



Australian Government

Australian Greenhouse Office

National Greenhouse Gas Inventory 2001

with
Methodology Supplements

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<http://www.greenhouse.gov.au/inventory>

The Intergovernmental Panel on Climate Change *Guidelines for National Greenhouse Gas Inventories* are at:

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PREFACE

As a Party to the United Nations Framework Convention on Climate Change (UNFCCC), Australia is required to produce a National Greenhouse Gas Inventory on an annual basis. National Greenhouse Gas Inventories have been produced for the years 1990 to 2001.

The 2001 Inventory has been compiled using the latest versions of the *Australian Methodology for the Estimation of Greenhouse Gas Emissions and Sinks* (NGGIC 1996, 1997a, 2003). Recent updates to the methodology are contained in the Methodology Supplements published with the 1995 to 2000 National Greenhouse Gas Inventories (NGGIC 1997b, 1998 and 1999; AGO 2000, 2001 and 2002a) and in the Methodology Supplements included in this volume. The National Carbon Accounting System methodology is documented in *Greenhouse Gas Emissions from Land Use Change in Australia: An Integrated Application of the National Carbon Accounting System* (AGO 2002b, 2003). Refinements to the methodologies are ongoing and the contents of this Inventory represent the best information available at the time of publication.

The major advance since the 2000 Inventory is the inclusion of hydrofluorocarbon (HFC) emissions from refrigeration and air conditioning equipment, which previously were not estimated. In addition, the results of an expert review of the livestock emissions methodology and data have been incorporated into the Inventory.

SUMMARY

Australia's National Greenhouse Gas Inventory serves the dual purpose of providing greenhouse gas emission estimates for the United Nations Framework Convention on Climate Change (UNFCCC) and for tracking Australia's progress towards its Kyoto target of limiting emissions to 108% of 1990 levels over the period 2008–2012.

The rules applying to the compilation of inventories for these two applications differ and they produce different emission estimates. The key differences between the accounting rules relate to forest sinks.

1. 108% Kyoto Target

Under the Inventory accounting provisions for the Kyoto target, Australia's net greenhouse gas emissions in 2001 totalled 542.6 Mt of carbon dioxide equivalent.

Total net emissions declined by 0.1% (0.5 Mt) over the period 1990 to 2001. From 2000 to 2001, emissions declined by 0.4% (2.3 Mt).

2. United Nations Convention on Climate Change

Under the Inventory accounting provisions for the UNFCCC, Australia's net greenhouse gas emissions in 2001 totalled 528.1 million tonnes (Mt) of carbon dioxide equivalent.

Total net emissions increased by 2.4% (12.3 Mt) over the period 1990 to 2001. From 2000 to 2001, emissions decreased by 0.1% (0.6 Mt).

The 2001 Inventory estimates have been compiled using the most up-to-date methods available and they reflect the methodology changes explained in the supplements included with this Inventory. Where these methodology changes have an impact on the Inventories for earlier years, these estimates have been recalculated.

Kyoto Accounting

- The Energy sector accounted for 68.0% (369.0 Mt) of total net emissions in 2001. From 1990 to 2001, Energy sector emissions increased by 28.9% (82.7 Mt), including a 1.4% (5.0 Mt) increase between 2000 and 2001. Stationary Energy (comprising Energy Industries, Manufacturing Industries and Construction, Other Sectors, and Other) was the main contributor to emissions in 2001, accounting for 47.8% (259.5 Mt) of total net emissions, followed by Transport with 14.2% (77.2 Mt). Stationary Energy emissions increased by 32.5% (63.6 Mt) between 1990 and 2001, and by 2.1% (5.4 Mt) from 2000 to 2001.
- Industrial Processes emissions contributed 4.6% (24.9 Mt) of total net emissions in 2001. Emissions from Industrial Processes decreased by 4.6% (1.2 Mt) between 1990 and 2001, primarily due to reductions in perfluorocarbon emissions from aluminium smelting. There was a 3.4% (0.8 Mt) increase from 2000 to 2001 due to increased hydrofluorocarbon emissions.
- Agricultural emissions made up 19.5% of the total net emissions for 2001. Agriculture contributed 105.8 Mt in 2001—a 2.7% (2.7 Mt) increase from 2000 and an 11.2% (10.7 Mt) increase from 1990.

- Under the Kyoto rules for land use, land use change and forestry:
 - Land use change emissions have declined by 69.2% (83.4 Mt) between 1990 and 2001, and declined by 21.7% (10.2 Mt) between 2000 and 2001. The reduction in emissions between 2000 and 2001 may not represent a true trend as estimates for this period will be revised once remote sensing data and the land use change analyses are completed for subsequent years.

Australia is required to include emissions from the land use change in its 1990 emissions baseline and in Inventories for later years. Deforestation is equivalent to land use change for this purpose. This means in practice that land use change emissions are treated in the same way in Australia's Inventory for the UNFCCC and for the Kyoto target.

- Reforestation activities (plantations established since 1990) are estimated to have sequestered approximately 11.1 Mt of CO₂ in 2001. Strictly speaking, the greenhouse sinks credits are accounted for in 2008–12 only. However, their inclusion in the 2001 Inventory account facilitates an understanding of Australia's emissions trends in relation to the 108% Kyoto target.
- Waste emissions contributed 3.1% (17.1 Mt) of net national emissions in 2001. Waste emissions increased by 11.7% (1.8 Mt) between 1990 and 2001, and by 2.2% (0.4 Mt) from 2000 to 2001, primarily due to an increase in methane generated during the decomposition of solid waste. This increase occurred despite an increase in methane recovered from solid waste.
- Carbon dioxide was the main greenhouse gas emitted in 2001—constituting some 69.9% of the aggregate greenhouse gas emissions. The two other major gases were methane (22.9%) and nitrous oxide (6.3%).

UNFCCC Accounting

- The accounting provisions for the UNFCCC are the same as the Kyoto target for the Energy, Industrial Processes, Agriculture and Waste sectors of the Inventory.
- Under UNFCCC accounting rules the Land Use Change and Forestry sector constituted a net source of 11.4 Mt in 2001. Emissions declined by 87.8% (81.7 Mt) between 1990 and 2001, and by 45.6% (9.5 Mt) from 2000 to 2001.
 - Accounting of forest activities under the UNFCCC is different to that under the Kyoto Protocol. In the UNFCCC Inventory, the Forest and Other Woody Biomass Stocks subsector provides a comprehensive inventory of net anthropogenic emissions from Australia's managed forest estate.
 - Emissions associated with prescribed burning of forests and wildfires and removals associated with pasture improvement and minimum tillage are also estimated.

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The following people have contributed to preparation of the 2001 Inventory:

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This document was edited by Cathy Nicoll (Communication Breakthrough).

¹ Commonwealth Scientific and Industrial Research Organisation

GENERAL NOTES

Units

The units mainly used in this Inventory are joules (J), grams (g), tonnes (t), metres (m) and litres (l), together with their multiples. Standard metric prefixes used in this Inventory are:

kilo (k)	=	10^3 (thousand)
mega (M)	=	10^6 (million)
giga (G)	=	10^9
tera (T)	=	10^{12}
peta (P)	=	10^{15}

Emissions are generally expressed in gigagrams (Gg) in the Inventory tables, as called for under international guidelines, and in megatonnes (Mt) in the text of the Inventory report.

gigagram (Gg)	= 1,000 tonnes = 1 kilotonne (kt)
megatonne (Mt)	= 1,000,000 tonnes = 1,000 Gg

Gases

CF ₄	perfluoromethane (a PFC)
C ₂ F ₆	perfluoroethane (a PFC)
CH ₄	methane
CO	carbon monoxide
CO ₂	carbon dioxide
HFCs	hydrofluorocarbons
N ₂ O	nitrous oxide
NMVOC	non-methane volatile organic compounds
NO _x	oxides of nitrogen
PFCs	perfluorocarbons
SF ₆	sulphur hexafluoride
SO ₂	sulphur dioxide

Global warming potentials

CO ₂ = 1	HFC-23 = 11,700
CH ₄ = 21	HFC-125 = 2,800
N ₂ O = 310	HFC-134a = 1,300
CF ₄ = 6,500	HFC-143a = 3,800
C ₂ F ₆ = 9,200	SF ₆ = 23,900

Conversion factors

From element basis to molecular mass

C → CO ₂ : x 44/12 = 3.67
C → CH ₄ : x 16/12 = 1.33
N → N ₂ O: x 44/28 = 1.57

From molecular mass to element basis

CO ₂ → C: x 12/44 = 0.27
CH ₄ → C: x 12/16 = 0.75
N ₂ O → N: x 28/44 = 0.64

Indicators

In the tables, the following standard indicators are used:

- NO (not occurring) when the activity or process does not occur in Australia
- NA (not applicable) when the activity occurs in Australia but the nature of the process does not result in emissions or removals
- NE (not estimated) where it is known that the activity occurs in Australia but there are no data or methodology available to derive an estimate of emissions
- IE (included elsewhere) where emissions or removals are estimated but included elsewhere in the Inventory. Summary Table 9 of the Common Reporting Format tables details the source category where these emissions or removals are reported
- C (confidential) where reporting at a disaggregated level could lead to the disclosure of confidential information.

Shading in cells indicates that there cannot be a value in that cell, because of the nature of the process or because of the Intergovernmental Panel on Climate Change (IPCC) reporting instructions for National Greenhouse Gas Inventories (IPCC 1997).

PART A

2001

**NATIONAL GREENHOUSE GAS INVENTORY
REPORT**

1. INTRODUCTION

1.1 STRUCTURE OF REPORT

Part A presents the 2001 National Greenhouse Gas Inventory Report. Chapter 1 of Part A provides an explanation of the Inventory preparation process. Chapter 2 provides a discussion of Australia's total net emissions and identifies trends in emissions between 1990 and 2001 for each of the sectors and the main greenhouse gases. A detailed discussion of each sector and a number of key subsectors is provided in Chapter 3.

Part B presents the UNFCCC Common Reporting Format tables and appendix tables. The tables include revised emissions estimates for the years 1990 to 2000.

Part C presents the emissions trends tables according to the Kyoto accounting provisions.

Part D presents methodology supplements, including modifications and additions to previously published methodologies. These supplements have been used in preparation of this Inventory and in recalculations of previous annual emissions where appropriate.

1.2 INVENTORY PREPARATION

As a Party to the United Nations Framework Convention on Climate Change (UNFCCC), Australia is required to submit an annual inventory of greenhouse gas emissions.

The Inventories are compiled in accordance with UNFCCC reporting guidelines on annual inventories (FCCC/CP/1999/7). In addition, the principles of the IPCC *Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories* (IPCC 2000), hereafter referred to as the IPCC Good Practice report, have been applied in the preparation of the 2001 Inventory.

As Australia has committed to meet the 108% Kyoto target, progress towards this target is being tracked using the internationally agreed methods for implementation of the Kyoto Protocol. The Australian, State and Territory governments under the umbrella of the National Greenhouse Strategy have a range of policies and programs to reduce greenhouse gas emissions.

The Australian Greenhouse Office is the agency responsible for coordinating Australia's greenhouse gas inventory activities. The preparation and review of Australia's National Greenhouse Gas Inventory is overseen jointly by representatives of the Australian, State and Territory Governments—constituting the National Greenhouse Gas Inventory Committee.

Australia has a national government and six State governments: New South Wales (NSW); Tasmania (Tas); Western Australia (WA); South Australia (SA); Victoria (Vic); Queensland (Qld); and two Territory governments—the Northern Territory (NT) and the Australian Capital Territory (ACT).

Gases

The Australian National Greenhouse Gas Inventory covers the major greenhouse gases—carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O), perfluorocarbons (PFCs), hydrofluorocarbons (HFCs) and sulphur hexafluoride (SF₆). Also covered are the indirect greenhouse gases—carbon monoxide (CO), oxides of nitrogen (NO_x), and non-methane volatile organic compounds (NMVOCs). Sulphur dioxide (SO₂), an aerosol precursor, is also included because emissions of this gas influence global warming.

Only greenhouse gas emissions from sources and removals by sinks resulting from human (anthropogenic) activities have been estimated and included in the Inventory. Natural processes are outside the scope of the Inventory.

The National Greenhouse Gas Inventory Report presents emissions for each gas as carbon dioxide equivalents (CO₂-e). As greenhouse gases vary in their radiative activity and in their atmospheric residence time, converting emissions into CO₂-e allows the integrated effect of emissions of the various gases to be compared. The conversion of emission data to CO₂-e is done using the concept of global warming potentials (GWPs).

GWPs represent the relative warming effect (i.e. cumulative radiative forcing²) of a unit mass of the gas when compared with the same mass of CO₂ over a specific period. The CO₂-e emissions are calculated by multiplying the actual mass of emissions of each gas by the appropriate GWP. Aggregate emissions are then obtained by summing the emissions of various greenhouse gases.

GWPs are revised from time to time as knowledge about the influence of different gases and processes on climate change increases. GWPs also vary with the time horizon being considered—by convention the 100-year horizon is used in policy analyses. To be consistent with the Kyoto and UNFCCC reporting requirements, the 100-year GWPs contained in the 1995 IPCC Second Assessment Report (IPCC 1996) are used in this document (e.g. 1 for CO₂, 21 for CH₄, 310 for N₂O, 6,500 for the PFC perfluoromethane (CF₄), 9,200 for the PFC perfluoroethane (C₂F₆), and 23,900 for SF₆).

GWPs need to take account of the indirect effects of gases emitted. The indirect effects of a number of gases—for example CO, NO_x, and NMVOCs—are not currently possible to characterise and these gases do not have GWPs. In accordance with the UNFCCC reporting guidelines, gases that do not have GWPs are reported but they are not included in the Inventory total.

Sectors

For the purpose of compiling a National Greenhouse Gas Inventory, source and sink categories are grouped under six sectors that have been defined by the IPCC. These represent the main human activities that contribute to the release or capture of greenhouse gases into or from the atmosphere:

1. Energy
2. Industrial Processes
3. Solvent and Other Product Use
4. Agriculture
5. Land Use Change and Forestry
6. Waste.

At various places in the Inventory, sectors are disaggregated to subsectors (e.g. 1A Fuel Combustion, or 4D Agricultural Soils), and sometimes more detailed disaggregations are provided (e.g. 1A3b Road Transportation). There is no correspondence between the level of disaggregation and the scale of greenhouse gas emissions.

Reporting year

For the large part, the Australian Inventory is compiled on a fiscal year basis as key data sources such as the national energy statistics are collected on this basis. The year 2001 refers to the Australian fiscal year from 1 July 2000 to 30 June 2001, and a similar format is used for other years. Time series consistency is maintained.

² Radiative forcing is a change in the energy balance of the global Earth-atmosphere system.

Averaging

In accordance with IPCC guidelines, emissions from Agriculture for each Inventory year are reported as a three-year average of the Inventories calculated for that year and for the preceding and subsequent years. In cases where data for the subsequent year are not yet available, the reported value is the two-year average of the Inventories in that year and the preceding year.

Relationship between inventory rules for the UNFCCC and the Kyoto Protocol

This 2001 National Greenhouse Gas Inventory is compiled according to the inventory reporting requirements for both the UNFCCC and the Kyoto emissions targets under the Kyoto Protocol. Australia's target agreed to at Kyoto is to limit greenhouse gas emissions to 108% of 1990 emissions levels over the period 2008–12. Requirements for national inventories under the UNFCCC have a number of different requirements and characteristics as compared to Kyoto inventories.

The UNFCCC requires parties to report on all anthropogenic (human-induced) emissions of greenhouse gases and removals from sinks, where adequate data are available. This means that the UNFCCC allows for comprehensive reporting of greenhouse gas sources, sectors and sinks. Net emissions from Australia's managed forest estate are reported annually in the UNFCCC inventory.

The Kyoto Protocol requires comprehensive reporting of anthropogenic emissions of six greenhouse gases (CO₂, CH₄, N₂O, PFCs, HFCs and SF₆) or, in the case of PFCs and HFCs, sets of gases across all sectors. The Kyoto Protocol also established a new approach to deal with credits and debits for land use, land use change and forestry. This approach allows credit for certain sinks activities with varying accounting requirements, which developed countries can use to meet their Kyoto Protocol targets.

Article 3.3 of the Kyoto Protocol provides only for a limited set of forestry activities—namely afforestation, reforestation and deforestation activities that have taken place on land since 1990. Under Article 3.4, developed country Parties to the Kyoto Protocol may elect (for 2008–12) to apply any or all defined additional sinks activities. These are defined as revegetation, forest management (capped), cropland management and grazing land management.

The accounting rules for Articles 3.3 and 3.4 lead to significant differences between the Protocol and the UNFCCC sinks inventory, which is constructed on a more comprehensive basis. The Kyoto Protocol allows crediting for only defined sinks activities within the land use, land use change and forestry categories. Consequently, the estimates for the Land Use Change and Forestry sector reported in the National Greenhouse Gas Inventory do not correspond to the estimates that apply to Kyoto targets. In addition, the accounting construct for measuring the performance of sinks differs between the UNFCCC and the Protocol.

The Kyoto Protocol also establishes a specific approach for dealing with emissions from land use change in relation to the calculation of developed countries' targets (assigned amounts). Article 3.7 states that countries with a net source of emissions from land use change and forestry in 1990 should include emissions from land use change in the baseline used for calculating their assigned amounts. In practice, this requires Australia to report land use change emissions for the Kyoto target, as this sector was a net source in 1990.

Synthetic gases (HFCs, PFCs, SF₆) should be included in all years of the UNFCCC inventory. The Kyoto Protocol makes provision for countries to choose whether 1990 or 1995 is used as the base year for synthetic gases, and Australia is yet to make that decision. The 2001 Inventory includes estimates for synthetic gases for 1990 onwards.

1.3 METHODOLOGIES AND RECALCULATIONS

Methodology

The Australian methodology for estimating greenhouse gas emissions and sinks uses a combination of country specific and IPCC methodologies and emission factors (see summary on page B-44). Australia predominantly uses Tier 2 approaches to estimating emissions³. These methods are consistent with the *Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories* (IPCC 1997).

The Australian methodologies are documented in a series of workbooks to ensure transparency. The 2001 Inventory relies on the Inventory methodology workbooks—*Australian Methodology for the Estimation of Greenhouse Gas Emissions and Sinks*, Workbooks 1.1 to 8.1 (NGGIC 1996), Workbook 4.2 (NGGIC 1997a) and Workbook 6.2 (NGGIC 2003)⁴. There have been, however, changes in the methodology for several sectors, and these are identified in the methodology supplement to this Inventory and the methodology supplements published with the 1995, 1996, 1997, 1998, 1999 and 2000 Inventories (NGGIC 1997b, 1998 and 1999; AGO 2000, 2001 and 2002a). The current methodology for each sector can be traced by consulting the methodology workbooks and the methodology supplements referenced in Table 1.

Emissions from the Forest and Grassland Conversion subsector (5B) of Land Use Change and Forestry are estimated by the National Carbon Accounting System. The National Carbon Accounting System is a model based accounting system that could be considered a Tier 3 approach. The methodology is documented in *Greenhouse Gas Emissions from Land Use Change in Australia: An Integrated Application of the National Carbon Accounting System* (AGO 2002b, 2003).

The methodology workbooks, supplements and reports are available from the Australian Greenhouse Office website at http://www.greenhouse.gov.au/inventory/methodology/method_content.html.

Table 1. Methodology workbooks and supplements required to compile the 2001 Inventory

Sector	Workbook	Supplements ^(a)
1. Energy		
Stationary Energy	1.1	1995–2001
Transport	3.1	1995, 1996, 1999, 2000, 2001
Fugitive Emissions	2.1	1995–2001
2. Industrial Processes	7.1	1995, 1996, 1997, 2000, 2001
3. Solvent and Other Product Use	7.1	
4. Agriculture		
Livestock	6.2	
Other Agriculture	5.1	1996, 1997, 1999, 2000
5. Land Use Change and Forestry		
UNFCCC subsectors		
5A, 5C, 5D	4.2	1996, 1997
5B	AGO 2002b	AGO 2003
5E	5.1	
6. Waste	8.1	1996, 1998, 2000

(a) Dates listed under supplements represent Inventory years, rather than the year of publication. For 1995 see NGGIC 1997b, 1996 see NGGIC 1998, 1997 see NGGIC 1999, 1998 see AGO 2000, for 1999 see AGO 2001, and for 2000 see AGO 2002a

³ An explanation of the Tier concept is provided in the Glossary

⁴ Note that the numbering of the workbooks does not correspond with the numbering of the IPCC categories.

Changes since the 2000 Inventory

Several changes in methodology and improvements in data have been introduced for the 2001 Inventory. These changes require emissions for 1990 to 2000 to be recalculated. Emission estimates in the current Inventory should not be compared with corresponding values of previous Inventories, or with analyses based on such Inventories.

The reasons for the changes in emissions from 1990 to 2000 are as follows:

- changes in methodology
- inclusion of emission estimates from the production of halocarbons and the use of HFCs in refrigeration and air conditioning equipment
- reallocation of iron and steel reductant emissions from Energy to Industrial Processes
- revision of data values
- end-of-series effects—some values are calculated as the average of the three latest years for which data are available, so each successive year's data lead automatically to the revision of the previous year's value
- the correction of previous computation errors—quality control procedures can identify minor errors (e.g. in spreadsheet cell addresses).

The specific changes are detailed in Section 3 in relation to each sector.

The net effect of all the revisions is to increase the 1990 estimate by 12.5 Mt CO₂-e (2.5%) and decrease the 2000 estimate by 6.5Mt CO₂-e (1.2%).

A full set of revised estimates for the years 1990 to 2000 has been prepared using the latest methodology. These estimates supersede all previously published estimates of emissions for 1990 to 2000. They are included in Appendix Table 6—Summary Table 1A for 1990 to 2000.

The National Greenhouse Gas Inventory represents the best data and methodology available at the time of publication. Continuing improvements in data quality and methods based on improved understanding of emissions sources and sinks are an ongoing feature of the Inventory.

1.4 KEY SOURCE ANALYSIS

The choice of methodology is important in managing Inventory uncertainty. Generally, Inventory uncertainty is lower when emissions are estimated using the most rigorous methods, but due to finite resources this may not be feasible for every source category. The IPCC Good Practice report (IPCC 2000) introduces the concept of *key source categories* for prioritising the inventory development process.

A *key source category* has a significant influence on a country's total inventory of direct greenhouse gases in terms of absolute level of emissions, the trend in emissions, or both. Australia has identified the key sources for the 2001 Inventory using the Tier 1 level and trend assessments as recommended in the IPCC Good Practice report. This approach identifies sources that contribute to 95% of the total emissions or 95% of the trend of the inventory in absolute terms.

Australia has identified 25 key sources through the level assessment, with an additional five categories identified through the trends assessment (Table 2). Energy Industries (solid fuel), Enteric Fermentation and Passenger Cars (Road Transportation) are the most significant of the key source categories—contributing 52.6% of emissions.

The Land Use Change and Forestry sector is not currently included in the IPCC key source assessment. For Australia, however, Land Use Change and Forestry is judged to be a key source given the magnitude of emissions and removals from the sector.

Table 2. Australian key source categories for the 2001 Inventory

IPCC Source Category		Gas	% Contribution to Level Assessment	Trend Assessment
1.A.1	Energy Industries – Solid Fuels	CO ₂	32.6	X
4.A	Enteric Fermentation	CH ₄	12.6	X
1.A.3.b.i.	Road Transportation – Passenger Cars	CO ₂	7.4	X
1.A.3.b.i.	Other Road Transportation	CO ₂	4.9	
1.A.1	Energy Industries – Gaseous Fuels	CO ₂	4.0	X
4.D	Agricultural Soils	N ₂ O	3.7	X
1.A.2	Manufacturing Industries and Construction – Gaseous Fuels	CO ₂	3.4	
6.A	Solid Waste Disposal on Land	CH ₄	2.9	X
1.B.1.a.i.	Fugitive Emissions – Underground Mines	CH ₄	2.4	X
1.A.2	Manufacturing Industries and Construction – Liquid Fuels	CO ₂	2.4	X
1.A.2	Manufacturing Industries and Construction – Solid Fuels	CO ₂	2.3	X
2.C.1	Iron and Steel Production	CO ₂	2.0	X
4.E	Prescribed Burning of Savannas	CH ₄	1.9	X
1.A.1	Energy Industries – Liquid Fuels	CO ₂	1.8	X
1.A.4	Other Sectors – Gaseous Fuels	CO ₂	1.7	X
4.E	Prescribed Burning of Savannas	N ₂ O	1.4	X
1.A.4	Other Sectors – Liquid Fuels	CO ₂	1.2	
1.B.1.a.ii.	Fugitive Emissions – Surface Mining	CH ₄	1.2	X
1.A.3.a	Civil Aviation – Jet Kerosene	CO ₂	1.0	X
1.A.3.b.i.	Road Transportation - Passenger Cars	N ₂ O	0.8	X
1.B.2.c.	Fugitive Emissions – Venting	CO ₂	0.7	X
1.B.2.b.	Fugitive Emissions – Natural Gas	CH ₄	0.7	X
2.A.1	Cement Production	CO ₂	0.6	X
1.B.2.c.	Fugitive Emissions – Flaring	CO ₂	0.6	X
2.B	Chemical Industry	CO ₂ -e	0.5	X
1.A.3.d.ii	Navigation (domestic)	CO ₂		X
1.A.4	Other Sectors – Biomass	CH ₄		X
1.A.5	Other – Liquid Fuels	CO ₂		X
2.C.3	Aluminium Production	PFC		X
2.F.1	Refrigeration and Air Conditioning Equipment	HFC		X

1.5 UNCERTAINTY

An important component of good practice is to quantify the uncertainties associated with emissions estimates, and the overall uncertainty of the estimate of total national emissions. Australia first published quantitative analyses of uncertainty for a limited number of sources and gases in the 1998 Inventory (AGO 2000). Quantitative assessment of uncertainties was extended to more sources and gases in the 1999 and 2000 Inventories (AGO 2001, 2002). The objective is to undertake detailed quantitative uncertainty analyses for all sources and gases for which it is reasonable to do so and for which probability distributions can be sensibly characterised. To be consistent with this objective, the coverage of quantitative uncertainty analysis reported in the 2001 Inventory is more extensive than in previous Inventories.

For the source categories and gases that have been assessed quantitatively, the uncertainty ranges being estimated are largely consistent with those identified in the IPCC Good Practice report.

1.6 QUALITY ASSURANCE AND QUALITY CONTROL

The IPCC Good Practice Tier 1 general inventory level quality control procedures were conducted for all sectors, and focused on key source categories. This included checks for transcription and computational errors, and documentation, archiving and reporting procedures. The 2001 Inventory emission estimates, activity data and emission factors were compared to those of the previous year and any significant deviations were analysed.

The Inventory report is distributed to other Commonwealth departments and agencies and relevant State experts through the National Greenhouse Gas Inventory Committee for independent review prior to submission.

Much of the Inventory is compiled using data collected in national surveys conducted according to statistical principles. The two largest national data providers, the Australian Bureau of Statistics and ABARE⁵, perform quality assurance and quality control procedures on the primary activity data, including both bottom-up and top-down approaches. Where this is supplemented by data from other sources, checks on the accuracy of the information have been conducted as far as practicable and have included comparisons with additional data sets where these were available.

Expert working groups developed the Australian sectoral methodologies. These methodologies have been reviewed by a wide range of technical experts in research institutions, governments and industry as well as by community groups.

1.7 PLANNED IMPROVEMENTS

Australia is committed to improving the basis for estimating national greenhouse gas emissions and will continue to provide updated emission estimates according to the best available methodologies and data. To ensure compliance with good practice, the Australian Greenhouse Office is undertaking a progressive technical review of sectoral methodologies and data sources for the Inventory. Key source categories are being reviewed as a priority. Revised methodologies for sectors and subsectors will be published as these are completed.

The expert review of the methodologies and data for estimating emissions from Livestock has now been completed and the results incorporated into this year's Inventory submission.

1.8 RESPONSES TO UNFCCC INVENTORY REVIEWS

In 2001, Australia's 1998 Inventory (AGO 2000) underwent both an individual in-country review and a centralised review. One of the key recommendations in relation to the Industrial Processes sector was that emissions from coke used in iron and steel production (previously accounted for under Stationary Energy) should be transferred to Industrial Processes. This change has now been made.

The UNFCCC Expert Review Team also requested that the sinks associated with alumina production and soda ash production be reviewed. These sinks have been retained whilst they continue to be investigated. Incomplete preliminary analysis suggests that the sink associated with alumina production may actually be larger than is currently being accounted for in the Inventory.

⁵ the Australian Bureau of Agricultural and Resource Economics

2. AUSTRALIA'S NET GREENHOUSE GAS EMISSIONS

2.1 EMISSIONS TOTALS

According to the Kyoto target accounting provisions, Australia's net greenhouse gas emissions in 2001 totalled 542.6 million tonnes (Mt) of CO₂-e.

Net national emissions for each of the major greenhouse gases in 2001 are shown in Table 3. Due to confidentiality requirements, emissions from some Industrial Processes subsectors are aggregated and reported as CO₂-e. The UNFCCC Inventory also requires reporting of the indirect greenhouse gases that do not have global warming potentials (as explained under section 1.2) these are shown as NA (not applicable) in Table 3.

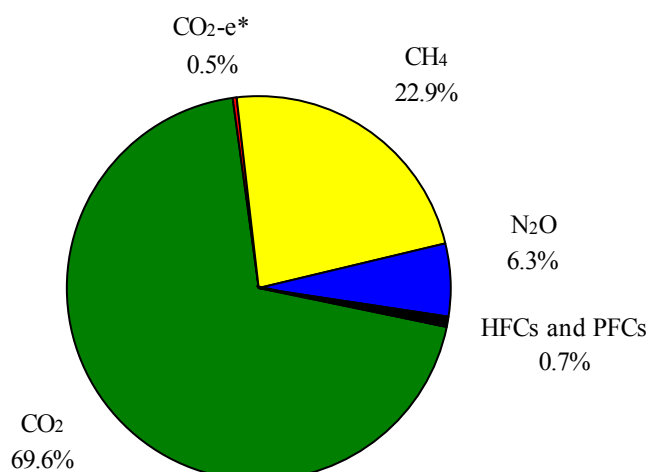
Emissions of CO₂ are the largest contributor with 69.6% of CO₂-e emissions, followed by CH₄ with 22.9% (Figure 1). Currently, data on some of the synthetic gases are not adequate to make reliable estimates of emissions. For example, data are not available for electricity supply and distribution as a source of SF₆. These will be included in the Inventory as data become available and methods are developed.

Table 3. Australian net greenhouse gas emissions by gas, 2001

Greenhouse Gas	Mt	GWP	Mt CO ₂ -e	% of total
Kyoto Accounting				
CO ₂	377.6	1	377.6	69.6
CH ₄	5.9	21	124.3	22.9
N ₂ O	0.1	310	34.1	6.3
HFCs	(a)	(a)	2.3	0.4
PFCs	(b)	(b)	1.5	0.3
SF ₆	NE	23,900	NE	NA
CO ₂ -e	C	1	2.8	0.5
Total CO ₂ -e	NA	NA	542.6	100.00
UNFCCC Accounting				
CO ₂	361.9	1	361.9	68.5
CH ₄	6.0	21	125.2	23.7
N ₂ O	0.1	310	34.4	6.5
HFCs	(a)	(a)	2.3	0.4
PFCs	(b)	(b)	1.5	0.3
SF ₆	NE	23,900	NE	NA
CO ₂ -e	C	1	2.8	0.5
NO _x	3.1	NA	NA	NA
CO	26.3	NA	NA	NA
NM VOC	2.5	NA	NA	NA
SO ₂	2.5	NA	NA	NA
Total CO ₂ -e	NA	NA	528.1	100.00

Notes: Values may not add due to rounding. (a) HFC-23 (GWP = 11,700), HFC-125 (GWP = 2,800), HFC-134a (GWP = 1,300) and HFC-143a (GWP = 3,800); (b) CF₄ (GWP = 6,500) and C₂F₆ (GWP = 9,200); (c) includes confidential data on nitric acid and ammonia production and soda ash production and use.

Figure 1. Contribution to total net CO₂-equivalent emissions by gas (Kyoto accounting), 2001



*Includes confidential N₂O and CO₂ emissions from nitric acid and ammonia production and soda ash production and use

2.2 SECTOR CONTRIBUTIONS TO TOTAL EMISSIONS

The combined Energy subsectors are the largest source of net national emissions, contributing 68.0% of emissions (Figure 2). Agriculture and land use, land use change and forestry activities are the next largest sources, contributing 19.5% and 4.8% of net national emissions respectively. The Energy sector is the major contributor to national CO₂ emissions (68.1%) while Agriculture is the main contributor of national CH₄ (62.7%) and N₂O (81.8%) emissions (Table 4).

Figure 2. Contribution to total net CO₂-equivalent emissions by sector (Kyoto accounting), 2001

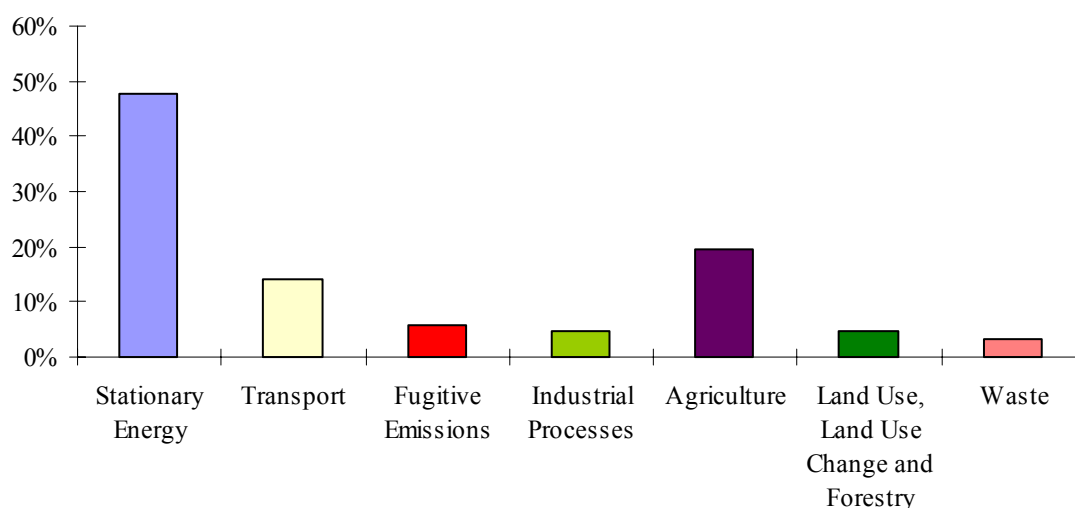


Table 4. Australian net greenhouse gas emissions by sector (Kyoto accounting), 2001

Sector and Subsector	CO ₂		CH ₄		N ₂ O		CO ₂ -e ^(a)	
	Mt	%	Mt	%	Mt	%	Mt	%
1 All Energy (Combustion + Fugitive)	336.3		1.30		0.02		369.0	
Stationary Energy	257.1	68.1	0.1	1.2	0.003	2.7	259.5	47.8
Transport	72.3	19.1	0.03	0.5	0.01	12.8	77.2	14.2
Fugitive Emissions from Fuel	6.9	1.8	1.2	20.3	0.0001	0.1	32.2	5.9
2 Industrial Processes	18.2	4.8	0.003	0.0	0.0	0.1	24.9 ^(b)	4.6
3 Solvent and Other Product Use^(c)	NA	NA	NA	NA	NA	NA	NA	NA
4 Agriculture	NA	NA	3.7	62.7	0.090	81.8	105.8	19.5
5 Land Use, Land Use Change and Forestry	23.1	6.1	0.1	2.0	0.0	0.9	25.9	4.8
6 Waste	0.0	0.0	0.8	13.3	0.002	1.6	17.1	3.1
Total Net Emissions	377.6	100.0	5.9	100.0	0.11	100.0	542.6	100.0

Values may not add due to rounding. (a) Calculated using GWPs in Table 3. (b) Includes HFCs (refrigeration and air conditioning equipment), PFCs (aluminium), SF₆ (magnesium production) and confidential CO₂ and N₂O data from nitric acid and ammonia production and soda ash production and use. (c) No emissions are included because all emissions from the sector are NMVOCs, which are not assigned a GWP. Details of these emissions are provided in the tables for Solvent and Other Product Use in Part B.

2.3 TRENDS

Kyoto accounting

Under inventory accounting rules for the Kyoto target, Australia's net emissions in 2001 were 542.6 Mt, compared with 544.9 Mt in 2000 and 543.1 Mt in 1990. This represents a 0.4% decrease in emissions from 2000 to 2001 and a 0.1% decrease from 1990 to 2001 (Figure 3).

Between 1990 and 2001, net emissions of CO₂ decreased by 3.7%, CH₄ emissions increased by 3.0%, N₂O emissions increased by 44.7%, HFC emissions increased by 108.2%, PFC and SF₆ emissions fell by 61.2% (Table 5).

Trends in emissions from each sector are discussed in Chapter 3. Annual emissions of each gas and from each sector for the years 1990 to 2001 are reported in Part C.

UNFCCC accounting

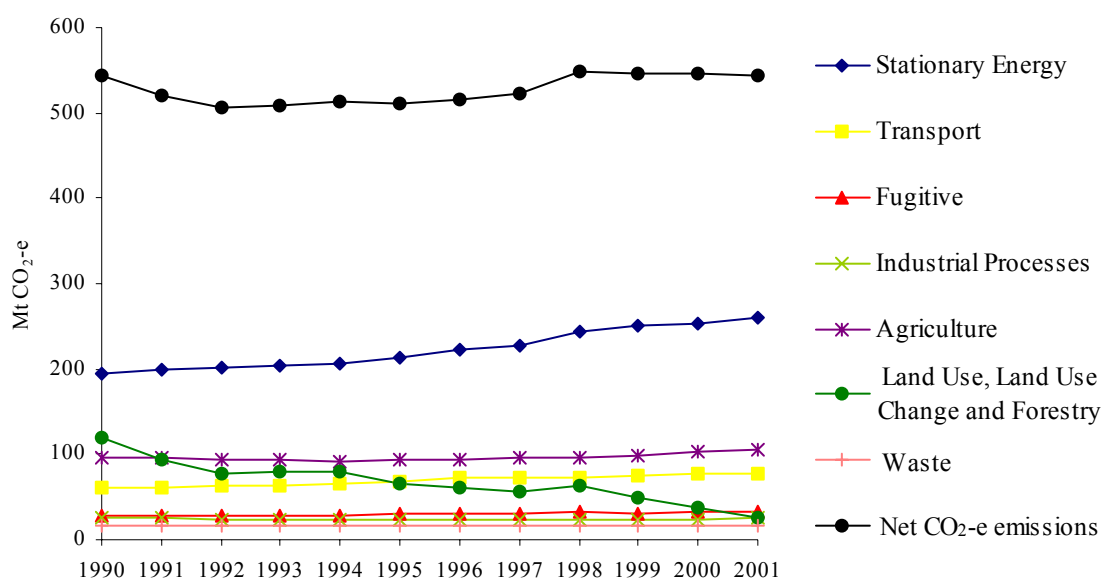
Under the inventory accounting rules for the UNFCCC, net national emissions in 2001 were 528.1 Mt, compared with 528.7 Mt in 2000 and 515.8 Mt in 1990. This represents a 0.1% decline in emissions from 2000 to 2001 and a 2.4% increase from 1990 to 2001. Annual emissions of each gas and from each sector for the years 1990 to 2001 are reported in Common Reporting Format Table 10 (see page B-74).

Table 5. Change in total net CO₂-equivalent emissions by gas (Kyoto accounting), 1990–2001

Greenhouse Gases	1990 Mt CO ₂ -e	2001 Mt CO ₂ -e	1990 % of Total	2001 % of Total	Changes Mt	% Change in Emissions
CO ₂	392.1	377.6	72.2	69.6	-14.4	-3.7
CH ₄	120.7	124.3	22.2	22.9	3.6	3.0
N ₂ O	23.6	34.1	4.3	6.3	10.5	44.7
HFCs	1.1	2.3	0.2	0.4	1.2	108.2
PFCs and SF ₆	3.9	1.5	0.7	0.3	-2.4	-61.2
CO ₂ -e ^(a)	1.7	2.8	0.3	0.5	1.0	59.0
Total CO₂-e	543.1	542.6	100.0	100.0	-0.5	-0.1

(a) Includes confidential CO₂ and N₂O data from nitric acid and ammonia production and soda ash production and use.

Figure 3. Trends in CO₂-equivalent emissions and removals by sector (Kyoto accounting), 1990–2001



3. EMISSIONS BY SECTOR

This chapter provides an overview of emissions, methodologies and levels of uncertainty for each sector. The numbering of sectors, subsectors and categories within the tables corresponds to the IPCC numbering used in the Inventory. Emissions are tabulated in Gg (gigagrams or thousands of tonnes) rather than Mt (megatonnes or millions of tonnes) to retain detail in the smaller subsectors. The chosen units are not intended to indicate the level of accuracy of the estimates.

3.1 ENERGY

Total emissions from the Energy sector for 2001 were estimated to be 369.0 Mt CO₂-e (Table 6). Energy Industries was the main contributor, accounting for 53.9% of emissions from the Energy sector. Other significant contributors to total Energy emissions were Transport (20.9%), and Manufacturing Industries and Construction (11.5%).

Energy sector emissions increased by 28.9% (82.7 Mt) between 1990 and 2001. Energy sector emissions increased by 5.0 Mt CO₂-e (1.4%) from 364.0 Mt in 2000. The main contributor to the increase in emissions between 2000 and 2001 was Energy Industries, which contributed an additional 5.8 Mt CO₂-e.

Table 6. Energy sector CO₂-equivalent emissions, 2001

Greenhouse Gas Source and Sink Categories	CO ₂ -equivalent emissions (Gg)				% Total Net National Emissions
	CO ₂ ^(a)	CH ₄ ^(b)	N ₂ O ^(c)	Total	
Total Net National Emissions	377,639	124,255	34,098	542,628	100.0
1 ENERGY	336,326	27,325	5,321	368,972	68.0
A Fuel Combustion Activities (National Approach)	329,403	2,067	5,292	336,761	62.1
1 Energy Industries	198,169	191	629	198,988	36.7
a Electricity and Heat Production	180,659	162	598	181,420	33.4
b Petroleum Refining	6,729	2	16	6,747	1.2
c Manufacture of Solid Fuels	10,781	26	14	10,821	2.0
2 Manufacturing Industries and Construction	42,035	49	230	42,314	7.8
3 Transport	72,260	631	4,356	77,247	14.2
a Civil Aviation	5,480	5	53	5,538	1.0
b Road Transportation	63,329	572	4,276	68,178	12.6
c Railways	1,824	2	16	1,842	0.3
d Navigation (Domestic)	1,587	51	10	1,648	0.3
e Other Transportation	41	0	0	41	0.0
4 Other Sectors	15,586	1,196	71	16,853	3.1
5 Other	1,353	1	6	1,360	0.3
a Lubricants	636	NE	NE	636	0.1
b Mobile (Military)	717	1	6	724	0.1
B Fugitive Emissions from Fuels	6,924	25,258	29	32,211	5.9
1 Solid Fuels	NE	18,446	NA	18,446	3.4
2 Oil and Natural Gas	6,924	6,812	29	13,765	2.5

Values may not add due to rounding. (a) GWP = 1 (b) GWP = 21 (c) GWP = 310

Comparison of Australian methodology with IPCC Reference Approach

Total CO₂ emissions from Fuel Combustion Activities estimated using the agreed Australian methodology (National Approach) are 329.4 Mt. Total CO₂ emissions estimated using the Reference Approach are 328.2 Mt. The difference between the estimates is largely attributed to differences in the treatment of coal combustion in each approach. The National Approach is able to fully capture the mix of different coal types, including coal by-products, used in the different subsectors, and to allocate appropriate emission factors to each. The IPCC Reference Approach, by contrast, is unable to capture this fine detail, and is obliged to use just two overall emission factor values (one for black coal and one for brown coal).

The -0.37% difference between the approaches is well within the limits of a $\pm 2\%$ difference, beyond which the UNFCCC require explanations.

The uncertainty associated with CO₂ emissions from Fuel Combustion is estimated to be less than $\pm 5\%$ (Table 7). Emissions from Fuel Combustion depend on the amount of fuel consumed and the characteristics of that fuel, both of which are known reasonably accurately.

Table 7. Quantified uncertainty for CO₂ emissions from the Energy sector^(a)

Greenhouse Gas Source and Sink Category	Uncertainty (%)
1 ENERGY	
A Fuel Combustion Activities	
(IPCC Reference Approach)	$\pm 3\%$
Coal	$\pm 4\%$
Petroleum	$\pm 3\%$
Natural gas	$\pm 2\%$

(a) Uncertainty reported at 95% confidence limits estimated using Latin Hypercube

3.1.1 Stationary Energy

Total estimated emissions from Stationary Energy combustion were 259.5 Mt CO₂-e in 2001, equal to 47.8% of net national emissions. Stationary Energy includes emissions from fuel combustion for energy in the following subsectors—Energy Industries (1A1), Manufacturing Industries and Construction (1A2), Other Sectors (residential, commercial and institutional, and agriculture, forestry and fishing) (1A4) and Other (lubricants and military transport) (1A5).

The Energy Industries subsector includes fuel combustion in electricity generation, petroleum refining, gas production and distribution, and solid fuel manufacture. Electricity and Heat Production (1A1a) contributed 181.4 Mt CO₂-e or 69.9% of Stationary Energy emissions in 2001. This category includes only emissions from electricity generation because heat production as defined by the IPCC does not occur in Australia. Estimated emissions from the remaining Energy Industries subsectors were 17.6 Mt in 2001.

The Manufacturing Industries and Construction subsector (1A2) emissions were 42.3 Mt CO₂-e in 2001. This subsector includes direct emissions from fuel combustion in manufacturing industries, ferrous and non-ferrous metals production, plastics production, construction and non-energy mining, including both stationary equipment and mobile equipment, such as earth moving and mining equipment. These calculations do not fully reflect the greenhouse impact of industry, since the emissions from industrial electricity use are included under Electricity and Heat Production (1A1a).

Estimated emissions from Other Sectors (1A4) were 16.9 Mt CO₂-e in 2001. This subsector comprises direct fuel combustion in the residential, and commercial and institutional sectors, including energy used in mobile equipment in agriculture, forestry and fishing industries.

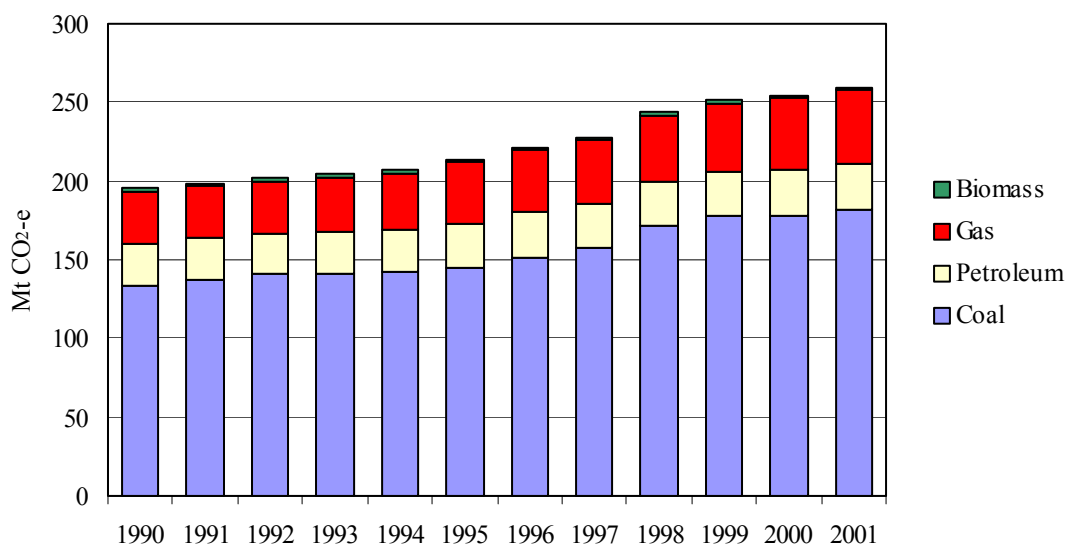
Other (1A5) includes emissions from lubricants (0.6 Mt) and military transport (0.7 Mt). Emissions from lubricants arise from the combustion of engine oil in vehicles.

Trends

Total Stationary Energy emissions increased by 32.7% (64.0 Mt) between 1990 and 2001, with emissions from coal combustion increasing by 36.0% (48.0 Mt) in the same period (Figure 4). Although coal accounted for the highest absolute increase in emissions over this period, natural gas related emissions showed the largest relative growth, increasing by 40.6% (13.7 Mt) between 1990 and 2001. Emissions from oil increased by 9.5% (2.8 Mt) in the same period. The increase in coal related emissions accounts for 75.0% of the overall increase in emissions, with gas accounting for a further 21.5% and oil for 4.4%. Emissions from biomass decreased by 0.8%.

Between 2000 and 2001, emissions from Stationary Energy increased by 2.1% (5.4 Mt).

Figure 4. Total CO₂-equivalent emissions from Stationary Energy combustion by fuel, 1990–2001



Electricity generation emissions increased by 5.7 Mt (3.3%) from 2000 to 2001, and by 52.3 Mt (40.5%) from 1990 to 2001. The 3.3% increase in emissions between 2000 and 2001 was driven by a 2.9% growth in the consumption of electricity. There was also a 0.4% increase in the emissions intensity of electricity consumed. The share of electricity generated from brown coal declined from 27.4% to 26.6% while the share of natural gas (a lower emissions intensity source of generation) increased from 7.0% to 7.6%. The share of hydro electricity declined.

Emissions from the remaining subsectors of Stationary Energy decreased by 0.3 Mt (0.4%) between 2000 and 2001, but increased overall by 11.7 Mt (17.6%) from 1990 to 2001. There was a 1.3% (0.6 Mt) decrease in emissions from the Manufacturing Industries and Construction subsector between 2000 and 2001, largely due to lower production of iron and steel and non-ferrous metals.

Methodology

Emissions from the Stationary Energy combustion are estimated using a Tier 2 approach. Country specific approaches have been used in all cases where they are seen to be more accurate than the IPCC default emission, oxidation factors and methodologies. The sequestration of feedstocks has been accounted for by using data obtained directly from various companies or through application of IPCC defaults. Non-CO₂ emission factors have been calculated using a sectoral equipment-weighted average

approach. The factors applied in this Inventory have been included in the Stationary Combustion Methodology Supplement (Part D).

A full description of the methodologies and emission factors are presented in the *Workbook for Fuel Combustion Activities (Stationary Sources) 1.1*, and the supplements in the 1995 to 2001 Inventories (NGGIC 1996, 1997b, 1998, 1999; AGO 2000, 2001, 2002).

The main source of activity data used for the 2001 Inventory is national statistics of energy consumption by industry sector and fuel type, compiled by ABARE. These are supplemented by data from various other sources including Australian power generator and chemical manufacturing companies, expert consultants, and the Australian Gas Association.

Uncertainty and levels of confidence

Uncertainty analyses were conducted for emissions from three sectors: 1A1a Electricity, 1A1b Petroleum Refining and 1A1c Manufacture of Solid Fuels and Other Energy Industries (Table 8).

The overall uncertainty in estimated emissions from electricity generation was $\pm 5\%$. The highest uncertainty was for N_2O , with an associated uncertainty of up to $\pm 16\%$. Emissions of N_2O (and CH_4) account for only small fraction, 0.4%, of the subsectors' total emissions, and have a negligible impact on overall uncertainty.

Table 8. Quantified uncertainty values for key Stationary Energy subcategories^(a)

Greenhouse Gas Source and Sink Category	Uncertainty (%)			
	CO_2	CH_4	N_2O	Total $\text{CO}_2\text{-e}$
1 ENERGY				
A Fuel Combustion Activities				
1A1a Electricity	± 5	± 4	± 15	± 5
Black coal	± 6	± 6	± 15	± 6
Brown coal	± 4	± 4	± 15	± 4
Petroleum	± 4	± 4	± 7	± 4
Natural gas	± 4	± 4	± 16	± 4
Biomass	NA	± 4	± 4	± 4
Biogas	NA	± 4	± 16	± 4
1A1b Petroleum Refining	± 4	± 9	± 12	± 4
Petroleum	± 4	± 9	± 12	± 4
Gas	± 4	± 9	± 12	± 4
1A1c Manufacture of Solid Fuels and Other Energy Industries	± 4	± 9	± 12	± 4
Coal	± 4	± 9	± 12	± 4
Petroleum	± 4	± 9	± 12	± 4
Gas	± 4	± 9	± 12	± 4

(a) Uncertainty reported at 95% confidence limits estimated using Latin Hypercube (a type of Monte Carlo) analysis

Overall uncertainty associated with emissions estimates from both 1A1b Petroleum Refining and 1A1c Manufacture of Solid Fuels and Other Energy Industries sectors was $\pm 4\%$. Again, the uncertainty associated with emissions of N_2O and CH_4 has negligible impact on overall uncertainty.

An uncertainty analysis on the mobile source categories of the Stationary Energy sector gave uncertainty values ranging from $\pm 16.4\%$ to $\pm 24.5\%$ for CO_2 , from $\pm 25.4\%$ to $\pm 63.9\%$ for CH_4 , and $\pm 44.7\%$ to $\pm 64.2\%$ for N_2O (Table 9).

