gas and source categories

	Sector	Emissions [Gg]												Share in Nat. Total 2001	Trend 1990-2001
		1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001		
NH_3	4 B	42.43	42.45	41.09	46.77	46.38	46.93	45.95	46.26	46.27	45.15	43.88	43.82	*81.6%*	*3.3%*
	4 D	8.35	9.34	7.22	7.95	9.48	8.29	7.83	8.89	8.17	8.12	8.30	8.29	*15.4%*	*-0.7%*
	4 F	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	*0.0%*	*-3.9%*
NO_x	4 B	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	-	-
	4 D	5.19	5.59	4.62	5.35	5.86	5.35	5.15	5.51	5.22	5.11	5.07	5.02	*2.5%*	*-3.4%*
	4 F	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	*0.0%*	*-2.3%*
NMVOC	4 B	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	-	-
	4 D	1.72	1.71	1.65	1.62	1.68	1.69	1.67	1.75	1.71	1.75	1.66	1.71	*0.7%*	*-0.5%*
	4 F	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	*0.1%*	*-3.4%*

7.1.2 Methodology

Source Category 4 B:

For the calculation of NH_3 emissions from cattle and swine the CORINAIR detailed methodology was applied, NH_3 emissions from the remaining livestock categories were estimated using the CORINAIR simple methodology.

Source Category 4 D:

The CORINAIR detailed method was applied for the estimation of NH_3 emissions from synthetic fertilizers as well as from organic fertilizers from the livestock categories cattle and swine. For sheep, horses and poultry the CORINAIR simple methodology was applied.

NH_3 emissions from legume cropland were estimated according the CORINAIR detailed methodology, NH_3 emissions from grassland and pastures were calculated using the CORINAIR simple method.

For the estimation of NO_X and NMVOC emissions the CORINAIR simple method was used.

Source Category 4 F:

CORINAIR simple methodology was used.

7.1.3 Uncertainty Assessment

Table 120 presents uncertainties for emissions, for activity data and for emission factors applied. Uncertainties were estimated or provided by the CORINAIR Guidebook (where default values were used for estimating emissions).

Compared to high uncertainties of emission factors, the uncertainty of the underlying statistical activity data is relatively low.

Table 120: Uncertainties of Emissions and Emission Factors (Agriculture)

Categories		NH_3 Emissions	NO_X Emissions	NMVOC Emissions	EF NH_3	EF NO_X	EF NMVOC
4 B 1 a	Dairy Cattle	--	--	--	+/- 30% [2]	--	--
4 B 1 b	Non-dairy Cattle	--	--	--	+/- 30% [2]	--	--
4 B 8	Swine	--	--	--	+/- 30% [2]	--	--
4 B 3/4/6/9	Sheep, Goats, Horses, Poultry	--	--	--	+/- 30% [2]	--	--
4 D	Agricultural Soils	+/- 25% [3]	+/- 18% [3]	--	+/- 50% [2a]	--	--
Activity Data							
Animal population		+/- 10% [1]					
Acricultural used land		+/- 5% [1]					

(1) [WINIWARTER & RYPDAL, 2001]
(2) CORINAIR
(2a) overall uncertainty of CORINAIR emission factors of all fertilizer types
(3) Calculation by expert (Monte Carlo Analysis), DI Gebetsroither (see also below under "Recalculation")

7.1.4 Recalculations

New methods applied driven different values in comparison to the 2002 submission. More details are given in the "recalculation" chapter of each sub- sector.

Most of the results were provided as studies by scientific institutes. The following reports have been prepared:

Gebetsroither E., Strebl F., Orthofer R., (2002): Greenhouse Gas Emissions from Enteric Fermentation in Austria; ARC Seibersdorf research, July 2002

Amon B., Hopfner- Sixt K., Amon T. (2002): Emission Inventory for the Agricultural Sector in Austria - Manure Management, Institute of Agricultural, Environmental and Energy Engineering (BOKU - University of Agriculture, Vienna), July 2002

Strebl F., Gebetsroither E., Orthofer R., (2002): Greenhouse Gas Emissions from Agricultural Soils in Austria; ARC Seibersdorf research, revised version, Nov. 2002

As these studies are not published, a detailed description of the applied methods is given in the IIR.

7.1.5 Completeness

Table 121 gives an overview of the NFR categories included in this chapter and presents the transformation matrix from SNAP categories. It also provides information on the completeness of emission estimates of all subcategories. A "✓" indicates that emissions from this subcategory were estimated.

Table 121: Overview of subcategories of Category Agriculture: transformation into SNAP Codes and status of estimation

NFR Category		SNAP		Status			
				NO_X	SO_2	NH_3	NMVOC
4 B	**MANURE MANAGEMENT**	**1005**	**MANURE MANAGEMENT REGARDING ORGANIC COMPOUNDS**	✓	NO	✓	NO
		1009	**MANURE MANAGEMENT REGARDING NITROGEN COMPOUNDS**	✓	NO	✓	NO
4 B 1	Cattle	--	--	NE	NO	✓	NO
4 B 1 a	Dairy Cattle	100501	Dairy cows	NE	NO	✓	NO
4 B 1 b	Non-Dairy Cattle	100502	Other cattle	NE	NO	✓	NO
4 B 2	Buffalo	100514	Buffalos	NE	NO	✓	NO
4 B 3	Sheep	100505	Ovines	NE	NO	✓	NO
4 B 4	Goats	100511	Goats	NE	NO	✓	NO
4 B 5	Camels and Lamas	100513	Camels	NE	NO	NE	NO
4 B 6	Horses	100506	Horses	NE	NO	✓	NO
4 B 7	Mules and Asses	100506	Mules and asses	NE	NO	IE (1)	NO
4 B 8	Swine	100503	Fattening pigs	NE	NO	✓	NO
4 B 9	Poultry	100507 100509	Laying hens Other poultry (ducks, gooses,…)	NE	NO	✓	NO
4 B 13	Other	100915	Other animals	NE	NO	✓	NO
4 C	**RICE CULTIVATION**	100103 100103	Rice Field (with fertilizers) Rice Field (without fertilizers)	NO	NO	NO	NO
4 D	**AGRICULTURAL SOILS**	**1001** **1002**	**CULTURES WITH FERTILIZERS** **CULTURES WITHOUT FERTILIZERS**	✓	NO	✓	✓

NFR Category		SNAP		Status			
				NO_X	SO_2	NH_3	NMVOC
4 D 1	Direct Soil Emissions	100205 100206	Grassland Fallows	✓	NO	✓	✓
4 F	**FIELD BURNING OF AGRICULTURAL WASTE**	**1003**	**ON- FIELD BURNING OF STUBBLE, STRAW, …**	✓	✓	✓	✓

(1) included in *4 B 6 Horses*, SNAP 100506

7.1.6 Planned Improvements

Planned Improvements are presented in the respective subcategories of this chapter.

7.2 Manure Management (NFR Category 4 B)

This chapter describes the estimation of NH_3 emissions by housing, storage and spreading of animal excreta. In 2001 84.1% of the agricultural NH_3 emissions were driven by this category.

7.2.1 Source Category Description

From 1990 to 2001 NH_3 emissions from *Manure Management* increased by 3.3% to 43.82 Gg. This is mainly due to the increase of the livestock of swine. The reduction of diary cows is partly counterbalanced by an increase in emissions per animal (because of the increasing gross energy intake, milk production and N excretion of diary cattle since 1990).

Table 122: NH_3 emissions and trend from Manure Management 1990-2001by subcategories and share in National Total.

Sector	NH_3 Emissions [Gg]												Share in Austrian Total 2001	Trend 1990-2001
	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001		
4 B	42.43	42.45	41.09	46.77	46.38	46.93	45.95	46.26	46.27	45.15	43.88	43.82	*81.6%*	*3.3%*
4 B 1	28.58	28.26	26.98	27.14	27.04	27.59	27.27	26.82	26.59	26.59	26.67	25.97	*48.3%*	*-9.1%*
4 B 1 a	12.51	12.14	11.70	11.54	11.32	10.06	10.12	10.65	10.97	10.69	9.68	9.29	*17.3%*	*-25.7%*
4 B 1 b	16.08	16.12	15.28	15.60	15.72	17.53	17.15	16.17	15.62	15.90	16.99	16.69	*31.1%*	*3.8%*
4 B 3	0.81	0.85	0.81	0.87	0.89	0.95	0.99	1.00	0.94	0.92	0.88	0.83	*1.6%*	*3.4%*
4 B 4	0.10	0.11	0.10	0.13	0.13	0.14	0.14	0.15	0.14	0.15	0.15	0.16	*0.3%*	*59.2%*
4 B 6	0.43	0.50	0.53	0.56	0.58	0.63	0.64	0.64	0.65	0.71	0.72	0.74	*1.4%*	*72.8%*
4 B 8	7.04	6.92	7.16	12.13	11.93	11.94	11.61	11.64	12.14	10.97	10.64	11.11	*20.7%*	*57.9%*
4 B 9	5.48	5.82	5.50	5.86	5.74	5.59	5.21	5.90	5.70	5.74	4.74	5.01	*9.3%*	*-8.6%*
4 B 13	0.00	0.00	0.00	0.07	0.08	0.08	0.08	0.11	0.10	0.08	0.08	0.00	*0.0%*	*0.0%*

7.2.2 Methodological Issues

Ammonia emissions from manure management are estimated according to the CORINAIR guidebook. The guidebook outlines a simple and a detailed methodology. Ammonia emissions from cattle and swine are estimated with the detailed methodology. Due to a lack in data availability, NH_3 emissions from the remaining livestock categories were estimated with the simple methodology. These livestock categories contribute about 23% to total NH_3 emissions.

Activity data

Livestock Numbers

[STATISTIK AUSTRIA, 2001] provides national data of annual livestock numbers on a very detailed level. These data are based on livestock counts held in December each year. The activity data used is presented in the following table. The inherent uncertainty is estimated to be about 5% [FREIBAUER & KALTSCHMITT, 2001].

The animal numbers of Young Swine were not taken into account because the emission factors for Breeding Sows already include nursery and growing pigs [SCHECHTNER, 1991].

Table 123: Domestic livestock population and its trend 1990-2001

Animal Categories	Population size [1000 heads] *												Trend 1990-2001
	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	
Dairy	905	876	842	828	810	706	698	720	729	698	621	598	*-33.9%*
Non dairy	1 679	1 658	1 559	1 421	1 519	1 619	1 574	1 478	1 443	1 455	1 534	1 520	*-9.5%*
Mother Cows (suckling cows >2yr)	47	57	60	69	90	210	212	171	154	177	253	258	*448.9%*
Cattle > 2yr	146	151	145	158	149	153	154	162	157	159	160	148	*1.4%*
Young Cattle <1yr	925	894	832	706	707	691	670	630	635	631	655	659	*-28.8%*
Young Cattle 1-2yr	561	555	521	573	573	564	537	514	496	488	466	455	*-18.9%*
Sheep	310	326	312	334	342	365	381	384	361	352	339	320	*3.4%*
Horses	49	58	61	65	67	72	73	74	75	82	83	85	*72.8%*
Swine	3 688	3 638	3 720	3 820	3 729	3 706	3 664	3 680	3 810	3 433	3 348	3 440	*-6.7%*
Fattening Pig >50kg	534	525	547	1 355	1 323	1 312	1 262	1 268	1 375	1 251	1 212	1 264	*n.a.*
Swine for breeding > 50kg	372	364	375	396	395	401	399	398	386	344	334	350	*-5.9%*
Young Swine <50kg	2 784	2 749	2 798	2 069	2 011	1 992	2 003	2 013	2 049	1 838	1 802	1 826	*n.a.*
Poultry	13 821	14 397	13 684	14 508	14 179	13 959	12 980	14 760	14 307	14 498	11 787	12 572	*-9.0%*
Chicken	13 139	13 479	12 872	13 589	13 266	13 157	12 215	13 950	13 540	13 798	11 077	11 905	*-9.4%*
Other Poultry	682	918	812	920	913	802	765	811	767	700	709	666	*-2.0%*
Other	0	0	0	37	38	40	42	56	50	39	38	0	*0*

* Differences to totals are due to rounding
n.a.: not applicable because counting methodology changed in the time period from 1990-2001

The statistical data as presented above generally provides consistent time series. However, there have been minor inconsistencies for the categories *Cattle, Poultry, Horses* and *Other*. For swine the time series of population size of the sub categories are not consistent due to a change in the counting methodology in 1993. However, this sub category data for swine is not used for estimating emissions.

Manure Management Systems

In Austria national statistics on manure management systems are not available. Up to now, a single comprehensive survey has been performed [KONRAD, 1995]. The survey was carried out from 1989 to 1992 and was first published in 1992 (Table 124). According to expert judgements a differentiation between conventional and organic systems would result in very high uncertainties. Thus, Austria's manure management systems distribution is estimated with data collected by [KONRAD, 1995] for the whole period of 1990-2001.

Table 124: Manure Management System distribution in Austria taken from [KONRAD, 1995]

Livestock category	Liquid/Slurry [%]	Solid Storage [%]	Pasture/range/paddock [%]
dairy cattle summer	16.7	62.0	21.3
dairy cattle winter	21.2	78.8	---
Dairy cattle winter/summer	18.95	70.4	10.65

suckling cows summer	16.7	62.0	21.3
suckling cows winter	21.2	78.8	---
suckling cows winter/summer	18.95	70.4	10.65
cattle 1 –2 years summer	7.7	39.9	52.4
cattle 1 –2 years winter	16.2	83.8	---
cattle 1 –2 years winter/summer	11.95	61.85	26.2
cattle < 1 year	28.75	71.25	---
non dairy cattle > 2 years	48.6	51.4	---
breeding sows	70	30	---
fattening pigs	71.9	28.1	---
nursery and growing pigs	81.38	18.62	---

Manure Management Systems are distinguished for *Dairy Cattle*, *Suckling Cows* and *Cattle 1–2 years* in "summer situation" and "winter situation" (Table 124). During the summer months, a part of the manure from these livestock categories is managed in "pasture/range/paddock". The value for "pasture/range/paddock" is estimated as follows: During summer, 14.1% of Austrian dairy cows and suckling cows are on alpine pastures 24 hours a day. 43.6 % are on pasture for 4 hours a day and 42.3 % stay in the housing for the whole year [KONRAD 1995]. "Alpine pasture" and "pasture" are counted together as MMS "pasture/range/paddock". As "pasture" only lasts for about 4 hours a day, only 1/6 of the dairy cow pasture-% (43.6%) is added to the total number. This results in 21.3% "pasture/range/paddock" during summer. In winter, "pasture/range/paddock" does not occur in Austria. Summer and winter each last for six months.

Estimation of NH_3 emissions includes one additional aspect: the differentiation between tied and loose housing systems for dairy cattle because NH_3 emissions from tied systems are much lower than from loose housing systems. In Austria, 98 % of the dairy cattle are kept in tied systems (KONRAD 1995). Thus, 98 % of N is excreted in tied systems and 2 % in loose housing systems. As there are currently no exact data available on manure management systems in Austrian animal husbandry, manure management system distribution within these two systems (solid system, liquid system, grazing) is assumed to be the same.

All other cattle livestock categories are assumed to be housed in loose houses.

7.2.2.1 Cattle (4 B 1) and Swine (4 B 8)

In the detailed methodology, the flow of total ammoniacal nitrogen (TAN or mineral N) is followed through the manure management system. The relative volumes of flow through the different pathways are determined by country-specific information on animal husbandry and manure management systems, while the proportion volatilised as ammonia at each stage in the system is treated as a percentage, based on measured values and expert judgement.

The detailed methodology requires input data of animal numbers, nitrogen excretion and manure management systems.

Total NH_3 emissions from Category 4 B 1 and 4 B 8 are calculated as follows:

$$NH_{3\ Total} = NH_{3\ (housing)} + NH_{3\ (storage)} + NH_{3\ (spreading)}$$

NH_3 emissions from housing

NH_3 emissions from dairy cattle (solid storage system) are estimated by multiplying N excretion in solid systems with the solid storage emission factor. NH_3 emissions from dairy cattle (liquid slurry systems) are estimated by multiplying N excretion in liquid slurry systems with the liquid slurry emission factor:

NH_3 (solid storage) = Nex (solid storage) x EF(ss)
NH_3 (liquid slurry) = Nex (liquid slurry) x EF(ls)

The sum of both gives NH_3 emitted from housing:

NH_3 (housing) = NH_3(solid storage) + NH_3 (liquid slurry)

Emission Factors

Table 125 gives emission factors for NH_3 emissions from animal housing. As far as possible, Swiss default values as given in the CORINAIR guidelines have been chosen to compile the Austrian inventory. Swiss animal husbandry is closest to Austrian animal husbandry. If no CORINAIR emission factors from Switzerland were available, the CORINAIR German default values were used.

Table 125. Emission factors for NH_3 emissions from animal housing used in the Austrian inventory

Manure management system	CORINAIR Emission factor [kg NH_3 (kg N excreted)$^{-1}$]
Dairy cattle, tied systems, liquid slurry system	0.04[1]
Dairy cattle, tied systems, solid storage system	0.039[1]
Diary cattle, loose houses, liquid slurry system	0.118[1]
Diary cattle, loose houses, solid storage system	0.118[1]
Other cattle, loose houses, liquid slurry system	0.118[1]
Other cattle, loose houses, solid storage system	0.118[1]
Fattening pigs, liquid slurry system	0.15[2]
Fattening pigs, solid storage system	15 % of total N + 30 % of the remaining TAN[2]
Sows plus litter, liquid slurry system	0.167[1]
Sows plus litter, solid storage system	0.167[1]

[1]…DÖHLER ET AL., 2001
[2]…EIDGENÖSSISCHE FORSCHUNGSANSTALT, 1997

N excretion by manure management system

Country-specific N excretion rates for Austrian cattle and swine were calculated using following formula:

N excretion per animal waste management system:

$$Nex_{(AWMS)} = \sum_{(T)} [N_{(T)} \times Nex_{(T)} \times AWMS_{(T)}]$$

$Nex_{(AWMS)}$ = N excretion per animal waste management system [kg yr^{-1}]
$N_{(T)}$ = number of animals of type T in the country (see Table 123)
$Nex_{(T)}$ = N excretion of animals of type T in the country [kg N animal^{-1} yr^{-1}] (see Table 126 and Table 127)
$AWMS_{(T)}$ = fraction of $Nex_{(T)}$ that is managed in one of the different distinguished animal waste management systems for animals of type T in the country (see Table 124)
(T) = type of animal category

N excretion from Austrian *Dairy Cattle* was estimated according to [GRUBER & STEINWIDDER, 1996], who intensively reviewed research on N excretion versus annual milk yield (Table 126).

Table 126: N excretion of Austrian dairy cows for the period 1990-2001

Year	Milk yield [kg yr^{-1}]	*Nitrogen excretion [kg/animal/yr]*	*Year*	Milk yield [kg yr^{-1}]	*Nitrogen excretion [kg/animal/yr]*
1990	3 791[1]	55.59	1996	4 346[1]	58.37
1991	3 848[2]	55.74	1997	4 510[1]	59.45
1992	3 907[1]	55.89	1998	4 548[1]	60.53
1993	3 991[1]	56.05	1999	4 716[1]	61.62
1994	4 076[1]	56.20	2000	4 977[1]	62.70
1995	4 217[1]	57.28	2001	5 252[3]	62.75

[1] BMLUF 2001
[2] BMLUF 1992
[3] extrapolated

N excretion rates for the livestock categories of *Non-Dairy Cattle* were derived from different sources (Table 127). The milk production of *Suckling Cows* is about 3 000 kg, thus the value of N excretion of *Dairy Cattle* with that annual milk production taken from [GRUBER & STEINWIDDER, 1996] was used for this livestock category. N excretion of *Cattle 1-2 years* were taken from this study as well. However, [GRUBER & STEINWIDDER, 1996] do not give data on N excretion of *Cattle <1 year* and *Cattle >2 years.* As there is no significant difference in husbandry of these livestock categories, N excretion of *Cattle <1 year* was taken from the revised German inventory on ammonia emissions and for N excretion of *Cattle >2 years* the value of the Swiss inventory was used.

Austrian specific N excretion values for *Swine* were also taken from [GRUBER & STEINWIDDER, 1996] (Table 127).

Table 127: N excretion values used for calculation of NH_3 emissions from Manure Management

Livestock category	Nitrogen excretion [kg per animal per yr]	Livestock category	Nitrogen excretion [kg per animal per yr]
suckling cows[1]	51.9[2]	Sheep	20.0[6]
cattle 1 – 2 years	42.2[2]	Goats	20.0[6]
cattle < 1 year	16.0[3]	Horses	50.0[7]
cattle > 2 years	60.0[4]	Chicken	0.8[6]
breeding sows[5]	26.9[2]	Other Poultry	2.0[7]
fattening pigs	15.0[4]	Other Animals	20.0[6]

(1) annual milk yield: 3 000 kg
(2) GRUBER & STEINWIDDER 1996
(3) DÖHLER ET AL. 2001
(4) Eidgenössische Forschungsanstalt für Agrarökologie und Landbau Zürich-Reckenholz 1997
(5) 2.1 litters per year
(6) IPCC DEFAULT
(7) CORINAIR

NH_3 emissions from storage

NH_3 emissions from storage are estimated from the amount of N left in the manure when the manure enters the storage. This amount of N is calculated as following:

From total N excretion the N excreted during grazing (see above) and the NH_3-N losses from the housing (see above) are subtracted. The remaining N enters the store.

Emission Factors

During manure storage, NH_3 is lost. These losses are estimated with CORINAIR default emission factors given in Table 128.

Table 128. NH_3-emission factors for manure storage

Manure storage system	CORINAIR Emission factor [kg NH_3 (kg TAN)$^{-1}$]
Cattle, liquid slurry system	0.15[1]
Cattle, solid storage system	0.30[1]
Pigs, liquid slurry system	0.12[1]
Pigs, solid storage system	0.30[1]

[1]…EIDGENÖSSISCHE FORSCHUNGSANSTALT, 1997

Emission factors only distinguish between cattle and pigs and between liquid slurry systems and solid storage systems (farmyard manure). According to the CORINAIR guidelines, uncertainties in ammonia emission factors are about ± 30%. As there is currently no information on storage systems in Austria, it is not possible to estimate NH_3 emissions from manure store more accurately.

TAN content in excreta

The detailed method makes use of the total ammoniacal nitrogen (TAN) when calculating emissions. The initial share of TAN must be known as well as any transformation rates between organic N and TAN. TAN content for Austrian cattle and pig manure is given in [SCHECHTNER, 1991].

Table 129: TAN content for Austrian cattle and pig manure after SCHECHTNER (1991)

Manure	TAN content for Austria [%]
cattle – solid storage system	15.0
cattle – liquid slurry system	50.0
pig – solid storage system	19.5
pig – liquid slurry system	65.0

Land spreading of animal excreta

Manure application is connected with NH_3 and N_2O losses that depend on the amount of manure N. The amount of N left in the manures after housing and storage was calculated as follows:

From total N excretion by Austrian livestock (see Table 126 and Table 127), the following is subtracted:

- NH_3-N losses from the housing (see below)
- NH_3-N losses during manure storage (see below)
- N_2O-N losses from manure management (see NIR 2003)

- N excreted during grazing (see formula N excretion per animal waste management system given in chapter "NH_3 emissions from housing")

The remaining N (calculated for each relevant animal category) is spread to agricultural soils ("manure N left for spreading").

NH_3-N losses are calculated as follows:

$$NH_3\text{-}N = NH_3\text{-emissions}_{(housing,\ storage)} * (14/17)$$

N_2O-N losses are calculated as follows:

$$N_2O\text{-}N = N_2O\text{-emissions}_{(manure\ management)} * (28/44)$$

NH_3

For *cattle and swine* the detailed CORINAIR Methodology (Tier 2) was applied.

This method distinguishes between the kind of waste produced by each animal sub-category: solid manure and liquid slurry. This is relevant, because TAN contents and therefore NH_3 emissions are highly dependent on the quality of waste and organic matter content in slurry. Furthermore, the detailed methodology suggests different NH_3-emission-factors depending on the target of land spreading: emissions are thought to be higher on grassland soils than on cropland soils, due to infiltration of applied animal waste being slower there.

$$NH_3\text{-}N_{spread} = N_{exLFS} * (Frac_{SS} * F_{TAN\ SS} * EF\text{-}NH_{3\ spread\ SS} + Frac_{LS} * F_{TAN\ LS} * EF\text{-}NH_{3\ spread\ LS})$$

NH_3-N_{spread}	=	NH_3-N emissions driven by intentional spreading of animal waste from Manure Management systems on agricultural soils (droppings of grazing animals are not included!)
N_{exLFS}	=	Annual amount of nitrogen in animal excreta left for spreading on agricultural soils, corrected for losses during manure management; it does not include nitrogen from grazing animals (see above)
$Frac_{SS}$	=	Fraction of nitrogen left for spreading produced as farmyard manure in a solid waste management system (see Table 124)
$Frac_{LS}$	=	Fraction of nitrogen left for spreading produced as liquid slurry in a liquid waste management system (see Table 124)
$F_{TAN\ SS}$	=	Fraction of total ammoniacal nitrogen (TAN) in animal waste produced in a solid waste management system (see Table 129)
$F_{TAN\ LS}$	=	Fraction of total ammoniacal nitrogen (TAN) in animal waste produced as slurry in a liquid waste management system (see Table 129)
$EF\text{-}NH_{3\ spread\ SS}$		Emission factor for NH_3 from animal waste from solid manure system (farmyard manure) spread on agricultural soils (see below)
$EF\text{-}NH_{3\ spread\ LS}$		Emission factor for NH_3 from animal waste from liquid slurry waste management system spread on agricultural soils (see below)

No appropriate Austrian specific data were available to use different emission factors depending on the target of spreading, i.e. whether animal waste is spread on grassland or cropland soils. Thus, following assumptions were made:

- To avoid underestimation of emissions, emission factors for spreading without incorporation were used.
- Animal waste from solid systems (farmyard manure) is spread on cropland soils only. This is in compliance with CORINAIR detailed method, which does not provide an emission factor for spreading of solid waste on grassland soils.
- For liquid slurry it was assumed, that cattle slurry is applied to grassland soils, while pig slurry is applied to arable soils. This assumption is driven by the idea, that feed for pig husbandry is produced on cropland soils, while fertilized grassland soils serve as feed producing area for cattle husbandry. CORINAIR default values were used:

Cattle: spreading of liquid slurry on grassland: 0,6
Pigs: spreading of liquid slurry on arable land: 0,25

7.2.2.2 Sheep (4 B 3), Goats (4 B 4), Horses (4 B 6), Poultry (4 B 9) and Other Animals (4 B 13)

The simple methodology uses an average emission factor per animal for each livestock category and multiplies this factor by the number of animals counted in the annual agricultural census. Table 130 presents the recommended ammonia emission factors for the different livestock categories given in the CORINAIR guidelines.

Emission factors presented in Table 130 include emissions from housing and storage. Emissions from surface spreading of manures are calculated under "land spreading of animal excreta" (see below)

Table 130: Default CORINAIR ammonia emission factors for the simpler methodology to calculate NH_3 emissions from manure management.[1]

NFR Category	Livestock category	NH_3 loss housing [kg NH_3 $head^{-1}$ yr^{-1}]	NH_3 loss storage [kg NH_3 $head^{-1}$ yr^{-1}]
4 B 3	Sheep [2]	0.24	
4 B 4	Goats [2]	0.24	
4 B 6	Horses (mules and asses included)	2.9	
4 B 9	Laying hens	0.19	0.03
4 B 9	Other Poultry (ducks, geese, turkeys)	0.48	0.06
4 B 13	Other animals	0.24	

[1] Emissions are expressed as kg NH_3 per animal, as counted in the annual agricultural census
[2] The emission factors are calculated for female adult animals; the emissions of the young animals are included in the given values.

The CORINAIR guidelines do not give default values for NH_3 emissions from the livestock category *Other Animals*. In Austria deer dominates this livestock category. NH_3 emissions from *Other Animals* are assumed to be similar to NH_3 emissions from grazing sheep (0.88 kg NH_3 $head^{-1}$ yr^{-1}). This is the most similar livestock category to deer as deer are kept on pasture.

CORINAIR distinguishes the livestock category "chicken" into "laying hens" and "broilers". In Austria chicken numbers are not distinguished. Thus, NH_3 emissions from both laying hens and broilers are estimated with the laying hen emission factor (and therefore slightly overestimated).

Land spreading of animal excreta

For *Sheep, Horses, Poultry* the simple CORINAIR methodology is applied:

The share of mineral N (total ammoniacal nitrogen, TAN) is estimated by application of a default factor for each animal waste category. NH_3 losses are derived in a second step based on TAN values by application of an CORINAIR default emission factor ($EF\text{-}NH_{3\ spread}$), which is also dependent on the quality of animal waste.

$$NH_3\text{-}N_{spread} = N_{exLFS} * Frac_{TAN} * EF\text{-}NH_{3\ spread}$$

$NH_3\text{-}N_{spread}$ = Emissions of NH_3-N driven by intentional spreading of animal waste from manure management systems on agricultural soils (droppings of grazing animals are not included) [t N]

N_{exLFS} = Annual amount of nitrogen in animal excreta left for spreading on agricultural soils, corrected for losses during manure management; it does not include nitrogen from grazing animals (see above).

$Frac_{TAN}$ = Fraction of total ammoniacal nitrogen (= mineral nitrogen) in animal manure [CORINAIR, 1996]

$EF\text{-}NH_{3\ spread}$ = Emission factor for NH_3 volatised from spreading of mineral nitrogen [CORINAIR, 1996]

7.2.3 Uncertainties

Uncertainties are presented in Table 120

7.2.4 Recalculations

For the first time NH_3 emissions from manure management were estimated with the detailed methodology (dairy cows, other cattle, fattening pigs, sows) or with the simple methodology (sheep and goats, horses, mules and asses, laying hens, broilers, other poultry, fur animals, any other animals) following the instructions in the updated CORINAIR guidelines (EMEP/CORINAIR, 2002). In contrast to submission 2002 it was assumed that most of the Austrian dairy cows (98%) are housed in tied systems that emit less NH_3.

Table 131: Difference to last submission of NH_3 emissions from subcategories of Category 4 B

NFR Categories	[Gg NH_3]										
	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
4 B MANURE MANAGEMENT	-29.90	-28.74	-27.08	-20.89	-20.70	-18.38	-17.94	-17.22	-17.01	-16.70	-15.80
4B1 Cattle	-32.80	-31.75	-30.08	-28.49	-28.19	-25.80	-25.01	-24.55	-24.46	-23.59	-22.22
4B1a Dairy	-19.16	-18.52	-17.76	-17.44	-17.03	-14.66	-14.29	-14.56	-14.54	-13.73	-12.05
4B1b Non- Dairy	-13.65	-13.23	-12.32	-11.05	-11.16	-11.13	-10.72	-9.98	-9.92	-9.85	-10.17
4B3 Sheep	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4B4 Goats	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4B6 Horses	-0.11	-0.13	-0.14	-0.15	-0.15	-0.17	-0.17	-0.17	-0.17	-0.19	-0.18
4B8 Swine	1.02	0.97	1.10	5.48	5.42	5.44	5.23	5.21	5.45	4.91	4.76
4B9 Poultry	1.99	2.17	2.04	2.19	2.15	2.06	1.93	2.16	2.08	2.08	1.76
4B13 Other	0.00	0.00	0.00	0.07	0.08	0.08	0.08	0.11	0.10	0.08	0.08

NH_3 emissions from manure management include emissions from housing and storage, but not from spreading and grazing, whereas data of submission 2002 included NH_3 emissions from all stages of manure management. Therefore, only total emissions of agriculture, i.e. the sum of manure management and agricultural soils are fully comparable with respective sums of submission 2002 data.

7.2.5 Planned Improvements

Studies on Austria's distribution of manure management systems are planned.

7.3 Agricultural Soils (4 D)

This chapter describes the estimation of ammonia (NH_3), nitrogen oxide (NO_x) and non-methane volatile organic compounds (NMVOC) emissions from source category *Agricultural Soils*. In 2001 15.9% of the agricultural NH_3 emissions, 99.9% of the agricultural NO_x emissions and 88.8% of the agricultural NMVOC emissions were driven by this source category.

7.3.1 Source Category Description

In 2001 NH_3 emissions from this source category contributed 15.4% to Austria's total. The emission trend shows a slight decrease by 0.7% since 1990. In the same period NO_X emissions of Agricultural Soils decreased by 3.4%. 2001 they contributed 2.5% to Austrian's total emissions. This source category's NMVOC emissions contribute only a negligible part (0.7% in 2001). The emission trend is quite stable (0.5% below 1990 levels).

Table 132: Emissions from Agricultural Soils by gas

Gas	Sector 4 D by gas [Gg]												Share in Austrian Total 2001	Trend 1990-2001
	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001		
NH_3	8.35	9.34	7.22	7.95	9.48	8.29	7.83	8.89	8.17	8.12	8.30	8.29	*15.4%*	*-0.7%*
NO_X	5.19	5.59	4.62	5.35	5.86	5.35	5.15	5.51	5.22	5.11	5.07	5.02	*2.5%*	*-3.4%*
NMVOC	1.72	1.71	1.65	1.62	1.68	1.69	1.67	1.75	1.71	1.75	1.66	1.71	*0.7%*	*-0.5%*

7.3.2 Methodological Issues

Emissions of NH_3, NO_x and NMVOC were calculated following the CORINAIR methodology. Wherever feasible, the "detailed methodology" as recommended by CORINAIR has been applied.

Activity Data

Data for necessary input parameters (activity data) were taken from the following sources:

Table 133: Data sources for nitrogen input to Agricultural Soils

NFR Category	Activity	Data Sources
4 D 1	Synthetic Fertilizers	Mineral fertilizer consumption: [ELECTRONIC DATA HANDBOOK, 2001] Urea fertilizer application in Austria: Sales data RWA, 2002[(2)]
4 D 1	Organic Fertilizers	Calculations following [GRUBER & STEINWIDDER, 1996]
4 D 1	Legume Cropland (N-fixing Crops)	Cropped area legume production: [GRÜNER BERICHT, 1999][(1)], Land use [ha]: Ministerial Reports, [ELECTRONIC DATA HANDBOOK, 2001] Harvest amount: [ELECTRONIC DATA HANDBOOK, 2001]
4 D 1	Grazing Animals	

[1] http://www.awi.bmlf.gv.at (Bundesanstalt für Agrarwirtschaft des BMLFUF)

[2] RWA: Raiffeisen Ware Austria

Detailed data about the use of different kinds of fertilizer are available until 1994, because until then, a fertilizer tax („Düngemittelabgabe") had been collected. Data about the total syn-

thetic fertilizer consumption are available for amounts (but not for fertilizer types) from the statistical office (STATISTIK AUSTRIA) and from an agricultural marketing association (Agrarmarkt Austria, AMA). Annual sales figures about urea are available for the years 1994 onwards from a leading fertilizer trading firm (Raiffeisen Ware Austria, RWA). These sources were used to get a time series of annual fertilizer application distinguishing urea fertilizers and other fertilizers ("mineral fertilizers").

The time series for fertilizer consumption is presented in Table 134. From the different synthetic nitrogen or combined fertilizers applied in Austria, only between 2 and 6% are urea fertilizers.

Table 134: Mineral fertiliser N consumption in Austria 1990-2001

Year	Nutrient Consumption [t N/yr]	of which Urea	Fraction Urea from total N fertiliser consumption [%]	Data Source
1990	140 379	3 965	2.8	estimated, GB[1]
1991	180 388	3 965	2.2	GB
1992	91 154	3 886	4.3	GB
1993	123 634	3 478	2.8	GB
1994	177 266	4 917	2.9	GB
1995	127 963	5 198	4.1	RWA[2]
1996	112 641	4 600	4.1	RWA
1997	143 818	6 440	4.5	RWA
1998	113 301	6 440	5.7	RWA
1999	113 409	6 808	6.0	RWA
2000	120 541	6 900	5.7	RWA
2001	120 541	6 900	5.7	RWA

1 [GRÜNER BERICHT, 1999]
2 Raiffeisen Ware Austria, sales company

The yearly numbers of the legume cropping areas were taken from [GRÜNER BERICHT, 1999]. Data of agricultural land use were taken from [STATISTISCHES JAHRBUCH, 2001].