Table 9. Quantified uncertainty values for mobile source categories^(a)

Greenhouse Gas Source and Sink Category	Uncertainty (%)		
	CO ₂	CH ₄	N ₂ O
1.A.4. Other Sectors			
b. Residential			
Lawn Mowers	±24.5	±45.2	±46.3
1.A.5. Other			
b. Mobile	±16.4	±25.4	±44.7
Military Transport – Land	±18.5	±32.9	±54.6
Military Transport – Water	±24.4	±63.9	±62.7
Military Transport – Aviation	±24.0	±47.2	±64.2

(a) Uncertainty reported at 95% confidence limits estimated using Monte Carlo analysis

Changes since the 2000 Inventory

All previous Inventories from 1990 to 2000 were recalculated when compiling the 2001 Inventory. This was necessary due to the following changes:

- Emissions associated with the use of reducing agents in the steel industry, such as coke and natural gas, previously included in the Energy sector under Manufacturing Industries and Construction (1A2), are now reported in the Industrial Processes sector.
- Emission factors for residential wood burning heaters (1A4b Residential biomass) were revised and a time series of emission factors was produced from newly available data. The time series captures the changes in appliances (including equipment share ratios), fuel and operation. The revised emission factors were used in recalculations for all inventory years (1990–2000). A full description of the methodologies and emission factors are in the Methodology Supplement (Part D)
- Revised energy consumption statistics for 1999 and 2000 were produced by ABARE.
- Data on mobile equipment activity in the stationary combustion sector are no longer available. A new set of non-CO₂ equipment weighted emission factors was created to adjust for this data change. Time series consistency was checked by comparing the 1999 emissions calculated using both new and old emission factors. The new emission factors caused very small changes (ranging from –0.03% for CH₄ to –0.06% for NMVOC) in calculated emissions.
- Double counting of emissions associated with recycled oil in the Lubricants subsector has been removed.

The overall effect of revisions is that Stationary Energy emissions reported for the year 2000 in this Inventory are 3.7% (9.8 Mt CO₂-e) lower than those published in the previous Inventory (AGO 2002).

Quality control

The IPCC Good Practice Tier 1 general inventory level quality control procedures were conducted for all subcategories. The 2001 Inventory estimates were also compared to those of all previous years for consistency. Absolute and relative annual changes were checked and any significant deviations were analysed. CO₂ and SO₂ emissions were also visually inspected through the use of trends graphs.

An exhaustive analysis of all sources of discrepancy between the National Approach and Reference Approach was undertaken to check for any source of systematic error. Reconciling emission estimates from each of these methodologies increases confidence that sources of systematic error have been removed.

3.1.2 Transport

The Transport subsector (1A3) comprises road transport, civil aviation (domestic), navigation (domestic), and railways. Domestic transport produced an estimated 77.2 Mt of CO₂-e emissions, or 14.2% of net national emissions in 2001.

Road transportation contributed 68.2 Mt CO₂-e or 88.3% of emissions from the Transport subsector. Passenger cars contributed 42.5 Mt or 62.3% of emissions from road transportation and 55.0% of the Transport subsector as a whole. Civil aviation (domestic air transport) was the next largest Transport category, resulting in emissions of 5.5 Mt CO₂-e. Railway fuel combustion accounted for 1.8 Mt of emissions (not counting the emissions from generating the electricity used by rail, included in 1A1a). Domestic navigation contributed 1.6 Mt CO₂-e.

Fuel used by international transport (international aviation and marine 'bunkers') are by international agreement reported separately from the national Inventory. In 2001, international bunker fuels generated 10.7 Mt of emissions.

Trends

Transport emissions increased by 24.6% (15.3 Mt) from 1990 to 2001, and by 0.3% (0.2 Mt) from 2000 to 2001 (Figure 5). Over this period, Transport emissions increased by about 2.0% annually, making this one of the fastest growing subsectors of the Inventory.

Figure 5. Total Transport emissions, 1990–2001

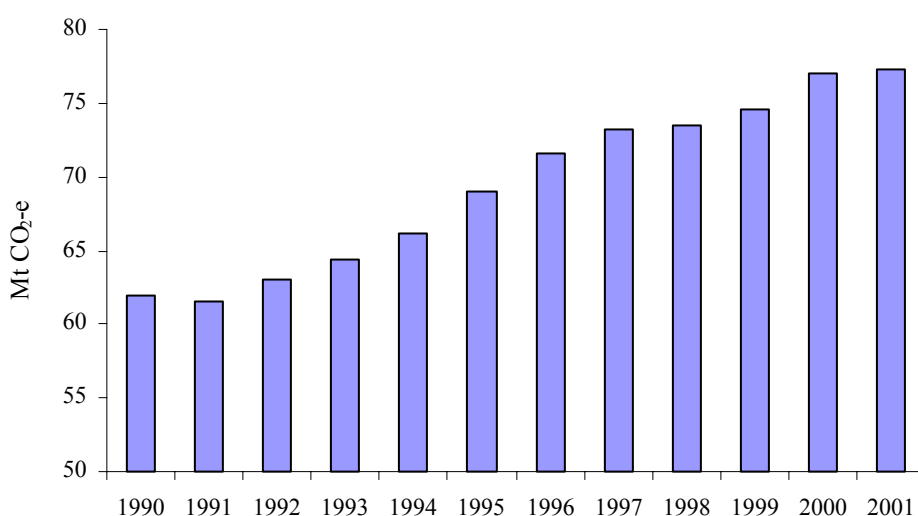


Figure 6 shows the estimated emissions in 1990 and 2001 from each of the subcategories in the Transport sector

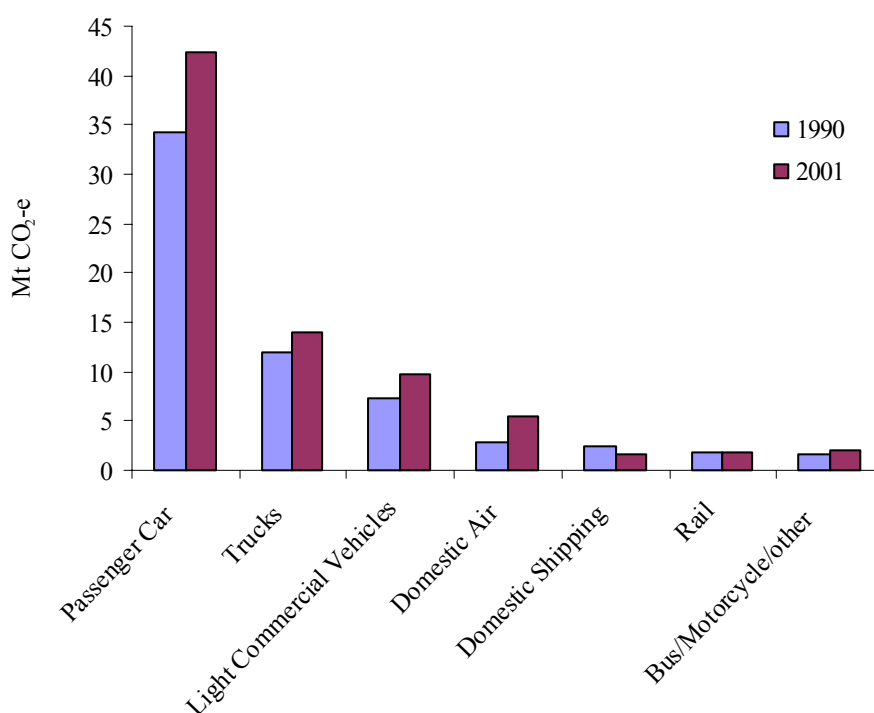
Road transport emissions increased by 24.4% (13.4 Mt) between 1990 and 2001 but decreased by 0.4% (0.2 Mt) from 2000 to 2001. This decrease is consistent with the reported 2% reduction in petrol consumption, and the 0.5% reduction for total fuel consumption, over the period. Emissions from cars increased by 25.8% (8.7 Mt) between 1990 and 2001.

Estimates of civil aviation (domestic air transport) emissions were 10.0% (0.5 Mt) higher in 2001 than in 2000 and 88.7% (2.6 Mt) higher than the 1990 level. This increase is partly due to increased air travel associated with the Sydney Olympics event in late 2000, which falls in the 2001 inventory accounting year. The reported fuel use in this subsector increased by 9.1% between 2000 and 2001 compared with a 5.8% increase between 1999 and 2000 (ABARE 2002a). This is consistent with trends in aircraft movements reported by Avstats (DTRS 2002).

Emissions from domestic shipping (navigation) in 2001 were 0.72 Mt (30.4%) lower than in 1990, and 0.03 Mt (1.9%) lower than in 2000. Large year to year fluctuations occur in emissions from this subsector and they are driven mostly by changes in activity. A number of factors influence navigation activity, including fuel price variations from country to country and the proportion of domestic freight transported by international ships.

Transport emissions are mostly CO₂ (93.5%), with only small amounts of CH₄ (0.8%) and N₂O (5.6%). The proportion of N₂O in Transport emissions increased from 2.7% in 1990 to 5.6% in 2001. This is due mainly to the increasing proportion of passenger vehicles equipped with three-way catalytic converters. Catalytic converters are an air pollution control tool that has been installed in new petrol passenger vehicles to ensure compliance with the regulatory emission limits introduced in 1987. While three-way converters reduce air pollution more effectively than two-way converters, they do produce more N₂O per unit of fuel use. Passenger cars with three-way converters emit 13% more CH₄ and 154% more N₂O per kilometre than cars with two-way converters or those without any pollution controls.

Figure 6. Comparison of Transport emissions by subcategory, 1990–2001



Methodology

The methodologies for estimating CO₂ emissions from Transport are based on the IPCC Tier 1 approach using country specific emission factors. Non-CO₂ gas emissions from the civil aviation category and passenger car subcategory are estimated using the IPCC Tier 2 approach and country specific emission factors, except for N₂O where default IPCC Tier 1 factors are used. The non-CO₂ emissions from other Transport source categories are estimated using the IPCC Tier 1 approach with a mixture of country specific and international emission factors. A full description of the methodologies and emission factors are presented in the *Workbook for Transport 3.1* and the supplements in the 1995, 1996, and 1999 to 2001 Inventories (NGGIC 1996, 1997b, 1998; AGO 2001, 2002).

The main sources of data are ABARE's Australian Energy Consumption and Production Data for 2001, the Department of Industry, Tourism and Resources monthly series *Sales of Petroleum Products by State Marketing Area*, and Avstats' Air Transport Statistics Airport Traffic Data (DTRS 2002).

No special methodology is required to disaggregate international and domestic aviation and navigation fuel consumption. In Australia, data on international and domestic fuel consumption are collected separately due to the differential excise tax placed on the fuel. Petroleum companies collect and report these data to the Department of Industry, Science and Resources.

Uncertainty and levels of confidence

Estimates of uncertainty were based either on expert judgement using the methodology recommended by the Revised 1996 IPCC Guidelines or Monte Carlo simulations (see Table 10).

Monte Carlo analyses were conducted for all subsectors and fuel types. The uncertainty distributions for emission factors and activity data were developed on the basis of expert judgement.

The total estimated uncertainties in the Transport subsector were $\pm 2\%$ for CO₂, $\pm 22\%$ for CH₄, and $\pm 40\%$ for N₂O. Uncertainties in the emissions from individual source categories ranged from $\pm 1\%$ to $\pm 24\%$ for CO₂, $\pm 22\%$ to $\pm 64\%$ for CH₄, and $\pm 34\%$ to $\pm 65\%$ for N₂O. The largest source of uncertainty is in the emission factors.

Table 10. Emissions and quantified uncertainty values for key Transport subcategories^(a)

Greenhouse Gas Source and Sink Category	Uncertainty (%)			Derivation of Uncertainty
	CO ₂	CH ₄	N ₂ O	
1.A.3. Transport	± 2	± 22	± 41	IPCC approach
	± 2	± 22	± 40	Monte Carlo
a. Civil Aviation	± 9	± 51	± 51	Monte Carlo
b. Road Transport	± 2	± 23	± 41	Monte Carlo
i. Passenger Cars	± 4	± 30	± 43	Monte Carlo
ii. Light Trucks	± 4	± 35	± 39	Monte Carlo
iii. Medium Trucks	± 5	± 39	± 57	Monte Carlo
iv. Heavy Trucks	± 5	± 41	± 59	Monte Carlo
v. Buses	± 4	± 32	± 53	Monte Carlo
vi. Motorcycles	± 5	± 40	± 59	Monte Carlo
c. Railways	± 1	± 39	± 39	Monte Carlo
d. Navigation	± 7	± 58	± 34	Monte Carlo
e. Other Transportation	± 24	± 47	± 63	Monte Carlo
International Bunkers				
Aviation	± 10	± 58	± 58	Monte Carlo
Marine	± 1	± 45	± 51	Monte Carlo

(a) Uncertainty reported at 95% confidence limits

Changes since the 2000 Inventory

During 1997 and 1998 a new Australian Design Rule was introduced to regulate exhaust and evaporative emissions from new petrol light duty vehicles up to 2.7 tonnes gross vehicle mass. In response to this change, a new age class called the post-1997 category was created to allow emissions to be estimated for petrol passenger vehicles that are compliant with this new Australian Design Rule (ADR 37/01). The 1986–1997 category includes vehicles covered by ADR 37/00 only.

The allocation of ABARE fuel consumption data to unlisted categories (ie off-road vehicles, military use, small marine craft and utility engines) was recalculated. The *Workbook for Transport 3.1* (Table A.1) provides the fuel allocation factors. These factors had previously been incorrectly applied to total fuel consumption (domestic and international), when they should have been applied to domestic fuel only.

Quality control

The IPCC Good Practice Tier 1 general inventory level quality control procedures were conducted for all categories. These include checks on data transcription, formulas and calculation, and transcription of units. The selection of emission factors and activity data were rechecked, emissions were recalculated and conversion factors were rechecked. Checks were made to ensure that references were correctly cited, units were correctly labelled, and experts were appropriately qualified in making judgements.

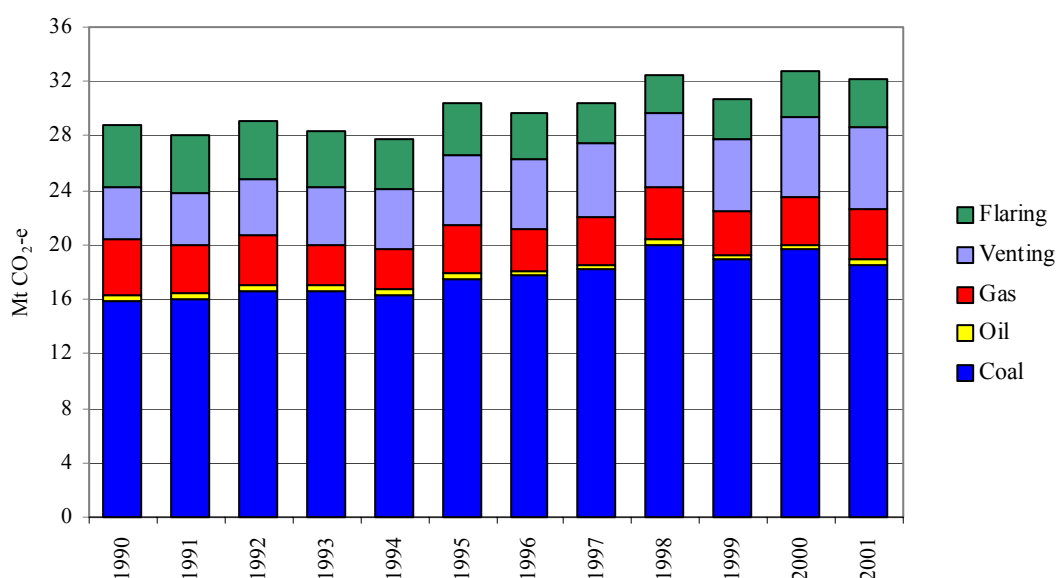
3.1.3 Fugitive Emissions Subsector

Total estimated Fugitive Emissions for 2001 were 32.2 Mt CO₂-e, representing 5.9% of net national emissions. Net Solid Fuel emissions, all of which are associated with coal mining and handling, contributed to 57.3% (18.4 Mt) of Fugitive Emissions. Oil and Natural Gas production, processing and distribution account for the remaining 42.7% (13.8 Mt) of Fugitive Emissions.

Trends

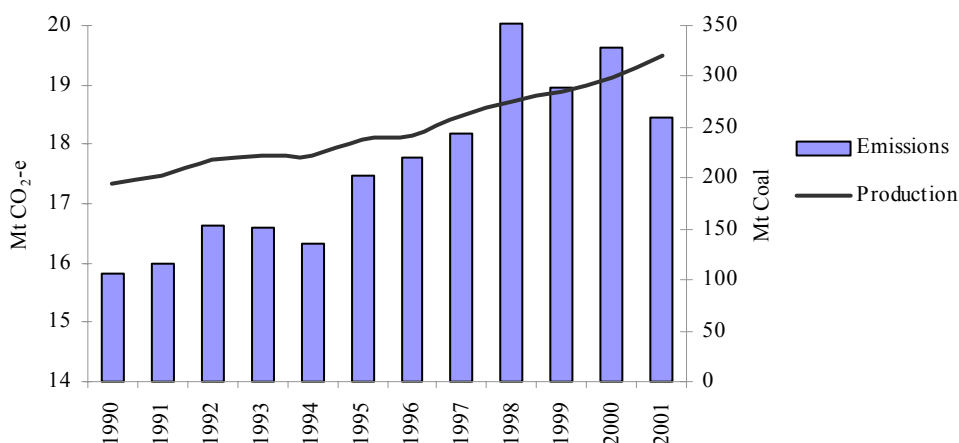
Overall Fugitive Emissions increased by 12.0% (3.4 Mt) between 1990 and 2001, and decreased by 2.1% (0.7 Mt) from 2000 to 2001 (Figure 7). From 2000 to 2001 fugitive emissions from Solid Fuels decreased by 1.2 Mt (6.1%) and Oil and Natural Gas emissions increased by 3.9% (0.5 Mt).

Figure 7. Total CO₂-equivalent Fugitive Emissions by subsector, 1990–2001



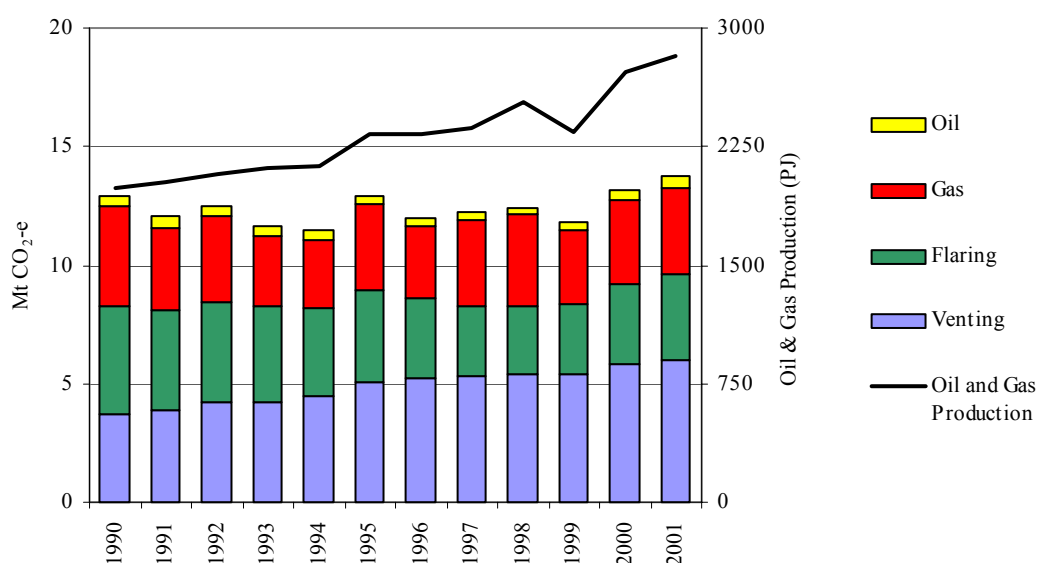
Net Solid Fuel emissions (CH_4 emissions less CH_4 recovered) increased by 16.6% (2.6 Mt) between 1990 and 2001. However, emissions tend to fluctuate from year to year, depending on the volume of coal mined and the share of gassy underground mines in total production. This is because it is the gassy underground mines that account for most fugitive emissions. Figure 8 shows that emissions from coal mining have generally been increasing since 1990. The increase in emissions is the result of an increase in overall activity—195 Mt of coal was produced in 1990 compared with 321 Mt in 2001, an increase of 65%. The emissions have not grown as fast as activity because growth has been greater in Class B (non-gassy) mines and surface mines than in Class A (gassy) mines. In addition, technologies to recover and utilise or flare CH_4 have been adopted in a small but growing number of mines. As the amount of CH_4 recovered is considered commercial-in-confidence only the net emissions are reported in the Inventory.

Figure 8. Fugitive CO_2 -equivalent emissions from coal mining, 1990–2001



Oil and Natural Gas fugitive emissions increased by 6.3% (0.8 Mt) between 1990 and 2001 (Figure 9). This compares with a 42% increase in production activity. The small rise in emissions relative to the increase in activity is the result of improvements in gas distribution and a reduction in the emissions from flaring. Between 2000 and 2001, emissions from oil related activities increased by 34.0% (0.14 Mt) and emissions from gas related activities decreased by 0.3% (0.01 Mt). Emissions from venting increased by 3.3% (0.2 Mt) from 2000 to 2001, and by 61.6% (2.3 Mt) between 1990 and 2001. Flaring related emissions increased by 6.0% (0.2 Mt) from 2000 to 2001, and decreased by 21.1% (1.0 Mt) between 1990 and 2001.

Figure 9. Fugitive CO₂-equivalent emissions from Oil and Gas production, 1990–2001



Methodology

Methane emissions from coal mining are based on a country specific Tier 2 approach where the emission factors ($\text{m}^3 \text{CH}_4/\text{tonne coal produced}$) are based on measurement from Australian mines. Emissions from venting and flaring, the other significant emissions source in this sector, are based on emissions estimates reported by the Australian Petroleum Production and Exploration Association. Flaring emissions are estimated using country specific default emission factors applied to a measured activity parameter (volume flared). Venting emissions are reported from measured data. Emissions from natural gas are based on country specific emission factors and activity data derived from statistics published by the Australian Gas Association. A full description of the methodologies and emission factors are presented in the *Workbook for Fugitive Fuel Emissions 2.1* and the supplements in the 1995 to 2001 Inventories (NGGIC 1996, 1997b, 1998, 1999; AGO 2000, 2001, 2002).

The main sources of data are the Australian Petroleum Production and Exploration Association Greenhouse Challenge submissions (<http://www.appea.com.au>), the Australian Gas Association's *Australian Gas Statistics* annual series, and the Department of Industry Science and Resources monthly series, *Australian Petroleum Statistics*.

Uncertainty and levels of confidence

An uncertainty analysis was conducted for Fugitive Emissions of CO₂, CH₄ and N₂O. The uncertainty distributions for emission factors and activity data for fugitive emissions from Solid Fuels are developed from confidence levels specified in the *Workbook for Fugitive Fuel Emissions 2.1* (NGGIC 1996). Confidence levels used for Oil and Natural Gas were based on expert judgment.

The overall uncertainty for Fugitive Emissions was estimated to be $\pm 11\%$ (Table 11). The estimated uncertainty for Solid Fuels CH₄ was $\pm 19\%$. Uncertainties in Oil and Natural Gas emissions were estimated to be $\pm 4\%$ for CO₂, $\pm 5\%$ for CH₄ and $\pm 4\%$ for N₂O.

Table 11. Quantified uncertainty values for key Fugitive Emissions subcategories^(a)

Greenhouse Gas Source and Sink Category		Uncertainty (%)			
		CO ₂	CH ₄	N ₂ O	CO ₂ -e
1 ENERGY					
B Fugitive Emissions		±4	±14	±4	±11
1B1 Solid Fuels		NE	±19	NE	±19
activities	1B1ai Underground mines	NE	±21	NE	±21
	Underground	NE	±21	NE	±21
	Post mining	NE	±17	NE	±17
	1B1aii Surface mining	NE	±17	NE	±17
1B2 Oil and Natural Gas		±4	±5	±4	±4
1B2a Oil		±8	±5	±8	±7
1B2b Natural gas		±9	±9	NA	±9
1B2c Venting and flaring		±4	±4	±4	±4

(a) Uncertainty reported at 95% confidence limits estimated using Latin Hypercube analysis

Changes since the 2000 Inventory

Emissions from underground mines were recalculated in response to the reclassification of the North Goonyella coal mine from Class B (non Gassy mine) to Class A (Gassy mine).

Quality control

The IPCC Good Practice Tier 1 general inventory level quality control procedures were conducted for all subsectors. Specific checks included a detailed check of the largest emissions subcategory 1B1a coal mining and handling. A detailed comparison of the data from the current year (2001) with data from all previous years (1990–2000) was carried out. These checks were able to identify and eliminate sources of random error in data transcription.

3.2 INDUSTRIAL PROCESSES

Total net emissions estimated from Industrial Processes were 24.9 Mt CO₂-e in 2001, or 4.6% of net national emissions (Table 12).

Greenhouse gas emissions from Industrial Processes are a by-product of various production processes. For example, high temperature processing of calcium carbonate to produce quick-lime gives rise to CO₂ emissions. The main determinant of Industrial Processes emissions from year to year is the quantity of the relevant product that is produced. Over time, technological change in production processes can also have a significant impact on Industrial Processes emissions per unit of production. For example, better process monitoring and control can reduce process emissions. Emissions from energy used in Industrial Processes are included in Stationary Energy.

Activity data for soda ash production and use, nitric acid production and ammonia production are commercial-in-confidence and due to the direct relationship between activity and emissions, emissions estimates by gas species are also confidential. These emissions are aggregated and reported as CO₂-e emissions. The discussion of speciated emissions from Industrial Processes relates to those subsectors where data are not confidential. Total CO₂-e emissions include all subsectors for which estimates have been derived.

Table 12. Industrial Processes sector CO₂ equivalent emissions, 2001

Greenhouse Gas Source and Sink Categories	CO ₂ -equivalent emissions (Gg)					%Total Net National Emissions
	CO ₂ ^(a)	CH ₄ ^(b)	N ₂ O ^(c)	HFC/PFC /SF ₆	Total ^(d)	
Total Net National Emissions	377,639	124,255	34,098	3,872	542,618	100.0
2 INDUSTRIAL PROCESSES	18,212	58	20	3,872	24,916	4.6
A Mineral Products	5,100	NE	NE	NA	5,100	0.9
B Chemical Industry ^(d)	C	NE	C	NA	2,754	0.5
C Metal Production	13,112	58	20	1,527	14,717	2.7
D Other Production	NE	NA	NA	NA	NE	NA
E Production of Halocarbons and Sulphur Hexafluoride	NO	NO	NO	NO	NO	NA
G Consumption of Halocarbons and Sulphur Hexafluoride ^(e)	NA	NA	NA	2,345	2,345	0.4

(a) GWP = 1. (b) GWP = 21. (c) GWP = 310. (d) Includes confidential emissions from soda ash production and use (CO₂), nitric acid production (N₂O) and ammonia production (CO₂); disaggregated emissions are confidential. (e) Emissions of SF₆ from switchgear are not estimated because of inadequate data.

The main gas emitted by Industrial Processes is CO₂, contributing 73.1% (18.2 Mt) of the sector's emissions in 2001. PFCs contributed 6.1% (1.5 Mt), HFCs contributed 9.4% (2.3Mt), N₂O contributed 0.1% (0.02Mt), and CH₄ 0.2% (0.06 Mt). CO₂-e emissions from the subsectors where data are confidential contributed 11.1% (2.8 Mt).

Metal Production contributed 59.1% (14.7 Mt) of the sector's CO₂-e emissions, Mineral Products contributed 20.5% (5.1 Mt), Chemical Industries contributed 11.1% (2.8 Mt), and the Consumption of Halocarbons contributed 9.4% (2.3 Mt).

Cement (clinker) production was responsible for 65.3% (3.3 Mt) of emissions from Mineral Products, followed by lime production at 19.9% (1.0 Mt), and limestone and dolomite use at 14.8% (0.8 Mt). Emissions from the Mineral Products subsector are exclusively CO₂.

Metal Production emissions are mostly attributable to iron and steel production with 71.7% (10.5 Mt) of CO₂-e emissions, and aluminium smelting with 28.3% (4.2 Mt). Emissions from the Metal Production subsector comprise CO₂, CH₄, N₂O, and PFCs.

Consumption of the halocarbon species HFC-125, HFC-134a and HFC143 in refrigeration and air conditioning equipment are the only sources included in the Inventory. It is proposed that emissions from other consumption sources be included in future.

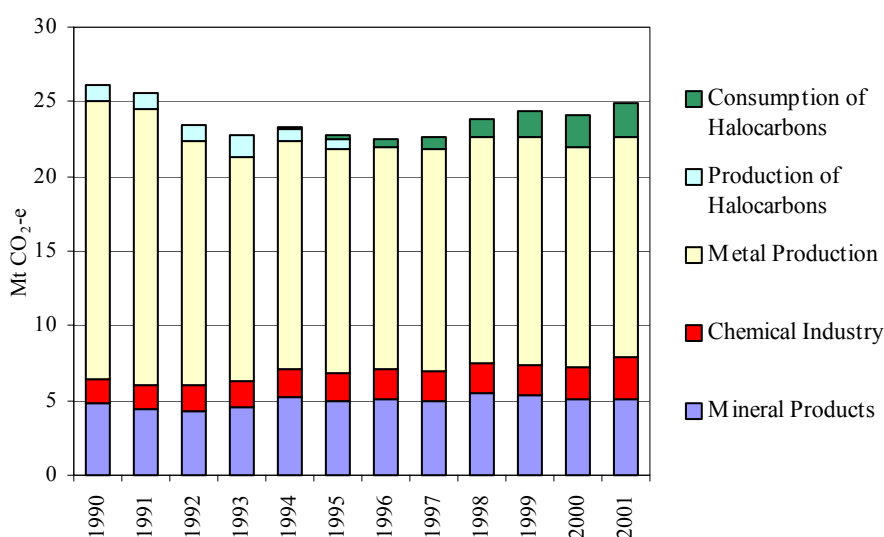
Soda ash production and use (CO₂ emissions), nitric acid production (N₂O emissions) and ammonia production (CO₂ emissions) are all included in the Chemical Industry subsector for which speciated emissions are confidential. Total emissions from this subsector are 2.8 Mt CO₂-e. Data on other chemical industries are not available at present.

Trends

Net emissions from Industrial Processes decreased by 4.6% (1.2 Mt) from 1990 to 2001, but increased by 3.4% (0.82 Mt) from 2000 to 2001 (Figure 10).

Net emissions from Mineral Products increased by 7.1% (0.34 Mt) from 1990 to 2001 due to increased production of cement clinker and lime. From 2000 to 2001, net emissions declined by 1.0% (0.05 Mt) as a result of a decrease in limestone and dolomite use, attributable to rationalisation in the Australian steel industry.

Figure 10. Emissions from Industrial Processes by subsector, 1990–2001



Chemical Industry emissions increased by 59.0% (1.0 Mt) between 1990 and 2001 and by 32.8% (0.7 Mt) from 2000 to 2001 due to increased production of nitric acid and ammonia.

Net emissions from Metal Production declined by 20.4% (3.8 Mt) from 1990 to 2001 despite an increase of 44.8% in aluminium production. This was due to a 61.2% (2.4 Mt) reduction in PFC emissions from aluminium smelting as a result of technological improvements in process control and monitoring. From 2000 to 2001, net Metal Production emissions decreased by 0.4% (0.06 Mt). Between 1996 and 2000 SF₆ was used as a cover gas in experimental work preparatory to the development of a commercial magnesium casting plant. A small quantity of SF₆ is still used in downstream uses of magnesium, however data are not available on these sources.

Halocarbons and sulphur hexafluoride are not produced in Australia. HCFC-22 was produced in Australia from 1990 to 1995 and the fugitive emissions of HFC-23 from this production peaked at 1.4 Mt CO₂-e in 1993 before declining to zero in 1996 when HCFC-22 production ceased.

Since the use of HFCs in refrigeration and air conditioning equipment commenced in 1994, emissions have increased by 2.2 Mt.

Several sources of greenhouse gases are not included in the Industrial Processes sector of the Inventory because of a lack of data. These include complete data on the consumption of halocarbons and SF₆ (2F) and the production of organic chemicals and plastics.

Emissions from industries that are currently omitted from the Inventory are considered to be small but growing. Continued growth in these emissions in the future combined with the high global warming potential of some of these greenhouse gases mean that they could become a significant component of the Inventory. Specifically, emissions of HFCs are likely to increase as they progressively replace ozone depleting substances.

Further work is required to determine SF₆ emissions from electricity transmission and distribution. To this end, research is being undertaken by the Australian Greenhouse Office as part of Australia's National Greenhouse Strategy to improve information and emissions estimates for the sector. Future Inventories will reflect the outcomes of this work.

Methodology

The methodologies used to estimate emissions associated with each industrial process are consistent with the IPCC approach. Generally the methods involve the product of activity level data (the amount

of material produced or consumed) and an associated emission factor per unit of production or consumption. Country specific emission factors are used where available.

Emissions of HFC from refrigeration and air conditioning are estimated using equipment based models that are consistent with IPCC Tier 2a methodologies (Burnbank Consulting 2002).

A full description of the methodologies and emission factors are presented in the *Workbook for Industrial Emissions 7.1* and the supplements in the 1995, 1996, 1997, 2000 and 2001 Inventories (NGGIC 1996, 1997b, 1998, 1999; AGO 2002). Any extensions of, or departures from, the IPCC methodologies are explained in the Workbook.

The main sources of data are Cement Industry Federation, National Lime Association, Wesfarmers, Incitec, Australian Aluminium Council, BHP, and ABARE's *Australian Commodity Statistics 2001* (ABARE 2002b).

Uncertainty and levels of confidence

An analysis of uncertainty was conducted using the methods recommended in the Revised 1996 IPCC Guidelines and random sampling techniques described in the IPCC Good Practice report (Monte Carlo and Latin Hypercube simulations). Uncertainty estimates of the components of each emission estimate (activity levels and emission factors) are based on expert judgement.

Using the IPCC approach and assuming the estimates are independent gives an overall uncertainty for estimated CO₂ emissions from the Industrial Processes sector of $\pm 6\%$ (Table 13). The overall uncertainty for CO₂ emissions from Metal Products, which contributes some 59.1% of the CO₂-e emissions from the sector, is estimated to be $\pm 7\%$. Uncertainty in these estimates is the major determinant of uncertainty in aggregate emissions for Industrial Processes.

Table 13. Quantified uncertainties for Industrial Processes subsectors using the IPCC approach

Greenhouse Gas Source and Sink Categories	Uncertainty (%)			
	CO ₂	CH ₄	N ₂ O	PFCs
2 INDUSTRIAL PROCESSES	± 6	± 9	± 16	NA
A Mineral Products	± 5	NA	NA	NA
1 Cement Production	± 7	NA	NA	NA
2 Lime Production	± 13	NA	NA	NA
3 Limestone and Dolomite Use	± 9	NA	NA	NA
4 Soda Ash Production and Use	± 22	NA	NA	NA
B Chemical Industry	± 7	NA	± 16	NA
1 Ammonia Production	± 7	NA	NA	NA
2 Nitric Acid Production	NA	NA	± 16	NA
C Metal Production	± 7	± 11	± 11	NA
1 Iron and Steel Production	± 10	± 11	± 11	NA
3 Aluminium Production	± 7	NA	NA	NA
4 SF ₆ Used in Aluminium and Magnesium Foundries	NA	NA	NA	NA

As the IPCC approach is not suitable for assessing uncertainty where approximately normal distribution assumptions cannot be sustained, an analysis was undertaken using Monte Carlo and Latin Hypercube techniques. These techniques can take into account asymmetric probability distributions associated with emission factors. For example, as the average emission factor for PFCs tends to the

minimum limit that is understood to be technically feasible, the probability of the emission factor being lower than estimated is less than the probability of it being higher than estimated.

The Monte Carlo analysis yielded an overall uncertainty of $\pm 6\%$ and the Latin Hypercube analysis gave an uncertainty of $\pm 5\%$ (Table 14). The uncertainty in the Industrial Processes subsectors ranged from $\pm 7\%$ to $\pm 29\%$.

Table 14. Quantified uncertainty values for key Industrial Processes subsectors using different techniques^(a)

Greenhouse Gas Source and Sink Categories	Uncertainty (%)	Derivation
2 INDUSTRIAL PROCESSES		
A1. Cement Production (CO ₂)	± 7	Based on IPCC approach
	± 7	Monte Carlo
	± 7	Latin Hypercube
A2. Lime Production (CO ₂)	± 14	Based on IPCC approach
	± 14	Monte Carlo
	± 15	Latin Hypercube
A3. Limestone Use (CO ₂)	± 11	Based on IPCC approach
	± 11	Monte Carlo
	± 12	Latin Hypercube
A3. Dolomite Use (CO ₂)	± 11	Based on IPCC approach
	± 11	Monte Carlo
	± 11	Latin Hypercube
B2. Nitric Acid (N ₂ O)	± 16	Based on IPCC approach
	± 15	Monte Carlo
	± 16	Latin Hypercube
C1. Iron and Steel (CO ₂)	± 10	Based on IPCC approach
	± 11	Monte Carlo
	± 10	Latin Hypercube
C1. Aluminium Production (CO ₂)	± 7	Based on IPCC approach
	± 7	Monte Carlo
	± 7	Latin Hypercube
C1. Aluminium Production (CF ₄ as CO ₂ -e)	NA	Based on IPCC approach
	± 29	Monte Carlo
	± 27	Latin Hypercube
C1. Aluminium Production (C ₂ F ₆ as CO ₂ -e)	NA	Based on IPCC approach
	± 27	Monte Carlo
	± 28	Latin Hypercube
Total CO ₂ -e for these subsectors	NA	Based on IPCC approach
	± 6	Monte Carlo
	± 5	Latin Hypercube

(a) Uncertainty reported at 95% confidence limits assuming approximately normal distributions.

Changes since the 2000 Inventory

There have been several changes since the 2000 Inventory. These include the following:

- PFC emission factors have been revised as part of continuous improvement by the aluminium industry as it implements the IPCC Good Practice report methods for estimating emissions.
- The nitric acid emission factor has been revised on the basis of continuous monitoring data. Previously, a default factor was used. The revised factor is substantially higher than the default factor. All data associated with nitric acid production are confidential.

- Soda ash production and use are now included in the total CO₂-e emissions from confidential subsectors.
- Emissions from reductant use in iron and steel have been reallocated from the Energy Sector to the Industrial Processes sector. All years from 1990 to 2000 have been recalculated.
- Emissions of HFC-23 from the production of HCFC-22 are included for the years 1990 to 1995. In addition, estimated HFC emissions from refrigeration and air conditioning equipment have been included.

Quality control

The IPCC Good Practice Tier 1 general inventory level quality control procedures were conducted for four source categories (cement clinker, lime, limestone and dolomite use, and aluminium production). Most of the data used for the Industrial Processes emissions estimates are provided by industry. At this stage the Inventory continues to rely on the quality control procedures of the data providers.

Comparisons with previous Inventory estimates are undertaken and large changes or other anomalies are discussed with the relevant industry representatives.

Production of the major commodities that influence emissions from Industrial Processes are related to the strength of the domestic economy and international commodity markets. The activity data for cement clinker, aluminium, steel, and lime for 2001 are consistent with what would be expected based on economic growth and international commodity demand. With regard to metal products, ABARE publishes information on the outlook for commodities both domestically and internationally. These publications are examined to identify any anomalies between information reported by industry and that analysed by ABARE, although it is recognised that ABARE depends upon industry for much of the basic information used in compiling commodity outlooks. In turn, industry representatives explore any issues of concern with experts employed by the relevant companies. A high level of cooperation is provided by the aluminium industry, cement industry, ammonia and nitric acid industry, and iron and steel industry.

3.3 AGRICULTURE

Agriculture produced an estimated 105.8 Mt CO₂-e emissions or 19.5% of net national emissions in 2001 (Table 15). These emissions consisted principally of CH₄ from Enteric Fermentation by livestock and N₂O from Agricultural Soils (the cultivation of agricultural soils, the use of nitrogen fertilisers on crops and improved pastures, and faecal and urine deposition from grazing animals onto pasture). These two sources accounted for 61.6% (65.2 Mt) and 18.2 % (19.3 Mt) respectively of the total greenhouse gas emissions from Agriculture. The Agriculture sector is the dominant national source of both CH₄ and N₂O—accounting for 62.7% (77.9 Mt) and 81.1% (27.9 Mt) respectively of the net national emissions for these two gases.

While livestock production and associated greenhouse gas emissions declined by 1.8% (1.2 Mt) between 1990 and 2001, there was a 1.1% (0.7 Mt) increase in emissions from 2000 to 2001. In contrast, there has been a 46.7% (11.9 Mt) increase in emissions from the remaining Agriculture subsectors between 1990 and 2001. The net result of these trends is an increase of 11.2% (10.7 Mt) in greenhouse gas emissions from Agriculture between 1990 and 2001, and a 2.7% (2.7 Mt) increase from 2000 to 2001.

Table 15. Agriculture sector CO₂-equivalent emissions, 2001

Greenhouse Gas Source and Sink Categories	CO ₂ -equivalent emissions (Gg)				%Total Net National Emissions
	CO ₂ ^(a)	CH ₄ ^(b)	N ₂ O ^(c)	Total	
Total Net National Emissions	377,639	124,255	34,098	542,618	100.0
4 AGRICULTURE		77,866	27,901	105,766	19.5
A Enteric Fermentation		65,205		65,205	12.0
B Manure Management		1,913	1,141	3,054	0.6
C Rice Cultivation		738		738	0.1
D Agricultural Soils		NE	19,286	19,286	3.6
E Prescribed Burning of Savannas		9,745	7,363	17,108	3.2
F Field Burning of Agricultural Residues		265	112	376	0.1

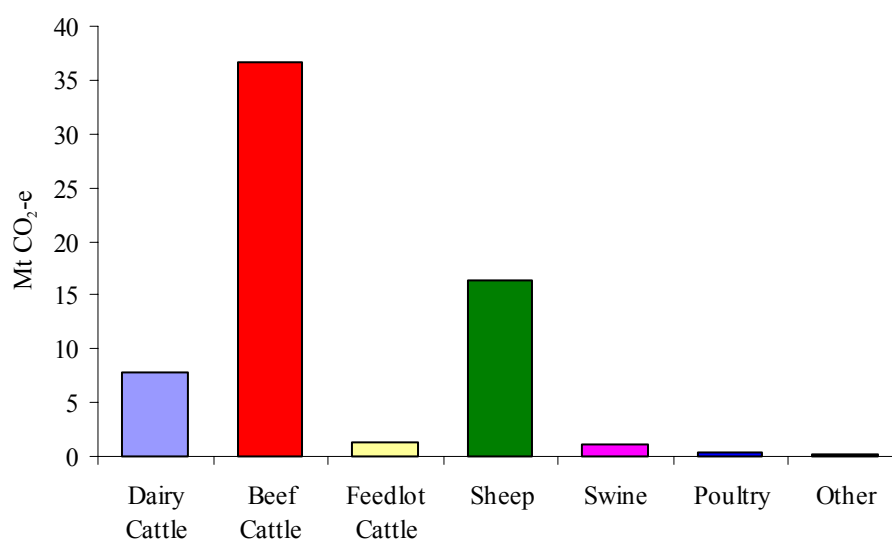
(a) GWP = 1. (b) GWP = 21 (c) GWP = 310

3.3.1 Livestock

Total emissions from Livestock are calculated as the total of the Enteric Fermentation and Manure Management subsectors (see Table 16). Livestock emissions were 68.3 Mt CO₂-e in 2001; this represented 64.5% of the Agriculture sector's emissions and 12.6% of net national emissions. The majority of these emissions were CH₄ (98.3%) with the remainder being N₂O. Most (97.1%) of the CH₄ emissions from Livestock arose from Enteric Fermentation with the remainder from Manure Management systems associated with intensive livestock industries.

Beef cattle (including feedlot animals) are the largest contributors of enteric CH₄, generating 62.6% of emissions in that subsector, followed by sheep (25.4%) and dairy cattle (11.6%). Swine industries are the major source of CH₄ from manure (65.6%), with dairy cattle (31.0%) and poultry (2.6%) also contributing. Emissions of N₂O mainly arise from feedlot cattle and poultry operations. Emissions from each livestock class are shown in Figure 11.

Figure 11. CO₂-equivalent emissions from different livestock classes, 2001

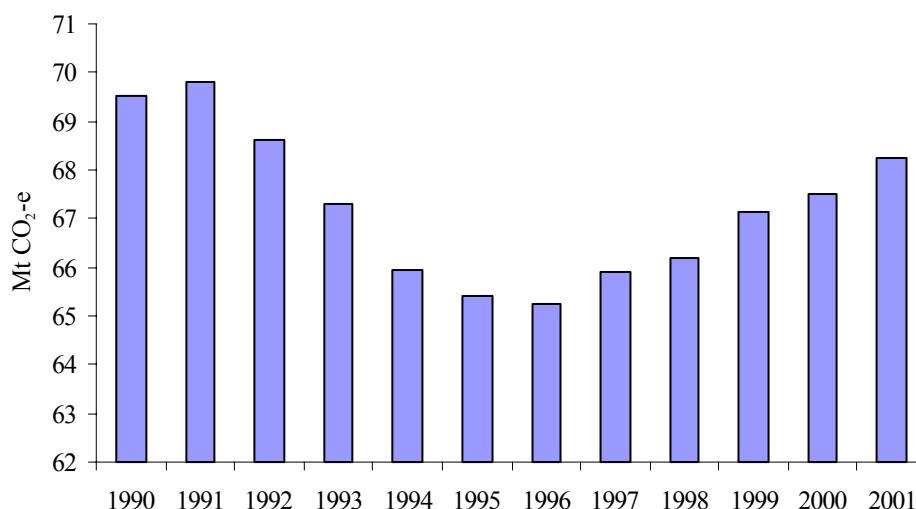


Trends

Livestock-related emissions peaked around 1990–91 (Figure 12), largely due to high sheep numbers. Emissions declined by 1.8% (1.2 Mt) between 1990 and 2001. The decline was the result of a 31.9% reduction in sheep numbers, due largely to an economic downturn in the industry following removal of the wool-price support scheme. There has been a partial compensating increase in beef (8.5%) and dairy cattle (23.7%) numbers since 1990, with total livestock emissions increasing after 1996 (Figure 12). Emissions from feedlot cattle more than doubled from 1990 to 2001 (an increase of 186%) due to the growth in the feedlot industry, but together these remain a small contributor (2.4%) to total livestock emissions. In 2001, Livestock emissions increased slightly (1.1% or 0.7 Mt) from 2000 levels.

The relative contribution of CH₄ and N₂O to Livestock emissions has been relatively stable. N₂O emissions increased by 116% (0.6 Mt CO₂-e) from 1990 to 2001 due to increasing intensification of the livestock industries. This trend is continuing with emissions increasing by 2.2% from 2000 to 2001. However, this results in little change to aggregate emissions because N₂O is such a small component of sector emissions.

Figure 12. CO₂-equivalent emissions from Livestock, 1990–2001



Methodology

Methane emissions from Enteric Fermentation are estimated using a country-specific Tier 2 approach for cattle (dairy, feedlot and free-range), sheep and pigs. These livestock classes produce over 98% of the national greenhouse emissions from livestock. Emissions are estimated based on feed intake which is derived from information on liveweights, liveweight gain, milk or wool production and feed digestibility. A Tier 1 approach using both country specific and IPCC default emission factors is used to estimate enteric CH₄ emissions for all other livestock classes. These are a small component (less than 2%) of the national Livestock emissions.

Emissions from Manure Management are calculated using the IPCC Tier 2 approach and they are based on an estimate of the volatile organic fraction of manure, the potential capacity of this material to produce CH₄, and the fraction of this potential likely to be realised in the management systems used in Australia. Nitrogen excretion in urine and faeces is calculated for cattle and sheep using a simple nitrogen balance technique, whilst swine excretion rates are based on an industry nutrient balance model. Emissions of N₂O are a function of this excretion, the manure management systems used, and the IPCC default emission factors.

A full description of the methodologies and emission factors are presented in the *Workbook for Livestock 6.2* (NGGIC 2003)

The main sources of data are: the Australian Bureau of Statistics for most livestock numbers and for wool production, the Australian Lotfeeders Association for feedlot animal numbers (<http://www.lotfeeders.com>), and industry statistics for milk production (<http://www.dairycorp.com.au>). Various input data such as liveweight gains and pasture digestibility are provided from databases or expert opinion.

Uncertainty and levels of confidence

An uncertainty analysis was undertaken for the Livestock subsectors, addressing both CH₄ and N₂O emissions. Uncertainty distributions were developed for the inputs and the relationships used in the Inventory. Where possible, uncertainties were based on quantitative analysis of probability distributions. Nevertheless, many of the distributions remain based on expert judgement. For many biological variables there are limits to the likely minimum and maximum values and these constrain the distributions. For example, feed intakes have maximum values that are defined by the physiology of the livestock and the characteristics of the feed. Minimum values of feed intake relate to productivity and survival below which the industry wouldn't attempt to operate.

The estimated uncertainty in Enteric Fermentation emissions ranged from –5.1% to +5.9% (Table 16) while the uncertainty in the Manure Management emissions was in the order of 10%. For total CO₂-e emissions from Livestock the uncertainty was estimated to be –5.3% to +6.1%. The uncertainty in the reported cattle numbers was the most significant contributor to the overall uncertainty even though this has been reduced over the past year.

Recent measurements of CH₄ emissions from sheep on high quality pastures and cattle on grain diets in Australia show that the Inventory procedure produces accurate estimates of CH₄ emission rates. However, further work is needed to reduce uncertainties relating to feed intakes, CH₄ emissions from sheep on low quality pasture, CH₄ emissions from beef cattle, and emissions from manure under a range of conditions.

Table 16. Relative uncertainty in emission estimates for the Livestock subsector^(a)

Greenhouse Gas Source and Sink Categories	Uncertainty (%)	
	CH ₄	N ₂ O
A. Enteric Fermentation	–5.1 to +5.9	
B. Manure Management	–9.8 to +11.1	–10.1 to +10.6

(a) Uncertainty reported at 95% confidence limits estimated using Monte Carlo analysis

Changes since the 2000 Inventory

A comprehensive review of the livestock methodology and data was undertaken during 2001–02. This review recommended a number of changes to the Australian methodology. These recommended changes (summarised below) have now been incorporated into the Inventory and all previous inventories from 1990 to 2000 have been recalculated.

Dairy Cattle

Minor adjustments have been made to the liveweights, liveweight gains, feed characteristics and the allocation of wastes to the different manure management systems. For milking cows a maximum of 92% of manure is allocated to pasture range and paddock as it is assumed that milking cows spend between 8% and 16% of the day in milking sheds and laneways. Manure from all other dairy cattle classes are allocated entirely (100%) to pasture range and paddock.

Non-Dairy Cattle and Sheep

Adjustments have been made to the liveweights, liveweight gains and feed characteristics. In addition, an estimate of the proportion of animals lactating in each season has been incorporated into the calculation of the additional intake for milk production.

Pigs

Based on an average of values in the literature, the enteric fermentation methane conversion rate has been increased to 0.7% of gross energy intake. The estimation of volatile solids and nitrogen in the waste stream of piggeries is now estimated using results from a published nutrient balance model used by the industry. This approach includes both the volatile solids and nitrogen excreted by the pigs and in the waste feed entering the manure management system.

Poultry

The default IPCC volatile solid value previously used to estimate emissions was believed to be overestimating production. The new methodology calculates volatile solids based on intake and digestibility of feed. For the estimation of N₂O emissions the poultry manure is now allocated between manure management systems with and without bedding.

Other

Nitrogen excretion rates for other livestock classes were revised as these are based on the average excretion rates of beef cattle and sheep, which have changed as result of the modifications described above.

Quality control

The IPCC Good Practice Tier 1 general inventory level quality control procedures were conducted for all subsectors. These checks addressed input data values, formulae, and summation procedures. The quality of much of the input data depends on the procedures of the organisations providing the data (e.g. the Australian Bureau of Statistics, Australian Lot Feeders Association, Meat and Livestock Australia, Wool International, Australian Dairy Corporation). Documentation of their quality assurance–quality control procedures was not readily available. The Australian Bureau of Statistics, for example, has a range of quality assurance–quality control procedures associated with survey design, data input and consistency checks on the survey results and the aggregated values (Nigel Gibson, Australian Bureau of Statistics, pers. comm.).

3.3.2 Other Agriculture

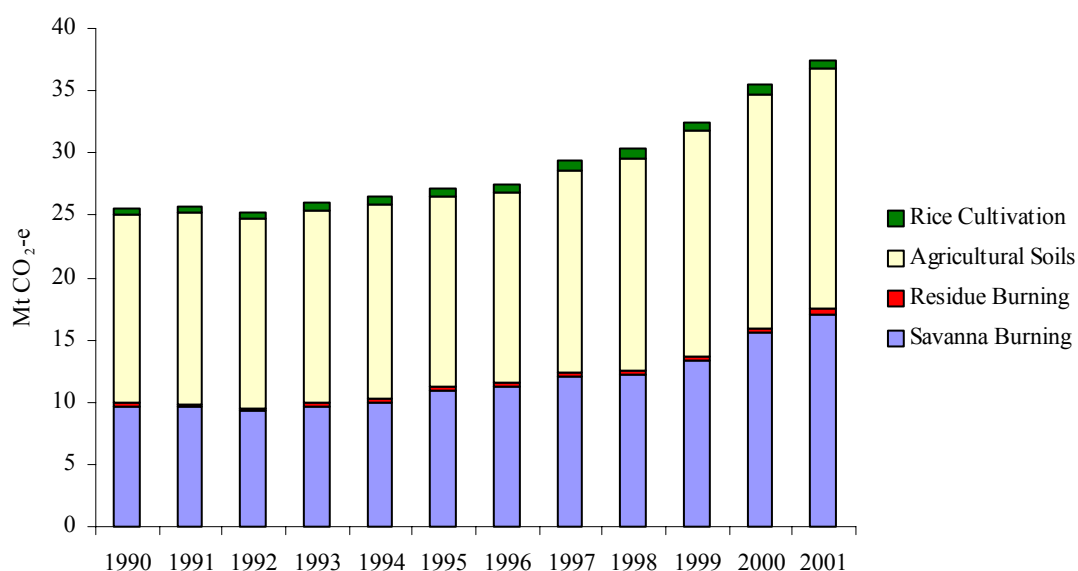
Total estimated emissions from the Other Agriculture subsectors in 2001 were 37.5 Mt CO₂-e. These include emissions from the Rice Cultivation (0.7 Mt), Agricultural Soils (19.3 Mt), Prescribed Burning of Savannas (17.1 Mt) and Field Burning of Agricultural Residues (0.4 Mt) subsectors (see Table 15). The burning of tropical savanna and temperate grasslands continues to be a small but significant contributor to agricultural (16.2 %) and national (3.2%) CO₂-e emissions of CH₄ and N₂O.

Trends

Emissions from the Other Agriculture subsectors increased by 46.7 % (11.9 Mt) between 1990 and 2001 (Figure 13). Specific changes in emissions are listed below:

- Emissions of CH₄ from rice cultivation increased by 50.4 % from 1990 to 2001 due to increases in the area of rice sown. Although the area of rice sown increased by 47% between 1990 and 1997, increasing competition for water from other industries resulted in some reduction in the area of rice sown between 1998 and 2002. The 2001 season went against this trend with the largest area of production in the last decade. As a three-year average (2000 to 2002) of crop production is used to calculate the 2001 emission, there was actually a small decline from 2000 to 2001 of 0.5%.
- Emissions of N₂O from Agricultural Soils increased by 27.4% from 1990 to 2001. This comprised:
 - a decline of 9.2% in emissions due to a reduction in the field deposition of animal waste that corresponds with reductions in the sheep and cattle populations
 - an increase of 65.1% in N₂O emissions from manure application in the field, predominantly from feedlot cattle and poultry production
 - an increase of 6.0% in emissions of N₂O from soil disturbance—this was a consequence of a 37% increase in crop area since 1990 which was offset by a 36% (or 10 million hectares) decline in the area of improved pasture between 1994 and 1996; the latter change is a statistical artefact associated with a change in the survey question; both before and after 1995, total pasture area and total crop area increased at similar rates
 - an increase of 140% in N₂O emissions from fertilised crops and pastures due to increased artificial nitrogen fertiliser application.
- CO₂-e emissions from Field Burning of Agricultural Residues increased by 38.6% from 1990 to 2001, comprising a 62.3% increase in emissions from cereal stubble burning, and a 35.1% decline in emissions from sugar cane burning as harvesting practices change.

Figure 13. Total emissions of Other Agriculture subsectors, 1990–2001



Reported estimates currently indicate a 77.0% (7.4 Mt) increase in emissions from savanna fires from 1990 to 2001. However, the methodology for estimating the area of fires is not consistent throughout this period—satellite imagery has been used exclusively in the later years and only on a limited basis for the early years of the decade. Fire scar areas in Western Australia and the Northern Territory measured by this means tend to be larger (up to 100%) than the fire areas estimated for the same

regions by local fire authority experts. There are insufficient data at this point to determine a correction factor for the earlier years.

Emissions from the Other Agriculture subsectors increased by 5.7% from 2000 to 2001. Over this period emissions of N₂O from Agricultural Soils increased by 2.3% and emissions from Field Burning of Agricultural Residues increased by 0.6%. The largest change in estimated emissions between 2000 and 2001 was a 10.2% (1.6 Mt) increase in emissions from savanna burning in Northern Australia. This was the result principally of extensive fires in Western Australia in 2001, the Northern Territory during 2001 and 2002, and in Queensland in 2000.

Methodology

The methodologies, emission factors and other parameters used to compile emissions from the Other (non-livestock) Agriculture subsectors are largely country specific, sourced principally from Australian studies. A full description of the methodologies and emission factors are presented in the *Workbook for Non-CO₂ Gases from the Biosphere 5.1* and the supplements in the 1996, 1997, 1999 and 2000 Inventories (NGGIC 1996, 1998, 1999; AGO 2001, 2002).

Emissions from Rice Cultivation (4C) are estimated using the IPCC Tier 2 methodology and a country specific emission factor. The methodologies for Prescribed Burning of Savannas (4E), and Field Burning of Agricultural Residues (4F) closely correspond to the IPCC Tier 2 methodologies but with modifications relevant to Australian conditions and the availability of relevant data.

Agricultural Soils (4D) emissions are estimated using country specific methods and emission factors. The estimated emissions from synthetic fertiliser application, nitrogen input from manure applied to soils and excretion of nitrogen on pasture range and paddock and correspond directly to the equivalent IPCC source categories. The emission of N₂O from soil disturbance (4D4) is a country specific category that accounts empirically for emissions associated with crop residues, nitrogen fixation, soil cultivation and atmospheric nitrogen deposition. It is defined as the difference between the annual emission rates from crop and pasture soils in the absence of direct inorganic and animal fertiliser application and the N₂O emissions from soils of the pristine ecosystems they replaced. The emission factor for this subsector is derived from Australian field studies in the wheat belt of Western Victoria, and the grazing systems of the Riverina. The soil disturbance category includes emissions from a number of IPCC categories, however, there is currently no reliable method to disaggregate them.

The main sources of data are the Australian Bureau of Statistics Agricultural Survey and Agricultural Census, Agricultural Industry Associations (Australian Rice Growers Association, the Australian Canegrowers Association, NSW Canegrowers Association, the Fertiliser Industry Federation of Australia), and the State Government Authorities responsible for fire control in private land, state forests, crown land, and National Parks.

Uncertainty and levels of confidence

Estimates of uncertainties in the emissions for the Other Agriculture subsectors were determined using a Latin Hypercube analysis (Table 17). Ideally, the probability distributions of the input variables would be determined by statistical analysis of real data. However, in the current analysis, suitable data sets were not available and the probability distributions were defined using expert judgement. The uncertainty in emission factors and associated parameters were determined from surveys of the published international literature, with emphasis on local Australian measurements. All variables are considered to be independent except fuel load and burning efficiency, which were positively correlated. The activity data with the greatest uncertainties are the areas of savanna fires. These are collated from a large and dispersed number of State government organisations with a wide range of data quality protocols.

There is large relative uncertainty in the emission estimates from all subcategories, ranging from approximately $\pm 20\%$ in the Rice Cultivation subsector, to -52% to $+110\%$ for Agricultural Soils

(animal production). Significantly, in all subsectors, most of this uncertainty was derived from the uncertainties in emission factors and associated parameters. Uncertainty in the activity data was a minor contributor to overall uncertainty. This is a result of using either three-year or ten-year averages of annual activity data. The effect of averaging is to significantly reduce the sensitivity of the emissions estimates to uncertainty in the value for any individual year. In most cases, the uncertainty ranges are distributed asymmetrically around the estimates because while emission factors usually have well constrained minima, their maxima are generally unconstrained.

Table 17. Relative uncertainty in emission estimates for Other Agriculture subsectors^(a)

Greenhouse Gas Source and Sink Categories	Uncertainty (%)				
	CH ₄	N ₂ O	NO _x	CO	NMVOC
4. AGRICULTURE					
C. Rice Cultivation					
1. Irrigated	-19 to 22				
D. Agricultural Soils		-52 to 110			
1. Direct Soil Emissions		-51 to 102			
2. Animal Production		-91 to 344			
4. Other		-76 to 189			
E. Prescribed Burning of Savannas	-64 to 120	-67 to 131	-67 to 131	-63 to 116	-62 to 115
F Field Burning of Agricultural Residues	-34 to 50	-36 to 51	-38 to 54	-36 to 57	-37 to 54
1. Cereals	-37 to 54	-44 to 66	-45 to 69	-40 to 62	-40 to 60
2. Pulse	NE	NE	NE	NE	NE
3. Tuber and Root	NE	NE	NE	NE	NE
4. Sugar Cane	-49 to 69	-51 to 72	-51 to 71	-49 to 66	-49 to 66

(a) Uncertainty reported at 95% confidence limits estimated using Latin Hypercube.

Changes since the 2000 Inventory

There have been two changes since the 2000 Inventory:

- Nitrogen deposition data were updated following the revision of the livestock methodology. The changes are minor in magnitude (approximately a 3% increase). It is assumed that all nitrogen not emitted as N₂O from manure treatment systems is ultimately applied to soil. This removes a minor case of double accounting which occurred in previous inventories.
- Sugar cane production and the proportion burnt in New South Wales have been revised for 1996–2000. These statistics are now sourced directly from the NSW Canegrowers Association.

The 2001 Australian Bureau of Statistics Agricultural Survey and Agricultural Census collected data on the extent of crop stubble burning throughout Australia. These data confirmed that the value of 0.23 for the parameter ‘fraction of crop stubble burned annually’, which was established from Australian Bureau of Statistics surveys in Victoria, and expert advice in other States, is still appropriate.

Quality control

The IPCC Good Practice Tier 1 general inventory level quality control procedures were conducted for all four subsectors. All data used in this section of the Inventory have been checked for transcription errors, accuracy of application of the methodology algorithms, and consistency with emission

estimates that were published in national Inventories for preceding years. At this stage the Inventory continues to rely on the quality control procedures of the data providers—the data collected by industry associations are considered to be accurate. Other data used in the Inventory are derived from the Agricultural Census conducted by the Australian Bureau of Statistics. The Bureau conducts a range of quality assurance–quality control procedures to check the accuracy and completeness of collection.

3.4 LAND USE CHANGE AND FORESTRY

The 2001 National Greenhouse Gas Inventory is presented to meet the accounting provisions of both the Kyoto target and the UNFCCC. The rules applying to the compilation of inventories for these two applications differ and produce different emission estimates.

3.4.1 Kyoto accounting

According to the Kyoto accounting provisions, land use, land use change and forestry activities constituted a net source of 25.9 Mt in 2001, representing 4.8% of the net national emissions (Table 18).

For Australia's Kyoto target, the treatment of emissions from land use change activities is the same as reported for inventory accounting under the UNFCCC—see subsector 5B Forest and Grassland Conversion below.

Under Kyoto accounting, reforestation activities (plantations established since 1990) are estimated to have sequestered approximately 11.1 Mt of CO₂ in 2001. Strictly speaking, the greenhouse sinks credits are accounted for in 2008–12 only. However, their inclusion in the 2001 Inventory account facilitates an understanding of Australia's emissions trends in relation to the 108% Kyoto target.

Table 18. Land use, land use change and forestry net CO₂-equivalent emissions, 2001 (Kyoto accounting)

Greenhouse Gas Source and Sink Categories	CO ₂ -equivalent emissions (Gg)				%Total Net National Emissions
	CO ₂ ^(a)	CH ₄ ^(b)	N ₂ O ^(c)	Total	
Total Net National Emissions	377,639	124,255	34,098	542,618	100.0
5 LAND USE, LAND USE CHANGE AND FORESTRY^(d)	23,084	2,499	305	25,888	4.8
Afforestation and Reforestation	–11,128			–11,128	–2.1
Land Use Change (deforestation)	34,213	2,499	305	37,016	6.8

(a) GWP = 1 (b) GWP = 21 (c) GWP = 310 (d) a negative sign denotes a sink

3.4.2 UNFCCC accounting

According to the UNFCCC accounting provisions the net emissions from the Land Use Change and Forestry sector were 11.4 Mt CO₂-e in 2001 (Table 19). The subsectors included in Land Use Change and Forestry are Changes in Forest and Other Woody Biomass Stocks (5A), Forest and Grassland Conversion (5B), CO₂ Emissions and Removals from Soil (5D) and Other (5E).

Forest and Other Woody Biomass Stocks (5A) comprises emissions and removals from changes in managed native forests, plantations, commercial harvest, and fuelwood consumption. This subsector is estimated to have constituted a net sink of 22.7 Mt CO₂-e in 2001.

Forest and Grassland Conversion (5B) comprises emissions and removals arising from the removal of forest with a minimum of 20% canopy cover, minimum height of two metres and a minimum area of 0.2 hectares. It includes emissions due to the burning and decay of cleared vegetation and from soil disturbed in the clearing process, and removals due to the subsequent regrowth of vegetation. Net emissions from the Forest and Grassland Conversion subsector were estimated to be 37.0 Mt CO₂-e in 2001.

CO₂ Emissions and Removals from Soil (5D) comprises removals associated with pasture improvement and minimum tillage (4.2 Mt).

Other (5E) comprises non-CO₂ gas emissions from prescribed burning of forests and wildfire. Estimated emissions for this subsector were 1.2 Mt CO₂-e in 2001.

Table 19. Land Use Change and Forestry net CO₂-equivalent emissions, 2001 (UNFCCC accounting)

Greenhouse Gas Source and Sink Categories	CO ₂ -equivalent emissions (Gg)			Total (includes CO ₂)
	CO ₂ ^(a)	CH ₄ ^(b)	N ₂ O ^(c)	
5 LAND USE CHANGE AND FORESTRY ^(d)	7,320	3,479	572	11,371
A Changes in Forest and Other Woody Biomass Stocks	-22,669			-22,669
B Forest and Grassland Conversion	34,213	2,499	305	37,016
C Abandonment of Managed Lands	NA			NA
D CO ₂ Emissions and Removals from Soil ^(e)	-4,223			-4,223
E Other ^(f)	NA	980	267	1,248

(a) GWP = 1 (b) GWP = 21 (c) GWP = 310 (d) a negative sign denotes a sink (e) sinks from minimum tillage and pasture improvement. (f) emissions from wildfires and prescribed burning

Emission Trends

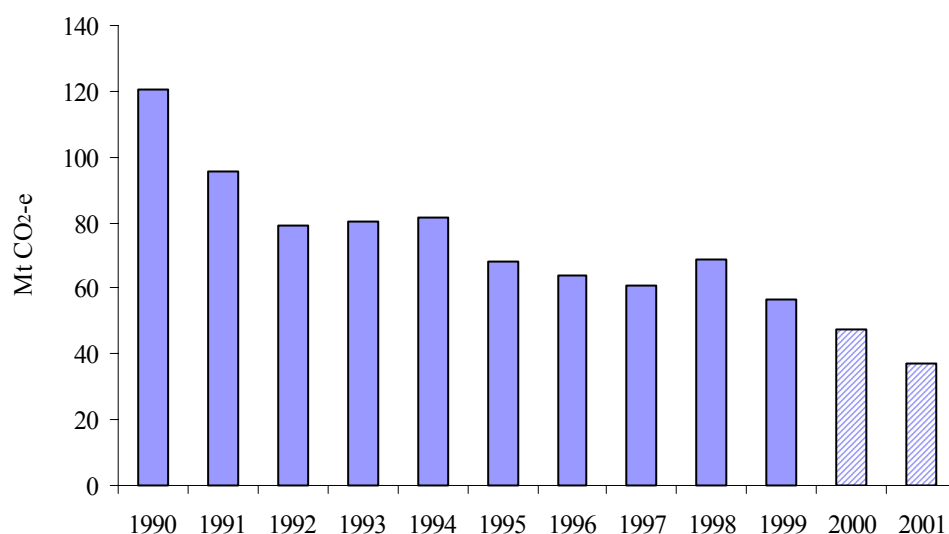
Emissions from forest harvesting increased by 20.8% (9.7 Mt) over the period 1990 to 2001 and by 3.4% (1.9 Mt) between 2000 and 2001. The sink associated with forest growth increased by 10.9% (7.8 Mt) from 1990 to 2001, and by 1.5% (1.2 Mt) from 2000 to 2001. The net effect of these changes is a reduction in the net forestry sink of 7.8% (1.9 Mt) from 1990 to 2001. Between 2000 and 2001 there was a further decrease in the net forestry sink of 2.9% (0.7 Mt).

The net emissions from the Forest and Grassland Conversion subsector were estimated to have declined by 69.2% (83.4 Mt) between 1990 and 2001. The annual rates of forest conversion and reclearing have decreased substantially (from 540,000 hectares in 1990 to 323,000 hectares in 1999), with consequent reductions in estimated emissions from burning and decay of aboveground biomass and belowground carbon loss. There is also a diminishing effect of extensive past land use change on decay of aboveground biomass and loss of belowground carbon. The 21.7% (10.2 Mt) reduction in emissions between 2000 and 2001 may not represent a true trend. Estimates for this period will be revised once remote sensing data and the land use change analyses are completed for subsequent years.

There was a 0.3 Mt (19.4%) decrease in prescribed burning and wildfire emissions between 1990 and 2001 and a 0.03 Mt (2.0%) increase from 2000 to 2001. No change is recorded in minimum tillage and pasture improvement emissions as these estimates rely on limited data that are not frequently updated.

Overall the total Land Use Change and Forestry emissions declined from 93.1 Mt in 1990 to 11.7 Mt in 2001, representing an 87.7% decrease.

Figure 14. Total net CO₂-equivalent emissions from Land Use Change, 1990–2001



The reduction in land use change emissions in 2000 and 2001 may not represent the true trend as these estimates will probably be revised upwards with subsequent analysis.

Methodology

The methodology, emission factors and other parameters used to compile the Land Use Change and Forestry estimates are largely country specific. A full description of the methodology used to estimate CO₂ emissions from 5A, 5D and 5E is presented in *Workbook for CO₂ from the Biosphere 4.2* and its 1996 and 1997 supplements (NGGIC 1997a, 1997b, 1998). The CO₂ emissions from 5B are now estimated using the National Carbon Accounting System. The National Carbon Accounting System is a model based accounting system supported by resource inventories, field studies and extensive multi-temporal remote sensing methods. The methodology is documented in AGO (2002b, 2003) and supersedes that described in Workbook 4.2.

A full description of the methodology used to estimate non-CO₂ emissions from all subsectors is presented in the *Workbook for Non-CO₂ Gases from the Biosphere 5.1* (NGGIC 1996).

The IPCC Guidelines consider only abandoned lands that are regrowing towards a natural state. Abandonment of Managed Lands (5C) is reported as ‘not applicable’ as abandoned lands in Australia are generally degraded due to problems such as salinity, hence regrowth is negligible.

Uncertainty and levels of confidence

Estimating emissions in the Land Use Change and Forestry sector is complex and difficult due to the inherent uncertainties associated with measuring anthropogenic or natural exchanges of greenhouse gases between the biosphere and the atmosphere. Generally a qualitative assessment of the uncertainties was made using professional judgement of those developing the methodologies and compiling the Inventory rather than a rigorous statistical analysis (Table 20). Sensitivity and uncertainty analyses specific to the Forest and Grassland Conversion subsector are documented in AGO (2002b).

Table 20. Estimation of uncertainties in components of the Land Use Change and Forestry subsectors (UNFCCC accounting)

Subsector	Uncertainty Level
5A Changes in Forest and Other Woody Biomass	Medium
5B Forest and Grassland Conversion	Low
5D Minimum Tillage and Pasture Improvement	High
5E Prescribed Burning and Wildfire	Medium

Low: Uncertainty of less than 20%; Medium: Uncertainty of 20–60%; High: Uncertainty of greater than 60%.

Changes since the 2000 Inventory

Since the 2000 Inventory there have been minor changes to the input data, but no changes to the methodology for subsectors 5A and 5E. The emissions estimates of Forest and Grassland Conversion (5B) have been recalculated for all years 1990 to 2000 applying the outcomes of a Continuous Improvement and Verification Program. The changes to data and method are described in detail in AGO 2003. Key changes are summarised below:

- Previous remote sensing analysis focused on areas of significant land use change; full continental coverage is now available.
- The time series (1972–2002) of land use change assessments is now complete. Previously the 1999 and 2000 emissions estimates were based on the average of the 1995–98 period.
- Probability thresholds used to identify forest areas have been refined.

The overall effect of the current revisions is that the estimate of net Land Use Change and Forestry emissions in 1990 is 8.3% (7.2 Mt) higher and the estimate for 2000 is 45.0% (17.1 Mt) lower than previously reported.

Quality control

The IPCC Good Practice Tier 1 general inventory level quality control procedures were conducted for all subsectors. Design and implementation of the National Carbon Accounting System and the programs contributing to it have been subjected to extensive peer review, and each program is subject to a quality assurance–quality control regime (see AGO 2002b). The *FullCAM* model incorporates previously calibrated and verified models. Several independent studies to test and calibrate the model were completed on various parts, integrations and applications of the models.

The quality assurance–quality control of the land use change emission estimates used a combination of spatial outputs and intermittent generation of long-term point-based models to allow for verification of results over both space and time.

3.5 WASTE

Total estimated Waste emissions for 2001 were 17.1 Mt CO₂-e, or 3.1% of total net national emissions (Table 21). The majority of these emissions were from Solid Waste Disposal on Land—contributing 15.2 Mt or 88.8% of Waste emissions. A further 1.9 Mt (11.1%) of Waste emissions were sourced from Wastewater Handling, and 0.02 Mt (0.1%) from Waste Incineration. Waste emissions are predominantly CH₄ generated from anaerobic decomposition of organic matter. Small amounts of CO₂ and N₂O are generated through the incineration of solvents and the decomposition of human wastes respectively.

Table 21. Waste CO₂-equivalent emissions, 2001

Greenhouse Gas Source and Sink Categories	CO ₂ -equivalent emissions (Gg)				%Total Net National Emissions
	CO ₂ ^(a)	CH ₄ ^(b)	N ₂ O ^(c)	Total	
Total Net National Emissions	377,639	124,255	34,098	542,618	100.00
6 WASTE	16	16,508	551	17,075	3.1
A Solid Waste Disposal on Land	NE	15,161	NE	15,161	2.8
B Wastewater Handling	NE	1,347	551	1,898	0.3
C Waste Incineration	16	NA	NE	16	0.0
D Other Waste	NA	NA	NA	NA	NA

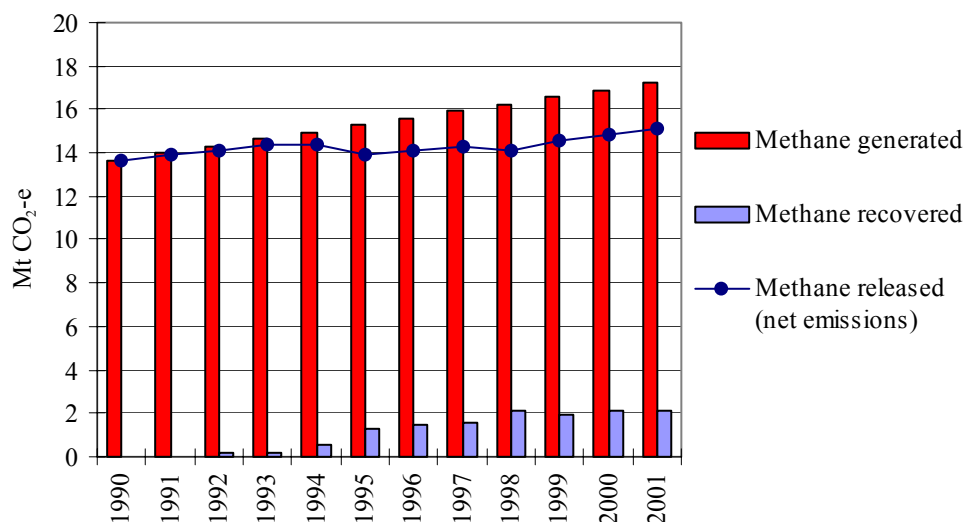
(a) GWP = 1. (b) GWP = 21. (c) GWP = 310.

Trends

Net Waste emission estimates (CH₄ emissions less CH₄ recovered) were 11.7% (1.8 Mt) higher in 2001 than they were in 1990 and 2.2% (0.4 Mt) higher than in 2000.

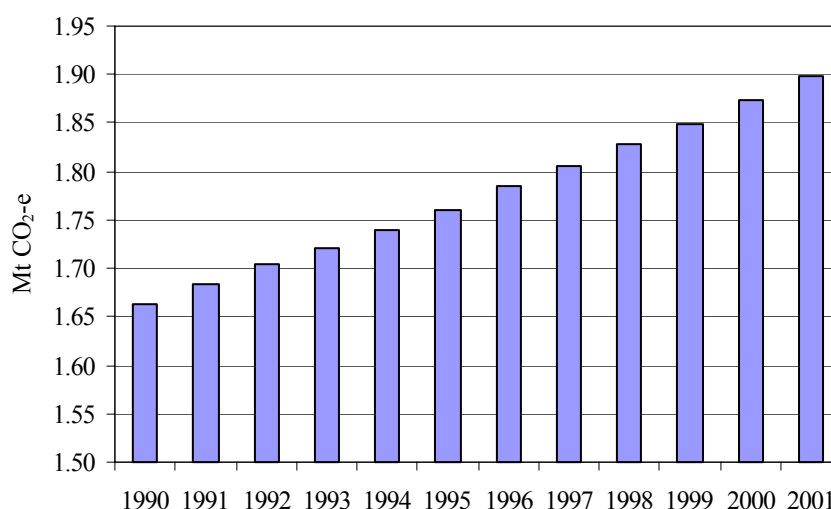
Net emissions from municipal Solid Waste Disposal on Land increased by 11.3% (1.5 Mt CO₂-e) over the period 1990 to 2001 (Figure 15), and by 2.3% (0.3 Mt CO₂-e) since 2000. This increase can be related to an increase in population and per capita waste disposal. It is important to note that because waste degradation is a slow process, estimates of CH₄ generation are largely a reflection of waste disposal from up to 25 years earlier.

Since 1993, rates of CH₄ recovery from solid waste have improved substantially, increasing from a negligible amount to 12.2% (2.1 Mt CO₂-e) of CH₄ generated (gross emissions) in 2001. This is reflected in the relatively stable net emission rates for 1993 to 2001.

Figure 15. Emissions from Solid Waste Disposal on Land, 1990–2001

Wastewater Handling emissions increased by 14.2% (0.24 Mt CO₂-e) over the period 1990 to 2001, with an increase of 1.4% (0.03 Mt CO₂-e) since 2000 (Figure 16). Estimates for Wastewater Handling emissions are based on population changes, hence estimates for CH₄ generation from sewage and recovery from wastewater plants and estimates of N₂O emissions from human sewage, increase at the same rate as population growth.

Figure 16. Emissions from Wastewater Handling, 1990–2001



Methodology

Emissions from Solid Waste Disposal on Land are estimated using a country specific methodology where the quantity of CH₄ released is estimated based on the average quantity of waste landfill in the 25 years prior to the inventory year and the CH₄ potential of landfilled waste. It is equivalent to a Tier 2 approach as defined in the IPCC Good Practice report. Data on CH₄ recovered from Solid Waste Disposal sites are obtained from the main companies involved in landfill gas recovery projects.

CH₄ releases and recovery from Wastewater are estimated using a combination of IPCC and country specific default values. The methodology is a country specific equivalent to a Tier 2 methodology. N₂O emissions are derived using the IPCC default methodology (Tier 1).

A full description of the methodologies and emission factors are presented in the Workbook for Waste Emissions 8.1 and the supplements in the 1996, 1998 and 2000 Inventories (NGGIC 1996, 1998; AGO 2000, 2002).

The main sources of data are demographic data from ABS (2002) and methane recovery data from companies involved in landfill gas recovery projects.

Uncertainty and levels of confidence

The level of uncertainty associated with landfill CH₄ recovery is lower than the level of uncertainty associated with CH₄ generated (gross emissions) from solid waste and CH₄ generated and recovered from wastewater. Landfill recovery data are obtained from organisations operating landfill gas recovery projects. The amounts of CH₄ generated from solid waste and wastewater are derived from default values and population data. It is conjectured that the uncertainty in emissions estimates from the Waste sector are substantial and could be as high as 50%. Comparison with estimates from the IPCC default method reinforce the assessment of uncertainty, although it is known that the IPCC default method overestimates emissions. To some extent, the assessment of uncertainty is conditioned by the fact that it is difficult to make a judgement about the data due to a lack of information, and it is considered appropriate that this be reflected in the assignment of a higher level of uncertainty.

It is recognised that the uncertainty could be substantially lower than 50%. For example, assuming that per capita waste, CH₄ potential and CH₄ recovered are approximately normally distributed with 95% confidence intervals of $\pm 20\%$, overall uncertainty derived from Latin Hypercube random sampling was $\pm 23.6\%$. Using these assumptions and assessing uncertainty for all years from 1990 to 2000

simultaneously, uncertainty ranged from $\pm 20.4\%$ in 1990 to $\pm 23.6\%$ in 2000. These results suggest that the overall uncertainty for Solid Waste Disposal is likely to be less than $\pm 50\%$. The uncertainty analysis will be refined once an expert review of the sector is undertaken.

Changes since the 2000 Inventory

There were no methodology changes in the Waste Sector, however the Australian Bureau of Statistics population statistics have been revised and updated following the release of the 2001 national census. All Inventory years back to 1995 have been recalculated as a result of this revision. This change has resulted in a 0.6% (0.1 Mt) decrease in CO₂-e emissions in 2000.

Quality control

The IPCC Good Practice Tier 1 general inventory level quality control procedures were conducted for all of the subsectors. Comparison of the estimates with those derived from the IPCC default methodologies suggests that the estimates are reasonable. The derivations of the estimates have been examined to ensure that all calculations accord with the methodology published in Workbook 8.1. In respect of population data, the Australian Bureau of Statistics undertakes detailed analysis of estimated population data and census data following each census. The difference between the estimates and census, referred to as the intercensal discrepancy, is substantially less than 1%.

4. GLOSSARY

Activity	a process that generates greenhouse gas emissions or uptake. In some sectors it refers to the level of production or manufacture for a given process or category.
Automotive diesel oil	(ADO) a middle distillate petroleum product used as a fuel in high speed diesel engines. It is mostly consumed in the Road and Rail Transport Sectors and Agriculture, Mining and Construction sectors.
Aviation	any domestic civil air transport activity, either commercial or general aviation (such as private, agricultural commuter and charter) services carrying freight or passengers. <i>International aviation</i> activities are reported but are not included in the National Inventory emissions total.
Anaerobic	a process relying on bacteria that can live without oxygen.
Anthropogenic	resulting from human activities. In the inventory, <i>anthropogenic emissions</i> are distinguished from <i>natural emissions</i> .
Bagasse	the fibrous residue of the sugar cane milling process which is used as a fuel in sugar mills.
Black coal	consists of three main types: <i>Sub-bituminous coals</i> are the lowest grade black coal in Australia with a high inherent moisture and high levels of volatile matter (42% to 49% on a dry mineral matter free basis). <i>Bituminous coals</i> have between 15% and 50% volatile matter and are high in carbonaceous matter. <i>Anthracite</i> , a hard coal containing a low level of volatile matter, is the highest grade coal but it is not produced in Australia.
Briquettes	a composition fuel manufactured from brown coal which is crushed, dried and moulded under high pressure without the addition of binders.
Brown coal or lignite	a low grade coal having a high volatile matter content and high inherent moisture. Brown coal use in Australia is confined to the State of Victoria and almost exclusively limited to steam raising for electricity generation.
Bus	any passenger vehicle with 10 or more seats including the driver.
Clinker	an intermediate product from which cement is made.
Coke	the solid product obtained from the carbonisation of suitable types of coal at high temperature. It is low in moisture and volatile matter and is mainly used in the iron and steel industry as an energy source and chemical agent. Semi-coke or coke obtained by carbonisation at low temperatures is included in this category.
Dolomite	a naturally occurring mineral ($\text{CaCO}_3.\text{MgCO}_3$) which can be used to produce lime, iron and steel.
Emission factor	the quantity of greenhouse gases emitted per unit of some specified activity.
Emission intensity	the total emissions divided by the total energy content of the fuels or the total energy used in a sector. The overall emissions intensity of coal used in Australia, for example, is determined by the quantity and emission factors for each of the many types and grades of coal used. See also emission factor.

Enteric fermentation	the process in animals by which gases, including methane, are produced as a by-product of microbial fermentation associated with digestion of feed.
Feedlot	a confined yard area with watering and feeding facilities where livestock (mainly beef cattle) are completely hand fed for the purpose of production. It does not include the feeding or penning of cattle for weaning, dipping or similar husbandry purposes or for drought or other emergency feeding, or at a slaughtering place or in recognised saleyards.
Feedstocks	products derived from crude oil and destined for further processing in the refining industry, other than blending. Includes products imported for refinery intake and those returned from the petrochemical industry to the refining industry, such as naphtha.
Flaring	is the process of combusting unwanted or excess gases at a crude oil or gas production site, a gas processing plant or an oil refinery.
Forest	Parties are required to select single minimum values for land area, tree crown cover and tree height. The NCAS when assessing Australia's land use change emissions utilises a criteria of 20% tree crown cover, 2 metre minimum tree height, and a minimum of 0.2 hectares in land area for inclusion. These minimum criteria are within the ranges outlined in the Marrakech Accords.
Fuel oil	covers all residual (heavy) fuel oils including those obtained by blending.
Fugitive emissions	generally deliberate but not fully controlled emissions that typically result from leaks, including those from pump seals, pipe flanges and valve stems. Fugitive emissions also includes methane emitted from coal mine seams During petroleum storage tank filling, venting loss of vapour is a fugitive emission.
Global warming potential	(GWP) represents the relative warming effect of a unit mass of a gas compared with the same mass of CO ₂ over a specific period. Multiplying the actual amount of gas emitted by the GWP gives the CO ₂ -equivalent emissions.
Greenhouse gases	gases that contribute to global warming, including carbon dioxide (CO ₂), methane (CH ₄), nitrous oxide (N ₂ O), perfluorocarbons (PFCs), hydrofluorocarbons (HFCs) and sulphur hexafluoride (SF ₆). In addition, the photochemically important gases NMVOCs, oxides of nitrogen (NO _x) and carbon monoxide (CO) are also considered. NMVOC, NO _x and CO are not direct greenhouse gases. However, they contribute indirectly to the greenhouse effect by influencing the rate at which ozone and other greenhouse gases are produced and destroyed in the atmosphere.
Gross calorific value	the quantity of heat released by unit quantity of fuel, when it is burned completely with oxygen, and the products of combustion are returned to liquid water at ambient temperature (101 kPa and 25°C). Gross calorific value is measured per unit mass or unit volume.
Heavy duty trucks	Vehicles constructed primarily for load carrying consisting of a prime mover having no significant load carrying area but with a turntable device which can be linked to a trailer.
HFC	hydrofluorocarbons, used as substitutes for chlorofluorocarbons (CFC) and hydrochlorofluorocarbons (HCFC).

Industrial Diesel Fuel	(IDF) a petroleum product primarily consumed in the Rail and Water Transport Sectors.
IPCC	The Intergovernmental Panel on Climate Change (IPCC) is the international body responsible for assessing the state of knowledge about climate change. The IPCC increases international awareness of climate change science and provides guidance to the international community on issues related to climate change response.
Key source	The IPCC Good Practice report (IPCC 2000) introduces the concept of key source categories for prioritising the inventory development process. A key source category has a significant influence on a country's total inventory of direct greenhouse gases in terms of absolute level of emissions, the trend in emissions, or both. The Tier 1 key source analysis identifies sources that contribute to 95% of the total emissions or 95% of the trend of the inventory in absolute terms. Tier 2 analysis identified sources that contribute to 90% of total uncertainty in the inventory.
Kyoto Protocol	The Kyoto Protocol to the Convention on Climate Change was developed through the UNFCCC negotiating process. The Protocol was negotiated in Kyoto, Japan, in 1997. It sets binding greenhouse gas emissions targets for UNFCCC developed country Parties that ratify the agreement.
Light Duty Trucks	Includes light commercial vehicles (vehicles constructed primarily for the carriage of goods and not exceeding 3.5 tonnes gross vehicle mass) and non-freight carrying trucks (specialist vehicles such as ambulances, hearses, fire engines or vehicles fitted with special purpose equipment and having no goods carrying capacity, eg cranes and cherry pickers).
Liquefied petroleum gas	(LPG) a light hydrocarbon fraction of the paraffin series. It occurs naturally, associated with crude oil and natural gas in many oil and gas deposits, and is also produced in the course of petroleum refinery processes. LPG consists of propane (C_3H_8) and butane (C_4H_{10}), or a mixture of the two. In Australia, LPG as marketed contains more propane than butane.
Lubricants	hydrocarbons that are rich in paraffin and not used as fuels. They are obtained by vacuum distillation of oil residues.
Manure	the animal waste, both faeces and urine, collected from yards and barns. Only the faecal component of manure is capable of producing methane.
Medium duty trucks	vehicles constructed primarily for load carrying with a gross vehicle mass exceeding 3.5 tonnes.
Military transport	includes all activity by military land vehicles, aircraft and ships.
National Carbon Accounting System	an integrated suite of models that estimate emissions from biomass, litter and soil carbon in a geographic information system framework with the support of resource inventories, field studies and remote sensing to assess land cover change.
National approach	a mix of Tier 1 and Tier 2 methodologies for estimating emissions from Fuel Combustion Activities (1A).
Natural gas	consists primarily of methane (around 90 per cent, with traces of other gaseous hydrocarbons, as well as nitrogen and carbon dioxide) occurring naturally in underground deposits. As a transport fuel it is generally used in compressed or liquefied form.

Navigation	all civilian (non-military) marine transport of passengers and freight. Domestic marine transport consists of coastal shipping (freight and cruises), interstate and urban ferry services, commercial fishing, and small pleasure craft movements. International shipping using marine bunker fuel purchased in Australia is reported but not included in the National Inventory emissions total.
NMVOG	non-methane volatile organic compounds such as alkanes, alkenes and alkynes, aromatic compounds and carbonyls that are gases at standard temperature and pressure (i.e. boiling points below 200°C) and normally 10 or less carbon atoms per molecule; excludes chlorofluorocarbons (CFCs).
Passenger cars	all passenger vehicles which carry fewer than 10 passengers (including the driver). These consist of cars, station wagons, taxis, minibuses, four wheel drive passenger vehicles and forward control passenger vehicles.
PFC	perfluorocarbons, chemical compounds containing carbon and fluorine atoms only (eg CF ₄ and C ₂ F ₆)
Plantation	an area of managed forest where the trees have been planted.
Prescribed burning	the intentional burning of forests to reduce the amount of combustible material present and thereby reduce the risk of wildfires. In Australia this is known as ‘fuel reduction burning’.
Process emission	the gas released as a result of chemical or physical transformation of materials from one form to another.
Reference approach	a ‘top-down’ Tier 1 IPCC methodology for estimating CO ₂ emissions from Fuel Combustion Activities (1A).
Road transport	includes all on-road and off-road activity by civilian (non-military) vehicles registered for road use.
Savanna	a grassland ecosystem with associated woody shrub and/or tree overstorey, the latter with projective foliage cover comprising less than 30% of the area. The IPCC category of ‘savanna’ is extended to include all non-agricultural grassland ecosystem types that experience burning in Australia.
Sink	any process or activity which removes a greenhouse gas, an aerosol or a precursor of a greenhouse gas from the atmosphere. It includes chemical transformations in the atmosphere and uptake of the gases from the atmosphere by the underlying land and ocean surfaces.
Solid waste	waste from various activities; includes <i>Municipal solid waste</i> (waste from domestic premises and council activities largely associated with servicing residential areas; such as street sweepings, street tree lopping, parks and gardens and litter bins), <i>Commercial and industrial waste</i> , and <i>Building and demolition waste</i> .
Solvent	an organic liquid used for cleaning or to dissolve materials.
Source	any process or activity that releases a greenhouse gas, an aerosol or a precursor of a greenhouse gas into the atmosphere.
Tier	the IPCC methods for estimating emissions and removals are divided into ‘Tiers’ encompassing different levels of activity and technology detail. <i>Tier 1 methods</i> are generally very simple (activity multiplied by default emissions factor) and require less data and expertise than the most complicated Tier 3 methods. <i>Tier 2 and 3 methods</i> generally require more

	<p>detailed country-specific information on things such as technology type or livestock characteristics. The concept of Tiers is also used to describe different levels of key source analysis, uncertainty analysis, and quality assurance and quality control activities.</p>
Town gas	<p>includes all manufactured gases that are typically reticulated to consumers, including synthetic natural gas, reformed natural gas, tempered LPG, and tempered natural gas.</p>
Uncertainty	<p>Uncertainty is a parameter associated with the result of measurement that characterises the dispersion of values that could be reasonably attributed to the measured quantity (eg. the sample variance or coefficient of variation). In general inventory terms, uncertainty refers to the lack of certainty (in inventory components) resulting from any causal factor such as unidentified sources and sinks, lack of transparency, and etc.</p>
UNFCCC	<p>the United Nations Framework Convention on Climate Change entered into force in 1994. Parties to the Convention have agreed to work towards achieving the Convention's ultimate aim of stabilising 'greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system'.</p>
Venting	<p>the process of releasing gas into the atmosphere without combustion. This may be done either at the production site or at the refinery or stripping plants. It is done to dispose of non-commercial gas or to relieve system pressure.</p>
Year	<p>unless otherwise specified, a year is the nominated Australian financial year (1 July to 30 June).</p>

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PART B

COMMON REPORTING FORMAT AND APPENDIX TABLES
(UNFCCC ACCOUNTING)

TABLE 1 SECTORAL REPORT FOR ENERGY
(Sheet 1 of 2)

Australia
2001
Submission 2003

GREENHOUSE GAS SOURCE AND SINK CATEGORIES							
	CO ₂	CH ₄	N ₂ O	NO _x (Gg)	CO	NM VOC	SO ₂
Total Energy	336,326.38	1,301.18	17.16	1,575.55	4,278.96	788.22	759.40
A. Fuel Combustion Activities (Sectoral Approach)	329,402.62	98.41	17.07	1,573.91	4,268.89	566.10	759.40
I. Energy Industries	198,168.52	9.08	2.03	648.49	65.96	8.24	587.72
a. Public Electricity and Heat Production	180,658.88	7.73	1.93	541.76	46.44	6.17	553.88
b. Petroleum Refining	6,728.83	0.09	0.05	46.23	5.65	0.09	24.00
c. Manufacture of Solid Fuels and Other Energy Industries	10,780.81	1.26	0.05	60.50	13.88	1.98	9.84
2. Manufacturing Industries and Construction	42,034.59	2.32	0.74	370.78	281.86	15.35	104.40
a. Iron and Steel	2,624.13	0.08	0.01	32.18	9.10	0.52	10.96
b. Non-Ferrous Metals	14,153.13	0.32	0.10	96.45	17.35	0.61	62.21
c. Chemicals	6,061.66	0.19	0.03	49.41	24.59	1.55	2.20
d. Pulp, Paper and Print	2,199.22	0.13	0.09	6.61	15.01	0.30	4.12
e. Food Processing, Beverages and Tobacco	3,225.83	0.95	0.42	14.31	157.45	1.71	6.61
f. Other (please specify)	13,770.62	0.66	0.10	171.81	58.36	10.66	18.30
All Other Manufacturing	1,404.45	0.08	0.01	7.29	14.48	1.58	0.49
Construction	3,465.83	0.28	0.03	48.92	18.92	5.23	2.84
Non-metallic Mineral Products	4,802.99	0.12	0.03	61.06	14.74	0.84	8.50
Mining (non-energy)	4,097.34	0.18	0.03	54.54	10.22	3.01	6.48
3. Transport	72,260.40	30.03	14.05	458.10	3,123.44	445.45	61.21
a. Civil Aviation	5,480.11	0.24	0.17	18.05	92.71	3.11	1.03
b. Road Transportation	63,329.27	27.26	13.79	378.41	2,892.89	417.72	42.19
c. Railways	1,823.75	0.08	0.05	40.44	5.34	1.88	3.08
d. Navigation	1,586.67	2.44	0.03	20.98	128.15	22.08	14.89
e. Other Transportation (please specify)	40.59	0.02	0.00	0.23	4.35	0.67	0.01
Recreational Vehicles	40.59	0.02	0.00	0.23	4.35	0.67	0.01

TABLE 1 SECTORAL REPORT FOR ENERGY
(Sheet 2 of 2)

Australia
2001
Submission 2003

GREENHOUSE GAS SOURCE AND SINK CATEGORIES		CO ₂	CH ₄	N ₂ O	NO _x (Gg)	CO	NMVOC	SO ₂
4. Other Sectors		15,585.94	56.93	0.23	90.89	789.85	96.20	5.61
a. Commercial/Institutional		3,854.41	0.07	0.02	4.56	2.39	0.21	1.65
b. Residential		7,527.29	56.34	0.17	7.75	758.86	86.20	0.53
c. Agriculture/Forestry/Fisheries		4,204.23	0.52	0.04	78.58	28.60	9.79	3.43
5. Other (please specify)		1,353.17	0.05	0.02	5.65	7.78	0.85	0.46
a. Stationary Lubricants	■	636.47	NE	NE	NE	NE	NE	NE
b. Mobile	■	636.47	NE	NE	NE	NE	NE	NE
Military Transport		716.70	0.05	0.02	5.65	7.78	0.85	0.46
		716.70	0.05	0.02	5.65	7.78	0.85	0.46
B. Fugitive Emissions from Fuels		6,923.76	1,202.76	0.09	1.64	10.07	222.13	NE
I. Solid Fuels		NE	878.36	NA	NA	NA	NA	NA
a. Coal Mining		NE	878.36	NA	NA	NA	NA	NA
b. Solid Fuel Transformation		NA	IE	NA	NA	NA	NA	NA
c. Other (please specify)	■	NA	NA	NA	NA	NA	NA	NA
NA		NA	NA	NA	NA	NA	NA	NA
2. Oil and Natural Gas		6,923.76	324.40	0.09	1.64	10.07	222.13	NE
a. Oil		400.66	5.24	0.01	0.13	1.29	104.09	NE
b. Natural Gas		9.86	173.71				31.67	NE
c. Venting and Flaring		6,513.24	145.46	0.08	1.51	8.78	86.37	NE
Venting		3,666.63	110.15				71.24	NE
Flaring		2,846.61	35.31	0.08	1.51	8.78	15.13	NE
d. Other (please specify)	■	NA	NA	NA	NA	NA	NA	NA
NA		NA	NA	NA	NA	NA	NA	NA
Memo Items:								
International Bankers		10,625.28	0.15	0.31	110.05	15.46	8.78	49.86
Aviation		8,151.32	0.03	0.24	43.61	13.40	6.70	1.54
Marine		2,473.96	0.12	0.07	66.44	2.06	2.08	48.33
Multilateral Operations		NE	NE	NE	NE	NE	NE	NE
CO₂ Emissions from Biomass		18,254.75						

TABLE 1.A(a) SECTORAL BACKGROUND DATA FOR ENERGY
Fuel Combustion Activities—Sectoral Approach
(Sheet 1 of 4)

Australia
2001
Submission 2003

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	AGGREGATE ACTIVITY DATA		IMPLIED EMISSION FACTORS ⁽²⁾			EMISSIONS		
	Consumption (TJ)	(¹)	CO ₂ (t/TJ)	CH ₄ (kg/TJ)	N ₂ O (kg/TJ)	CO ₂ (Gg)	CH ₄ (Gg)	N ₂ O (Gg)
1.A. Fuel Combustion	4,657,196.32	GCV				329,402.62	98.41	17.07
Liquid Fuels	1,511,803.53	GCV	66.69	21.73	9.47	100,820.67	32.85	14.32
Solid Fuels	2,003,692.39	GCV	90.33	0.88	1.00	180,984.37	1.76	2.01
Gaseous Fuels	930,010.40	GCV	51.18	6.86	0.11	47,597.57	6.38	0.10
Biomass	211,690.00	GCV	86.23	271.32	3.06 ⁽³⁾	18,254.75	57.44	0.65
Other Fuels	NA	GCV	NA	NA	NA	NA	NA	NA
1.A.1. Energy Industries	2,396,549.66	GCV				198,168.52	9.08	2.03
Liquid Fuels	135,463.34	GCV	68.40	1.82	0.60	9,266.36	0.25	0.08
Solid Fuels	1,846,773.89	GCV	91.09	0.76	1.03	168,223.53	1.40	1.90
Gaseous Fuels	403,362.43	GCV	51.27	12.77	0.10	20,678.63	5.15	0.04
Biomass	10,950.00	GCV	56.58	208.34	0.63 ⁽³⁾	619.55	2.28	0.01
Other Fuels	NA	GCV	NA	NA	NA	NA	NA	NA
a. Public Electricity and Heat Production	2,092,933.14	GCV				180,658.88	7.73	1.93
Liquid Fuels	26,406.94	GCV	69.39	3.41	0.60	1,832.29	0.09	0.02
Solid Fuels	1,828,116.89	GCV	91.43	0.76	1.03	167,146.58	1.38	1.88
Gaseous Fuels	227,459.30	GCV	51.35	17.49	0.10	11,680.01	3.98	0.02
Biomass	10,950.00	GCV	56.58	208.34	0.63 ⁽³⁾	619.55	2.28	0.01
Other Fuels	NA	GCV	NA	NA	NA	NA	NA	NA
b. Petroleum Refining	103,750.00	GCV				6,728.83	0.09	0.05
Liquid Fuels	84,820.00	GCV	67.91	0.83	0.60	5,760.47	0.07	0.05
Solid Fuels	NA	GCV	NA	NA	NA	NA	NA	NA
Gaseous Fuels	18,930.00	GCV	51.15	1.06	0.10	968.36	0.02	0.00
Biomass	NA	GCV	NA	NA	NA ⁽³⁾	NA	NA	NA
Other Fuels	NA	GCV	NA	NA	NA	NA	NA	NA
c. Manufacture of Solid Fuels and Other Energy Industries	199,866.53	GCV				10,780.81	1.26	0.05
Liquid Fuels	24,236.40	GCV	69.05	3.52	0.60	1,673.61	0.09	0.01
Solid Fuels	18,657.00	GCV	57.72	1.01	0.80	1,076.95	0.02	0.01
Gaseous Fuels	156,973.13	GCV	51.16	7.35	0.10	8,030.26	1.15	0.02
Biomass	NA	GCV	NA	NA	NA ⁽³⁾	NA	NA	NA
Other Fuels	NA	GCV	NA	NA	NA	NA	NA	NA

⁽¹⁾ Gross calorific values (GCV).

⁽²⁾ Accurate estimation of CH₄ and N₂O emissions depends on combustion conditions, technology, and emission control policy, as well as fuel characteristics. Therefore, caution should be used when comparing the implied emission factors.

⁽³⁾ Carbon dioxide emissions from biomass are reported under Memo Items. The content of the cells is not included in the totals.