Table 135: Legume cropping areas and agricultural land use, 1990-2001

Areas [ha]												
Legume	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
peas	40 619	37 880	43 706	44 028	38 839	19 133	30 782	50 913	58 637	46 007	41 114	38 567
soja beans	9 271	14 733	52 795	54 064	46 632	13 669	13 315	15 217	20 031	18 541	15 537	16 336
horse/field beans	13 131	14 377	14 014	1 064	10 081	6 886	4 574	2 783	2 043	2 333	2 952	2 952
clover hey, lucerne,..	57 875	65 467	64 379	68 124	72 388	71 024	72 052	75 976	76 245	75 028	74 266	72 196
Areas [1000 ha]												
Land use	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Cropland (total)	1 408	1 427	1 418	1 402	1 403	1 403	1 403	1 386	1 386	1 386	1 382	1 380
Grassland (total)	1 993	1 993	1 993	1 982	1 982	1 977	1 977	1 980	1 980	1 957	1 957	1 957
Grassland (extensive)	846	846	846	848	848	857	857	851	851	833	833	833

Harvest data were taken from [GRÜNER BERICHT, 2001], partly adopted from [JONAS & NIELSEN, 2002] and are presented in Table 136.

Table 136: Harvest Data, 1990-2001

Harvest [1000 t]												
	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
clover-hey	717	797	587	628	743	823	858	962	1 014	1 025	1 025	1 025
soja bean	18	37	81	103	105	31	27	34	51	50	33	33
horse- /fodderbean	41	37	31	29	27	17	10	6	5	6	7	7
peas	145	133	137	107	134	60	93	162	178	140	97	97

7.3.2.1 Application of fertilizers

Synthetic fertilizers

NH_3

For the calculation of NH_3 emissions from synthetic fertilizers the CORINAIR detailed method was applied. This method uses specific NH_3 emission factors for different types of synthetic fertilizers and for different climatic conditions (see CORINAIR Emission Inventory Guidebook, Tab 5.1, p. B1010-15; Group III countries"). According to CORINAIR, Austria belongs to Group III "*temperate and cool temperate countries*" with largely acidic soils

In Austria, full time-series data only for urea and non-urea synthetic fertilizers (see Table 134), but with no further specifications, are available. For urea the CORINAIR default value of 0.15 t NH_3-N per t of fertilizer-N was applied. As calcium-ammonium-nitrate and ammonium-nitrate fertilizers represent the dominant form of non-urea synthetic fertilizers being used in Europe [FREIBAUER AND KALTSCHMITT, 2001], an average emission factor of 0.02 t NH_3-N per t of fertilizer-N was applied (expert judgement ARC Seibersdorf research GmbH) for fertilizers other than urea.

NO_X

The CORINAIR simple method was applied. Emissions of NO_x are calculated as a fixed percentage of total fertilizer nitrogen applied to soil. The CORINAIR recommended emission factor is based on measured fertilizer losses (which were between 0.003% and 11% of the applied fertilizer nitrogen [CORINAIR Guidebook 1999, p. B1010-5;].

For all mineral fertilizer types the CORINAIR recommended emission factor of 0,3 % (i.e. 0,003 t NO_x-N per t applied fertilizer-N) was used.

Organic Fertilizers

Only NO_X-emissions are considered. NH_3 emissions are reported under source category 4 B (see chapter 0 - land spreading of animal excreta).

NO_x losses from animal manure spreading are not addressed explicitly in the CORINAIR Guidebook. [FREIBAUER AND KALTSCHMITT, 2001] suggest in their calculation of an European greenhouse gas inventory a conservative estimate of 1% of manure nitrogen being emitted in the form of NO_x-N. Following these recommendations, an emission factor of 0,01 t NO_x-N per t of organic fertilizer-N spread on agricultural soils was used.

7.3.2.2 Unfertilised cultures

Legume cropland

NH_3

CORINAIR detailed methodology was applied using the CORINAIR default emission factor of 0.01 t of NH_3-N per t of N. The amount of N-input to soils via N-fixation of legumes (F_{BN}) was estimated on the basis of the cropping areas:

$$F_{BN} = LCA * B_{Fix} / 1000$$

F_{BN} = Annual amount of nitrogen input to agricultural soils from N-fixation by legume crops [t]
LCA = Legume cropping area [ha]
B_{Fix} = Annual biological nitrogen fixation rate of legumes [kg/ha]

Activity data (LCA) for the years 1990-2001 can be found in Table 135. Values for biological nitrogen fixation (120 kg N/ ha for peas, soy beans and horse/field beans and 160 kg N/ ha for clover- hey, respectively) were taken from a study by the Federal Environmental Agency [GÖTZ, 1998]; activity data remained constant over the time series.

NO_X

According to the CORINAIR guidebook definition, unfertilized cropland includes legume production on agricultural areas. For the calculation of NO_X emissions from unfertilized cropland the CORINAIR simple method was applied.

Nitrogen input through legume crop residues is calculated according to the CORINAIR recommended procedure. Nitrogen fixed in biomass, given in annual harvest data (see Table 136) is multiplied with the expansion factor for crop residues [GÖTZ, 1998]. The same NO_x emission factor as for the emissions from synthetic fertilizers was applied (0.003 t NO_x-N per t applied fertilizer-N).

Grassland and Pastures

The method applied for calculation of the emissions is the CORINAIR simple method.

According to the CORINAIR Guidebook, unfertilized pasture grassland represents areas that receive nitrogen through manure from grazing animals but no fertilizer inputs. For these areas the CORINAIR default value of 4 kg NH_3-N per ha was applied.

NMVOC emissions from vegetation

The method applied for calculation of the emissions is the CORINAIR simple method.

Biogenic emissions from vegetation canopies of natural grasslands are derived as described in the following equation [CORINAIR, 1999, p. B 1104-7, Table 4.1]:

$$E\text{-}NMVOC = CA * \varepsilon\text{-}NMVOC * D * \Gamma$$

E-NMVOC = Annual NMVOC emissions from vegetation [t]
CA = Cropping area of vegetation [ha]
ε–NMVOC = NMVOC potential emission rate per unit of dry matter and time unit [mg / dry matter.hours]
D = Foliar biomass density [t dry matter / ha]
Γ = Time integral (over 6 or 12 months) of emission hours. This value includes a correction variable that represents the effect of short-term temperature and solar radiation changes [hours]

This method is also suggested to be applied for fertilized cultures. The recommended parameter values for Austria are outlined in Table 137.

Aboveground biomass of agricultural crops was calculated using official cropping area (see Table 135) and expansion factors for leaves. For simplification, wheat was considered to be representative for the vegetation cover of agricultural crop land.

Table 137: Parameters for calculation of NMVOC emissions from vegetation canopies of agriculturally used land (iso = isopren; mts = terpene; ovoc = other VOC's)

	Effective emission hours [a] (12 mon)			Biomass Density [b] D [t / ha]	Emission Potential [c]		
	Γ-mts	Γ-ovoc [hours]	Γ–iso		ε–iso	ε-mts	ε-ovoc [µg / g dry matter . hour]
Grassland	734	734	540	0,4	0	0,1	1,5
Alpine grassland	734	734	540	0,2	0	0,1	1,5
Agricultural crops	734	734	540	0,6	0,09	0,13	1,5

a) Γ = integrated effective emission hours, corrected to represent the effects of short term temperature and solar radiation changes on emissions

b) D = foliar biomass density (in t dry matter per ha)

c) ε = average emission potential

The results are highly dependent on the assumptions about biomass density.

7.3.3 Uncertainties

The uncertainties presented in Table 138were calculated by Monte Carlo analysis, using a model implemented with @risk software. The model uses a probability distribution as an input value instead of a single fixed value.

Table 138: Uncertainties of NH_3 and NO_X emissions from acricultural soils

Direct soil emissions	Uncertainty (standard deviation)	
	NH_3	NO_X
Mineral fertilizer application	51%	18%
Animal waste application	20%	
Unfertilized cultures	27%	
Total	**25%**	**18%**

For NH_3 uncertainty values between 25–51% were estimated, ammonia emissions from synthetic (mineral) fertilizer application showed the maximum of 51% uncertainty.

The overall uncertainty for this inventory (in terms of one standard deviation) was calculated to be around 25% for NH_3 and 18% for NO_x. The uncertainties are relatively constant over all years of the calculation period; the difference of uncertainties between years was found to be less than 3%.

7.3.4 Recalculations

In last year's submission emissions were estimated on level 1 (sector overview table) only. Submission 2003 includes for the first time data for the sub sector level. For this reason no comparison on the sub-sector level can be presented.

Table 139: Difference to submission 2002 of NH_3, NO_X, NMVOC emissions from Category 4 D Agricultural Soils

Gas	4D AGRICULTURAL SOILS										
	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
NH_3 [Gg]	3.53	4.52	2.39	3.11	4.68	3.53	3.08	4.14	3.46	3.45	3.65
NO_X [Gg]	-0.96	-0.58	-1.55	-0.83	-0.28	-0.73	-0.92	-0.56	-0.81	-0.85	-0.87
NMVOC [Gg]	-0.80	-0.81	-0.86	-0.89	-0.82	-0.80	-0.81	-0.72	-0.75	-0.71	-0.79

The main reason for the inconsistency of NH_3 emissions in submission 2002 and 2003 is the fact, that in the previous submission NH_3 emissions from land spreading of animal manure and grazing animals were accounted for under "Manure Management" and not under "Agricultural Soils". Therefore, only total emissions of agriculture, i.e. the sum of manure management and agricultural soils are fully comparable with respective sums of submission 2002 data.

7.4 Field Burning of Agricultural Waste (4 F)

This category comprises SO_2, NMVOC, NO_x and NH_3 emissions from burning straw and residual wood of vinicultures on open fields in Austria.

Burning agricultural residues on open fields in Austria is legally restricted by provincial law and since 1993 additionally by federal law and is only occasionally permitted on a very small scale. Therefore the contribution of emissions from this category to the total emissions is considered very low.

7.4.1 Source Category Description

In 2001 NMVOC emissions from this source category contributed 0.09% to Austria's total. The emission trend shows a decrease by 3.4% since 1990. In the same period NH_3 emissions of Agricultural Soils decreased by 3.9%. 2001 they contributed 0.05% to Austrian's total emissions. This source category's SO_2 and NO_X emissions contribute only a negligible part to Austria's total, their trends are slightly decreasing.

Table 140: Emissions from Field Burning of Agricultural Waste by gas

Gas	Sector 4 F by gas [Gg]												Share in Austrian Total 2001	Trend 1990-2001
	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001		
SO_2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	*0.01%*	*-1.6%*
NH_3	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	*0.05%*	*-3.9%*
NO_X	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	*0.00%*	*-2.3%*
NMVOC	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	*0.09%*	*-3.4%*

7.4.2 Methodological Issues

A simple method (Emission = Activity x Emission Factor) using country specific and CORINAIR default emission factors was used.

Emission factors

Viniculture

National emission factors for SO_2, NO_x and NMVOC are taken from [JOANNEUM RESEARCH, 1995]. NH_3 emission factors are taken from [CORINAIR, 1996].

Cereals

National emission factors for SO_2 are taken from [JOANNEUM RESEARCH, 1995]. NO_x emission factors are taken from [ENERGIEBERICHT, 1990]. NH_3 and NMVOC emission factors were taken from [CORINAIR, 1994]

A calorific value of 7,1 MJ/kg burnt wood which corresponds to burning wood logs in poor operation furnace systems was used to convert the emission factors from [kg/TJ] to [kg/Mg]. Table 152 presents the resulting emission factors.

Table 141: Emission factors for burning residual wood of vinicultures

	SO_2 [g/ Mg Waste]	NOx [g/ Mg Waste]	NMVOC [g/ Mg Waste]	NH3 [g/ Mg Waste]
Cereals	78	177,5	5350	600
Residual wood of vinicultures	78	284	14 200	1 900

Activity Data

According to an expert judgement from Dr. Johannes Schima from the *Presidential Conference of Austrian Agricultural Chambers*, about 6 000 ha of straw fields are burnt every year. This value was used for all years. Following the [CORINAIR Guidebook, 1994], the average amount of straw burnt is about 5 tons per hectare.

Activity data of viniculture area are taken from the Statistical Yearbooks 1991-2002 [STATISTIK AUSTRIA]. According to an expert judgement from the *Federal Association of Viniculture* (Bundesweinbauverband Österreich) the amount of residual wood per hectare viniculture is 1.5 to 2.5 t residual wood and the part of it that is burnt is estimated to be 1 to 3%. For the calculations the upper limits (3% of 2.5 t/ha) have been used resulting in a factor of 0.075 t burnt residual wood per hectar viniculture area.

Table 142: *Activity data for burning residual wood of vinicultures 1990–2001*

Year	Viniculture Area [ha]	Burnt Residual Wood [t]	Year	Viniculture Area [ha]	Burnt Residual Wood [t]
1990	58 364	4 377	1996	55 628	4 172
1991	58 364	4 377	1997	52 494	3 937
1992	58 364	4 377	1998	52 494	3 937
1993	57 216	4 291	1999	51 214	3 841
1994	57 216	4 291	2000	51 214	3 841
1995	55 628	4 172	2001	51 214	3 841

7.4.3 Recalculations

Emissions from burning residual wood of vinicultures were recalculated using updated activity data and new emission factors:

- Previously the same activity data for the viniculture area in Austria was used for all years, for this year's inventory the time series has been updated using the Statistical Yearbooks 1991-2002 [STATISTIK AUSTRIA]. However, updated data are not available for all years[12].
- Based on expert judgement the amount of residual wood per hectare viniculture area and the share of annually burnt wood have been updated.
- The emission factors have been updated.

[12] Only for 1990, 1993, 1995, 1997 and 1999 updated data is available, for the other years the last available data was used (e.g. for 1991 and 1992 the data of 1990 was used).

Table 143: Recalculations with respect to previous submission from category 4 F

Diff. [Gg]	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
SO_2	-0.0065	-0.0065	-0.0065	-0.0065	-0.0065	-0.0065	-0.0065	-0.0065	-0.0065	-0.0065	-0.0065
NMVOC	-0.4007	-0.4007	-0.4007	-0.4019	-0.4019	-0.4036	-0.4036	-0.4070	-0.4070	-0.4083	-0.4083
NH_3	0.0098	0.0098	0.0098	0.0086	0.0086	0.0069	0.0069	0.0035	0.0035	0.0022	0.0022
NO_X	-0.0142	-0.0142	-0.0142	-0.0143	-0.0143	-0.0143	-0.0143	-0.0144	-0.0144	-0.0144	-0.0144

8 WASTE (NFR CATEGORY 6)

8.1 Sector Overview

This chapter includes information on and descriptions of methods for estimating NO_X, SO_2, NH_3 and NMVOC emissions as well as references of activity data and emission factors concerning waste management and treatment activities reported under NFR Category *6 Waste* for the period from 1990 to 2000.

The emissions addressed in this chapter include emissions from the subcategories Solid *Waste Disposal on Land* and *Waste Incineration.* There are no NO_X, SO_2, NH_3 and NMVOC emissions reported in the subcategories *Wastewater Handling* and *Other (Sludge Spreading and Compost Production)*.

8.1.1 Emission Trends

Table 144 and Figure 11 present SO_2, NO_X, NMVOC and NH_3 emissions from NFR Category 6 *Waste* for the period from 1990 to 2001.

As can be seen in the table, the share of this category in Austria's National Totals of NO_X, NMVOC and NH_3 is below 0.1%. SO_2 emissions decreased by 16%, however, the trend in total SO_2 emissions is –53%, this is the reason for the higher share in national total emissions of SO_2 emissions originating from NFR Category 6 *Waste* of 0.15% in 2001 compared to 1990 in 0.08%.

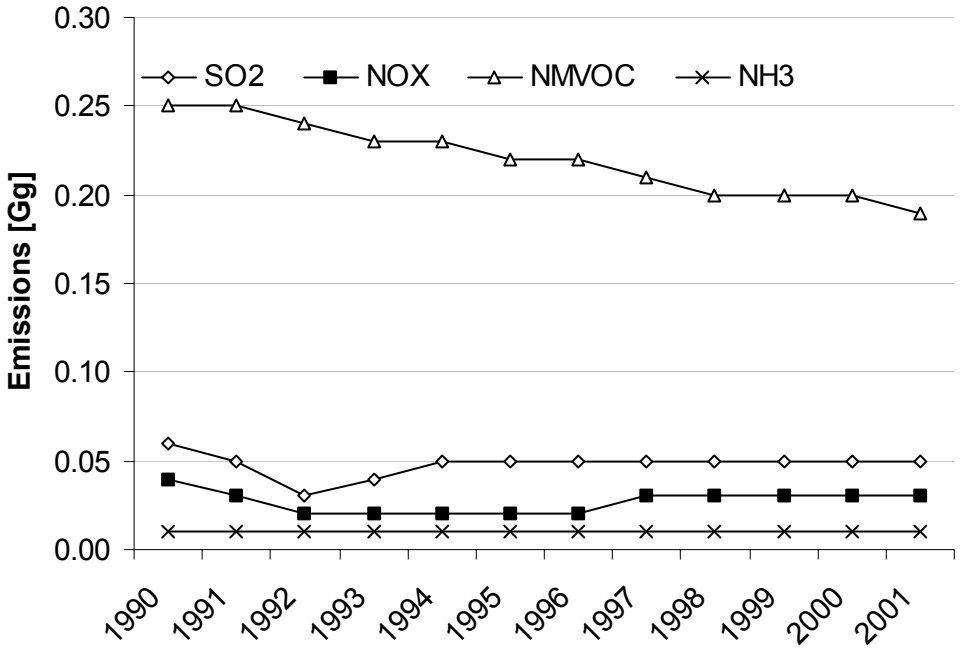

Figure 11: Emissions from NFR Category 6 Waste and trends 1990-2001

Table 144: Emissions of NO_X, SO_2, NH_3 and NMVOCs and their trend from 1990-2001 from NFR Category 6 Waste

Year	Emissions [Gg]			
	SO_2	NO_X	NMVOC	NH_3
1990	0.06	0.04	0.25	0.01
1991	0.05	0.03	0.25	0.01
1992	0.03	0.02	0.24	0.01
1993	0.04	0.02	0.23	0.01
1994	0.05	0.02	0.23	0.01
1995	0.05	0.02	0.22	0.01
1996	0.05	0.02	0.22	0.01
1997	0.05	0.03	0.21	0.01
1998	0.05	0.03	0.20	0.01
1999	0.05	0.03	0.20	0.01
2000	0.05	0.03	0.20	0.01
2001	0.05	0.03	0.19	0.01
Trend 1990-2001	***-16%***	***-32%***	***-24%***	***-20%***
Share in National Total 1990	*0.08%*	*0.02%*	*0.07%*	*0.02%*
Share in National Total 2001	*0.15%*	*0.03%*	*0.08%*	*0.01%*

SO_2 , NO_x Emissions

SO_2 and NO_x emissions originate from the subcategory *Waste Incineration*, emissions are decreasing constantly due to decreasing waste incineration activities: NO_X emissions decreased by 32% from 1990 to 2001, SO_2 emissions 16% in the same period.

NMVOC Emissions

NMVOC emissions from category Waste mainly originate from *Solid Waste Disposal on Land. Waste Incineration* is minor source and contribute less than 1%.

NMVOC emissions from *Solid Waste Disposal on Land* decreased over the considered period by almost 24% as a result of the waste management policies and increasing recovery rate of landfill gas.

NH_3 Emissions

NH_3 Emissions originate from *Solid Waste Disposal on Land. Waste Incineration* is a minor source and account for about 5% of NH_3 emissions. Due to rounding the emissions seem to be stable but they decreased by 20% also due to the increasing recovery rate of landfill gas.

8.1.2 Methodology

The general method for estimating emissions for the waste sector, as recommended by the IPCC, is multiplying activity data for each subcategory with an emission factor. In some cases, however, country-specific methods were used. In those cases detailed information on the applied methods is provided in the corresponding subchapter.

8.1.3 Recalculations

Recalculations have been made for subcategory *6 A 1 Managed Waste Disposal on Land (*see explanation on Table 150) and for subcategory *6 C Waste Incineration*.

8.1.4 Completeness

Table 145 gives an overview of the SNAP categories included in this chapter and also provides information on the status of emission estimates of all subcategories. A "✓" indicates that emissions from this subcategory have been estimated.

Table 145: Overview of subcategories of Category 6 Waste: transformation into SNAP Codes and status of estimation

NFR Category		SNAP	Status			
			NO_X	SO_2	NH_3	NMVOC
6 A	SOLID WASTE DISPOSAL ON LAND					
6 A 1	Managed Waste Disposal	090401 Solid Waste Disposal on Land	NO	NO	✓	✓
6 A 2	Unmanaged Waste Disposal	090402 Unmanaged Waste Disposal	NO	NO	NO	NO
6 B	WASTEWATER HANDLING					
6 B 1	Industrial Wastewater	091001 Waste water treatment in industry	NO	NO	NO	NO
6 B 2	Domestic and Commercial Wastewater	091002 Waste water treatment in residential/commercial sect.	NO	NO	NO	NO
6 C	WASTE INCINERATION					
		090901 Incineration of corpses	✓	NO	NO	✓
		090201 Incineration of municipal waste	✓	✓	✓	✓
		090208 Incineration of waste oil	✓	✓	✓	✓
6 D	OTHER WASTE					
		091003 Sludge spreading	NO	NO	NO	NO
		091005 Compost production	NO	NO	NO	NO

8.2 Waste Disposal on Land (CRF Source Category 6 A)

8.2.1 Managed Waste Disposal on Land (6 A 1)

8.2.1.1 Source Category Description

In Austria 100% of waste disposal sites are managed sites (landfills).

Managed waste disposal on land accounts for the main contribution to NH_3 and NMVOC emissions in the IPCC Category *6 Waste*.

The anaerobic degradation of land filled organic substances results in the formation of landfill gas. About 300mg per m³ landfill gas are NMVOC and about 10mg per m³ landfill gas are NH_3. Most active landfills in Austria have gas collection systems. According to expert judgement since 1983 the amount of the collected and burnt landfill gas increased exponentially. While for example the amount of the collected landfill gas was about 2% in 1990, this amount reached 21% in the year 2001.

Table 146 presents NMVOC and NH_3 emissions from managed waste disposal on land for the period from 1990 to 2001.

As can be seen in the table, the trend of NMVOC and NH_3 emissions during the period is decreasing. From 1990 to 2001 the CH_4 emissions decreased by 24% respectively 20% according to increasing amount of the collected landfill-gas.

Table 146: NMVOC and NH_3 emissions from Category 6 A 1 1990-2001

Emissions [Gg]	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
NMVOC	0.25	0.24	0.24	0.23	0.23	0.22	0.22	0.21	0.20	0.20	0.19	0.19
NH_3	0.008	0.008	0.008	0.008	0.008	0.007	0.007	0.007	0.007	0.007	0.006	0.006

8.2.1.2 Methodological Issues

For calculating the emissions of solid waste disposal on land the directly deposited waste is separated into two categories: "residual waste" and "non residual waste".

For "residual waste" activity data were available for each year, whereas, because of lack of data, for "non residual waste" the same value was used for all years.

8.2.1.2.1 Residual waste

"Residual waste" is waste from households and similar establishments, which is directly deposited at landfills without any treatment. It originates in private households, administrative facilities of commerce, industry and public administration, kinder gardens, schools, hospitals, small enterprises, agriculture, market places and other institutions covered by the municipal waste collection system.

According to the "federal waste management plan 2001" recycling and treatment of waste from households and similar establishments followed the following routes in 1999:

- 34.3% recycling
- 15.4% recycling (biogenous waste)
- 0.8% treatment in plants for hazardous waste
- 6.3% mechanico-biological pre-treatment
- 14.7% thermal treatment (incineration)
- ***28.5% direct deposition at landfills ("residual waste")***;

The detailed calculation of the CH_4 emissions from "residual waste" is shown in Table 147.

First the overall amount of generated landfill gas per ton waste was calculated, taking the DOC-content (200 kg C/Mg Waste) of the waste and the average temperature at the landfill (30°C) into account. Once disposed, waste emits landfill-gas for many years. The amount of gas emitted per year is not constant, it declines exponentially over time. For the calculation the amount of landfill-gas produced in the year of disposal and in the 30 years after disposal are taken into account. To determine the total amount of landfill gas emissions for one year, the amounts generated by waste disposed in the last 31 years are summed up. After subtracting the collected gas and multiplying by the NMVOC and NH_3 content of landfill gas (300mg/m³ respectively 10mg/m³) the emitted quantity of these gases from residual waste were obtained.

Table 147: Calculation of the CH_4 emissions of residual waste

Calculation of	Formula	Explanation	
G_L...Long term specific quantity of generated landfill gas [m^3/ t waste]	$G_L=1.868*DOC*(0.014T+0.28)$	T……	Temperature of the disposal site (approximately 30°C) [K]
		DOC…….	Bio-degradable organic carbon content of directly deposited residual waste (estimated in [HACKL & MAUSCHITZ, 1999]) [200kgC/Mg waste]
G_t…Cumulated specific quantity of gas after t years [m³/ t waste]	$G_t=G_L*(1-10^{(-kt)})$	G_L…….	Long term specific amount of generated landfill gas
		k……...	Degrade constant =0.035
		t……	Number of years
$G_t(a)$...Specific accrued quantity of gas in the t^{th} year [m³/ t waste]	$G_t(a)=G_t-G_{t-1}$	G_t…….	Cumulated specific amount of gas in the year t
		G_{t-1}……...	Cumulated specific amount of gas in the year before t
G_{geb}...Quantity of incidental landfill gas in the year t [m³]	$G_{geb}=G_t(a)*waste_{t=0}$	$G_t(a)$…….	Specific accrued amount of gas in the year t
		$waste_{t=0}$…	Waste deposited in the year t=0
G_T...Total incidental gas in the year t [m³]	$G_T=\Sigma_0^{31}(G_{geb})$ Quantity of gas generated in the last 31 years is summed up	G_{geb}……..	Quantity of incidental landfill gas in the year t

Calculation of	Formula		Explanation
G…Emitted gas [m³]	$G=G_T*(1-j)$	G_T…….	Total incidental gas in the year t
		j……	Collecting factor; estimated for 1999: j = 0.2
NMVOC, NH_3 Emissions	EM=G*c	c……	Concentration of NMVOC and NH_3 NMVOC = 300mg/m³ emitted gas NH_3 = 10mg/m³ emitted gas

8.2.1.2.2 Non Residual Waste

"Non Residual Waste" is directly deposited waste other than residual waste and comprises:

- bulk waste
- construction waste
- mixed industrial waste
- road sweepings
- sewage sludge
- rakings
- residual matter from waste treatment

For the calculation the methodology of Marticorena was used, with the assumption that the composition and quantity of deposited non residual waste was constant. The deposited non residual waste was split up into three groups and the incidental quantity of gas was calculated for each group.

1. Well bio-degradable waste (half-life period: 1-20 years)
2. Hardly bio-degradable waste (half-life period: 20-100 years)
3. Very hardly bio-degradable waste (half-life period: >>100 years)

After calculating the total emitted gas of each group the values were summed up, multiplied with the collecting factor and the share of NMVOC and NH_3 in the generated gas. This resulted in the emitted quantity of NMVOC and NH_3 of "non residual waste".

The detailed calculation steps are shown in Table 148.

Table 148: Calculation of the CH_4 emissions of directly deposited waste except residual waste

Calculation of	Formula		Explanation
Methodology of Marticorena to calculate the formation potential for 100 years	$M=M_0e^{-(kt)}$	M……	Incidental quantity of gas [m³]
		M_0……..	Formation potential of landfill gas [m³]*
		k…….	Velocity constant $k=-\ln(0.5)/t_{1/2}$
		$t_{1/2}$……..	Half life (calculated for each group, weighted by the quantity of the deposited waste [BAUMELER, 1998]) [a]
		t…….	Running parameter; years from 0-100
G…Total emitted quantity of landfill gas after 100 years	$G=\Sigma_1^3(M_{t=0}-M_{t=100})$	$M_{t=0}$……	Gas formation potential in the year 0

Calculation of	Formula		Explanation
under the restriction, that the quantity and the formation of the deposited waste is constant during 100 years [m³]		$M_{t=100}$…….	Gas formation potential in the year 100
		$M_{t=0}$-$M_{t=100}$..	Total emitted quantity of landfill gas in each group after 100 years
		Σ_1^3……..	Summation of the 3 groups
		G……	Total emitted quantity of landfill gas [m³]
NMVOC,	EM=G*c	c……	Concentration of NMVOC and NH_3
NH_3 Emissions			NMVOC = 300mg/m³ emitted gas
			NH_3 = 10mg/m³ emitted gas

*For each of the 3 groups the kind of waste was specified, the quantity and the carbon-flow were listed. For each carbon flow, a formation potential of landfill gas was calculated, and the summed up formation potential was displayed as M_O.

Activity data

Because of the consideration of the emissions from the last 31 years the quantities of "residual waste" as of 1960 are needed. Thus the activity data from the year 1950 to 1989 were taken from a study [HACKL & MAUSCHITZ, 1999].

The quantities of residual waste from 1990 until 1997 were taken from the current BAWP [BMUJF-BWAP, 1998].

The quantities of 1998 were taken from the UMWELTBUNDESAMT database for solid waste disposals "Deponiedatenbank". According to the Landfill Ordinance [Deponieverordnung (Federal Gazette BGBl. Nr 164/1996)], which came into force in 1997, the operators of landfill sites have to report their activity data annually to UMWELTBUNDESAMT (*Deponiedatenbank* – "Austrian disposal database"). Emissions from 1998 to 2001 have been recalculated on the basis of these data.

Contrary to data for "residual waste", data for "non residual waste" are not available for each year. In 1995, the quantity of "non residual waste" was estimated to be 2 905 000 t/a [BAUMELER et al., 1998]. This value was assumed to be constant for all years.

Activity data are presented in Table 149.

Table 149: Activity data for "*Residual waste" and "Non Residual Waste" 1990–2001*

Year	Residual Waste [Mg/a]	Non Residual Waste [Mg/a]
1990	1 210 400	2 905 000
1991	1 093 900	2 905 000
1992	985 000	2 905 000
1993	834 400	2 905 000
1994	675 700	2 905 000
1995	624 400	2 905 000
1996	661 900	2 905 000
1997	694 600	2 905 000
1998	1 007 294	2 905 000
1999	1 040 001	2 905 000

Year	Residual Waste [Mg/a]	Non Residual Waste [Mg/a]
2000	1 052 061	2 905 000
2001	1 052 061	2 905 000

8.2.1.3 Recalculations

For the years 1990 to 1997 all activity data were taken from the current *Bundes-Abfallwirtschaftsplan* (Federal Waste Management Plan) and remained unchanged. According to an order for landfills [Deponieverordnung (BGBl. Nr 164/1996 §29)], that was legalised in 1997, all operators of landfill sites have to report their activity data directly to UMWELTBUNDESAMT (*Deponiedatenbank* - Austrian disposal database). Emissions from 1998 to 2001 have been recalculated on the basis of these data.

Table 150: Recalculations with respect to previous submission from Category Managed Waste Disposal on Land 1990-2000

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
NMVOC [Mg Difference]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.38	-1.84	-6.27
NH_3 [Gg Difference]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05	-0.06	-0.21

8.2.1.4 Planned Improvements

The following improvements are planned:

- Review of the methodology of estimating emissions (including emission factors)
- Update of activity data for "Non Residual Waste"
- Revise the time series of "Residual Waste"
- Update the rate of the collected landfill-gas

8.3 Waste Incineration (CRF Source Category 6 C)

8.3.1 Source Category Description

In this category SO_2, NO_X, NMVOC and NH_3 emissions from *Incineration of Corpses* and *Incineration of Waste Oil* are included as well as emissions from *Incineration of Domestic or Municipal Waste*.

In Austria waste oil is incinerated in especially designed so called "USK-facilities". The emissions of waste oil combustion for energy use (e.g. in cement industry) are reported under *NFR sector 1 A Fuel Combustion*.

In general municipal, industrial and hazardous waste are combusted in district heating plants or in industrial sites and the energy is used. Therefore their emissions are reported in *NFR sector 1 A Fuel Combustion*. There is only one waste incineration plant which has been operated until 1991 with a capacity of 22 000 tons of waste per year without using the energy. This plant has been rebuilt as a district heating plant starting operation in 1996. Therefore the emissions of this plant are reported under *CRF sector 1 A Fuel Combustion* from 1996 onwards.

Emissions from Category *Open Burning Of Agricultural Waste* is included in Chapter 7.4.

Table 151 presents SO_2, NO_X, NMVOC and NH_3 emissions and the trends over the considered time period.

Main source of the considered emissions in the subcategory *Waste Incineration* is *Incineration of Waste Oil*. Only for the years 1990 and 1991 emissions of *Incineration of Domestic or Municipal Waste* is reported (explanation see above). That's why the trend over the time period shows a sharp decline in 1992. Since then the trend shows a steady increase due to increasing activity data in the categories *Incineration of Waste Oil* and *Incineration of Corpses* where *Incineration of Corpses* is only a minor source of NO_X and NMVOC emissions.

Table 151: SO_2, NO_X, NMVOC and NH_3 emissions from Category 6 C.

Gas [Gg]	Emissions [Gg]												Trend 1990-2001
	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	
SO_2	0.0648	0.0521	0.0326	0.0381	0.0453	0.0472	0.0490	0.0508	0.0526	0.0544	0.0544	0.0544	*-16%*
NO_X	0.0399	0.0342	0.0175	0.0199	0.0231	0.0239	0.0247	0.0254	0.0262	0.0270	0.0269	0.0269	*-32%*
NMVOC	0.0085	0.0082	0.0010	0.0012	0.0013	0.0014	0.0014	0.0014	0.0015	0.0015	0.0015	0.0015	*-82%*
NH_3	0.0002	0.0002	0.0002	0.0002	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	*34%*

8.3.2 Methodological Issues

CORINAIR simple methodology is applied: the quantity of waste is multiplied with an emission factor for SO_X, NO_X, NMVOC and NH_3.

8.3.2.1 Incineration of domestic or municipal waste; Incineration of waste oil

Emission factors

National emission factors for SO_2, NO_X and NMVOC are taken from [BMWA-EB, 1990], [BMWA-EB, 1996]. NH_3 emission factors are taken from [KNOFLACHER, 1993].

A heating value of 8.7 GJ/Mg Municipal Waste was used to convert the emission factors from [kg/TJ] to [kg/Mg].

For waste oil, the emission factors for heavy oil were selected and a heating value of 40.3 GJ/Mg Waste Oil was used to convert the emission factors from [kg/TJ] to [kg/Mg].

Table 152: Emission factors of IPCC Category 6 C Waste Incineration.

	SO_2 [g/ Mg Waste]	NO_X [g/ Mg Waste]	NMVOC [g/ Mg Waste]	NH_3 [g/ Mg Waste]
Municipal Waste	1 131	870	330.6	0.17
Waste Oil	18 135	8 060	403	110

Activity data

For municipal solid waste the known capacity of 22 000 tons of waste per year of one waste incineration plant was taken.

For waste oil the activity data were taken from [BOOS et al., 1995].

Table 153: Activity data for IPCC Category 6 C Waste Incineration.

Year	Municipal Waste [Mg]	Waste Oil [Mg]
1990	22 000	2 200
1991	22 000	1 500
1992	0	1 800
1993	0	2 100
1994	0	2 500
1995	0	2 600
1996	0	2 700
1997	0	2 800
1998	0	2 900
1999	0	3 000
2000	0	3 000
2001	0	3 000

8.3.2.2 Incineration of corpses

Incineration of corpses accounts for contribution to NO_X emissions in the IPCC Category *6 Waste*.

NO_X and NMVOC emissions from this category are generally low and amount to 0.003 Gg and 0.0003 Gg respectively for all years from 1990 to 2001. The number of corpses decreased over the period from 1990 to 2001; due to rounding the emissions appear to remain steady.

Table 154: NO_X and NMVOC emissions from incineration of corpses 1990–2000

Emissions [Gg]	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
NO_X	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003
NMVOC	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003

Methodology

The applied emission factor of 300g NO_X/Corpse and of 31g NMVOC/Corpse was taken from a Swiss study [BUWAL, 1995].

The number of deaths per year were obtained from STATISTIK AUSTRIA. It is assumed that about 12% of the total number of corpses are incinerated per year (see Table 155).

Table 155: Number of incinerated corpses 1990–2001

Year	Total number of corpses	Number of incinerated corpses
1990	82 952	9 954
1991	83 428	10 011
1992	83 162	9 979
1993	82 517	9 902
1994	80 684	9 682
1995	81 171	9 741
1996	80 790	9 695
1997	79 432	9 532
1998	78 339	9 401
1999	78 200	9 384
2000	76 780	9 214
2001	76 780	9 214

8.3.3 Recalculations

In the previous submission emissions from waste incineration in district heating plants were reported under category *6 C Waste Incineration.* According to the GPG, chapter 5.3.1.3 and the recommendations of the in-country review team (see paragraph 212 of the [CR 2001]) they are now reported as 'other fuels' under category *1 A 1 a Public Electricity and Heat Production*.

The activity data for incineration of corpses were updated according to the actual death statistics published by STATISTIK AUSTRIA.

8.3.4 Planned Improvements

It is planned to review the methodology of estimating emissions (including emission factors) and to update activity data.

ABBREVIATIONS

General

AMA	Agrarmarkt Austria
BAWP	Bundes-AbfallwirtschaftsplanFederal Waste Management Plan
BMLFUW	Bundesministerium für Land- und Forstwirtschaft, Umwelt und WasserwirtschaftFederal Ministry for Agriculture, Forestry, Environment and Water Management
BMUJF	Bundesministerium für Umwelt, Jugend und FamilieFederal Ministry for Environment, Youth and Family(before 2000, now domain of Environment: BMLFUW)
BUWAL	Bundesamt für Umwelt, Wald und Landschaft, BernThe Swiss Agency for the Environment, Forests and Landscape (SAEFL), Bern
CORINAIR	Core Inventory Air
CORINE	Coordination d´information Environmentale
CRF	Common Reporting Format
DKDB	DampfkesseldatenbankAustrian 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
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)
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/CLRTAP 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.)
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/CLRTAP	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)

Notation Keys

according to UNFCCC guidelines on reporting and review [FCCC/CP/1997/7]

"NO" (not occurring)	for emissions by sources and removals by sinks of greenhouse gases that do not occur for a particular gas or source/sink category within a country;
"NE" (not estimated)	for existing emissions by sources and removals by sinks of greenhouse gases which have not been estimated. Where "NE" is used in an inventory for emissions or removals of CO_2 , CH_4 , N_2O, HFCs, PFCs, or SF_6 , the Party should indicate, using the completeness table of the common reporting format, why emissions could not be estimated;
"NA" (not applicable)	for activities in a given source/sink category that do not result in emissions or removals of a specific gas. If categories in the common reporting format for which "NA" is applicable are shaded, they do not need to be filled in;
"IE" (included elsewhere)	for emissions by sources and removals by sinks of greenhouse gases estimated but included elsewhere in the inventory instead of the expected source/sink category. Where "IE" is used in an inventory, the Party should indicate, using the completeness table of the common reporting format, where in the inventory the emissions or removals from the displaced source/sink 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 and removals by sinks of greenhouse gases which could lead to the disclosure of confidential information, given the provisions of paragraph 19 [FCCC/CP/1997/7];
"0"	for emissions by sources and removals by sinks of greenhouse gases which are estimated to be less than one half the unit being used to record the inventory table, and which therefore appear as zero after rounding. The amount should still be included in the national totals and any relevant subtotals. In the sectoral background tables of the common reporting format Parties should provide data as detailed as methods allow.

Chemical Symbols

Symbol	Name
Greenhouse gases	
CH_4	Methane
CO_2	Carbon Dioxide
N_2O	Nitrous Oxide
HFCs	Hydroflurocarbons
PFCs	Perfluorocarbons
SF_6	Sulphur hexafluoride
Further chemical compounds	
CO	Carbon Monoxide
Cd	Cadmium
NH_3	Ammonia
Hg	Mercury
NO_X	Nitrogen Oxides (NO plus NO_2)
NO_2	Nitrogen Dioxide
NMVOC	Non-Methane Volatile Organic Compounds
PAH	Polycyclic Aromatic Hydrocarbons
Pb	Lead
POP	Persistent Organic Pollutants
SO_2	Sulfur Dioxide
SO_X	Sulfur Oxides

Units and Metric Symbols

UNIT	Name	Unit for
g	gram	mass
t	ton	mass
W	watt	power
J	joule	calorific value
m	meter	length

Mass Unit Conversion		
1g		
1kg	= 1.000g	
1t	= 1.000kg	= 1Mg
1kt	= 1.000t	= 1Gg
1Mt	= 1 Mio t	= 1Tg

Metric Symbol	Prefix	Factor
P	peta	10^{15}
T	tera	10^{12}
G	giga	10^{9}
M	mega	10^{6}
k	kilo	10^{3}
h	hecto	10^{2}
da	deca	10^{1}
d	deci	10^{-1}
c	centi	10^{-2}
m	milli	10^{-3}
μ	micro	10^{-6}
n	nano	10^{-9}

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ANNEX 1: NATIONAL ENERGY BALANCE

National Energy Balance Data

The following tables present the data of the national energy balance by IEA categories. Heat calorific values are presented in the end of this Annex. Data was submitted to the UMWELTBUNDESAMT by STATISTIC AUSTRIA in November 2002.

Information on the categories of the energy balance and on fuel categories can be found in Chapter 4.6 of the IIR 2003.

Table 1: National Energy Balance 1990-2001. Coking Coal [1000 tons].

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Indigenous Production	0	0	0	0	0	0	0	0	0	0	0	0
Total Imports (Balance)	2 376	2 071	2 120	1 766	1 919	1 778	2 013	2 167	2 089	2 146	1 738	1 861
Total Exports (Balance)	0	0	0	0	0	0	0	0	0	0	0	0
International Marine Bunkers	0	0	0	0	0	0	0	0	0	0	0	0
Stock Change (National Territory)	-39	25	-125	111	4	130	80	-57	83	45	139	30
Gross Inland Deliveries (Obs.)	2 337	2 096	1 995	1 877	1 923	1 908	2 093	2 111	2 172	2 191	1 878	1 892
Statistical Difference	0	0	0	0	0	0	0	0	0	0	0	0
Total Transformation Sector	2 337	2 096	1 995	1 877	1 923	1 908	2 093	2 111	2 172	2 191	1 878	1 892
Public Electricity	0	0	0	0	0	0	0	0	0	0	0	0
Public Combined Heat and Power	0	0	0	0	0	0	0	0	0	0	0	0
Public Heat Plants	0	0	0	0	0	0	0	0	0	0	0	0
Auto Producers of Electricity	0	0	0	0	0	0	0	0	0	0	0	0
Auto Producers for CHP	0	0	0	0	0	0	0	0	0	0	0	0
Auto Producer Heat Plants	0	0	0	0	0	0	0	0	0	0	0	0
Gas Works (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0
Coke Ovens (Transformation)	2 337	2 096	1 995	1 877	1 923	1 908	2 093	2 111	2 172	2 191	1 878	1 892
Blast Furnaces (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0
Patent Fuel Plants	0	0	0	0	0	0	0	0	0	0	0	0
BKB (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0
Total Energy Sector	0	0	0	0	0	0	0	0	0	0	0	0
Coal Mines	0	0	0	0	0	0	0	0	0	0	0	0
Patent Fuel Plants	0	0	0	0	0	0	0	0	0	0	0	0
Coke Ovens (Energy)	0	0	0	0	0	0	0	0	0	0	0	0
Blast Furnaces (Energy)	0	0	0	0	0	0	0	0	0	0	0	0
Gas Works (Energy)	0	0	0	0	0	0	0	0	0	0	0	0
BKB (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0
Petroleum refineries	0	0	0	0	0	0	0	0	0	0	0	0
Power Plants	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Energy)	0	0	0	0	0	0	0	0	0	0	0	0
Distribution Losses	0	0	0	0	0	0	0	0	0	0	0	0
Final Consumption	0	0	0	0	0	0	0	0	0	0	0	0
Total Transport	0	0	0	0	0	0	0	0	0	0	0	0
Rail	0	0	0	0	0	0	0	0	0	0	0	0
Inland Waterways	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Transport)	0	0	0	0	0	0	0	0	0	0	0	0
Total Industry	0	0	0	0	0	0	0	0	0	0	0	0
Iron and Steel	0	0	0	0	0	0	0	0	0	0	0	0
Chemical (incl.Petro-Chemical)	0	0	0	0	0	0	0	0	0	0	0	0
Non ferrous Metals	0	0	0	0	0	0	0	0	0	0	0	0
Non metallic Mineral Products	0	0	0	0	0	0	0	0	0	0	0	0
Transportation Equipment	0	0	0	0	0	0	0	0	0	0	0	0
Machinery	0	0	0	0	0	0	0	0	0	0	0	0
Mining and Quarrying	0	0	0	0	0	0	0	0	0	0	0	0
Food, Beverages and Tobacco	0	0	0	0	0	0	0	0	0	0	0	0
Pulp, Paper and Printing	0	0	0	0	0	0	0	0	0	0	0	0
Wood and Wood Products	0	0	0	0	0	0	0	0	0	0	0	0
Construction	0	0	0	0	0	0	0	0	0	0	0	0
Textiles and Leather	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Industry)	0	0	0	0	0	0	0	0	0	0	0	0
Total Other Sectors	0	0	0	0	0	0	0	0	0	0	0	0
Commerce - Public Services	0	0	0	0	0	0	0	0	0	0	0	0
Residential	0	0	0	0	0	0	0	0	0	0	0	0
Agriculture	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Others)	0	0	0	0	0	0	0	0	0	0	0	0
Total Non-Energy Use	0	0	0	0	0	0	0	0	0	0	0	0

Table 2: National Energy Balance 1990-2001. Bituminous Coal & Anthracite [1000 tons].

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Indigenous Production	0	0	1	1	1	1	0	0	0	0	0	0
Total Imports (Balance)	1 233	1 717	1 692	1 422	1 096	1 216	1 724	1 623	1 657	1 215	1 675	1 863
Total Exports (Balance)	0	0	9	0	0	1	2	4	0	0	0	0
International Marine Bunkers	0	0	0	0	0	0	0	0	0	0	0	0
Stock Change (National Territory)	589	270	-197	-257	91	268	-21	348	-97	52	157	11
Gross Inland Deliveries (Obs.)	1 822	1 987	1 487	1 165	1 188	1 484	1 701	1 966	1 559	1 266	1 832	1 874
Statistical Difference	0	0	0	0	0	0	0	0	0	0	0	0
Total Transformation Sector	1 421	1 561	1 075	746	822	1 082	1 245	1 437	1 061	912	1 414	1 670
Public Electricity	964	957	647	394	485	550	1 076	1 275	890	740	1 203	1 390
Public Combined Heat and Power	409	535	352	318	327	518	128	127	127	140	161	242
Public Heat Plants	0	0	0	0	0	0	0	0	0	0	0	0
Auto Producers of Electricity	0	0	0	0	0	0	19	5	4	4	10	13
Auto Producers for CHP	48	68	76	34	10	14	22	31	40	29	40	26
Auto Producer Heat Plants	0	0	0	0	0	0	0	0	0	0	0	0
Gas Works (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0
Coke Ovens (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0
Blast Furnaces (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0
Patent Fuel Plants	0	0	0	0	0	0	0	0	0	0	0	0
BKB (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0
Total Energy Sector	0	0	0	0	0	0	0	0	0	7	33	2
Coal Mines	0	0	0	0	0	0	0	0	0	0	0	0
Patent Fuel Plants	0	0	0	0	0	0	0	0	0	0	0	0
Coke Ovens (Energy)	0	0	0	0	0	0	0	0	0	0	0	0
Blast Furnaces (Energy)	0	0	0	0	0	0	0	0	0	0	0	0
Gas Works (Energy)	0	0	0	0	0	0	0	0	0	0	0	0
BKB (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0
Petroleum refineries	0	0	0	0	0	0	0	0	0	0	0	0
Power Plants	0	0	0	0	0	0	0	0	0	7	33	2
Non Specified (Energy)	0	0	0	0	0	0	0	0	0	0	0	0
Distribution Losses	0	0	0	0	0	0	0	0	0	0	0	0
Final Consumption	400	425	410	417	365	400	455	528	497	346	384	201
Total Transport	3	0	1	0	0	0	1	1	1	1	1	1
Rail	3	0	1	0	0	0	1	1	1	1	1	1
Inland Waterways	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Transport)	0	0	0	0	0	0	0	0	0	0	0	0
Total Industry	152	177	212	248	218	250	299	399	382	241	295	124
Iron and Steel	0	0	0	0	0	0	0	0	0	0	0	0
Chemical (incl.Petro-Chemical)	6	8	27	42	42	45	49	73	70	44	54	23
Non ferrous Metals	0	0	0	0	0	0	0	0	0	0	0	0
Non metallic Mineral Products	145	142	164	167	142	163	191	208	199	125	154	65
Transportation Equipment	0	0	0	0	0	0	0	0	0	0	0	0
Machinery	0	0	0	0	0	0	0	0	0	0	0	0
Mining and Quarrying	0	0	0	0	0	0	0	0	0	0	0	0
Food, Beverages and Tobacco	0	0	0	0	0	0	0	0	0	0	0	0
Pulp, Paper and Printing	1	27	22	38	35	43	58	118	113	71	87	37
Wood and Wood Products	0	0	0	0	0	0	0	0	0	0	0	0
Construction	0	0	0	0	0	0	0	0	0	0	0	0
Textiles and Leather	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Industry)	0	0	0	0	0	0	0	0	0	0	0	0
Total Other Sectors	245	248	198	169	146	149	156	128	113	103	88	76
Commerce - Public Services	16	19	11	12	9	10	12	12	11	8	9	4
Residential	226	226	184	155	135	137	142	114	101	95	78	71
Agriculture	3	3	3	2	2	2	2	2	1	1	1	1
Non Specified (Others)	0	0	0	0	0	0	0	0	0	0	0	0
Total Non-Energy Use	2	2	2	2	1	1	1	1	1	1	1	1

Table 3: National Energy Balance 1990-2001. Patent Fuel [1000 tons].

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Indigenous Production	0	0	0	0	0	0	0	0	0	0	0	0
Total Imports (Balance)	0	0	0	0	0	0	0	7	4	4	4	1
Total Exports (Balance)	0	0	0	0	0	0	0	0	0	0	0	0
International Marine Bunkers	0	0	0	0	0	0	0	0	0	0	0	0
Stock Change (National Territory)	0	0	0	0	0	0	0	0	0	0	0	0
Gross Inland Deliveries (Obs.)	0	0	0	0	0	0	0	7	4	4	4	1
Statistical Difference	0	0	0	0	0	0	0	0	0	0	0	0
Total Transformation Sector	0	0	0	0	0	0	0	0	0	0	0	0
Public Electricity	0	0	0	0	0	0	0	0	0	0	0	0
Public Combined Heat and Power	0	0	0	0	0	0	0	0	0	0	0	0
Public Heat Plants	0	0	0	0	0	0	0	0	0	0	0	0
Auto Producers of Electricity	0	0	0	0	0	0	0	0	0	0	0	0
Auto Producers for CHP	0	0	0	0	0	0	0	0	0	0	0	0
Auto Producer Heat Plants	0	0	0	0	0	0	0	0	0	0	0	0
Gas Works (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0
Coke Ovens (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0
Blast Furnaces (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0
Patent Fuel Plants	0	0	0	0	0	0	0	0	0	0	0	0
BKB (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0
Total Energy Sector	0	0	0	0	0	0	0	0	0	0	0	0
Coal Mines	0	0	0	0	0	0	0	0	0	0	0	0
Patent Fuel Plants	0	0	0	0	0	0	0	0	0	0	0	0
Coke Ovens (Energy)	0	0	0	0	0	0	0	0	0	0	0	0
Blast Furnaces (Energy)	0	0	0	0	0	0	0	0	0	0	0	0
Gas Works (Energy)	0	0	0	0	0	0	0	0	0	0	0	0
BKB (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0
Petroleum refineries	0	0	0	0	0	0	0	0	0	0	0	0
Power Plants	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Energy)	0	0	0	0	0	0	0	0	0	0	0	0
Distribution Losses	0	0	0	0	0	0	0	0	0	0	0	0
Final Consumption	0	0	0	0	0	0	0	7	4	4	4	1
Total Transport	0	0	0	0	0	0	0	0	0	0	0	0
Rail	0	0	0	0	0	0	0	0	0	0	0	0
Inland Waterways	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Transport)	0	0	0	0	0	0	0	0	0	0	0	0
Total Industry	0	0	0	0	0	0	0	0	0	0	0	0
Iron and Steel	0	0	0	0	0	0	0	0	0	0	0	0
Chemical (incl.Petro-Chemical)	0	0	0	0	0	0	0	0	0	0	0	0
Non ferrous Metals	0	0	0	0	0	0	0	0	0	0	0	0
Non metallic Mineral Products	0	0	0	0	0	0	0	0	0	0	0	0
Transportation Equipment	0	0	0	0	0	0	0	0	0	0	0	0
Machinery	0	0	0	0	0	0	0	0	0	0	0	0
Mining and Quarrying	0	0	0	0	0	0	0	0	0	0	0	0
Food, Beverages and Tobacco	0	0	0	0	0	0	0	0	0	0	0	0
Pulp, Paper and Printing	0	0	0	0	0	0	0	0	0	0	0	0
Wood and Wood Products	0	0	0	0	0	0	0	0	0	0	0	0
Construction	0	0	0	0	0	0	0	0	0	0	0	0
Textiles and Leather	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Industry)	0	0	0	0	0	0	0	0	0	0	0	0
Total Other Sectors	0	0	0	0	0	0	0	7	4	4	4	1
Commerce - Public Services	0	0	0	0	0	0	0	1	1	1	1	0
Residential	0	0	0	0	0	0	0	6	3	3	3	0
Agriculture	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Others)	0	0	0	0	0	0	0	0	0	0	0	0
Total Non-Energy Use	0	0	0	0	0	0	0	0	0	0	0	0

Table 4: National Energy Balance 1990-2001. Lignite and Brown Coal [1000 tons].

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Indigenous Production	2 448	2 081	1 771	1 691	1 369	1 297	1 108	1 130	1 140	1 137	1 249	1 206
Total Imports (Balance)	36	53	22	1	19	29	43	23	13	13	34	6
Total Exports (Balance)	3	3	3	1	0	0	0	0	0	1	0	0
International Marine Bunkers	0	0	0	0	0	0	0	0	0	0	0	0
Stock Change (National Territory)	23	639	-330	-347	-146	417	470	163	-287	419	7	319
Gross Inland Deliveries (Obs.)	2 503	2 770	1 459	1 345	1 241	1 743	1 621	1 316	866	1 569	1 290	1 531
Statistical Difference	0	0	0	0	0	0	0	0	0	0	0	0
Total Transformation Sector	2 133	2 338	1 167	1 068	984	1 524	1 495	1 205	763	1 403	1 218	1 470
Public Electricity	1 182	1 445	583	301	405	1 081	1 358	1 164	738	1 372	1 168	1 420
Public Combined Heat and Power	881	830	484	668	509	339	48	13	3	9	26	26
Public Heat Plants	16	8	9	7	7	9	9	4	0	0	0	0
Auto Producers of Electricity	0	0	0	0	0	0	4	0	0	0	0	0
Auto Producers for CHP	54	54	91	92	63	95	76	23	22	22	23	23
Auto Producer Heat Plants	0	0	0	0	0	0	0	0	0	0	0	0
Gas Works (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0
Coke Ovens (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0
Blast Furnaces (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0
Patent Fuel Plants	0	0	0	0	0	0	0	0	0	0	0	0
BKB (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0
Total Energy Sector	4	3	1	0	1	0	0	1	0	15	2	0
Coal Mines	3	1	0	0	0	0	0	0	0	0	0	0
Patent Fuel Plants	0	0	0	0	0	0	0	0	0	0	0	0
Coke Ovens (Energy)	0	0	0	0	0	0	0	0	0	0	0	0
Blast Furnaces (Energy)	0	0	0	0	0	0	0	0	0	0	0	0
Gas Works (Energy)	0	0	0	0	0	0	0	0	0	0	0	0
BKB (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0
Petroleum refineries	0	0	0	0	0	0	0	0	0	0	0	0
Power Plants	1	2	1	0	1	0	0	1	0	15	2	0
Non Specified (Energy)	0	0	0	0	0	0	0	0	0	0	0	0
Distribution Losses	0	0	0	0	0	0	0	0	0	0	0	0
Final Consumption	366	429	291	277	257	219	126	111	103	150	70	61
Total Transport	0	0	0	0	0	0	0	0	0	0	0	0
Rail	0	0	0	0	0	0	0	0	0	0	0	0
Inland Waterways	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Transport)	0	0	0	0	0	0	0	0	0	0	0	0
Total Industry	149	211	118	136	139	115	33	46	45	94	26	21
Iron and Steel	0	0	0	0	0	0	0	0	0	0	0	0
Chemical (incl.Petro-Chemical)	0	0	0	0	0	0	0	0	0	0	0	0
Non ferrous Metals	0	0	0	0	0	0	0	0	0	0	0	0
Non metallic Mineral Products	11	14	4	0	1	4	6	3	3	6	2	2
Transportation Equipment	0	0	0	0	0	0	0	0	0	0	0	0
Machinery	0	0	0	0	0	0	0	0	0	0	0	0
Mining and Quarrying	0	0	0	0	0	0	0	0	0	0	0	0
Food, Beverages and Tobacco	2	1	1	1	0	0	0	0	0	0	0	0
Pulp, Paper and Printing	134	193	112	133	139	111	26	43	42	87	25	19
Wood and Wood Products	0	0	0	0	0	0	0	0	0	0	0	0
Construction	2	3	1	1	0	0	0	0	0	0	0	0
Textiles and Leather	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Industry)	0	0	0	0	0	0	0	0	0	0	0	0
Total Other Sectors	217	218	173	141	117	104	93	65	58	57	44	40
Commerce - Public Services	9	14	6	9	10	5	3	3	3	7	2	1
Residential	208	205	168	132	108	99	90	62	55	50	42	39
Agriculture	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Others)	0	0	0	0	0	0	0	0	0	0	0	0
Total Non-Energy Use	0	0	0	0	0	0	0	0	0	0	0	0

Table 5: National Energy Balance 1990-2001. Brown Coal Briquettes [1000 tons].

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Indigenous Production	0	0	0	0	0	0	0	0	0	0	0	0
Total Imports (Balance)	295	286	239	237	181	173	167	133	103	106	95	98
Total Exports (Balance)	0	0	0	0	0	1	1	0	0	0	0	0
International Marine Bunkers	0	0	0	0	0	0	0	0	0	0	0	1
Stock Change (National Territory)	12	32	13	-20	19	1	0	0	0	0	0	0
Gross Inland Deliveries (Obs.)	306	318	252	217	200	172	167	133	103	106	95	98
Statistical Difference	0	0	0	0	0	0	0	0	0	0	0	0
Total Transformation Sector	12	32	13	12	10	0	0	0	0	0	0	0
Public Electricity	7	13	6	5	5	0	0	0	0	0	0	0
Public Combined Heat and Power	0	0	0	0	0	0	0	0	0	0	0	0
Public Heat Plants	5	19	8	7	5	0	0	0	0	0	0	0
Auto Producers of Electricity	0	0	0	0	0	0	0	0	0	0	0	0
Auto Producers for CHP	0	0	0	0	0	0	0	0	0	0	0	0
Auto Producer Heat Plants	0	0	0	0	0	0	0	0	0	0	0	0
Gas Works (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0
Coke Ovens (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0
Blast Furnaces (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0
Patent Fuel Plants	0	0	0	0	0	0	0	0	0	0	0	0
BKB (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0
Total Energy Sector	0	0	0	0	0	0	0	0	0	0	0	0
Coal Mines	0	0	0	0	0	0	0	0	0	0	0	0
Patent Fuel Plants	0	0	0	0	0	0	0	0	0	0	0	0
Coke Ovens (Energy)	0	0	0	0	0	0	0	0	0	0	0	0
Blast Furnaces (Energy)	0	0	0	0	0	0	0	0	0	0	0	0
Gas Works (Energy)	0	0	0	0	0	0	0	0	0	0	0	0
BKB (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0
Petroleum refineries	0	0	0	0	0	0	0	0	0	0	0	0
Power Plants	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Energy)	0	0	0	0	0	0	0	0	0	0	0	0
Distribution Losses	0	0	0	0	0	0	0	0	0	0	0	0
Final Consumption	295	286	239	205	190	172	167	133	103	106	95	98
Total Transport	0	0	0	0	0	0	0	0	0	0	0	0
Rail	0	0	0	0	0	0	0	0	0	0	0	0
Inland Waterways	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Transport)	0	0	0	0	0	0	0	0	0	0	0	0
Total Industry	44	25	17	15	24	14	13	0	0	0	0	0
Iron and Steel	0	0	0	0	0	0	0	0	0	0	0	0
Chemical (incl.Petro-Chemical)	0	0	0	0	0	0	0	0	0	0	0	0
Non ferrous Metals	0	0	0	0	0	0	0	0	0	0	0	0
Non metallic Mineral Products	0	0	0	0	0	0	0	0	0	0	0	0
Transportation Equipment	0	0	0	0	0	0	0	0	0	0	0	0
Machinery	0	0	0	0	0	0	0	0	0	0	0	0
Mining and Quarrying	0	0	0	0	0	0	0	0	0	0	0	0
Food, Beverages and Tobacco	1	2	1	0	0	0	0	0	0	0	0	0
Pulp, Paper and Printing	43	23	16	15	24	14	13	0	0	0	0	0
Wood and Wood Products	0	0	0	0	0	0	0	0	0	0	0	0
Construction	0	0	0	0	0	0	0	0	0	0	0	0
Textiles and Leather	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Industry)	0	0	0	0	0	0	0	0	0	0	0	0
Total Other Sectors	251	261	223	190	166	158	154	132	103	106	95	98
Commerce - Public Services	6	11	8	7	11	6	6	20	11	11	13	5
Residential	235	240	206	176	149	146	142	108	88	91	79	90
Agriculture	10	11	9	8	7	6	6	5	4	4	3	4
Non Specified (Others)	0	0	0	0	0	0	0	0	0	0	0	0
Total Non-Energy Use	0	0	0	0	0	0	0	0	0	0	0	0

Table 6: National Energy Balance 1990-2001. Coke Oven Coke [1000 tons].

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Indigenous Production	1 725	1 540	1 487	1 402	1 432	1 448	1 559	1 566	1 598	1 608	1 385	1 394
Total Imports (Balance)	815	893	685	580	607	718	652	764	642	654	981	1 091
Total Exports (Balance)	1	2	2	0	0	1	0	0	0	2	14	1
International Marine Bunkers	0	0	0	0	0	0	0	0	0	0	0	0
Stock Change (National Territory)	-136	78	-1	54	83	178	-10	39	24	-54	77	46
Gross Inland Deliveries (Obs.)	2 402	2 508	2 169	2 035	2 122	2 343	2 200	2 369	2 264	2 205	2 429	2 530
Statistical Difference	0	0	0	0	0	0	0	0	0	0	0	0
Total Transformation Sector	596	609	526	521	569	647	601	683	660	638	718	747
Public Electricity	0	0	0	0	0	0	0	0	0	0	0	0
Public Combined Heat and Power	0	0	0	0	0	0	0	0	0	0	0	0
Public Heat Plants	0	0	0	0	0	0	0	0	0	0	0	0
Auto Producers of Electricity	0	0	0	0	0	0	0	0	0	0	0	0
Auto Producers for CHP	0	0	0	0	0	0	0	0	0	0	0	0
Auto Producer Heat Plants	0	0	0	0	0	0	0	0	0	0	0	0
Gas Works (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0
Coke Ovens (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0
Blast Furnaces (Transformation)	596	609	526	521	569	647	601	683	660	638	718	747
Patent Fuel Plants	0	0	0	0	0	0	0	0	0	0	0	0
BKB (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0
Total Energy Sector	97	119	110	97	106	121	112	127	123	119	134	139
Coal Mines	0	0	0	0	0	0	0	0	0	0	0	0
Patent Fuel Plants	0	0	0	0	0	0	0	0	0	0	0	0
Coke Ovens (Energy)	0	0	0	0	0	0	0	0	0	0	0	0
Blast Furnaces (Energy)	97	119	110	97	106	121	112	127	123	119	134	139
Gas Works (Energy)	0	0	0	0	0	0	0	0	0	0	0	0
BKB (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0
Petroleum refineries	0	0	0	0	0	0	0	0	0	0	0	0
Power Plants	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Energy)	0	0	0	0	0	0	0	0	0	0	0	0
Distribution Losses	0	0	0	0	0	0	0	0	0	0	0	0
Final Consumption	853	893	712	598	556	564	557	502	455	459	465	487
Total Transport	0	0	0	0	0	0	0	0	0	0	0	0
Rail	0	0	0	0	0	0	0	0	0	0	0	0
Inland Waterways	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Transport)	0	0	0	0	0	0	0	0	0	0	0	0
Total Industry	243	252	165	154	165	185	186	221	201	222	260	254
Iron and Steel	234	233	142	151	157	177	164	179	166	181	211	207
Chemical (incl.Petro-Chemical)	2	4	4	1	2	3	8	13	11	13	15	15
Non ferrous Metals	1	2	3	0	2	2	4	7	6	7	8	8
Non metallic Mineral Products	4	7	11	1	1	2	4	14	12	14	17	17
Transportation Equipment	0	0	0	0	0	0	0	0	0	0	0	0
Machinery	0	1	1	0	0	1	1	0	0	0	0	0
Mining and Quarrying	0	0	0	0	0	0	0	0	0	0	0	0
Food, Beverages and Tobacco	1	2	3	0	1	1	3	5	4	5	5	5
Pulp, Paper and Printing	0	0	0	0	0	0	0	0	0	0	0	0
Wood and Wood Products	0	0	0	0	0	0	0	0	0	0	0	0
Construction	0	3	1	0	0	0	0	0	0	0	0	0
Textiles and Leather	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Industry)	0	0	1	0	0	0	2	2	2	2	3	3
Total Other Sectors	610	641	547	444	391	379	371	281	254	237	205	233
Commerce - Public Services	13	14	12	10	9	8	8	6	6	5	5	6
Residential	585	615	524	426	375	363	356	269	244	227	196	223
Agriculture	12	12	11	9	8	7	7	5	5	5	4	5
Non Specified (Others)	0	0	0	0	0	0	0	0	0	0	0	0
Total Non-Energy Use	857	887	821	819	891	1 011	930	1 057	1 025	989	1 112	1 156

Table 7: National Energy Balance 1990-2001. Peat [1000 tons].

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Indigenous Production	1	1	1	1	1	1	1	1	1	1	1	1
Total Imports (Balance)	0	0	0	0	0	0	0	0	0	0	0	0
Total Exports (Balance)	0	0	0	0	0	0	0	0	0	0	0	0
International Marine Bunkers	0	0	0	0	0	0	0	0	0	0	0	0
Stock Change (National Territory)	0	0	0	0	0	0	0	0	0	0	0	0
Gross Inland Deliveries (Obs.)	1	1	1	1	1	1	1	1	1	1	1	1
Statistical Difference	0	0	0	0	0	0	0	0	0	0	0	0
Total Transformation Sector	0	0	0	0	0	0	0	0	0	0	0	0
Public Electricity	0	0	0	0	0	0	0	0	0	0	0	0
Public Combined Heat and Power	0	0	0	0	0	0	0	0	0	0	0	0
Public Heat Plants	0	0	0	0	0	0	0	0	0	0	0	0
Auto Producers of Electricity	0	0	0	0	0	0	0	0	0	0	0	0
Auto Producers for CHP	0	0	0	0	0	0	0	0	0	0	0	0
Auto Producer Heat Plants	0	0	0	0	0	0	0	0	0	0	0	0
Gas Works (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0
Coke Ovens (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0
Blast Furnaces (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0
Patent Fuel Plants	0	0	0	0	0	0	0	0	0	0	0	0
BKB (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0
Total Energy Sector	0	0	0	0	0	0	0	0	0	0	0	0
Coal Mines	0	0	0	0	0	0	0	0	0	0	0	0
Patent Fuel Plants	0	0	0	0	0	0	0	0	0	0	0	0
Coke Ovens (Energy)	0	0	0	0	0	0	0	0	0	0	0	0
Blast Furnaces (Energy)	0	0	0	0	0	0	0	0	0	0	0	0
Gas Works (Energy)	0	0	0	0	0	0	0	0	0	0	0	0
BKB (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0
Petroleum refineries	0	0	0	0	0	0	0	0	0	0	0	0
Power Plants	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Energy)	0	0	0	0	0	0	0	0	0	0	0	0
Distribution Losses	0	0	0	0	0	0	0	0	0	0	0	0
Final Consumption	1	1	1	1	1	1	1	1	1	1	1	1
Total Transport	0	0	0	0	0	0	0	0	0	0	0	0
Rail	0	0	0	0	0	0	0	0	0	0	0	0
Inland Waterways	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Transport)	0	0	0	0	0	0	0	0	0	0	0	0
Total Industry	0	0	0	0	0	0	0	0	0	0	0	0
Iron and Steel	0	0	0	0	0	0	0	0	0	0	0	0
Chemical (incl.Petro-Chemical)	0	0	0	0	0	0	0	0	0	0	0	0
Non ferrous Metals	0	0	0	0	0	0	0	0	0	0	0	0
Non metallic Mineral Products	0	0	0	0	0	0	0	0	0	0	0	0
Transportation Equipment	0	0	0	0	0	0	0	0	0	0	0	0
Machinery	0	0	0	0	0	0	0	0	0	0	0	0
Mining and Quarrying	0	0	0	0	0	0	0	0	0	0	0	0
Food, Beverages and Tobacco	0	0	0	0	0	0	0	0	0	0	0	0
Pulp, Paper and Printing	0	0	0	0	0	0	0	0	0	0	0	0
Wood and Wood Products	0	0	0	0	0	0	0	0	0	0	0	0
Construction	0	0	0	0	0	0	0	0	0	0	0	0
Textiles and Leather	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Industry)	0	0	0	0	0	0	0	0	0	0	0	0
Total Other Sectors	1	1	1	1	1	1	1	1	1	1	1	1
Commerce - Public Services	0	0	0	0	0	0	0	0	0	0	0	0
Residential	1	1	1	1	1	1	1	1	1	1	1	1
Agriculture	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Others)	0	0	0	0	0	0	0	0	0	0	0	0
Total Non-Energy Use	0	0	0	0	0	0	0	0	0	0	0	0

Table 8: National Energy Balance 1990-2001. Coke Oven Gas [TJ].