TABLE 1.A(a) SECTORAL BACKGROUND DATA FOR ENERGY
Fuel Combustion Activities—Sectoral Approach
(Sheet 2 of 4)

Australia
2001
Submission 2003

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	AGGREGATE ACTIVITY DATA		IMPLIED EMISSION FACTORS ⁽²⁾			EMISSIONS		
	Consumption (TJ)	⁽¹⁾	CO ₂ (t/TJ)	CH ₄ (kg/TJ)	N ₂ O (kg/TJ)	CO ₂ (Gg)	CH ₄ (Gg)	N ₂ O (Gg)
1.A.2 Manufacturing Industries and Construction	798,721.23	GCV				42,034.59	2.32	0.74
Liquid Fuels	180,843.43	GCV	67.55	4.33	0.63	12,216.65	0.78	0.11
Solid Fuels	148,938.50	GCV	80.74	1.19	0.67	12,026.01	0.18	0.10
Gaseous Fuels	348,409.30	GCV	51.07	1.08	0.10	17,791.93	0.38	0.03
Biomass	120,530.00	GCV	94.25	8.15	4.10 ⁽³⁾	11,360.47	0.98	0.49
Other Fuels	NA	GCV	NA	NA	NA	NA	NA	NA
a. Iron and Steel	55,794.00	GCV				2,624.13	0.08	0.01
Liquid Fuels	1,307.00	GCV	60.29	19.20	0.46	78.79	0.03	0.00
Solid Fuels	29,407.00	GCV	42.93	1.07	0.18	1,262.37	0.03	0.01
Gaseous Fuels	25,080.00	GCV	51.15	0.94	0.09	1,282.96	0.02	0.00
Biomass	NA	GCV	NA	NA	NA ⁽³⁾	NA	NA	NA
Other Fuels	NA	GCV	NA	NA	NA	NA	NA	NA
b. Non-Ferrous Metals	218,299.00	GCV				14,153.13	0.32	0.10
Liquid Fuels	35,589.00	GCV	71.92	2.88	0.75	2,559.40	0.10	0.03
Solid Fuels	59,530.00	GCV	90.88	1.24	0.80	5,410.13	0.07	0.05
Gaseous Fuels	120,880.00	GCV	51.15	1.10	0.10	6,183.60	0.13	0.01
Biomass	2,300.00	GCV	92.12	4.20	4.10 ⁽³⁾	211.88	0.01	0.01
Other Fuels	NA	GCV	NA	NA	NA	NA	NA	NA
c. Chemicals	105,123.23	GCV				6,061.66	0.19	0.03
Liquid Fuels	33,703.44	GCV	61.32	3.18	0.60	2,066.60	0.11	0.02
Solid Fuels	8,337.50	GCV	95.83	1.17	0.80	798.99	0.01	0.01
Gaseous Fuels	63,082.30	GCV	50.67	1.10	0.10	3,196.06	0.07	0.01
Biomass	NA	GCV	NA	NA	NA ⁽³⁾	NA	NA	NA
Other Fuels	NA	GCV	NA	NA	NA	NA	NA	NA
d. Pulp, Paper and Print	55,850.00	GCV				2,199.22	0.13	0.09
Liquid Fuels	2,940.00	GCV	66.94	2.62	0.60	196.81	0.01	0.00
Solid Fuels	7,780.00	GCV	88.20	1.30	0.80	686.20	0.01	0.01
Gaseous Fuels	25,730.00	GCV	51.15	1.19	0.10	1,316.21	0.03	0.00
Biomass	19,400.00	GCV	92.12	4.20	4.10 ⁽³⁾	1,787.13	0.08	0.08
Other Fuels	NA	GCV	NA	NA	NA	NA	NA	NA
e. Food Processing, Beverages and Tobacco	148,150.00	GCV				3,225.83	0.95	0.42
Liquid Fuels	6,270.00	GCV	63.17	1.25	0.60	396.09	0.01	0.00
Solid Fuels	14,750.00	GCV	90.65	1.30	0.80	1,337.04	0.02	0.01
Gaseous Fuels	29,180.00	GCV	51.15	1.14	0.10	1,492.70	0.03	0.00
Biomass	97,950.00	GCV	94.75	9.06	4.10 ⁽³⁾	9,280.40	0.89	0.40
Other Fuels	NA	GCV	NA	NA	NA	NA	NA	NA
f. Other (please specify)	215,504.99	GCV				13,770.62	0.66	0.10
Liquid Fuels	101,033.99	GCV	68.48	5.28	0.60	6,918.95	0.53	0.06
Solid Fuels	29,134.00	GCV	86.88	1.12	0.77	2,531.28	0.03	0.02
Gaseous Fuels	84,457.00	GCV	51.15	1.04	0.10	4,320.39	0.09	0.01
Biomass	880.00	GCV	92.12	4.20	4.10 ⁽³⁾	81.07	0.00	0.00
Other Fuels	NA	GCV	NA	NA	NA	NA	NA	NA

TABLE 1.A(a) SECTORAL BACKGROUND DATA FOR ENERGY
Fuel Combustion Activities—Sectoral Approach
(Sheet 3 of 4)

Australia
2001
Submission 2003

GREENHOUSE GAS SOURCE AND SINK CATEGORIES		AGGREGATE ACTIVITY DATA		IMPLIED EMISSION FACTORS ⁽²⁾			EMISSIONS		
		Consumption (TJ)	⁽¹⁾	CO ₂	CH ₄	N ₂ O	CO ₂	CH ₄	N ₂ O
				(t/TJ)	(kg/TJ)	(kg/TJ)	(Gg)	(Gg)	(Gg)
I.A.3 Transport		1,089,546.92	GCV				72,260.40	30.03	14.05
Gasoline		688,348.65	GCV	65.75	33.81	19.28	45,262.04	23.27	13.27
Diesel		316,166.91	GCV	69.09	7.46	1.94	21,844.52	2.36	0.61
Natural Gas		4,628.67	GCV	51.40	128.61	1.00	237.91	0.60	0.00
Solid Fuels		4,870.00	GCV	89.10	32.00	1.00	433.92	0.16	0.00
Biomass		0.00	GCV	0.00	0.00	0.00 ⁽⁸⁾	0.00	0.00	0.00
Other Fuels		75,532.70	GCV	59.34	48.22	2.06	4,482.00	3.64	0.16
a. Civil Aviation		79,503.70	GCV				5,480.11	0.24	0.17
Aviation Gasoline		3,493.30	GCV	67.32	57.00	0.90	235.17	0.20	0.00
Jet Kerosene		76,010.40	GCV	69.00	0.48	2.22	5,244.95	0.04	0.17
b. Road Transportation		961,513.18	GCV				63,329.27	27.26	13.79
Gasoline		608,844.95	GCV	65.34	37.84	21.52	39,781.93	23.04	13.10
Diesel Oil		278,769.57	GCV	69.00	7.99	1.93	19,235.94	2.23	0.54
Natural Gas		4,628.67	GCV	51.40	128.61	1.00	237.91	0.60	0.00
Biomass		NA	GCV	NA	NA	NA ⁽⁸⁾	NA	NA	NA
Other Fuels <i>(please specify)</i>		69,270.00	GCV				4,073.49	1.39	0.15
LPG		69,270.00	GCV	58.81	20.11	2.17	4,073.49	1.39	0.15
c. Railways		26,430.00	GCV				1,823.75	0.08	0.05
Solid Fuels		NA	GCV	NA	NA	NA	NA	NA	NA
Liquid Fuels		26,430.00	GCV	69.00	3.00	2.00	1,823.75	0.08	0.05
Other Fuels <i>(please specify)</i>		NA	GCV				NA	NA	NA
Natural Gas		NA	GCV	NA	NA	NA	NA	NA	NA
d. Navigation		21,478.77	GCV				1,586.67	2.44	0.03
Coal		4,870.00	GCV	89.10	32.00	1.00	433.92	0.16	0.00
Residual Oil		7,856.07	GCV	72.86	3.00	2.00	572.42	0.02	0.02
Gas/Diesel Oil		2,490.00	GCV	69.00	4.00	2.00	171.82	0.01	0.00
Other Fuels <i>(please specify)</i>		6,262.70	GCV				408.51	2.25	0.01
Gasoline		6,212.70	GCV	65.34	360.00	0.90	405.94	2.24	0.01
Natural Gas		50.00	GCV	51.40	243.00	1.00	2.57	0.01	0.00
Other Transportation		621.27	GCV				40.59	0.02	0.00
Liquid Fuels		621.27	GCV	65.34	30.00	0.90	40.59	0.02	0.00
Solid Fuels		NA	GCV	NA	NA	NA	NA	NA	NA
Gaseous Fuels		NA	GCV	NA	NA	NA	NA	NA	NA

TABLE 1.A(a) SECTORAL BACKGROUND DATA FOR ENERGY
Fuel Combustion Activities—Sectoral Approach
(Sheet 4 of 4)

Australia
2001
Submission 2003

GREENHOUSE GAS SOURCE AND SINK CATEGORIES		AGGREGATE ACTIVITY DATA		IMPLIED EMISSION FACTORS ⁽²⁾			EMISSIONS		
		Consumption (TJ)	(1)	CO ₂ (t/TJ)	CH ₄ (kg/TJ)	N ₂ O (kg/TJ)	CO ₂ (Gg)	CH ₄ (Gg)	N ₂ O (Gg)
1.A.4 Other Sectors		353,320.16	GCV				15,585.94	56.93	0.23
Liquid Fuels		96,390.16	GCV	66.35	25.82	0.62	6,395.93	2.49	0.06
Solid Fuels		3,110.00	GCV	96.76	6.64	0.80	300.91	0.02	0.00
Gaseous Fuels		173,610.00	GCV	51.20	1.46	0.11	8,889.10	0.25	0.02
Biomass		80,210.00	GCV	78.23	675.38	1.83 ⁽³⁾	6,274.73	54.17	0.15
Other Fuels		NA	GCV	NA	NA	NA	NA	NA	NA
a. Commercial/Institutional									
Liquid Fuels		70,060.00	GCV				3,854.41	0.07	0.02
Solid Fuels		15,470.00	GCV	61.26	0.77	0.60	947.69	0.01	0.01
Gaseous Fuels		2,950.00	GCV	96.67	1.30	0.80	285.18	0.00	0.00
Biomass		51,210.00	GCV	51.19	1.11	0.15	2,621.55	0.06	0.01
Other Fuels		430.00	GCV	91.92	3.70	4.10 ⁽³⁾	39.53	0.00	0.00
b. Residential									
Liquid Fuels		222,180.16	GCV				7,527.29	56.34	0.17
Solid Fuels		19,860.16	GCV	62.69	98.62	0.68	1,245.03	1.96	0.01
Gaseous Fuels		160.00	GCV	98.31	105.00	0.80	15.73	0.02	0.00
Biomass		122,380.00	GCV	51.21	1.60	0.10	6,266.53	0.20	0.01
Other Fuels		79,780.00	GCV	78.15	679.00	1.82 ⁽³⁾	6,235.20	54.17	0.15
c. Agriculture/Forestry/Fisheries									
Liquid Fuels		61,080.00	GCV				4,204.23	0.52	0.04
Solid Fuels		61,060.00	GCV	68.84	8.48	0.60	4,203.21	0.52	0.04
Gaseous Fuels		20.00	GCV	51.15	1.10	0.10	1.02	0.00	0.00
Biomass		NA	GCV	NA	NA	NA ⁽³⁾	NA	NA	NA
Other Fuels		NA	GCV	NA	NA	NA	NA	NA	NA
1.A.5 Other (Not elsewhere specified)⁽⁴⁾		19,058.35	GCV				1,353.17	0.05	0.02
Liquid Fuels		19,058.35	GCV	71.00	2.75	1.05	1,353.17	0.05	0.02
Solid Fuels		NA	GCV	NA	NA	NA	NA	NA	NA
Gaseous Fuels		NA	GCV	NA	NA	NA	NA	NA	NA
Biomass		NA	GCV	NA	NA	NA ⁽³⁾	NA	NA	NA
Other Fuels		NA	GCV	NA	NA	NA	NA	NA	NA

⁽⁴⁾ Military fuel use is included under this category.

Documentation Box:

1A1c Manufacturing of Solid Fuels and Other Energy Industries includes a derived gas, coke oven gas, which is allocated to solid fuels. The carbon dioxide emission factor used for coke oven gas was 37.0 Gg/PJ (oxidation factor of 99.5%) and for black coal was 91.8 Gg/PJ (oxidation factor of 98.0%).
1A2f Other includes: Mining (non-energy minerals); Non-metallic mineral products; All other Manufacturing; and Construction.
1A5 Lubricants and Military transport emissions.

TABLE 1.A(b) SECTORAL BACKGROUND DATA FOR ENERGY
CO₂ from Fuel Combustion Activities—Reference Approach (IPCC Worksheet 1-1)
(Sheet 1 of 4)

Australia
2001
Submission 2003

FUEL TYPES	Unit	Production	Imports	Exports	International bunkers	Stock change	Apparent consumption	Conversion factor ⁽¹⁾ (TJ/Unit)	(1)	Apparent consumption (TJ)	Carbon emission factor (t C/TJ)	Carbon content (Gg C)	Carbon stored (Gg C)	Net carbon emissions (Gg C)	Fraction of carbon oxidized	Actual CO ₂ emissions (Gg CO ₂)
Liquid Fossil	Primary Fuels															
	Crude Oil	PJ	1,432.10	1,019.47	889.62		-121.65	1,683.60	1,000.00	GCV	18.60	31,314.90	0.00	31,314.90	0.99	113,673.10
	Orimulsion	PJ		NO	NO		NA	0.00	NA	GCV	NA	0.00	NO	0.00	NA	0.00
	Natural Gas Liquids	PJ	107.49	16.79	71.57		7.41	45,301.43	1,000.00	GCV	16.20	733.88	0.00	733.88	0.99	2,664.00
	Gasoline	PJ		40.65	46.51	0.00	-1.74	-4.12	1,000.00	GCV	18.03	-74.31	0.00	-74.31	0.99	-269.76
	Jet Kerosene	PJ		14.27	27.80	118.10	1.30	-132.93	1,000.00	GCV	19.01	-2,526.89	0.00	-2,526.89	0.99	-9,172.61
	Other Kerosene	PJ		0.00	0.37	0.00	0.22	-0.59	1,000.00	GCV	19.01	-11.27	0.00	-11.27	0.99	-40.91
	Shale Oil	PJ		NO	NO		NA	0.00	NA	GCV	NA	0.00	NO	0.00	NA	0.00
	Gas / Diesel Oil	PJ		43.58	48.97	4.70	-16.93	6.84	1,000.00	GCV	19.01	130.02	NA	130.02	0.99	471.99
	Residual Fuel Oil	PJ		33.21	28.87	29.50	-20.38	-4.79	1,000.00	GCV	20.10	-96.23	0.00	-96.23	0.99	-349.31
	LPG	PJ		NA	NA		NA	0.00	NA	GCV	16.20	0.00	NA	0.00	NA	0.00
	Ethane	PJ		0.00	0.00		0.00	0.00	1,000.00	GCV	15.41	0.00	226.40	-226.40	1.00	-830.15
	Naphtha	PJ		0.00	0.00		0.00	0.00	1,000.00	GCV	17.98	0.00	NA	0.00	1.00	0.00
Liquid Fossil Totals	Bitumen	PJ		1.49	0.11		-0.17	1.54	1,000.00	GCV	22.01	33.98	624.18	-590.20	1.00	-2,164.07
	Lubricants	PJ		1.29	10.80	0.00	-0.24	-9.27	1,000.00	GCV	20.10	-186.35	258.96	-445.31	1.00	-1,632.81
	Petroleum Coke	PJ		10.43	0.00		0.00	10.43	1,000.00	GCV	22.01	229.55	229.55	0.00	1.00	0.00
	Refinery Feedstocks	PJ		NA	NA		NA	0.00	NA	GCV	NA	0.00	NO	0.00	NA	0.00
	Other Oil	PJ		16.61	5.61		3.54	7.46	1,000.00	GCV	18.60	138.78	580.00	-441.22	1.00	-1,617.80
Solid Fossil	Primary Fuels															
	Anthracite	PJ		NO	NO		NA	0.00	NA	GCV	NA	0.00	NO	0.00	NA	0.00
	Coking Coal	PJ		NA	NA		NA	0.00	NA	GCV	NA	0.00	2,648.29	-2,648.29	1.00	-9,710.41
	Other Bit. Coal	PJ		6,878.50	0.00	5,517.60	-51.00	1,411.90	1,000.00	GCV	24.70	34,868.71	0.00	34,868.71	1.00	127,851.94
	Sub-bit. Coal	PJ		NA	NA		NA	0.00	NA	GCV	NA	0.00	NA	0.00	NA	0.00
	Lignite	PJ		664.70	0.00	0.00	0.00	664.70	1,000.00	GCV	25.25	16,784.85	0.00	16,784.85	1.00	61,544.47
	Oil Shale	PJ		0.00	0.00		0.00	0.00	NA	GCV	NA	0.00	NA	0.00	NA	0.00
	Peat	PJ		NO	NO		NA	0.00	NA	GCV	NA	0.00	NO	0.00	NA	0.00
	BKB & Patent Fuel	PJ		0.00	0.02		-1.50	1.48	1,000.00	GCV	28.64	42.38	0.00	42.38	0.99	153.85
	Coke Oven Gas Coke	PJ		0.00	0.50		6.80	-7.30	1,000.00	GCV	32.59	-237.91	0.00	-237.91	0.99	-863.63
Solid Fuel Totals																
Gaseous Fossil																
Total																
Biomass total																

⁽¹⁾ Gross calorific values (GCV)

TABLE 1.A(c) COMPARISON OF CO₂ EMISSIONS FROM FUEL COMBUSTION
(Sheet 1 of 1)

Australia
2001
Submission 2003

FUEL TYPES	Reference approach		National approach ⁽¹⁾		Difference	
	Energy consumption (PJ)	CO ₂ emissions (Gg)	Energy consumption (PJ)	CO ₂ emissions (Gg)	Energy consumption (%)	CO ₂ emissions (%)
Liquid Fuels (excluding international bunkers)	1,603.47	100,731.66	1,511.80	100,820.67	6.06	-0.09
Solid Fuels (excluding international bunkers)	2,070.78	178,976.21	2,003.69	180,984.37	3.35	-1.11
Gaseous Fuels	977.30	48,464.71	930.01	47,597.57	5.08	1.82
Other ⁽²⁾	NA	NA	NA	NA	NA	NA
Total ⁽²⁾	4,651.55	328,172.58	4,445.51	329,402.62	4.63	-0.37

(1) "National approach" is used to indicate the approach (if different from the Reference approach) followed by the Party to estimate its CO₂ emissions from fuel combustion reported in the national greenhouse gas Inventory.

(2) Emissions from biomass are not included.

Note: In addition to estimating CO₂ emissions from fuel combustion by sector, Parties should also estimate these emissions using the IPCC Reference Approach as found in the IPCC Guidelines, Worksheet 1-1(Volume 2, Workbook). The Reference Approach is to assist in verifying the sectoral data. Parties should also complete the above tables to compare the alternative estimates, and if the emission estimates lie more than 2 percent apart, should explain the source of this difference in the documentation box provided.

Documentation Box:

Three main reasons explain the difference between the Reference Approach and the National Approach as displayed in the above table and Table 1A(b):

- 1) Partly an artefact caused by deficiencies in the design of Tables 1.A(b) and 1.A(d). The CRF doesn't allow for the subtraction of the energy content of the fuels whose carbon is sequestered. It only allows for the subtraction of the sequestered carbon and carbon emitted elsewhere, i.e. in other sectors. Therefore, the energy consumption reported using this method for the Reference Approach includes energy which is netted out of the National Approach. The energy consumption for the Reference Approach and the National Approach will, therefore, never balance using the CRF tables in their current format.
- 2) The CRF tables assume that all ethane is sourced from oil refineries, derived from crude oil. This is false. In Australia, all ethane supplied to the chemical industry is sourced from gas wells, separated from methane at gas processing plants. It is therefore classed as a gaseous fuel, not a liquid fuel.
- 3) The defect described under point (1) also leads to slight discrepancies in both emission factors and oxidation factors between the two approaches for a number of individual fuel types.

In Table 1.A(b) Gas Biomass is Biogas sourced from Waste Landfills and is assumed to be used for electricity generation.

TABLE 1.A(d) SECTORAL BACKGROUND DATA FOR ENERGY
Feedstocks and Non-Energy Use of Fuels
(Sheet 1 of 1)

Australia
2001
Submission 2003

FUEL TYPE	ACTIVITY DATA AND RELATED INFORMATION		IMPLIED EMISSION FACTOR Carbon emission factor (t C/TJ)	ESTIMATE of carbon stored in non-energy use of fuels (Gg C)
	Fuel quantity (TJ)	Fraction of carbon stored		
Naphtha	0.00	NA	NA	NA
Lubricants	21,590.00	0.75	15.99	258.96
Bitumen	28,360.00	0.60	36.68	624.18
Coal Oils and Tars (from Coking Coal)	4,910.00	0.75	22.09	81.35
Natural Gas	0.00	NA	NA	NA
Gas/Diesel Oil	0.00	NA	NA	NA
LPG	0.00	NA	NA	NA
Butane	0.00	NA	NA	NA
Ethane	28,360.00	NA	NA	226.40
Other (please specify)				
Natural gas distribution and leakage	10,712.87	NA	NA	150.21
Natural gas used in reduction of iron ore	21,500.00	NA	NA	299.88
Coke used in reduction of iron ore	80,370.00	NA	NA	2,566.94
Petroleum Products Used as Feedstocks	16,976.56	NA	NA	314.09
Oil Refinery Flaring	4,890.00	0.00	0.00	91.49
Petroleum Coke for Anodes	10,430.00	0.00	0.00	229.55
Solvents	9,690.00	0.75	24.00	174.42

Additional information

CO ₂ not emitted (Gg CO ₂)	Subtracted from energy sector (specify source category)
NA	NA
949.53	A.5. Other
2,288.65	A.5. Other
298.28	A.2.c. Chemicals
NA	A.1.c. Other Energy Industries
NA	NA
NA	NA
NA	NA
830.15	A.2.c. Chemicals
550.77	A.1.c. Manufacture of Solid Fuels and Other Energy Industries
1,099.57	A.2.a. Iron and Steel
9,412.13	A.2.a. Iron and Steel
1,151.66	A.2.c. Chemicals
335.45	A.1.b. Petroleum Refining
841.70	A.2.b. Non-Ferrous Metals
639.54	A.5. Other

Documentation box: A fraction of energy carriers is stored in such products as plastics or asphalt. The non-stored fraction of the carbon in the energy carrier or product is oxidized, resulting in carbon dioxide emissions, either during the use of the energy carriers in the industrial production (e.g. fertilizer production), or during the use of the products (e.g. solvents, lubricants), or in both (e.g. monomers). To report associated emissions use the above table, filling an extra "Additional information" table, as shown below.

Associated CO ₂ emissions (Gg)	Allocated under (Specify source category) ^(a)
9,412.13	2.C.1. Iron and Steel Production
1,099.57	2.C.1. Iron and Steel Production
335.45	1.B.2.a. Oil - iv. Refining / Storage
841.70	2.C.3. Aluminium Production
213.18	Waste Incineration
Not oxidised: emitted as CH ₄ and some CO ₂	1.B.2.b. Natural Gas ii. Distribution

^(a) e.g. Industrial Processes, Waste Incineration, etc.

TABLE 1.B.1 SECTORAL BACKGROUND DATA FOR ENERGY
Fugitive Emissions from Solid Fuels
(Sheet 1 of 1)

Australia
2001
Submission 2003

Additional information ^(a)

Description	Value
Amount of CH ₄ drained (recovered) and utilized or flared (Gg)	C
Number of active underground mines	49
Number of mines with drainage (recovery) systems	4

^(a) For underground mines.

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	ACTIVITY DATA Amount of fuel produced (Mt)	IMPLIED EMISSION FACTOR CH ₄ (kg/t)	CO ₂ (kg/t)	EMISSIONS	
				CH ₄ (Gg)	CO ₂ (Gg)
I. B. I. a. Coal Mining and Handling					
i. Underground Mines	312.13			878.36	NE
Mining Activities	92.46	6.33	NA	584.86	NE
Post-Mining Activities		5.99	NA	553.65	NE
Surface Mines		0.34	NA	31.21	NE
Mining Activities	219.67	1.34	NA	293.49	NE
Post-Mining Activities		1.34	NA	293.49	NE
I. B. I. b. Solid Fuel Transformation					
I. B. I. c. Other (please specify)	IE	NA	NA	IE	NA
NA				NA	NA
NA	NA	NA	NA	NA	NA

Documentation box:

Run-of-mine data used

I.B.1.b. Solid Fuel Transformation is reported in 2.C.1. Iron and Steel Production

Data on methane recovered, utilised or flared is Confidential

TABLE 1.B.2 SECTORAL BACKGROUND DATA FOR ENERGY
Fugitive Emissions from Oil and Natural Gas
(Sheet 1 of 1)

Australia
2001
Submission 2003

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	ACTIVITY DATA		IMPLIED EMISSION FACTORS				EMISSIONS		
	Description	Unit	Value	CO ₂ (kg/unit)	CH ₄ (kg/unit)	N ₂ O (kg/unit)	CO ₂ (G-g)	CH ₄ (G-g)	N ₂ O (G-g)
I. B. 2. a. Oil							400.66	5.24	0.01
i. Exploration	NA	NA	NA	NA	NA		169.85	2.08	0.005
ii. Production	Crude oil and ORF produced	PJ	1,432.10	NA	600.87		NA	0.86	
iii. Transport	Quantity shipped	PJ	306.00	NA	745.00		NA	0.23	
iv. Refining / Storage	Oil refined	PJ	1,676.55	137,668.43	1,235.00		230.81	2.07	0.01
v. Distribution of oil products	Petrol, Diesel and Avgas sales	PJ	1,124.65	NA	NA		NA	NA	
vi. Other	NA	NA	NA	NA	NA		NA	NA	
I. B. 2. b. Natural Gas							9.86	173.71	
Exploration	NA	NA	NA	NA	NA		NA	NA	
i. Production / Processing	Gas produced	PJ	1,385.03	NA	1,077.59		NE	1.49	
ii. Transmission	Gas transmitted	PJ	756.00	622.49	10,733.58		0.47	8.11	
Distribution	Utility sales	PJ	418.67	22,422.22	391,953.91		9.39	164.10	
iii. Other Leakage	NE	NE	NE	NE	NE		NE	NE	
NA	NA	NA	NA	NA	NA		NA	NA	
I. B. 2. c. Venting							3,666.63	110.15	
i. Oil	NA	NA	NA	NA	NA		NA	NA	
ii. Gas	PJ gas produced	PJ	1,385.03	2,647,321.63	79,530.97		3,666.63	110.15	
iii. Combined	NA	NA	NA	NA	NA		NA	NA	
Flaring							2,846.61	35.31	0.08
i. Oil	IE	IE	IE	NA	NA		IE	IE	IE
ii. Gas	IE	IE	IE	NA	NA		IE	IE	IE
iii. Combined	PJ gas and oil produced	PJ	2,817.13	1,010,464.83	12,533.31	28.93	2,846.61	35.31	0.08
I.B.2.d. Other (please specify)							NA	NA	NA
NA	NA	NA	NA	NA	NA		NA	NA	NA

Additional information

Description	Value	Unit
Pipelines length (km)	93,934.50	km
Number of oil wells	NA	NA
Number of gas wells	NA	NA
Gas throughput	31,524.00	million m ³
Oil throughput ^(a)	667,000.00	bbls/day
Other relevant information (specify)		NA
NA		NA

^(a) barrels per day

TABLE 1.C SECTORAL BACKGROUND DATA FOR ENERGY
International Bunkers and Multilateral Operations
(Sheet 1 of 1)

Australia
2001
Submission 2003

Additional information

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	ACTIVITY DATA	IMPLIED EMISSION FACTORS			EMISSIONS		
		CO ₂	CH ₄	N ₂ O	CO ₂	CH ₄	N ₂ O
		(t/TJ)	(kg/TJ)	(kg/TJ)	(Gg)	(Gg)	(Gg)
Marine Bunkers	34,200.00				2,473.96	0.12	0.07

Fuel consumption	Allocation (percent)	
	Domestic	International
Marine	38.58	61.42
Aviation	40.23	59.77

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	ACTIVITY DATA Consumption (TJ)	IMPLIED EMISSION FACTORS			EMISSIONS		
		CO ₂ (t/TJ)	CH ₄ (kg/TJ)	N ₂ O (kg/TJ)	CO ₂ (Gg)	CH ₄ (Gg)	N ₂ O (Gg)
Marine Bunkers	34,200.00				2,473.96	0.12	0.07
Gasoline	NA	NA	NA	NA	NA	NA	NA
Gas/Diesel Oil	4,660.00	69.00	7.00	2.00	321.55	0.03	0.01
Residual Fuel Oil	29,540.00	72.86	3.00	2.00	2,152.40	0.09	0.06
Lubricants	NA	NA	NA	NA	NA	NA	NA
Coal	NA	NA	NA	NA	NA	NA	NA
Other (please specify)	NA	NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA	NA	NA
Aviation Bunkers	118,130.00				8,151.32	0.03	0.24
Jet Kerosene	118,130.00	69.00	0.24	2.07	8,151.32	0.03	0.24
Gasoline	NA	NA	NA	NA	NA	NA	NA
Multilateral Operations	NE	NE	NE	NE	NE	NE	NE

Note: In accordance with the IPCC Guidelines, international aviation and marine bunker fuel emissions from fuel sold to ships or aircraft engaged in international transport should be excluded from national totals and reported separately for informational purposes only.

Documentation box: Please explain how the consumption of International Marine and Aviation Bunkers fuels was estimated and separated from the domestic consumption.
Petroleum companies provide international and domestic bunker fuel consumption for maritime and aviation activities. Data on international and domestic fuel consumption are collected separately due to differential excise taxes placed on the fuel.

TABLE 2(I) SECTORAL REPORT FOR INDUSTRIAL PROCESSES
(Sheet 1 of 2)

Australia
2001
Submission 2003

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	CO ₂	CH ₄	N ₂ O	HFCs ⁽¹⁾		PFCs ⁽¹⁾		SF ₆		NO _x	CO	NMVOC	SO ₂
	(Gg)			P	A	P	A	P	A				
				CO ₂ equivalent (Gg)						(Gg)			
Total Industrial Processes	18,211.90	2.76	0.07	NE	2,344.90	NE	1,527.04	NE	0.00	55.70	8.04	62.33	1,729.33
A. Mineral Products	5,099.94	NA	NA							NE	NE	16.73	NE
1. Cement Production	3,328.36												NE
2. Lime Production	1,015.22												
3. Limestone and Dolomite Use	756.35												
4. Soda Ash Production and Use ⁽²⁾	C												
5. Asphalt Roofing	NO										NO	NO	
6. Road Paving with Asphalt	NE									NE	NE	16.73	NE
7. Other (please specify)	NE	NA	NA							NA	NA	NA	NA
Glass production	NE	NA	NA							NA	NA	NA	NA
Magnesia Production	NE	NA	NA							NA	NA	NA	NA
B. Chemical Industry ⁽²⁾	C	NE	C	NA	NA	NA	NA	NA	NA	NE	NE	NE	NE
1. Ammonia Production	C		NE							NE	NE	NE	NE
2. Nitric Acid Production			C							NE	NE		
3. Adipic Acid Production			NO							NO	NO	NO	
4. Carbide Production	NO	NO									NO	NO	NO
5. Other (please specify)	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA
Polymers and other chemicals	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA
C. Metal Production	13,111.96	2.76	0.07	NA	NA	NA	1,527.04	NA	NE	55.70	8.04	0.10	1,729.33
1. Iron and Steel Production	10,467.76	2.76	0.07							55.70	8.04	0.10	0.08
2. Ferroalloys Production	NA	NA								NA	NA	NA	NA
3. Aluminium Production	2,644.20	NA					1,527.04			NE	NE	NE	45.67
4. SF ₆ Used in Aluminium and Magnesium Foundries									NE				
5. Other (please specify)	NE	NE	NE	NE	NA	NA	NA	NA	NA	NE	NE	NE	1,683.59
Copper, lead, zinc, nickel and silver	NE	NE	NE	NE	NA	NA	NA	NA	NA	NE	NE	NE	1,683.59

⁽¹⁾ P = Potential emissions based on Tier 1 approach of the IPCC Guidelines. A = Actual emissions based on Tier 2 approach of the IPCC Guidelines. This only applies in sectors where methods exist for both tiers.

⁽²⁾ Speciated emissions from Soda Ash Production and Use, Ammonia Production and Nitric Acid Production are Confidential. These emissions are reported in Summary Table 2 and Table 10s5 as CO₂-e emissions. The total emissions from 2A4 Soda Ash Production and Use and 2B. Chemical Industry are 2754.06 Gg CO₂-e

TABLE 2(I) SECTORAL REPORT FOR INDUSTRIAL PROCESSES
(Sheet 2 of 2)

Australia
2001
Submission 2003

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	CO ₂	CH ₄	N ₂ O	HFCs		PFCs		SF ₆		NO _x	CO	NM VOC	SO ₂
	(Gg)			P	A	P	A	P	A		(Gg)		
D. Other Production	NE									NE	NE	45.50	NE
1. Pulp and Paper										NE	NE	NE	NE
2. Food and Drink	NE											45.50	
E. Production of Halocarbons and SF₆													
1. By-product Emissions										NO	NO		
Production of HCFC-22										NO	NO		
Other										NA			
2. Fugitive Emissions										NO			
3. Other (please specify)										NA			
NA										NA			
F. Consumption of Halocarbons and SF₆													
1. Refrigeration and Air Conditioning Equipment				NE	2,344.90	NE	NE	NE	NE	NE			
2. Foam Blowing				NE	2,344.90	NE	NE	NO	NO	NO			
3. Fire Extinguishers				NE	NE	NE	NE	NO	NO	NO			
4. Aerosols/ Metered Dose Inhalers				NE	NE	NE	NO	NO	NO	NO			
5. Solvents				NE	NE	NE	NO	NO	NO	NO			
6. Semiconductor Manufacture				NO	NO	NO	NO	NO	NO	NO			
7. Electrical Equipment				NO	NO	NO	NO	NE	NE	NE			
8. Other (please specify)				NA	NA	NA	NA	NA	NA	NA			
NA				NA	NA	NA	NA	NA	NA	NA			
G. Other (please specify)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

TABLE 2(I).A-G SECTORAL BACKGROUND DATA FOR INDUSTRIAL PROCESSES
Emissions of CO₂, CH₄ and N₂O
(Sheet 1 of 2)

Australia
2001
Submission 2003

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	ACTIVITY DATA		IMPLIED EMISSION FACTORS			EMISSIONS			
	Description	Production/Consumption quantity (kt)	CO ₂ (t/t)	CH ₄ (t/t)	N ₂ O (t/t)	CO ₂ (Gg)		CH ₄ (Gg)	
						(⁽¹⁾)	(⁽¹⁾)	(⁽¹⁾)	(⁽¹⁾)
A. Mineral Products									
1. Cement Production	Clinker production	6,425.41	0.52			5,099.94	NA	NA	NA
2. Lime Production	Commercial and in-house	1,489.22	0.68			3,328.36	NA		
3. Limestone and Dolomite Use	Used in iron and steel	1,835.02	0.41			1,015.22	NA		
4. Soda Ash						756.35	NA		
						C	NA		
	Soda ash production	C	C			C	NA		
	Soda ash use	C	C			C	NA		
5. Asphalt Roofing	NO	NO	NO			NO	NO		
6. Road Paving with Asphalt	Bitumen used in spray sealing	309.74	NE			NE	NE		
7. Other (please specify)						NE	NE	NA	NA
Glass Production			NE			NE	NE		
Magnesia Production		NA	NE	NA	NA	NE	NE	NA	NA
B. Chemical Industry									
1. Ammonia Production	Production	C	C	NA	NE	C	NA	NE	C
2. Nitric Acid Production	Production	C			C				NE
3. Adipic Acid Production	NO	NO			NO				C
4. Carbide Production	NO	NO	NO	NO					NO
Silicon Carbide	NO	NO	NO	NO		NO	NO	NO	
Calcium Carbide	NE	NE	NE	NE		NE	NE	NE	
5. Other (please specify)						NE	NE	NE	NE
Carbon Black									
Ethylene	NE	NE	NE	NE	NE				
Dichloroethylene	NE	NE	NE	NE	NE	NE	NE	NE	NE
Styrene	NE	NE	NE	NE	NE				
Methanol	NE	NE	NE	NE	NE				
NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

(¹) Adjusted emissions, reduced to account for emission recovery, oxidation, destruction and transformation.

TABLE 2(I).A-G SECTORAL BACKGROUND DATA FOR INDUSTRIAL PROCESSES
Emissions of CO₂, CH₄ and N₂O
(Sheet 2 of 2)

Australia
2001
Submission 2003

GREENHOUSE GAS SOURCE AND SINK CATEGORIES		ACTIVITY DATA		IMPLIED EMISSION FACTORS			EMISSIONS						
		Production/Consumption quantity Description	CO ₂ (t/t)	CH ₄ (t/t)	N ₂ O (t/t)	CO ₂		CH ₄		N ₂ O			
						(Gg)	(t)	(Gg)	(t)	(Gg)	(t)		
C. Metal Production													
1. Iron and Steel Production	Crude steel (BF/BOS)	6,027.00					13,111.96	NA		2.76	NA	0.07	NA
	Crude steel (BF/BOS)	6,027.00	NA				10,467.76	NA		2.76	NA	0.07	
Pig Iron	Natural gas (PJ)	21.5	51.15	0.00			1,099.83	NA		0.02	NA	0.002	
Sinter	NA	NA	NA	NA			NA	NA	NA	NA	NA		
Coke	Coke (PJ)	79.99	117.11	0.03			9,367.93	NA		2.74	NA	0.06	
Other (please specify)								NA	NA	NA	NA		
NA	NA	NA	NA	NA			NA	NA	NA	NA	NA		
2. Ferroalloys Production	NA	NA	NA	NA			NA	NA	NA	NA	NA		
3. Aluminium Production	Primary aluminium	1,788.00	1.48	NA			2,644.20	NA		NA	NA		
4. SF ₆ Used in Aluminium and Magnesium Foundries								NA					
5. Other (please specify)													
Copper, lead, zinc, nickel and silver	NE	NE	NE	NE			NE	NA	NA	NE	NA	NE	NA
								NE	NA	NE	NA	NE	NA
D. Other Production								NE					
1. Pulp and Paper													
2. Food and Drink	Bread, wine, beer, sugar, meat	NE	NE				NE	NE					
G. Other (please specify)													
NA	NA	NA	NA	NA			NA	NA	NA	NA	NA	NA	NA

(1) Adjusted emissions, reduced to account for emission recovery, oxidation, destruction and transformation.

Documentation box:

Data on iron and steel sourced from industry; data on aluminium production sourced from ABARE (2002); data to derive average emission factors for PFCs for aluminium provided by the Australian Aluminium Council

Emissions from aluminium are net of alumina sink

To protect commercial-in-confidence data specified emissions from Soda Ash Production and Use, Ammonia Production, and Nitric Acid Production are Confidential. These emissions are reported in Summary Table 2 and Table 10s5 as CO₂-e emissions. The total emissions from these sources are 2754.06 Gg CO₂-e.

BF/BOS refers to blast furnace/basic oxygen system

TABLE 2(ii) SECTORAL REPORT FOR INDUSTRIAL PROCESSES—EMISSIONS OF HFCs, PFCs AND SF₆
(Sheet 1 of 2)

Australia
2001
Submission 2003

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	HFC-23	HFC-32	HFC-41	HFC-43-10mee	HFC-125	HFC-134	HFC-134a	HFC-152a	HFC-143	HFC-143a	HFC-227ea	HFC-236fa	HFC-245ca	Total HFCs ⁽¹⁾	CF ₄	C ₂ F ₆	C ₃ F ₈	C ₄ F ₁₀	c-C ₄ F ₈	C ₃ F ₁₂	C ₆ F ₁₄	Total PFCs ⁽¹⁾	SF ₆
	(t) ⁽²⁾																						
Total Actual Emissions of Halocarbons (by chemical) and SF₆	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE		198.45	25.77	NE	NE	NE	NE	NE		NE
C. Metal Production															198.45	25.77	NE	NE	NE	NE	NE		NE
Aluminium Production															198.45	25.77	NE	NE	NE	NE	NE		NE
SF ₆ Used in Aluminium Foundries																							NO
SF ₆ Used in Magnesium Foundries																							NE
E. Production of Halocarbons and SF₆	NO	NO	NO																				NE
1. By-product Emissions	NO	NO	NO																				NO
Production of HCFC-22	NO																						NO
Other																							NE
2. Fugitive Emissions	NO	NO	NO																				NO
3. Other (please specify)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA										NA
NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA										NA
F(a). Consumption of Halocarbons and SF₆ (actual emissions - Tier 2)	NE	NE	NE	NE	76.68	NE	1,393.14	NE	NE	83.97	NE	NE	NE										NE
1. Refrigeration and Air Conditioning Equipment	NE	NE	NE	NO	76.68	NE	1,393.14	NE	NE	83.97	NE	NE	NE										NE
2. Foam Blowing	NE	NO	NE	NO	NE	NE	NE	NE	NE	NE	NO	NO	NE										NO
3. Fire Extinguishers	NE	NO	NE	NO	NE	NE	NE	NE	NE	NE	NO	NO	NE										NO
4. Aerosols/Metered Dose Inhalers	NO	NO	NO	NO	NO	NO	NE	NE	NE	NO	NO	NO	NO										NO
5. Solvents	NE	NO	NE	NE	NO	NE	NE	NE	NE	NO	NO	NO	NE										NO
6. Semiconductor Manufacture	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO										NO
7. Electrical Equipment																							NE
8. Other (please specify)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA										NA
NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA										NA
G. Other (please specify)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA										NA
NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA										NA

⁽¹⁾ Although shaded, the columns with HFCs and PFCs totals on sheet 1 are kept for consistency with sheet 2 of the table.

⁽²⁾ Note that the units used in this table differ from those used in the rest of the Sectoral report tables, i.e. [t] instead of [Gg].

TABLE 2(IJ) SECTORAL REPORT FOR INDUSTRIAL PROCESSES—EMISSIONS OF HFCs, PFCs AND SF₆
(Sheet 2 of 2)

Australia
2001
Submission 2003

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	HFC-23	HFC-32	HFC-41	HFC-43-10mcc	HFC-125	HFC-134	HFC-134a	HFC-152a	HFC-143	HFC-143a	HFC-227ea	HFC-236fa	HFC-245ca	Total HFCs	CF ₄	C ₂ F ₆	C ₃ F ₈	C ₄ F ₁₀	e-C ₄ F ₈	C ₅ F ₁₂	C ₆ F ₁₄	Total PFCs	SF ₆
	(t)																						
F(p). Total Potential Emissions of Halocarbons (by chemical) and SF ₆	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE		NE	NE	NE	NE	NE	NE	NE		NE
Production	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO		NO	NO	NO	NO	NO	NO	NO		NO
Import	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE		NE	NE	NE	NE	NE	NE	NE		NE
In bulk	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE		NE	NE	NE	NE	NE	NE	NE		NE
In products	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE		NE	NE	NE	NE	NE	NE	NE		NE
Export	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE		NE	NE	NE	NE	NE	NE	NE		NE
In bulk	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE		NE	NE	NE	NE	NE	NE	NE		NE
In products	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE		NE	NE	NE	NE	NE	NE	NE		NE
Destroyed amount	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE		NE	NE	NE	NE	NE	NE	NE		NE
GWP values used	11700	650	150	1300	2800	1000	1300	140	300	3800	2900	6300	560		6500	9200	7000	7000	8700	7500	7400		23900
Total Actual Emissions (Gg CO ₂ eq.)	NE	NE	NE	NE	214.72	NE	1,811.09		NE	319.09	NE	NE	NE	2,344.90	1,289.93	237.11	NE	NE	NE	NE	NE	1,527.04	NE
C. Metal Production															1,289.93	237.11	NO	NO	NO	NO	NO	1,527.04	NE
E. Production of Halocarbons and SF ₆	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NE	NO	NO	NO	NO	NO	NO	NO
F(a). Consumption of Halocarbons and SF ₆	NE	NE	NE	NE	214.72	NE	1,811.09	NE	NE	319.09	NE	NE	NE	2,344.90	NE	NE	NE	NE	NE	NE	NE	NE	NE
G. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ratio of Potential/Actual Emissions from Consumption of Halocarbons and SF ₆																							
Actual Emissions – F(a) (Gg CO ₂ eq.)	NE	NE	NE	NE	214.72	NE	1,811.09	NE	NE	319.09	NE	NE	NE	2,344.90	NE	NE	NE	NE	NE	NE	NE	NE	NE
Potential Emissions – F(p) (t) (Gg CO ₂ eq.)	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
Potential/Actual Emissions Ratio	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

TABLE 2(II). C, E SECTORAL BACKGROUND DATA FOR INDUSTRIAL PROCESSES

Metal Production; Production of Halocarbons and SF₆
(Sheet 1 of 1)

Australia

2001

Submission 2003

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	ACTIVITY DATA		IMPLIED EMISSION FACTORS	EMISSIONS	
	Description	(t)	(kg/t)	(t)	(t)
C. PFCs and SF₆ from Metal Production					
PFCs from Aluminium Production					
CF ₄	Primary aluminium	1,788,000.00	0.11	198.45	NA
C ₂ F ₆	Primary aluminium	1,788,000.00	0.01	25.77	NA
SF ₆				0.00	NA
Aluminium Foundries	(SF ₆ consumption)	NO	NO	NO	NO
Magnesium Foundries	(SF ₆ consumption)	NE	NE	NE	NA
E. Production of Halocarbons and SF₆					
1. By-product Emissions					
Production of HCFC-22					
HFC-23	NO	NO	NO	NO	NO
Other (specify chemical)					
NA	NA	NA	NA	NA	NA
2. Fugitive Emissions					
HFCs (specify chemical)					
NO	NO	NO	NO	NO	NO
PFCs (specify chemical)					
NO	NO	NO	NO	NO	NO
SF ₆	NO	NO	NO	NO	NO
3. Other (please specify)					
NA	NA	NA	NA	NA	NA

⁽¹⁾ Adjusted emissions, reduced to account for emission recovery, oxidation, destruction and transformation

TABLE 2(I).F. SECTORAL BACKGROUND DATA FOR INDUSTRIAL PROCESSES
Consumption of Halocarbons and SF₆
(Sheet 1 of 2)

Australia
2001
Submission 2003

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	ACTIVITY DATA			IMPLIED EMISSION FACTORS			EMISSIONS	
	Filled in new manufactured products	In operating systems (average annual stocks)	Remained in products at decommissioning	Product manufacturing factor	Product life factor	Disposal loss factor	From manufacturing	From stocks
	(t)			(% per annum)			(t)	
1 Refrigeration								
Air Conditioning Equipment								
Domestic Refrigeration (<i>Specify chemical</i>)								
NE	NE	NE	NE	NE	NE	NE	NE	NE
Commercial Refrigeration								
NE	NE	NE	NE	NE	NE	NE	NE	NE
Transport Refrigeration								
NE	NE	NE	NE	NE	NE	NE	NE	NE
Industrial Refrigeration								
NE	NE	NE	NE	NE	NE	NE	NE	NE
Stationary Air-Conditioning								
NE	NE	NE	NE	NE	NE	NE	NE	NE
Mobile Air-Conditioning								
NE	NE	NE	NE	NE	NE	NE	NE	NE
2 Foam Blowing								
Hard Foam								
NE	NE	NE	NE	NE	NE	NE	NE	NE
Soft Foam								
NE	NE	NE	NE	NE	NE	NE	NE	NE

TABLE 2(II).F SECTORAL BACKGROUND DATA FOR INDUSTRIAL PROCESSES
Consumption of Halocarbons and SF₆
(Sheet 2 of 2)

Australia

2001

Submission 2003

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	ACTIVITY DATA <i>Amount of fluid</i>			IMPLIED EMISSION FACTORS			EMISSIONS	
	Filled in new manufactured products	In operating systems (average annual stocks)	Remained in products at decommissioning	Product manufacturing factor	Product life factor	Disposal loss factor	From manufacturing	From disposal
					(% per annum)			(t)
3 Fire Extinguishers								
NE	NE	NE	NE	NE	NE	NE	NE	NE
4 Aerosols								
Metered Dose Inhalers								
NE	NE	NE	NE	NE	NE	NE	NE	NE
Other								
NE	NE	NE	NE	NE	NE	NE	NE	NE
5 Solvents								
NE	NE	NE	NE	NE	NE	NE	NE	NE
6 Semiconductors								
NO	NO	NO	NO	NO	NO	NO	NO	NO
7 Electric Equipment								
NE	NE	NE	NE	NE	NE	NE	NE	NE
NA	NA	NA	NA	NA	NA	NA	NA	NA

TABLE 3 SECTORAL REPORT FOR SOLVENT AND OTHER PRODUCT USE
(Sheet 1 of 1)

Australia
2001
Submission 2003

GREENHOUSE GAS SOURCE AND SINK CATEGORIES		CO ₂	N ₂ O (Gg)	NM VOC
Total Solvent and Other Product Use		NA	NE	140.31
A. Paint Application		NA	NA	62.18
B. Degreasing and Dry Cleaning		NA	NA	35.27
C. Chemical Products, Manufacture and Processing				0.78
D. Other (<i>please specify</i>)		NA	NE	42.09
Domestic and Commercial Aerosol Products		NA	NE	25.33
Other Domestic and Commercial Products		NA	NE	7.79
Consumer Cleaning Products		NA	NE	8.96

TABLE 3.A-D SECTORAL BACKGROUND DATA FOR SOLVENT AND OTHER PRODUCT USE
(Sheet 1 of 1)

Australia
2001
Submission 2003

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	ACTIVITY DATA		IMPLIED EMISSION FACTORS	
	Description	(kt)	CO ₂ (t/t)	N ₂ O (t/t)
A. Paint Application	Production	260.76	0.00	0.00
B. Degreasing and Dry Cleaning	Population	NA	0.00	0.00
C. Chemical Products, Manufacture and Processing				
D. Other <i>(please specify)</i>				
Domestic and Commercial Aerosol Products	Population	NA	0.00	0.00
Other Domestic and Commercial Products	Population	NA	0.00	0.00
Consumer Cleaning Products	Population	NA	0.00	0.00

TABLE 4 SECTORAL REPORT FOR AGRICULTURE
(Sheet 1 of 2)

Australia
2001
Submission 2003

GREENHOUSE GAS SOURCE AND SINK		CH ₄	N ₂ O	NO _x	CO	NM VOC
CATEGORIES		(Gg)				
Total Agriculture		3,707.88	90.00	1,393.05	18,590.11	1,084.42
A. Enteric Fermentation		3,104.98				
1. Cattle		2,303.51				
Dairy Cattle		359.53				
Non-Dairy Cattle		1,943.97				
2. Buffalo		0.37				
3. Sheep		789.03				
4. Goats		1.78				
5. Camels and Llamas		0.10				
6. Horses		3.92				
7. Mules and Asses		0.00				
8. Swine		3.79				
9. Poultry		NE				
10. Other (please specify)		2.48				
Alpaca		0.04				
Deer		1.51				
Ostriches/Emus		0.93				
B. Manure Management		91.10	3.68			NA
1. Cattle		29.13				
Dairy Cattle		28.20				
Non-Dairy Cattle		0.93				
2. Buffalo		NE				
3. Sheep		NE				
4. Goats		NE				
5. Camels and Llamas		NE				
6. Horses		NE				
7. Mules and Asses		NE				
8. Swine		59.75				
9. Poultry		2.22				

TABLE 4 SECTORAL REPORT FOR AGRICULTURE
(Sheet 2 of 2)

Australia
2001
Submission 2003

GREENHOUSE GAS SOURCE AND SINK CATEGORIES		CH ₄	N ₂ O	NO _x (Gg)	CO	NM VOC
B. Manure Management (continued)						
10. Anaerobic Lagoons			0.07			NA
11. Liquid Systems			0.00			NA
12. Solid Storage and Dry Lot			1.91			NA
13. Other <i>(please specify)</i>			1.70			NA
Digester			0.00			NA
Poultry with bedding			1.64			NA
Poultry without bedding			0.06			NA
C. Rice Cultivation		35.14				NA
1. Irrigated		35.14				NA
2. Rainfed		NO				NA
3. Deep Water		NO				NA
4. Other <i>(please specify)</i>		NA				NA
NA		NA				NA
D. Agricultural Soils		NE	62.21			NA
1. Direct Soil Emissions		NE	24.95			NA
2. Animal Production		NE	14.54			NA
3. Indirect Emissions		NE	NE			NA
4. Other <i>(please specify)</i>		NA	22.73			NA
Soil Disturbance		NA	22.73			NA
E. Prescribed Burning of Savannas		464.05	23.75	1,372.27	18,098.02	1,055.72
F. Field Burning of Agricultural Residues		12.62	0.36	20.78	492.10	28.71
1. Cereals		11.40	0.28	16.28	444.53	25.93
2. Pulse		NO	NO	NO	NO	NA
3. Tuber and Root		NO	NO	NO	NO	NA
4. Sugar Cane		1.22	0.08	4.51	47.56	2.77
5. Other <i>(please specify)</i>		NA	NA	NA	NA	NA
NA		NA	NA	NA	NA	NA
G. Other <i>(please specify)</i>		NA	NA	NA	NA	NA
NA		NA	NA	NA	NA	NA

TABLE 4.A SECTORAL BACKGROUND DATA FOR AGRICULTURE
Enteric Fermentation
(Sheet 1 of 1)

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	ACTIVITY DATA AND OTHER RELATED INFORMATION			IMPLIED EMISSION FACTORS	
	Population size (1000 head)	Average daily feed intake (MJ/day)	CH ₄ conversion (%)	CH ₄ (kg CH ₄ /head/yr)	
1. Cattle	NA	NA	NA	NA	NA
Dairy Cattle	3,177	226.0	7.59	113.16	
Non-Dairy Cattle	24,476	132.7	9.06	79.42	
2. Buffalo	7	NA	NA	55.00	
3. Sheep	114,740	16.9	6.16	6.88	
4. Goats	356	NA	NA	5.00	
5. Camels and Llamas	2	NA	NA	46.00	
6. Horses	218	NA	NA	18.00	
7. Mules and Asses	0	NA	NA	10.00	
8. Swine	2,629	30.8	0.71	1.44	
9. Poultry	89,918	NA	NA	NA	
10. Other (please specify)					
Alpacas	4	NA	NA	10.00	
Deer	141	NA	NA	10.70	
Ostriches/Emus	185	NA	NA	5.00	

Additional information (for Tier 2)

Disaggregated list of animals		Dairy Cattle	Non-Dairy Cattle - Free range	Non-Dairy Cattle - Feedlot	Sheep	Swine
Indicators:						
Weight	(kg)	470.90	382.32	463.60	45.44	60.60
Feeding situation ^(c)		Pasture	Pasture	Stall-fed	Pasture	Stall-fed
Milk yield	(kg/day)	13.39	NA	NA	NA	NA
Work	(hrs/day)	NA	NA	NA	NA	NA
Pregnant	(%)	NA	NA	NA	NA	NA
Digestibility of feed	(%)	76.28	59.68	80.00	63.02	NA

Documentation box:

Feed intakes are presented only for those species where it is calculated. For the minor species, a Tier 1 approach was used and no intake calculated.

The intake, liveweight and digestibility values are national means. For example, average intake was calculated as the sum of all intakes by class by season by region divided by the sum of animal numbers. Similarly weight was calculated as the total herd weight divided by the total number of animals. Full disaggregation of data by species by State by season can be found in the Australian Methodology Workbook for Livestock 6.2. This includes data used for the Inventory calculations that are not requested in this table.

Methane conversion was calculated as daily methane emissions (drawn from Table4s1) converted to energy terms (55.22 MJ/kg) divided by the daily feed intake (which assumes an energy value in feed of 18.4 MJ/kg).

Milk yield is calculated as a national average from industry statistics.

Feedlot cattle data are presented in the additional table as a separate class but these animals are included in the Non-Dairy Cattle class in the main table.

TABLE 4.B(a) SECTORAL BACKGROUND DATA FOR AGRICULTURE
CH₄ Emissions from Manure Management
(Sheet 1 of 1)

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	ACTIVITY DATA AND OTHER RELATED INFORMATION					IMPLIED EMISSION FACTORS CH ₄ (kg CH ₄ /head/yr)	
	Population size (1000 head)	Allocation by climate region ⁽¹⁾			VS ⁽²⁾ daily excretion (kg dm/head/dy)		CH ₄ producing potential (Bo) ⁽²⁾ (CH ₄ m ³ /kg VS)
		Cool	Temperate	Warm			
1. Cattle	NA	NA	NA	NA	NA	NA	
Dairy Cattle	3,177	0.0	90.7	9.3	470.9	2.7	
Non-Dairy Cattle - Feedlot	653	0.0	46.5	53.5	483.9	1.9	
2. Buffalo	7	0.0	0.0	100.0	NA	NA	
3. Sheep	114,740	0.0	92.2	7.8	45.4	NA	
4. Goats	356	0.0	78.3	21.7	NA	NA	
5. Camels and Llamas	2	0.0	20.2	79.8	NA	NA	
6. Horses	218	0.0	57.8	42.2	NA	NA	
7. Mules and Asses	0	0.0	0.0	100.0	NA	NA	
8. Swine	2,629	0.0	78.2	21.8	60.6	0.3	
9. Poultry	89,918	0.0	84.7	15.3	1.1	0.0	

⁽¹⁾ Climate regions are defined in terms of annual average temperature as follows: Cool=less than 15°C; Temperate=15°C to 25°C inclusive; and Warm=greater than 25°C (see Table 4.2 of the IPCC Guidelines (Volume 3, Reference Manual, p. 4.8)).