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Indigenous Production	13 117	12 276	11 164	10 636	10 790	10 906	11 419	11 605	12 166	12 220	10 466	9 776
Total Imports (Balance)	0	0	0	0	0	0	0	0	0	0	0	0
Total Exports (Balance)	0	0	0	0	0	0	0	0	0	0	0	0
International Marine Bunkers	0	0	0	0	0	0	0	0	0	0	0	0
Stock Change (National Territory)	0	0	0	0	0	0	0	0	0	0	0	0
Gross Inland Deliveries (Obs.)	13 117	12 276	11 164	10 636	10 790	10 906	11 419	11 605	12 166	12 220	10 466	9 776
Statistical Difference	0	0	0	0	0	0	0	0	0	0	0	0
Total Transformation Sector	3 385	2 763	2 885	2 960	3 490	6 228	3 545	3 087	3 087	4 005	3 794	2 013
Public Electricity	0	0	0	0	0	0	0	0	0	0	0	0
Public Combined Heat and Power	0	0	0	0	0	0	0	0	0	0	0	0
Public Heat Plants	0	0	0	0	0	0	0	0	0	0	0	0
Auto Producers of Electricity	0	0	0	0	0	0	2 183	2 002	2 033	2 649	3 256	0
Auto Producers for CHP	3 385	2 763	2 885	2 960	3 490	6 228	1 362	1 085	1 054	1 357	489	1 963
Auto Producer Heat Plants	0	0	0	0	0	0	0	0	0	0	50	50
Gas Works (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0
Coke Ovens (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0
Blast Furnaces (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0
Patent Fuel Plants	0	0	0	0	0	0	0	0	0	0	0	0
BKB (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0
Total Energy Sector	3 621	3 188	2 863	2 474	2 274	1 987	3 058	2 781	3 279	2 951	3 115	3 099
Coal Mines	0	0	0	0	0	0	0	0	0	0	0	0
Patent Fuel Plants	0	0	0	0	0	0	0	0	0	0	0	0
Coke Ovens (Energy)	3 621	3 188	2 863	2 474	2 274	1 987	3 058	2 781	3 279	2 951	3 115	3 099
Blast Furnaces (Energy)	0	0	0	0	0	0	0	0	0	0	0	0
Gas Works (Energy)	0	0	0	0	0	0	0	0	0	0	0	0
BKB (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0
Petroleum refineries	0	0	0	0	0	0	0	0	0	0	0	0
Power Plants	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Energy)	0	0	0	0	0	0	0	0	0	0	0	0
Distribution Losses	0	0	0	0	0	0	0	0	0	0	0	0
Final Consumption	6 111	6 325	5 416	5 202	5 026	2 691	4 946	5 737	5 801	5 264	3 557	0
Total Transport	0	0	0	0	0	0	0	0	0	0	0	0
Rail	0	0	0	0	0	0	0	0	0	0	0	0
Inland Waterways	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Transport)	0	0	0	0	0	0	0	0	0	0	0	0
Total Industry	6 111	6 325	5 416	5 202	5 026	2 691	4 946	5 737	5 801	5 264	3 557	0
Iron and Steel	6 111	6 325	5 416	5 202	5 026	2 691	4 946	5 737	5 801	5 264	3 557	0
Chemical (incl.Petro-Chemical)	0	0	0	0	0	0	0	0	0	0	0	0
Non ferrous Metals	0	0	0	0	0	0	0	0	0	0	0	0
Non metallic Mineral Products	0	0	0	0	0	0	0	0	0	0	0	0
Transportation Equipment	0	0	0	0	0	0	0	0	0	0	0	0
Machinery	0	0	0	0	0	0	0	0	0	0	0	0
Mining and Quarrying	0	0	0	0	0	0	0	0	0	0	0	0
Food, Beverages and Tobacco	0	0	0	0	0	0	0	0	0	0	0	0
Pulp, Paper and Printing	0	0	0	0	0	0	0	0	0	0	0	0
Wood and Wood Products	0	0	0	0	0	0	0	0	0	0	0	0
Construction	0	0	0	0	0	0	0	0	0	0	0	0
Textiles and Leather	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Industry)	0	0	0	0	0	0	0	0	0	0	0	0
Total Other Sectors	0	0	0	0	0	0	0	0	0	0	0	0
Commerce - Public Services	0	0	0	0	0	0	0	0	0	0	0	0
Residential	0	0	0	0	0	0	0	0	0	0	0	0
Agriculture	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Others)	0	0	0	0	0	0	0	0	0	0	0	0
Total Non-Energy Use	0	0	0	0	0	0	0	0	0	0	0	0

Table 9: National Energy Balance 1990-2001. Blast Furnace Gas [TJ].

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Indigenous Production	16 175	16 530	14 273	14 281	15 614	17 564	16 311	18 528	18 608	17 313	19 491	20 275
Total Imports (Balance)	0	0	0	0	0	0	0	0	0	0	0	0
Total Exports (Balance)	0	0	0	0	0	0	0	0	0	0	0	0
International Marine Bunkers	0	0	0	0	0	0	0	0	0	0	0	0
Stock Change (National Territory)	0	0	0	0	0	0	0	0	0	0	0	0
Gross Inland Deliveries (Obs.)	16 175	16 530	14 273	14 281	15 614	17 564	16 311	18 528	18 608	17 313	19 491	20 275
Statistical Difference	0	0	0	0	0	0	0	0	0	0	0	0
Total Transformation Sector	4 822	4 352	5 405	5 006	5 477	5 766	6 317	7 725	5 644	6 703	6 260	2 448
Public Electricity	0	0	0	0	0	0	0	0	0	0	0	0
Public Combined Heat and Power	0	0	0	0	0	0	0	0	0	0	0	0
Public Heat Plants	0	0	0	0	0	0	0	0	0	0	0	0
Auto Producers of Electricity	0	0	0	0	0	0	4 493	5 447	4 320	4 530	5 257	0
Auto Producers for CHP	4 822	4 352	5 405	5 006	5 477	5 766	1 824	2 278	1 324	2 173	1 003	2 448
Auto Producer Heat Plants	0	0	0	0	0	0	0	0	0	0	0	0
Gas Works (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0
Coke Ovens (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0
Blast Furnaces (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0
Patent Fuel Plants	0	0	0	0	0	0	0	0	0	0	0	0
BKB (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0
Total Energy Sector	1 983	2 026	1 749	1 750	1 914	2 175	633	720	723	672	757	787
Coal Mines	0	0	0	0	0	0	0	0	0	0	0	0
Patent Fuel Plants	0	0	0	0	0	0	0	0	0	0	0	0
Coke Ovens (Energy)	1 983	2 026	1 749	1 750	1 914	2 175	633	720	723	672	757	787
Blast Furnaces (Energy)	0	0	0	0	0	0	0	0	0	0	0	0
Gas Works (Energy)	0	0	0	0	0	0	0	0	0	0	0	0
BKB (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0
Petroleum refineries	0	0	0	0	0	0	0	0	0	0	0	0
Power Plants	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Energy)	0	0	0	0	0	0	0	0	0	0	0	0
Distribution Losses	0	0	0	0	0	0	0	0	0	0	0	0
Final Consumption	9 370	10 152	7 119	7 525	8 224	9 622	9 360	10 083	12 241	9 937	12 474	17 039
Total Transport	0	0	0	0	0	0	0	0	0	0	0	0
Rail	0	0	0	0	0	0	0	0	0	0	0	0
Inland Waterways	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Transport)	0	0	0	0	0	0	0	0	0	0	0	0
Total Industry	9 370	10 152	7 119	7 525	8 224	9 622	9 360	10 083	12 241	9 937	12 474	17 039
Iron and Steel	9 370	10 152	7 119	7 525	8 224	9 622	9 360	10 083	12 241	9 937	12 474	17 039
Chemical (incl.Petro-Chemical)	0	0	0	0	0	0	0	0	0	0	0	0
Non ferrous Metals	0	0	0	0	0	0	0	0	0	0	0	0
Non metallic Mineral Products	0	0	0	0	0	0	0	0	0	0	0	0
Transportation Equipment	0	0	0	0	0	0	0	0	0	0	0	0
Machinery	0	0	0	0	0	0	0	0	0	0	0	0
Mining and Quarrying	0	0	0	0	0	0	0	0	0	0	0	0
Food, Beverages and Tobacco	0	0	0	0	0	0	0	0	0	0	0	0
Pulp, Paper and Printing	0	0	0	0	0	0	0	0	0	0	0	0
Wood and Wood Products	0	0	0	0	0	0	0	0	0	0	0	0
Construction	0	0	0	0	0	0	0	0	0	0	0	0
Textiles and Leather	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Industry)	0	0	0	0	0	0	0	0	0	0	0	0
Total Other Sectors	0	0	0	0	0	0	0	0	0	0	0	0
Commerce - Public Services	0	0	0	0	0	0	0	0	0	0	0	0
Residential	0	0	0	0	0	0	0	0	0	0	0	0
Agriculture	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Others)	0	0	0	0	0	0	0	0	0	0	0	0
Total Non-Energy Use	0	0	0	0	0	0	0	0	0	0	0	0

Table 10: National Energy Balance 1990-2001. Crude Oil [1000 tons].

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Indigenous Production	1 149	1 280	1 180	1 154	1 099	1 035	992	972	959	1 002	971	957
Refinery Losses	0	0	0	113	139	206	103	82	89	76	35	35
Refinery Intake (Calculated)	7 952	8 273	8 732	8 522	8 898	8 619	8 754	9 374	9 190	8 635	8 240	8 799
Refinery Intake (Observed)	7 952	8 273	8 732	8 522	8 898	8 619	8 754	9 374	9 190	8 635	8 240	8 799
Refinery Fuel	0	0	0	0	0	0	0	0	0	0	0	0
Total Imports (Balance)	6 797	7 000	7 550	7 453	7 790	7 590	7 737	8 450	8 269	7 698	7 315	7 940
Total Exports (Balance)	0	0	0	0	0	0	51	25	44	51	61	63
Stock Change (National Territory)	6	-8	3	-84	9	-6	75	-23	6	-14	16	-36
Statistical Difference	0	0	0	0	0	0	0	0	0	0	0	0

Table 11: National Energy Balance 1990-2001. Natural Gas Liquids [1000 tons].

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Indigenous Production	41	41	40	40	47	43	53	55	88	61	101	55
Refinery Losses	0	0	0	0	0	0	0	0	0	0	0	0
Refinery Intake (Calculated)	41	41	40	40	47	43	53	43	226	71	107	55
Refinery Intake (Observed)	41	41	40	40	47	43	53	43	226	71	107	55
Refinery Fuel	0	0	0	0	0	0	0	0	0	0	0	0
Total Imports (Balance)	0	0	0	0	0	0	0	0	135	0	6	0
Total Exports (Balance)	0	0	0	0	0	0	0	0	0	0	0	0
Stock Change (National Territory)	0	0	0	0	0	0	0	-12	2	10	0	0
Statistical Difference	0	0	0	0	0	0	0	0	0	0	0	0

Table 12: National Energy Balance 1990-2001. Refinery Feedstocks [1000 tons].

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Refinery Losses	0	0	0	0	0	0	0	0	0	0	0	0
Refinery Intake (Calculated)	1 327	1 530	1 224	1 158	952	637	684	853	607	873	540	653
Refinery Intake (Observed)	1 327	1 530	1 224	1 158	952	637	684	853	607	873	540	652
Refinery Fuel	0	0	0	0	0	0	0	0	0	0	0	1
Total Imports (Balance)	1 211	1 394	1 058	708	848	637	712	664	729	740	627	570
Total Exports (Balance)	0	0	0	0	102	103	62	14	13	15	76	42
Stock Change (National Territory)	30	34	86	349	105	1	-58	189	-196	115	-32	115

Table 13: National Energy Balance 1990-2001. Residual Fuel Oil [1000 tons].

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Refinery Gross Output	1 913	1 981	1 821	1 678	1 472	1 513	1 441	1 540	1 347	1 308	979	1 044
Refinery Fuel	81	77	80	126	143	139	56	49	63	22	37	7
Total Imports (Balance)	400	240	220	541	456	532	386	449	671	468	262	280
Total Exports (Balance)	185	149	65	110	77	38	121	180	18	37	152	228
International Marine Bunkers	0	0	0	0	0	0	0	0	0	0	0	0
Stock Change (National Territory)	-93	-88	-188	-29	109	-117	119	128	-38	-131	246	256
Gross Inland Deliveries (Obs.)	1 954	1 907	1 709	1 954	1 816	1 750	1 770	1 888	1 899	1 586	1 299	1 345
Statistical Difference	0	0	0	0	0	0	0	0	0	0	0	0
Total Transformation Sector	406	500	454	789	738	666	694	806	883	797	455	500
Public Electricity	28	37	10	102	95	88	198	391	351	271	117	197
Public Combined Heat and Power	253	297	229	408	398	316	177	149	230	281	162	184
Public Heat Plants	46	64	106	112	81	71	106	53	108	63	59	59
Auto Producers of Electricity	0	0	0	0	0	0	85	78	102	85	65	1
Auto Producers for CHP	80	102	109	168	164	191	128	135	92	94	51	58
Auto Producer Heat Plants	0	0	0	0	0	0	0	0	0	2	1	1
Gas Works (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0
Coke Ovens (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Blast Furnaces (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0
Petrochemical Industry	0	0	0	0	0	0	0	0	0	0	0	0
Patent Fuel Plants	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0
Total Energy Sector	0	0	0	0	0	0	0	0	0	0	0	0
Coal Mines	0	0	0	0	0	0	0	0	0	0	0	0
Oil and Gas Extraction	0	0	0	0	0	0	0	0	0	0	0	0
Coke Ovens (Energy)	0	0	0	0	0	0	0	0	0	0	0	0
Blast Furnaces (Energy)	0	0	0	0	0	0	0	0	0	0	0	0
Gas Works (Energy)	0	0	0	0	0	0	0	0	0	0	0	0
Power Plants	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Energy)	0	0	0	0	0	0	0	0	0	0	0	0
Distribution Losses	0	0	0	0	0	0	0	0	0	0	0	0
Final Consumption	1 548	1 407	1 255	1 165	1 078	1 084	1 076	1 081	1 016	789	843	846
Total Transport	0	0	0	0	0	0	0	0	0	0	0	0
International Civil Aviation	0	0	0	0	0	0	0	0	0	0	0	0
Domestic Air Transport	0	0	0	0	0	0	0	0	0	0	0	0
Road	0	0	0	0	0	0	0	0	0	0	0	0
Rail	0	0	0	0	0	0	0	0	0	0	0	0
Inland Waterways	0	0	0	0	0	0	0	0	0	0	0	0
Pipeline Transport	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Transport)	0	0	0	0	0	0	0	0	0	0	0	0
Total Industry	577	605	540	661	670	602	538	817	743	514	566	538
Iron and Steel	88	92	88	105	125	141	112	283	257	178	196	186
Chemical (incl.Petro-Chemical)	23	23	17	19	25	23	23	29	27	18	20	19
Non ferrous Metals	4	4	4	4	5	6	8	13	12	8	9	9
Non metallic Mineral Products	113	108	108	157	134	118	102	141	129	89	98	93
Transportation Equipment	13	15	13	16	17	15	5	4	4	3	3	3
Machinery	11	13	11	13	14	14	16	17	15	10	11	11
Mining and Quarrying	6	6	5	7	7	6	8	8	7	5	6	5
Food, Beverages and Tobacco	77	85	78	88	83	78	54	61	56	39	43	40
Pulp, Paper and Printing	123	131	116	139	140	95	76	101	92	64	70	67
Wood and Wood Products	15	15	13	14	15	18	21	30	27	19	21	20
Construction	32	34	21	24	25	19	28	32	29	20	22	21
Textiles and Leather	26	30	24	27	28	22	28	35	32	22	24	23
Non Specified (Industry)	46	49	41	47	52	46	57	63	58	40	44	42
Total Other Sectors	971	802	715	504	408	482	539	264	273	275	277	307
Commerce - Public Services	309	225	199	161	163	209	231	52	47	32	36	34
Residential	471	410	367	244	174	194	219	151	161	173	172	194
Agriculture	191	167	149	99	71	79	89	61	65	70	70	79
Non Specified (Others)	0	0	0	0	0	0	0	0	0	0	0	0
Total Non-Energy Use	0	0	0	0	0	0	0	0	0	0	0	1

Table 14: National Energy Balance 1990-2001. Heating and Oher Gas Oil [1000 tons].

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Refinery Gross Output	1 239	1 575	1 412	1 639	1 614	1 454	1 598	1 604	1 280	1 245	1 062	1 301
Refinery Fuel	0	0	0	0	0	0	0	1	2	6	0	0
Total Imports (Balance)	0	0	0	88	18	165	376	355	577	615	533	626
Total Exports (Balance)	0	0	0	59	48	0	0	0	0	0	1	3
International Marine Bunkers	0	0	0	0	0	0	0	0	0	0	0	0
Stock Change (National Territory)	5	-48	10	-35	-58	39	-17	-53	41	1	4	39
Gross Inland Deliveries (Obs.)	1 244	1 527	1 422	1 634	1 526	1 658	1 956	1 906	1 895	1 854	1 598	1 963
Statistical Difference	0	0	0	0	0	0	0	0	0	0	0	0
Total Transformation Sector	0	0	0	2	2	2	1	2	3	1	0	19
Public Electricity	0	0	0	0	0	0	0	0	0	0	0	15
Public Combined Heat and Power	0	0	0	2	2	2	0	0	0	0	0	4
Public Heat Plants	0	0	0	0	0	0	1	2	2	0	0	0

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Auto Producers of Electricity	0	0	0	0	0	0	0	0	0	0	0	0
Auto Producers for CHP	0	0	0	0	0	0	0	0	0	0	0	0
Auto Producer Heat Plants	0	0	0	0	0	0	0	0	0	0	0	0
Gas Works (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0
Coke Ovens (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0
Blast Furnaces (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0
Petrochemical Industry	0	0	0	0	0	0	0	0	0	0	0	0
Patent Fuel Plants	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0
Total Energy Sector	0	0	0	0	0	0	0	0	0	0	0	0
Coal Mines	0	0	0	0	0	0	0	0	0	0	0	0
Oil and Gas Extraction	0	0	0	0	0	0	0	0	0	0	0	0
Coke Ovens (Energy)	0	0	0	0	0	0	0	0	0	0	0	0
Blast Furnaces (Energy)	0	0	0	0	0	0	0	0	0	0	0	0
Gas Works (Energy)	0	0	0	0	0	0	0	0	0	0	0	0
Power Plants	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Energy)	0	0	0	0	0	0	0	0	0	0	0	0
Distribution Losses	0	0	0	0	0	0	0	0	0	0	0	0
Final Consumption	1 244	1 527	1 422	1 631	1 524	1 656	1 955	1 904	1 893	1 853	1 597	1 944
Total Transport	0	0	0	0	0	0	0	0	0	0	0	0
International Civil Aviation	0	0	0	0	0	0	0	0	0	0	0	0
Domestic Air Transport	0	0	0	0	0	0	0	0	0	0	0	0
Road	0	0	0	0	0	0	0	0	0	0	0	0
Rail	0	0	0	0	0	0	0	0	0	0	0	0
Inland Waterways	0	0	0	0	0	0	0	0	0	0	0	0
Pipeline Transport	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Transport)	0	0	0	0	0	0	0	0	0	0	0	0
Total Industry	1	5	4	14	8	8	29	11	12	10	3	10
Iron and Steel	0	0	0	0	0	0	0	0	0	0	0	0
Chemical (incl.Petro-Chemical)	0	0	0	0	0	0	1	0	0	0	0	0
Non ferrous Metals	0	0	0	0	0	0	1	0	0	0	0	0
Non metallic Mineral Products	0	1	1	1	1	1	3	2	2	2	1	2
Transportation Equipment	0	0	0	0	0	0	1	0	0	0	0	0
Machinery	0	0	0	1	1	1	3	1	1	1	0	1
Mining and Quarrying	0	0	0	0	0	0	1	1	1	0	0	0
Food, Beverages and Tobacco	0	0	0	3	1	1	3	1	1	1	0	1
Pulp, Paper and Printing	0	0	0	1	0	0	2	0	0	0	0	0
Wood and Wood Products	0	0	0	0	0	0	1	0	0	0	0	0
Construction	0	1	1	4	3	2	4	3	3	2	1	2
Textiles and Leather	0	0	0	0	0	0	3	0	0	0	0	0
Non Specified (Industry)	0	1	1	2	1	1	6	3	3	2	1	2
Total Other Sectors	1 243	1 523	1 417	1 617	1 516	1 648	1 926	1 893	1 880	1 843	1 594	1 934
Commerce - Public Services	26	87	84	141	86	89	205	219	237	197	62	197
Residential	1 216	1 434	1 333	1 475	1 429	1 558	1 720	1 673	1 643	1 644	1 531	1 735
Agriculture	1	1	1	1	1	1	1	1	1	1	1	1
Non Specified (Others)	0	0	0	0	0	0	0	0	0	0	0	0
Total Non-Energy Use	0	0	0	0	0	0	0	0	0	0	0	0

Table 15: National Energy Balance 1990-2001. Diesel [1000 tons].

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Refinery Gross Output	1 531	1 634	1 833	1 965	2 034	1 920	2 008	2 311	2 615	2 430	2 662	2 658
Refinery Fuel	0	0	0	2	2	1	1	1	1	0	0	0
Total Imports (Balance)	576	686	589	609	800	937	1 777	1 159	1 898	1 877	2 075	2 433
Total Exports (Balance)	3	40	73	104	88	83	97	271	467	459	415	415
International Marine Bunkers	0	0	0	0	0	0	0	0	0	0	0	0
Stock Change (National Territory)	-7	46	97	140	-24	94	-106	195	-108	44	-59	-8
Gross Inland Deliveries (Obs.)	2 097	2 326	2 446	2 608	2 720	2 867	3 581	3 394	3 937	3 892	4 263	4 668

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Statistical Difference	0	0	0	0	0	0	0	0	0	0	0	0
Total Transformation Sector	0	0	0	5	5	8	4	7	1	3	1	0
Public Electricity	0	0	0	2	1	4	1	2	0	2	0	0
Public Combined Heat and Power	0	0	0	0	0	0	0	2	1	0	0	0
Public Heat Plants	0	0	0	1	2	1	1	2	0	0	0	0
Auto Producers of Electricity	0	0	0	1	0	2	1	0	0	1	1	0
Auto Producers for CHP	0	0	0	1	2	1	1	1	0	0	0	0
Auto Producer Heat Plants	0	0	0	0	0	0	0	0	0	0	0	0
Gas Works (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0
Coke Ovens (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0
Blast Furnaces (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0
Petrochemical Industry	0	0	0	0	0	0	0	0	0	0	0	0
Patent Fuel Plants	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0
Total Energy Sector	0	0	0	0	0	0	0	0	0	0	0	0
Coal Mines	0	0	0	0	0	0	0	0	0	0	0	0
Oil and Gas Extraction	0	0	0	0	0	0	0	0	0	0	0	0
Coke Ovens (Energy)	0	0	0	0	0	0	0	0	0	0	0	0
Blast Furnaces (Energy)	0	0	0	0	0	0	0	0	0	0	0	0
Gas Works (Energy)	0	0	0	0	0	0	0	0	0	0	0	0
Power Plants	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Energy)	0	0	0	0	0	0	0	0	0	0	0	0
Distribution Losses	0	0	0	0	0	0	0	0	0	0	0	0
Final Consumption	2 096	2 326	2 446	2 603	2 715	2 859	3 578	3 388	3 936	3 889	4 261	4 668
Total Transport	1 727	1 992	2 101	2 069	2 166	2 287	2 917	2 751	3 234	3 196	3 527	3 891
International Civil Aviation	0	0	0	0	0	0	0	0	0	0	0	0
Domestic Air Transport	0	0	0	0	0	0	0	0	0	0	0	0
Road	1 665	1 935	2 045	2 014	2 111	2 236	2 870	2 703	3 188	3 147	3 473	3 836
Rail	54	50	49	48	49	45	41	41	41	42	47	47
Inland Waterways	7	7	7	7	6	6	6	6	6	7	7	8
Pipeline Transport	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Transport)	0	0	0	0	0	0	0	0	0	0	0	0
Total Industry	52	18	25	192	204	222	302	282	340	334	371	411
Iron and Steel	0	0	0	0	0	0	0	0	0	0	0	0
Chemical (incl.Petro-Chemical)	1	0	0	2	2	3	3	3	4	4	4	5
Non ferrous Metals	0	0	0	0	0	0	0	0	0	0	0	0
Non metallic Mineral Products	1	0	0	3	3	3	5	4	5	5	6	6
Transportation Equipment	4	1	2	13	14	15	21	19	23	23	26	28
Machinery	0	0	0	0	0	0	0	0	0	0	0	0
Mining and Quarrying	4	1	2	14	14	16	21	20	24	24	26	29
Food, Beverages and Tobacco	0	0	0	1	1	1	1	1	1	1	1	2
Pulp, Paper and Printing	0	0	0	0	0	0	1	1	1	1	1	1
Wood and Wood Products	1	0	0	3	3	3	4	4	5	4	5	6
Construction	42	14	20	154	163	177	241	225	272	266	296	328
Textiles and Leather	1	0	0	2	2	2	3	3	4	4	4	4
Non Specified (Industry)	0	0	0	1	1	1	1	1	1	1	2	2
Total Other Sectors	318	316	320	342	345	350	359	355	361	359	363	366
Commerce - Public Services	6	2	3	23	24	26	36	33	40	39	44	49
Residential	0	0	0	0	0	0	0	0	0	0	0	0
Agriculture	312	314	317	319	321	324	323	322	321	320	319	318
Non Specified (Others)	0	0	0	0	0	0	0	0	0	0	0	0
Total Non-Energy Use	0	0	0	0	0	0	0	0	0	0	0	0

Table 16: National Energy Balance 1990-2001. Other Kerosene [1000 tons].

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Refinery Gross Output	33	43	45	-2	13	8	5	3	8	1	1	1
Refinery Fuel	0	0	0	0	0	0	0	0	0	0	0	1

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Total Imports (Balance)	14	4	18	0	0	4	10	10	16	15	5	0
Total Exports (Balance)	14	13	31	7	13	6	5	2	8	0	0	0
International Marine Bunkers	0	0	0	0	0	0	0	0	0	0	0	0
Stock Change (National Territory)	-16	-4	-2	23	2	-1	1	-1	1	0	0	0
Gross Inland Deliveries (Obs.)	18	31	30	14	2	5	12	10	17	16	6	1
Statistical Difference	0	0	0	0	0	0	0	0	0	0	0	0
Total Transformation Sector	0	0	0	0	0	0	0	0	0	0	0	0
Public Electricity	0	0	0	0	0	0	0	0	0	0	0	0
Public Combined Heat and Power	0	0	0	0	0	0	0	0	0	0	0	0
Public Heat Plants	0	0	0	0	0	0	0	0	0	0	0	0
Auto Producers of Electricity	0	0	0	0	0	0	0	0	0	0	0	0
Auto Producers for CHP	0	0	0	0	0	0	0	0	0	0	0	0
Auto Producer Heat Plants	0	0	0	0	0	0	0	0	0	0	0	0
Gas Works (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0
Coke Ovens (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0
Blast Furnaces (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0
Petrochemical Industry	0	0	0	0	0	0	0	0	0	0	0	0
Patent Fuel Plants	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0
Total Energy Sector	0	0	0	0	0	0	0	0	0	0	0	0
Coal Mines	0	0	0	0	0	0	0	0	0	0	0	0
Oil and Gas Extraction	0	0	0	0	0	0	0	0	0	0	0	0
Coke Ovens (Energy)	0	0	0	0	0	0	0	0	0	0	0	0
Blast Furnaces (Energy)	0	0	0	0	0	0	0	0	0	0	0	0
Gas Works (Energy)	0	0	0	0	0	0	0	0	0	0	0	0
Power Plants	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Energy)	0	0	0	0	0	0	0	0	0	0	0	0
Distribution Losses	0	0	0	0	0	0	0	0	0	0	0	0
Final Consumption	18	31	30	14	2	5	12	10	17	16	6	1
Total Transport	0	0	0	0	0	0	0	0	0	0	0	0
International Civil Aviation	0	0	0	0	0	0	0	0	0	0	0	0
Domestic Air Transport	0	0	0	0	0	0	0	0	0	0	0	0
Road	0	0	0	0	0	0	0	0	0	0	0	0
Rail	0	0	0	0	0	0	0	0	0	0	0	0
Inland Waterways	0	0	0	0	0	0	0	0	0	0	0	0
Pipeline Transport	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Transport)	0	0	0	0	0	0	0	0	0	0	0	0
Total Industry	0	0	1	0	0	0	0	0	0	0	0	0
Iron and Steel	0	0	0	0	0	0	0	0	0	0	0	0
Chemical (incl.Petro-Chemical)	0	0	0	0	0	0	0	0	0	0	0	0
Non ferrous Metals	0	0	0	0	0	0	0	0	0	0	0	0
Non metallic Mineral Products	0	0	0	0	0	0	0	0	0	0	0	0
Transportation Equipment	0	0	0	0	0	0	0	0	0	0	0	0
Machinery	0	0	0	0	0	0	0	0	0	0	0	0
Mining and Quarrying	0	0	0	0	0	0	0	0	0	0	0	0
Food, Beverages and Tobacco	0	0	0	0	0	0	0	0	0	0	0	0
Pulp, Paper and Printing	0	0	0	0	0	0	0	0	0	0	0	0
Wood and Wood Products	0	0	0	0	0	0	0	0	0	0	0	0
Construction	0	0	1	0	0	0	0	0	0	0	0	0
Textiles and Leather	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Industry)	0	0	0	0	0	0	0	0	0	0	0	0
Total Other Sectors	18	31	29	14	2	5	12	10	17	16	6	1
Commerce - Public Services	18	31	29	14	2	5	12	10	17	16	6	1
Residential	0	0	0	0	0	0	0	0	0	0	0	0
Agriculture	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Others)	0	0	0	0	0	0	0	0	0	0	0	0
Total Non-Energy Use	0	0	0	0	0	0	0	0	0	0	0	0

Table 17: National Energy Balance 1990-2001. Kerosene Type Jet Fuel [1000 tons].

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Refinery Gross Output	289	334	375	378	376	420	479	505	535	508	544	513
Refinery Fuel	0	0	0	0	0	0	0	0	0	0	0	0
Total Imports (Balance)	13	8	9	10	27	23	24	11	9	21	35	37
Total Exports (Balance)	5	0	0	3	0	0	0	0	6	5	5	5
International Marine Bunkers	0	0	0	0	0	0	0	0	0	0	0	0
Stock Change (National Territory)	2	-6	-21	1	0	4	-8	-1	-2	2	-4	4
Gross Inland Deliveries (Obs.)	299	336	363	386	403	447	495	515	536	525	569	549
Statistical Difference	0	0	0	0	0	0	0	0	0	0	0	0
Total Transformation Sector	0	0	0	0	0	0	0	0	0	0	0	0
Public Electricity	0	0	0	0	0	0	0	0	0	0	0	0
Public Combined Heat and Power	0	0	0	0	0	0	0	0	0	0	0	0
Public Heat Plants	0	0	0	0	0	0	0	0	0	0	0	0
Auto Producers of Electricity	0	0	0	0	0	0	0	0	0	0	0	0
Auto Producers for CHP	0	0	0	0	0	0	0	0	0	0	0	0
Auto Producer Heat Plants	0	0	0	0	0	0	0	0	0	0	0	0
Gas Works (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0
Coke Ovens (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0
Blast Furnaces (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0
Petrochemical Industry	0	0	0	0	0	0	0	0	0	0	0	0
Patent Fuel Plants	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0
Total Energy Sector	0	0	0	0	0	0	0	0	0	0	0	0
Coal Mines	0	0	0	0	0	0	0	0	0	0	0	0
Oil and Gas Extraction	0	0	0	0	0	0	0	0	0	0	0	0
Coke Ovens (Energy)	0	0	0	0	0	0	0	0	0	0	0	0
Blast Furnaces (Energy)	0	0	0	0	0	0	0	0	0	0	0	0
Gas Works (Energy)	0	0	0	0	0	0	0	0	0	0	0	0
Power Plants	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Energy)	0	0	0	0	0	0	0	0	0	0	0	0
Distribution Losses	0	0	0	0	0	0	0	0	0	0	0	0
Final Consumption	299	336	363	386	403	447	495	515	536	525	569	549
Total Transport	299	336	363	386	403	447	495	515	536	525	569	549
International Civil Aviation	274	307	332	356	371	412	465	493	506	489	537	447
Domestic Air Transport	25	29	31	30	32	35	30	22	30	36	32	102
Road	0	0	0	0	0	0	0	0	0	0	0	0
Rail	0	0	0	0	0	0	0	0	0	0	0	0
Inland Waterways	0	0	0	0	0	0	0	0	0	0	0	0
Pipeline Transport	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Transport)	0	0	0	0	0	0	0	0	0	0	0	0
Total Industry	0	0	0	0	0	0	0	0	0	0	0	0
Iron and Steel	0	0	0	0	0	0	0	0	0	0	0	0
Chemical (incl.Petro-Chemical)	0	0	0	0	0	0	0	0	0	0	0	0
Non ferrous Metals	0	0	0	0	0	0	0	0	0	0	0	0
Non metallic Mineral Products	0	0	0	0	0	0	0	0	0	0	0	0
Transportation Equipment	0	0	0	0	0	0	0	0	0	0	0	0
Machinery	0	0	0	0	0	0	0	0	0	0	0	0
Mining and Quarrying	0	0	0	0	0	0	0	0	0	0	0	0
Food, Beverages and Tobacco	0	0	0	0	0	0	0	0	0	0	0	0
Pulp, Paper and Printing	0	0	0	0	0	0	0	0	0	0	0	0
Wood and Wood Products	0	0	0	0	0	0	0	0	0	0	0	0
Construction	0	0	0	0	0	0	0	0	0	0	0	0
Textiles and Leather	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Industry)	0	0	0	0	0	0	0	0	0	0	0	0
Total Other Sectors	0	0	0	0	0	0	0	0	0	0	0	0
Commerce - Public Services	0	0	0	0	0	0	0	0	0	0	0	0
Residential	0	0	0	0	0	0	0	0	0	0	0	0
Agriculture	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Others)	0	0	0	0	0	0	0	0	0	0	0	0

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Total Non-Energy Use	0	0	0	0	0	0	0	0	0	0	0	0

Table 18: National Energy Balance 1990-2001. Gasoline Type Jet Fuel [1000 tons].

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Refinery Gross Output	0	0	0	0	0	0	0	0	0	0	0	0
Refinery Fuel	0	0	0	0	0	0	0	0	0	0	0	1
Total Imports (Balance)	2	3	3	3	3	4	2	3	3	3	3	4
Total Exports (Balance)	0	0	0	0	0	0	1	1	0	1	1	1
International Marine Bunkers	0	0	0	0	0	0	0	0	0	0	0	0
Stock Change (National Territory)	1	0	0	0	0	-2	1	0	0	0	0	-1
Gross Inland Deliveries (Obs.)	2	3	3	3	3	2	2	2	3	3	2	2
Statistical Difference	0	0	0	0	0	0	0	0	0	0	0	0
Total Transformation Sector	0	0	0	0	0	0	0	0	0	0	0	0
Public Electricity	0	0	0	0	0	0	0	0	0	0	0	0
Public Combined Heat and Power	0	0	0	0	0	0	0	0	0	0	0	0
Public Heat Plants	0	0	0	0	0	0	0	0	0	0	0	0
Auto Producers of Electricity	0	0	0	0	0	0	0	0	0	0	0	0
Auto Producers for CHP	0	0	0	0	0	0	0	0	0	0	0	0
Auto Producer Heat Plants	0	0	0	0	0	0	0	0	0	0	0	0
Gas Works (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0
Coke Ovens (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0
Blast Furnaces (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0
Petrochemical Industry	0	0	0	0	0	0	0	0	0	0	0	0
Patent Fuel Plants	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0
Total Energy Sector	0	0	0	0	0	0	0	0	0	0	0	0
Coal Mines	0	0	0	0	0	0	0	0	0	0	0	0
Oil and Gas Extraction	0	0	0	0	0	0	0	0	0	0	0	0
Coke Ovens (Energy)	0	0	0	0	0	0	0	0	0	0	0	0
Blast Furnaces (Energy)	0	0	0	0	0	0	0	0	0	0	0	0
Gas Works (Energy)	0	0	0	0	0	0	0	0	0	0	0	0
Power Plants	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Energy)	0	0	0	0	0	0	0	0	0	0	0	0
Distribution Losses	0	0	0	0	0	0	0	0	0	0	0	0
Final Consumption	2	3	3	3	3	2	2	2	3	3	2	2
Total Transport	2	3	3	3	3	2	2	2	3	3	2	2
International Civil Aviation	0	0	0	0	0	0	0	0	0	0	0	0
Domestic Air Transport	2	3	3	3	3	2	2	2	3	3	2	2
Road	0	0	0	0	0	0	0	0	0	0	0	0
Rail	0	0	0	0	0	0	0	0	0	0	0	0
Inland Waterways	0	0	0	0	0	0	0	0	0	0	0	0
Pipeline Transport	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Transport)	0	0	0	0	0	0	0	0	0	0	0	0
Total Industry	0	0	0	0	0	0	0	0	0	0	0	0
Iron and Steel	0	0	0	0	0	0	0	0	0	0	0	0
Chemical (incl.Petro-Chemical)	0	0	0	0	0	0	0	0	0	0	0	0
Non ferrous Metals	0	0	0	0	0	0	0	0	0	0	0	0
Non metallic Mineral Products	0	0	0	0	0	0	0	0	0	0	0	0
Transportation Equipment	0	0	0	0	0	0	0	0	0	0	0	0
Machinery	0	0	0	0	0	0	0	0	0	0	0	0
Mining and Quarrying	0	0	0	0	0	0	0	0	0	0	0	0
Food, Beverages and Tobacco	0	0	0	0	0	0	0	0	0	0	0	0
Pulp, Paper and Printing	0	0	0	0	0	0	0	0	0	0	0	0
Wood and Wood Products	0	0	0	0	0	0	0	0	0	0	0	0
Construction	0	0	0	0	0	0	0	0	0	0	0	0
Textiles and Leather	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Industry)	0	0	0	0	0	0	0	0	0	0	0	0

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Total Other Sectors	0	0	0	0	0	0	0	0	0	0	0	0
Commerce - Public Services	0	0	0	0	0	0	0	0	0	0	0	0
Residential	0	0	0	0	0	0	0	0	0	0	0	0
Agriculture	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Others)	0	0	0	0	0	0	0	0	0	0	0	0
Total Non-Energy Use	0	0	0	0	0	0	0	0	0	0	0	0

Table 19: National Energy Balance 1990-2001. Motor Gasoline [1000 tons].

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Refinery Gross Output	2 631	2 400	2 462	2 340	2 541	2 271	2 297	2 410	2 232	2 141	1 815	1 922
Refinery Fuel	0	0	0	0	0	0	0	0	0	0	0	0
Total Imports (Balance)	258	387	506	541	618	715	612	547	759	762	670	603
Total Exports (Balance)	281	127	214	311	640	596	700	831	824	825	472	582
International Marine Bunkers	0	0	0	0	0	0	0	0	0	0	0	0
Stock Change (National Territory)	-54	136	-78	-2	-5	12	10	-22	36	-31	-33	51
Gross Inland Deliveries (Obs.)	2 554	2 796	2 676	2 568	2 513	2 402	2 218	2 105	2 204	2 047	1 980	1 994
Statistical Difference	0	0	0	0	0	0	0	0	0	0	0	0
Total Transformation Sector	0	0	0	0	0	0	0	0	0	0	0	0
Public Electricity	0	0	0	0	0	0	0	0	0	0	0	0
Public Combined Heat and Power	0	0	0	0	0	0	0	0	0	0	0	0
Public Heat Plants	0	0	0	0	0	0	0	0	0	0	0	0
Auto Producers of Electricity	0	0	0	0	0	0	0	0	0	0	0	0
Auto Producers for CHP	0	0	0	0	0	0	0	0	0	0	0	0
Auto Producer Heat Plants	0	0	0	0	0	0	0	0	0	0	0	0
Gas Works (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0
Coke Ovens (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0
Blast Furnaces (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0
Petrochemical Industry	0	0	0	0	0	0	0	0	0	0	0	0
Patent Fuel Plants	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0
Total Energy Sector	0	0	0	0	0	0	0	0	0	0	0	0
Coal Mines	0	0	0	0	0	0	0	0	0	0	0	0
Oil and Gas Extraction	0	0	0	0	0	0	0	0	0	0	0	0
Coke Ovens (Energy)	0	0	0	0	0	0	0	0	0	0	0	0
Blast Furnaces (Energy)	0	0	0	0	0	0	0	0	0	0	0	0
Gas Works (Energy)	0	0	0	0	0	0	0	0	0	0	0	0
Power Plants	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Energy)	0	0	0	0	0	0	0	0	0	0	0	0
Distribution Losses	0	0	0	0	0	0	0	0	0	0	0	0
Final Consumption	2 554	2 796	2 676	2 568	2 513	2 402	2 218	2 105	2 204	2 047	1 980	1 994
Total Transport	2 506	2 748	2 636	2 530	2 442	2 358	2 177	2 063	2 096	2 045	1 978	1 992
International Civil Aviation	0	0	0	0	0	0	0	0	0	0	0	0
Domestic Air Transport	0	0	0	0	0	0	0	0	0	0	0	0
Road	2 506	2 748	2 636	2 530	2 442	2 358	2 177	2 063	2 096	2 045	1 978	1 992
Rail	0	0	0	0	0	0	0	0	0	0	0	0
Inland Waterways	0	0	0	0	0	0	0	0	0	0	0	0
Pipeline Transport	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Transport)	0	0	0	0	0	0	0	0	0	0	0	0
Total Industry	46	46	38	35	68	42	39	40	103	2	2	2
Iron and Steel	0	0	0	0	0	0	0	0	0	0	0	0
Chemical (incl.Petro-Chemical)	7	3	0	0	0	0	0	0	4	0	1	1
Non ferrous Metals	0	0	0	0	0	0	0	0	0	0	0	0
Non metallic Mineral Products	0	0	0	0	0	0	0	0	0	0	0	0
Transportation Equipment	32	35	30	28	55	34	32	32	80	1	1	0
Machinery	0	0	0	0	0	0	0	0	1	0	0	0
Mining and Quarrying	0	0	0	0	0	0	0	0	0	0	0	0
Food, Beverages and Tobacco	0	0	0	0	0	0	0	0	0	0	0	0

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Pulp, Paper and Printing	1	1	1	1	1	1	1	1	2	0	0	0
Wood and Wood Products	0	0	0	0	0	0	0	0	0	0	0	0
Construction	5	6	6	5	10	6	6	6	14	0	0	1
Textiles and Leather	1	1	1	1	1	1	1	1	1	0	0	0
Non Specified (Industry)	0	0	0	0	1	0	0	0	1	0	0	0
Total Other Sectors	2	2	2	2	3	2	2	2	5	0	0	0
Commerce - Public Services	2	2	2	2	3	2	2	2	5	0	0	0
Residential	0	0	0	0	0	0	0	0	0	0	0	0
Agriculture	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Others)	0	0	0	0	0	0	0	0	0	0	0	0
Total Non-Energy Use	7	3	0	0	0	0	0	0	4	0	1	1

Table 20: National Energy Balance 1990-2001. Lubricants [1000 tons].

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Refinery Gross Output	31	31	27	25	26	73	109	113	107	105	111	117
Refinery Fuel	0	0	0	0	0	1	0	0	0	0	0	0
Total Imports (Balance)	177	171	115	98	105	51	50	51	53	52	57	51
Total Exports (Balance)	32	30	48	35	34	41	49	57	53	51	58	65
International Marine Bunkers	0	0	0	0	0	0	0	0	0	0	0	0
Stock Change (National Territory)	-12	-28	26	4	-8	4	-5	1	-1	-3	-1	5
Gross Inland Deliveries (Obs.)	164	144	120	92	89	86	105	108	106	103	108	108
Statistical Difference	0	0	0	0	0	0	0	0	0	0	0	0
Total Transformation Sector	0	0	0	0	0	0	0	0	0	0	0	0
Public Electricity	0	0	0	0	0	0	0	0	0	0	0	0
Public Combined Heat and Power	0	0	0	0	0	0	0	0	0	0	0	0
Public Heat Plants	0	0	0	0	0	0	0	0	0	0	0	0
Auto Producers of Electricity	0	0	0	0	0	0	0	0	0	0	0	0
Auto Producers for CHP	0	0	0	0	0	0	0	0	0	0	0	0
Auto Producer Heat Plants	0	0	0	0	0	0	0	0	0	0	0	0
Gas Works (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0
Coke Ovens (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0
Blast Furnaces (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0
Petrochemical Industry	0	0	0	0	0	0	0	0	0	0	0	0
Patent Fuel Plants	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0
Total Energy Sector	18	16	13	10	10	9	11	12	11	11	12	12
Coal Mines	0	0	0	0	0	0	0	0	0	0	0	0
Oil and Gas Extraction	1	1	1	1	0	0	1	1	1	1	1	1
Coke Ovens (Energy)	5	5	4	3	3	3	3	4	3	3	4	4
Blast Furnaces (Energy)	0	0	0	0	0	0	0	0	0	0	0	0
Gas Works (Energy)	1	1	1	0	0	0	1	1	1	1	1	1
Power Plants	2	1	1	1	1	1	1	1	1	1	1	1
Non Specified (Energy)	9	8	7	5	5	5	6	6	6	6	6	6
Distribution Losses	0	0	0	0	0	0	0	0	0	0	0	0
Final Consumption	146	128	107	82	79	77	94	96	95	92	97	96
Total Transport	67	59	49	38	36	35	43	44	43	42	44	44
International Civil Aviation	0	0	0	0	0	0	0	0	0	0	0	0
Domestic Air Transport	0	0	0	0	0	0	0	0	0	0	0	0
Road	66	58	48	37	35	34	42	43	42	41	43	43
Rail	0	0	0	0	0	0	0	0	0	0	0	0
Inland Waterways	0	0	0	0	0	0	0	0	0	0	0	0
Pipeline Transport	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Transport)	1	1	1	1	1	1	1	1	1	1	1	1
Total Industry	76	67	56	43	41	40	49	50	49	48	50	50
Iron and Steel	14	13	10	8	8	8	9	9	9	9	9	9
Chemical (incl.Petro-Chemical)	6	6	5	4	3	3	4	4	4	4	4	4
Non ferrous Metals	2	2	2	1	1	1	1	2	1	1	2	2

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Non metallic Mineral Products	10	9	7	6	5	5	6	7	6	6	7	7
Transportation Equipment	2	2	1	1	1	1	1	1	1	1	1	1
Machinery	3	3	2	2	2	2	2	2	2	2	2	2
Mining and Quarrying	3	3	2	2	2	2	2	2	2	2	2	2
Food, Beverages and Tobacco	10	9	8	6	6	5	7	7	7	7	7	7
Pulp, Paper and Printing	8	7	6	5	4	4	5	5	5	5	5	5
Wood and Wood Products	3	2	2	1	1	1	2	2	2	2	2	2
Construction	2	1	1	1	1	1	1	1	1	1	1	1
Textiles and Leather	4	4	3	2	2	2	3	3	3	3	3	3
Non Specified (Industry)	8	7	6	5	5	4	5	6	5	5	6	6
Total Other Sectors	3	3	2	2	2	2	2	2	2	2	2	2
Commerce - Public Services	3	3	2	2	2	2	2	2	2	2	2	2
Residential	0	0	0	0	0	0	0	0	0	0	0	0
Agriculture	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Others)	0	0	0	0	0	0	0	0	0	0	0	0
Total Non-Energy Use	164	144	120	92	89	86	105	108	106	103	108	108

Table 21: National Energy Balance 1990-2001. White Spirit [1000 tons].

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Refinery Gross Output	0	7	8	7	7	5	5	0	0	0	0	0
Refinery Fuel	0	0	0	0	0	0	0	0	0	0	0	0
Total Imports (Balance)	11	9	8	8	6	8	8	11	12	12	7	6
Total Exports (Balance)	0	2	3	1	0	0	1	1	1	0	0	0
International Marine Bunkers	0	0	0	0	0	0	0	0	0	0	0	1
Stock Change (National Territory)	0	0	1	0	1	-1	0	1	0	1	1	0
Gross Inland Deliveries (Obs.)	11	14	14	14	14	12	12	11	11	13	7	7
Statistical Difference	0	0	0	0	0	0	0	0	0	0	0	0
Total Transformation Sector	0	0	0	0	0	0	0	0	0	0	0	0
Public Electricity	0	0	0	0	0	0	0	0	0	0	0	0
Public Combined Heat and Power	0	0	0	0	0	0	0	0	0	0	0	0
Public Heat Plants	0	0	0	0	0	0	0	0	0	0	0	0
Auto Producers of Electricity	0	0	0	0	0	0	0	0	0	0	0	0
Auto Producers for CHP	0	0	0	0	0	0	0	0	0	0	0	0
Auto Producer Heat Plants	0	0	0	0	0	0	0	0	0	0	0	0
Gas Works (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0
Coke Ovens (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0
Blast Furnaces (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0
Petrochemical Industry	0	0	0	0	0	0	0	0	0	0	0	0
Patent Fuel Plants	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0
Total Energy Sector	0	0	0	0	0	0	0	0	0	0	0	0
Coal Mines	0	0	0	0	0	0	0	0	0	0	0	0
Oil and Gas Extraction	0	0	0	0	0	0	0	0	0	0	0	0
Coke Ovens (Energy)	0	0	0	0	0	0	0	0	0	0	0	0
Blast Furnaces (Energy)	0	0	0	0	0	0	0	0	0	0	0	0
Gas Works (Energy)	0	0	0	0	0	0	0	0	0	0	0	0
Power Plants	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Energy)	0	0	0	0	0	0	0	0	0	0	0	0
Distribution Losses	0	0	0	0	0	0	0	0	0	0	0	0
Final Consumption	11	14	14	14	14	12	12	11	11	13	7	7
Total Transport	0	0	0	0	0	0	0	0	0	0	0	0
International Civil Aviation	0	0	0	0	0	0	0	0	0	0	0	0
Domestic Air Transport	0	0	0	0	0	0	0	0	0	0	0	0
Road	0	0	0	0	0	0	0	0	0	0	0	0
Rail	0	0	0	0	0	0	0	0	0	0	0	0
Inland Waterways	0	0	0	0	0	0	0	0	0	0	0	0
Pipeline Transport	0	0	0	0	0	0	0	0	0	0	0	0

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Non Specified (Transport)	0	0	0	0	0	0	0	0	0	0	0	0
Total Industry	11	14	14	14	14	12	12	11	11	13	7	7
Iron and Steel	0	0	0	0	0	0	0	0	0	0	0	0
Chemical (incl.Petro-Chemical)	11	14	10	10	10	10	9	8	5	4	3	3
Non ferrous Metals	0	0	0	0	0	0	0	0	0	0	0	0
Non metallic Mineral Products	0	0	0	0	0	0	0	0	0	0	0	0
Transportation Equipment	0	0	4	4	4	2	3	3	6	8	3	4
Machinery	0	0	0	0	0	0	0	0	0	0	0	0
Mining and Quarrying	0	0	0	0	0	0	0	0	0	0	0	0
Food, Beverages and Tobacco	0	0	0	0	0	0	0	0	0	0	0	0
Pulp, Paper and Printing	0	0	0	0	0	0	0	0	0	0	0	0
Wood and Wood Products	0	0	0	0	0	0	0	0	0	0	0	0
Construction	0	0	0	0	0	0	0	0	0	1	1	0
Textiles and Leather	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Industry)	0	0	0	0	0	0	0	0	0	0	0	0
Total Other Sectors	0	0	0	0	0	0	0	0	0	0	0	0
Commerce - Public Services	0	0	0	0	0	0	0	0	0	0	0	0
Residential	0	0	0	0	0	0	0	0	0	0	0	0
Agriculture	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Others)	0	0	0	0	0	0	0	0	0	0	0	0
Total Non-Energy Use	11	14	10	10	10	10	9	8	5	4	3	3

Table 22: National Energy Balance 1990-2001. Bitumen [1000 tons].

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Refinery Gross Output	269	281	380	284	311	254	263	299	300	326	343	402
Refinery Fuel	0	0	0	0	0	0	2	0	4	0	0	0
Total Imports (Balance)	284	232	70	154	162	187	250	242	279	231	292	296
Total Exports (Balance)	3	21	15	22	25	5	11	6	1	1	45	78
International Marine Bunkers	0	0	0	0	0	0	0	0	0	0	0	0
Stock Change (National Territory)	-12	0	6	-6	-2	4	-7	7	-2	4	-3	-1
Gross Inland Deliveries (Obs.)	538	492	441	410	446	440	493	542	572	560	587	618
Statistical Difference	0	0	0	0	0	0	0	0	0	0	0	0
Total Transformation Sector	0	0	0	0	0	0	0	0	0	0	0	0
Public Electricity	0	0	0	0	0	0	0	0	0	0	0	0
Public Combined Heat and Power	0	0	0	0	0	0	0	0	0	0	0	0
Public Heat Plants	0	0	0	0	0	0	0	0	0	0	0	0
Auto Producers of Electricity	0	0	0	0	0	0	0	0	0	0	0	0
Auto Producers for CHP	0	0	0	0	0	0	0	0	0	0	0	0
Auto Producer Heat Plants	0	0	0	0	0	0	0	0	0	0	0	0
Gas Works (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0
Coke Ovens (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0
Blast Furnaces (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0
Petrochemical Industry	0	0	0	0	0	0	0	0	0	0	0	0
Patent Fuel Plants	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0
Total Energy Sector	0	0	0	0	0	0	0	0	0	0	0	0
Coal Mines	0	0	0	0	0	0	0	0	0	0	0	0
Oil and Gas Extraction	0	0	0	0	0	0	0	0	0	0	0	0
Coke Ovens (Energy)	0	0	0	0	0	0	0	0	0	0	0	0
Blast Furnaces (Energy)	0	0	0	0	0	0	0	0	0	0	0	0
Gas Works (Energy)	0	0	0	0	0	0	0	0	0	0	0	0
Power Plants	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Energy)	0	0	0	0	0	0	0	0	0	0	0	0
Distribution Losses	0	0	0	0	0	0	0	0	0	0	0	0
Final Consumption	538	492	441	410	446	440	493	542	572	560	587	618
Total Transport	0	0	0	0	0	0	0	0	0	0	0	0
International Civil Aviation	0	0	0	0	0	0	0	0	0	0	0	0

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Domestic Air Transport	0	0	0	0	0	0	0	0	0	0	0	0
Road	0	0	0	0	0	0	0	0	0	0	0	0
Rail	0	0	0	0	0	0	0	0	0	0	0	0
Inland Waterways	0	0	0	0	0	0	0	0	0	0	0	0
Pipeline Transport	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Transport)	0	0	0	0	0	0	0	0	0	0	0	0
Total Industry	538	492	441	410	446	440	493	542	572	560	587	618
Iron and Steel	0	0	0	0	0	0	0	0	0	0	0	0
Chemical (incl.Petro-Chemical)	0	0	0	0	0	0	0	0	0	0	0	0
Non ferrous Metals	0	0	0	0	0	0	0	0	0	0	0	0
Non metallic Mineral Products	0	0	0	0	0	0	0	0	0	0	0	0
Transportation Equipment	0	0	0	0	0	0	0	0	0	0	0	0
Machinery	0	0	0	0	0	0	0	0	0	0	0	0
Mining and Quarrying	0	0	0	0	0	0	0	0	0	0	0	0
Food, Beverages and Tobacco	0	0	0	0	0	0	0	0	0	0	0	0
Pulp, Paper and Printing	0	0	0	0	0	0	0	0	0	0	0	0
Wood and Wood Products	0	0	0	0	0	0	0	0	0	0	0	0
Construction	538	492	441	410	446	440	493	542	572	560	587	618
Textiles and Leather	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Industry)	0	0	0	0	0	0	0	0	0	0	0	0
Total Other Sectors	0	0	0	0	0	0	0	0	0	0	0	0
Commerce - Public Services	0	0	0	0	0	0	0	0	0	0	0	0
Residential	0	0	0	0	0	0	0	0	0	0	0	0
Agriculture	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Others)	0	0	0	0	0	0	0	0	0	0	0	0
Total Non-Energy Use	538	492	441	410	446	440	493	542	572	560	587	618

Table 23: National Energy Balance 1990-2001. Other Oil Products [1000 tons].

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Refinery Gross Output	555	713	810	819	965	827	989	1 018	1 025	990	906	1 055
Refinery Fuel	0	0	231	301	312	278	330	343	332	276	271	293
Total Imports (Balance)	191	90	66	188	23	69	90	143	106	101	149	85
Total Exports (Balance)	1	0	3	96	1	39	54	6	137	131	139	162
International Marine Bunkers	0	0	0	0	0	0	0	0	0	0	0	0
Stock Change (National Territory)	-41	-31	59	-19	-16	-4	14	-9	7	0	-7	11
Gross Inland Deliveries (Obs.)	703	772	701	591	659	574	710	803	668	683	638	697
Statistical Difference	0	0	0	0	0	0	0	0	0	0	0	1
Total Transformation Sector	22	19	0	1	1	0	0	0	0	0	0	0
Public Electricity	0	0	0	0	0	0	0	0	0	0	0	0
Public Combined Heat and Power	0	0	0	0	0	0	0	0	0	0	0	0
Public Heat Plants	0	0	0	0	0	0	0	0	0	0	0	0
Auto Producers of Electricity	0	0	0	0	0	0	0	0	0	0	0	0
Auto Producers for CHP	0	0	0	0	0	0	0	0	0	0	0	0
Auto Producer Heat Plants	0	0	0	0	0	0	0	0	0	0	0	0
Gas Works (Transformation)	22	19	0	1	1	0	0	0	0	0	0	0
Coke Ovens (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0
Blast Furnaces (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0
Petrochemical Industry	0	0	0	0	0	0	0	0	0	0	0	0
Patent Fuel Plants	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0
Total Energy Sector	0	0	0	0	0	0	0	0	0	0	0	0
Coal Mines	0	0	0	0	0	0	0	0	0	0	0	0
Oil and Gas Extraction	0	0	0	0	0	0	0	0	0	0	0	0
Coke Ovens (Energy)	0	0	0	0	0	0	0	0	0	0	0	0
Blast Furnaces (Energy)	0	0	0	0	0	0	0	0	0	0	0	0
Gas Works (Energy)	0	0	0	0	0	0	0	0	0	0	0	0
Power Plants	0	0	0	0	0	0	0	0	0	0	0	0

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Non Specified (Energy)	0	0	0	0	0	0	0	0	0	0	0	0
Distribution Losses	0	0	0	0	0	0	0	0	0	0	0	0
Final Consumption	681	753	701	590	659	574	710	803	668	683	638	697
Total Transport	0	0	0	0	0	0	0	0	0	0	0	0
International Civil Aviation	0	0	0	0	0	0	0	0	0	0	0	0
Domestic Air Transport	0	0	0	0	0	0	0	0	0	0	0	0
Road	0	0	0	0	0	0	0	0	0	0	0	0
Rail	0	0	0	0	0	0	0	0	0	0	0	0
Inland Waterways	0	0	0	0	0	0	0	0	0	0	0	0
Pipeline Transport	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Transport)	0	0	0	0	0	0	0	0	0	0	0	0
Total Industry	681	753	701	590	659	574	710	803	668	683	638	697
Iron and Steel	0	0	0	0	0	0	0	0	0	0	0	0
Chemical (incl.Petro-Chemical)	681	753	701	590	659	574	710	803	668	683	638	697
Non ferrous Metals	0	0	0	0	0	0	0	0	0	0	0	0
Non metallic Mineral Products	0	0	0	0	0	0	0	0	0	0	0	0
Transportation Equipment	0	0	0	0	0	0	0	0	0	0	0	0
Machinery	0	0	0	0	0	0	0	0	0	0	0	0
Mining and Quarrying	0	0	0	0	0	0	0	0	0	0	0	0
Food, Beverages and Tobacco	0	0	0	0	0	0	0	0	0	0	0	0
Pulp, Paper and Printing	0	0	0	0	0	0	0	0	0	0	0	0
Wood and Wood Products	0	0	0	0	0	0	0	0	0	0	0	0
Construction	0	0	0	0	0	0	0	0	0	0	0	0
Textiles and Leather	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Industry)	0	0	0	0	0	0	0	0	0	0	0	0
Total Other Sectors	0	0	0	0	0	0	0	0	0	0	0	0
Commerce - Public Services	0	0	0	0	0	0	0	0	0	0	0	0
Residential	0	0	0	0	0	0	0	0	0	0	0	0
Agriculture	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Others)	0	0	0	0	0	0	0	0	0	0	0	0
Total Non-Energy Use	681	753	701	590	659	574	710	803	668	683	638	697

Table 24: National Energy Balance 1990-2001. LPG [1000 tons].

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Refinery Gross Output	47	43	51	96	37	60	20	45	30	19	34	0
Refinery Fuel	8	8	1	2	0	19	6	0	1	2	20	0
Total Imports (Balance)	97	149	151	114	210	149	184	148	132	152	159	140
Total Exports (Balance)	14	44	40	34	58	42	42	55	19	20	17	4
International Marine Bunkers	0	0	0	0	0	0	0	0	0	0	0	0
Stock Change (National Territory)	2	18	1	-6	-15	20	-3	-5	3	0	-5	6
Gross Inland Deliveries (Obs.)	125	158	162	168	174	166	152	132	144	149	150	143
Statistical Difference	0	0	0	0	0	0	0	0	0	0	0	0
Total Transformation Sector	1	4	4	3	3	3	3	2	1	1	0	0
Public Electricity	0	0	0	0	0	0	0	0	0	0	0	0
Public Combined Heat and Power	0	0	0	0	0	0	0	0	0	0	0	0
Public Heat Plants	1	4	4	3	3	3	3	2	1	1	0	0
Auto Producers of Electricity	0	0	0	0	0	0	0	0	0	0	0	0
Auto Producers for CHP	0	0	0	0	0	0	0	0	0	0	0	0
Auto Producer Heat Plants	0	0	0	0	0	0	0	0	0	0	0	0
Gas Works (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0
Coke Ovens (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0
Blast Furnaces (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0
Petrochemical Industry	0	0	0	0	0	0	0	0	0	0	0	0
Patent Fuel Plants	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0
Total Energy Sector	0	0	0	0	0	0	0	0	0	0	0	0
Coal Mines	0	0	0	0	0	0	0	0	0	0	0	0

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Oil and Gas Extraction	0	0	0	0	0	0	0	0	0	0	0	0
Coke Ovens (Energy)	0	0	0	0	0	0	0	0	0	0	0	0
Blast Furnaces (Energy)	0	0	0	0	0	0	0	0	0	0	0	0
Gas Works (Energy)	0	0	0	0	0	0	0	0	0	0	0	0
Power Plants	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Energy)	0	0	0	0	0	0	0	0	0	0	0	0
Distribution Losses	0	0	0	0	0	0	0	0	0	0	0	0
Final Consumption	124	153	158	165	172	163	150	130	143	148	150	143
Total Transport	4	4	4	4	4	4	4	4	4	4	4	4
International Civil Aviation	0	0	0	0	0	0	0	0	0	0	0	0
Domestic Air Transport	0	0	0	0	0	0	0	0	0	0	0	0
Road	4	4	4	4	4	4	4	4	4	4	4	4
Rail	0	0	0	0	0	0	0	0	0	0	0	0
Inland Waterways	0	0	0	0	0	0	0	0	0	0	0	0
Pipeline Transport	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Transport)	0	0	0	0	0	0	0	0	0	0	0	0
Total Industry	68	79	50	57	67	65	74	61	67	63	64	55
Iron and Steel	5	5	4	4	4	4	13	13	15	15	15	13
Chemical (incl.Petro-Chemical)	0	0	0	0	0	0	0	0	0	0	0	0
Non ferrous Metals	8	8	7	6	7	6	6	5	5	6	6	5
Non metallic Mineral Products	13	14	12	16	22	24	23	15	16	16	17	14
Transportation Equipment	1	2	1	1	1	3	2	4	5	0	0	0
Machinery	6	6	5	6	6	6	7	4	5	5	5	4
Mining and Quarrying	1	1	0	1	1	1	1	1	1	1	1	1
Food, Beverages and Tobacco	4	4	4	4	3	3	2	2	2	2	2	2
Pulp, Paper and Printing	1	1	1	2	1	1	2	1	1	1	1	1
Wood and Wood Products	0	0	0	1	0	0	1	0	0	0	0	0
Construction	24	31	9	10	12	10	9	7	8	8	8	7
Textiles and Leather	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Industry)	6	8	8	8	9	9	8	7	8	8	8	7
Total Other Sectors	52	70	104	103	100	93	72	65	71	81	82	84
Commerce - Public Services	34	49	83	79	76	65	37	25	28	33	33	29
Residential	16	19	19	22	22	26	31	36	39	43	44	50
Agriculture	2	2	2	2	2	3	3	4	4	4	5	5
Non Specified (Others)	0	0	0	0	0	0	0	0	0	0	0	0
Total Non-Energy Use	0	0	0	0	0	0	0	0	0	0	0	0

Table 25: National Energy Balance 1990-2001. Refinery Gas [1000 tons].

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Refinery Gross Output	373	327	339	319	341	305	359	351	348	341	312	328
Refinery Fuel	373	327	339	319	341	305	359	351	348	338	310	327
Total Imports (Balance)	0	0	0	0	0	0	0	0	0	0	0	0
Total Exports (Balance)	0	0	0	0	0	0	0	0	0	0	0	0
International Marine Bunkers	0	0	0	0	0	0	0	0	0	2	2	1
Stock Change (National Territory)	0	0	0	0	0	0	0	0	0	0	0	0
Gross Inland Deliveries (Obs.)	0	0	0	0	0	0	0	0	0	0	0	0
Statistical Difference	0	0	0	0	0	0	0	0	0	0	0	0
Total Transformation Sector	0	0	0	0	0	0	0	0	0	0	0	0
Public Electricity	0	0	0	0	0	0	0	0	0	0	0	0
Public Combined Heat and Power	0	0	0	0	0	0	0	0	0	0	0	0
Public Heat Plants	0	0	0	0	0	0	0	0	0	0	0	0
Auto Producers of Electricity	0	0	0	0	0	0	0	0	0	0	0	0
Auto Producers for CHP	0	0	0	0	0	0	0	0	0	0	0	0
Auto Producer Heat Plants	0	0	0	0	0	0	0	0	0	0	0	0
Gas Works (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0
Coke Ovens (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0
Blast Furnaces (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Petrochemical Industry	0	0	0	0	0	0	0	0	0	0	0	0
Patent Fuel Plants	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0
Total Energy Sector	0	0	0	0	0	0	0	0	0	0	0	0
Coal Mines	0	0	0	0	0	0	0	0	0	0	0	0
Oil and Gas Extraction	0	0	0	0	0	0	0	0	0	0	0	0
Coke Ovens (Energy)	0	0	0	0	0	0	0	0	0	0	0	0
Blast Furnaces (Energy)	0	0	0	0	0	0	0	0	0	0	0	0
Gas Works (Energy)	0	0	0	0	0	0	0	0	0	0	0	0
Power Plants	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Energy)	0	0	0	0	0	0	0	0	0	2	2	1
Distribution Losses	0	0	0	0	0	0	0	0	0	0	0	0
Final Consumption	0	0	0	0	0	0	0	0	0	0	0	0
Total Transport	0	0	0	0	0	0	0	0	0	0	0	0
International Civil Aviation	0	0	0	0	0	0	0	0	0	0	0	0
Domestic Air Transport	0	0	0	0	0	0	0	0	0	0	0	0
Road	0	0	0	0	0	0	0	0	0	0	0	0
Rail	0	0	0	0	0	0	0	0	0	0	0	0
Inland Waterways	0	0	0	0	0	0	0	0	0	0	0	0
Pipeline Transport	0	0	0	0	0	0	0	0	0	2	2	1
Non Specified (Transport)	0	0	0	0	0	0	0	0	0	0	0	0
Total Industry	0	0	0	0	0	0	0	0	0	2	2	1
Iron and Steel	0	0	0	0	0	0	0	0	0	0	0	0
Chemical (incl.Petro-Chemical)	0	0	0	0	0	0	0	0	0	0	0	0
Non ferrous Metals	0	0	0	0	0	0	0	0	0	0	0	0
Non metallic Mineral Products	0	0	0	0	0	0	0	0	0	0	0	0
Transportation Equipment	0	0	0	0	0	0	0	0	0	0	0	0
Machinery	0	0	0	0	0	0	0	0	0	0	0	0
Mining and Quarrying	0	0	0	0	0	0	0	0	0	0	0	0
Food, Beverages and Tobacco	0	0	0	0	0	0	0	0	0	0	0	0
Pulp, Paper and Printing	0	0	0	0	0	0	0	0	0	0	0	0
Wood and Wood Products	0	0	0	0	0	0	0	0	0	0	0	0
Construction	0	0	0	0	0	0	0	0	0	0	0	0
Textiles and Leather	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Industry)	0	0	0	0	0	0	0	0	0	0	0	0
Total Other Sectors	0	0	0	0	0	0	0	0	0	0	0	0
Commerce - Public Services	0	0	0	0	0	0	0	0	0	0	0	0
Residential	0	0	0	0	0	0	0	0	0	0	0	0
Agriculture	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Others)	0	0	0	0	0	0	0	0	0	0	0	0
Total Non-Energy Use	0	0	0	0	0	0	0	0	0	0	0	0

Table 26: National Energy Balance 1990-2001. Natural Gas [TJ].

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Indigenous Production	46 376	47 729	51 722	53 559	48 776	53 336	53 701	51 404	56 440	62 524	64 826	62 194
Total Imports (Balance)	187 917	184 138	183 846	193 697	179 430	229 114	236 579	216 911	224 009	219 484	222 784	227 406
Total Exports (Balance)	0	0	12	0	189	576	0	0	698	0	633	14 713
Stock Change (National Territory)	-15 054	-73	-7 946	-7 212	18 891	-12 290	-3 340	8 236	4 168	6 867	-11 295	19 095
Gross Inland Deliveries (Obs.)	219 239	231 794	227 610	240 044	246 908	269 583	286 941	276 551	283 920	288 876	275 682	293 982
Statistical Difference	0	0	0	0	0	0	0	0	0	-1	0	0
Total Transformation Sector	74 710	76 968	74 215	80 159	94 010	95 817	108 595	96 829	100 564	102 771	79 212	78 398
Public Electricity	28 100	25 602	20 818	20 129	23 477	21 731	30 433	27 354	34 382	30 571	22 256	22 239
Public Combined Heat and Power	23 810	24 752	24 529	25 628	27 342	30 757	34 179	31 061	29 381	35 099	29 602	30 928
Public Heat Plants	6 677	7 200	7 148	8 135	7 517	11 513	13 681	8 373	7 741	7 455	5 461	5 453
Auto Producers of Electricity	1 265	1 303	1 256	1 357	1 591	1 622	19 953	22 299	21 190	18 436	12 925	11 749
Auto Producers for CHP	14 858	18 111	20 464	24 910	34 084	30 195	10 349	7 741	7 870	10 443	8 513	7 575
Auto Producer Heat Plants	0	0	0	0	0	0	0	0	0	766	454	454
Gas Works (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0
Coke Ovens (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0
Blast Furnaces (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0
Conversion to Liquids	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0
Total Energy Sector	13 411	13 437	12 495	14 070	13 271	14 001	12 134	12 297	11 219	11 316	9 957	22 241
Coal Mines	0	0	0	0	0	0	0	0	0	0	0	0
Oil and Gas Extraction	5 339	5 396	5 027	5 255	5 228	5 746	3 022	3 709	2 989	3 017	2 665	3 099
Inputs to Oil Refineries	8 045	8 041	7 469	7 983	6 928	7 606	8 382	7 898	7 305	7 339	6 356	7 380
Coke Ovens (Energy)	0	0	0	0	0	0	0	0	0	0	0	0
Gas Works (Energy)	28	1	0	833	1 115	650	731	690	926	960	935	11 761
Power Plants	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Energy)	0	0	0	0	0	0	0	0	0	0	0	0
Distribution Losses	2 726	3 352	3 259	1 471	1 788	4 643	718	230	1 776	2 493	-207	10 835
Final Consumption	113 479	122 072	126 906	129 338	127 802	144 603	154 713	156 527	159 807	161 653	176 216	172 563
Total Transport	3 045	3 297	3 570	3 865	3 780	4 092	4 216	4 199	6 344	7 807	9 627	11 596
Road	0	0	0	0	0	0	0	0	0	0	0	0
Pipeline Transport	3 045	3 297	3 570	3 865	3 780	4 092	4 216	4 199	6 344	7 807	9 627	11 596
Non Specified (Transport)	0	0	0	0	0	0	0	0	0	0	0	0
Total Industry	69 486	66 841	65 954	64 308	67 046	72 820	76 245	80 832	80 328	78 264	88 270	78 320
Iron and Steel	10 594	9 589	9 517	9 424	10 481	11 142	11 875	14 266	14 177	13 812	15 578	13 822
Chemical (incl.Petro-Chemical)	7 762	7 139	7 383	7 491	7 603	8 176	8 165	9 900	9 839	9 586	10 812	9 593
Non ferrous Metals	1 361	1 208	1 574	1 899	2 025	2 134	1 975	2 315	2 301	2 242	2 528	2 243
Non metallic Mineral Products	10 153	10 300	9 342	9 631	10 126	10 997	11 690	12 966	12 885	12 554	14 159	12 563
Transportation Equipment	1 545	1 776	1 924	2 071	2 381	2 532	2 361	1 138	1 131	1 102	1 242	1 102
Machinery	2 501	2 486	2 449	2 658	2 985	3 220	3 156	1 458	1 449	1 412	1 592	1 413
Mining and Quarrying	2 648	2 486	1 819	1 829	1 990	2 496	2 586	2 471	2 455	2 392	2 698	2 394
Food, Beverages and Tobacco	8 939	8 879	8 222	7 732	8 705	9 333	8 999	9 429	9 370	9 129	10 297	9 136
Pulp, Paper and Printing	12 948	12 253	12 246	9 976	8 812	9 695	10 703	16 496	16 393	15 972	18 014	15 983
Wood and Wood Products	1 729	1 705	1 784	1 657	1 919	2 026	2 206	1 621	1 611	1 570	1 771	1 571
Construction	736	710	875	1 208	1 386	1 519	1 446	538	535	521	588	521
Textiles and Leather	3 531	3 267	3 499	3 279	2 985	3 364	3 625	2 353	2 338	2 278	2 570	2 280
Non Specified (Industry)	5 039	5 043	5 318	5 454	5 649	6 186	7 457	5 880	5 844	5 693	6 421	5 698
Total Other Sectors	40 947	51 934	57 382	61 164	56 976	67 691	74 252	71 497	73 135	75 583	78 319	82 648
Commerce - Public Services	7 765	12 096	18 129	17 929	15 762	23 148	24 117	18 769	18 652	18 172	20 496	18 185
Residential	32 828	39 412	38 833	42 772	40 774	44 066	49 599	52 164	53 901	56 796	57 204	63 773
Agriculture	355	426	420	462	441	476	536	564	583	614	619	690
Non Specified (Others)	0	0	0	0	0	0	0	0	0	0	0	0
Total Non-Energy Use	14 913	15 965	10 735	15 006	10 036	10 518	10 781	10 669	10 554	10 644	10 504	9 945

Table 27: National Energy Balance 1990-2001. Fuel Wood [TJ].