⁽²⁾ VS=Volatile Solids; Bo=maximum methane producing capacity for manure IPCC Guidelines (Volume 3, Reference Manual, p.4.23 and p. 4.15).

Documentation Box:

Animal mass is calculated as a national average for those species where it is recorded in the Australian inventory approach. For Dairy Cattle, this includes milking cattle as well as other classes in the dairy herd (eg heifers, dairy bulls). These other classes are a small portion of the herd but importantly have very different feeding conditions to Non-Dairy Cattle and hence are here dealt with separately as part of the dairy herd. Animal mass for Non-Dairy Cattle is the weighted average for Feedlot Cattle as free range cattle are not considered to produce methane from manure as explained below.

Volatile solids for Dairy and Feedlot Cattle are calculated from average feed intake (Table4.A) adjusted for digestibility and ash content.

Volatile solids and values for waste management systems for Non-Dairy Cattle refer only to cattle kept in feedlots and are calculated similarly to that for Dairy Cattle. The predominantly free-ranging cattle, sheep and other livestock in Australia are not considered to produce significant methane from manure as it is voided under generally, hot, dry, aerobic conditions with substantial bioturbation.

Additional information (for Tier 2)

Animal category ^(a)	Indicator	Climate region	Animal waste management system				
			Anaerobic lagoon	Liquid system	Daily spread	Solid storage and dry lot	Pasture range paddock
Dairy Cattle	Allocation(%)	Cool	NA	NA	NA	NA	NA
		Temperate	4.9	0.4	1.3	0.0	93.3
		Warm	2.5	0.0	5.8	0.0	91.7
	MCF ^(a)	Cool	NA	NA	NA	NA	NA
		Temperate	90.0	35.0	0.5	1.5	1.0
		Warm	90.0	65.0	1.0	5.0	2.0
Non-Dairy Cattle	Allocation(%)	Cool	NA	NA	NA	NA	NA
		Temperate	NA	NA	NA	100.0	NA
		Warm	NA	NA	NA	100.0	NA
	MCF ^(a)	Cool	NA	NA	NA	NA	NA
		Temperate	NA	NA	NA	1.5	NA
		Warm	NA	NA	NA	5.0	NA
Swine	Allocation(%)	Cool	NA	NA	NA	NA	NA
		Temperate	70.7	0.0	24.7	4.1	0.0
		Warm	92.0	1.5	1.5	5.0	0.0
	MCF ^(a)	Cool	NA	NA	NA	NA	NA
		Temperate	90.0	35.0	0.5	1.5	NA
		Warm	90.0	65.0	1.0	5.0	NA

^(a) MCF = Methane Conversion Factor (IPCC Guidelines, (Volume 3, Reference Manual, p. 4.9)). In the case of use of other climate region categorization, please replace the entries in the cells with the climate regions for which the MCFs are specified.

TABLE 4.B(b) SECTORAL BACKGROUND DATA FOR AGRICULTURE
N₂O Emissions from Manure Management
(Sheet 1 of 1)

Australia
2001
Submission 2003

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Population size (1000s)	Nitrogen excretion (kg N/head/yr)	ACTIVITY DATA AND OTHER RELATED INFORMATION					IMPLIED EMISSION FACTORS	
			Nitrogen excretion per animal waste management system (kg N/yr)					Emission factor per animal waste management system	
			Anaerobic lagoon	Liquid system	Daily spread	Solid storage and dry lot	Pasture range and paddock	Other	(kg N ₂ O-N/kg N)
Non-Dairy Cattle - Free Range	23,823	39.1	NA	NA	NA	NA	931,815,810.9	NA	Anaerobic lagoon
Dairy Cattle	3,177	139.1	21,029,165.0	1,617,834.5	7,330,847.6	NA	411,943,415.2	NA	Liquid system
Sheep	114,740	7.0	NA	NA	NA	NA	806,128,085.0	NA	Solid storage and dry lot
Swine	2,629	12.1	23,935,529.9	102,845.2	6,251,862.3	1,368,645.4	NA	134,158.5	Other
Poultry	89,918	NA	NA	NA	NA	NA	1,848,844.0	59,779,288.8	
Other (please specify)									
Non-Dairy Cattle-Feedlot	653	91.0	NA	NA	NA	59,380,379.7	NA	NA	
Goats, horses, deer, buffalo, donkeys, mules, emus, ostriches, alpacas, camels	914	NA	NA	NA	NA	NA	14,651,308.1	NA	
Total per AWMS⁽¹⁾			44,964,694.9	1,720,679.8	13,582,709.9	60,749,025.2	2,166,387,463.1	59,913,447.3	

⁽¹⁾ AWMS = Animal Waste Management System.

Documentation box:

Non-Dairy cattle are here disaggregated into free-range and feedlot cattle. This is important as both the characteristics of nitrogen excretion differ as does the handling of the waste in terms of the Inventory process. Nitrous oxide emissions from managed manure systems arises only from feedlot cattle.

Nitrogen excretion rates for the aggregated livestock classes are reported in the Australian Methodology Workbook for Livestock 6.2

TABLE 4.C SECTORAL BACKGROUND DATA FOR AGRICULTURE

Rice Cultivation

(Sheet 1 of 1)

Australia

2001

Submission 2003

GREENHOUSE GAS SOURCE AND SINK CATEGORIES		ACTIVITY DATA AND OTHER RELATED INFORMATION			IMPLIED EMISSION FACTOR	EMISSIONS
		Harvested area (10 ⁻⁹ m ² /yr)	Organic amendments added :			
			type	(t/ha)		
1. Irrigated						35.14
	Continuously Flooded		1.56	NA	NA	35.14
	Intermittently Flooded	Single Aeration	NO	NO	NO	NO
	Multiple Aeration		NO	NO	NO	NO
2. Rainfed						NO
	Flood Prone		NO	NO	NO	NO
	Drought Prone		NO	NO	NO	NO
3. Deep Water						NO
	Water Depth 50-100 cm		NO	NO	NO	NO
	Water Depth > 100 cm		NO	NO	NO	NO
4. Other (please specify)						NA
	NA		NA	NA	NO	NA
Upland Rice			NO			
Total			1.56			

TABLE 4.D SECTORAL BACKGROUND DATA FOR AGRICULTURE
Agricultural Soils
(Sheet 1 of 1)

Australia
2001
Submission 2003

Additional information

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	ACTIVITY DATA AND OTHER RELATED INFORMATION		IMPLIED EMISSION FACTORS		EMISSIONS (Gg N ₂ O)
	Description	Value	Unit		
Direct Soil Emissions	N input to soils (kg N/yr)				24.95
Synthetic Fertilizers	Use of synthetic fertilizers (kg N/yr)	1,013,010,333	(kg N ₂ O-N/kg N)	0.013	19.90
Animal Wastes Applied to Soils	Nitrogen input from manure applied to soils (kg N/yr)	178,585,094	(kg N ₂ O-N/kg N)	0.018	5.05
N-fixing Crops	Dry pulses and soybeans produced (kg dry biomass/yr)	IE	(kg N ₂ O-N/kg dry biomass)	NA	IE
Crop Residue	Dry production of other crops (kg dry biomass/yr)	IE	(kg N ₂ O-N/kg dry biomass)	NA	IE
Cultivation of Histosols	Area of cultivated organic soils (ha)	IE	(kg N ₂ O-N/ha)	NA	IE
Animal Production	N excretion on pasture range and paddock (kg N/yr)	2,166,387,463	(kg N₂O-N/kg N)	0.004	14.54
Indirect Emissions					NE
Atmospheric Deposition	Volatilized N (NH ₃ and NO _x) from fertilizers and animal wastes (kg N/yr)	IE	(kg N ₂ O-N/kg N)	NA	IE
Nitrogen Leaching and Run-off	N from fertilizers and animal wastes that is lost through leaching and run off (kg N/yr)	NE	(kg N ₂ O-N/kg N)	NA	NE
Other (please specify)					22.73
Soil Disturbance	Area of improved pasture and crops (ha)	49,869,203	(kg N ₂ O-N/ha)	0.290	22.73

^(a) Use the fractions as specified in the IPCC Guidelines (Volume 3, Reference Manual, pp. 4.92 - 4.113).


Documentation box:

Emissions from soil disturbance are the difference between N₂O emissions from pasture and cropping systems and the emissions from the natural ecosystem they replaced. The category accounts for N₂O emissions associated with atmospheric nitrogen deposition, soil cultivation, nitrogen fixation by legume crops, and nitrogen input from crop residues. It does not include indirect emissions from nitrogen leaching. Methodology is detailed in the Australian methodology workbook 5.1.

The quantity of nitrogen input from manure applied to soils differs from nitrogen excretion reported in Table 4.B(b) as it has been adjusted to account for nitrogen emitted as N₂O from the manure management systems.

TABLE 4.E SECTORAL BACKGROUND DATA FOR AGRICULTURE
Prescribed Burning of Savannas
(Sheet 1 of 1)

Australia
2001
Submission 2003

GREENHOUSE GAS SOURCE AND SINK CATEGORIES		ACTIVITY DATA AND OTHER RELATED INFORMATION				IMPLIED EMISSION FACTORS		EMISSIONS	
		Area of savanna burned (k ha/yr)	Average aboveground biomass density (t dm/ha)	Fraction of savanna burned	Biomass burned (Gg dm)	Nitrogen fraction in biomass	CH ₄ (kg/t dm)	N ₂ O	(Gg) CH ₄ N ₂ O
(specify ecological zone)									
NSW		105.25	6.90	1.00	522.87	0.01	2.15	0.11	464.05 23.75
Tas		9.20	9.00	1.00	59.61	0.01	2.15	0.11	1.12 0.06
WA		18,446.49	7.70	1.00	102,267.34	0.01	2.15	0.11	0.13 0.01
SA		102.26	3.00	1.00	220.89	0.01	2.15	0.11	219.53 11.24
Vic		16.03	11.70	1.00	135.07	0.01	2.15	0.11	0.47 0.02
Qld		5,842.03	3.00	1.00	12,618.78	0.01	2.15	0.11	0.29 0.01
NT		24,029.83	5.80	1.00	100,348.59	0.01	2.15	0.11	27.09 1.39
ACT		0.00	11.10	1.00	0.00	0.01	0.00	0.00	215.41 11.03
									0.00 0.00

Additional information

	Living	Dead
Fraction of aboveground biomass	NA	NA
Fraction oxidized	NA	0.72
Carbon fraction	NA	0.46

Documentation box:

The values reported as "Area of Savanna" are 10-year averages of actual areas of savanna burned. These are calculated using a combination of statistics collected by State fire authorities and fire areas of fire scars measured from satellite imagery. Fuel loads reported are fine fuels susceptible to burning.
Fraction oxidized is the product of the proportion of the fire scar which is actually burned, the proportion of fuel exposed to burning which is actually burned, and the proportion of burned fuel which is actually volatilised.

TABLE 4.F SECTORAL BACKGROUND DATA FOR AGRICULTURE
Field Burning of Agricultural Residues
(Sheet 1 of 1)

Australia
2001
Submission 2003

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	ACTIVITY DATA AND OTHER RELATED INFORMATION						IMPLIED EMISSION FACTORS			EMISSIONS	
	Crop production (t)	Residue/ Crop ratio	Dry matter fraction	Fraction burned in fields	Biomass burned (Gg dm)	Nitrogen fraction in biomass of residues	CH ₄ (kg/t dm)	N ₂ O (kg/t dm)	CH ₄ (Gg)	N ₂ O (Gg)	
1. Cereals											
Wheat	23,432,747.46	1.50	0.90	0.12	3,492.42	0.0032	1.87	0.04	11.40	0.28	
Barley	5,887,739.37	1.50	0.80	0.12	780.01	0.0032	1.87	0.04	6.52	0.13	
Maize	375,489.57	1.50	0.80	0.30	129.77	0.0075	1.96	0.09	1.46	0.03	
Oats	1,083,794.18	1.50	0.80	0.12	143.58	0.0032	1.87	0.04	0.25	0.01	
Rye	NE	1.50	0.80	0.12	NE	0.0032	NE	NE	0.27	0.01	
Rice	5,887,739.37	1.31	0.80	0.82	1,117.86	0.0065	1.96	0.08	2.19	0.09	
Other (please specify)									0.71	0.01	
Millet	41,865.09	1.50	0.80	0.12	5.55	0.00	1.87	0.04	0.01	0.00	
Sorghum	2,025,525.96	1.50	0.80	0.12	268.34	0.00	1.87	0.04	0.50	0.01	
Triticale	802,563.80	1.50	0.80	0.12	106.32	0.00	1.87	0.04	0.20	0.00	
2. Pulse									NO	NO	
Dry bean	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
Peas	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
Soybeans	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
Other (please specify)									NA	NA	
NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3 Tuber and Root									NO	NO	
Potatoes	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
Other (please specify)									NA	NA	
NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
4 Sugar Cane	33,578,050.90	0.25	0.20	0.41	653.33	0.01	1.87	0.12	1.22	0.08	
5 Other (please specify)									NA	NA	
NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	

TABLE 5 SECTORAL REPORT FOR LAND-USE CHANGE AND FORESTRY
(Sheet 1 of 1)

Australia
2001
Submission 2003

GREENHOUSE GAS SOURCE AND SINK CATEGORIES		CO ₂ emissions	CO ₂ removals	Net CO ₂ emissions/ removals	CH ₄	N ₂ O	NO _x	CO
		(Gg)						
Total Land-Use Change and Forestry		90,665.39	-83,345.87	7,319.53	165.68	1.85	64.58	3,461.28
A. Changes in Forest and Other Woody Biomass Stocks		56,452.86	-79,122.33	-22,669.46				
1. Tropical Forests		IE	IE	NA				
2. Temperate Forests		IE	IE	NA				
3. Boreal Forests		IE	IE	NA				
4. Grasslands/Tundra		IE	IE	NA				
5. Other <i>(please specify)</i>		56,452.86	-79,122.33	-22,669.46				
Harvested Wood		IE	IE	NA				
Managed Native Forest		NA	NA	NA				
Plantations		NA	-57,328.10	-57,328.10				
Commercial Harvest		NA	-21,794.23	-21,794.23				
Fuelwood Consumed		43,896.36	NA	43,896.36				
		12,556.50	NA	12,556.50				
B. Forest and Grassland Conversion		34,212.53	0.00	34,212.53	119.00	0.98	29.44	2,084.71
1. Tropical Forests		IE	IE	NA	IE	IE	IE	IE
2. Temperate Forests		IE	IE	NA	IE	IE	IE	IE
3. Boreal Forests		IE	IE	NA	IE	IE	IE	IE
4. Grasslands/Tundra		IE	IE	NA	IE	IE	IE	IE
5. Other <i>(please specify)</i>		34,212.53	0.00	34,212.53	119.00	0.98	29.44	2,084.71
a) Above Ground		27,427.30	NA	27,427.30	119.00	0.98	29.44	2,084.71
b) Below Ground ⁽¹⁾		6,785.23	NA	6,785.23	NA	NA	NA	NA
C. Abandonment of Managed Lands		NA	NA	NA				
1. Tropical Forests		NA	NA	NA				
2. Temperate Forests		NA	NA	NA				
3. Boreal Forests		NA	NA	NA				
4. Grasslands/Tundra		NA	NA	NA				
5. Other <i>(please specify)</i>		NA	NA	NA				
NA		NA	NA	NA				
D. CO₂ Emissions and Removals from Soil		NE	-4,223.54	-4,223.54				
Cultivation of Mineral Soils		NE	NE	NE				
Cultivation of Organic Soils		NE	NE	NE				
Liming of Agricultural Soils		NE	NE	NE				
Forest Soils		NE	NE	NE				
Other <i>(please specify)</i>		NA	-4,223.54	-4,223.54				
Pasture Improvement and Minimum Tillage		NA	-4,223.54	-4,223.54				
E. Other <i>(please specify)</i>		NA	NA	NA	46.68	0.86	35.15	1,376.57
Prescribed Burning and Wildfire in Forests		NA	NA	NA	46.68	0.86	35.15	1,376.57

⁽¹⁾ The reporting of CO₂ emissions from soils, due to Forest and Grassland Conversion (land use change), in 5B differs from the IPCC Guidelines which reports these emissions under 5D.

TABLE 6 SECTORAL REPORT FOR WASTE
(Sheet 1 of 1)

Australia
2001
Submission 2003

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	CO ₂	CH ₄	N ₂ O	NO _x	CO	NMVOC	SO ₂
	(Gg)						
Total Waste	16.30	786.10	1.78	NE	NE	3.62	NE
A. Solid Waste Disposal on Land	NE	721.94		NA	NA	3.30	
1. Managed Waste Disposal on Land	NE	721.94		NA	NA	3.30	
2. Unmanaged Waste Disposal Sites	NA	NA		NA	NA	NA	
3. Other <i>(please specify)</i>	NA	NA		NA	NA	NA	
NA	NA	NA		NA	NA	NA	
B. Wastewater Handling		64.16	1.78	NA	NA	0.33	
1. Industrial Wastewater		35.65	NE	NA	NA	0.15	
2. Domestic and Commercial Wastewater		28.51	1.78	NA	NA	0.18	
3. Other <i>(please specify)</i>		NA	NA	NA	NA	NA	
NA		NA	NA	NA	NA	NA	
C. Waste Incineration	16.30	NE	NE	NE	NE	NE	NE
D. Other <i>(please specify)</i>	NA	NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA	NA	NA

TABLE 6.A SECTORAL BACKGROUND DATA FOR WASTE
Solid Waste Disposal
(Sheet 1 of 1)

Australia
2001
Submission 2003
Additional information

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	ACTIVITY DATA AND OTHER RELATED INFORMATION				IMPLIED EMISSION FACTOR		EMISSIONS ⁽¹⁾	
	Annual MSW at the SWDS (Gg)	MCF	DOC degraded (Gg)	CH ₄ recovery ⁽²⁾ (Gg)	CH ₄ (t/t MSW)	CO ₂ (t/t MSW)	CH ₄ (Gg)	CO ₂ (Gg)
1 Managed Waste Disposal on Land	12,674.97	1.00	NA	99,15	0.06	NA	721.94	NE
2 Unmanaged Waste Disposal Sites - deep (>5 m)	NA	NA	NA	NA	0.00	0.00	NA	NA
- shallow (<5 m)	NA	NA	NA	NA	0.00	0.00	NA	NA
3 Other (please specify)	NA	NA	NA	NA	0.00	0.00	NA	NA
NA	NA	NA	NA	NA	0.00	0.00	NA	NA

TABLE 6.C SECTORAL BACKGROUND DATA FOR WASTE
Waste Incineration
(Sheet 1 of 1)

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	ACTIVITY DATA Amount of incinerated wastes (Gg)	IMPLIED EMISSION FACTOR				EMISSIONS		
		CO ₂ (kg/t waste)	CH ₄ (kg/t waste)	N ₂ O (kg/t waste)	CO ₂ ⁽³⁾ (Gg)	CH ₄ (Gg)	N ₂ O (Gg)	
Waste Incineration (please specify)	NA	NA	NA	NA	16.30	NE	NE	NE
(biogenic) ⁽¹⁾	NA	NA	NA	NA	NA	NA	NA	NA
(plastics and other non-biogenic waste) ⁽³⁾	NA	NA	NA	NA	NA	NA	NA	NA
Solvents	5.61	2,904.00	NA	NA	16.30	NE	NE	NE
NA	NA	NA	NA	NA	NA	NA	NA	NA

MSW – Municipal Solid Waste, SWDS – Solid Waste Disposal Site, MCF – Methane Correction Factor, DOC – Degradable Organic Carbon (IPCC Guidelines (Volume 3. Reference Manual, section 6.2.4)). MSW includes household waste, yard/garden waste, commercial/market waste and organic industrial solid waste. MSW should not include inorganic industrial waste such as construction or demolition materials.

⁽¹⁾ Actual emissions (after recovery)

⁽²⁾ CH₄ recovered and flared or utilized

⁽³⁾ Under Waste Disposal, CO₂ emissions should be reported only when the disposed wastes are combusted at the disposal site which might constitute a management practice.

CO₂ emissions from non-biogenic wastes are included in the totals, while the CO₂ emissions from biogenic wastes are not included in the totals.

Documentation box:

All relevant information used in calculation should be provided in the additional information box and in the documentation box.

Parties that use country specific models should note this with a brief rationale in the documentation box and fill the relevant cells only.

The Australian methodology for solid waste is based on the US Regression model—see Workbook 7.1. The MSW value used is a 25-year average for waste.

DOC is not calculated separately. Methane potential is assumed to be 79 litres per kilogram (Doom and Barlaz, 1995; US EPA-600/R-95-019).

Description	Value
Total population (1000s)	19,604.00
Urban population (1000s)	NA
Waste generation rate (kg/capita/day)	2.23
Fraction of MSW disposed to SWDS	1.00
Fraction of DOC in MSW	NA
Fraction of wastes incinerated	NE
Fraction of wastes recycled	NA
CH ₄ oxidation factor	NA
CH ₄ fraction in landfill gas	0.50
Number of SWDS recovering CH ₄	NA
CH ₄ generation rate constant (k)	NA
Time lag considered (yr)	25.00
Composition of landfilled waste (%)	NA
Paper and paperboard	NA
Food and garden waste	NA
Plastics	NA
Glass	NA
Textiles	NA
Other (specify)	NA
Other – inert	NA
Other – organic	NA
NA	NA

TABLE 6.B SECTORAL BACKGROUND DATA FOR WASTE
Wastewater Handling
(Sheet 1 of 1)

Australia
2001
Submission 2003

GREENHOUSE GAS SOURCE AND SINK CATEGORIES				ACTIVITY DATA AND RELATED INFORMATION ⁽¹⁾				IMPLIED EMISSION FACTOR				EMISSIONS ⁽²⁾			
		Total organic product		CH ₄ recovered and/or flared		CH ₄		N ₂ O		Wastewater		CH ₄		N ₂ O	
		Wastewater	Sludge	Wastewater	Sludge	Wastewater	Sludge	Wastewater	Sludge	(kg/kg DC)	(kg/kg DC)	Wastewater	Sludge	Wastewater	Sludge
		(Gg DC ⁽¹⁾ /yr)	(Gg)	(Gg)	(Gg)	(kg/kg DC)	(kg/kg DC)	(kg/kg DC)	(kg/kg DC)	(kg/kg DC)	(kg/kg DC)	(Gg)	(Gg)	(Gg)	(Gg)
Industrial Wastewater		NE	NE	1.73	NE	NE	NE	NE	NE	NE	NE	35.65	NE	NE	NE
Domestic and Commercial Wastewater		NE	NE	24.36	NE	NE	NE	NE	NE	NE	NE	28.51	NE	NE	1.78
Other (please specify)															
NA		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
GREENHOUSE GAS SOURCE AND SINK CATEGORIES				ACTIVITY DATA AND OTHER RELATED INFORMATION				IMPLIED EMISSION FACTOR				EMISSIONS			
		Population		Protein consumption		N fraction		N ₂ O		N ₂ O		N ₂ O		N ₂ O	
		(1000s)	(kg/person/yr)	(protein in kg/person/yr)	(kg N/kg protein)	(kg N/kg protein)	(kg N/kg protein)	(kg N ₂ O-N/kg sewage N produced)	(kg N ₂ O-N/kg sewage N produced)	(kg N ₂ O-N/kg sewage N produced)	(kg N ₂ O-N/kg sewage N produced)	(Gg)	(Gg)	(Gg)	(Gg)
N ₂ O from human sewage		19,485	36.28		0.16			0.01							1.78

⁽¹⁾ DC – degradable organic component. DC indicators are COD (Chemical Oxygen Demand) for industrial wastewater and BOD (Biochemical Oxygen Demand) for Domestic/Commercial wastewater/sludge (IPCC Guidelines (Volume 3. Reference Manual, pp. 6.14, 6.18)).

⁽²⁾ Actual emissions (after recovery)

Additional information

Additional information			
Total wastewater (m ³):		Domestic	Industrial
Treated wastewater (%):		NE	NE
		NE	NE
Wastewater streams:	Wastewater output (m ³)	DC (kgCOD/m ³)	
Industrial wastewater		NE	NE
Iron and steel		NE	NE
Non-ferrous		NE	NE
Fertilizers		NE	NE
Food and beverage		NE	NE
Paper and pulp		NE	NE
Organic chemicals		NE	NE
Other (specify)		NA	NA
NA		NA	NA
Domestic and Commercial	22,500	DC (kg BOD/1000 person/yr)	
Other	NA		
NA	NA		

Handling systems:			
	Industrial wastewater treated (%)	Ind. sludge treated (%)	Domestic wastewater treated (%)
Aerobic	NA	NA	NA
Anaerobic	NA	NA	NA
Other (specify)	NA	NA	NA
NA	NA	NA	NA

Documentation box:

The Australian methodology for Wastewater is based on IPCC and Australian default values—Workbook 7.1. The estimate for Wastewater includes both wastewater and sludge. Total population data are disaggregated between the sewered (82%) and unsewered (18%) population. Emissions of N₂O are estimated using the IPCC Default methodology. Protein consumption per capita is sourced from Australian Institute of Health and Welfare (1998)

SUMMARY 1.A SUMMARY REPORT FOR NATIONAL GREENHOUSE GAS INVENTORIES (IPCC TABLE 7A)
(Sheet 1 of 3)

Australia
2001
Submission 2003

GREENHOUSE GAS SOURCE AND SINK CATEGORIES		CO ₂ emissions	CO ₂ removals	CH ₄	N ₂ O	HFCs			PFCs			SF ₆			NO _x	CO	NMVOC	SO ₂
						CO ₂ equivalent (Gg)			(Gg)			(Gg)						
						P	A		P	A		P	A					
Total National Emissions and Removals						361,874.10	0.00	5,963.59	110.86						3,088.88	26,338.39	2,475.61	2,488.73
1. Energy		336,326.38		1,301.18	17.16										1,575.55	4,278.96	788.22	759.40
A. Fuel Combustion		328,172.58																
Reference Approach		329,402.62																
Sectoral Approach				98.41	17.07										1,573.91	4,268.89	566.10	759.40
1. Energy Industries		198,168.52		9.08	2.03										648.49	65.96	8.24	587.72
2. Manufacturing Industries and Construction		42,034.59		2.32	0.74										370.78	281.86	15.35	104.40
3. Transport		72,260.40		30.03	14.05										458.10	3,123.44	445.45	61.21
4. Other Sectors		15,585.94		56.93	0.23										90.89	789.85	96.20	5.61
5. Other		1,353.17		0.05	0.02										5.65	7.78	0.85	0.46
B. Fugitive Emissions from Fuels		6,923.76		1,202.76	0.09										1.64	10.07	222.13	NE
1. Solid Fuels		NE		878.36	NA										NA	NA	NA	NA
2. Oil and Natural Gas		6,923.76		324.40	0.09										1.64	10.07	222.13	NE
2. Industrial Processes ⁽¹⁾		18,211.90		2.76	0.07										55.70	8.04	62.33	1,729.33
A. Mineral Products		5,099.94		NA	NA										NE	NE	16.73	NE
B. Chemical Industry		C		NE	C										NE	NE	NE	NE
C. Metal Production		13,111.96		2.76	0.07										55.70	8.04	0.10	1,729.33
D. Other Production		NE													NE	NE	45.50	NE
E. Production of Halocarbons and SF ₆															NO			
F. Consumption of Halocarbons and SF ₆															NE	NE		
G. Other		NA		NA	NA										NA	NA	NA	NA

P = Potential emissions based on Tier 1 approach of the IPCC Guidelines

A = Actual emissions based on Tier 2 approach of the IPCC Guidelines

(1) Excludes confidential Soda Ash Production and Use, Ammonia Production and Nitric Acid Production emissions representing 2754.06 Gg CO₂-e

SUMMARY 1.A SUMMARY REPORT FOR NATIONAL GREENHOUSE GAS INVENTORIES (IPCC TABLE 7A)
(Sheet 2 of 3)

Australia
2001
Submission 2003

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	CO ₂ emissions	CO ₂ removals	CH ₄	N ₂ O	HFCs		PFCs		SF ₆		NO _x	CO	NMVOC	SO ₂
					P	A	P	A	P	A				
CO ₂ equivalent (Gg)														
(Gg)														
3. Solvent and Other Product Use	NA			NE							NA	NA	140.31	NA
4. Agriculture	NA	NA	3,707.88	90.00							1,393.05	18,590.11	1,084.42	NA
A. Enteric Fermentation			3,104.98											
B. Manure Management			91.10	3.68									NA	
C. Rice Cultivation			35.14										NA	
D. Agricultural Soils	NA	NA	NE	62.21									NA	
E. Prescribed Burning of Savannas			464.05	23.75							1372.27	18098.02	1,055.72	
F. Field Burning of Agricultural Residues			12.62	0.36							20.78	492.10	28.71	
G. Other			NA	NA	NA						NA	NA	NA	NA
5. Land-Use Change and Forestry	7,319.53	0.00	165.68	1.85							64.58	3,461.28	396.70	NA
A. Changes in Forest and Other Woody Biomass Stocks	0.00	-22,669.46												
B. Forest and Grassland Conversion	34212.53	0.00	119.00	0.98							29.44	2,084.71	230.30	
C. Abandonment of Managed Lands	NA	NA												
D. CO ₂ Emissions and Removals from Soil	NE	-4,223.54												
E. Other	NA	NA	46.68	0.86										
6. Waste	16.30		786.10	1.78							35.15	1,376.57	166.40	NA
A. Solid Waste Disposal on Land	NE		721.94								NE	NA	3.62	NE
B. Wastewater Handling			64.16	1.78							NA	NA	0.33	
C. Waste Incineration	16.30		NE	NE							NE	NE	NE	NE
D. Other	NA		NA	NA							NA	NA	NA	NA
7. Other (please specify)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

SUMMARY 1.A SUMMARY REPORT FOR NATIONAL GREENHOUSE GAS INVENTORIES (IPCC TABLE 7A)
(Sheet 3 of 3)

Australia
2001
Submission 2003

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	CO ₂ emissions	CO ₂ removals	CH ₄	N ₂ O	CO ₂ equivalent (Gg)								(Gg)				
					HFCs		PFCs		SF ₆		NO _x	CO	NMVOC	SO ₂			
					P	A	P	A	P	A							
Memo Items: ⁽¹⁾																	
International Bankers	10,625.28		0.15	0.31								110.05	15.46	8.78	49.86		
Aviation	8,151.32		0.03	0.24								43.61	13.40	6.70	1.54		
Marine	2,473.96		0.12	0.07								66.44	2.06	2.08	48.33		
Multilateral Operations	NE		NE	NE								NE	NE	NE	NE		
CO ₂ Emissions from Biomass	18,254.75																

⁽¹⁾ Memo Items are not included in the national totals.

SUMMARY 1.B SHORT SUMMARY REPORT FOR NATIONAL GREENHOUSE GAS INVENTORIES (IPCC TABLE 7B)
(Sheet 1 of 1)

Australia
2001
Submission 2003

GREENHOUSE GAS SOURCE AND SINK CATEGORIES		CO ₂ emissions	CO ₂ removals	CH ₄	N ₂ O	HFCs				PFCs				SF ₆				NO _x	CO	NMVOC	SO ₂				
						CO ₂ equivalent (Gg)				(Gg)				(Gg)											
						P		A		P		A		P		A						P		A	
						P	A	P	A	P	A	P	A	P	A	P	A								
Total National Emissions and Removals						361,874.10	0.00	5,963.59	110.86	NE	NE	1,527.04	NE	NE	NE	3,088.88	26,338.39	2,475.61	2,488.73						
1. Energy		336,326.38		1,301.18	17.16											1,575.55	4,278.96	788.22	759.40						
A. Fuel Combustion		328,172.58																							
		Reference Approach																							
		Sectoral Approach		98.41	17.07											1,573.91	4,268.89	566.10	759.40						
B. Fugitive Emissions from Fuels		6,923.76		1,202.76	0.09											1.64	10.07	222.13	NE						
2. Industrial Processes ¹		18,211.90		2.76	0.07					NE	2,344.90	NE	1,527.04	NE	NE	55.70	8.04	62.33	1,729.33						
3. Solvent and Other Product Use		NA		NA	NE											NA	NA	140.31	NA						
4. Agriculture		NA		3,707.88	90.00											1,393.05	18,590.11	1,084.42	NA						
5. Land-Use Change and Forestry		7,319.53	0.00	165.68	1.85											64.58	3,461.28	396.70	NA						
6. Waste		16.30		786.10	1.78											NE	NE	3.62	NE						
7. Other		NA		NA	NA					NA	NA	NA	NA	NA	NA	NA	NA	NA	NA						
Memo Items:																									
International Bankers		10,625.28		0.15	0.31											110.05	15.46	8.78	49.86						
Aviation		8,151.32		0.03	0.24											43.61	13.40	6.70	1.54						
Marine		2,473.96		0.12	0.07											66.44	2.06	2.08	48.33						
Multilateral Operations		NE		NE	NE											NE	NE	NE	NE						
CO ₂ Emissions from Biomass		18,254.75																							

P = Potential emissions based on Tier 1 approach of the IPCC Guidelines

A = Actual emissions based on Tier 2 approach of the IPCC Guidelines

(1) Excludes confidential Soda Ash Production and Use, Ammonia Production and Nitric Acid Production emissions representing 2754.06 Gg CO₂-e

SUMMARY 2 SUMMARY REPORT FOR CO₂ EQUIVALENT EMISSIONS
(Sheet 1 of 1)

Australia
2001
Submission 2003

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	CO ₂	CH ₄	N ₂ O	HFCs	PFCs	SF ₆	Total
	CO ₂ equivalent (Gg)						
Total (Net Emissions)	361,874.10	125,235.39	34,365.40	2,344.90	1,527.04	NE	528,100.88
1. Energy	336,326.38	27,324.71	5,320.71				368,971.79
A. Fuel Combustion (Sectoral Approach)	329,402.62	2,066.69	5,291.77				336,761.08
1. Energy Industries	198,168.52	190.67	628.64				198,987.82
2. Manufacturing Industries and Construction	42,034.59	48.74	230.24				42,313.57
3. Transport	72,260.40	630.57	4,355.72				77,246.68
4. Other Sectors	15,585.94	1,195.62	70.96				16,852.52
5. Other	1,353.17	1.10	6.21				1,360.48
B. Fugitive Emissions from Fuels	6,923.76	25,258.01	28.94				32,210.71
1. Solid Fuels	NE	18,445.52	NE				18,445.52
2. Oil and Natural Gas	6,923.76	6,812.50	28.94				13,765.20
2. Industrial Processes	18,211.90	57.91	20.44	2,344.90	1,527.04	NE	24,916.24
A. Mineral Products	5,099.94	NA	NA				5,099.94
B. Chemical Industry ¹	C	NE	C	NA	NA	NA	2,754.06
C. Metal Production	13,111.96	57.91	20.44		1,527.04	NE	14,717.35
D. Other Production	NE						NE
E. Production of Halocarbons and SF ₆				NO	NO	NO	NO
F. Consumption of Halocarbons and SF ₆				2,344.90	NE	NE	2,344.90
G. Other	NA	NA	NA	NA	NA	NA	NA
3. Solvent and Other Product Use	NA		NE				NE
4. Agriculture	NA	77,865.55	27,900.92				105,766.47
A. Enteric Fermentation		65,204.54					65,204.54
B. Manure Management		1,913.05	1,140.66				3,053.71
C. Rice Cultivation		737.90					737.90
D. Agricultural Soils	NA	NE	19,285.67				19,285.67
E. Prescribed Burning of Savannas		9,745.09	7,363.08				17,108.16
F. Field Burning of Agricultural Residues		264.97	111.51				376.49
G. Other		NA	NA				NA
5. Land-Use Change and Forestry	7,319.53	3,479.19	572.32				11,371.03
6. Waste	16.30	16,508.03	551.01				17,075.34
A. Solid Waste Disposal on Land	NE	15,160.68					15,160.68
B. Wastewater Handling		1,347.35	551.01				1,898.35
C. Waste Incineration	16.30	NE	NE				16.30
D. Other	NA	NA	NA				NA
7. Other (please specify)	NA	NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA	NA	NA
Memo Items:							
International Bunkers	10,625.28	3.14	96.99				10,725.41
Aviation	8,151.32	0.59	75.78				8,227.70
Marine	2,473.96	2.55	21.20				2,497.71
Multilateral Operations	NE	NE	NE				NE
CO₂ Emissions from Biomass	18,254.75						18,254.75

1. Speciated emissions from Soda Ash Production and Use, Ammonia Production and Nitric Acid Production are Confidential. These emissions are reported in Summary Table 2 Table 10s5 as CO₂-e emissions. The total confidential emissions from 2A. Mineral Products and 2B. Chemical Industry shown at 2B are 2754.06 Gg CO₂-e.

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	CO ₂ emissions	CO ₂ removals	Net CO ₂ emissions / removals	CH ₄	N ₂ O	Total emissions
Land-Use Change and Forestry	CO ₂ equivalent (Gg)					
A. Changes in Forest and Other Woody Biomass Stocks	56,452.86	-79,122.33	-22,669.46			-22,669.46
B. Forest and Grassland Conversion	34,212.53	0.00	34,212.53	2,498.95	304.82	37,016.30
C. Abandonment of Managed Lands	NA	NA	NA			NA
D. CO ₂ Emissions and Removals from Soil	NE	-4,223.54	-4,223.54			-4,223.54
E. Other	NA	NA	NA	980.24	267.50	1,247.73
Total CO ₂ Equivalent Emissions from Land-Use Change and Forestry	90,665.39	-83,345.87	7,319.53	3,479.19	572.32	11,371.03
Total CO ₂ Equivalent Emissions without Land-Use Change and Forestry ^(a)						516,729.85
Total CO ₂ Equivalent Emissions with Land-Use Change and Forestry ^(a)						528,100.88

^(a) The information in these rows is requested to facilitate comparison of data, since Parties differ in the way they report emissions and removals from Land-Use Change and Forestry.

SUMMARY 3 SUMMARY REPORT FOR METHODS AND EMISSION FACTORS USED
(Sheet 1 of 2)

Australia
2001
Submission 2003

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	CO ₂		CH ₄		N ₂ O		HFCs		PFCs		SF ₆	
	Method applied ⁽¹⁾	Emission factor ⁽²⁾	Method applied ⁽¹⁾	Emission factor ⁽²⁾	Method applied ⁽¹⁾	Emission factor ⁽²⁾	Method applied ⁽¹⁾	Emission factor ⁽²⁾	Method applied ⁽¹⁾	Emission factor ⁽²⁾	Method applied ⁽¹⁾	Emission factor ⁽²⁾
1. Energy	T1, T2	CS	T1, T2	CS	T1, T2	D, CS						
A. Fuel Combustion	RA, T2	CS	T2	CS	T2	CS						
1. Energy Industries	T2	CS	T2	CS	T2	CS						
2. Manufacturing Industries and Construction	T2	CS	T2	CS	T2	CS						
3. Transport	T1, T2	CS	T1, T2	CS	T1, T2	D, CS						
4. Other Sectors	T1, T2	CS	T1, T2	CS	T1, T2	CS						
5. Other	T1, T2	CS	T1, T2	CS	T1, T2	CS						
B. Fugitive Emissions from Fuels	T2	CS	T2	CS	T2	CS						
1. Solid Fuels	NE	NA	T2	CS	NE	NE						
2. Oil and Natural Gas	T2	CS	T2	CS	T2	CS						
2. Industrial Processes	T2	CS	T2	CS	T1	D	T1, T2	D, CS	T1c	CS	T2	CS
A. Mineral Products	T2	CS	NE	NA	NE	NA						
B. Chemical Industry	T1	CS, D	NE	NA	T1	D	NE	NA	NA	NA	NA	NA
C. Metal Production	T2	CS	T2	CS	NE	NA			T1c	CS	T2	CS
D. Other Production	NE	NA										
E. Production of Halocarbons and SF ₆							T1	D	NA	NA	NA	NA
F. Consumption of Halocarbons and SF ₆							T2	CS	NE	NA	NE	NA
G. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

⁽¹⁾ Use the following notation keys to specify the method applied: D (IPCC default), RA (Reference Approach), T1 (IPCC Tier 1), T1a, T1b, T1c (IPCC Tier 1a, Tier 1b and Tier 1c, respectively), T2 (IPCC Tier 2), T3 (IPCC Tier 3), C (CORINAIR), CS (Country Specific), M (Model). If using more than one method, enumerate the relevant methods. Explanations of any modifications to the default IPCC methods, as well as information on the proper use of methods per source category where more than one method is indicated, and explanations on the country specific methods, should be provided in the documentation box of the relevant Sectoral background data table.

⁽²⁾ Use the following notation keys to specify the emission factor used: D (IPCC default), C (CORINAIR), CS (Country Specific), PS (Plant Specific), M (Model). Where a mix of emission factors has been used, use different notations in one and the same cells with further explanation in the documentation box of the relevant Sectoral background data table.

SUMMARY 3 SUMMARY REPORT FOR METHODS AND EMISSION FACTORS USED
(Sheet 2 of 2)

Australia
2001
Submission 2003

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	CO ₂		CH ₄		N ₂ O		HFCs		PFCs		SF ₆	
	Method applied ⁽¹⁾	Emission factor ⁽²⁾	Method applied ⁽¹⁾	Emission factor ⁽²⁾	Method applied ⁽¹⁾	Emission factor ⁽²⁾	Method applied ⁽¹⁾	Emission factor ⁽²⁾	Method applied ⁽¹⁾	Emission factor ⁽²⁾	Method applied ⁽¹⁾	Emission factor ⁽²⁾
3. Solvent and Other Product Use	NE	NE	NE	NE	NE	NE						
4. Agriculture	NE	NE	CS	CS,D	CS	CS,D						
A. Enteric Fermentation			CS	CS								
B. Manure Management			CS	CS,D	CS	D						
C. Rice Cultivation			T2	CS, D								
D. Agricultural Soils	NA	NA	NA	NA	CS	CS						
E. Prescribed Burning of Savannas			CS	CS	CS	CS						
F. Field Burning of Agricultural Residues			CS	CS	CS	CS						
G. Other	NA	NA	NA	NA	NA	NA						
5. Land-Use Change and Forestry	CS	CS	CS	CS	CS	CS						
A. Changes in Forest and Other Woody Biomass Stocks	CS	CS										
B. Forest and Grassland Conversion	CS,M	CS,M	CS	CS	CS	CS						
C. Abandonment of Managed Lands	CS	CS										
D. CO ₂ Emissions and Removals from Soil	CS	CS										
E. Other	CS	CS	CS	CS	CS	CS						
6. Waste	T2	CS	T2	M,D	T1	D						
A. Solid Waste Disposal on Land	NA	NA	T2	M								
B. Wastewater Handling			T2	D	T1	D						
C. Waste Incineration	T2	CS	NE	NA	NE	NA						
D. Other	NA	NA	NA	NA	NA	NA						
7. Other (please specify)	NA	NA	NA	NA	NA	NA						
NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	CO ₂		CH ₄		N ₂ O		HFCs		PFCs		SF ₆		NO _x		CO		NMVOC		SO ₂	
	Estimate	Quality	Estimate	Quality	Estimate	Quality	Estimate	Quality	Estimate	Quality	Estimate	Quality	Estimate	Quality	Estimate	Quality	Estimate	Quality	Estimate	Quality
Total National Emissions and Removals																				
1 Energy																				
A. Fuel Combustion Activities	PART	H-L	PART	M-L	PART	M-L							PART	M-L	PART	M-L	PART	M-L	ALL	H
Reference Approach	ALL	H																		
Sectoral Approach	ALL	H	PART	L	PART	L							PART	L	PART	L	PART	L	ALL	H
1. Energy Industries	ALL	H	ALL	L	ALL	L							ALL	L	ALL	L	ALL	L	ALL	H
2. Manufacturing Industries and Construction	ALL	H	ALL	L	ALL	L							ALL	L	ALL	L	ALL	L	ALL	H
3. Transport	ALL	H	ALL	M	ALL	M							ALL	M	ALL	M	ALL	M	ALL	H
4. Other Sectors	ALL	H	ALL	L	ALL	L							ALL	L	ALL	L	ALL	L	ALL	H
5. Other	ALL	H	PART	L	PART	L							PART	L	PART	L	PART	L	ALL	H
B. Fugitive Emissions from Fuels	PART	L	PART	M	PART	L							ALL	L	ALL	L	ALL	L	ALL	L
1. Solid Fuels	NE	NE	PART	M	NE	NE														NA
2. Oil and Natural Gas	PART	L	PART	M	ALL	L							ALL	L	ALL	L	ALL	L	ALL	NA
2 Industrial Processes																				
A. Mineral Products	PART	M	PART	L	PART	L	NE	NA	ALL	M	PART	H	NE	NA	NE	NA	PART	M	PART	M
	ALL	M	NE	NA	NE	NA							NE	NA	NE	NA	PART	M	NE	NA
B. Chemical Industry	PART	M	NE	NA	PART	M	NE	NA	NA	NA	NA		NE	NA	NE	NA	NE	NA	NE	NA
C. Metal Production	PART	H	ALL	L	NE	NA			ALL	M	ALL	H	NE	NA	NE	NA	NE	NA	PART	M
D. Other Production	NE	NA											NE	NA	NE	NA	NE	NA	NE	NA
E. Production of Halocarbons and SF ₆							ALL	M	NA	NA	NA	NA								

Note: To fill in the table use the notation key as given in the IPCC Guidelines (Volume 1. Reporting Instructions, Tables, 37)

TABLE 7 OVERVIEW TABLE FOR NATIONAL GREENHOUSE GAS INVENTORIES (IPCC TABLE 8A)
(Sheet 2 of 3)

GREENHOUSE GAS SOURCE AND SINK CATEGORIES		CO ₂		CH ₄		N ₂ O		HFCs		PFCs		SF ₆		NO _x		CO		NMVOC		SO ₂	
		Estimate	Quality	Estimate	Quality	Estimate	Quality	Estimate	Quality	Estimate	Quality	Estimate	Quality	Estimate	Quality	Estimate	Quality	Estimate	Quality	Estimate	Quality
2 Industrial Processes (continued)																					
F. Consumption of Halocarbons and SF ₆																					
Potential																					
Actual																					
G. Other		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
3 Solvent and Other Product Use																					
NE		NA	NA	ALL	M	ALL	L							NE	NA	NE	NA	ALL	L	NE	NA
4 Agriculture		NA	NA	ALL	M	ALL	M							ALL	L	ALL	L	ALL	L	NA	NA
A. Enteric Fermentation				ALL	M																
B. Manure Management				ALL	M	ALL	L											NA	NA		
C. Rice Cultivation				ALL	L													NA	NA		
D. Agricultural Soils		NA	NA	NA	NA	ALL	L											NA	NA		
E. Prescribed Burning of Savannas				ALL	L	ALL	L							ALL	L	ALL	L	ALL	L	NA	NA
F. Field Burning of Agricultural Residues				ALL	L	ALL	L							ALL	L	ALL	L	ALL	L	NA	NA
G. Other				NA	NA	NA	NA							NA	NA	NA	NA	NA	NA	NA	NA
5 Land-Use Change and Forestry																					
ALL		M		ALL	L	ALL	L							ALL	L	ALL	L	NA	NA	NA	NA
A. Changes in Forest and Other Woody Biomass Stocks		ALL	M																		
B. Forest and Grassland Conversion		ALL	M	ALL	L	ALL	L							ALL	L	ALL	L	ALL	L		

TABLE 7 OVERVIEW TABLE FOR NATIONAL GREENHOUSE GAS INVENTORIES (IPCC TABLE 8A)
(Sheet 3 of 3)

Australia
2001
Submission 2003

GREENHOUSE GAS SOURCE AND SINK CATEGORIES		CO ₂		CH ₄		N ₂ O		HFCs		PFCs		SF ₆		NO _x		CO		NMVOC		SO ₂	
		Estimate	Quality	Estimate	Quality	Estimate	Quality	Estimate	Quality	Estimate	Quality	Estimate	Quality	Estimate	Quality	Estimate	Quality	Estimate	Quality	Estimate	Quality
5 Land-Use Change and Forestry (continued)																					
C. Abandonment of Managed Lands		NE	NA																		
D. CO ₂ Emissions and Removals from Soil		PART	L																		
E. Other		ALL	M	ALL	L	ALL	L							ALL	L	ALL	L	ALL	L	NA	NA
6 Waste		PART	L	ALL	L	PART	L							NE	NA	NE	NA	ALL	L	NE	NA
A. Solid Waste Disposal on Land		NA	NA	ALL	L									NA	NA	NA	NA	ALL	L		
B. Wastewater Handling				ALL	L	PART	L							NA	NA	NA	NA	ALL	L		
C. Waste Incineration		PART	L	NA	NA	NE	NA							NE	NA	NE	NA	NE	NA	NE	NA
D. Other		NA	NA	NA	NA	NA	NA							NA	NA	NA	NA	NA	NA	NA	NA
7 Other (please specify)		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
NA		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Memo Items:																					
International Bankers		ALL	H	ALL	M	ALL	M							ALL	M	ALL	M	ALL	M	ALL	H
Aviation		ALL	H	ALL	M	ALL	M							ALL	M	ALL	M	ALL	M	ALL	H
Marine		ALL	H	ALL	M	ALL	M							ALL	M	ALL	M	ALL	M	ALL	H
Multilateral Operations		NE	NE	NE	NE	NE	NE							NE	NE	NE	NE	NE	NE	NE	NE
CO₂ Emissions from Biomass		ALL	M																		

TABLE 8(a) RECALCULATION—RECALCULATED DATA
Recalculated
(Sheet 1 of 2)

year: 1990

Australia
2001
Submission 2003

GREENHOUSE GAS SOURCE AND SINK CATEGORIES									
	CO ₂			CH ₄			N ₂ O		
	Previous submission CO ₂ equivalent (Gg)	Latest submission (Gg)	Difference (%)	Previous submission CO ₂ equivalent (Gg)	Latest submission (Gg)	Difference (%)	Previous submission CO ₂ equivalent (Gg)	Latest submission (Gg)	Difference (%)
Total National Emissions and Removals	355,991.12	363,230.98	2.03	118,862.87	121,900.36	2.56	23,182.32	23,894.67	3.07
1. Energy	271,182.19	258,622.51	-4.63	25,074.75	25,155.07	0.32	2,469.95	2,465.51	-0.18
1.A. Fuel Combustion Activities	265,219.48	252,659.80	-4.74	2,308.88	2,389.20	3.48	2,434.29	2,429.84	-0.18
1.A.1. Energy Industries	141,805.68	141,805.68	0.00	39.88	39.88	0.00	438.33	438.33	0.00
1.A.2. Manufacturing Industries and Construction	50,029.11	37,384.55	-25.27	34.27	32.46	-5.29	238.22	211.26	-11.32
1.A.3. Transport	59,217.60	59,726.89	0.86	607.72	551.33	-9.28	1,633.96	1,701.64	4.14
1.A.4. Other Sectors	12,485.74	12,485.74	0.00	1,625.84	1,764.58	8.53	116.22	74.88	-35.57
1.A.5. Other	1,681.35	1,256.94	-25.24	1.16	0.95	-18.56	7.55	3.74	-50.50
1.B. Fugitive Emissions from Fuels	5,962.71	5,962.71	0.00	22,765.87	22,765.87	0.00	35.67	35.67	0.00
1.B.1. Solid Fuel	NE	NE	0.00	15,816.36	15,816.36	0.00	NE	NE	0.00
1.B.2. Oil and Natural Gas	5,962.71	5,962.71	0.00	6,949.51	6,949.51	0.00	35.67	35.67	0.00
2. Industrial Processes	6,684.93	19,238.10	187.78	61.73	59.93	-2.92	C	26.78	0.00
2.A. Mineral Products ⁽¹⁾	4,858.20	4,763.45	-1.95	NA	NA	0.00	NA	NA	0.00
2.B. Chemical Industry ⁽¹⁾	C	C	0.00	NE	NE	0.00	C	C	-100.00
2.C. Metal Production	1,826.73	14,474.64	692.38	61.73	59.93	-2.92	NE	26.78	0.00
2.D. Other Production	NE	NE	0.00						
2.G. Other	NA	NA	0.00	NA	NA	0.00	NA	NA	0.00
3. Solvent and Other Product Use	NA	NA	0.00	NA	NA	0.00	NE	NE	0.00
4. Agriculture	NA	NA	0.00	72,131.55	75,158.34	4.20	19,217.75	19,916.03	3.63
4.A. Enteric Fermentation				64,381.68	67,468.47	4.79			
4.B. Manure Management				1,568.16	1,508.17	-3.83	300.26	527.43	75.66
4.C. Rice Cultivation				490.50	490.50	0.00			
4.D. Agricultural Soils	NA	NA	0.00	NE	NE	0.00	14,669.16	15,140.27	3.21
4.E. Prescribed Burning of Savannas				5,507.04	5,507.04	0.00	4,160.95	4,160.95	0.00
4.F. Field Burning of Agricultural Residues				184.17	184.17	0.00	87.38	87.38	0.00
4.G. Other				NA	NA	0.00	NA	NA	0.00
5. Land-Use Change and Forestry (net)	78,123.99	85,370.37	9.28	6,791.51	6,723.70	-1.00	1,012.05	1,003.77	-0.82
5.A. Changes in Forest and Other Woody Biomass Stocks	-24,598.42	-24,598.42	0.00						
5.B. Forest and Grassland Conversion	106,945.95	114,192.33	6.78	5,574.78	5,506.96	-1.22	680.01	671.74	-1.22
5.C. Abandonment of Managed Lands	NA	NA	0.00						
5.D. CO ₂ Emissions and Removals from Soil	-4,223.54	-4,223.54	0.00						
5.E. Other	NA	NA	0.00	1,216.73	1,216.73	0.00	332.03	332.03	0.00

1. Emissions of N₂O from Nitric Acid Production and CO₂ from Ammonia Production and Soda Ash Production and Use are confidential and are aggregated and reported in Table 8(a)s2 under "Confidential emissions reported as CO₂-equivalents".