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Indigenous Production	61 401	66 501	63 235	64 028	60 260	65 763	70 726	65 357	63 416	62 799	57 814	65 571
Total Imports (Balance)	2 288	2 832	2 421	3 064	2 382	1 623	2 423	2 017	1 604	1 486	1 803	1 803
Total Exports (Balance)	28	80	57	29	73	222	107	114	140	34	180	180
Stock Change (National Territory)	-545	706	382	113	-179	189	243	-54	0	0	0	0
Gross Inland Deliveries (Obs.)	63 116	69 960	65 982	67 176	62 390	67 354	73 285	67 206	64 881	64 251	59 437	67 194
Statistical Difference	0	0	0	0	0	0	0	0	0	0	0	0
Total Transformation Sector	0	0	0	0	0	0	0	0	210	0	0	0
Public Electricity	0	0	0	0	0	0	0	0	0	0	0	0
Public Combined Heat and Power	0	0	0	0	0	0	0	0	0	0	0	0
Public Heat Plants	0	0	0	0	0	0	0	0	210	0	0	0
Auto Producers of Electricity	0	0	0	0	0	0	0	0	0	0	0	0
Auto Producers for CHP	0	0	0	0	0	0	0	0	0	0	0	0
Auto Producer Heat Plants	0	0	0	0	0	0	0	0	0	0	0	0
Total Energy Sector	0	0	0	0	0	0	0	0	0	0	0	0
Coal Mines	0	0	0	0	0	0	0	0	0	0	0	0
Patent Fuel Plants	0	0	0	0	0	0	0	0	0	0	0	0
Coke Ovens (Energy)	0	0	0	0	0	0	0	0	0	0	0	0
Blast Furnaces (Energy)	0	0	0	0	0	0	0	0	0	0	0	0
Gas Works (Energy)	0	0	0	0	0	0	0	0	0	0	0	0
BKB (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0
Petroleum refineries	0	0	0	0	0	0	0	0	0	0	0	0
Power Plants	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Energy)	0	0	0	0	0	0	0	0	0	0	0	0
Distribution Losses	0	0	0	0	0	0	0	0	0	0	0	0
Final Consumption	63 116	69 960	65 982	67 176	62 390	67 354	73 285	67 206	64 672	64 251	59 437	67 194
Total Transport	2	2	1	1	1	1	1	0	0	0	0	0
Rail	2	2	1	1	1	1	1	0	0	0	0	0
Inland Waterways	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Transport)	0	0	0	0	0	0	0	0	0	0	0	0
Total Industry	661	734	706	802	904	1 074	783	272	151	148	135	157
Iron and Steel	0	0	0	0	0	0	0	0	0	0	0	0
Chemical (incl.Petro-Chemical)	0	0	0	10	0	0	0	0	0	0	0	0
Non ferrous Metals	0	0	0	0	0	0	0	0	0	0	0	0
Non metallic Mineral Products	47	44	43	41	42	62	7	1	1	1	1	1
Transportation Equipment	0	0	0	0	0	0	0	0	0	0	0	0
Machinery	28	26	34	31	31	31	10	0	0	0	0	0
Mining and Quarrying	0	9	0	0	0	0	2	0	0	0	0	0
Food, Beverages and Tobacco	121	114	77	144	94	93	23	15	8	8	7	9
Pulp, Paper and Printing	9	26	0	0	0	0	54	1	1	0	0	1
Wood and Wood Products	233	253	221	226	291	300	319	76	42	42	38	44
Construction	0	0	102	113	156	289	142	79	44	43	39	46
Textiles and Leather	19	26	17	21	21	21	5	0	0	0	0	0
Non Specified (Industry)	205	236	213	216	270	279	221	99	55	54	49	57
Total Other Sectors	62 454	69 225	65 275	66 374	61 485	66 278	72 501	66 934	64 520	64 102	59 302	67 036
Commerce - Public Services	1 330	1 294	1 177	1 145	1 091	1 167	1 063	873	486	476	434	506
Residential	57 500	63 902	60 298	61 361	56 812	61 250	67 202	62 144	60 237	59 853	55 377	62 585
Agriculture	3 625	4 028	3 801	3 868	3 581	3 861	4 236	3 917	3 797	3 773	3 491	3 945
Non Specified (Others)	0	0	0	0	0	0	0	0	0	0	0	1

Table 28: National Energy Balance 1990-2001. Wood Waste [TJ].

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Indigenous Production	13 668	14 819	15 705	18 136	18 456	18 739	20 571	26 311	22 341	28 523	28 603	29 896
Total Imports (Balance)	1 864	2 437	2 536	2 116	2 418	2 144	1 744	2 838	2 344	2 641	2 819	4 095
Total Exports (Balance)	2 072	2 116	2 240	1 517	2 221	2 617	2 819	5 181	5 034	6 137	6 509	7 978
Stock Change (National Territory)	0	0	0	0	0	0	0	0	0	0	0	0
Gross Inland Deliveries (Obs.)	13 461	15 139	16 001	18 736	18 653	18 265	19 496	23 968	19 651	25 027	24 913	26 012
Statistical Difference	0	0	0	0	0	0	0	0	0	0	0	0
Total Transformation Sector	2 450	3 881	4 316	7 440	9 181	8 864	10 038	12 941	7 092	11 673	11 536	10 425
Public Electricity	0	0	0	0	0	0	0	0	14	17	9	517
Public Combined Heat and Power	0	0	0	0	0	73	98	117	111	81	77	296
Public Heat Plants	2 045	3 020	3 404	3 515	3 714	4 332	5 988	5 904	5 904	6 453	7 010	7 566
Auto Producers of Electricity	0	0	0	0	0	189	2 493	3 041	34	2 636	2 108	877
Auto Producers for CHP	405	861	912	3 925	5 467	4 270	1 459	3 806	950	2 394	2 248	1 085
Auto Producer Heat Plants	0	0	0	0	0	0	0	72	79	92	83	83
Total Energy Sector	0	0	0	0	0	0	0	0	0	0	0	0
Coal Mines	0	0	0	0	0	0	0	0	0	0	0	0
Patent Fuel Plants	0	0	0	0	0	0	0	0	0	0	0	0
Coke Ovens (Energy)	0	0	0	0	0	0	0	0	0	0	0	0
Blast Furnaces (Energy)	0	0	0	0	0	0	0	0	0	0	0	0
Gas Works (Energy)	0	0	0	0	0	0	0	0	0	0	0	0
BKB (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0
Petroleum refineries	0	0	0	0	0	0	0	0	0	0	0	0
Power Plants	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Energy)	0	0	0	0	0	0	0	0	0	0	0	0
Distribution Losses	0	0	0	0	0	0	0	0	0	0	0	0
Final Consumption	11 011	11 258	11 685	11 295	9 472	9 401	9 458	11 027	12 558	13 354	13 377	15 587
Total Transport	79	87	113	165	171	233	250	272	291	340	367	404
Rail	0	0	0	0	0	0	0	0	0	0	0	0
Inland Waterways	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Transport)	79	87	113	165	171	233	250	272	291	340	367	404
Total Industry	9 245	9 123	9 492	8 846	7 156	6 709	6 584	7 565	8 544	7 910	7 162	8 210
Iron and Steel	0	0	0	0	0	0	20	0	0	0	0	0
Chemical (incl.Petro-Chemical)	2 898	2 902	3 258	2 173	1 808	1 722	2 062	2 413	1 575	2 616	765	877
Non ferrous Metals	0	0	0	0	0	0	0	0	0	0	0	0
Non metallic Mineral Products	0	0	0	0	0	0	2	0	0	0	0	0
Transportation Equipment	0	0	0	0	0	0	0	0	0	0	0	0
Machinery	0	0	0	0	0	0	11	6	6	2	2	2
Mining and Quarrying	0	0	0	0	0	0	0	0	0	0	0	0
Food, Beverages and Tobacco	10	10	10	9	9	9	6	1	1	0	0	0
Pulp, Paper and Printing	3 662	3 475	3 952	4 547	3 605	3 911	2 502	2 761	5 842	4 376	5 287	6 061
Wood and Wood Products	2 569	2 620	2 185	2 035	1 652	968	1 810	2 076	910	896	1 083	1 242
Construction	39	39	29	28	28	27	47	71	55	7	8	10
Textiles and Leather	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Industry)	68	78	58	55	55	72	125	236	154	13	15	18
Total Other Sectors	1 687	2 048	2 080	2 284	2 144	2 459	2 624	3 190	3 723	5 103	5 848	6 974
Commerce - Public Services	765	854	793	731	736	698	581	502	474	525	634	727
Residential	551	739	804	1 009	996	1 137	1 330	1 795	2 198	3 182	3 627	4 371
Agriculture	371	455	483	545	412	624	713	894	1 051	1 397	1 587	1 876
Non Specified (Others)	0	0	0	0	0	0	0	0	0	0	0	0

Table 29: National Energy Balance 1990-2001. Black Liquor [TJ].

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Indigenous Production	17 799	17 737	18 067	18 544	19 606	21 392	21 174	21 675	22 916	23 619	24 060	23 238
Total Imports (Balance)	0	0	0	0	0	0	0	0	0	0	0	0
Total Exports (Balance)	0	0	0	0	0	0	0	0	0	0	0	0
Stock Change (National Territory)	0	0	0	0	0	0	0	0	0	0	0	0
Gross Inland Deliveries (Obs.)	17 799	17 737	18 067	18 544	19 606	21 392	21 174	21 675	22 916	23 619	24 060	23 238
Statistical Difference	0	0	0	0	0	0	0	0	0	0	0	0
Total Transformation Sector	5 260	5 670	6 076	7 091	8 897	9 267	9 505	8 580	11 354	10 003	7 197	7 317
Public Electricity	0	0	0	0	0	0	0	0	0	0	0	0
Public Combined Heat and Power	0	0	0	0	0	0	0	0	0	0	0	0
Public Heat Plants	0	0	0	0	0	0	0	0	0	0	0	0
Auto Producers of Electricity	2 618	2 822	3 024	4 033	5 060	5 271	5 406	5 140	8 867	6 158	2 001	3 116
Auto Producers for CHP	2 642	2 848	3 052	3 058	3 837	3 997	4 099	3 440	2 487	3 845	5 196	4 200
Auto Producer Heat Plants	0	0	0	0	0	0	0	0	0	0	0	0
Total Energy Sector	0	0	0	0	0	0	0	0	0	0	0	0
Coal Mines	0	0	0	0	0	0	0	0	0	0	0	0
Patent Fuel Plants	0	0	0	0	0	0	0	0	0	0	0	0
Coke Ovens (Energy)	0	0	0	0	0	0	0	0	0	0	0	0
Blast Furnaces (Energy)	0	0	0	0	0	0	0	0	0	0	0	0
Gas Works (Energy)	0	0	0	0	0	0	0	0	0	0	0	0
BKB (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0
Petroleum refineries	0	0	0	0	0	0	0	0	0	0	0	0
Power Plants	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Energy)	0	0	0	0	0	0	0	0	0	0	0	0
Distribution Losses	0	0	0	0	0	0	0	0	0	0	0	0
Final Consumption	12 540	12 067	11 991	11 453	10 709	12 125	11 669	13 094	11 562	13 616	16 864	15 921
Total Transport	0	0	0	0	0	0	0	0	0	0	0	0
Rail	0	0	0	0	0	0	0	0	0	0	0	0
Inland Waterways	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Transport)	0	0	0	0	0	0	0	0	0	0	0	0
Total Industry	12 540	12 067	11 991	11 453	10 709	12 125	11 669	13 094	11 562	13 616	16 864	15 921
Iron and Steel	0	0	0	0	0	0	0	0	0	0	0	0
Chemical (incl.Petro-Chemical)	0	0	0	0	0	0	0	0	0	0	0	0
Non ferrous Metals	0	0	0	0	0	0	0	0	0	0	0	0
Non metallic Mineral Products	0	0	0	0	0	0	0	0	0	0	0	0
Transportation Equipment	0	0	0	0	0	0	0	0	0	0	0	0
Machinery	0	0	0	0	0	0	0	0	0	0	0	0
Mining and Quarrying	0	0	0	0	0	0	0	0	0	0	0	0
Food, Beverages and Tobacco	0	0	0	0	0	0	0	0	0	0	0	0
Pulp, Paper and Printing	12 540	12 067	11 991	11 453	10 709	12 125	11 669	13 094	11 562	13 616	16 864	15 921
Wood and Wood Products	0	0	0	0	0	0	0	0	0	0	0	0
Construction	0	0	0	0	0	0	0	0	0	0	0	0
Textiles and Leather	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Industry)	0	0	0	0	0	0	0	0	0	0	0	0
Total Other Sectors	0	0	0	0	0	0	0	0	0	0	0	0
Commerce - Public Services	0	0	0	0	0	0	0	0	0	0	0	0
Residential	0	0	0	0	0	0	0	0	0	0	0	0
Agriculture	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Others)	0	0	0	0	0	0	0	0	0	0	0	0

Table 30: National Energy Balance 1990-2001. Biogas [TJ].

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Indigenous Production	0	0	0	0	0	35	39	48	27	159	229	198
Total Imports (Balance)	0	0	0	0	0	0	0	0	0	0	0	0
Total Exports (Balance)	0	0	0	0	0	0	0	0	0	0	0	0
Stock Change (National Territory)	0	0	0	0	0	0	0	0	0	0	0	0
Gross Inland Deliveries (Obs.)	0	0	0	0	0	35	39	48	27	159	229	198
Statistical Difference	0	0	0	0	0	0	0	0	0	0	0	0
Total Transformation Sector	0	0	0	0	0	35	39	48	27	127	179	142
Public Electricity	0	0	0	0	0	0	0	0	0	13	20	20
Public Combined Heat and Power	0	0	0	0	0	0	0	0	0	0	0	0
Public Heat Plants	0	0	0	0	0	0	0	0	0	0	0	0
Auto Producers of Electricity	0	0	0	0	0	0	0	0	0	29	69	64
Auto Producers for CHP	0	0	0	0	0	35	39	48	27	85	89	58
Auto Producer Heat Plants	0	0	0	0	0	0	0	0	0	0	0	0
Total Energy Sector	0	0	0	0	0	0	0	0	0	0	0	0
Coal Mines	0	0	0	0	0	0	0	0	0	0	0	0
Patent Fuel Plants	0	0	0	0	0	0	0	0	0	0	0	0
Coke Ovens (Energy)	0	0	0	0	0	0	0	0	0	0	0	0
Blast Furnaces (Energy)	0	0	0	0	0	0	0	0	0	0	0	0
Gas Works (Energy)	0	0	0	0	0	0	0	0	0	0	0	0
BKB (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0
Petroleum refineries	0	0	0	0	0	0	0	0	0	0	0	0
Power Plants	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Energy)	0	0	0	0	0	0	0	0	0	0	0	0
Distribution Losses	0	0	0	0	0	0	0	0	0	0	0	0
Final Consumption	0	0	0	0	0	0	0	0	0	32	50	56
Total Transport	0	0	0	0	0	0	0	0	0	0	0	0
Rail	0	0	0	0	0	0	0	0	0	0	0	0
Inland Waterways	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Transport)	0	0	0	0	0	0	0	0	0	0	0	0
Total Industry	0	0	0	0	0	0	0	0	0	32	50	56
Iron and Steel	0	0	0	0	0	0	0	0	0	0	0	0
Chemical (incl.Petro-Chemical)	0	0	0	0	0	0	0	0	0	0	0	0
Non ferrous Metals	0	0	0	0	0	0	0	0	0	0	0	0
Non metallic Mineral Products	0	0	0	0	0	0	0	0	0	0	0	0
Transportation Equipment	0	0	0	0	0	0	0	0	0	0	0	0
Machinery	0	0	0	0	0	0	0	0	0	0	0	0
Mining and Quarrying	0	0	0	0	0	0	0	0	0	0	0	0
Food, Beverages and Tobacco	0	0	0	0	0	0	0	0	0	15	8	0
Pulp, Paper and Printing	0	0	0	0	0	0	0	0	0	17	41	56
Wood and Wood Products	0	0	0	0	0	0	0	0	0	0	0	0
Construction	0	0	0	0	0	0	0	0	0	0	0	0
Textiles and Leather	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Industry)	0	0	0	0	0	0	0	0	0	0	0	0
Total Other Sectors	0	0	0	0	0	0	0	0	0	0	0	0
Commerce - Public Services	0	0	0	0	0	0	0	0	0	0	0	0
Residential	0	0	0	0	0	0	0	0	0	0	0	0
Agriculture	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Others)	0	0	0	0	0	0	0	0	0	0	0	0

Table 31: National Energy Balance 1990-2001. Sewage Sludge Gas [TJ].

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Indigenous Production	0	0	0	631	638	619	668	691	715	714	742	821
Total Imports (Balance)	0	0	0	0	0	0	0	0	0	0	0	0
Total Exports (Balance)	0	0	0	0	0	0	0	0	0	0	0	0
Stock Change (National Territory)	0	0	0	0	0	0	0	0	0	0	0	0
Gross Inland Deliveries (Obs.)	0	0	0	631	638	619	668	691	715	714	742	821
Statistical Difference	0	0	0	0	0	0	0	0	0	0	0	0
Total Transformation Sector	0	0	0	631	638	619	668	691	715	714	742	821
Public Electricity	0	0	0	0	0	10	31	52	50	17	39	49
Public Combined Heat and Power	0	0	0	0	0	0	0	0	0	0	0	0
Public Heat Plants	0	0	0	0	0	0	0	4	2	0	0	0
Auto Producers of Electricity	0	0	0	0	0	0	0	0	0	0	0	39
Auto Producers for CHP	0	0	0	631	638	609	637	635	663	696	703	733
Auto Producer Heat Plants	0	0	0	0	0	0	0	0	0	0	0	0
Total Energy Sector	0	0	0	0	0	0	0	0	0	0	0	0
Coal Mines	0	0	0	0	0	0	0	0	0	0	0	0
Patent Fuel Plants	0	0	0	0	0	0	0	0	0	0	0	0
Coke Ovens (Energy)	0	0	0	0	0	0	0	0	0	0	0	0
Blast Furnaces (Energy)	0	0	0	0	0	0	0	0	0	0	0	0
Gas Works (Energy)	0	0	0	0	0	0	0	0	0	0	0	0
BKB (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0
Petroleum refineries	0	0	0	0	0	0	0	0	0	0	0	0
Power Plants	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Energy)	0	0	0	0	0	0	0	0	0	0	0	0
Distribution Losses	0	0	0	0	0	0	0	0	0	0	0	0
Final Consumption	0	0	0	0	0	0	0	0	0	0	0	0
Total Transport	0	0	0	0	0	0	0	0	0	0	0	0
Rail	0	0	0	0	0	0	0	0	0	0	0	0
Inland Waterways	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Transport)	0	0	0	0	0	0	0	0	0	0	0	0
Total Industry	0	0	0	0	0	0	0	0	0	0	0	0
Iron and Steel	0	0	0	0	0	0	0	0	0	0	0	0
Chemical (incl.Petro-Chemical)	0	0	0	0	0	0	0	0	0	0	0	0
Non ferrous Metals	0	0	0	0	0	0	0	0	0	0	0	0
Non metallic Mineral Products	0	0	0	0	0	0	0	0	0	0	0	0
Transportation Equipment	0	0	0	0	0	0	0	0	0	0	0	0
Machinery	0	0	0	0	0	0	0	0	0	0	0	0
Mining and Quarrying	0	0	0	0	0	0	0	0	0	0	0	0
Food, Beverages and Tobacco	0	0	0	0	0	0	0	0	0	0	0	0
Pulp, Paper and Printing	0	0	0	0	0	0	0	0	0	0	0	0
Wood and Wood Products	0	0	0	0	0	0	0	0	0	0	0	0
Construction	0	0	0	0	0	0	0	0	0	0	0	0
Textiles and Leather	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Industry)	0	0	0	0	0	0	0	0	0	0	0	0
Total Other Sectors	0	0	0	0	0	0	0	0	0	0	0	0
Commerce - Public Services	0	0	0	0	0	0	0	0	0	0	0	0
Residential	0	0	0	0	0	0	0	0	0	0	0	0
Agriculture	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Others)	0	0	0	0	0	0	0	0	0	0	0	0

Table 32: National Energy Balance 1990-2001. Landfill Gas [TJ].

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Indigenous Production	0	0	0	77	88	195	307	524	527	524	457	1 343
Total Imports (Balance)	0	0	0	0	0	0	0	0	0	0	0	0
Total Exports (Balance)	0	0	0	0	0	0	0	0	0	0	0	0
Stock Change (National Territory)	0	0	0	0	0	0	0	0	0	0	0	0
Gross Inland Deliveries (Obs.)	0	0	0	77	88	195	307	524	527	524	457	1 343
Statistical Difference	0	0	0	0	0	0	0	0	0	0	0	0
Total Transformation Sector	0	0	0	0	0	146	271	519	520	524	457	1 342
Public Electricity	0	0	0	0	0	0	0	0	0	25	20	63
Public Combined Heat and Power	0	0	0	0	0	29	31	27	30	0	0	4
Public Heat Plants	0	0	0	0	0	0	0	0	0	0	0	0
Auto Producers of Electricity	0	0	0	0	0	117	240	492	490	499	438	1 275
Auto Producers for CHP	0	0	0	0	0	0	0	0	0	0	0	0
Auto Producer Heat Plants	0	0	0	0	0	0	0	0	0	0	0	0
Total Energy Sector	0	0	0	0	0	0	0	0	0	0	0	0
Coal Mines	0	0	0	0	0	0	0	0	0	0	0	0
Patent Fuel Plants	0	0	0	0	0	0	0	0	0	0	0	0
Coke Ovens (Energy)	0	0	0	0	0	0	0	0	0	0	0	0
Blast Furnaces (Energy)	0	0	0	0	0	0	0	0	0	0	0	0
Gas Works (Energy)	0	0	0	0	0	0	0	0	0	0	0	0
BKB (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0
Petroleum refineries	0	0	0	0	0	0	0	0	0	0	0	0
Power Plants	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Energy)	0	0	0	0	0	0	0	0	0	0	0	0
Distribution Losses	0	0	0	0	0	0	0	0	0	0	0	0
Final Consumption	0	0	0	77	88	49	36	5	7	0	0	0
Total Transport	0	0	0	0	0	0	0	0	0	0	0	0
Rail	0	0	0	0	0	0	0	0	0	0	0	0
Inland Waterways	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Transport)	0	0	0	0	0	0	0	0	0	0	0	0
Total Industry	0	0	0	0	0	0	0	0	0	0	0	0
Iron and Steel	0	0	0	0	0	0	0	0	0	0	0	0
Chemical (incl.Petro-Chemical)	0	0	0	0	0	0	0	0	0	0	0	0
Non ferrous Metals	0	0	0	0	0	0	0	0	0	0	0	0
Non metallic Mineral Products	0	0	0	0	0	0	0	0	0	0	0	0
Transportation Equipment	0	0	0	0	0	0	0	0	0	0	0	0
Machinery	0	0	0	0	0	0	0	0	0	0	0	0
Mining and Quarrying	0	0	0	0	0	0	0	0	0	0	0	0
Food, Beverages and Tobacco	0	0	0	0	0	0	0	0	0	0	0	0
Pulp, Paper and Printing	0	0	0	0	0	0	0	0	0	0	0	0
Wood and Wood Products	0	0	0	0	0	0	0	0	0	0	0	0
Construction	0	0	0	0	0	0	0	0	0	0	0	0
Textiles and Leather	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Industry)	0	0	0	0	0	0	0	0	0	0	0	0
Total Other Sectors	0	0	0	77	88	49	36	5	7	0	0	0
Commerce - Public Services	0	0	0	77	88	49	36	5	7	0	0	0
Residential	0	0	0	0	0	0	0	0	0	0	0	0
Agriculture	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Others)	0	0	0	0	0	0	0	0	0	0	0	0

Table 33 presents heat calorific values taken from the IEA used for estimating emissions.

Table 33: Heat calorific values [MJ/kg], [MJ/m³] taken from the IEA 1990-2001.

Fuel Code	Fuel Description		1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
101A	Coking Coal	Transf.	29.07	29.07	29.07	29.07	29.07	29.07	29.07	29.07	29.07	29.07	29.07	29.07
102A	Hard Coal	Final Cons.	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00
		Transf.	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00
104A	Hard Coal Briquettes	Final Cons.								31.00	31.00	31.00	31.00	31.00
105A	Brown Coal	Final Cons.	10.90	10.90	10.90	10.90	10.90	10.90	9.90	9.90	9.90	9.77	9.82	9.82
		Transf.	10.90	10.90	10.90	10.90	10.90	10.90	9.90	9.90	9.90	9.77	9.82	9.82
106A	Brown Coal Briquettes	Final Cons.	19.30	19.30	19.30	19.30	19.30	19.30	19.30	19.30	19.30	19.30	19.30	19.30
		Transf.	19.30	19.30	19.30	19.30	19.30	19.30	19.30	19.30	19.30	19.30	19.30	19.30
107A	Coke Oven Coke	Final Cons.	28.20	28.20	28.20	28.50	28.50	28.50	28.20	28.20	28.20	28.20	28.20	28.20
		Transf.	28.20	28.20	28.20	28.50	28.50	28.50	28.20	28.20	28.20	28.20	28.20	28.20
113A	Peat	Final Cons.	8.80	8.80	8.80	8.80	8.80	8.80	8.80	8.80	8.80	8.80	8.80	8.80
304A	Coke Oven Gas	Production	17.52	17.52	17.52	17.52	17.52	17.52	17.52	17.52	17.52	17.52	17.52	17.52
305A	Blast Furnace Gas	Production	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50
201A	Crude Oil	Average	42.50	42.50	42.50	42.50	42.50	42.50	42.50	42.51	42.50	42.52	42.52	42.50
203X	Residual Fuel Oil	Final Cons.	41.00	41.10	41.10	41.30	41.30	40.46	40.33	40.28	40.27	41.54	41.50	41.50
		Transf.	41.00	41.10	41.10	41.30	41.30	40.46	40.33	40.28	40.27	40.49	40.19	40.19
204A	Gas oil	Final Cons.	42.60	42.60	42.60	42.60	42.60	42.70	42.80	42.80	42.80	42.80	42.80	42.80
		Transf.	42.60	42.60	42.60	42.60	42.60	42.70	42.80	42.80	42.80	42.62	42.32	42.32
2050	Diesel	Final Cons.	42.60	42.60	42.60	42.60	42.60	42.70	42.70	42.70	42.70	42.80	42.80	42.80
		Transf.	42.60	42.60	42.60	42.60	42.60	42.70	42.70	42.70	42.70	42.63	42.80	42.80
206A	Petroleum	Final Cons.	43.60	43.60	43.60	43.60	43.60	43.30	43.38	43.41	43.41	43.41	43.41	43.41
206B	Kerosene	Final Cons.	43.60	43.60	43.60	43.60	43.60	43.30	43.38	43.41	43.41	43.41	43.41	43.41
207A	Aviation Gasoline	Final Cons.	41.60	41.60	41.60	42.50	42.50	42.50	42.50	42.50	42.50	42.50	42.50	42.50
2080	Motor Gasoline	Final Cons.	41.60	41.60	41.60	42.50	42.50	42.50	42.50	42.50	42.50	42.50	42.50	42.50
217A	Refinery Feedstocks	Average	40.30	40.30	40.30	40.30	40.30	40.30	40.30	40.30	40.30	42.70	42.95	42.85
219A	Lubricants	Final Cons.	41.80	41.80	41.80	41.80	41.80	41.80	41.80	41.80	41.80	43.83	43.49	43.49
		Transf.	41.80	41.80	41.80	41.80	41.80	41.80						
220A	White Spirit	Final Cons.	41.60	41.60	41.60	42.50	42.50	42.50	42.50	42.50	42.50	42.50	42.50	42.50
222A	Bitumen	Final Cons.	41.80	41.80	41.80	41.80	41.80	41.80	41.80	41.80	41.80	43.83	43.49	43.49
		Transf.	41.80	41.80	41.80	41.80	41.80	41.80						
224A	Other Petroleum Products	Final Cons.	41.80	41.80	41.80	41.80	41.80	41.80	41.80	41.80	41.80	43.83	43.49	43.49
		Transf.	41.80	41.80	41.80	41.80	41.80	41.80						
302A	Natural Gas Liquids (NGL)	Average	45.22	45.22	45.22	45.22	45.22	45.22	45.22	45.22	45.22	45.22	45.22	45.22
303A	Liquefied Petroleum Gas (LPG)	Final Cons.	46.30	46.20	46.20	46.20	46.20	46.30	46.32	46.31	46.32	46.00	46.00	46.00
301A	Natural Gas	Final Cons.	36.00	36.00	36.00	36.00	36.00	36.00	36.00	36.00	36.00	35.85	35.85	35.85
		Transf.	36.00	36.00	36.00	36.00	36.00	36.00	36.00	36.00	36.00	35.85	35.85	35.85
		Transf.	46.30	46.20	46.20	46.20	46.20	46.30	46.32	46.31	46.32	46.04	46.34	46.34
308A	Refinery Gas	Transf.	49.00	49.00	49.00	49.00	49.00	49.00	49.00	49.00	49.00	42.23	45.93	45.93

Table 34 presents heat calorific values taken from STATISTIK AUSTRIA used for estimating emissions.

Table 34: Heat calorific values [MJ/kg] taken from STATISTIK AUSTRIA 1990-2001.

Fuel Code	Fuel Description		1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
114B	Municipal Waste	Average	9.20	9.20	9.20	9.20	9.20	9.20	8.50	8.70	8.70	8.70	8.70	8.70
114C	Hazardous Waste	Average	9.20	9.20	9.20	9.20	9.20	9.20	8.50	8.70	8.70	8.70	8.70	8.70
115A	Industrial Waste	Average	9.20	9.20	9.20	9.20	9.20	9.20	8.50	8.70	8.70	8.70	8.70	8.70
111A	Fuel Wood	Average	15.50	15.50	15.50	14.35	14.35	14.35	14.35	14.35	14.35	14.35	14.35	14.35
116A	Wood Wastes	Average	9.20	9.20	9.20	9.20	9.20	9.20	8.50	8.70	8.70	8.70	8.70	8.70
118A	Sewage Sludge	Average	9.20	9.20	9.20	9.20	9.20	9.20	8.50	8.70	8.70	8.70	8.70	8.70
215A	Black Liquor	Average	9.20	9.20	9.20	9.20	9.20	9.20	8.50	8.70	8.70	8.70	8.70	8.70

Table 35 presents IPCC default values for heat calorific values used for estimating emissions.

Table 35: Heat calorific values [MJ/kg], [MJ/m³]: IPCC default values 1990-2001.

Fuel Code	Fuel Description		1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
309A	Biogas	Average	23.40	23.40	23.40	23.40	23.40	23.40	23.40	23.40	23.40	23.40	23.40	23.40
309B	Sewage Sludge Gas	Average	27.00	27.00	27.00	27.00	27.00	27.00	27.00	27.00	27.00	27.00	27.00	27.00
310A	Gas from Waste Disposal Site	Average	25.00	25.00	25.00	25.00	25.00	25.00	25.00	25.00	25.00	25.00	25.00	25.00

ANNEX 2: NRF FOR 2001, TREND TABLES

The following annex presents emission data for the year 2001 in the "New Format for Reporting - NFR" as submitted under the UNECE/CLRTAP Convention in 2003.

Furthermore, trend tables for NO_X, SO_2, NMVOC and NH_3 as well as for heavy metals, POPs and particulate matter, as included in "Austria's Annual National Air Emissions Inventory 1980-2001. Submission under the Convention on Long-range Transboundary Air Pollution (CLRTAP)", are presented.

TABLE 1V 1A: National sector emissions: Main pollutants, particulate matter and heavy metals
Version 2002-1

COUNTRY: AT (as ISO2 code)
DATE: 16.12.2002 (as DD.MM.YYYY)
YEAR: 2001 (as YYYY, year of Emmissions)

These five yellow lines will not be read by UNECE! These lines can be modified freely for your own reference purposes.
Footnotes to the emission figures reported should be submitted together with the emission data, but in a separate document.
Please fill out the blue marked fields. You may use the aggregation levels instead of the gray marked fields in aggregation.
You must use for each field either a number or one of the following codes (capitals, no dots in between, see EB.AIR/GE.1/2002/2): NO , NA , NE , IE , C
Footnotes or any other information entered into this table will not be taken into account.

NFR sectors to be reported to CLRTAP			A = Allowable Aggregation	*Yearly minimum reporting*												*Additional reporting*					
				Main Pollutants					Particulate matter			Priority metals				Other metals					
				NOx	CO	NMVOC	SOx	NH3	TSP	PM10	PM2.5	Pb	Cd	Hg		As	Cr	Cu	Ni	Se	Zn
				Gg NO_2	Gg	Gg	Gg SO_2	Gg	Mg	Mg	Mg	Mg	Mg	Mg		Mg	Mg	Mg	Mg	Mg	Mg
1 A 1 a	(a)	1 A 1 a Public Electricity and Heat Production		9.27	2.71	0.69	4.21	0.16													
1 A 1 b	(a)	1 A 1 b Petroleum refining		3.30	0.49	0.00	3.62	0.08													
1 A 1 c	(a)	1 A 1 c Manufacture of Solid Fuels and Other Energy Industries		0.46	0.02	0.00	0.00	0.00													
1 A 2	(a)	**1 A 2 Manufacturing Industries and Construction**	**A**	24.84	15.47	3.63	6.22	0.21													
1 A 2 a	(a)	1 A 2 a Iron and Steel		0.34	0.06	0.00	0.29	0.02													
1 A 2 b	(a)	1 A 2 b Non-ferrous Metals		0.19	0.05	0.00	0.17	0.00													
1 A 2 c	(a)	1 A 2 c Chemicals		1.07	0.62	0.09	1.01	0.02													
1 A 2 d	(a)	1 A 2 d Pulp, Paper and Print		3.90	3.92	0.68	0.89	0.05													
1 A 2 e	(a)	1 A 2 e Food Processing, Beverages and Tobacco		0.67	0.09	0.01	0.36	0.01													
1 A 2 f	(a)	1 A 2 f Other (Please specify in a covering note)		18.67	10.72	2.85	3.50	0.10													
1 A 3 a ii (i)		1 A 3 a ii Civil Aviation (Domestic, LTO)		0.13	1.99	0.05	0.02	0.00													
1 A 3 a ii (ii)		1 A 3 a ii Civil Aviation (Domestic, Cruise)		0.19	0.06	0.02	0.02	0.00													
1 A 3 b	(a)	**1 A 3 b Road Transportation**	**A**	97.14	216.63	29.34	3.00	0.31													

Note 1: Main Pollutants should cover the timespan from 1980 to latest year.

HM should cover the timespan from 1990 to latest year.

PM should cover the timespan 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 notavailable. Grey cells show which sectors can be aggregated into the sector marked A. Black cells occur when two possible levels of aggregation are possible.