TABLE 8(a) RECALCULATION—RECALCULATED DATA
Recalculated
(Sheet 2 of 2)

1990

year:

Australia
2001
Submission 2003

GREENHOUSE GAS SOURCE AND SINK CATEGORIES									
	CO ₂		Difference (%)	CH ₄		Difference (%)	N ₂ O		Difference (%)
	Previous submission CO ₂ equivalent (Gg)	Latest submission CO ₂ equivalent (Gg)		Previous submission CO ₂ equivalent (Gg)	Latest submission CO ₂ equivalent (Gg)		Previous submission CO ₂ equivalent (Gg)	Latest submission CO ₂ equivalent (Gg)	
6. Waste	NE	NE	0.00	14,802.33	14,803.33	0.00	482.57	482.57	0.00
6.A. Solid Waste Disposal on Land	NE	NE	0.00	13,623.32	13,623.32	0.00			
6.B. Wastewater Handling				1,180.01	1,180.01	0.00	482.57	482.57	0.00
6.C. Waste Incineration	NE	NE	0.00	NE	NE	0.00	NE	NE	0.00
6.D. Other	NA	NA	0.00	NA	NA	0.00	NA	NA	0.00
7. Other (please specify)	NA	NA	0.00	NA	NA	0.00	NA	NA	0.00
NA	NA	NA	0.00	NA	NA	0.00	NA	NA	0.00
Memo Items:									
International Bankers	6,400.97	6,400.97	0.00	2.63	2.63	0.00	57.81	57.81	0.00
Multilateral Operations	NE	NE	0.00	NE	NE	0.00	NE	NE	0.00
CO ₂ Emissions from Biomass	16,514.85	16,514.85	0.00						
GREENHOUSE GAS SOURCE AND SINK CATEGORIES									
	HFC's		Difference (%)	PFC's		Difference (%)	SF ₆		Difference (%)
	Previous submission CO ₂ equivalent (Gg)	Latest submission CO ₂ equivalent (Gg)		Previous submission CO ₂ equivalent (Gg)	Latest submission CO ₂ equivalent (Gg)		Previous submission CO ₂ equivalent (Gg)	Latest submission CO ₂ equivalent (Gg)	
Total Actual Emissions	NE	1,126.27	0.00	4,092.78	3,938.28	-3.77	NE	NE	0.00
2.C.3. Aluminium Production				4,092.78	3,938.28	-3.77	NA	NA	0.00
2.E. Production of Halocarbons and SF ₆	NO	1,126.27	0.00	NO	NO	0.00	NO	NO	0.00
2.F. Consumption of Halocarbons and SF ₆	NE	NE	0.00	NE	NE	0.00	NE	NE	0.00
Other	NA	NA	0.00	NA	NA	0.00	NA	NA	0.00
Potential Emissions from Consumption of HFCs/PFCs and SF ₆	NA	NA	NA	NA	NA	NA	NA	NA	NA
Confidential emissions reported as CO ₂ equivalents ⁽¹⁾	1170.2	1732.00	48.01						
			Previous submission	Latest submission		Difference			
			CO ₂ equivalent (Gg)						
			503,299.25						
			417,371.70						
			515,822.56						
			422,724.72						
			2.49						
			1.28						

TABLE 8(a) RECALCULATION—RECALCULATED DATA

Recalculated

year:

1991

Australia

2001

Submission 2003

GREENHOUSE GAS SOURCE AND SINK CATEGORIES									
	CO ₂			CH ₄			N ₂ O		
	Previous submission CO ₂ equivalent (Gg)	Latest submission (Gg)	Difference (%)	Previous submission CO ₂ equivalent (Gg)	Latest submission (Gg)	Difference (%)	Previous submission CO ₂ equivalent (Gg)	Latest submission (Gg)	Difference (%)
Total National Emissions and Removals	331,474.91	341,284.72	2.96	116,405.53	121,251.08	4.16	23,285.52	24,264.32	4.20
1. Energy	273,221.44	260,716.76	-4.58	24,548.20	24,653.62	0.43	2,694.00	2,745.01	1.89
1.A. Fuel Combustion Activities	267,476.32	254,971.64	-4.68	2,316.51	2,421.93	4.55	2,660.56	2,711.57	1.92
1.A.1. Energy Industries	145,296.14	145,296.14	0.00	40.30	40.30	0.00	456.17	456.17	0.00
1.A.2. Manufacturing Industries and Construction	49,404.94	36,829.60	-25.45	33.70	31.89	-5.35	232.26	205.38	-11.58
1.A.3. Transport	58,574.54	59,076.56	0.86	571.59	540.59	-5.42	1,845.34	1,969.71	6.74
1.A.4. Other Sectors	12,558.60	12,558.60	0.00	1,669.88	1,808.30	8.29	118.92	76.32	-35.82
1.A.5. Other	1,642.11	1,210.75	-26.27	1.05	0.84	-19.36	7.87	3.99	-49.26
1.B. Fugitive Emissions from Fuels	5,745.12	5,745.12	0.00	22,231.69	22,231.69	0.00	33.44	33.44	0.00
1.B.1. Solid fuel	NE	NE	0.00	15,979.04	15,979.04	0.00	NE	NE	0.00
1.B.2. Oil and Natural Gas	5,745.12	5,745.12	0.00	6,252.65	6,252.65	0.00	33.44	33.44	0.00
2. Industrial Processes	6,377.88	18,882.92	196.07	57.46	55.21	-3.92	C	26.64	0.00
2.A. Mineral Products ⁽¹⁾	4,551.14	4,477.14	-1.63	NA	NA	0.00	NA	NA	0.00
2.B. Chemical Industry ⁽¹⁾	C	C	0.00	NE	NE	0.00	C	C	-100.00
2.C. Metal Production	1,826.74	14,405.78	688.61	57.46	55.21	-3.92	NE	26.64	0.00
2.D. Other Production	NE	NE	0.00						
2.G. Other	NA	NA	0.00	NA	NA	0.00	NA	NA	0.00
3. Solvent and Other Product Use	NA	NA	0.00	NA	NA	0.00	NE	NE	0.00
4. Agriculture	NA	NA	0.00	71,014.77	75,381.67	6.15	19,223.89	20,079.24	4.45
4.A. Enteric Fermentation				63,447.84	67,704.15	6.71			
4.B. Manure Management				1,565.59	1,508.06	-3.67	409.69	584.27	42.61
4.C. Rice Cultivation				536.08	523.78	-2.29			
4.D. Agricultural Soils	NA	NA	0.00	NE	NE	0.00	14,737.55	15,280.50	3.68
4.E. Prescribed Burning of Savannas				5,283.33	5,467.19	3.48	3,991.92	4,130.84	3.48
4.F. Field Burning of Agricultural Residues				181.93	178.48	-1.89	84.72	83.63	-1.29
4.G. Other				NA	NA	0.00	NA	NA	0.00
5. Land-Use Change and Forestry (net)	51,875.59	61,685.04	18.91	5,652.13	6,027.62	6.64	878.86	924.67	5.21
5.A. Changes in Forest and Other Woody Biomass Stocks	-24,084.18	-24,084.18	0.00						
5.B. Forest and Grassland Conversion	80,183.31	89,992.76	12.23	4,396.96	4,772.45	8.54	536.34	582.14	8.54
5.C. Abandonment of Managed Lands	NA	NA	0.00						
5.D. CO ₂ Emissions and Removals from Soil	-4,223.54	-4,223.54	0.00						
5.E. Other	NA	NA	0.00	1,255.17	1,255.17	0.00	342.52	342.52	0.00

1. Emissions of N₂O from Nitric Acid Production and CO₂ from Ammonia Production and Soda Ash Production and Use are confidential and are aggregated and reported in Table 8(a)s2 under "Confidential emissions reported as CO₂-equivalents".

TABLE 8(a) RECALCULATION—RECALCULATED DATA
Recalculated
(Sheet 2 of 2)

1991

year:

Australia
2001
Submission 2003

GREENHOUSE GAS SOURCE AND SINK CATEGORIES									
	CO ₂		Difference (%)	CH ₄		Difference (%)	N ₂ O		Difference (%)
	Previous submission CO ₂ equivalent (Gg)	Latest submission (Gg)		Previous submission CO ₂ equivalent (Gg)	Latest submission (Gg)		Previous submission CO ₂ equivalent (Gg)	Latest submission (Gg)	
6. Waste	NE	NE	0.00	15,132.96	15,132.96	0.00	488.76	488.76	0.00
6.A. Solid Waste Disposal on Land	NE	NE	0.00	13,937.81	13,937.81	0.00			
6.B. Wastewater Handling				1,195.15	1,195.15	0.00	488.76	488.76	0.00
6.C. Waste Incineration	NE	NE	0.00	NE	NE	0.00	NE	NE	0.00
6.D. Other	NA	NA	0.00	NA	NA	0.00	NA	NA	0.00
7. Other <i>(please specify)</i>	NA	NA	0.00	NA	NA	0.00	NA	NA	0.00
NA									
Memo Items:									
International Bunkers	6,378.80	6,378.80	0.00	2.38	2.38	0.00	57.68	57.68	0.00
Multilateral Operations	NE	NE	0.00	NE	NE	0.00	NE	NE	0.00
CO₂ Emissions from Biomass	16,641.90	16,641.90	0.00						
GREENHOUSE GAS SOURCE AND SINK CATEGORIES									
	HFCs		Difference (%)	PFCs		Difference (%)	SF ₆		Difference (%)
	Previous submission CO ₂ equivalent (Gg)	Latest submission (Gg)		Previous submission CO ₂ equivalent (Gg)	Latest submission (Gg)		Previous submission CO ₂ equivalent (Gg)	Latest submission (Gg)	
Total Actual Emissions	NE	1,126.27	0.00	4,096.10	3,941.47	-3.77	NE	NE	0.00
2.C.3. Aluminium Production				4,096.10	3,941.47	-3.77	NA	NA	0.00
2.E. Production of Halocarbons and SF ₆	NO	1,126.27	0.00	NO	NO	0.00	NO	NO	0.00
2.F. Consumption of Halocarbons and SF ₆	NE	NE	0.00	NE	NE	0.00	NE	NE	0.00
Other	NA	NA	0.00	NA	NA	0.00	NA	NA	0.00
Potential Emissions from Consumption of HFCs/PFCs and SF₆	NA	NA	NA	NA	NA	NA	NA	NA	NA
Confidential emissions reported as CO₂ equivalents⁽¹⁾	1133.7	1732.00	52.77						
			Previous submission		Latest submission		Difference		
			CO ₂ equivalent (Gg)		(Gg)		Difference (%)		
Total CO ₂ Equivalent Emissions with Land-Use Change and Forestry			476,395.76		493,599.87		3.61		
Total CO ₂ Equivalent Emissions without Land-Use Change and Forestry			417,989.17		424,962.54		1.67		

1. Includes confidential emissions of N₂O from Nitric Acid Production and CO₂ from Ammonia Production and Soda Ash production and use

TABLE 8(a) RECALCULATION—RECALCULATED DATA

Recalculated

(Sheet 1 of 2)

year:

1992

Australia

2001

Submission 2003

GREENHOUSE GAS SOURCE AND SINK CATEGORIES									
	CO ₂			CH ₄			N ₂ O		
	Previous submission CO ₂ equivalent (Gg)	Latest submission (Gg)	Difference (%)	Previous submission CO ₂ equivalent (Gg)	Latest submission (Gg)	Difference (%)	Previous submission CO ₂ equivalent (Gg)	Latest submission (Gg)	Difference (%)
Total National Emissions and Removals	314,756.15	327,936.56	4.19	116,534.40	120,138.89	3.09	23,523.90	24,182.57	2.80
1. Energy	275,843.00	265,401.81	-3.79	25,592.92	25,743.13	0.59	3,070.66	2,992.46	-2.55
1.A. Fuel Combustion Activities	270,002.05	259,560.87	-3.87	2,324.97	2,475.18	6.46	3,037.41	2,959.21	-2.57
1.A.1. Energy Industries	148,512.17	148,512.17	0.00	42.25	42.25	0.00	465.67	465.67	0.00
1.A.2. Manufacturing Industries and Construction	47,228.03	36,707.28	-22.28	32.41	30.90	-4.66	208.00	185.53	-10.80
1.A.3. Transport	60,023.66	60,194.18	0.28	532.44	546.34	2.61	2,236.54	2,225.53	-0.49
1.A.4. Other Sectors	12,894.80	12,894.80	0.00	1716.80	1,854.81	8.04	121.98	78.08	-35.99
1.A.5. Other	1,343.39	1,252.43	-6.77	1.07	0.88	-18.12	5.21	4.40	-15.67
1.B. Fugitive Emissions from Fuels	5840.95	5,840.95	0.00	23,267.95	23,267.95	0.00	33.25	33.25	0.00
1.B.1. Solid Fuel	NE	NE	0.00	16619.63	16,619.63	0.00	NE	NE	0.00
1.B.2. Oil and Natural Gas	5,840.95	5,840.95	0.00	6648.32	6,648.32	0.00	33.25	33.25	0.00
2. Industrial Processes	6,195.25	16,642.72	168.64	59.54	60.65	1.85	C	22.28	-100.00
2.A. Mineral Products ⁽¹⁾	4,373.14	4,299.14	-1.69	NA	NA	0.00	NA	NA	0.00
2.B. Chemical Industry ⁽¹⁾	C	C	0.00	NE	NE	0.00	C	C	0.00
2.C. Metal Production	1,822.11	12,343.58	577.43	59.54	60.65	1.85	NE	22.28	0.00
2.D. Other Production	NE	NE	0.00						
2.G. Other	NA	NA	0.00	NA	NA	0.00	NA	NA	0.00
3. Solvent and Other Product Use	NA	NA	0.00	NA	NA	0.00	NA	NA	0.00
4. Agriculture	NA	NA	0.00	71,014.77	73,969.76	4.16	19,223.89	19,877.70	3.40
4.A. Enteric Fermentation				63,447.84	66,430.81	4.70			
4.B. Manure Management				1,565.59	1,537.61	-1.79	409.69	641.52	56.59
4.C. Rice Cultivation				536.08	536.08	0.00			
4.D. Agricultural Soils	NA	NA	0.00	NE	NE	0.00	14,737.55	15,159.54	2.86
4.E. Prescribed Burning of Savannas				5,283.33	5,283.33	0.00	3,991.92	3,991.92	0.00
4.F. Field Burning of Agricultural Residues				181.93	181.93	0.00	84.72	84.72	0.00
4.G. Other				NA	NA	0.00	NA	NA	0.00
5. Land-Use Change and Forestry (net)	32,717.91	45,892.02	40.27	4,557.65	5,055.84	10.93	734.63	795.40	8.27
5.A. Changes in Forest and Other Woody Biomass Stocks	-24,543.87	-24,543.87	0.00						
5.B. Forest and Grassland Conversion	61,485.32	74,659.43	21.43	3,373.60	3,871.79	14.77	411.51	472.28	14.77
5.C. Abandonment of Managed Lands	NA	NA	0.00						
5.D. CO ₂ Emissions and Removals from Soil	-4,223.54	-4,223.54	0.00						
5.E. Other	NA	NA	0.00	1,184.05	1,184.05	0.00	323.12	323.12	0.00

1. Emissions of N₂O from Nitric Acid Production and CO₂ from Ammonia Production and Soda Ash Production and Use are confidential and are aggregated and reported in Table 8(a)s2 under "Confidential emissions reported as CO₂-equivalents".

TABLE 8(a) RECALCULATION—RECALCULATED DATA
Recalculated
(Sheet 2 of 2)

1992

year:

Australia
2001
Submission 2003

GREENHOUSE GAS SOURCE AND SINK CATEGORIES									
	CO ₂		Difference (%)	CH ₄		Difference (%)	N ₂ O		Difference (%)
	Previous submission CO ₂ equivalent (Gg)	Latest submission (Gg)		Previous submission CO ₂ equivalent (Gg)	Latest submission (Gg)		Previous submission CO ₂ equivalent (Gg)	Latest submission (Gg)	
6. Waste	NE	NE	0.00	15,309.51	15,309.51	0.00	494.73	494.73	0.00
6.A. Solid Waste Disposal on Land	NE	NE	0.00	14,099.77	14,099.77	0.00			
6.B. Wastewater Handling				1,209.74	1,209.74	0.00	494.73	494.73	0.00
6.C. Waste Incineration	NE	NE	0.00	NE	NE	0.00	NE	NE	0.00
6.D. Other	NA	NA	0.00	NA	NA	0.00	NA	NA	0.00
7. Other <i>(please specify)</i>	NA	NA	0.00	NA	NA	0.00	NA	NA	0.00
NA									
Memo Items:									
International Bunkers	6,584.40	6,584.40	0.00	2.35	2.35	0.00	59.67	59.67	0.00
Multilateral Operations	NE	NE	0.00	NE	NE	0.00	NE	NE	0.00
CO₂ Emissions from Biomass	15,141.52	15,141.52	0.00						
GREENHOUSE GAS SOURCE AND SINK CATEGORIES									
	HFCs		Difference (%)	PFCs		Difference (%)	SF ₆		Difference (%)
	Previous submission CO ₂ equivalent (Gg)	Latest submission (Gg)		Previous submission CO ₂ equivalent (Gg)	Latest submission (Gg)		Previous submission CO ₂ equivalent (Gg)	Latest submission (Gg)	
Total Actual Emissions	NE	1,053.94	0.00	4,089.47	3,935.10	-3.77	NE	NE	0.00
2.C.3. Aluminium Production				4,089.47	3,935.10	-3.77	NA	NA	0.00
2.E. Production of Halocarbons and SF ₆	NO	1,053.94	0.00	NO	NO	0.00	NO	NO	0.00
2.F. Consumption of Halocarbons and SF ₆	NE	NE	0.00	NE	NE	0.00	NE	NE	0.00
Other	NA	NA	0.00	NA	NA	0.00	NA	NA	0.00
Potential Emissions from Consumption of HFCs/PFCs and SF₆	NA	NA	NA	NA	NA	NA	NA	NA	NA
Confidential emissions reported as CO₂ equivalents⁽¹⁾	1181.7	1715.43	45.16						
			Previous submission	Latest submission			Difference		
			CO ₂ equivalent (Gg)				Difference (%)		
Total CO ₂ Equivalent Emissions with Land-Use Change and Forestry			460,085.66				478,962.47		
Total CO ₂ Equivalent Emissions without Land-Use Change and Forestry			422,075.48				427,219.21		

1. Includes confidential emissions of N₂O from Nitric Acid Production and CO₂ from Ammonia Production and Soda Ash production and use

TABLE 8(a) RECALCULATION—RECALCULATED DATA

year: 1993

Recalculated
(Sheet 1 of 2)Australia
2001
Submission 2003

GREENHOUSE GAS SOURCE AND SINK CATEGORIES									
	CO ₂			CH ₄			N ₂ O		
	Previous submission CO ₂ equivalent (Gg)	Latest submission (Gg)	Difference (%)	Previous submission CO ₂ equivalent (Gg)	Latest submission (Gg)	Difference (%)	Previous submission CO ₂ equivalent (Gg)	Latest submission (Gg)	Difference (%)
Total National Emissions and Removals	323,463.38	332,760.42	2.87	115,682.83	118,911.69	2.79	24,424.40	25,049.37	2.56
1. Energy	278,986.82	268,804.61	-3.65	24,774.47	24,912.47	0.56	3,373.59	3,269.30	-3.09
1.A. Fuel Combustion Activities	273,139.47	262,957.26	-3.73	2,364.46	2,502.46	5.84	3,341.68	3,237.38	-3.12
1.A.1. Energy Industries	149,790.74	149,790.74	0.00	43.32	43.32	0.00	462.62	462.62	0.00
1.A.2. Manufacturing Industries and Construction	47,423.36	37,143.37	-21.68	34.74	33.27	-4.24	228.57	206.68	-9.58
1.A.3. Transport	60,757.06	61,358.05	0.99	519.37	559.43	7.71	2,515.95	2,483.96	-1.27
1.A.4. Other Sectors	13,375.86	13,375.86	0.00	1765.91	1,865.57	5.64	125.56	79.68	-36.54
1.A.5. Other	1,792.45	1,289.24	-28.07	1.12	0.87	-22.20	8.97	4.45	-50.40
1.B. Fugitive Emissions from Fuels	5,847.35	5,847.35	0.00	22410.00	22,410.00	0.00	31.92	31.92	0.00
1.B.1. Solid Fuel	NE	NE	0.00	16611.41	16,611.41	0.00	NE	NE	0.00
1.B.2. Oil and Natural Gas	5,847.35	5,847.35	0.00	5798.60	5,798.60	0.00	31.92	31.92	0.00
2. Industrial Processes	6,492.85	16,771.14	158.30	57.45	63.29	10.16	C	21.76	-100.00
2.A. Mineral Products ⁽¹⁾	4,570.87	4,507.25	-1.39	NA	NA	0.00	NA	NA	0.00
2.B. Chemical Industry ⁽¹⁾	C	C	0.00	NE	NE	0.00	C	C	-100.00
2.C. Metal Production	1,921.97	12,198.89	534.71	57.45	63.29	10.16	NE	21.76	0.00
2.D. Other Production	NE	NE	0.00						
2.G. Other	NA	65.00	0.00	NA	NA	0.00	NA	NA	0.00
3. Solvent and Other Product Use	NA	NA	0.00	NA	NA	0.00	NE	NE	0.00
4. Agriculture	NA	NA	0.00	70,139.82	72,904.79	3.94	19,757.23	20,425.69	3.38
4.A. Enteric Fermentation				62,212.30	64,995.27	4.47			
4.B. Manure Management				1,616.51	1,598.51	-1.11	469.85	720.16	53.27
4.C. Rice Cultivation				598.63	598.63	0.00			
4.D. Agricultural Soils	NA	NA	0.00	NE	NE	0.00	15,027.95	15,446.11	2.78
4.E. Prescribed Burning of Savannas				5,517.29	5,517.29	0.00	4,168.69	4,168.69	0.00
4.F. Field Burning of Agricultural Residues				195.09	195.09	0.00	90.73	90.73	0.00
4.G. Other				NA	NA	0.00	NA	NA	0.00
5. Land-Use Change and Forestry (net)	37,983.71	47,184.67	24.22	5,070.17	5,390.22	6.31	793.98	833.02	4.92
5.A. Changes in Forest and Other Woody Biomass Stocks	-24,154.58	-24,154.58	0.00						
5.B. Forest and Grassland Conversion	66,361.83	75,562.79	13.86	3,907.08	4,227.12	8.19	476.58	515.62	8.19
5.C. Abandonment of Managed Lands	NA	NA	0.00						
5.D. CO ₂ Emissions and Removals from Soil	-4,223.54	-4,223.54	0.00						
5.E. Other	NA	NA	0.00	1,163.09	1,163.09	0.00	317.40	317.40	0.00

1. Emissions of N₂O from Nitric Acid Production and CO₂ from Ammonia Production and Soda Ash Production and Use are confidential and are aggregated and reported in Table 8(a)s2 under "Confidential emissions reported as CO₂-equivalents".

TABLE 8(a) RECALCULATION—RECALCULATED DATA
Recalculated
(Sheet 2 of 2)

1993

year:

Australia
2001
Submission 2003

GREENHOUSE GAS SOURCE AND SINK CATEGORIES									
CO ₂		CH ₄		N ₂ O					
Previous submission	Latest submission	Previous submission	Latest submission	Previous submission	Latest submission	CO ₂ equivalent (Gg)	Difference	CO ₂ equivalent (Gg)	Difference
CO ₂ equivalent (Gg)	CO ₂ equivalent (Gg)	CO ₂ equivalent (Gg)	CO ₂ equivalent (Gg)	CO ₂ equivalent (Gg)	CO ₂ equivalent (Gg)	CO ₂ equivalent (Gg)	(%)	CO ₂ equivalent (Gg)	(%)
6. Waste	NE	NE	15,640.92	499.60	499.60	499.60	0.00	499.60	0.00
6.A. Solid Waste Disposal on Land	NE	NE	14,419.29				0.00		
6.B. Wastewater Handling			1,221.64	499.60	499.60	499.60	0.00	499.60	0.00
6.C. Waste Incineration	NE	NE	NE	NE	NE	NE	0.00	NE	0.00
6.D. Other	NA	NA	NA	NA	NA	NA	0.00	NA	0.00
7. Other <i>(please specify)</i>	NA	NA	NA	NA	NA	NA	0.00	NA	0.00
NA									
Memo Items:									
International Bunkers	6,987.84	6,987.84	2.40	63.35	63.35	63.35	0.00	63.35	0.00
Multilateral Operations	NE	NE	NE	NE	NE	NE	0.00	NE	0.00
CO ₂ Emissions from Biomass	16,799.68	16,799.68					0.00		
GREENHOUSE GAS SOURCE AND SINK CATEGORIES									
HFCs		PFCs		SF ₆					
Previous submission	Latest submission	Previous submission	Latest submission	Previous submission	Latest submission	CO ₂ equivalent (Gg)	Difference	CO ₂ equivalent (Gg)	Difference
CO ₂ equivalent (Gg)	CO ₂ equivalent (Gg)	CO ₂ equivalent (Gg)	CO ₂ equivalent (Gg)	CO ₂ equivalent (Gg)	CO ₂ equivalent (Gg)	CO ₂ equivalent (Gg)	(%)	CO ₂ equivalent (Gg)	(%)
Total Actual Emissions	NE	1,446.59	2,833.07	3,035.44	2,833.07	NE	-6.67	NE	0.00
2.C.3. Aluminium Production				3,035.44	2,833.07	NA	-6.67	NA	0.00
2.E. Production of Halocarbons and SF ₆	NO	1,446.59	NO	NO	NO	NO	0.00	NO	0.00
2.F. Consumption of Halocarbons and SF ₆	NE	NE	NE	NE	NE	NE	0.00	NE	0.00
Other	NA	NA	NA	NA	NA	NA	0.00	NA	0.00
Potential Emissions from Consumption of HFCs/PFCs and SF ₆	NA	NA	NA	NA	NA	NA	NA	NA	NA
Confidential emissions reported as CO ₂ equivalents ⁽¹⁾	1186.1	1726.78		45.59					
		Previous submission	Latest submission						
		CO ₂ equivalent (Gg)	CO ₂ equivalent (Gg)						
Total CO ₂ Equivalent Emissions with Land-Use Change and Forestry		467,792.12	482,727.92						
Total CO ₂ Equivalent Emissions without Land-Use Change and Forestry		423,944.26	429,320.01						

1. Includes confidential emissions of N₂O from Nitric Acid Production and CO₂ from Ammonia Production and Soda Ash production and use

TABLE 8(a) RECALCULATION—RECALCULATED DATA
Recalculated
(Sheet 1 of 2)

year: 1994

Australia
2001
Submission 2003

GREENHOUSE GAS SOURCE AND SINK CATEGORIES									
	CO ₂			CH ₄			N ₂ O		
	Previous submission CO ₂ equivalent (Gg)	Latest submission (Gg)	Difference (%)	Previous submission CO ₂ equivalent (Gg)	Latest submission (Gg)	Difference (%)	Previous submission CO ₂ equivalent (Gg)	Latest submission (Gg)	Difference (%)
Total National Emissions and Removals	331,883.01	340,556.46	2.61	114,301.80	117,508.96	2.81	25,037.30	25,680.78	2.57
1. Energy	284,097.13	272,700.18	-4.01	24,334.15	24,668.53	1.37	3,663.23	3,546.98	-3.17
1.A. Fuel Combustion Activities	278,524.56	267,127.62	-4.09	2,378.57	2,470.77	3.88	3,634.76	3,518.52	-3.20
1.A.1. Energy Industries	150,850.78	150,850.78	0.00	43.99	43.99	0.00	468.04	468.04	0.00
1.A.2. Manufacturing Industries and Construction	50,008.85	38,645.38	-22.72	35.76	34.13	-4.56	233.49	209.36	-10.33
1.A.3. Transport	62,300.00	62,765.30	0.75	511.58	576.05	12.60	2,797.16	2,757.11	-1.43
1.A.4. Other Sectors	13,491.90	13,491.90	0.00	1,786.06	1,815.63	1.66	126.68	79.08	-37.57
1.A.5. Other	1,873.02	1,374.24	-26.63	1.17	0.96	-18.20	9.40	4.92	-47.65
1.B. Fugitive Emissions from Fuels	5,572.57	5,572.57	0.00	21,955.58	22,197.77	1.10	28.46	28.46	0.00
1.B.1. Solid Fuel	NE	NE	0.00	16,084.42	16,326.61	1.51	NE	NE	0.00
1.B.2. Oil and Natural Gas	5,572.57	5,572.57	0.00	5,871.16	5,871.16	0.00	28.46	28.46	0.00
2. Industrial Processes	7,334.22	18,615.55	153.82	70.47	69.82	-0.93	C	24.07	-100.00
2.A. Mineral Products ⁽¹⁾	5,294.76	5,210.39	-1.59	NA	NA	0.00	NA	NA	0.00
2.B. Chemical Industry ⁽¹⁾	C	C	0.00	NE	NE	0.00	C	C	-100.00
2.C. Metal Production	2,039.45	13,405.16	557.29	70.47	69.82	-0.93	NE	24.07	0.00
2.D. Other Production	NE	NE	0.00						
2.G. Other	NA	NA	0.00	NA	NA	0.00	NA	NA	0.00
3. Solvent and Other Product Use	NA	NA	0.00	NA	NA	0.00	NE	NE	0.00
4. Agriculture	NA	NA	0.00	69,110.51	71,641.98	3.66	20,066.89	20,760.84	3.46
4.A. Enteric Fermentation				60,960.78	63,485.50	4.14			
4.B. Manure Management				1,646.05	1,652.81	0.41	519.87	793.08	52.55
4.C. Rice Cultivation				606.24	606.24	0.00			
4.D. Agricultural Soils	NA	NA	0.00	NE	NE	0.00	15,143.49	15,564.23	2.78
4.E. Prescribed Burning of Savannas				5,705.22	5,705.22	0.00	4,310.69	4,310.69	0.00
4.F. Field Burning of Agricultural Residues				192.21	192.21	0.00	92.84	92.84	0.00
4.G. Other				NA	NA	0.00	NA	NA	0.00
5. Land-Use Change and Forestry (net)	40,451.67	49,240.72	21.73	5,207.64	5,549.58	6.57	802.28	843.99	5.20
5.A. Changes in Forest and Other Woody Biomass Stocks	-23,173.16	-23,173.16	0.00						
5.B. Forest and Grassland Conversion	67,848.37	76,637.42	12.95	4,100.68	4,442.63	8.34	500.20	541.91	8.34
5.C. Abandonment of Managed Lands	NA	NA	0.00						
5.D. CO ₂ Emissions and Removals from Soil	-4,223.54	-4,223.54	0.00						
5.E. Other	NA	NA	0.00	1,106.96	1,106.96	0.00	302.08	302.08	0.00

1. Emissions of N₂O from Nitric Acid Production and CO₂ from Ammonia Production and Soda Ash Production and Use are confidential and are aggregated and reported in Table 8(a)s2 under "Confidential emissions reported as CO₂-equivalents".

TABLE 8(a) RECALCULATION—RECALCULATED DATA
Recalculated
(Sheet 2 of 2)

1994

year:

Australia
2001
Submission 2003

GREENHOUSE GAS SOURCE AND SINK CATEGORIES									
CO ₂		CH ₄		N ₂ O					
Previous submission	Latest submission	Previous submission	Latest submission	Previous submission	Latest submission	CO ₂ equivalent (Gg)	Difference	CO ₂ equivalent (Gg)	Difference
CO ₂ equivalent (Gg)	(Gg)	CO ₂ equivalent (Gg)	(Gg)	CO ₂ equivalent (Gg)	(Gg)	(%)	(%)	(Gg)	(%)
6. Waste	NE	NE	15,579.04	504.91	504.91	0.00	0.00	504.91	0.00
6.A. Solid Waste Disposal on Land	NE	NE	14,344.40			0.00	0.00		
6.B. Wastewater Handling			1,234.64	504.91	504.91	0.00	0.00	504.91	0.00
6.C. Waste Incineration	NE	NE	NE	NE	NE	0.00	0.00	NE	0.00
6.D. Other	NA	NA	NA	NA	NA	0.00	0.00	NA	0.00
7. Other <i>(please specify)</i>	NA	NA	NA	NA	NA	0.00	0.00	NA	0.00
NA									
Memo Items:									
International Bunkers	7,239.92	7,365.97	2.53	2.64	65.63	1.74	4.31	65.63	1.63
Multilateral Operations	NE	NE	NE	NE	NE	0.00	0.00	NE	0.00
CO ₂ Emissions from Biomass	17,618.70	17,618.70				0.00			
GREENHOUSE GAS SOURCE AND SINK CATEGORIES									
HFCs		PFCs		SF ₆					
Previous submission	Latest submission	Previous submission	Latest submission	Previous submission	Latest submission	CO ₂ equivalent (Gg)	Difference	CO ₂ equivalent (Gg)	Difference
CO ₂ equivalent (Gg)	(Gg)	CO ₂ equivalent (Gg)	(Gg)	CO ₂ equivalent (Gg)	(Gg)	(%)	(%)	(Gg)	(%)
Total Actual Emissions	NE	936.01	1,847.57	1,986.34	1,847.57	0.00	-6.99	NE	0.00
2.C.3. Aluminium Production				1,986.34	1,847.57		-6.99	NA	0.00
2.E. Production of Halocarbons and SF ₆	NO	811.70	NO	NO	NO	0.00	0.00	NO	0.00
2.F. Consumption of Halocarbons and SF ₆	NE	124.31	NE	NE	NE	0.00	0.00	NE	0.00
Other	NA	NA	NA	NA	NA	0.00	0.00	NA	0.00
Potential Emissions from Consumption of HFCs/PFCs and SF ₆	NA	NA	NA	NA	NA	NA	NA	NA	NA
Confidential emissions reported as CO ₂ equivalents ⁽¹⁾	1297.8	1859.71				43.30			
		Previous submission	Latest submission						
		CO ₂ equivalent (Gg)	(Gg)						
Total CO ₂ Equivalent Emissions with Land-Use Change and Forestry		474,506.22	488,389.49						
Total CO ₂ Equivalent Emissions without Land-Use Change and Forestry		428,044.63	432,755.19						

1. Includes confidential emissions of N₂O from Nitric Acid Production and CO₂ from Ammonia Production and Soda Ash production and use

TABLE 8(a) RECALCULATION—RECALCULATED DATA

Recalculated year: 1995

(Sheet 1 of 2)

Australia
2001
Submission 2003

GREENHOUSE GAS SOURCE AND SINK CATEGORIES									
	CO ₂			CH ₄			N ₂ O		
	Previous submission CO ₂ equivalent (Gg)	Latest submission (Gg)	Difference (%)	Previous submission CO ₂ equivalent (Gg)	Latest submission (Gg)	Difference (%)	Previous submission CO ₂ equivalent (Gg)	Latest submission (Gg)	Difference (%)
Total National Emissions and Removals	336,264.66	338,396.03	0.63	115,540.60	118,822.74	2.84	25,438.40	26,102.50	2.61
1. Energy	294,119.56	282,424.83	-3.98	26,282.39	27,097.86	3.10	3,979.26	3,839.76	-3.51
1.A. Fuel Combustion Activities	288,404.73	276,710.00	-4.05	2,385.47	2,432.71	1.98	3,949.84	3,810.33	-3.53
1.A.1. Energy Industries	156,807.47	156,807.47	0.00	47.22	47.22	0.00	481.00	481.00	0.00
1.A.2. Manufacturing Industries and Construction	50,860.23	39,169.22	-22.99	38.65	36.98	-4.34	255.17	230.41	-9.70
1.A.3. Transport	64,790.01	65,366.69	0.89	507.57	596.85	17.59	3,075.33	3,014.65	-1.97
1.A.4. Other Sectors	13,961.17	13,961.17	0.00	1,790.60	1,750.56	-2.24	127.10	78.25	-38.43
1.A.5. Other	1,985.85	1,405.45	-29.23	1.42	1.11	-21.65	11.23	6.02	-46.43
1.B. Fugitive Emissions from Fuels	5,714.83	5,714.83	0.00	23,896.93	24,665.15	3.21	29.42	29.42	0.00
1.B.1. Solid Fuel	NE	NE	0.00	16,711.94	17,480.17	4.60	NE	NE	0.00
1.B.2. Oil and Natural Gas	5,714.83	5,714.83	0.00	7,184.98	7,184.98	0.00	29.42	29.42	0.00
2. Industrial Processes	6,964.63	18,596.36	167.01	72.41	71.79	-0.87	C	24.76	-100.00
2.A. Mineral Products ⁽¹⁾	5,069.60	5,008.05	-1.21	NA	NA	0.00	NA	NA	0.00
2.B. Chemical Industry ⁽¹⁾	C	C	0.00	NE	NE	0.00	C	C	-100.00
2.C. Metal Production	1,895.03	13,588.31	617.05	72.41	71.79	-0.87	NE	24.76	0.00
2.D. Other Production	NE	NE	0.00						
2.G. Other	NA	NA	0.00	NA	NA	0.00	NA	NA	0.00
3. Solvent and Other Product Use	NA	NA	0.00	NA	NA	0.00	NE	NE	0.00
4. Agriculture	NA	NA	0.00	69,111.43	71,672.28	3.71	20,181.85	20,963.65	3.87
4.A. Enteric Fermentation				60,390.00	62,927.20	4.20			
4.B. Manure Management				1,648.69	1,672.34	1.43	510.05	820.25	60.82
4.C. Rice Cultivation				648.74	648.74	0.00			
4.D. Agricultural Soils	NA	NA	0.00	NE	NE	0.00	14,873.42	15,345.02	3.17
4.E. Prescribed Burning of Savannas				6,223.56	6,223.56	0.00	4,702.32	4,702.32	0.00
4.F. Field Burning of Agricultural Residues				200.45	200.45	0.00	96.05	96.05	0.00
4.G. Other				NA	NA	0.00	NA	NA	0.00
5. Land-Use Change and Forestry (net)	35,163.64	37,358.01	6.24	4,832.45	4,808.19	-0.50	766.24	763.28	-0.39
5.A. Changes in Forest and Other Woody Biomass Stocks	-22,380.22	-22,380.22	0.00						
5.B. Forest and Grassland Conversion	61,767.40	63,961.77	3.55	3,661.03	3,636.77	-0.66	446.57	443.61	-0.66
5.C. Abandonment of Managed Lands	NA	NA	0.00						
5.D. CO ₂ Emissions and Removals from Soil	-4,223.54	-4,223.54	0.00						
5.E. Other	NA	NA	0.00	1,171.42	1,171.42	0.00	319.67	319.67	0.00

1. Emissions of N₂O from Nitric Acid Production and CO₂ from Ammonia Production and Soda Ash Production and Use are confidential and are aggregated and reported in Table 8(a)2 under "Confidential emissions reported as CO₂-equivalents".

TABLE 8(a) RECALCULATION—RECALCULATED DATA
Recalculated
(Sheet 2 of 2)

1995

year:

Australia
2001
Submission 2003

GREENHOUSE GAS SOURCE AND SINK CATEGORIES									
	CO ₂		Difference (%)	CH ₄		Difference (%)	N ₂ O		Difference (%)
	Previous submission CO ₂ equivalent (Gg)	Latest submission (Gg)		Previous submission CO ₂ equivalent (Gg)	Latest submission (Gg)		Previous submission CO ₂ equivalent (Gg)	Latest submission (Gg)	
6. Waste	16.83	16.83	0.00	15,241.92	15,172.62	-0.45	511.05	511.05	0.00
6.A. Solid Waste Disposal on Land	NE	NE	0.00	13,992.28	13,922.98	-0.50			
6.B. Wastewater Handling				1,249.64	1,249.64	0.00	511.05	511.05	0.00
6.C. Waste Incineration	16.83	16.83	0.00	NE	NE	0.00	NE	NE	0.00
6.D. Other	NA	NA	0.00	NA	NA	0.00	NA	NA	0.00
7. Other <i>(please specify)</i>	NA	NA	0.00	NA	NA	0.00	NA	NA	0.00
NA									
Memo Items:									
International Bunkers	8,532.60	8,532.60	0.00	3.37	3.37	0.00	77.15	77.15	0.00
Multilateral Operations	NE	NE	0.00	NE	NE	0.00	NE	NE	0.00
CO₂ Emissions from Biomass	18,447.90	18,447.90	0.00						
GREENHOUSE GAS SOURCE AND SINK CATEGORIES									
	HFCs		Difference (%)	PFCs		Difference (%)	SF ₆		Difference (%)
	Previous submission CO ₂ equivalent (Gg)	Latest submission (Gg)		Previous submission CO ₂ equivalent (Gg)	Latest submission (Gg)		Previous submission CO ₂ equivalent (Gg)	Latest submission (Gg)	
Total Actual Emissions	NE	977.42	0.00	1,367.71	1,309.06	-4.29	NE	NE	0.00
2.C.3. Aluminium Production				1,367.71	1,309.06	-4.29	NA	NA	0.00
2.E. Production of Halocarbons and SF ₆	NO	718.85	0.00	NO	NO	0.00	NO	NO	0.00
2.F. Consumption of Halocarbons and SF ₆	NE	258.57	0.00	NE	NE	0.00	NE	NE	0.00
Other	NA	NA	0.00	NA	NA	0.00	NA	NA	0.00
Potential Emissions from Consumption of HFCs/PFCs and SF₆	NA	NA	NA	NA	NA	NA	NA	NA	NA
Confidential emissions reported as CO₂ equivalents⁽¹⁾	1291.5	1816.93	40.68						
			Previous submission	Latest submission			Difference		
			CO ₂ equivalent (Gg)				Difference		
							CO ₂ equivalent (Gg)		
Total CO ₂ Equivalent Emissions with Land-Use Change and Forestry			479,902.91				487,424.68		
Total CO ₂ Equivalent Emissions without Land-Use Change and Forestry			439,140.58				444,495.20		

1. Includes confidential emissions of N₂O from Nitric Acid Production and CO₂ from Ammonia Production and Soda Ash production and use

TABLE 8(a) RECALCULATION—RECALCULATED DATA

Recalculated year: 1996

(Sheet 1 of 2)

Australia
2001
Submission 2003

GREENHOUSE GAS SOURCE AND SINK CATEGORIES									
	CO ₂			CH ₄			N ₂ O		
	Previous submission CO ₂ equivalent (Gg)	Latest submission (Gg)	Difference (%)	Previous submission CO ₂ equivalent (Gg)	Latest submission (Gg)	Difference (%)	Previous submission CO ₂ equivalent (Gg)	Latest submission (Gg)	Difference (%)
Total National Emissions and Removals	342,962.70	344,309.22	0.39	115,783.58	118,609.02	2.44	25,667.93	26,375.69	2.76
1. Energy	303,456.97	292,173.10	-3.72	26,485.04	26,862.10	1.42	4,226.77	4,099.30	-3.02
1.A. Fuel Combustion Activities	298,206.44	286,922.57	-3.78	2,372.53	2,394.56	0.93	4,196.04	4,068.57	-3.04
1.A.1. Energy Industries	163,334.69	163,334.69	0.00	48.18	48.18	0.00	498.83	498.83	0.00
1.A.2. Manufacturing Industries and Construction	51,869.00	40,314.68	-22.28	38.96	37.30	-4.25	257.46	232.99	-9.50
1.A.3. Transport	66,829.20	67,710.68	1.32	485.55	618.05	27.29	3,299.68	3,252.37	-1.43
1.A.4. Other Sectors	14,044.93	14,044.93	0.00	1,798.32	1,689.81	-6.03	127.81	77.61	-39.28
1.A.5. Other	2,128.63	1,517.59	-28.71	1.53	1.22	-19.79	12.27	6.77	-44.76
1.B. Fugitive Emissions from Fuels	5,250.53	5,250.53	0.00	24,112.51	24,467.54	1.47	30.72	30.72	0.00
1.B.1. Solid Fuel	NE	NE	0.00	17,431.48	17,786.50	2.04	NE	NE	0.00
1.B.2. Oil and Natural Gas	5,250.53	5,250.53	0.00	6,681.03	6,681.03	0.00	30.72	30.72	0.00
2. Industrial Processes	7,115.20	18,671.59	162.42	73.47	71.97	-2.03	C	24.63	-100.00
2.A. Mineral Products ⁽¹⁾	5,151.98	5,076.15	-1.47	NA	NA	0.00	NA	NA	0.00
2.B. Chemical Industry ⁽¹⁾	C	C	0.00	NE	NE	0.00	C	C	-100.00
2.C. Metal Production	1,963.22	13,595.44	592.51	73.47	71.97	-2.03	NE	24.63	0.00
2.D. Other Production	NE	NE	0.00						
2.G. Other	NA	NA	0.00	NA	NA	0.00	NA	NA	0.00
3. Solvent and Other Product Use	NA	NA	0.00	NA	NA	0.00	NE	NE	0.00
4. Agriculture	NA	NA	0.00	69,163.47	71,769.92	3.77	20,178.01	21,007.74	4.11
4.A. Enteric Fermentation				60,164.32	62,732.85	4.27			
4.B. Manure Management				1,653.22	1,691.14	2.29	494.98	840.67	69.84
4.C. Rice Cultivation				702.28	702.28	0.00			
4.D. Agricultural Soils	NA	NA	0.00	NE	NE	0.00	14,725.64	15,209.67	3.29
4.E. Prescribed Burning of Savannas				6,426.76	6,426.76	0.00	4,855.86	4,855.86	0.00
4.F. Field Burning of Agricultural Residues				216.89	216.89	0.00	101.53	101.53	0.00
4.G. Other				NA	NA	0.00	NA	NA	0.00
5. Land-Use Change and Forestry (net)	32,377.00	33,451.01	3.32	4,710.93	4,554.09	-3.33	745.34	726.21	-2.57
5.A. Changes in Forest and Other Woody Biomass Stocks	-22,431.63	-22,431.63	0.00						
5.B. Forest and Grassland Conversion	59,032.18	60,106.18	1.82	3,579.77	3,422.93	-4.38	436.66	417.53	-4.38
5.C. Abandonment of Managed Lands	NA	NA	0.00						
5.D. CO ₂ Emissions and Removals from Soil	-4,223.54	-4,223.54	0.00						
5.E. Other	NA	NA	0.00	1,131.16	1,131.16	0.00	308.68	308.68	0.00

1. Emissions of N₂O from Nitric Acid Production and CO₂ from Ammonia Production and Soda Ash Production and Use are confidential and are aggregated and reported in Table 8(a)s2 under "Confidential emissions reported as CO₂-equivalents".

TABLE 8(a) RECALCULATION—RECALCULATED DATA
Recalculated
(Sheet 2 of 2)

1996

year:

Australia
2001
Submission 2003

GREENHOUSE GAS SOURCE AND SINK CATEGORIES									
	CO ₂		Difference (%)	CH ₄		Difference (%)	N ₂ O		Difference (%)
	Previous submission CO ₂ equivalent (Gg)	Latest submission (Gg)		Previous submission CO ₂ equivalent (Gg)	Latest submission (Gg)		Previous submission CO ₂ equivalent (Gg)	Latest submission (Gg)	
6. Waste	13.53	13.53	0.00	15,350.68	15,350.94	0.00	517.81	517.81	0.00
6.A. Solid Waste Disposal on Land	NE	NE	0.00	14,084.51	14,084.77	0.00			
6.B. Wastewater Handling				1,266.17	1,266.17	0.00	517.81	517.81	0.00
6.C. Waste Incineration	13.53	13.53	0.00	NE	NE	0.00	NE	NE	0.00
6.D. Other	NA	NA	0.00	NA	NA	0.00	NA	NA	0.00
7. Other <i>(please specify)</i>	NA	NA	0.00	NA	NA	0.00	NA	NA	0.00
NA									
Memo Items:									
International Bunkers	9,030.65	9,030.65	0.00	3.35	3.35	0.00	81.69	81.69	0.00
Multilateral Operations	NE	NE	0.00	NE	NE	0.00	NE	NE	0.00
CO₂ Emissions from Biomass	18,437.02	18,437.02	0.00						
GREENHOUSE GAS SOURCE AND SINK CATEGORIES									
	HFCs		Difference (%)	PFCs		Difference (%)	SF ₆		Difference (%)
	Previous submission CO ₂ equivalent (Gg)	Latest submission (Gg)		Previous submission CO ₂ equivalent (Gg)	Latest submission (Gg)		Previous submission CO ₂ equivalent (Gg)	Latest submission (Gg)	
Total Actual Emissions	NE	602.54	0.00	1,292.09	1,205.39	-6.71	8.60	8.60	0.00
2.C.3. Aluminium Production				1,292.09	1,205.39	-6.71	NA	NA	0.00
2.E. Production of Halocarbons and SF ₆	NO	NO	0.00	NO	NO	0.00	NO	NO	0.00
2.F. Consumption of Halocarbons and SF ₆	NE	602.54	0.00	NE	NE	0.00	NE	NE	0.00
Other	NA	NA	0.00	NA	NA	0.00	8.60	8.60	0.00
Potential Emissions from Consumption of HFCs/PFCs and SF₆	NA	NA	NA	NA	NA	NA	NA	NA	NA
Confidential emissions reported as CO₂ equivalents⁽¹⁾	1359.2	1970.11	44.95						
			Previous submission	Latest submission		Difference			
			CO ₂ equivalent (Gg)	(Gg)		Difference (%)			
Total CO ₂ Equivalent Emissions with Land-Use Change and Forestry			487,074.10			493,071.98			
Total CO ₂ Equivalent Emissions without Land-Use Change and Forestry			449,240.83			454,340.67			

1. Includes confidential emissions of N₂O from Nitric Acid Production and CO₂ from Ammonia Production and Soda Ash production and use

TABLE 8(a) RECALCULATION—RECALCULATED DATA

Recalculated year: 1997

(Sheet 1 of 2)

Australia
2001
Submission 2003

GREENHOUSE GAS SOURCE AND SINK CATEGORIES									
	CO ₂			CH ₄			N ₂ O		
	Previous submission CO ₂ equivalent (Gg)	Latest submission (Gg)	Difference (%)	Previous submission CO ₂ equivalent (Gg)	Latest submission (Gg)	Difference (%)	Previous submission CO ₂ equivalent (Gg)	Latest submission (Gg)	Difference (%)
Total National Emissions and Removals	352,140.13	348,489.26	-1.04	117,438.92	120,902.33	2.95	27,224.79	27,999.49	2.85
1. Energy	311,061.87	299,491.76	-3.72	26,983.08	27,749.41	2.84	4,477.18	4,346.55	-2.92
1.A. Fuel Combustion Activities	306,013.18	294,443.08	-3.78	2,831.90	2,427.02	-14.30	4,455.61	4,324.97	-2.93
1.A.1. Energy Industries	169,403.10	169,403.10	0.00	98.71	98.71	0.00	531.95	531.95	0.00
1.A.2. Manufacturing Industries and Construction	51,444.82	39,855.61	-22.53	51.74	49.52	-4.30	272.63	248.09	-9.00
1.A.3. Transport	68,395.02	69,060.28	0.97	484.99	638.20	31.59	3,508.35	3,459.89	-1.38
1.A.4. Other Sectors	14,585.63	14,585.63	0.00	2,194.87	1,639.36	-25.31	129.92	78.09	-39.89
1.A.5. Other	2,184.62	1,538.46	-29.58	1.58	1.23	-21.91	12.76	6.95	-45.51
1.B. Fugitive Emissions from Fuels	5,048.68	5,048.68	0.00	24,151.19	25,322.39	4.85	21.57	21.57	0.00
1.B.1. Solid Fuel	NE	NE	0.00	17,005.23	18,176.44	6.89	NE	NE	0.00
1.B.2. Oil and Natural Gas	5,048.68	5,048.68	0.00	7,145.96	7,145.96	0.00	21.57	21.57	0.00
2. Industrial Processes	7,143.39	18,661.15	161.24	72.30	70.73	-2.18	C	24.55	-100.00
2.A. Mineral Products ⁽¹⁾	5,083.05	5,008.60	-1.46	NA	NA	0.00	NA	NA	0.00
2.B. Chemical Industry ⁽¹⁾	C	C	0.00	NE	NE	0.00	C	C	-100.00
2.C. Metal Production	2,060.33	13,652.55	562.64	72.30	70.73	-2.18	NE	24.55	0.00
2.D. Other Production	NE	NE	0.00	NE	NE	0.00	NE	NE	0.00
2.G. Other	NA	NA	0.00	NA	NA	0.00	NA	NA	0.00
3. Solvent and Other Product Use	NA	NA	0.00	NA	NA	0.00	NA	NA	0.00
4. Agriculture	NA	NA	0.00	69,963.20	72,884.27	4.18	21,453.58	22,361.37	4.23
4.A. Enteric Fermentation	NE	NE	0.00	60,407.77	63,270.17	4.74	NE	NE	0.00
4.B. Manure Management	NE	NE	0.00	1,702.80	1,761.42	3.44	492.64	875.52	77.72
4.C. Rice Cultivation	NE	NE	0.00	722.05	722.05	0.00	NE	NE	0.00
4.D. Agricultural Soils	NE	NE	0.00	NE	NE	0.00	15,649.24	16,174.12	3.35
4.E. Prescribed Burning of Savannas	NE	NE	0.00	6,884.31	6,884.31	0.00	5,201.57	5,201.57	0.00
4.F. Field Burning of Agricultural Residues	NE	NE	0.00	246.28	246.32	0.02	110.13	110.17	0.03
4.G. Other	NE	NE	0.00	NA	NA	0.00	NA	NA	0.00
5. Land-Use Change and Forestry (net)	33,917.94	30,319.41	-10.61	4,837.95	4,613.37	-4.64	770.19	742.80	-3.56
5.A. Changes in Forest and Other Woody Biomass Stocks	-22,517.35	-22,517.90	0.00	NE	NE	0.00	NE	NE	0.00
5.B. Forest and Grassland Conversion	60,658.83	57,060.86	-5.93	3,644.80	3,420.22	-6.16	444.59	417.20	-6.16
5.C. Abandonment of Managed Lands	NA	NA	0.00	NA	NA	0.00	NA	NA	0.00
5.D. CO ₂ Emissions and Removals from Soil	-4,223.54	-4,223.54	0.00	NE	NE	0.00	NE	NE	0.00
5.E. Other	NA	NA	0.00	1,193.15	1,193.15	0.00	325.60	325.60	0.00

1. Emissions of N₂O from Nitric Acid Production and CO₂ from Ammonia Production and Soda Ash Production and Use are confidential and are aggregated and reported in Table 8(a)s2 under "Confidential emissions reported as CO₂-equivalents".