NFR sectors to be reported to CLRTAP			A = Allowable Aggregation	*Yearly minimum reporting*												*Additional reporting*					
				Main Pollutants					Particulate matter			Priority metals				Other metals					
				NOx	CO	NMVOC	SOx	NH3	TSP	PM10	PM2.5	Pb	Cd	Hg		As	Cr	Cu	Ni	Se	Zn
				Gg NO_2	Gg	Gg	Gg SO_2	Gg	Mg	Mg	Mg	Mg	Mg	Mg		Mg	Mg	Mg	Mg	Mg	Mg
1 A 3 b i		1 A 3 b i R.T., Passenger cars		42.11	176.82	14.06	1.88	0.25													
1 A 3 b ii		1 A 3 b ii R.T., Light duty vehicles		5.29	5.32	0.80	0.32	0.01													
1 A 3 b iii		1 A 3 b iii R.T., Heavy duty vehicles		49.17	8.81	2.76	0.79	0.02													
1 A 3 b iv		1 A 3 b iv R.T., Mopeds & Motorcycles		0.54	25.67	5.28	0.01	0.03													
1 A 3 b v		1 A 3 b v R.T., Gasoline evaporation		0.00	0.00	6.44	0.00	0.00													
1 A 3 b vi		1 A 3 b vi R.T., Automobile tyre and brake wear		0.00	0.00	0.00	0.00	0.00													
1 A 3 b vii		1 A 3 b vii R.T., Automobile road abrasion		0.00	0.00	0.00	0.00	0.00													
1 A 3 c	(a)	1 A 3 c Railways		1.69	0.49	0.24	0.10	0.00													
1 A 3 d ii		1 A 3 d ii National Navigation		0.57	2.75	0.68	0.02	0.00													
1 A 3 e	**(a)**	**1 A 3 e Other (Please specify in a covering note)**	**A**	1.74	0.06	0.01	0.00	0.01													
1 A 3 e i		1 A 3 e i Pipeline compressors		0.00	0.00	0.00	0.00	0.00													
1 A 3 e ii		1 A 3 e ii Other mobile sources and machinery		0.00	0.00	0.00	0.00	0.00													
1 A 4 a	(a)	1 A 4 a Commercial / Institutional		1.61	7.45	0.66	0.80	0.05													
1 A 4 b	(a)	**1 A 4 b Residential**	**A**	15.53	345.94	32.74	8.99	0.62													
1 A 4 b i		1 A 4 b i Residential plants		0.00	0.00	0.00	0.00	0.00													
1 A 4 b ii		1 A 4 b ii Household and gardening (mobile)		0.89	21.72	5.76	0.02	0.00													

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NFR sectors to be reported to CLRTAP			A = Allowable Aggregation	Yearly minimum reporting											Additional reporting					
				Main Pollutants					Particulate matter			Priority metals			Other metals					
				NOx	CO	NMVOC	SOx	NH3	TSP	PM10	PM2.5	Pb	Cd	Hg	As	Cr	Cu	Ni	Se	Zn
				Gg NO_2	Gg	Gg	Gg SO_2	Gg	Mg	Mg	Mg	Mg	Mg	Mg	Mg	Mg	Mg	Mg	Mg	Mg
1 A 4 c	(a)	**1 A 4 c Agriculture / Forestry / Fishing**	**A**	23.21	49.54	10.78	0.84	0.05												
1 A 4 c i		1 A 4 c i Stationary		0.00	0.00	0.00	0.00	0.00												
1 A 4 c ii		1 A 4 c ii Off-road Vehicles and Other Machinery		22.15	27.03	8.78	0.37	0.01												
1A 4 c iii		1A 4 c iii National Fishing		0.00	0.00	0.00	0.00	0.00												
1 A 5 a	(a)	1 A 5 a Other, Stationary (including Military)		0.00	0.00	0.00	0.00	0.00												
1 A 5 b	(a)	1 A 5 b Other, Mobile (Including military)		0.00	0.00	0.00	0.00	0.00												
1B1	(a)	**1B1 Fugitive Emissions from Solid Fuels**	**A**	0.00	0.00	0.00	0.00	0.00												
1 B 1 a	(a)	1 B 1 a Coal Mining and Handling		0.00	0.00	0.00	0.00	0.00												
1 B 1 b	(a)	1 B 1 b Solid fuel transformation		0.00	0.00	0.00	0.00	0.00												
1 B 1 c	(a)	1 B 1 c Other (Please specify in a covering note)		0.00	0.00	0.00	0.00	0.00												
1 B 2	(a)	**1 B 2 Oil and natural gas**	**A**	0.00	0.00	3.61	0.16	0.00												
1 B 2 a	(a)	**1 B 2 a Oil**	**A**	0.00	0.00	3.45	0.00	0.00												
1 B 2 a i	(a)	1 B 2 a i Exploration Production, Transport		0.00	0.00	0.00	0.00	0.00												
1 B 2 a iv	(a)	1 B 2 a iv Refining / Storage		0.00	0.00	1.38	0.00	0.00												
1 B 2 a v	(a)	1 B 2 a v Distribution of oil products		0.00	0.00	2.07	0.00	0.00												
1 B 2 a vi	(a)	1 B 2 a vi Other		0.00	0.00	0.00	0.00	0.00												
1 B 2 b	(a)	1 B 2 b Natural gas		0.00	0.00	0.16	0.16	0.00												
1 B 2 c	(a)	1 B 2 c Venting and flaring		0.00	0.00	0.00	0.00	0.00												

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NFR sectors to be reported to CLRTAP			A = Allowable Aggregation	Yearly minimum reporting											Additional reporting					
				Main Pollutants					Particulate matter			Priority metals			Other metals					
				NOx	CO	NMVOC	SOx	NH3	TSP	PM10	PM2.5	Pb	Cd	Hg	As	Cr	Cu	Ni	Se	Zn
				Gg NO_2	Gg	Gg	Gg SO_2	Gg	Mg	Mg	Mg	Mg	Mg	Mg	Mg	Mg	Mg	Mg	Mg	Mg
2 A	(a)	**2 A MINERAL PRODUCTS (b)**	**A**	5.24	16.74	5.17	0.18	0.00												
2 A 1	(a)	2 A 1 Cement Production		3.96	7.63	0.22	0.18	0.00												
2 A 2	(a)	2 A 2 Lime Production		0.00	0.00	0.00	0.00	0.00												
2 A 3	(a)	2 A 3 Limestone and Dolomite Use		0.00	0.00	0.00	0.00	0.00												
2 A 4	(a)	2 A 4 Soda Ash Production and use		0.00	0.00	0.00	0.00	0.00												
2 A 5	(a)	2 A 5 Asphalt Roofing		0.00	9.11	4.68	0.00	0.00												
2 A 6	(a)	2 A 6 Road Paving with Asphalt		0.00	0.00	0.26	0.00	0.00												
2 A 7	(a)	2 A 7 Other including Non Fuel Mining & Construction (Please specify in a covering note)		1.28	0.00	0.01	0.00	0.00												
2 B	(a)	**2 B CHEMICAL INDUSTRY**	**A**	4.40	11.11	12.34	3.19	0.08												
2 B 1	(a)	2 B 1 Ammonia Production		0.00	0.04	0.00	0.00	0.01												
2 B 2	(a)	2 B 2 Nitric Acid Production		0.00	0.00	0.00	0.00	0.00												
2 B 3	(a)	2 B 3 Adipic Acid Production		0.00	0.00	0.00	0.00	0.00												
2 B 4	(a)	2 B 4 Carbide Production		0.00	0.00	0.00	0.00	0.00												
2 B 5	(a)	2 B 5 Other (Please specify in a covering note)		4.40	11.07	12.34	3.19	0.07												
2 C	(a)	2 C METAL PRODUCTION		4.27	171.55	0.51	5.28	0.00												
2 D	(a)	2 D OTHER PRODUCTION (b)	**A**	0.74	0.54	2.74	0.00	0.00												
2 D 1	(a)	2 D 1 Pulp and Paper		0.74	0.54	0.54	0.00	0.00												
2 D 2	(a)	2 D 2 Food and Drink		0.00	0.00	2.19	0.00	0.00												
2 G	(a)	2 G OTHER (Please specify in a covering note)		0.00	0.00	0.00	0.00	0.00												

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NFR sectors to be reported to CLRTAP			A = Allowable Aggregation	Yearly minimum reporting												Additional reporting					
				Main Pollutants					Particulate matter			Priority metals			Other metals						
				NOx	CO	NMVOC	SOx	NH3	TSP	PM10	PM2.5	Pb	Cd	Hg	As	Cr	Cu	Ni	Se	Zn
				Gg NO_2	Gg	Gg	Gg SO_2	Gg	Mg	Mg	Mg	Mg	Mg	Mg	Mg	Mg	Mg	Mg	Mg	Mg	Mg
3 A	(a)	3 A PAINT APPLICATION		0.00	0.00	14.40	0.00	0.00													
3 B	(a)	3 B DEGREASING AND DRY CLEANING		0.00	0.00	0.00	0.00	0.00													
3 C	(a)	3 C CHEMICAL PRODUCTS, MANUFACTURE AND PROCESSING		0.00	0.00	16.48	0.00	0.00													
3 D	(a)	3 D OTHER including products containing HMs and POPs (Please specify in a covering note)		0.00	0.00	96.06	0.00	0.00													
4 B	(a)	**4 B MANURE MANAGEMENT (c)**	**A**	0.00	0.00	0.00	0.00	43.82													
4 B 1	(a)	4 B 1 Cattle		0.00	0.00	0.00	0.00	25.97													
4 B 1 a	(a)	4 B 1 a Dairy		0.00	0.00	0.00	0.00	9.29													
4 B 1 b	(a)	4 B 1 b Non-Dairy		0.00	0.00	0.00	0.00	16.69													
4 B 2	(a)	4 B 2 Buffalo		0.00	0.00	0.00	0.00	0.00													
4 B 3	(a)	4 B 3 Sheep		0.00	0.00	0.00	0.00	0.83													
4 B 4	(a)	4 B 4 Goats		0.00	0.00	0.00	0.00	0.16													
4 B 5	(a)	4 B 5 Camels and Llamas		0.00	0.00	0.00	0.00	0.00													
4 B 6	(a)	4 B 6 Horses		0.00	0.00	0.00	0.00	0.74													
4 B 7	(a)	4 B 7 Mules and Asses		0.00	0.00	0.00	0.00	0.00													
4 B 8	(a)	4 B 8 Swine		0.00	0.00	0.00	0.00	11.11													
4 B 9	(a)	4 B 9 Poultry		0.00	0.00	0.00	0.00	5.01													
4 B 13	(a)	4 B 13 Other		0.00	0.00	0.00	0.00	0.00													
4 C	(a)	4 C RICE CULTIVATION		0.00	0.00	0.00	0.00	0.00													

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NFR sectors to be reported to CLRTAP			A = Allowable Aggregation	Yearly minimum reporting												Additional reporting					
				Main Pollutants					Particulate matter			Priority metals				Other metals					
				NOx	CO	NMVOC	SOx	NH3	TSP	PM10	PM2.5	Pb	Cd	Hg		As	Cr	Cu	Ni	Se	Zn
				Gg NO_2	Gg	Gg	Gg SO_2	Gg	Mg	Mg	Mg	Mg	Mg	Mg		Mg	Mg	Mg	Mg	Mg	Mg
4 D	(a)	**4 D AGRICULTURAL SOILS**	**A**	5.02	0.00	1.71	0.00	8.29													
4 D 1	(a)	4 D 1 Direct Soil Emission		5.02	0.00	1.71	0.00	8.29													
4 F	(a)	4 F FIELD BURNING OF AGRICULTURAL WASTES		0.01	1.72	0.22	0.00	0.03													
4 G	(a)	4 G OTHER (d)		0.00	0.00	0.00	0.00	0.00													
5 B	(a)	5 B FOREST AND GRASSLAND CONVERSION		0.00	0.00	0.00	0.00	0.00													
6 A	(a)	6 A SOLID WASTE DISPOSAL ON LAND		0.00	14.49	0.19	0.00	0.01													
6 B	(a)	6 B WASTE-WATER HANDLING		0.00	0.00	0.00	0.00	0.00													
6 C	(a)	6 C WASTE INCINERATION (e)		0.03	0.01	0.00	0.05	0.00													
6 D	(a)	6 D OTHER WASTE (f)		0.00	0.00	0.00	0.00	0.00													
7	(a)	7 OTHER		0.00	0.00	0.00	0.00	0.00													
		National Total		199.40	859.74	232.25	36.67	53.72													

Memo Items																					
1 A 3 a i (i)	(a)	International Aviation (LTO)		0.00	0.00	0.00	0.00	0.00													
1 A 3 a i (ii)	(a)	International Aviation (Cruise)		0.00	0.00	0.00	0.00	0.00													
1 A 3 d i	(a)	International Navigation		0.00	0.00	0.00	0.00	0.00													
5 E	(a)	5 E Other		0.90	0.00	124.62	0.00	0.00													
X		X (11 08 Volcanoes)		0.00	0.00	0.00	0.00	0.00													

(a) Sectors already reported to UNFCCC for NOx, 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.
Note 1: Main Pollutants should cover the timespan from 1980 to latest year.
HM should cover the timespan from 1990 to latest year.
PM should cover the timespan 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

Trend table 1: SO_2 [Gg] 1980-2001

NFR-Sectors											
	1 ENERGY	1 A FUEL COMBUSTION ACTIVITIES	1 B FUGITIVE EMISSIONS FROM FUELS	2 INDUSTRIAL PROCESSES	3 SOLVENT AND OTHER PRODUCT USE	4 AGRICULTURE	5 LAND USE CHANGE AND FORESTRY	6 WASTE	7 OTHER	0 **NATIONAL TOTAL**	I B International Bunkers
1980	309.46	306.90	2.56	33.62	NO	0.05	NE	0.41	NE	**343.54**	0.11
1981	270.00	268.10	1.89	33.13	NO	0.05	NE	0.41	NE	**303.58**	0.12
1982	255.57	253.83	1.75	32.61	NO	0.05	NE	0.41	NE	**288.64**	0.11
1983	184.50	182.91	1.59	31.99	NO	0.05	NE	0.41	NE	**216.94**	0.14
1984	169.50	167.83	1.67	30.87	NO	0.05	NE	0.41	NE	**200.82**	0.19
1985	151.88	150.35	1.53	30.51	NO	0.05	NE	0.41	NE	**182.84**	0.20
1986	133.77	132.31	1.46	28.76	NO	0.05	NE	0.41	NE	**162.99**	0.17
1987	116.36	114.84	1.52	24.37	NO	0.05	NE	0.41	NE	**141.19**	0.20
1988	89.76	88.11	1.65	15.42	NO	0.05	NE	0.21	NE	**105.44**	0.23
1989	80.90	79.17	1.73	13.22	NO	0.05	NE	0.13	NE	**94.29**	0.28
1990	68.12	66.12	2.00	10.49	NO	0.00	NE	0.06	NE	**78.68**	0.28
1991	62.34	61.04	1.30	9.27	NO	0.00	NE	0.05	NE	**71.67**	0.32
1992	51.11	49.11	2.00	7.95	NO	0.00	NE	0.03	NE	**59.09**	0.34
1993	49.59	47.49	2.10	8.28	NO	0.00	NE	0.04	NE	**57.91**	0.36
1994	42.83	41.55	1.28	8.76	NO	0.00	NE	0.05	NE	**51.63**	0.38
1995	43.61	42.08	1.53	8.35	NO	0.00	NE	0.05	NE	**52.01**	0.42
1996	41.83	40.63	1.20	9.28	NO	0.00	NE	0.05	NE	**51.16**	0.47
1997	36.10	36.03	0.07	9.62	NO	0.00	NE	0.05	NE	**45.77**	0.48
1998	34.16	34.11	0.04	8.78	NO	0.00	NE	0.05	NE	**42.99**	0.50
1999	30.33	30.19	0.14	8.60	NO	0.00	NE	0.05	NE	**38.99**	0.49
2000	29.82	29.67	0.15	8.17	NO	0.00	NE	0.05	NE	**38.05**	0.53
2001	27.97	27.81	0.16	8.64	NO	0.00	NE	0.05	NE	**36.67**	0.51

Trend table 2: NO_2 [Gg] 1980-2001

NFR-Sectors											
	1 ENERGY	1 A FUEL COMBUSTION ACTIVITIES	1 B FUGITIVE EMISSIONS FROM FUELS	2 INDUSTRIAL PROCESSES	3 SOLVENT AND OTHER PRODUCT USE	4 AGRICULTURE	5 LAND USE CHANGE AND FORESTRY	6 WASTE	7 OTHER	0 **NATIONAL TOTAL**	I B International Bunkers
1980	204.96	204.96	IE	32.34	NO	5.08	NE	0.19	NE	**242.57**	1.05
1981	191.58	191.58	IE	30.92	NO	5.13	NE	0.19	NE	**227.82**	1.17
1982	189.35	189.35	IE	29.29	NO	5.16	NE	0.19	NE	**223.99**	1.09
1983	193.48	193.48	IE	27.90	NO	5.25	NE	0.19	NE	**226.82**	1.37
1984	194.85	194.85	IE	26.66	NO	5.28	NE	0.19	NE	**226.98**	1.87
1985	201.08	201.08	IE	25.06	NO	5.28	NE	0.19	NE	**231.61**	1.99
1986	199.09	199.09	IE	20.73	NO	5.26	NE	0.19	NE	**225.28**	1.70
1987	197.64	197.64	IE	19.61	NO	5.71	NE	0.19	NE	**223.15**	1.95
1988	192.70	192.70	IE	19.50	NO	4.97	NE	0.11	NE	**217.27**	2.29
1989	188.30	188.30	IE	19.01	NO	5.26	NE	0.07	NE	**212.63**	2.79
1990	181.24	181.24	IE	17.41	NO	5.20	NE	0.04	NE	**203.88**	2.77
1991	186.05	186.05	IE	17.48	NO	5.60	NE	0.03	NE	**209.16**	3.12
1992	178.97	178.97	IE	16.84	NO	4.63	NE	0.02	NE	**200.46**	3.40
1993	174.48	174.48	IE	17.11	NO	5.36	NE	0.02	NE	**196.98**	3.61
1994	167.90	167.90	IE	16.84	NO	5.86	NE	0.02	NE	**190.63**	3.77
1995	166.96	166.96	IE	15.81	NO	5.36	NE	0.02	NE	**188.15**	4.23
1996	186.12	186.12	IE	15.33	NO	5.16	NE	0.02	NE	**206.64**	4.66
1997	173.84	173.84	IE	15.32	NO	5.52	NE	0.03	NE	**194.70**	4.85
1998	182.85	182.85	IE	14.90	NO	5.22	NE	0.03	NE	**203.00**	5.01
1999	172.52	172.52	IE	14.88	NO	5.12	NE	0.03	NE	**192.55**	4.92
2000	176.67	176.67	IE	14.60	NO	5.08	NE	0.03	NE	**196.38**	5.36
2001	179.70	179.70	IE	14.64	NO	5.02	NE	0.03	NE	**199.40**	5.16

Trend table 3: NMVOC [Gg] 1980-2001

NFR-Sectors											
	1 ENERGY	1 A FUEL COMBUSTION ACTIVITIES	1 B FUGITIVE EMISSIONS FROM FUELS	2 INDUSTRIAL PROCESSES	3 SOLVENT AND OTHER PRODUCT USE	4 AGRICULTURE	5 LAND USE CHANGE AND FORESTRY	6 WASTE	7 OTHER	0 **NATIONAL TOTAL**	I B International Bunkers
1980	192.29	183.33	8.96	24.34	140.16	4.91	NE	0.27	NE	**361.96**	0.11
1981	193.39	185.12	8.26	23.13	143.76	4.84	NE	0.27	NE	**365.38**	0.13
1982	192.50	184.85	7.66	22.17	147.36	4.96	NE	0.26	NE	**367.26**	0.12
1983	194.24	186.87	7.37	21.87	150.96	4.87	NE	0.26	NE	**372.21**	0.15
1984	197.48	190.06	7.42	21.68	154.56	4.93	NE	0.26	NE	**378.91**	0.20
1985	197.47	189.76	7.71	20.67	158.16	4.96	NE	0.26	NE	**381.53**	0.22
1986	192.91	185.03	7.87	19.67	162.16	4.87	NE	0.26	NE	**379.88**	0.18
1987	191.24	183.26	7.99	19.76	166.16	4.90	NE	0.26	NE	**382.33**	0.21
1988	178.02	170.09	7.93	20.23	169.60	5.02	NE	0.26	NE	**373.12**	0.25
1989	166.72	158.51	8.21	20.20	172.40	4.97	NE	0.26	NE	**364.54**	0.30
1990	158.22	149.44	8.78	16.68	167.69	1.94	NE	0.25	NE	**344.78**	0.30
1991	162.34	152.69	9.64	18.17	140.03	1.93	NE	0.25	NE	**322.72**	0.33
1992	148.98	139.26	9.72	19.69	122.39	1.87	NE	0.24	NE	**293.17**	0.37
1993	142.97	133.29	9.68	21.18	115.79	1.84	NE	0.23	NE	**282.02**	0.39
1994	130.32	123.14	7.18	21.56	115.96	1.90	NE	0.23	NE	**269.97**	0.42
1995	125.62	119.20	6.43	21.24	122.13	1.91	NE	0.22	NE	**271.13**	0.46
1996	123.69	118.14	5.54	21.26	121.63	1.89	NE	0.22	NE	**268.68**	0.54
1997	96.37	91.36	5.00	21.22	130.10	1.97	NE	0.21	NE	**249.86**	0.60
1998	92.61	88.05	4.56	20.81	126.94	1.93	NE	0.20	NE	**242.49**	0.66
1999	86.67	82.98	3.69	21.09	126.94	1.97	NE	0.20	NE	**236.86**	0.64
2000	81.71	78.02	3.69	20.79	126.94	1.87	NE	0.20	NE	**231.51**	0.67
2001	82.44	78.84	3.61	20.75	126.94	1.92	NE	0.19	NE	**232.25**	0.65

Trend table 4: CO [Gg] 1980-2001

NFR-Sectors											
	1 ENERGY	1 A FUEL COMBUSTION ACTIVITIES	1 B FUGITIVE EMISSIONS FROM FUELS	2 INDUSTRIAL PROCESSES	3 SOLVENT AND OTHER PRODUCT USE	4 AGRICULTURE	5 LAND USE CHANGE AND FORESTRY	6 WASTE	7 OTHER	0 **NATIONAL TOTAL**	I B International Bunkers
1980	1399.0	1399.0	IE	346.7	NO	30.3	NE	18.9	NE	**1794.8**	0.3
1981	1357.9	1357.9	IE	344.1	NO	30.3	NE	18.9	NE	**1751.1**	0.4
1982	1328.7	1328.7	IE	341.0	NO	30.3	NE	18.8	NE	**1718.8**	0.3
1983	1304.8	1304.8	IE	340.3	NO	30.2	NE	18.8	NE	**1694.1**	0.4
1984	1306.7	1306.7	IE	372.2	NO	30.3	NE	18.7	NE	**1727.9**	0.6
1985	1278.8	1278.8	IE	380.4	NO	30.3	NE	18.7	NE	**1708.1**	0.6
1986	1227.1	1227.1	IE	370.3	NO	30.2	NE	18.6	NE	**1646.2**	0.5
1987	1214.0	1214.0	IE	315.7	NO	30.2	NE	18.4	NE	**1578.4**	0.6
1988	1118.3	1118.3	IE	322.7	NO	30.2	NE	18.5	NE	**1489.8**	0.7
1989	1038.8	1038.8	IE	339.1	NO	30.2	NE	18.6	NE	**1426.7**	0.9
1990	949.7	949.7	IE	267.9	NO	1.8	NE	18.6	NE	**1238.0**	0.8
1991	987.6	987.6	IE	238.7	NO	1.8	NE	18.3	NE	**1246.3**	0.9
1992	894.4	894.4	IE	283.4	NO	1.8	NE	18.0	NE	**1197.6**	1.0
1993	851.9	851.9	IE	295.3	NO	1.7	NE	17.5	NE	**1166.5**	1.1
1994	788.4	788.4	IE	309.4	NO	1.7	NE	17.2	NE	**1116.8**	1.1
1995	773.3	773.3	IE	237.9	NO	1.7	NE	16.7	NE	**1029.7**	1.3
1996	772.2	772.2	IE	259.9	NO	1.7	NE	16.4	NE	**1050.2**	1.4
1997	699.9	699.9	IE	267.9	NO	1.7	NE	15.8	NE	**985.4**	1.5
1998	681.1	681.1	IE	255.1	NO	1.7	NE	15.2	NE	**953.1**	1.6
1999	657.7	657.7	IE	232.8	NO	1.7	NE	15.0	NE	**907.2**	1.6
2000	618.9	618.9	IE	223.5	NO	1.7	NE	14.7	NE	**858.7**	1.7
2001	643.6	643.6	IE	199.9	NO	1.7	NE	14.5	NE	**859.7**	1.6

Trend table 5: NH_3 [Gg] 1980-2001

NFR-Sectors											
	1 ENERGY	1 A FUEL COMBUSTION ACTIVITIES	1 B FUGITIVE EMISSIONS FROM FUELS	2 INDUSTRIAL PROCESSES	3 SOLVENT AND OTHER PRODUCT USE	4 AGRICULTURE	5 LAND USE CHANGE AND FORESTRY	6 WASTE	7 OTHER	0 **NATIONAL TOTAL**	I B International Bunkers
1980	1.28	1.28	IE	0.21	NO	49.85	NE	0.01	NE	**51.35**	0.00
1981	1.20	1.20	IE	0.20	NO	50.72	NE	0.01	NE	**52.13**	0.00
1982	1.20	1.20	IE	0.19	NO	51.01	NE	0.01	NE	**52.41**	0.00
1983	1.18	1.18	IE	0.19	NO	52.02	NE	0.01	NE	**53.40**	0.00
1984	1.21	1.21	IE	0.19	NO	52.41	NE	0.01	NE	**53.83**	0.00
1985	1.27	1.27	IE	0.19	NO	52.10	NE	0.01	NE	**53.57**	0.00
1986	1.29	1.29	IE	0.18	NO	51.53	NE	0.01	NE	**53.00**	0.00
1987	1.29	1.29	IE	0.18	NO	52.47	NE	0.01	NE	**53.95**	0.00
1988	1.27	1.27	IE	0.19	NO	49.86	NE	0.01	NE	**51.33**	0.00
1989	1.30	1.30	IE	0.18	NO	50.95	NE	0.01	NE	**52.44**	0.00
1990	1.27	1.27	IE	0.18	NO	50.80	NE	0.01	NE	**52.27**	0.00
1991	1.41	1.41	IE	0.17	NO	51.82	NE	0.01	NE	**53.41**	0.00
1992	1.42	1.42	IE	0.16	NO	48.33	NE	0.01	NE	**49.92**	0.00
1993	1.53	1.53	IE	0.17	NO	54.74	NE	0.01	NE	**56.45**	0.00
1994	1.50	1.50	IE	0.13	NO	55.89	NE	0.01	NE	**57.53**	0.00
1995	1.54	1.54	IE	0.10	NO	55.24	NE	0.01	NE	**56.88**	0.00
1996	1.62	1.62	IE	0.09	NO	53.81	NE	0.01	NE	**55.54**	0.00
1997	1.57	1.57	IE	0.10	NO	55.18	NE	0.01	NE	**56.86**	0.00
1998	1.57	1.57	IE	0.10	NO	54.47	NE	0.01	NE	**56.14**	0.00
1999	1.52	1.52	IE	0.12	NO	53.30	NE	0.01	NE	**54.94**	0.00
2000	1.41	1.41	IE	0.10	NO	52.20	NE	0.01	NE	**53.72**	0.00
2001	1.50	1.50	IE	0.08	NO	52.14	NE	0.01	NE	**53.72**	0.00

Trend table 6: Cd [Mg] 1985-2001

NFR-Sectors											
	1 ENERGY	1 A FUEL COMBUSTION ACTIVITIES	1 B FUGITIVE EMISSIONS FROM FUELS	2 INDUSTRIAL PROCESSES	3 SOLVENT AND OTHER PRODUCT USE	4 AGRICULTURE	5 LAND USE CHANGE AND FORESTRY	6 WASTE	7 OTHER	0 **NATIONAL TOTAL**	I B International Bunkers
1985	3.65	3.65	IE	0.88	0.00	0.22	NE	0.14	NE	**4.89**	0.00
1986	3.29	3.29	IE	0.76	0.00	0.22	NE	0.12	NE	**4.38**	0.00
1987	2.74	2.74	IE	0.70	0.00	0.22	NE	0.11	NE	**3.76**	0.00
1988	2.29	2.29	IE	0.67	0.00	0.22	NE	0.08	NE	**3.25**	0.00
1989	2.10	2.10	IE	0.63	0.00	0.22	NE	0.06	NE	**3.01**	0.00
1990	2.01	2.01	IE	0.50	0.00	0.01	NE	0.06	NE	**2.59**	0.00
1991	2.00	2.00	IE	0.44	0.00	0.01	NE	0.05	NE	**2.50**	0.00
1992	1.83	1.83	IE	0.33	0.00	0.01	NE	0.01	NE	**2.18**	0.00
1993	1.90	1.90	IE	0.29	0.00	0.01	NE	0.01	NE	**2.21**	0.00
1994	1.62	1.62	IE	0.26	0.00	0.01	NE	0.00	NE	**1.90**	0.00
1995	1.44	1.44	IE	0.21	0.00	0.01	NE	0.00	NE	**1.67**	0.00
1996	1.50	1.50	IE	0.19	0.00	0.01	NE	0.00	NE	**1.71**	0.00
1997	1.52	1.52	IE	0.20	0.00	0.01	NE	0.00	NE	**1.73**	0.00
1998	1.50	1.50	IE	0.17	0.00	0.01	NE	0.00	NE	**1.68**	0.00
1999	1.37	1.37	IE	0.19	0.00	0.01	NE	0.00	NE	**1.58**	0.00
2000	1.21	1.21	IE	0.20	0.00	0.01	NE	0.00	NE	**1.43**	0.00
2001	1.32	1.32	IE	0.20	0.00	0.01	NE	0.00	NE	**1.53**	0.00

Trend table 7: Hg [Mg] 1985-2001

NFR-Sectors											
	1 ENERGY	1 A FUEL COMBUSTION ACTIVITIES	1 B FUGITIVE EMISSIONS FROM FUELS	2 INDUSTRIAL PROCESSES	3 SOLVENT AND OTHER PRODUCT USE	4 AGRICULTURE	5 LAND USE CHANGE AND FORESTRY	6 WASTE	7 OTHER	0 **NATIONAL TOTAL**	I B International Bunkers
1985	2.29	2.29	IE	1.93	NO	0.03	NE	0.09	NE	**4.33**	0.00
1986	2.02	2.02	IE	1.77	NO	0.03	NE	0.08	NE	**3.90**	0.00
1987	1.61	1.61	IE	1.61	NO	0.03	NE	0.07	NE	**3.33**	0.00
1988	1.26	1.26	IE	1.49	NO	0.03	NE	0.06	NE	**2.84**	0.00
1989	1.15	1.15	IE	1.35	NO	0.03	NE	0.06	NE	**2.59**	0.00
1990	1.25	1.25	IE	1.20	NO	0.00	NE	0.05	NE	**2.50**	0.00
1991	1.30	1.30	IE	1.04	NO	0.00	NE	0.05	NE	**2.39**	0.00
1992	1.16	1.16	IE	0.85	NO	0.00	NE	0.02	NE	**2.03**	0.00
1993	1.18	1.18	IE	0.68	NO	0.00	NE	0.02	NE	**1.89**	0.00
1994	1.08	1.08	IE	0.52	NO	0.00	NE	0.02	NE	**1.62**	0.00
1995	1.00	1.00	IE	0.54	NO	0.00	NE	0.02	NE	**1.57**	0.00
1996	1.00	1.00	IE	0.50	NO	0.00	NE	0.02	NE	**1.52**	0.00
1997	1.00	1.00	IE	0.52	NO	0.00	NE	0.02	NE	**1.55**	0.00
1998	0.95	0.95	IE	0.41	NO	0.00	NE	0.01	NE	**1.37**	0.00
1999	0.90	0.90	IE	0.35	NO	0.00	NE	0.01	NE	**1.27**	0.00
2000	0.82	0.82	IE	0.32	NO	0.00	NE	0.01	NE	**1.15**	0.00
2001	0.83	0.83	IE	0.32	NO	0.00	NE	0.01	NE	**1.16**	0.00

Trend table 8: Pb [Mg] 1985-2001

NFR-Sectors											
	1 ENERGY	1 A FUEL COMBUSTION ACTIVITIES	1 B FUGITIVE EMISSIONS FROM FUELS	2 INDUSTRIAL PROCESSES	3 SOLVENT AND OTHER PRODUCT USE	4 AGRICULTURE	5 LAND USE CHANGE AND FORESTRY	6 WASTE	7 OTHER	0 **NATIONAL TOTAL**	I B International Bunkers
1985	259.91	259.91	IE	63.99	0.02	1.12	NE	5.85	NE	**330.89**	0.00
1986	256.61	256.61	IE	53.79	0.02	1.12	NE	5.27	NE	**316.82**	0.00
1987	250.68	250.68	IE	49.13	0.02	1.12	NE	4.69	NE	**305.65**	0.00
1988	225.46	225.46	IE	46.30	0.02	1.12	NE	2.59	NE	**275.50**	0.00
1989	196.70	196.70	IE	42.76	0.02	1.12	NE	1.64	NE	**242.24**	0.00
1990	171.88	171.88	IE	32.63	0.02	0.06	NE	1.02	NE	**205.62**	0.00
1991	142.04	142.04	IE	27.56	0.02	0.06	NE	0.78	NE	**170.47**	0.00
1992	99.04	99.04	IE	19.00	0.02	0.06	NE	0.49	NE	**118.61**	0.00
1993	70.42	70.42	IE	15.45	0.02	0.06	NE	0.38	NE	**86.34**	0.00
1994	48.25	48.25	IE	12.24	0.02	0.06	NE	0.27	NE	**60.83**	0.00
1995	13.69	13.69	IE	4.77	0.02	0.06	NE	0.01	NE	**18.56**	0.00
1996	13.63	13.63	IE	4.40	0.02	0.06	NE	0.01	NE	**18.12**	0.00
1997	12.20	12.20	IE	4.90	0.02	0.06	NE	0.01	NE	**17.20**	0.00
1998	10.76	10.76	IE	4.76	0.02	0.06	NE	0.01	NE	**15.62**	0.00
1999	9.65	9.65	IE	5.01	0.02	0.06	NE	0.01	NE	**14.76**	0.00
2000	8.21	8.21	IE	5.54	0.02	0.06	NE	0.01	NE	**13.85**	0.00
2001	8.70	8.70	IE	5.51	0.02	0.06	NE	0.01	NE	**14.30**	0.00

Trend table 9: PAH [Mg] 1985-2001

NFR-Sectors											
	1 ENERGY	1 A FUEL COMBUSTION ACTIVITIES	1 B FUGITIVE EMISSIONS FROM FUELS	2 INDUSTRIAL PROCESSES	3 SOLVENT AND OTHER PRODUCT USE	4 AGRICULTURE	5 LAND USE CHANGE AND FORESTRY	6 WASTE	7 OTHER	0 **NATIONAL TOTAL**	I B International Bunkers
1985	11.85	11.85	IE	7.88	0.15	8.47	NE	0.00	NE	**28.35**	0.00
1986	11.21	11.21	IE	7.82	0.15	8.46	NE	0.00	NE	**27.64**	0.00
1987	11.03	11.03	IE	7.91	0.15	8.46	NE	0.00	NE	**27.56**	0.00
1988	10.06	10.06	IE	7.46	0.15	8.46	NE	0.00	NE	**26.14**	0.00
1989	9.52	9.52	IE	7.57	0.15	8.46	NE	0.00	NE	**25.70**	0.00
1990	9.44	9.44	IE	7.44	0.15	0.49	NE	0.00	NE	**17.51**	0.00
1991	10.32	10.32	IE	7.18	0.15	0.49	NE	0.00	NE	**18.13**	0.00
1992	9.38	9.38	IE	3.59	0.11	0.49	NE	0.00	NE	**13.56**	0.00
1993	9.31	9.31	IE	0.52	0.07	0.48	NE	0.00	NE	**10.39**	0.00
1994	8.38	8.38	IE	0.59	0.06	0.48	NE	0.00	NE	**9.51**	0.00
1995	8.82	8.82	IE	0.49	0.04	0.48	NE	0.00	NE	**9.83**	0.00
1996	9.51	9.51	IE	0.90	0.02	0.48	NE	0.00	NE	**10.90**	0.00
1997	8.55	8.55	IE	0.47	0.01	0.48	NE	0.00	NE	**9.50**	0.00
1998	8.19	8.19	IE	0.41	0.00	0.48	NE	0.00	NE	**9.08**	0.00
1999	8.01	8.01	IE	0.25	0.00	0.48	NE	0.00	NE	**8.74**	0.00
2000	7.49	7.49	IE	0.19	0.00	0.48	NE	0.00	NE	**8.16**	0.00
2001	8.22	8.22	IE	0.19	0.00	0.48	NE	0.00	NE	**8.89**	0.00