TABLE 8(a) RECALCULATION—RECALCULATED DATA
Recalculated
(Sheet 2 of 2)

year:

1997

Australia
2001
Submission 2003

GREENHOUSE GAS SOURCE AND SINK CATEGORIES									
	CO ₂		Difference (%)	CH ₄		Difference (%)	N ₂ O		Difference (%)
	Previous submission CO ₂ equivalent (Gg)	Latest submission CO ₂ equivalent (Gg)		Previous submission CO ₂ equivalent (Gg)	Latest submission CO ₂ equivalent (Gg)		Previous submission CO ₂ equivalent (Gg)	Latest submission CO ₂ equivalent (Gg)	
6. Waste	16.94	16.94	0.00	15,582.38	15,584.55	0.01	523.83	524.23	0.08
6.A. Solid Waste Disposal on Land	NE	NE	0.00	14,301.48	14,302.69	0.01			
6.B. Wastewater Handling				1,280.90	1,281.86	0.08	523.83	524.23	0.08
6.C. Waste Incineration	16.94	16.94	0.00	NE	NE	0.00	NE	NE	0.00
6.D. Other	NA	NA	0.00	NA	NA	0.00	NA	NA	0.00
7. Other <i>(please specify)</i>	NA	NA	0.00	NA	NA	0.00	NA	NA	0.00
NA									
Memo Items:									
International Bunkers	9,020.41	9,020.41	0.00	3.29	3.29	0.00	81.71	81.71	0.00
Multilateral Operations	NE	NE	0.00	NE	NE	0.00	NE	NE	0.00
CO₂ Emissions from Biomass	20,275.50	20,275.50	0.00						
GREENHOUSE GAS SOURCE AND SINK CATEGORIES									
	HFCs		Difference (%)	PFCs		Difference (%)	SF ₆		Difference (%)
	Previous submission CO ₂ equivalent (Gg)	Latest submission CO ₂ equivalent (Gg)		Previous submission CO ₂ equivalent (Gg)	Latest submission CO ₂ equivalent (Gg)		Previous submission CO ₂ equivalent (Gg)	Latest submission CO ₂ equivalent (Gg)	
Total Actual Emissions	NE	907.09	0.00	1,122.24	1,050.67	-6.38	5.98	5.98	0.00
2.C.3. Aluminium Production				1,122.24	1,050.67	-6.38	NA	NA	0.00
2.E. Production of Halocarbons and SF ₆	NO	NO	0.00	NO	NO	0.00	NO	NO	0.00
2.F. Consumption of Halocarbons and SF ₆	NE	907.09	0.00	NE	NE	0.00	NE	NE	0.00
Other	NA	NA	0.00	NA	NA	0.00	5.98	5.98	0.00
Potential Emissions from Consumption of HFCs/PFCs and SF₆	NA	NA	NA	NA	NA	NA	NA	NA	NA
Confidential emissions reported as CO₂ equivalents⁽¹⁾	1334.6	1958.03	46.72						
			Previous submission	Latest submission		Difference			
			CO ₂ equivalent (Gg)	CO ₂ equivalent (Gg)		Difference (%)			
Total CO ₂ Equivalent Emissions with Land-Use Change and Forestry			499,266.61	501,306.89		0.41			
Total CO ₂ Equivalent Emissions without Land-Use Change and Forestry			459,740.53	408,209.05		-11.21			

1. Includes confidential emissions of N₂O from Nitric Acid Production and CO₂ from Ammonia Production and Soda Ash production and use

TABLE 8(a) RECALCULATION—RECALCULATED DATA
Recalculated
(Sheet 1 of 2)

year: 1998

Australia
2001
Submission 2003

GREENHOUSE GAS SOURCE AND SINK CATEGORIES									
	CO ₂			CH ₄			N ₂ O		
	Previous submission CO ₂ equivalent (Gg)	Latest submission (Gg)	Difference (%)	Previous submission CO ₂ equivalent (Gg)	Latest submission (Gg)	Difference (%)	Previous submission CO ₂ equivalent (Gg)	Latest submission (Gg)	Difference (%)
Total National Emissions and Removals	369,689.95	372,753.24	0.83	118,595.74	122,570.35	3.35	28,388.27	29,305.50	3.23
1. Energy	327,056.86	315,517.98	-3.53	28,667.64	29,505.84	2.92	4,736.45	4,650.80	-1.81
1.A. Fuel Combustion Activities	321,767.89	310,229.01	-3.59	2,821.80	2,332.77	-17.33	4,703.24	4,617.59	-1.82
1.A.1. Energy Industries	184,779.29	184,779.29	0.00	105.73	105.73	0.00	594.69	594.69	0.00
1.A.2. Manufacturing Industries and Construction	51,376.86	40,222.52	-21.71	53.26	51.12	-4.02	275.75	252.13	-8.57
1.A.3. Transport	68,425.03	69,122.80	1.02	486.73	655.89	34.75	3,691.38	3,688.58	-0.08
1.A.4. Other Sectors	14,785.31	14,785.31	0.00	2,174.58	1,518.83	-30.15	128.97	75.87	-41.17
1.A.5. Other	2,401.40	1,319.08	-45.07	1.50	1.19	-20.64	12.44	6.31	-49.25
1.B. Fugitive Emissions from Fuels	5,288.97	5,288.97	0.00	25,845.84	27,173.08	5.14	33.21	33.21	0.00
1.B.1. Solid Fuel	NE	NE	0.00	18,721.53	20,048.78	7.09	NE	NE	0.00
1.B.2. Oil and Natural Gas	5,288.97	5,288.97	0.00	7,124.30	7,124.30	0.00	33.21	33.21	0.00
2. Industrial Processes	7,830.18	18,943.26	141.93	77.21	75.70	-1.95	C	23.63	-100.00
2.A. Mineral Products ⁽¹⁾	5,477.55	5,433.39	-0.81	NA	NA	0.00	NA	NA	0.00
2.B. Chemical Industry ⁽¹⁾	C	C	0.00	NE	NE	0.00	C	C	-100.00
2.C. Metal Production	2,352.63	13,509.87	474.25	77.21	75.70	-1.95	NE	23.63	0.00
2.D. Other Production	NE	NE	0.00						
2.G. Other	NA	NA	0.00	NA	NA	0.00	NA	NA	0.00
3. Solvent and Other Product Use	NA	NA	0.00	NA	NA	0.00	NE	NE	0.00
4. Agriculture	NA	NA	0.00	70,034.29	73,116.55	4.40	22,405.72	23,377.94	4.34
4.A. Enteric Fermentation				60,361.37	63,358.32	4.97			
4.B. Manure Management				1,760.74	1,846.08	4.85	548.11	974.93	77.87
4.C. Rice Cultivation				724.47	724.47	0.00			
4.D. Agricultural Soils	NA	NA	0.00	NE	NE	0.00	16,509.10	17,054.53	3.30
4.E. Prescribed Burning of Savannas				6,929.53	6,929.53	0.00	5,235.73	5,235.73	0.00
4.F. Field Burning of Agricultural Residues				258.18	258.15	-0.01	112.78	112.76	-0.02
4.G. Other				NA	NA	0.00	NA	NA	0.00
5. Land-Use Change and Forestry (net)	34,785.78	38,274.87	10.03	4,408.02	4,458.75	1.15	716.43	722.62	0.86
5.A. Changes in Forest and Other Woody Biomass Stocks	-22,710.40	-22,709.30	0.00						
5.B. Forest and Grassland Conversion	61,719.71	65,207.71	5.65	3,223.58	3,274.31	1.57	393.21	399.40	1.57
5.C. Abandonment of Managed Lands	NA	NA	0.00						
5.D. CO ₂ Emissions and Removals from Soil	-4,223.54	-4,223.54	0.00						
5.E. Other	NA	NA	0.00	1,184.44	1,184.44	0.00	323.22	323.22	0.00

1. Emissions of N₂O from Nitric Acid Production and CO₂ from Ammonia Production and Soda Ash Production and Use are confidential and are aggregated and reported in Table 8(a)s2 under "Confidential emissions reported as CO₂-equivalents".

TABLE 8(a) RECALCULATION—RECALCULATED DATA
Recalculated
(Sheet 2 of 2)

1998

year:

Australia
2001
Submission 2003

GREENHOUSE GAS SOURCE AND SINK CATEGORIES									
	CO ₂		Difference (%)	CH ₄		Difference (%)	N ₂ O		Difference (%)
	Previous submission CO ₂ equivalent (Gg)	Latest submission (Gg)		Previous submission CO ₂ equivalent (Gg)	Latest submission (Gg)		Previous submission CO ₂ equivalent (Gg)	Latest submission (Gg)	
6. Waste	17.13	17.13	0.00	15,408.59	15,413.51	0.03	529.66	530.50	0.16
6.A. Solid Waste Disposal on Land	NE	NE	0.00	14,113.45	14,116.30	0.02			
6.B. Wastewater Handling				1,295.14	1,297.22	0.16	529.66	530.50	0.16
6.C. Waste Incineration	17.13	17.13	0.00	NE	NE	0.00	NE	NE	0.00
6.D. Other	NA	NA	0.00	NA	NA	0.00	NA	NA	0.00
7. Other <i>(please specify)</i>	NA	NA	0.00	NA	NA	0.00	NA	NA	0.00
NA									
Memo Items:									
International Bunkers	9,473.01	9,473.01	0.00	2.98	2.98	0.00	86.32	86.32	0.00
Multilateral Operations	NE	NE	0.00	NE	NE	0.00	NE	NE	0.00
CO₂ Emissions from Biomass	20,492.97	20,492.97	0.00						
GREENHOUSE GAS SOURCE AND SINK CATEGORIES									
	HFCs		Difference (%)	PFCs		Difference (%)	SF ₆		Difference (%)
	Previous submission CO ₂ equivalent (Gg)	Latest submission (Gg)		Previous submission CO ₂ equivalent (Gg)	Latest submission (Gg)		Previous submission CO ₂ equivalent (Gg)	Latest submission (Gg)	
Total Actual Emissions	NE	1,311.25	0.00	1,466.61	1,396.99	-4.75	3.66	3.66	0.00
2.C.3. Aluminium Production				1,466.61	1,396.99	-4.75	NA	NA	0.00
2.E. Production of Halocarbons and SF ₆	NO	NO	0.00	NO	NO	0.00	NO	NO	0.00
2.F. Consumption of Halocarbons and SF ₆	NE	1,311.25	0.00	NE	NE	0.00	NE	NE	0.00
Other	NA	NA	0.00	NA	NA	0.00	3.66	3.66	0.00
Potential Emissions from Consumption of HFCs/PFCs and SF₆	NA	NA	NA	NA	NA	NA	NA	NA	NA
Confidential emissions reported as CO₂ equivalents⁽¹⁾	1501.8	2132.86	42.02						
			Previous submission	Latest submission			Difference		
			CO ₂ equivalent (Gg)				Difference (%)		
Total CO ₂ Equivalent Emissions with Land-Use Change and Forestry			519,646.02	529,470.19			1.89		
Total CO ₂ Equivalent Emissions without Land-Use Change and Forestry			479,735.79	436,372.35			-9.04		

1. Includes confidential emissions of N₂O from Nitric Acid Production and CO₂ from Ammonia Production and Soda Ash production and use

TABLE 8(a) RECALCULATION—RECALCULATED DATA

Recalculated year: 1999

(Sheet 1 of 2)

Australia
2001
Submission 2003

GREENHOUSE GAS SOURCE AND SINK CATEGORIES											
	CO ₂			Difference (%)	CH ₄			Difference (%)	N ₂ O		
	Previous submission CO ₂ equivalent (Gg)	Latest submission (Gg)			Previous submission CO ₂ equivalent (Gg)	Latest submission (Gg)			Previous submission CO ₂ equivalent (Gg)	Latest submission (Gg)	Difference (%)
Total National Emissions and Removals											
1. Energy											
1.A. Fuel Combustion Activities											
1.A.1. Energy Industries											
1.A.2. Manufacturing Industries and Construction											
1.A.3. Transport											
1.A.4. Other Sectors											
1.A.5. Other											
1.B. Fugitive Emissions from Fuels											
1.B.1. Solid Fuel											
1.B.2. Oil and Natural Gas											
2. Industrial Processes											
2.A. Mineral Products ⁽¹⁾											
2.B. Chemical Industry ⁽¹⁾											
2.C. Metal Production											
2.D. Other Production											
2.G. Other											
3. Solvent and Other Product Use											
4. Agriculture											
4.A. Enteric Fermentation											
4.B. Manure Management											
4.C. Rice Cultivation											
4.D. Agricultural Soils											
4.E. Prescribed Burning of Savannas											
4.F. Field Burning of Agricultural Residues											
4.G. Other											
5. Land-Use Change and Forestry (net)											
5.A. Changes in Forest and Other Woody Biomass Stocks											
5.B. Forest and Grassland Conversion											
5.C. Abandonment of Managed Lands											
5.D. CO ₂ Emissions and Removals from Soil											
5.E. Other											

1. Emissions of N₂O from Nitric Acid Production and CO₂ from Ammonia Production and Soda Ash Production and Use are confidential and are aggregated and reported in Table 8(a)s2 under "Confidential emissions reported as CO₂-equivalents".

TABLE 8(a) RECALCULATION—RECALCULATED DATA
Recalculated
(Sheet 2 of 2)

year:

1999

Australia
2001
Submission 2003

GREENHOUSE GAS SOURCE AND SINK CATEGORIES									
CO ₂		CH ₄		N ₂ O					
Previous submission	Latest submission	Previous submission	Latest submission	Previous submission	Latest submission	CO ₂ equivalent (Gg)	Difference	CO ₂ equivalent (Gg)	Difference
CO ₂ equivalent (Gg)	CO ₂ equivalent (Gg)	CO ₂ equivalent (Gg)	CO ₂ equivalent (Gg)	CO ₂ equivalent (Gg)	CO ₂ equivalent (Gg)	CO ₂ equivalent (Gg)	(%)	CO ₂ equivalent (Gg)	(%)
6. Waste									
17.49	17.49	0.00	15,902.75	15,911.34	0.05	535.51	536.84	0.25	0.25
NE	NE	0.00	14,593.29	14,598.63	0.04				
6.A. Solid Waste Disposal on Land									
						535.51	536.84	0.25	0.25
6.B. Wastewater Handling									
17.49	17.49	0.00	1,309.45	1,312.70	0.25	NE	NE	0.00	0.00
6.C. Waste Incineration									
NA	NA	0.00	NA	NA	0.00	NA	NA	0.00	0.00
6.D. Other									
NA	NA	0.00	NA	NA	0.00	NA	NA	0.00	0.00
7. Other (please specify)									
NA	NA	0.00	NA	NA	0.00	NA	NA	0.00	0.00
Memo Items:									
9,718.28	9,752.78	0.36	3.04	3.11	2.42	88.43	88.74	0.35	0.35
NE	NE	0.00	NE	NE	0.00	NE	NE	0.00	0.00
CO₂ Emissions from Biomass									
20,145.07	20,145.07	0.00							

GREENHOUSE GAS SOURCE AND SINK CATEGORIES									
HFCs		PFCs		SF ₆					
Previous submission	Latest submission	Previous submission	Latest submission	Previous submission	Latest submission	CO ₂ equivalent (Gg)	Difference	CO ₂ equivalent (Gg)	Difference
CO ₂ equivalent (Gg)	CO ₂ equivalent (Gg)	CO ₂ equivalent (Gg)	CO ₂ equivalent (Gg)	CO ₂ equivalent (Gg)	CO ₂ equivalent (Gg)	CO ₂ equivalent (Gg)	(%)	CO ₂ equivalent (Gg)	(%)
Total Actual Emissions									
NE	1,694.44	0.00	1,005.82	981.99	-2.37	3.59	3.59	0.00	0.00
2.C.3. Aluminium Production									
			1,005.82	981.99	-2.37	NA	NA	0.00	0.00
2.E. Production of Halocarbons and SF₆									
NE	NO	0.00	NO	NO	0.00	NO	NO	0.00	0.00
2.F. Consumption of Halocarbons and SF₆									
NE	1,694.44	0.00	NE	NE	0.00	NE	NE	0.00	0.00
NA	NA	0.00	NA	NA	0.00	3.59	3.59	0.00	0.00
Potential Emissions from Consumption of HFCs/PFCs and SF₆									
NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Confidential emissions reported as CO₂-equivalents⁽¹⁾									
1418.1	2019.63	42.42							
Previous submission		Latest submission		Difference					
CO ₂ equivalent (Gg)		CO ₂ equivalent (Gg)		(%)					
523,993.10		527,578.50		0.68					
485,693.68		497,104.92		2.35					

1. Includes confidential emissions of N₂O from Nitric Acid Production and CO₂ from Ammonia Production and Soda Ash production and use

TABLE 8(a) RECALCULATION—RECALCULATED DATA

Recalculated year:

(Sheet 1 of 2)

GREENHOUSE GAS SOURCE AND SINK CATEGORIES									
CO ₂			CH ₄			N ₂ O			
Previous submission	Latest submission	Difference	Previous submission	Latest submission	Difference	Previous submission	Latest submission	Difference	
CO ₂ equivalent (Gg)	CO ₂ equivalent (Gg)	(%)	CO ₂ equivalent (Gg)	CO ₂ equivalent (Gg)	(%)	CO ₂ equivalent (Gg)	CO ₂ equivalent (Gg)	(%)	
Total National Emissions and Removals									3,89
L. Energy	379,852.36	-3.77	121,054.39	124,810.76	3.10	31,905.57	33,145.92	3.89	
	339,203.28	-2.65	27,429.38	28,581.06	4.20	5,192.36	5,205.58	0.25	
1.A. Fuel Combustion Activities	332,716.03	-2.70	2,406.08	2,207.11	-8.27	5,165.74	5,178.97	0.26	
1.A.1. Energy Industries	191,289.69	0.58	167.30	192.64	15.15	610.69	611.79	0.18	
1.A.2. Manufacturing Industries and Construction	52,128.10	-18.30	54.01	51.61	-4.44	274.08	246.13	-10.20	
1.A.3. Transport	71,692.91	0.56	503.59	663.26	31.71	4,138.21	4,242.46	2.52	
1.A.4. Other Sectors	15,208.21	1.16	1,679.71	1,298.50	-22.70	130.33	72.78	-44.16	
1.A.5. Other	2,397.12	-46.78	1.46	1.10	-24.82	12.44	5.82	-53.23	
1.B. Fugitive Emissions from Fuels	6,487.25	0.02	25,023.30	26,373.96	5.40	26.61	26.61	0.00	
1.B.1. Solid Fuel	NE	0.00	18,411.31	19,638.07	6.66	NE	NE	0.00	
1.B.2. Oil and Natural Gas	6,487.25	0.02	6,612.00	6,735.88	1.87	26.61	26.61	0.00	
2. Industrial Processes	7,786.75	140.73	62.16	60.80	-2.19	C	22.88	0.00	
2.A. Mineral Products ⁽¹⁾	5,208.09	-1.10	NA	NA	0.00	NA	NA	0.00	
2.B. Chemical Industry ⁽¹⁾	C	0.00	NE	NE	0.00	C	C	-100.00	
2.C. Metal Production	2,578.66	427.17	62.16	60.80	-2.19	NE	22.88	0.00	
2.D. Other Production	NE	0.00							
2.G. Other	NA	0.00	NA	NA	0.00	NA	NA	0.00	
3. Solvent and Other Product Use	NA	0.00	NA	NA	0.00	NE	NE	0.00	
4. Agriculture	NA	0.00	72,956.42	76,255.48	4.52	25,483.94	26,769.79	5.05	
4.A. Enteric Fermentation			61,346.19	64,495.65	5.13				
4.B. Manure Management			1,765.33	1,911.95	8.31	615.36	1,115.65	81.30	
4.C. Rice Cultivation			738.61	741.34	0.37				
4.D. Agricultural Soils	NA	0.00	NE	NE	0.00	18,076.61	18,860.84	4.34	
4.E. Prescribed Burning of Savannas			8,843.68	8,843.68	0.00	6,682.00	6,682.00	0.00	
4.F. Field Burning of Agricultural Residues			262.61	262.85	0.09	109.97	111.29	1.20	
4.G. Other			NA	NA	0.00	NA	NA	0.00	
5. Land-Use Change and Forestry (net)	32,846.03	-49.64	4,470.13	3,763.39	-15.81	687.55	604.02	-12.15	
5.A. Changes in Forest and Other Woody Biomass Stocks	-23,724.96	-1.58							
5.B. Forest and Grassland Conversion	60,794.53	-27.44	3,527.30	2,802.83	-20.54	430.26	341.89	-20.54	
5.C. Abandonment of Managed Lands	NA	0.00							
5.D. CO ₂ Emissions and Removals from Soil	-4,223.54	0.00							
5.E. Other	NA	0.00	942.84	960.56	1.88	257.29	262.13	1.88	

1. Emissions of N_2O from Nitric Acid Production and CO_2 from Ammonia Production and Soda Ash Production and Use are confidential and are aggregated and reported in Table 8(a)(b)(2) under "Confidential emissions reported as CO_2 -equivalents".

TABLE 8(a) RECALCULATION—RECALCULATED DATA
Recalculated year: 2000
(Sheet 2 of 2)

Australia
2001
Submission 2003

GREENHOUSE GAS SOURCE AND SINK CATEGORIES									
	CO ₂		Difference (%)	CH ₄		Difference (%)	N ₂ O		Difference (%)
	Previous submission CO ₂ equivalent (Gg)	Latest submission (Gg)		Previous submission CO ₂ equivalent (Gg)	Latest submission (Gg)		Previous submission CO ₂ equivalent (Gg)	Latest submission (Gg)	
6. Waste	16.30	16.30	0.00	16,136.29	16,150.03	0.09	541.73	543.65	0.35
6.A. Solid Waste Disposal on Land	NE	NE	0.00	14,811.63	14,820.66	0.06			
6.B. Wastewater Handling				1,324.67	1,329.37	0.35	541.73	543.65	0.35
6.C. Waste Incineration	16.30	16.30	0.00	NE	NE	0.00	NE	NE	0.00
6.D. Other	NA	NA	0.00	NA	NA	0.00	NA	NA	0.00
7. Other (please specify)	NA	NA	0.00	NA	NA	0.00	NA	NA	0.00
NA	NA	NA	0.00	NA	NA	0.00	NA	NA	0.00
Memo Items:									
International Bankers	10,197.09	10,099.67	-0.96	3.15	3.36	6.48	92.88	91.69	-1.29
Multilateral Operations	NE	NE	0.00	NE	NE	0.00	NE	NE	0.00
CO ₂ Emissions from Biomass		20,146.07	0.00						
GREENHOUSE GAS SOURCE AND SINK CATEGORIES									
	HFCs		Difference (%)	PFCs		Difference (%)	SF ₆		Difference (%)
	Previous submission CO ₂ equivalent (Gg)	Latest submission (Gg)		Previous submission CO ₂ equivalent (Gg)	Latest submission (Gg)		Previous submission CO ₂ equivalent (Gg)	Latest submission (Gg)	
Total Actual Emissions	NE	2,084.83	0.00	973.12	1,103.21	13.37	2.39	2.39	0.00
2.C.3. Aluminium Production				973.12	1,103.21	13.37	NA	NA	0.00
2.E. Production of Halocarbons and SF ₆	NO	NO	0.00	NO	NO	0.00	NO	NO	0.00
2.F. Consumption of Halocarbons and SF ₆	NE	2,084.83	0.00	NE	NE	0.00	NE	NE	0.00
Other	NA	NA	0.00	NA	NA	0.00	2.39	2.39	0.00
Potential Emissions from Consumption of HFCs/PFCs and SF ₆	NA	NA	NA	NA	NA	NA	NA	NA	NA
Confidential emissions reported as CO ₂ equivalents ⁽¹⁾	1464.6	2076.35	41.77						
	Previous submission			Latest submission			Difference		
	CO ₂ equivalent (Gg)			CO ₂ equivalent (Gg)			Difference		
Total CO ₂ Equivalent Emissions with Land-Use Change and Forestry	535,252.41			528,747.17			-1.22		
Total CO ₂ Equivalent Emissions without Land-Use Change and Forestry	497,248.70			507,837.30			2.13		

1. Includes confidential emissions of N₂O from Nitric Acid Production and CO₂ from Ammonia Production and Soda Ash production and use

TABLE 8(b) RECALCULATION—EXPLANATORY INFORMATION
(Sheet 1 of 1)

Australia
2001
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Specify the sector and source/sink category where changes in estimates have occurred:		GHG	RECALCULATION DUE TO			Addition/removal/ replacement of source/sink categories
			Methods	Emission factors	Activity data	
1.A.1	Stationary Energy Combustion - Energy Industries	CH ₄ , N ₂ O, CO, NO _x , NMVOC		Technology weighted Non-CQ emission factors recalculated back to 1999 to incorporate mobile equipment	Revised energy consumption data for 1999 and 2000. Separate consumption data for mobile equipment are no longer available	
1.A.2	Stationary Energy Combustion - Manufacturing Industries and Construction	CO ₂ , CH ₄ , N ₂ O, CO, NO _x , NMVOC, SO ₂		Technology weighted Non-CQ emission factors recalculated back to 1999 to incorporate mobile equipment	Revised energy consumption data for 1999 and 2000. Separate consumption data for mobile equipment are no longer available	Emissions from reductants used in iron and steel production have been moved to the Industrial Processes sector
1.A.3	Transport - Passenger Cars	CO ₂ , CH ₄ , N ₂ O, CO, NO _x , NMVOC, SO ₂	A new age class was introduced to accommodate new design rule (ADR 37/01)	New emission factors for the new age class		
1.A.3	Transport - Aviation and Marine Bunkers	CO ₂ , CH ₄ , N ₂ O, CO, NO _x , NMVOC, SO ₂			The factors for allocation activity data to unlist categories was incorrectly applied to both international bunkers and domestic fuel. Factors are now applied to domestic fuels only.	
1.A.4	Stationary Energy Combustion - Other Sectors	CO ₂ , CH ₄ , N ₂ O, CO, NO _x , NMVOC, SO ₂	New methodology used to calculate emission factors for wood heaters for all years	Technology weighted Non-CQ emission factors recalculated back to 1999 to incorporate mobile equipment	Revised energy consumption data for 1999 and 2000. Separate consumption data for mobile equipment are no longer available	
1.A.5	Stationary Energy Combustion - Other	CO ₂	Recycled waste oil now reported in subsector where combusted to avoid double counting			
1.B	Fugitive Emissions From Fuels	CO ₂ , CH ₄ , N ₂ O, CO, NO _x , NMVOC, SO ₂			Revised Activity Data from APPEA	Oil exploration N ₂ O emissions added from 1999 due to revised APPEA data
1.B.1a	Fugitive Emissions From Solid Fuels - Coal mining and handling	CH ₄			Reclassification of a non-gassy mine to gassy.	
2.B.2	Nitric Acid Production	N ₂ O		Revised emission factor derived from continuous monitoring.		These emissions are reported as part of the sum of "Confidential data reported as CO ₂ -e"
2.C.1	Iron and Steel Production	CO ₂ , CH ₄ , N ₂ O, CO, NO _x , NMVOC, SO ₂				Reductant use emissions in iron and steel production allocated to Industrial Processes to be consistent with the IPCC Guidelines
2.C.3	Aluminium Production	PFCs		Revised emission factor as a result of continuous improvement in methods by the aluminium industry		
2.E.1	By-product Emissions from production of HCFC-22	HFC-23	IPCC default method applied	Default IPCC emission factor of 4% applied.	Activity data obtained from Environment Australia	Emissions included for the first time. Production ceased in 1995
2.F.1	Refrigeration and Air Conditioning Equipment	HFCs	Equipment-based method applied			Actual emissions included in the inventory for the first time. Derived from equipment
4.A	Enteric Fermentation	CH ₄	Revisions have been made to input data (eg liveweight, feed quality). In addition for non-dairy cattle and sheep an estimate of the proportion of animals lactating in each season has been incorporated into the calculation of additional intake for milk production	Methane conversion rate for pigs increased from 0.6% to 0.7% based on average of values in the literature.	2000 been recalculated as the average of years 1999, 2000 and 2001. Data in all years were checked and a number transcription errors fixed	
4.B	Manure Management	CH ₄ and N ₂ O	Revisions made to the allocation of waste to different MMS. The calculation of volatile solids for pigs and poultry was also revised with the pig values now incorporating VS from waste feed entering the MMS. 'Other livestock' N excretion rates modified following changes to cattle and sheep average excretion rates	IPCC Good Practice N ₂ O emission factors for poultry have been applied	2000 been recalculated as the average of years 1999, 2000 and 2001. Data in all years were checked and a number transcription errors fixed	
4.D	Agricultural Soils	N ₂ O	Changes to 4A and 4B result in changes to N excreted and applied to soils. Methodology also now adjusts N applied to soils for the amount of N released as N ₂ O in 4B.			
4.F	Field Burning of Agricultural Residues	CH ₄ , N ₂ O, NO _x , CO, NMVOC			Revised data for sugar cane production and the proportion burnt in New South Wales 1996-2000	
5.A	Changes in Forest and Other Woody Biomass	CO ₂			Data on removals for 1999 and 2000 has been corrected.	
5.B	Forest and Grassland Conversion	CO ₂ , CH ₄ , N ₂ O, NO _x , CO, NMVOC	Minor modifications to the allocation to soil carbon pools and the allocation of biomass to tree components.		Area of change is now based on complete continental coverage and time series analysis. Technical improvements have been made to the land use change assessment methods	
6.A	Managed Solid Waste Disposal on Land	CH ₄			Population data updated following publication of the results of a national census.	
6.B	Wastewater Handling	CH ₄ , N ₂ O			Population data updated following publication of the results of a national census.	

Documentation box: Use the documentation box to report the justifications of the changes as to improvements in the accuracy, completeness and consistency of the inventory.

Changes to 4.C Rice Cultivation and 5E Prescribed Burning and Wildfires are due to inclusion of 2001 data in the calculation of average 2000 activity data.

Some differences in the recalculation tables are due to inconsistent rounding or transcription errors in the previous submissions. Only differences due to changes in data and methodology are reported in Table 8(b).

TABLE 9 COMPLETENESS
(Sheet 1 of 2)

Australia
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Sources and sinks not reported (NE)				
GHG	Sector	Source/sink category	Explanation	
CO ₂	1. Energy	1.B.1.a Coal Mining	No data, no suitable emission factors.	
	1. Energy	1.B.2.b Natural Gas: (i) Production/Processing	No data are available.	
	1. Energy	1.B.2.b Natural Gas: (iii) Other Leakage	No data are available.	
	2. Industrial Processes	2.A.6. Mineral Products: Road Paving with Asphalt	No data are available.	
	2. Industrial Processes	2.A.7 Other: Glass Production	No data are available.	
	2. Industrial Processes	2.A.7 Other: Magnesia Production	No data were provided by companies producing magnesia in Australia.	
	2. Industrial Processes	2.B.4. Chemical Industry: Carbide Production	There is no carbide production in Australia but there is acetylene use produced from imported calcium carbide. No data are available.	
	2. Industrial Processes	2.B.5. Chemical Industry: Other	No data are available.	
	2. Industrial Processes	2.C.5. Metal Production: Other	No methodology developed. Metals production is predominantly from sulfide ores rather than carbonate ores. No data are available on production from carbonate ores, if any.	
	2. Industrial Processes	2.D.1. Other Production: Pulp and paper	No data are available.	
	2. Industrial Processes	2.D.2. Other Production : Food and Drink	No methodology developed.	
	5. Land Use Change and Forestry	5.D Cultivation of mineral and organic soils, Liming of agricultural soils, and Forest soils	No national methodology or data are available. Emissions due to Forest and Grassland Conversion are reported under 5B.	
	6. Waste	6.A.1. Managed Waste Disposal on Land	No methodology developed.	
	Memo Items	Multilateral Operations	No data or methodology available	
CH ₄	1. Energy	1.A.5.a Lubricants	No national methodology.	
	1. Energy	1.B.1.a.ii Post-mining activities	Assumed that no post-mining emissions associated with surface mines.	
	1. Energy	1.B.2.b Natural Gas: (iii) Other Leakage	No data are available.	
	2. Industrial Processes	2.B.4. Chemical Industry: Carbide Production	No data are available.	
	2. Industrial Processes	2.B.5. Chemical Industry: Other	No data are available for polymers and other chemicals such as carbon black and fertiliser production.	
	2. Industrial Processes	2.C.5. Metal Production: Other	No methodology developed.	
	4. Agriculture	4.A.9 Enteric Fermentation - Poultry	IPCC Guidelines do not provide default emission factors for poultry.	
	4. Agriculture	4.B Manure Management: 4.B.2 - 4.B.7	Manure of free-ranging animals are not considered to produce significant quantities of CH ₄ under Australian conditions. IPCC defaults are not used as they are likely to produce an overestimate of emissions for these conditions (see Gonzalez-Avalos and Ruiz-Suarez (2001) Bioresource Technology, 80, 63-71.)	
	4. Agriculture	4.D Agricultural Soils: 4.D.1 - 4.D.3	No data or methodology available	
	6. Waste	6.C Waste Incineration: Solvents	No methodology available	
		Memo Items	Multilateral Operations	No data or methodology available
N ₂ O	1. Energy	1.A.5.a Lubricants	No national methodology.	
	1. Energy	1.B.2.b Natural Gas: (iii) Other Leakage	No data are available.	
	2. Industrial Processes	2.B.1. Chemical Industry: Ammonia Production	No methodology available.	
	2. Industrial Processes	2.B.5. Chemical Industry: Other	No data are available.	
	2. Industrial Processes	2.C.5. Metal Production: Other	No methodology developed.	
	3. Solvent and Other Product	3.D. Other	No data are available.	
	4. Agriculture	4.D.3 N leaching and runoff	No country specific data or emission factors are available.	
	6. Waste	6.B.1 Wastewater Handling: Industrial Wastewater	No data are available.	
	6. Waste	6.C Waste Incineration: Solvents	No data are available.	
	Memo Items	Multilateral Operations	No data or methodology available	
HFCs	2. Industrial Processes	2.F. Consumption of Halocarbons: 2.F.2 - 2.F.6	No reliable data are available.	
PFCs	2. Industrial Processes	2.F. Consumption of Halocarbons: 2.F.1 and 2.F.3	No reliable data are available.	
SF ₆	2. Industrial Processes	2.C4. SF ₆ Used in Aluminium and Magnesium Foundries	No longer used as a cover gas in trial magnesium casting plant, however small quantity are used in downstream uses of magnesium. Data is not available on these sources.	
	2. Industrial Processes	2.F.7.Electricity equipment	No reliable data are available.	
Sources and sinks reported elsewhere (IE)				
GHG	Source/sink category	Allocation as per IPCC Guidelines	Allocation used by the Party	Explanation
CO ₂	1. Energy	1.B.2.c Flaring (i) Oil and (ii) Gas	1.B.2.c Flaring (iii) Combined Oil and Gas	Flaring emissions for Oil and Gas are not available separately. They are reported as a combined figure.
	5. Land Use Change and Forestry	5.A.1-4: Temperate, tropical and boreal forests, grassland/tundra and harvested wood.	5.A.5 Other	Data are currently unavailable in a format that allows allocation of emissions and removals according to the particular forest categories given in the CRF.
	5. Land Use Change and Forestry	5.B.1-4: Temperate, tropical and boreal forests and grassland/tundra	5.B.5 Other	Forests and grasslands data are currently unavailable in a format that allows allocation of emissions according to the particular forest categories given in the CRF.
CH ₄	1. Energy	1.B.1.b Solid Fuel Transformation	2.C Industrial Processes: Iron and Steel Production	Fugitive emissions associated with Coke production are included in the CH ₄ emission factor for integrated iron and steel plants.
	1. Energy	1.B.2.c Flaring (i) Oil and (ii) Gas	1.B.2.c Flaring (iii) Combined Oil and Gas	Flaring emissions for Oil and Gas are not available separately. They are reported as a combined figure.
	5. Land Use Change and Forestry	5.B.1-4: Temperate, tropical and boreal forests and grassland/tundra	5.B.5 Other	Forests and grasslands data are currently unavailable in a format that allows allocation of emissions according to the particular forest categories given in the CRF.
N ₂ O	1. Energy	1.B.2.c Flaring (i) Oil and (ii) Gas	1.B.2.c Flaring (iii) Combined Oil and Gas	Flaring emissions for Oil and Gas are not available separately. They are reported as a combined figure.
	4. Agriculture	4.D.1 Nitrogen fixing crops, crop residues, direct emissions from cultivation of histosols 4.D.3 Atmospheric Deposition	4.D Other: Soil Disturbance	Country specific methodology. See Workbook for Non-CO ₂ Gases from the Biosphere (NGGIC (1996)).
	5. Land Use Change and Forestry	5.B.1-4: Temperate, tropical and boreal forests and grassland/tundra	5.B.5 Other	Forests and grasslands data are currently unavailable in a format that allows allocation of emissions according to the particular forest categories given in the CRF.
HFCs	NA	NA	NA	NA
PFCs	NA	NA	NA	NA
SF ₆	NA	NA	NA	NA

TABLE 9 COMPLETENESS
(Sheet 2 of 2)

Australia
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Submission 2003

Additional GHG Emissions Reported						
GHG	Source Category	Emissions (Gg)	Estimated GWP Value (100-year horizon)	Emissions CO ₂ Equivalent (G-g)	Reference to the Data Source of GWP Value	Explanation
NO _x	Energy	1575.55	NA	NA	NA	Methodology described in Australian methodology workbooks
CO	Energy	4278.96	NA	NA	NA	Methodology described in Australian methodology workbooks
NM VOC	Energy	788.22	NA	NA	NA	Methodology described in Australian methodology workbooks
SO ₂	Energy	759.40	NA	NA	NA	Methodology described in Australian methodology workbooks
NO _x	Industrial Processes	55.70	NA	NA	NA	Methodology described in Australian methodology workbooks
CO	Industrial Processes	8.04	NA	NA	NA	Methodology described in Australian methodology workbooks
NM VOC	Industrial Processes	62.33	NA	NA	NA	Methodology described in Australian methodology workbooks
SO ₂	Industrial Processes	1729.33	NA	NA	NA	Methodology described in Australian methodology workbooks
NM VOC	Solvents	140.31	NA	NA	NA	Methodology described in Australian methodology workbooks
NO _x	Agriculture	1393.05	NA	NA	NA	Methodology described in Australian methodology workbooks
CO	Agriculture	18,590.11	NA	NA	NA	Methodology described in Australian methodology workbooks
NM VOC	Agriculture	1,084.42	NA	NA	NA	Methodology described in Australian methodology workbooks
NO _x	Land Use Change and Forestry	64.58	NA	NA	NA	Methodology described in Australian methodology workbooks
CO	Land Use Change and Forestry	3,461.28	NA	NA	NA	Methodology described in Australian methodology workbooks
NM VOC	Land Use Change and Forestry	396.70	NA	NA	NA	Methodology described in Australian methodology workbooks
NM VOC	Waste	3.62	NA	NA	NA	Methodology described in Australian methodology workbooks

1. Speciated emissions from Ammonia Production, Nitric Acid Production, and Soda Ash Production and Use are Confidential. These emissions are reported in Table 10s5 as Confidential emissions reported as CO₂-e.

TABLE 10 EMISSIONS TRENDS (CH₄)
(Sheet 2 of 6)

Australia
2001
Submission 2003

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Base Year											
	(Gg)											
Total Emissions	5,804.78	5,773.86	5,720.90	5,662.46	5,595.66	5,548.23	5,488.05	5,427.25	5,366.68	5,306.27	5,245.87	5,185.46
1. Energy	1,197.86	1,173.98	1,225.86	1,186.31	1,174.69	1,290.37	1,279.15	1,321.40	1,405.04	1,298.78	1,361.00	1,301.18
A. Fuel Combustion (Sectoral Approach)	113.77	113.77	117.87	119.16	117.66	115.84	114.03	115.57	111.08	108.47	105.10	98.41
1. Energy Industries	1.90	1.92	2.06	2.06	2.09	2.25	2.29	2.47	2.03	1.77	1.77	9.08
2. Manufacturing Industries and Construction	1.55	1.53	1.47	1.58	1.63	1.76	1.78	2.36	2.43	2.43	2.46	2.33
3. Transport	84.03	86.11	88.32	88.84	86.46	83.36	80.47	78.06	72.33	66.93	61.83	56.93
4. Other Sectors	0.05	0.05	0.04	0.04	0.05	0.05	0.06	0.06	0.06	0.05	0.05	0.05
B. Fugitive Emissions from Fuels	1,084.09	1,038.65	1,108.00	1,067.14	1,057.04	1,174.53	1,165.12	1,205.83	1,293.96	1,190.31	1,255.90	1,202.76
1. Solid Fuel	753.16	760.91	791.41	791.02	777.46	832.39	846.98	865.54	954.70	903.33	935.15	878.36
2. Oil and Natural Gas	330.93	297.75	316.59	276.12	279.58	342.12	318.14	340.28	339.25	286.99	320.76	324.40
2. Industrial Processes	2.85	2.63	2.89	3.01	3.32	3.42	3.43	3.37	3.60	3.36	2.90	2.76
A. Mineral Products	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
B. Chemical Industry	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
C. Metal Production	2.85	2.63	2.89	3.01	3.32	3.42	3.43	3.37	3.60	3.36	2.90	2.76
D. Other Production	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
E. Production of Halocarbons and SF ₆	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
F. Consumption of Halocarbons and SF ₆	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
G. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
3. Solvent and Other Product Use	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
4. Agriculture	3,578.97	3,589.60	3,522.37	3,471.66	3,411.52	3,412.97	3,417.62	3,470.68	3,481.74	3,553.24	3,631.21	3,707.88
A. Enteric Fermentation	3,212.78	3,224.01	3,163.37	3,095.01	3,023.12	2,996.53	2,987.28	3,012.87	3,071.06	3,056.58	3,071.22	3,104.98
B. Manure Management	71.82	71.81	73.22	76.12	78.71	79.64	80.53	83.88	87.91	89.93	91.05	91.10
C. Rice Cultivation	23.36	24.94	25.53	28.51	28.87	30.89	33.44	34.38	34.50	31.94	35.30	35.14
D. Agricultural Soils	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
E. Prescribed Burning of Savannas	262.24	260.34	251.59	262.23	271.68	296.36	306.04	327.82	329.98	362.62	421.13	464.05
F. Field Burning of Agricultural Residues	8.77	8.50	8.66	9.29	9.15	9.55	10.33	11.73	12.29	12.17	12.52	12.62
G. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
5. Land-Use Change and Forestry	320.18	287.03	240.75	256.68	264.27	228.96	216.86	219.68	212.32	206.20	179.21	165.68
A. Changes in Forest and Other Woody Biomass Stocks	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
B. Forest and Grassland Conversion	262.24	227.26	184.37	201.29	211.55	173.18	163.00	162.87	155.92	152.80	133.47	119.00
C. Abandonment of Managed Lands	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
D. CO ₂ Emissions and Removals from Soil	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
E. Other	57.94	59.77	56.38	55.39	52.71	55.78	53.86	56.82	56.40	53.40	45.74	46.68
6. Waste	704.92	720.63	729.02	744.91	741.86	722.51	731.00	742.12	733.98	757.68	769.05	786.10
A. Solid Waste Disposal on Land	648.73	663.71	671.42	686.63	683.07	663.00	670.70	681.08	672.20	695.17	705.75	721.94
B. Waste-water Handling	56.19	56.91	57.61	58.17	58.79	59.51	60.29	61.04	61.77	62.51	63.30	64.16
C. Waste Incineration	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
D. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
7. Other (please specify)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Memo Items:	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
International Bankers	0.13	0.11	0.11	0.11	0.13	0.16	0.16	0.16	0.14	0.15	0.16	0.15
Aviation	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.03	0.03	0.03	0.03	0.03
Marine	0.11	0.09	0.09	0.09	0.10	0.14	0.14	0.12	0.12	0.12	0.13	0.12
Multilateral Operations	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
CO₂ Emissions from Biomass	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

TABLE 10 EMISSIONS TRENDS (N₂O)
(Sheet 3 of 6)

Australia
2001
Submission 2003

GREENHOUSE GAS SOURCE AND SINK CATEGORIES		Base year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
			(Gg)											
Total Emissions		77.08	77.08	76.27	76.01	80.80	82.84	84.20	85.08	90.32	94.53	100.27	106.92	110.86
1. Energy		7.95	7.95	8.85	9.65	10.55	11.44	12.39	13.22	14.02	15.00	15.88	16.79	17.16
A. Fuel Combustion (Sectoral Approach)		7.84	7.84	8.75	9.55	10.44	11.35	12.29	13.12	13.95	14.90	15.80	16.71	17.07
1. Energy Industries		1.41	1.41	1.47	1.50	1.49	1.51	1.55	1.61	1.72	1.92	1.95	1.97	2.03
2. Manufacturing Industries and Construction		0.68	0.68	0.66	0.60	0.67	0.68	0.74	0.75	0.80	0.81	0.82	0.79	0.74
3. Transport		5.49	5.49	6.35	7.18	8.01	8.89	9.72	10.49	11.16	11.90	12.77	13.69	14.05
4. Other Sectors		0.24	0.24	0.25	0.25	0.26	0.26	0.25	0.25	0.25	0.24	0.24	0.23	0.23
5. Other		0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.02	0.02	0.02	0.02	0.02
B. Fugitive Emissions from Fuels		0.12	0.12	0.11	0.11	0.10	0.09	0.09	0.10	0.07	0.11	0.07	0.09	0.09
1. Solid Fuel		NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
2. Oil and Natural Gas		0.12	0.12	0.11	0.11	0.10	0.09	0.09	0.10	0.07	0.11	0.07	0.09	0.09
2. Industrial Processes		0.09	0.09	0.09	0.07	0.07	0.08	0.08	0.08	0.08	0.08	0.08	0.07	0.07
A. Mineral Products		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
B. Chemical Industry ⁽¹⁾		C	C	C	C	C	C	C	C	C	C	C	C	C
C. Metal Production		0.09	0.09	0.09	0.07	0.07	0.08	0.08	0.08	0.08	0.08	0.08	0.07	0.07
D. Other Production		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
E. Production of Halocarbons and SF ₆														
F. Consumption of Halocarbons and SF ₆														
G. Other		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
3. Solvent and Other Product Use		NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
4. Agriculture		64.25	64.25	64.77	64.12	65.89	66.97	67.62	67.77	72.13	75.41	80.33	86.35	90.00
A. Enteric Fermentation		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
B. Manure Management		1.70	1.70	1.88	2.07	2.32	2.56	2.65	2.71	2.82	3.14	3.37	3.60	3.68
C. Rice Cultivation		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
D. Agricultural Soils		48.84	48.84	49.29	48.90	49.83	50.21	49.50	49.06	52.17	55.01	58.04	60.84	62.21
E. Prescribed Burning of Savannas		13.42	13.42	13.33	12.88	13.45	13.91	15.17	15.66	16.78	16.89	18.56	21.55	23.75
F. Field Burning of Agricultural Residues		0.28	0.28	0.27	0.27	0.29	0.30	0.31	0.33	0.36	0.36	0.36	0.36	0.36
G. Other		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
5. Land-Use Change and Forestry		3.24	3.24	2.98	2.57	2.69	2.72	2.46	2.34	2.40	2.33	2.25	1.95	1.85
A. Changes in Forest and Other Woody Biomass Stocks		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
B. Forest and Grassland Conversion		2.17	2.17	1.88	1.52	1.66	1.75	1.43	1.35	1.35	1.29	1.26	1.10	0.98
C. Abandonment of Managed Lands		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
D. CO ₂ Emissions and Removals from Soil		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
E. Other		1.07	1.07	1.10	1.04	1.02	0.97	1.03	1.00	1.05	1.04	0.99	0.85	0.86
6. Waste		1.56	1.56	1.58	1.60	1.61	1.63	1.65	1.67	1.69	1.71	1.73	1.75	1.78
A. Solid Waste Disposal on Land		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
B. Waste-water Handling		1.56	1.56	1.58	1.60	1.61	1.63	1.65	1.67	1.69	1.71	1.73	1.75	1.78
C. Waste Incineration		NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
D. Other		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
7. Other (please specify)		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
NA														
Memo Items:														
International Bankers		0.19	0.19	0.19	0.19	0.20	0.22	0.25	0.26	0.26	0.28	0.29	0.30	0.31
Aviation		0.13	0.13	0.13	0.14	0.15	0.16	0.17	0.19	0.19	0.22	0.22	0.22	0.24
Marine		0.06	0.06	0.05	0.05	0.05	0.06	0.07	0.08	0.07	0.06	0.07	0.08	0.07
Multilateral Operations		NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
CO₂ Emissions from Biomass														

1. Speciated emissions from Ammonia Production, Nitric Acid Production, and Soda Ash Production and Use are Confidential. These emissions are reported in Table 10s5 as Confidential emissions reported as CO₂-e.

TABLE 10 EMISSION TRENDS (HFCs, PFCs and SF₆)
(Sheet 4 of 6)

Australia
2001
Submission 2003

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Base year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
	(Gg)												
Emissions of HFCs— CO ₂ equivalent (Gg)	1,126.27	1,126.27	1,126.27	1,053.94	1,446.59	936.01	977.42	602.54	907.09	1,311.25	1,694.44	2,084.83	2,344.90
HFC-23	0.10	0.10	0.10	0.09	0.12	0.07	0.06	NO	NO	NO	NO	NO	NO
HFC-32	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
HFC-41	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
HFC-43-10mee	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
HFC-125	NE	NE	NE	NE	NE	0.02	0.03	0.05	0.05	0.06	0.07	0.08	0.08
HFC-134	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
HFC-134a	NE	NE	NE	NE	NE	0.00	0.05	0.22	0.42	0.69	0.94	1.19	1.39
HFC-152a	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
HFC-143	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
HFC-143a	NE	NE	NE	NE	NE	0.02	0.03	0.05	0.06	0.07	0.07	0.09	0.08
HFC-227ea	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
HFC-236fa	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
HFC-245ca	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
Emissions of PFCs— CO ₂ equivalent (Gg)	3,938.28	3,938.28	3,941.47	3,935.10	2,833.07	1,847.57	1,309.06	1,205.39	1,050.67	1,396.99	981.99	1,103.21	1,527.04
CF ₄	0.51	0.51	0.51	0.51	0.37	0.24	0.17	0.16	0.14	0.18	0.13	0.14	0.20
C ₂ F ₆	0.07	0.07	0.07	0.07	0.05	0.03	0.02	0.02	0.02	0.02	0.02	0.02	0.03
C ₃ F ₈	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
C ₄ F ₁₀	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
e-C ₄ F ₈	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
C ₃ F ₁₂	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
C ₆ F ₁₄	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
Emissions of SF ₆ — CO ₂ equivalent (Gg)	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
SF ₆	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE

Chemical	GWPs
HFC-23	11700
HFC-32	650
HFC-41	150
HFC-43-10mee	1300
HFC-125	2800
HFC-134	1000
HFC-134a	1300
HFC-152a	140
HFC-143	300
HFC-143a	3800
HFC-227ea	2900
HFC-236fa	6300
HFC-245ca	560
PFCs	
CF ₄	6500
C ₂ F ₆	9200
C ₃ F ₈	7000
C ₄ F ₁₀	7000
e-C ₄ F ₈	8700
C ₃ F ₁₂	7500
C ₆ F ₁₄	7400
SF ₆	23900

TABLE 10 EMISSION TRENDS (SUMMARY)
(Sheet 5 of 6)

Australia
2001
Submission 2003

GREENHOUSE GAS EMISSIONS	Base year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
					CO ₂ equivalent (Gg)								
Net CO ₂ emissions/removals	363,230.98	363,230.98	341,284.72	327,936.56	332,695.42	340,556.46	338,396.03	344,309.22	348,489.26	372,753.24	369,594.83	365,526.10	361,874.10
CO ₂ emissions (without LUCF)	277,860.61	277,860.61	279,599.68	282,044.54	285,510.75	291,315.73	301,038.02	310,858.22	318,169.85	334,478.37	344,148.95	348,983.64	354,554.58
Confidential emissions reported as CO ₂ -e ⁽¹⁾	1,732.00	1,732.00	1,593.44	1,715.43	1,726.78	1,859.71	1,816.93	1,970.11	1,958.03	2,132.86	2,019.63	2,076.35	2,754.06
CH ₄	121,900.36	121,900.36	121,251.08	120,138.89	118,911.69	117,508.96	118,822.74	118,609.02	120,902.33	122,570.35	122,204.60	124,810.76	125,235.39
N ₂ O	23,894.67	23,894.67	24,264.32	24,182.57	25,049.37	25,680.78	26,102.50	26,375.69	27,999.49	29,305.50	31,083.00	33,145.92	34,365.40
HFCs	1,126.27	1,126.27	1,126.27	1,053.94	1,446.59	936.01	977.42	602.54	907.09	1,311.25	1,694.44	2,084.83	2,344.90
PFCs	3,938.28	3,938.28	3,941.47	3,935.10	2,833.07	1,847.57	1,309.06	1,205.39	1,050.67	1,396.99	981.99	1,103.21	1,527.04
SF ₆	NE	NE	NE	NE	NE	NE	NE	8.60	5.98	3.66	3.59	2.39	NE
Total (with net CO ₂ emissions/removals)	515,822.56	515,822.56	493,461.31	478,962.47	482,662.92	488,389.49	487,424.68	493,080.58	501,312.86	529,473.85	527,582.08	528,749.56	528,100.88
Total (without CO ₂ from LUCF)	430,452.19	430,452.19	431,776.26	433,070.45	435,478.25	439,148.77	450,066.67	459,629.57	470,993.45	491,198.98	502,136.20	512,207.10	520,781.36

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Base year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
					CO ₂ equivalent (Gg)								
1. Energy	286,243.09	286,243.09	288,115.39	294,137.40	296,986.38	300,915.69	313,362.45	323,134.50	331,587.72	349,674.62	356,777.21	364,009.32	368,971.79
2. Industrial Processes	26,121.36	26,121.36	25,625.94	23,430.11	22,797.63	23,352.73	22,796.32	22,554.85	22,678.20	23,887.35	24,345.77	24,095.12	24,916.24
3. Solvent and Other Product Use	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
4. Agriculture	95,074.37	95,074.37	95,460.91	93,847.46	93,330.48	92,402.82	92,635.93	92,777.66	95,245.64	96,494.49	99,519.86	103,025.26	105,766.47
5. Land-Use Change and Forestry	93,097.84	93,097.84	68,637.33	51,743.26	53,407.91	55,634.30	42,929.48	38,731.30	35,675.58	43,456.24	30,473.57	20,909.87	11,371.03
6. Waste	15,285.90	15,285.90	15,621.73	15,804.24	16,140.52	16,083.95	15,700.50	15,882.27	16,125.72	15,961.15	16,465.66	16,709.99	17,075.34
7. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

1. Includes confidential emissions of CO₂ from Ammonia Production (2B1) and Soda Ash Production and Use (2A4), and N₂O from Nitric Acid Production (2B2).