Trend table 10: DIOXIN [g] 1985-2001

NFR-Sectors											
	1 ENERGY	1 A FUEL COMBUSTION ACTIVITIES	1 B FUGITIVE EMISSIONS FROM FUELS	2 INDUSTRIAL PROCESSES	3 SOLVENT AND OTHER PRODUCT USE	4 AGRICULTURE	5 LAND USE CHANGE AND FORESTRY	6 WASTE	7 OTHER	0 **NATIONAL TOTAL**	I B International Bunkers
1985	108.87	108.87	IE	51.66	5.19	6.05	NE	15.90	NE	**187.67**	0.00
1986	107.25	107.25	IE	51.39	6.20	6.05	NE	15.89	NE	**186.78**	0.00
1987	115.27	115.27	IE	51.18	0.24	6.05	NE	15.89	NE	**188.62**	0.00
1988	110.82	110.82	IE	41.97	1.06	6.05	NE	15.48	NE	**175.38**	0.00
1989	102.05	102.05	IE	41.51	1.06	6.05	NE	15.29	NE	**165.96**	0.00
1990	101.29	101.29	IE	39.13	1.06	0.35	NE	18.19	NE	**160.02**	0.00
1991	80.00	80.00	IE	35.27	1.04	0.35	NE	17.75	NE	**134.42**	0.00
1992	52.37	52.37	IE	22.01	0.02	0.35	NE	0.53	NE	**75.28**	0.00
1993	49.00	49.00	IE	17.14	0.02	0.35	NE	0.22	NE	**66.73**	0.00
1994	44.06	44.06	IE	11.39	0.00	0.35	NE	0.08	NE	**55.89**	0.00
1995	45.40	45.40	IE	12.32	0.00	0.35	NE	0.08	NE	**58.16**	0.00
1996	47.56	47.56	IE	11.27	0.00	0.35	NE	0.08	NE	**59.26**	0.00
1997	46.59	46.59	IE	12.25	0.00	0.35	NE	0.08	NE	**59.27**	0.00
1998	43.31	43.31	IE	11.53	0.00	0.35	NE	0.08	NE	**55.27**	0.00
1999	38.25	38.25	IE	12.70	0.00	0.35	NE	0.08	NE	**51.38**	0.00
2000	35.02	35.02	IE	14.14	0.00	0.35	NE	0.08	NE	**49.59**	0.00
2001	37.79	37.79	IE	14.04	0.00	0.35	NE	0.08	NE	**52.25**	0.00

Trend table 11: HCB [kg] 1985-2001

NFR-Sectors											
	1 ENERGY	1 A FUEL COMBUSTION ACTIVITIES	1 B FUGITIVE EMISSIONS FROM FUELS	2 INDUSTRIAL PROCESSES	3 SOLVENT AND OTHER PRODUCT USE	4 AGRICULTURE	5 LAND USE CHANGE AND FORESTRY	6 WASTE	7 OTHER	0 **NATIONAL TOTAL**	I B International Bunkers
1985	82.61	82.61	IE	13.34	7.70	1.21	NE	1.11	NE	**105.97**	0.00
1986	79.78	79.78	IE	13.28	8.11	1.21	NE	1.11	NE	**103.50**	0.00
1987	82.51	82.51	IE	13.25	8.11	1.21	NE	1.11	NE	**106.19**	0.00
1988	77.67	77.67	IE	11.23	8.21	1.21	NE	0.70	NE	**99.03**	0.00
1989	72.98	72.98	IE	11.13	9.34	1.21	NE	0.52	NE	**95.18**	0.00
1990	72.51	72.51	IE	9.73	9.05	0.07	NE	0.39	NE	**91.76**	0.00
1991	69.21	69.21	IE	8.05	6.39	0.07	NE	0.28	NE	**84.00**	0.00
1992	55.54	55.54	IE	4.96	7.49	0.07	NE	0.11	NE	**68.17**	0.00
1993	53.46	53.46	IE	3.72	6.47	0.07	NE	0.04	NE	**63.76**	0.00
1994	47.69	47.69	IE	2.47	1.25	0.07	NE	0.02	NE	**51.50**	0.00
1995	50.03	50.03	IE	2.68	0.00	0.07	NE	0.02	NE	**52.81**	0.00
1996	52.92	52.92	IE	2.46	0.00	0.07	NE	0.02	NE	**55.46**	0.00
1997	48.89	48.89	IE	2.67	0.00	0.07	NE	0.02	NE	**51.65**	0.00
1998	45.97	45.97	IE	2.51	0.00	0.07	NE	0.02	NE	**48.56**	0.00
1999	42.98	42.98	IE	2.77	0.00	0.07	NE	0.02	NE	**45.84**	0.00
2000	39.15	39.15	IE	3.09	0.00	0.07	NE	0.02	NE	**42.32**	0.00
2001	43.21	43.21	IE	3.06	0.00	0.07	NE	0.02	NE	**46.36**	0.00

Trend table 12: TSP [Mg] 1990-2001

	NFR sectors	1990	1995	1999	2000	2001
1	ENERGY	32 541	33 867	34 523	34 994	36 233
1 A	FUEL COMBUSTION ACTIVITIES	32 541	33 867	34 523	34 994	36 233
1 B	FUGITIVE EMISSIONS FROM FUELS	IE	IE	IE	IE	IE
2	INDUSTRIAL PROCESSES	24 273	25 431	28 673	27 391	27 367
3	SOLVENT AND OTHER PRODUCT USE	NO	NO	NO	NO	NO
4	AGRICULTURE	16 983	16 775	16 759	15 871	15 878
5	LAND USE CHANGE AND FORESTRY	NE	NE	NE	NE	NE
6	WASTE	166	184	205	205	205
7	OTHER	NE	NE	NE	NE	NE
	NATIONAL TOTAL	**73 962**	**76 257**	**80 160**	**78 461**	**79 682**
	International Bunkers	307	456	531	577	556

Trend table 13: PM 10 [Mg] 1990-2001

	NFR sectors	1990	1995	1999	2000	2001
1	ENERGY	25 290	26 025	26 003	26 083	26 661
1 A	FUEL COMBUSTION ACTIVITIES	25 290	26 025	26 003	26 083	26 661
1 B	FUGITIVE EMISSIONS FROM FUELS	IE	IE	IE	IE	IE
2	INDUSTRIAL PROCESSES	13 509	13 192	14 700	14 095	14 077
3	SOLVENT AND OTHER PRODUCT USE	NO	NO	NO	NO	NO
4	AGRICULTURE	7 655	7 555	7 553	7 142	7 148
5	LAND USE CHANGE AND FORESTRY	NE	NE	NE	NE	NE
6	WASTE	79	87	97	97	97
7	OTHER	NE	NE	NE	NE	NE
	NATIONAL TOTAL	**46 532**	**46 860**	**48 353**	**47 416**	**47 983**

	NFR sectors	1990	1995	1999	2000	2001
	International Bunkers	307	456	531	577	556

Trend table 14: PM 2,5 [Mg] 1990-2001

	NFR sectors	1990	1995	1999	2000	2001
1	ENERGY	21 321	21 920	21 700	21 636	21 985
1 A	FUEL COMBUSTION ACTIVITIES	21 321	21 920	21 700	21 636	21 985
1 B	FUGITIVE EMISSIONS FROM FUELS	IE	IE	IE	IE	IE
2	INDUSTRIAL PROCESSES	5 333	4 699	5 155	4 964	4 956
3	SOLVENT AND OTHER PRODUCT USE	NO	NO	NO	NO	NO
4	AGRICULTURE	898	868	870	804	808
5	LAND USE CHANGE AND FORESTRY	NE	NE	NE	NE	NE
6	WASTE	25	27	30	30	30
7	OTHER	NE	NE	NE	NE	NE
	NATIONAL TOTAL	**27 577**	**27 514**	**27 754**	**27 435**	**27 779**
	International Bunkers	307	456	531	577	556

ANNEX 3: EXTRACTS FROM AUSTRIAN LEGISLATION

This annex presents extracts from Austrian legislation, which regulate monitoring, reporting and verification of emissions at plant level.

Cement production:

BGBl 1993/ 63 Verordnung für Anlagen zur Zementerzeugung

§ 5. Der Betriebsanlageninhaber hat

1. kontinuierliche Messungen der Emissionskonzentrationen an Gesamtstaub, SO_2 und Stickstoffoxiden (berechnet als NO_2) der Ofenanlage entsprechend der Z 1 der Anlage zu dieser Verordnung durchzuführen ...

Zur Durchführung der Messungen gemäß Z 2 und 3 sind Anstalten des Bundes oder eines Bundeslandes, staatlich autorisierte Anstalten, Ziviltechniker oder Gewerbebetreibende, jeweils im Rahmen ihrer Befugnisse, heranzuziehen.

§ 6 Die Ergebnisse der Messungen gemäß § 5 sind in einem Messbericht festzuhalten, welcher

1. bei Messungen gemäß § 5 Z 1 die Messwerte in Form von Aufzeichnungen eines kontinuierlich registrierenden Messgerätes und die gemäß § 4 Abs. 1 zu führenden Aufzeichnungen über Grenzwertüberschreitungen,

zu enthalten hat. Der Messbericht ist mindestens fünf Jahre in der Betriebsanlage derart aufzubewahren, dass er den behördlichen Organen jederzeit zur Einsicht vorgewiesen werden kann.

Anlage

(§ 5)

Emissionsmessungen

1. Kontinuierliche Messungen

a) Die Datenaufzeichnung hat durch automatisch registrierende Messgeräte in Form von Halbstundenmittelwerten unter Angabe von Datum, Uhrzeit und Messstelle zu erfolgen. Die Verfügbarkeit der Daten hat mindestens 90 % zu betragen. Als Bezugszeitraum gilt ein Monat.

b) Registrierende Emissionsmessgeräte sind im Abnahmeversuch und alle drei Jahre durch einen Sachverständigen aus dem im § 5 letzter Satz angeführten Personenkreis zu kalibrieren.

c) Jährlich ist eine Funktionskontrolle an registrierenden Emissionsmessgeräten durch Sachverständige aus dem im § 5 letzter Satz angeführten Personenkreis vorzunehmen.

Foundries:

BGBl 1994/ 447 Verordnung für Gießereien

§ 5 (1) Der Betriebsanlageninhaber hat Einzelmessungen der Emissionskonzentration der im § 3 Abs. 1 angeführten Stoffe entsprechend der Z 1 lit. A bis c der Anlage 2 dieser Verord-

nung in regelmäßigen, drei Jahre nicht übersteigenden Zeitabständen durchführen zu lassen (wiederkehrende Emissionsmessungen).

(2) Der Betriebsanlageninhaber hat kontinuierliche Messungen der Emissionskonzentrationen ... entsprechend der Z2 der Anlage 2 zu dieser Verordnung durchzuführen.

(3) Zur Durchführung der Messungen gemäß Abs. 1 sowie zur Funktionskontrolle und Kalibrierung von Messgeräten für Messungen gemäß Abs. 2 sind Anstalten des Bundes oder eines Bundeslandes, staatlich autorisierte Anstalten, Ziviltechniker oder Gewerbebetreibende, jeweils im Rahmen ihrer Befugnisse, oder akkreditierte Stellen im Rahmen des fachlichen Umfangs ihrer Akkreditierung (§ 11 Abs. 2 des Akkreditierungsgesetzes, BGBI Nr 468/ 1992) heranzuziehen.

§ 6 Die Ergebnisse der Messungen gemäß § 5 sind in einem Messbericht festzuhalten, welcher

1. bei Messungen gemäß § 5 Abs. 1 die Messwerte und die Betriebsbedingungen während der Messungen (Betriebszustand, Verbrauch an Brennstoff, Rohmaterial und Zuschlagstoffen),

2. bei Messungen gemäß § 5 Abs. 2 die Messwerte in Form von Aufzeichnungen eines kontinuierlich registrierenden Messgerätes und die gemäß § 4 Abs. 2 zu führenden Aufzeichnungen über Grenzwertüberschreitungen, zu enthalten hat. Der Messbericht ist mindestens drei Jahre, bei Messungen gemäß § 5 Abs. 1 jedenfalls bis zur jeweils nächsten Messung, in der Betriebsanlage derart aufzubewahren, dass er den behördlichen Organen jederzeit zur Einsicht vorgewiesen werden kann.

Anlage 2

(§ 5)

Emissionsmessungen

1. Einzelmessungen

a) Einzelmessungen sind für alle im § 3 Abs. 1 angeführten Stoffe bei jenem Betriebzustand durchzuführen, in dem nachweislich die Anlagen vorwiegende betrieben werden. Die Durchführung der Messungen hat nach den Regeln der Technik zu erfolgen.

c) Die Abgasmessungen sind an einer repräsentativen Entnahmestelle im Kanalquerschnitt, die vor Aufnahme der Messungen zu bestimmen ist, vorzunehmen. Es sind innerhalb eines Zeitraumes von drei Stunden drei Messwerte als Halbstundenmittelwerte zu bilden, deren einzelne Ergebnisse zu beurteilen sind.

2. Kontinuierliche Messungen

a) Die Datenaufzeichnung hat durch automatisch registrierende Messgeräte in Form von Halbstundenmittelwerte unter Angabe von Datum, Uhrzeit und Messstelle zu erfolgen. Die Verfügbarkeit der Daten hat mindestens 90 % zu betragen. Als Bezugszeitraum gilt ein Monat.

b) Registrierende Emissionsmessgeräte sind im Abnahmeversuch und alle drei Jahre durch einen Sachverständigen aus dem im § 5 Abs. 3 angeführten Personenkreis zu kalibrieren.

c) Jährlich ist eine Funktionskontrolle an registrierenden Emissionsmessgeräten durch Sachverständige aus dem im § 5 Abs. 3 angeführten Personenkreis vorzunehmen.

Glass production:

BGBl 1994/ 498 Verordnung für Anlagen zur Glaserzeugung

§ 5 (2) Zur Kontrolle der Einhaltung der im § 3 festgelegten Emissionsgrenzwerte sind unter Beachtung des § 4 jeweils mindestens drei Messwerte als Halbstundenmittelwerte zu bestimmen.

(4) Die Durchführung der Emissionsmessungen hat nach den Regeln der Technik (z.B. nach den vom Verein deutscher Ingenieure herausgegebenen und beim Österreichischen Normungsinstitut, Heinestraße 38, 1021 Wien, erhältlichen Richtlinien VDI 2268, Blätter 1, 2 und 4, VDI 2462, Blätter 1 bis 5 und 8, und VDI 2456, Blätter 1, 2, 8 und 10) zu erfolgen.

§ 7 (1) Der Betriebsanlageninhaber hat in regelmäßigen, ein Jahr, bei Schmelzeinrichtungen gemäß § 3 Z 5 lit. D drei Jahre, nicht übersteigenden Zeitabständen Messungen zur Kontrolle der Einhaltung der im § 3 festgelegten Emissionsgrenzwerte entsprechend den §§ 4 bis 6 durchführen zu lassen.

(2) Zur Durchführung der Messungen sind Anstalten des Bundes oder eines Bundeslandes, staatlich autorisierte Anstalten, Ziviltechniker oder Gewerbebetreibende, jeweils im Rahmen ihrer Befugnisse, oder akkreditierte Stellen im Rahmen des fachlichen Umfangs ihrer Akkreditierung (§ 11 Abs. 2 des Akkreditierungsgesetzes, BGBl Nr 468/ 1992) heranzuziehen.

(3) Die Messwerte für die im § 3 angeführten Stoffe sowie der während der Messung herrschenden Betriebszustände sind zusammen mit den Kriterien, nach denen der Zeitraum für die Messung, der stärksten Emission festgelegt worden ist, in einem Messbericht festzuhalten. Im Messbericht sind auch die verwendeten Messverfahren zu beschreiben. Der Messbericht und sonstige zum Nachweis der Einhaltung der im § 3 festgelegten Emissionsgrenzwerte dienende Unterlagen sind bis zur nächsten Messung in der Betriebsanlage derart aufzubewahren, dass sie den behördlichen Organen jederzeit zur Einsicht vorgewiesen werden können.

Iron and steel production:

BGBl II 1997/ 160 Verordnung für Anlagen zur Erzeugung von Eisen und Stahl

§ 6 (1) Der Betriebsanlageninhaber hat, soweit die Absätze 3 und 4 nicht anderes bestimmen, Einzelmessungen der Emissionskonzentrationen der im § 3 Abs. 1 und im § 4 (mit Ausnahme des § 4 Abs. 3 lit. c) angeführten Stoffe entsprechend der Z 1 lit. a bis c der Anlage zu dieser Verordnung in regelmäßigen, drei Jahre nicht übersteigenden Zeitabständen, durchführen zu lassen (wiederkehrende Emissionsmessungen).

(3) Der Betriebsinhaber hat, soweit Abs. 4 oder 5 nicht anderes bestimmt. Entweder kontinuierliche Messungen der Emissionskonzentrationen ... entsprechend der Z 2 der Anlage zu dieser Verordnung durchzuführen oder kontinuierliche Funktionsprüfungen der rauchgas- und bzw. oder Abluftfilteranlagen von Einrichtungen gemäß § 4 durchzuführen, wenn sich durch diese Prüfungen mit hinreichender Sicherheit die Einhaltung der vorgeschriebenen Emissionsgrenzwerte für Staub festgestellt werden kann.

§ 6 (6) Zur Durchführung der Messungen gemäß Abs. 1 und 2 sowie zur Funktionskontrolle und Kalibrierung von Messgeräten für Messungen gemäß Abs. 3 sind akkreditierte Stellen im Rahmen des fachlichen Umfangs ihrer Akkreditierung (§ 11 Abs. 2 des Akkreditierungsgesetzes, BGBl Nr 468/ 1992), Anstalten des Bundes oder eines Bundeslandes, staatlich autorisierte Anstalten, Ziviltechniker oder Gewerbebetreibende, jeweils im Rahmen ihrer Befugnisse, heranzuziehen.

§ 7 Die Ergebnisse der Messungen gemäß § 6 sind in einem Messbericht festzuhalten, der zu enthalten hat:

1. bei Messungen gemäß § 6 Abs. 1 und 2 die Messwerte und die Betriebsbedingungen während der Messungen (Betriebszustand, Verbrauch Brennstoff, Rohmaterial und Zuschlagstoffen),

2. bei Messungen gemäß § 6 Abs. 3 und 4 die Messwerte in Form von Aufzeichnungen eines kontinuierlich registrierenden Messgerätes,

3. bei Funktionsprüfungen gemäß § 6 Abs. 3 die gemessenen Parameter in Form von Aufzeichnungen eines kontinuierlich registrierenden Messgerätes.

Der Messbericht ist mindestens drei Jahre, bei Messungen gemäß § 6 Abs. 1 und 2 jedenfalls bis zur jeweils nächsten Messung, in der Betriebsanlage derart aufzubewahren, dass er den behördlichen Organen zur Einsicht vorgewiesen werden kann.

Anlage

(§ 6)

Emissionsmessungen

1. Einzelmessungen

a) Einzelmessungen sind für alle im § 3 Abs. 1 und 3 und im § 4 angeführten Stoffe bei jenem Betriebszustand durchzuführen, in dem nachweislich die Anlagen vorwiegend betrieben werden. Die Durchführung der Messungen hat nach den Regeln der Technik zu erfolgen.

2. Kontinuierliche Messungen

a) Die Datenaufzeichnung hat durch ein automatisch registrierendes Messgerät in Form von Halbstundenmittelwerten unter Angabe von Datum, Uhrzeit und Messstelle zu erfolgen. Die Verfügbarkeit der Daten hat mindestens 90% zu betragen. Als Bezugszeitraum gilt ein Monat.

b) Das registrierende Messgerät ist im Abnahmeversuch und alle drei Jahre durch einen Sachverständigen aus dem im § 6 Abs. 5 angeführten Personenkreis zu kalibrieren.

c) Jährlich ist eine Funktionskontrolle des registrierenden Messgerätes durch einen Sachverständigen aus dem im § 6 Abs. 5 angeführten Personenkreis vorzunehmen.

Sinter plants:

BGBl II 1997/ 163 Verordnung für Anlagen zum Sintern von Eisenerzen

§ 5 (1) Der Betriebanlageninhaber hat Einzelmessungen der Emissionskonzentration der im § 3 Abs. 1 Z 2 lit. a und b und Z 3 angeführten Stoffe entsprechend der Z 1 in der Anlage zu dieser Verordnung in regelmäßigen, drei Jahre nicht übersteigenden Zeitabständen, durchzuführen zu lassen (wiederkehrende Emissionsmessungen).

(2) Der Betriebanlageninhaber hat kontinuierliche Messungen der Emissionskonzentrationen von Staub, Stickstoffoxiden und Schwefeldioxid entsprechend der Z 2 der Anlage dieser Verordnung durchzuführen.

(3) Zur Durchführung der Messungen gemäß Abs. 1 sowie zur Funktionskontrolle und Kalibrierung von Messgeräten für Messungen gemäß Abs. 2 sind akkreditierte Stellen im Rahmen des fachlichen Umfangs ihrer Akkreditierung (§ 11 Abs. 2 des Akkreditierungsgesetzes, BGBl Nr 468/ 1992), Anstalten des Bundes oder eines Bundeslandes, staatlich autorisierte Anstalten, Ziviltechniker oder Gewerbebetreibende, jeweils im Rahmen ihrer Befugnisse, heranzuziehen.

§ 6 Die Ergebnisse der Messungen gemäß § 5 sind in einem Messbericht festzuhalten, der zu enthalten hat:

1. bei Messungen gemäß § 5 Abs. 1 die Messwerte und die Betriebsbedingungen während der Messungen (Betriebszustand, Verbrauch an Brennstoff und Einsatzmaterial),

2. bei Messungen gemäß § 5 Abs. 2 die Messwerte in Form von Aufzeichnungen eines kontinuierlich registrierenden Messgerätes.

Der Messbericht ist mindestens drei Jahre, bei Messungen gemäß § 5 Abs. 1 jedenfalls bis zur jeweils nächsten Messung, in der Betriebsanlage derart aufzubewahren, dass er den behördlichen Organen jederzeit zur Einsicht vorgewiesen werden kann.

Anlage

(§ 5)

Emissionsmessungen

1. Einzelmessungen

a) Einzelmessungen sind für die im § 3 Abs. 1 Z 2 lit. a und b und Z 3 angeführten Stoffe bei jenem Betriebszustand durchzuführen, in dem nachweislich die Anlagen vorwiegend betrieben werden. Die Durchführung der Messungen hat nach den Regeln der Technik zu erfolgen.

2. Kontinuierliche Messungen

a) Die Datenaufzeichnung hat durch ein automatisch registrierendes Messgerät in Form von Halbstundenmittelwerten unter Angabe von Datum, Uhrzeit und Messstelle zu erfolgen. Die Verfügbarkeit der Daten hat mindestens 90 % zu betragen. Als Bezugszeitraum gilt ein Monat.

b) Das registrierende Messgerät ist im Abnahmeversuch und alle drei Jahre durch einen Sachverständigen aus dem im § 5 Abs. 3 angeführten Personenkreis zu kalibrieren. Die Kalibrierung hat nach den Regeln der Technik zu erfolgen.

c) Jährlich ist eine Funktionskontrolle des registrierenden Messgerätes durch einen Sachverständigen aus dem im § 5 Abs. 3 angeführten Personenkreis vorzunehmen.

Combustion plants:

BGBl II 1997/ 331 Feuerungsanlagen-Verordnung

Emissionsmessungen

§ 4 (1) Der Betriebsanlageninhaber hat Emissionsmessungen sowie die Bestimmung des Abgasverlustes entsprechend der Anlage 1 zu dieser Verordnung durchzuführen bzw. durchführen zu lassen.

(2) Zur Durchführung der Emissionseinzelmessungen sowie zur Bestimmung des Abgasverlustes ist ein Sachverständiger aus dem im § 2 Abs. 2 zweiter Satz genannten Personenkreis heranzuziehen.

§ 5 (1) Der Betriebsanlageninhaber hat, sofern in dieser Verordnung nicht anderes bestimmt ist,

1. kontinuierliche Messungen der Emissionskonzentrationen, abhängig von der jeweiligen Brennstoffwärmeleistung und dem eingesetzten Brennstoff, entsprechende der folgenden Tabelle durchzuführen

Brennstoff	Staub	CO	SO_2	NO_x	
fest	> 10	> 10	> 30	> 30	MW
flüssig	> 10	> 10	> 50	> 30	MW
gasförmig	-	> 10	-	> 30	MW

Prüfungen

Erstmalige Prüfung

§ 23 (1) Feuerungsanlagen sind anlässlich ihrer Inbetriebnahme einer erstmaligen Prüfung zu unterziehen.

(2) Die erstmalige Prüfung hat in der Erbringung des Nachweises zu bestehen, dass die Feuerungsanlage den Anforderungen dieser Verordnung entspricht.

Wiederkehrende Prüfungen

§ 25 (1) Feuerungsanlagen sind jährlich zu prüfen. Bei dieser jährlichen Prüfung sind die Feuerungsanlagen hinsichtlich jener Anlagenteile, die für die Emissionen oder deren Begrenzung von Bedeutung sind, zu besichtigen und auf etwaige Mängel zu kontrollieren... Weiters sind jährlich die Ergebnisse der gemäß § 5 durchgeführten kontinuierlichen Messungen zu beurteilen.

Prüfbescheinigung

§ 27 Das Ergebnis jeder Prüfung muss in einer Prüfbescheinigung festgehalten sein, die insbesondere festgestellte Mängel sowie Vorschläge zu deren Behebung zu enthalten hat. Die Prüfbescheinigung ist im Original in der Betriebsanlage zumindest fünf Jahre so aufzubewahren, dass sie den behördlichen Organen jederzeit zur Einsicht vorgewiesen werden kann.

Anlage 1

(§§ 4 und 25)

Emissionsmessungen

1. Die Messungen sind

1.3 für gasförmige Emissionen nach den Regeln der Technik, oder nach einem diesen Verfahren gleichwertigen Verfahren durchzuführen.

2. Die Messstellen sind so festzulegen, dass eine repräsentative und messtechnisch einwandfreie Emissionsmessung gewährleistet ist.

3. Einzelmessungen

3.2 Die Einzelmessungen sind an einer repräsentativen Entnahmestelle im Kanalquerschnitt vorzunehmen. Es sind innerhalb eines Zeitraumes von drei Stunden drei messwerte als Halbstundenmittelwerte zu bilden.

4. Kontinuierliche Messungen

4.1 Die Datenaufzeichnung hat durch automatisch registrierende Messgeräte in Form von Halbstundenmittelwerten unter Angabe von Datum, Uhrzeit und Messstelle zu erfolgen. Die

Verfügbarkeit der Daten hat mindestens 90 % zu betragen. Als Bezugszeitraum gilt ein Monat. Die Messergebnisse müssen mit dem einzuhaltenden Grenzwert vergleichbar sein.

4.2 Registrierende Emissionsmessgeräte sind im Abnahmeversuch und mindestens alle drei Jahre durch einen Sachverständigen aus dem im § 2 Abs. 2 zweiter Satz angeführten Personenkreis zu kalibrieren. Die Kalibrierung hat nach den Regeln der Technik (z.B. nach den vom Verein Deutscher Ingenieure herausgegebenen und beim Österreichischen Normungsinstitut, Heinestraße 38, 1021 Wien, erhältlichen Richtlinien VDI 2066, Blatt 4 und Blatt 6, und VDI 3950, Blatt 1E) zu erfolgen.

4.3 Jährlich ist eine Funktionskontrolle an registrierenden Emissionsmessgeräten durch Sachverständige aus dem im § 2 Abs. 2 zweiter Satz angeführten Personenkreis vorzunehmen.

Non-ferrous metal production:

BGBl II 1998/ 1 Verordnung zur Erzeugung von Nichteisenmetallen

§ 6 (1) Der Betriebsanlageninhaber hat Einzelmessungen der Emissionskonzentration der im § 3 Abs. 1 und im § 4 angeführten Stoffe entsprechend der Z 1 lit. a bis c der Anlage zu dieser Verordnung in regelmäßigen, drei Jahre nicht übersteigenden Zeitabständen durchführen zu lassen (wiederkehrende Emissionsmessungen).

(2) Der Betriebsanlageninhaber hat kontinuierliche Messungen ... entsprechend der Z 2 der Anlage zu dieser Verordnung reingasseitig (im Kamin) durchzuführen.

(3) Zur Durchführung der Messungen gemäß Abs. 1 sowie zur Funktionskontrolle und Kalibrierung von Messgeräten für Messungen gemäß Abs. 2 sind akkreditierte Stellen im Rahmen des fachlichen Umfangs ihrer Akkreditierung (§ 11 Abs. 2 des Akkreditierungsgesetzes, BGBl Nr 468/ 1992), Anstalten des Bundes oder eines Bundeslandes, staatlich autorisierte Anstalten, Ziviltechniker oder Gewerbebetreibende, jeweils im Rahmen ihrer Befugnisse, heranzuziehen.

§ 7 Die Ergebnisse der Messungen gemäß § 6 sind in einem Messbericht festzuhalten, der zu enthalten hat:

1. bei Messungen gemäß § 6 Abs. 1 die Messwerte und die Betriebsbedingungen während der Messungen (Betriebszustand, Verbrauch an Brennstoff, Rohmaterial und Zuschlagstoffen),

2. bei Messungen gemäß § 6 Abs. 2 die Messwerte in Form von Aufzeichnungen eines kontinuierlich registrierenden Messgerätes und die gemäß § 5 Abs. 2 zu führenden Aufzeichnungen über Grenzwertüberschreitungen.

Der Messbericht ist mindestens drei Jahre, bei Messungen gemäß § 6 Abs. 1 jedenfalls bis zur jeweils nächsten Messung, in der Betriebsanlage derart aufzubewahren, dass er den behördlichen Organen jederzeit zur Einsicht vorgewiesen werden kann.

Anlage

(§ 6)

Emissionsmessungen

1. Einzelmessungen

a) Einzelmessungen sind für alle im § 3 Abs. 1 und 4 angeführten Stoffe bei jenem Betriebszustand durchzuführen, in dem nachweislich die Anlagen vorwiegend betrieben werden. Die Durchführung der Messungen hat nach den Regeln der Technik zu erfolgen.

2. Kontinuierliche Messungen

a) Die Datenaufzeichnung hat durch ein automatisch registrierendes Messgerät in Form von Halbstundenmittelwerten unter Angabe von Datum, Uhrzeit und Messstelle zu erfolgen. Die Verfügbarkeit der Daten hat mindestens 90 % zu betragen. Als Bezugszeitraum gilt ein Monat.

b) Das registrierende Messgerät ist im Abnahmeversuch und alle drei Jahre durch einen Sachverständigen aus dem im § 6 Abs. 3 angeführten Personenkreis zu kalibrieren.

c) Die Wartung des registrierende Messgerätes ist durch einen Sachverständigen aus dem im § 6 Abs. 3 angeführten Personenkreis mindestens einmal jährlich vornehmen zu lassen.

Steam boilers:

BGBl 1988/ 380 idF (BGBl 1993/ 185, BGBl I 1997/ 115, BGBl I 1998/ 158) Luftreinhaltegesetz für Kesselanlagen

Überwachung

§ 7 (1) Die in Betrieb befindlichen Dampfkesselanlagen ... sind einmal jährlich durch einen befugten Sachverständigen auf die Einhaltung der Bestimmungen dieses Bundesgesetzes zu überprüfen. Die Überprüfung umfasst die Besichtigung der Anlage und deren Komponenten, soweit sie für die Emissionen oder deren Begrenzung von Bedeutung sind, verbunden mit der Kontrolle vorhandener Messergebnisse oder Messregistrierungen.

§ 8 (1) Die Behörde hat im Genehmigungsbescheid festzulegen, ob und in welchem Umfange Abnahmemessungen sowie wiederkehrende Emissionsmessungen an der Dampfkesselanlage durchzuführen sind. Emissionsmessungen sind ferner durchzuführen, wenn der befugte Sachverständige anlässlich einer Überprüfung gemäß § 7 Grund zur Annahme hat, dass die einzuhaltenden Emissionsgrenzwerte im Betrieb überschritten werden.

Pflichten des Betreibers

§ 10 (3) Der Betreiber hat der Behörde oder dem hierzu beauftragten Sachverständigen während der Betriebszeit den Zutritt zu der Anlage zu gestatten und Einsicht in alle die Emissionen der Dampfkesselanlage betreffenden Aufzeichnungen zu gewähren, die in einem Dampfkesselanlagenbuch zusammenzufassen sind.

BGBl 1989/ 19 idF (BGBl 1990/ 134, BGBl 1994/ 785, BGBl II 1997/ 324) Luftreinhalteverordnung für Kesselanlagen

Emissionseinzelmessungen

§ 2 a (1) Die Durchführung der Emissionsmessungen hat nach den Regeln der Technik zu erfolgen.

(2) Die in Anlage 7 wiedergegebene ÖNORM M 9415-1, Ausgabe Mai 1991, und die in Anlage 8 wiedergegebene ÖNORM 9415-3, Ausgabe Mai 1991, sind verbindlich anzuwenden.

§ 3 (1) Emissionseinzelmessungen sind für jede Schadstoffkomponente bei jenem feuerungstechnisch stationären Betriebzustand durchzuführen, bei dem nachweislich die Anlage vorwiegend betrieben wird.

(2) Für die Durchführung der Emissionseinzelmessungen ist die in Anlage 9 wiedergegebene ÖNORM M 9415-2, Ausgabe Mai 1991, verbindlich anzuwenden.

Kontinuierliche Emissionsmessungen

§ 4 (3) Kontinuierliche Emissionsmessungen der Massekonzentration einer Emission (§ 8 Abs. 1 LRG-K) haben i der Regel in Halbstundenmittelwerten zu erfolgen.

(5) Die Messstellen sind auf Grund des Gutachtens eines befugten Sachverständigen (§ 7 Abs. 2 LRG-K) von der Behörde derart festzulegen, dass eine repräsentative und messtechnisch einwandfreie Emissionsmessung gewährleistet ist.

§ 5. Für kontinuierliche Emissionsmessungen hat die Datenaufzeichnung zu erfolgen:

1. Durch automatisch registrierende Messgeräte in Form von Halbstundenmittelwerten unter Angabe von Datum, Uhrzeit und Messstelle. Die Verfügbarkeit der Daten hat mindestens 90 % zu betragen. Als Bezugszeitraum gilt ein Monat.

3. Die Auswertung der Messdaten aus registrierenden Messgeräten hat mittels Auswertegeräten zu erfolgen, die dafür geeignet sind und die dem Stand der Technik entsprechen.

5. Registrierende Emissionsmessgeräte und Auswertegeräte sind im Abnahmeversuch und danach alle drei Jahre durch einen Sachverständigen zu kalibrieren. Die Kalibrierung hat nach den geltenden einschlägigen technischen Regelwerken zu erfolgen.

6. Jährlich ist eine Funktionskontrolle an registrierenden Emissionsmessgeräten durch Sachverständige vorzunehmen.

§ 7 (1) Der Betreiber hat während des Betriebes der Anlage an den Messgeräten mindestens einmal wöchentlich zu kontrollieren, ob der Nullpunkt einjustiert ist und die erforderliche Messfunktion gegeben ist.

(2) Die Messgeräte und alle dazuhörenden Komponenten sind mindestens alle drei Monate zu warten. Hierüber hat der Betreiber Aufzeichnungen zu führen.

(3) Der Sachverständige hat im Rahmen der Überwachung die Aufzeichnungen gemäß Abs. 2 zu kontrollieren und in begründeten Fällen die Richtigkeit der Anzeige der Messgeräte zu überprüfen.