TABLE 10 EMISSIONS TRENDS (CO₂-e)
(Sheet 6 of 6)

Australia
2001
Submission 2003

GREENHOUSE GAS SOURCE AND SINK CATEGORIES												
Base year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
(Gg)												
1. Energy	286,243.09	286,243.09	294,137.40	296,986.38	300,915.69	313,362.45	323,134.50	331,587.72	349,674.62	356,777.21	364,009.32	368,971.79
A. Fuel Combustion (Sectoral Approach)	257,478.85	260,105.15	264,995.26	268,697.11	273,116.90	282,953.04	293,385.71	301,195.07	317,179.36	326,023.91	331,120.30	336,761.08
1. Energy Industries	142,283.89	145,792.61	149,020.09	150,296.69	151,362.82	157,335.68	163,881.70	170,033.76	185,479.71	189,873.98	193,195.15	198,987.82
2. Manufacturing Industries and Construction	37,628.27	37,066.87	36,923.72	37,383.32	38,888.87	39,436.62	40,584.96	40,153.22	40,525.77	43,907.13	42,886.28	42,313.57
3. Transport	61,979.86	61,979.86	62,966.05	64,401.43	66,098.47	68,978.19	71,581.10	73,158.36	73,467.27	74,592.28	77,000.89	77,246.68
4. Other Sectors	14,325.20	14,443.22	14,827.69	15,321.11	15,386.62	15,789.98	15,812.35	16,303.08	16,380.01	16,411.29	16,755.24	16,852.52
5. Other	1,261.63	1,215.59	1,257.71	1,294.56	1,380.12	1,412.58	1,525.59	1,546.64	1,326.59	1,239.23	1,282.74	1,360.48
B. Fugitive Emissions from Fuels	28,764.25	28,010.24	29,142.15	28,289.27	27,798.79	30,409.41	29,748.79	30,392.65	32,495.26	30,753.30	32,889.02	32,210.71
1. Solid Fuel	15,816.36	15,979.04	16,619.63	16,611.41	16,326.61	17,480.17	17,786.50	18,176.44	20,048.78	18,969.85	19,638.07	18,445.52
2. Oil and Natural Gas	12,947.88	12,031.20	12,522.52	11,677.86	11,472.19	12,929.24	11,962.29	12,216.22	12,446.49	11,783.44	13,250.95	13,765.20
2. Industrial Processes	26,121.36	25,625.94	23,430.11	22,797.63	23,352.73	22,796.32	22,554.85	22,678.20	23,887.35	24,345.77	24,095.12	24,916.24
A. Mineral Products	4,763.45	4,477.14	4,299.14	4,507.25	5,210.39	5,008.05	5,076.15	5,008.60	5,433.39	5,355.99	5,150.78	5,099.94
B. Chemical Industry	1,732.00	1,732.00	1,593.44	1,726.78	1,859.71	1,816.93	1,970.11	1,938.03	2,132.86	2,019.63	2,076.35	2,754.06
C. Metal Production	18,499.64	18,429.10	16,361.61	15,117.02	15,346.62	14,993.92	14,897.44	14,798.50	15,006.19	15,272.13	14,780.76	14,717.35
D. Other Production	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
E. Production of Halocarbons and SF ₆	1,126.27	1,126.27	1,053.94	1,446.59	811.70	718.85	NO	NO	NO	NO	NO	NO
F. Consumption of Halocarbons and SF ₆	NE	NE	NE	NE	124.31	258.57	611.15	913.07	1,314.91	1,698.03	2,087.22	2,344.90
G. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
3. Solvent and Other Product Use	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
4. Agriculture	95,074.37	95,074.37	93,847.46	93,330.48	92,402.82	92,635.93	92,777.66	95,245.64	96,494.49	99,519.86	103,025.26	105,766.47
A. Enteric Fermentation	67,468.47	67,468.47	66,430.81	64,995.27	63,485.50	62,927.20	62,732.85	63,270.17	63,358.32	64,188.14	64,495.65	65,204.54
B. Manure Management	2,035.60	2,035.60	2,179.13	2,318.67	2,445.89	2,492.60	2,531.81	2,636.94	2,821.01	2,932.97	3,027.60	3,053.71
C. Rice Cultivation	490.50	490.50	536.08	598.63	606.24	648.74	702.28	722.05	724.47	670.72	741.34	737.90
D. Agricultural Soils	15,140.27	15,140.27	15,159.54	15,446.11	15,364.23	15,345.02	15,209.67	16,174.12	17,054.35	17,993.55	18,860.84	19,285.67
E. Prescribed Burning of Savannas	9,667.99	9,598.03	9,275.25	9,685.99	10,015.91	10,925.88	11,282.61	12,085.87	12,165.26	13,368.67	15,525.68	17,108.16
F. Field Burning of Agricultural Residues	271.55	262.12	266.65	285.82	285.05	296.50	318.43	356.50	370.90	365.81	374.14	376.49
G. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
5. Land-Use Change and Forestry	93,097.84	68,637.33	51,743.26	53,407.91	55,634.30	42,929.48	38,731.30	35,675.58	43,456.24	30,473.57	20,909.87	11,371.03
A. Changes in Forest and Other Woody Biomass Stocks	-24,598.42	-24,084.18	-24,543.87	-24,154.58	-23,173.16	-22,380.22	-22,431.63	-22,517.90	-22,709.30	-23,298.18	-23,349.21	-22,669.46
B. Forest and Grassland Conversion	120,371.03	95,347.36	79,003.50	80,305.54	81,621.96	68,042.15	63,946.64	60,898.28	68,881.42	56,567.78	47,259.93	37,016.30
C. Abandonment of Managed Lands	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
D. CO ₂ Emissions and Removals from Soil	-4,223.54	-4,223.54	-4,223.54	-4,223.54	-4,223.54	-4,223.54	-4,223.54	-4,223.54	-4,223.54	-4,223.54	-4,223.54	-4,223.54
E. Other	1,548.77	1,597.69	1,507.17	1,480.49	1,409.04	1,491.09	1,439.84	1,518.75	1,507.67	1,427.52	1,222.69	1,247.73
6. Waste	15,285.90	15,285.90	15,804.24	16,140.52	16,083.95	15,700.50	15,882.27	16,125.72	15,961.15	16,465.66	16,709.99	17,075.34
A. Solid Waste Disposal on Land	13,623.32	13,937.81	14,099.77	14,419.29	14,344.40	13,922.98	14,084.77	14,302.69	14,116.30	14,598.63	14,820.66	15,160.68
B. Waste-water Handling	1,662.58	1,662.58	1,704.47	1,721.23	1,739.55	1,760.69	1,783.97	1,806.09	1,827.72	1,849.54	1,873.02	1,898.35
C. Waste Incineration	NE	NE	NE	NE	NE	16.83	13.53	16.94	17.13	17.49	16.30	16.30
D. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
7. Other (please specify)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total Emissions/Removals with LUCF	515,822.56	515,822.56	478,962.47	482,662.92	488,389.49	487,424.68	493,080.58	501,312.86	529,473.85	527,582.08	528,749.56	528,100.88
Total Emissions without LUCF	422,724.72	422,724.72	424,823.97	429,255.01	432,755.19	444,495.20	454,349.28	465,637.28	486,017.61	497,108.51	507,839.69	516,729.85
Memo Items:												
International Bankers	6,461.40	6,438.86	6,646.42	7,053.58	7,435.31	8,613.12	9,115.69	9,105.41	9,562.31	9,844.63	10,194.71	10,725.41
Aviation	4,385.62	4,385.62	4,840.41	5,247.80	5,403.82	5,912.32	6,370.59	6,561.81	7,300.53	7,336.08	7,399.42	8,227.70
Marine	2,075.79	2,075.79	1,806.01	1,805.78	2,031.49	2,700.80	2,745.10	2,543.60	2,261.79	2,508.55	2,795.29	2,497.71
Multilateral Operations	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
CO ₂ Emissions from Biomass	16,514.85	16,641.90	15,141.52	16,799.68	17,618.70	18,447.90	18,437.02	20,275.50	20,492.97	20,145.07	20,146.07	18,254.75

APPENDIX TABLE 1 ENERGY (INCLUDING TRANSPORT)

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APPENDIX TABLE 1—2001

Fuel combustion activities 1A-1 (sheet 1): Emissions from energy industries (all sources)

SOURCE CATEGORIES		ACTIVITY DATA	EMISSION ESTIMATES						
Fossil fuels		Energy use (PJ)	CO ₂ (Gg)	CH ₄ (Gg)	N ₂ O (Gg)	NO _x (Gg)	CO (Gg)	NM VOC (Gg)	
1A1	Energy Industries	2396.55	198168.52	9.08	2.03	648.49	65.96	8.24	
	Coal	1846.77	168223.53	1.40	1.90	450.54	25.69	3.12	
	Petroleum	135.46	9266.36	0.25	0.08	89.31	17.47	2.65	
	Gas	403.36	20678.63	5.15	0.04	95.62	19.56	1.70	
	Wood, wood waste	1.45	NA	0.00	0.01	0.38	0.02	0.00	
	Biogas	9.50	NA	2.28	0.00	12.64	3.23	0.76	
1A1a	Electricity and Heat Production	2092.93	180658.88	7.73	1.93	541.76	46.44	6.17	
	Black coal	1168.79	106099.32	1.03	0.96	356.72	13.17	1.98	
	Brown coal incl. briquettes	659.33	61047.26	0.35	0.92	88.47	10.68	1.12	
	Petroleum	26.41	1832.29	0.09	0.02	29.44	7.59	0.98	
	Gas	227.46	11680.01	3.98	0.02	54.10	11.74	1.32	
	Wood, wood waste	1.45	NA	0.00	0.01	0.38	0.02	0.00	
	Biogas	9.50	NA	2.28	0.00	12.64	3.23	0.76	
	Electricity generation	2092.93	180658.88	7.73	1.93	541.76	46.44	6.17	
	Black coal	1168.79	106099.32	1.03	0.96	356.72	13.17	1.98	
	Brown coal incl. briquettes	659.33	61047.26	0.35	0.92	88.47	10.68	1.12	
	Petroleum	26.41	1832.29	0.09	0.02	29.44	7.59	0.98	
	Gas	227.46	11680.01	3.98	0.02	54.10	11.74	1.32	
	Wood, wood waste	1.45	NA	0.00	0.01	0.38	0.02	0.00	
	Biogas	9.50	NA	2.28	0.00	12.64	3.23	0.76	

The CO₂ emissions from biomass fuels are reported in APPENDIX TABLE 1—2001 Fuel Combustion Activities 1-Memo items: Biomass Fuels. These emissions are not included in the subsector totals of the Common Reporting Format tables.

APPENDIX TABLE 1—2001

Fuel combustion activities 1A-1 (sheet 2): Emissions from energy industries (all sources)

SOURCE CATEGORIES		ACTIVITY DATA	EMISSION ESTIMATES					
		Energy use (PJ)	CO ₂ (Gg)	CH ₄ (Gg)	N ₂ O (Gg)	NO _x (Gg)	CO (Gg)	NMVOC (Gg)
Fossil fuels	1A1b Petroleum refining	103.75	6728.83	0.09	0.05	46.23	5.65	0.09
	Petroleum	84.82	5760.47	0.07	0.05	32.55	4.58	0.07
	Gas	18.93	968.36	0.02	0.00	13.68	1.07	0.02
1A1c Manufacture of Solid Fuels and Other Energy Industries		199.87	10780.81	1.26	0.05	60.50	13.88	1.98
	Coal	18.66	1076.95	0.02	0.01	5.35	1.83	0.02
	Petroleum	24.24	1673.61	0.09	0.01	27.31	5.30	1.60
	Gas	156.97	8030.26	1.15	0.02	27.83	6.74	0.36
Coke ovens		19.06	1097.64	0.02	0.02	5.70	1.85	0.02
	Coal	18.00	1020.19	0.02	0.01	5.17	1.77	0.02
	Petroleum	1.06	77.45	0.00	0.00	0.53	0.08	0.00
Briquetting		0.66	56.77	0.00	0.00	0.19	0.07	0.00
	Coal	0.66	56.77	0.00	0.00	0.19	0.07	0.00
	Coal mining	22.12	1526.29	0.08	0.01	25.71	4.88	1.54
	Petroleum	22.12	1526.29	0.08	0.01	25.71	4.88	1.54

APPENDIX TABLE 1—2001

Fuel combustion activities 1A-1 (sheet 3): Emissions from energy industries (all sources)

SOURCE CATEGORIES		ACTIVITY DATA	EMISSION ESTIMATES					
		Energy use (PJ)	CO ₂ (Gg)	CH ₄ (Gg)	N ₂ O (Gg)	NO _x (Gg)	CO (Gg)	NM VOC (Gg)
Fossil fuels								
1A1c	Manufacture of Solid Fuels and Other Energy Industries (cont.)							
	Oil and gas production and field processing	145.44	7455.91	1.06	0.02	26.53	6.50	0.39
	Petroleum	1.06	69.87	0.00	0.00	1.06	0.34	0.05
	Gas	144.39	7386.05	1.05	0.01	25.46	6.16	0.33
	Natural gas transmission	10.69	546.85	0.08	0.00	2.01	0.49	0.03
	Gas	10.69	546.85	0.08	0.00	2.01	0.49	0.03
	Gas production and distribution	1.90	97.37	0.02	0.00	0.36	0.09	0.00
	Gas	1.90	97.37	0.02	0.00	0.36	0.09	0.00

APPENDIX TABLE 1—2001

Fuel combustion activities 1A-2 (sheet 1): Emissions from manufacturing industries and construction (all sources)

SOURCE CATEGORIES		ACTIVITY DATA	EMISSION ESTIMATES						
Fossil fuels		Energy use (PJ)	CO ₂ (Gg)	CH ₄ (Gg)	N ₂ O (Gg)	NO _x (Gg)	CO (Gg)	NMVOC (Gg)	
1A2	Manufacturing Industries and Construction	798.72	42034.59	2.32	0.74	370.78	281.86	15.35	
	Coal	148.94	12026.01	0.18	0.10	49.73	12.75	0.66	
	Petroleum	180.84	12216.65	0.78	0.11	138.50	84.07	12.58	
	Gas	348.41	17791.93	0.38	0.03	172.67	14.48	0.40	
	Biomass	120.53	NA	0.98	0.49	9.88	170.55	1.71	
	a. Iron and Steel	55.79	2624.13	0.08	0.01	32.18	9.10	0.52	
	Coal	29.41	1262.37	0.03	0.01	8.65	1.23	0.03	
	Petroleum	1.31	78.79	0.03	0.00	0.59	6.15	0.47	
	Gas	25.08	1282.96	0.02	0.00	22.94	1.71	0.03	
	Wood, Wood Waste	NA	NA	NA	NA	NA	NA	NA	
	b. Non-Ferrous Metals	218.30	14153.13	0.32	0.10	96.45	17.35	0.61	
	Coal	59.53	5410.13	0.07	0.05	18.86	6.16	0.06	
	Petroleum	35.59	2559.40	0.10	0.03	14.66	4.36	0.40	
	Gas	120.88	6183.60	0.13	0.01	62.76	5.26	0.13	
	Wood, Wood Waste	2.30	NA	0.01	0.01	0.17	1.56	0.02	
	c. Chemicals	105.12	6061.66	0.19	0.03	49.41	24.59	1.55	
	Coal	8.34	798.99	0.01	0.01	3.16	0.77	0.01	
	Petroleum	33.70	2066.60	0.11	0.02	16.61	21.28	1.47	
	Gas	63.08	3196.06	0.07	0.01	29.64	2.54	0.07	
	d. Wood and Paper Product Manufacturing	55.85	2199.22	0.13	0.09	6.61	15.01	0.30	
	Coal	7.78	686.20	0.01	0.01	2.23	0.82	0.01	
	Petroleum	2.94	196.81	0.01	0.00	1.42	0.64	0.14	
	Gas	25.73	1316.21	0.03	0.00	1.50	0.35	0.03	
	Wood, Wood Waste	19.40	NA	0.08	0.08	1.46	13.19	0.13	

The CO₂ emissions from biomass fuels are reported in APPENDIX TABLE 1—2001 Fuel Combustion Activities 1-Memo items: Biomass Fuels. These emissions are not included in the subsector totals of the Common Reporting Format tables.

APPENDIX TABLE 1—2001

Fuel combustion activities 1A-2 (sheet 2): Emissions from manufacturing industries and construction (all sources)

SOURCE CATEGORIES		ACTIVITY DATA	EMISSION ESTIMATES						
		Energy use (PJ)	CO ₂ (Gg)	CH ₄ (Gg)	N ₂ O (Gg)	NO _x (Gg)	CO (Gg)	NMVOC (Gg)	
Fossil fuels									
	e. Food Processing, Beverages, and Tobacco	148.15	3225.83	0.95	0.42	14.31	157.45	1.71	
	Coal	14.75	1337.04	0.02	0.01	3.04	1.56	0.01	
	Petroleum	6.27	396.09	0.01	0.00	1.63	0.38	0.09	
	Gas	29.18	1492.70	0.03	0.00	1.44	0.32	0.05	
	Wood, Wood Waste	4.20	NA	0.02	0.02	0.32	2.86	0.03	
	Bagasse	93.75	NA	0.87	0.38	7.88	152.34	1.53	
	f. Other	215.50	13770.62	0.66	0.10	171.81	58.36	10.66	
	Coal	29.13	2531.28	0.03	0.02	13.78	2.21	0.54	
	Petroleum	101.03	6918.95	0.53	0.06	103.58	51.26	10.02	
	Gas	84.46	4320.39	0.09	0.01	54.39	4.29	0.10	
	Wood, Wood Waste	0.88	NA	0.00	0.00	0.07	0.60	0.01	
	Mining (non-energy)	60.52	4097.34	0.18	0.03	54.54	10.22	3.01	
	Coal	7.43	607.42	0.01	0.01	3.26	0.53	0.01	
	Petroleum	43.31	2989.78	0.16	0.03	50.43	9.56	2.99	
	Gas	9.78	500.14	0.01	0.00	0.84	0.14	0.01	
	Non-metallic mineral products	78.31	4802.99	0.12	0.03	61.06	14.74	0.84	
	Coal	20.65	1823.61	0.02	0.02	10.22	1.58	0.02	
	Petroleum	5.48	355.14	0.04	0.00	3.00	8.99	0.76	
	Gas	51.30	2624.24	0.05	0.01	47.78	3.58	0.06	
	Wood, Wood Waste	0.88	NA	0.00	0.00	0.07	0.60	0.01	
	All other manufacturing	25.96	1404.45	0.08	0.01	7.29	14.48	1.58	
	Coal	1.05	100.25	0.00	0.00	0.30	0.11	0.51	
	Petroleum	3.39	203.35	0.06	0.00	1.33	13.81	1.04	
	Gas	21.52	1100.85	0.02	0.00	5.66	0.56	0.03	
	Construction	50.71	3465.83	0.28	0.03	48.92	18.92	5.23	
	Petroleum	48.85	3370.68	0.28	0.03	48.81	18.90	5.23	
	Gas	1.86	95.15	0.00	0.00	0.11	0.02	0.00	

APPENDIX TABLE 1—2001

Fuel combustion activities 1A-2 (sheet 3): Emissions from manufacturing industries only (all sources)

SOURCE CATEGORIES		EMISSION ESTIMATES						
	ACTIVITY DATA							
	Energy use (PJ)	CO ₂ (Gg)	CH ₄ (Gg)	N ₂ O (Gg)	NO _x (Gg)	CO (Gg)	NM VOC (Gg)	
Fossil fuels								
Manufacturing ^a	687.49	34471.42	1.86	0.68	267.32	252.71	7.11	
Coal	141.50	11418.59	0.17	0.09	46.47	12.23	0.65	
Petroleum	88.68	5856.18	0.35	0.06	39.25	55.61	4.36	
Gas	336.77	17196.64	0.37	0.03	171.72	14.32	0.39	
Biomass	120.53	NA	0.98	0.49	9.88	170.55	1.71	

a. Includes all sub-categories other than Mining (non-energy) and Construction from the Manufacturing and Construction category.

APPENDIX TABLE 1—2001

Fuel combustion activities 1A-3 (sheet 1): Emissions from transport

SOURCE CATEGORY	ACTIVITY DATA	EMISSION ESTIMATES						
		CO ₂ (Gg)	CH ₄ (Gg)	N ₂ O (Gg)	NO _x (Gg)	CO (Gg)	NM VOC (Gg)	SO ₂ (Gg)
1A3 Transport								
1A3 a Civil Aviation								
i International Aviation (International Bunkers)								
Jet Kerosene	118.13	8151.32	0.03	0.24	43.61	13.40	6.70	1.54
ii Domestic								
Aviation Gasoline	79.50	5480.11	0.24	0.17	18.05	92.71	3.11	1.03
	3.49	235.17	0.20	0.00	0.27	79.65	1.79	0.05
Jet Kerosene	76.01	5244.95	0.04	0.17	17.78	13.07	1.32	0.99
1A3 b Road Transportation								
i Cars								
Automotive Gasoline	961.51	63329.27	27.26	13.79	378.41	2892.89	417.72	42.19
	585.38	37988.17	20.98	13.00	226.69	2340.86	153.26	10.64
	512.92	33513.99	19.76	12.86	199.37	2086.35	131.27	7.75
Passenger Cars with Catalysts ^a	149.26	9752.83	1.90	4.67	22.72	157.04	9.97	2.26
Passenger Cars with Catalysts ^b	298.35	19493.89	15.22	8.13	140.30	1385.60	79.89	4.51
Passenger Cars without Catalysts ^c	55.64	3635.71	2.11	0.05	30.87	441.89	33.03	0.84
Passenger Cars without Catalysts ^d	9.67	631.56	0.54	0.01	5.47	101.81	8.39	0.15
ADO	21.35	1472.93	0.05	0.05	4.79	5.02	2.46	2.48
LPG	50.45	2966.76	1.00	0.09	22.40	249.42	19.51	0.40
Natural Gas	0.67	34.49	0.18	0.00	0.13	0.07	0.01	0.00

a. Post-97 vehicles with three way catalysts

b. 1986–97 vehicles with mixture of two and three way catalysts

c. 1976–85 vehicles

d. Pre-76 vehicles

APPENDIX TABLE 1—2001

Fuel combustion activities 1A-3 (sheet 2): Emissions from transport

SOURCE CATEGORY		ACTIVITY DATA	EMISSION ESTIMATES							
			CO ₂ (Gg)	CH ₄ (Gg)	N ₂ O (Gg)	NO _x (Gg)	CO (Gg)	NMVOC (Gg)	SO ₂ (Gg)	
1A3 b Road Transportation (cont.)										
ii Light Trucks		144.08	9451.26	3.45	0.41	53.74	408.95	31.09		6.17
Automotive Gasoline		86.56	5655.74	2.97	0.23	34.50	313.94	19.75		1.31
ADO		40.60	2801.60	0.09	0.12	10.38	9.47	4.65		4.72
LPG		16.79	987.36	0.35	0.06	8.83	85.52	6.69		0.13
Natural Gas		0.13	6.56	0.03	0.00	0.02	0.01	0.00		0.00
iii Heavy Duty Trucks and Buses ^a		228.46	15654.83	2.56	0.38	97.61	108.73	19.76		25.34
Medium Duty Trucks		83.56	5737.91	1.14	0.18	45.34	53.32	9.04		9.14
Automotive Gasoline		4.60	300.69	0.01	0.00	1.38	5.95	0.57		0.07
ADO		77.91	5376.26	1.09	0.17	43.32	44.67	8.00		9.07
LPG		0.97	57.06	0.02	0.00	0.54	2.70	0.47		0.01
Natural Gas		0.08	3.90	0.01	0.00	0.09	0.02	0.00		0.00
Heavy Duty Trucks		118.08	8146.88	0.95	0.15	37.68	38.94	6.96		13.72
Automotive Gasoline		0.19	12.21	0.00	0.00	0.03	0.12	0.01		0.00
ADO		117.89	8134.67	0.95	0.15	37.66	38.83	6.95		13.72
LPG		0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00
Natural Gas		0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00
Buses		26.82	1770.03	0.47	0.05	14.59	16.46	3.76		2.47
Automotive Gasoline		0.98	64.27	0.02	0.00	0.64	7.99	0.57		0.01
ADO		21.02	1450.48	0.06	0.05	9.17	5.39	2.92		2.45
LPG		1.06	62.32	0.01	0.00	0.27	2.33	0.23		0.01
Natural Gas		3.75	192.96	0.38	0.00	4.50	0.75	0.04		0.00
iv Motorcycles		3.60	235.02	0.27	0.00	0.37	34.35	8.16		0.05
Automotive Gasoline		3.60	235.02	0.27	0.00	0.37	34.35	8.16		0.05

a. The category "Heavy Duty Trucks and Buses" includes medium duty trucks, heavy duty trucks and buses.

**APPENDIX TABLE 1—2001
Fuel combustion activities 1A-3 (sheet 3): Emissions from transport**

SOURCE CATEGORY	ACTIVITY DATA	EMISSION ESTIMATES						
		CO ₂ (Gg)	CH ₄ (Gg)	N ₂ O (Gg)	NO _x (Gg)	CO (Gg)	NMVO (Gg)	SO ₂ (Gg)
1A3 b Road Transportation (cont.)								
v Evaporative Emissions from Vehicles								
Automotive Gasoline	e	NA	NA	NA	NA	NA	205.44	NA
<i>Passenger Cars with Catalysts^a</i>	e	NA	NA	NA	NA	NA	205.44	NA
<i>Passenger Cars with Catalysts^b</i>	e	NA	NA	NA	NA	NA	49.00	NA
<i>Passenger Cars without Catalysts^c</i>	e	NA	NA	NA	NA	NA	97.10	NA
<i>Passenger Cars without Catalysts^d</i>	e	NA	NA	NA	NA	NA	24.21	NA
<i>Light Trucks</i>	e	NA	NA	NA	NA	NA	6.28	NA
<i>Medium Duty Trucks</i>	e	NA	NA	NA	NA	NA	25.70	NA
<i>Heavy Duty Trucks</i>	e	NA	NA	NA	NA	NA	1.37	NA
<i>Buses</i>	e	NA	NA	NA	NA	NA	0.03	NA
<i>Motorcycles</i>	e	NA	NA	NA	NA	NA	0.40	NA
		NA	NA	NA	NA	NA	1.35	NA
1A3 c Railways	26.43	1823.75	0.08	0.05	40.44	5.34	1.88	3.08
ADO	26.43	1823.75	0.08	0.05	40.44	5.34	1.88	3.08
IDF	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Coal	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

a. Post-97 vehicles with three way catalysts

b. 1986–97 vehicles with mixture of two and three way catalysts

c. 1976–85 vehicles

d. Pre-76 vehicles

e. Evaporative emissions are estimated with the same activity data as are used for estimating combustion emissions

APPENDIX TABLE 1—2001
Fuel combustion activities 1A-3 (sheet 4): Emissions from transport

SOURCE CATEGORY	ACTIVITY DATA	EMISSION ESTIMATES						
	Energy Use (PJ)	CO ₂ (Gg)	CH ₄ (Gg)	N ₂ O (Gg)	NO _x (Gg)	CO (Gg)	NMVOC (Gg)	SO ₂ (Gg)
1A3 d Navigation	55.68	4060.62	2.56	0.10	87.42	130.21	24.15	63.22
i International Marine (Bunkers)	34.20	2473.96	0.12	0.07	66.44	2.06	2.08	48.33
ADO	4.66	321.55	0.03	0.01	7.36	0.76	0.21	0.54
IDF	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Fuel Oil	29.54	2152.40	0.09	0.06	59.08	1.30	1.86	47.79
ii Navigation (Domestic)	21.48	1586.67	2.44	0.03	20.98	128.15	22.08	14.89
Automotive Gasoline (small craft)	6.21	405.94	2.24	0.01	1.58	126.12	20.13	0.09
ADO	2.49	171.82	0.01	0.00	2.75	0.61	0.19	0.29
IDF	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Fuel Oil	7.86	572.42	0.02	0.02	15.71	0.35	0.49	12.71
Natural Gas	0.05	2.57	0.01	0.00	0.01	0.00	0.00	0.00
Coal	4.87	433.92	0.16	0.00	0.93	1.07	1.27	1.80
1A3 e Other Transportation	0.62	40.59	0.02	0.00	0.23	4.35	0.67	0.01
i Off-road Vehicles	0.62	40.59	0.02	0.00	0.23	4.35	0.67	0.01
Automotive Gasoline	0.62	40.59	0.02	0.00	0.23	4.35	0.67	0.01

APPENDIX TABLE 1—2001

Fuel combustion activities 1A-3 (sheet 5): Emissions from transport—energy and vehicle use statistics

Fuel Consumption Estimates for a (Passenger) Automobile from Transport Energy and Vehicle Age Statistics						
			Age Category			
		Year	Post-97	86-97	76-85	Pre-76
Vehicle Age	Percent of Total VKT	Year	1	2	3	4
(years)						
0	4.90	2001	4.9	0	0	0
1	9.00	2000	9	0	0	0
2	8.24	1999	8.24	0	0	0
3	7.45	1998	7.45	0	0	0
4	6.66	1997	0	6.66	0	0
5	6.38	1996	0	6.38	0	0
6	6.09	1995	0	6.09	0	0
7	5.81	1994	0	5.81	0	0
8	5.52	1993	0	5.52	0	0
9	5.23	1992	0	5.23	0	0
10	4.83	1991	0	4.83	0	0
11	4.43	1990	0	4.43	0	0
12	4.02	1989	0	4.02	0	0
13	3.62	1988	0	3.62	0	0
14	3.21	1987	0	3.21	0	0
15	2.83	1986	0	2.83	0	0
16	2.45	1985	0	0	2.45	0
17	2.06	1984	0	0	2.06	0
18	1.68	1983	0	0	1.68	0
19	1.29	1982	0	0	1.29	0
20+	4.30	1972-1981	0	0	2.58	1.72
Proportion of total fleet kilometres			30%	59%	10%	2%
Fuel Consumption Rate (L/km)			0.114	0.115	0.125	0.127
Proportion of fuel consumption			29%	58%	11%	2%

APPENDIX TABLE 1—2001
Fuel combustion activities 1A-3 (sheet 6): Emissions from transport—proportion of fuel consumed by vehicle type

Proportion Of Fuel Consumed By Vehicle Type (Q _{ik}) (Based on data for 1997–98)				
Vehicle Type	Fuel Type			
	Automotive Gasoline (k=1)	ADO (k=2)	LPG (k=3)	NG (k=8)
Passenger Cars	0.842	0.077	0.728	0.145
Light Trucks	0.142	0.146	0.242	0.028
Medium Duty Trucks ^a	0.008	0.279	0.014	0.016
Heavy Duty Trucks	0.000	0.423	0.000	0.000
Buses	0.002	0.075	0.015	0.811
Motorcycles	0.006	0.000	0.000	0.000

Source: ATF 1998, Apelbaum Consulting Group, 2001

a. Medium Trucks is the sum of Other Truck Types and Rigid Trucks

APPENDIX TABLE 1—2001

Fuel combustion activities 1A-3 (sheet 7): Emissions from transport—fuel consumption rates by vehicle type

Fuel Consumption Rates By Vehicle Type (l/km) (R _{ik})		
(Based on data for 1997–98)		
Vehicle Type	Fuel Type	
	Automotive Gasoline	ADO LPG
Passenger Cars (i=1)	a	0.119
Light Trucks (i=2)	0.130	0.120
Medium Duty Trucks (i=3) ^b	0.249	0.283
Heavy Duty Trucks (i=4)	0.506	0.510
Buses (i=5)	0.175	0.291
Motorcycles (i=6)	0.059	NA

a. See AGE_DIST for passenger car fuel consumption split by vehicle age.

b. Medium Trucks is the sum of Other Truck Types and Rigid Trucks

**APPENDIX TABLE 1—2001
Fuel combustion activities 1A-3, 1A-4 b, 1A-5 b (sheet 8):
Emissions from transport—Energy and vehicle use statistics**

Sector	ABARE Energy (PJ) ^a	Energy (PJ) ^b	VKT (billions of km) ^c
Energy—fuel combustion activities			
All Transport	1104.96^d	1089.55^e	
Automotive Gasoline	621.27	615.68	
ADO	310.75	307.69	
LPG	69.27	69.27	
Aviation Gasoline	3.62	3.49	
Jet Kerosene	82.62	76.01	
IDF	0.00	0.00	
Fuel Oil	7.86	7.86	
Natural Gas	4.70	4.68	
Coal	4.87	4.87	
1A3 a ii Domestic Aviation			
Aviation Gasoline	3.62	3.49	
Jet Kerosene	82.62	76.01	
1A3 a i International Aviation			
Jet Kerosene	118.13	118.13	

a. Data from ABARE

b. Energy data derived for emissions estimates by following the methodology outlined in Workbook for Transport (Mobile Sources) Workbook 3.1 Revision 1 1996.

c. VKT data derived for emissions estimates by following the methodology outlined in Workbook for Transport (Mobile Sources) Workbook 3.1 Revision 1 1996.

d. All transport includes Transport (1A3), lawn mowers (1A4) and military vehicles (1A5). It does not contain energy data for international bunkers.

e. This value is for Transport (1A3) only. This value differs slightly from the ABARE value (footnote d) since lawn mowers (1A4) and military vehicles (1A5) are not included. Under the current methodology, the energy consumption from 1A4 and 1A5 are apportioned from the ABARE data.

APPENDIX TABLE 1—2001
Fuel combustion activities 1A-3, 1A-4 b, 1A-5 b (sheet 9):
Emissions from transport—Energy and vehicle use statistics

Sector	ABARE Energy (PJ)	Energy (PJ)	VKT (billions of km)
Energy—fuel combustion activities			
1A3 b Road Transportation	975.34	961.51	195.23
Automotive Gasoline	621.27	608.84	151.36
<i>Leaded</i>	101.01		
<i>Unleaded</i>	520.26		
ADO	280.17	278.77	28.16
LPG	69.27	69.27	15.72
Natural Gas	4.63	4.63	0.00
1A3 b i Cars			
Automotive Gasoline		512.92	129.38
<i>Passenger Cars with Catalysts^a</i>		149.26	38.28
<i>Passenger Cars with Catalysts^b</i>		298.35	75.86
<i>Passenger Cars without Catalysts^c</i>		55.64	13.02
<i>Passenger Cars without Catalysts^d</i>		9.67	2.23
ADO		21.35	4.65
LPG		50.45	11.55
Natural Gas		0.67	0.00
1A3 b ii Light Trucks			
Automotive Gasoline		86.56	19.47
ADO		40.60	8.77
LPG		16.79	3.96
Natural Gas		0.13	0.00

Notes: Only data relevant to estimating emissions under the current methodology are presented. See Workbook for Transport (Mobile Sources) Workbook 3.1 for further details.

See Table 1A-3 (sheet 8) for description of data in columns.

- a. Post-97 vehicles with three way catalysts
- b. 1986–97 vehicles with mixture of two and three way catalysts
- c. 1976–85 vehicles
- d. Pre-76 vehicles

APPENDIX TABLE 1—2001

**Fuel combustion activities 1A-3, 1A-4 b, 1A-5 b (sheet 10):
Emissions from transport—Energy and vehicle use statistics**

Sector	ABARE Energy (PJ)	Energy (PJ)	VKT (billions of km)
Energy—fuel combustion activities			
1A3 b iii Heavy Duty Trucks and Buses^a			
Medium Duty Trucks			
Automotive Gasoline		4.60	0.55
ADO		77.91	6.89
LPG		0.97	0.11
Natural Gas		0.08	
Heavy Duty Trucks			
Automotive Gasoline		0.19	0.01
ADO		117.89	5.99
LPG		0.00	0.00
Natural Gas		0.00	
Buses			
Automotive Gasoline		0.98	0.16
ADO		21.02	1.87
LPG		1.06	0.10
Natural Gas		3.75	
1A3 b iv Motorcycle			
Automotive Gasoline		3.60	1.78

Note: See Table 1A-3 (sheet 8) for description of data in columns.

a. Heavy Duty Trucks and Buses includes medium duty vehicles, heavy duty vehicles and buses

APPENDIX TABLE 1—2001

**Fuel Combustion activities 1A-3, 1A-4 b, 1A-5 b (sheet 11):
Emissions from transport—Energy and vehicle use statistics**

Sector	ABARE Energy (PJ)	Energy (PJ)	VKT (billions of km)
Energy—fuel combustion activities			
1A3 c Railways			
ADO	26.43	26.43	
IDF	0.00	0.00	
Coal	0.00	0.00	
1A3 d i International (Marine Bunkers)			
ADO	4.66	4.66	
IDF	0.00	0.00	
Fuel Oil	29.54	29.54	
1A3 d ii Navigation (domestic)			
Automotive Gasoline (small craft)		6.21	
ADO	4.15	2.49	
IDF	0.00	0.00	
Fuel Oil	7.86	7.86	
Natural Gas	0.05	0.05	
Coal	4.87	4.87	
1A3 e i Off-road Vehicles			
Automotive Gasoline		0.62	

APPENDIX TABLE 1—2001

Fuel combustion activities 1A-3, 1A-4 b, 1A-5 b (sheet 12): Emissions from transport—Energy and vehicle use statistics

Sector	ABARE Energy (PJ) ^a	Energy (PJ) ^b	VKT (billions of km) ^c
Energy—fuel combustion activities			
1A4 b Residential			
Lawn Mowers			
Automotive Gasoline		4.97	
1A5 b Mobile			
Military Transport-Land			
Automotive Gasoline		0.62	
ADO		1.40	
Military Transport-Water			
ADO		1.66	
Fuel Oil		0.00	
Military Transport-Aviation			
Aviation Gasoline		0.13	
Jet Kerosene		6.61	

Notes: Only data relevant to estimating emissions under the current methodology are presented. See Workbook for Transport (Mobile Sources) Workbook 3.1 for further details.
See Table 1A-3 (sheet 8) for description of data in columns.

APPENDIX TABLE 1—2001

Fuel combustion activities 1A-4 (sheet 1): Emissions from other sectors—Commercial/Institutional (all sources)

SOURCE CATEGORIES	ACTIVITY DATA	EMISSION ESTIMATES					
		CO ₂ (Gg)	CH ₄ (Gg)	N ₂ O (Gg)	NO _x (Gg)	CO (Gg)	NM VOC (Gg)
Fossil fuels	Energy use (PJ)						
1A4a Commercial/Institutional	70.06	3854.41	0.07	0.02	4.56	2.39	0.21
Coal	2.95	285.18	0.00	0.00	0.85	0.31	0.00
Petroleum	15.47	947.69	0.01	0.01	1.45	0.45	0.08
Gas	51.21	2621.55	0.06	0.01	2.24	1.43	0.12
Wood, Wood Waste	0.43	NA	0.00	0.00	0.03	0.20	0.00

APPENDIX TABLE 1—2001

Fuel combustion activities 1A-4 (sheet 2): Emissions from other sectors—Residential (all sources)

SOURCE CATEGORIES	ACTIVITY DATA	EMISSION ESTIMATES					
		CO ₂ (Gg)	CH ₄ (Gg)	N ₂ O (Gg)	NO _x (Gg)	CO (Gg)	NM VOC (Gg)
Fossil fuels	Energy use (PJ)						
1A4b Residential^a	222.18	7527.29	56.34	0.17	7.75	758.86	86.20
Coal	0.16	15.73	0.02	0.00	0.03	0.92	0.03
Petroleum	19.86	1245.03	1.96	0.01	1.15	64.81	17.18
Gas	122.38	6266.53	0.20	0.01	4.77	1.96	0.38
Wood, Wood Waste	79.78	NA	54.17	0.15	1.80	691.18	68.62

a. Includes emissions from lawnmowers

APPENDIX TABLE 1—2001

Fuel combustion activities 1A-4 (sheet 3): Emissions from other sectors—Residential (mobile equipment)

SOURCE CATEGORIES	ACTIVITY DATA	EMISSION ESTIMATES					
Fossil fuels	Energy use (PJ)	CO ₂ (Gg)	CH ₄ (Gg)	N ₂ O (Gg)	NO _x (Gg)	CO (Gg)	NM VOC (Gg)
1A4b Residential							
Lawnmowers							
Petroleum	4.97	324.75	1.89	0.00	0.43	64.61	17.15

APPENDIX TABLE 1—2001

Fuel combustion activities 1A-4 (sheet 4): Emissions from other sectors—Agriculture/Forestry/Fishing (all sources)

SOURCE CATEGORIES	ACTIVITY DATA	EMISSION ESTIMATES					
Fossil fuels	Energy use (PJ)	CO ₂ (Gg)	CH ₄ (Gg)	N ₂ O (Gg)	NO _x (Gg)	CO (Gg)	NM VOC (Gg)
1A4c Agriculture/Forestry/Fishing	61.08	4204.23	0.52	0.04	78.58	28.60	9.79
Petroleum	61.06	4203.21	0.52	0.04	78.58	28.60	9.79
Gas	0.02	1.02	0.00	0.00	0.00	0.00	0.00

APPENDIX TABLE 1—2001

Fuel combustion activities 1A-5 (sheet 1): Emissions from Other—combustion related

SOURCE CATEGORIES		EMISSION ESTIMATES						
	ACTIVITY DATA							
Fossil fuels	Energy use (PJ)	CO ₂ (Gg)	CH ₄ (Gg)	N ₂ O (Gg)	NO _x (Gg)	CO (Gg)	NM VOC (Gg)	
1A5a Other	8.64	636.47	NE	NE	NE	NE	NE	NE
Lubricants and greases (not allocated to sector)								
Petroleum ¹	8.64	636.47	NE	NE	NE	NE	NE	NE

¹ This figure includes an allowance for recycled lubricants which are subsequently burned as fuel oil.

APPENDIX TABLE 1—2001

Fuel combustion activities 1A-5 (sheet 2): Emissions from Other (mobile equipment)

SOURCE CATEGORIES	ACTIVITY DATA	EMISSION ESTIMATES (Gg)						
		CO ₂	CH ₄	N ₂ O	NO _x	CO	NM VOC	SO ₂
1A5 Other								
1A5 b Mobile	10.42	716.70	0.05	0.02	5.65	7.78	0.85	0.46
Military Transport—Land	2.02	137.26	0.03	0.00	1.46	3.47	0.59	0.17
Automotive Gasoline	0.62	40.59	0.02	0.00	0.26	2.63	0.42	0.01
ADO	1.40	96.66	0.01	0.00	1.20	0.84	0.17	0.16
Military Transport—Water	1.66	114.83	0.01	0.00	2.63	0.27	0.08	0.20
ADO	1.66	114.54	0.01	0.00	2.62	0.27	0.08	0.19
Fuel Oil	0.00	0.29	0.00	0.00	0.01	0.00	0.00	0.01
Military Transport—Aviation	6.74	464.61	0.01	0.01	1.56	4.04	0.18	0.09
Aviation Gasoline	0.13	8.53	0.01	0.00	0.01	2.89	0.06	0.00
Jet Kerosene	6.61	456.08	0.00	0.01	1.55	1.15	0.12	0.09

APPENDIX TABLE 1—2001

Fugitive emissions from solid fuels 1B-1: Coal mining

SOURCE AND SINK CATEGORIES		ACTIVITY DATA	EMISSION ESTIMATES	
		Production (Mt)	CO ₂ (Gg)	CH ₄ (Gg)
1B1	Solid fuels			
1B1a	Coal mining^a	312.13	NE	878.36
1B1ai	Underground mines	92.46	NE	584.86
	Underground activities	92.46	NE	553.65
	Post mining activities	40.46	NE	31.21
1B1aii	Surface mining	219.67	NE	293.49
	Surface activities	219.67	NE	293.49
	Post mining activities	219.67	NE	NE
1B1b	Solid fuel transformation^b	IE	NA	IE
1B1c	Other^c	NA	NA	NA

- Production tonnage shown here is less than total coal produced in Australia, because it excludes production from mines which are estimated to have zero emissions.
- Emissions from solid fuel transformation processes in Australia are reported under Industrial Process emissions, Iron and Steel.
- This includes emissions from abandoned mines, and from burning coal seams and waste piles. However, no methodologies are currently provided by the Revised 1996 IPCC Guidelines or the Good Practice Report

APPENDIX TABLE 1—2001

Fugitive emissions from fuels 1B-2 (sheet 1): Oil and natural gas

SOURCE AND SINK CATEGORIES		ACTIVITY DATA	EMISSION ESTIMATES						
		Fuel quantity (PJ)	CO ₂	CH ₄	N ₂ O	NO _x	CO	NM VOC	
1B2a Oil		NA	400.66	5.24	0.01	0.13	1.29	104.09	
i	Exploration (for both oil and gas) ^a	NA	169.85	2.08	0.01	0.00	0.56	0.90	
ii	Crude oil production	1432.10	NA	0.9	NA	NA	NA	8.75	
iii	Crude oil transport: domestic	306.00	NA	0.2	NA	NA	NA	1.29	
iv	Crude oil refining and storage ^b	1676.55	230.81	2.07	0.01	0.13	0.73	34.56	
v	Petroleum product distribution	1124.65	NA	NA	NA	NA	NA	58.60	
vi	Other ^c	NA	NA	NA	NA	NA	NA	NA	
1B2b Natural Gas		NA	9.86	173.71	NA	NA	NA	31.67	
i	Production and processing	1385.03	NE	1.49	NA	NA	NA	0.39	
ii	Transmission	756.00	0.47	8.11	NA	NA	NA	1.75	
ii	Distribution	418.67	9.39	164.10	NA	NA	NA	29.52	
iii	Other ^d	NE	NE	NE	NE	NE	NE	NE	
1B2c Venting and Flaring^e		2817.13	6513.24	145.46	0.08	1.51	8.78	86.37	
	Venting at gas processing plant	1385.03	3666.63	110.15	NA	NA	NA	71.24	
	Flaring	2817.13	2846.61	35.31	0.08	1.51	8.78	15.13	
	Not included in totals	NA	NA	1.42	NA	NA	NA	8.02	
	Crude oil transport: exports	889.62	NA	0.66	NA	NA	NA	3.74	
	Crude oil transport: imports	1019.47	NA	0.76	NA	NA	NA	4.28	

- The emission estimates for this source cannot be related to the number of wells drilled.
- Includes flaring at oil refineries. Note that N₂O is reported under Flaring/oil in Table 1.B.2
- All emissions are accounted in the preceding sub-categories.
- This category comprises only emissions on the customer's side of the meter.
- Activity data for venting and flaring is total oil and gas production.

APPENDIX TABLE 1—2001

Fugitive emissions from fuels 1B-2 (sheet 2): Distribution of petroleum products

SOURCE AND SINK CATEGORIES	ACTIVITY DATA	EMISSION ESTIMATES
1B2a v Petroleum product distribution	Consumption (PJ)	NM VOC (Gg)
Petrol	621.33	57.05
Diesel	499.96	1.28
Avgas	3.36	0.27

APPENDIX TABLE 1—2001

Fuel combustion activities 1-Memo Items: Biomass Fuels

SOURCE CATEGORIES		ACTIVITY DATA	EMISSION ESTIMATES
Biomass fuels		Energy use (PJ)	CO ₂ (Gg)
1A	Fuel Combustion Activities	211.69	18254.75
	Wood, wood waste	108.44	8875.28
	Bagasse	93.75	8893.50
	Biogas	9.50	485.97
1A1a	Electricity and Heat Production	10.95	619.55
	Wood, wood waste	1.45	133.57
	Biogas	9.50	485.97
1A2	Manufacturing Industries and Construction	120.53	11360.47
	Wood, wood waste	26.78	2466.97
	Bagasse	93.75	8893.50
	a. Iron and Steel	NA	NA
	Wood, wood waste	NA	NA
	b. Non-Ferrous Metals	2.30	211.88
	Wood, wood waste	2.30	211.88
	d. Wood and Paper Product Manufacturing	19.40	1787.13
	Wood, wood waste	19.40	1787.13
	e. Food Processing, Beverages, and Tobacco	97.95	9280.40
	Wood, wood waste	4.20	386.90
	Bagasse	93.75	8893.50
	f. Other—Non-metallic Mineral Products	0.88	81.07
	Wood, wood waste	0.88	81.07
1A4a	Commercial/Institutional	0.43	39.53
	Wood, wood waste	0.43	39.53
1A4b	Residential	79.78	6235.20
	Wood, wood waste	79.78	6235.20

Note: These emissions are reported, but not included in subsector totals in COMMON REPORTING FORMAT TABLES.

STANDARD DATA TABLE 1—2001

Energy 1A: Fuel combustion activities—IPCC reference approach (part 1)

MODULE: ENERGY										
SUBMODULE: CO ₂ FROM ENERGY SOURCES										
WORKSHEET: 1-1										
Fuel types		A Production (PJ)	B Imports (PJ)	C Exports (PJ)	D International bunkers (PJ)	E Stock change (PJ)	F=(A+B-C-D-E) Apparent consumption (PJ)	G CO ₂ emission factor (Gg/PJ)	H Fraction of carbon oxidised	I=(F×G×H) Actual CO ₂ emission (Gg)
Liquid Fossil	Crude Oil and Condensate	1432.1	1019.5	889.6	0.0	-121.6	1683.6	68.2	0.99	113673.1
	LPG	107.5	16.8	71.6	0.0	7.4	45.3	59.4	0.99	2664.0
	Automotive Gasoline	0.0	40.7	45.6	0.0	-1.7	-3.2	66.0	0.99	-210.4
	Aviation Gasoline	0.0	0.0	0.9	0.0	0.0	-0.9	68.0	0.99	-60.8
	Aviation Turbine Fuel	0.0	14.3	27.8	118.1	1.3	-132.9	69.7	0.99	-9172.6
	Kerosine	0.0	0.0	0.4	0.0	0.2	-0.6	69.7	0.99	-40.9
	Heating Oil	0.0	0.0	0.0	0.0	0.0	0.0	69.7	0.99	-0.3
	Diesel Fuel	0.0	43.6	49.0	4.7	-16.9	6.8	69.7	0.99	472.0
	Fuel Oil	0.0	33.2	28.9	29.5	-20.4	-4.8	73.6	0.99	-348.5
	Lubes	0.0	1.3	10.8	0.0	-0.2	-9.3	73.7	1.00	-683.3
	Bitumen	0.0	1.5	0.1	0.0	-0.2	1.5	80.7	1.00	124.6
	Other Products	0.0	16.6	5.6	0.0	3.5	7.461	68.2	0.99	503.8
	Petroleum Coke	0.0	10.4	0.0	0.0	0.0	10.4	80.7	1.00	841.7
	Petroleum Products not Oxidised									
Liquid Fossil Totals		1539.6	1197.8	1130.2	152.3	-148.6	1520.2			-6206.5
Solid Fossil	Black Coal	6878.5	0.0	5517.6	0.0	-51.0	1411.9	90.6	1.00	127851.9
	Brown Coal	664.7	0.0	0.0	0.0	0.0	664.7	92.6	1.00	61544.5
	Coal by-products	N/A	0.0	0.0	0.0	0.0	0.0	81.0	0.99	0.0
	Coke	N/A	0.0	0.5	0.0	6.8	-7.3	119.5	0.99	-863.6
	Briquettes	N/A	0.0	0.0	0.0	-1.5	1.5	105.0	0.99	153.8
	Coal Products not Oxidised						-84.1			-9710.4
	Solid Fossil Totals	7543.2	0.0	5518.1	0.0	-45.7	1986.7			178976.2
Gaseous Fossil	Natural Gas	1386.9	0.0	409.6	0.0	0.0	977.3	51.5	0.995	50106.8
	Natural Gas not oxidised						-46.5			-2480.5
Gaseous Fossil Totals		1386.9	0.0	409.6	0.0	0.0	930.8	NA	NA	47626.3
Total Biomass ^a										

a. Australia does not collect statistics of national biomass consumption except by summing consumption estimates made using the detailed technology or 'bottom up' approach. Estimates can be found in the detailed technology inventory

STANDARD DATA TABLE 1—2001

Energy 1A: Fuel combustion activities—IPCC reference approach (part 2)

MODULE: ENERGY SUBMODULE: CO₂ FROM ENERGY SOURCES WORKSHEET: 1-1 EMISSIONS FROM INTERNATIONAL BUNKERS (INTERNATIONAL MARINE AND AIR TRANSPORT)						
Fuel types	A Quantities Delivered (Ml)	B Conversion Factor (MJ/l)	C=(AxB) Quantities Delivered (PJ)	D CO ₂ Emission Factor (Gg/PJ)	E Fraction of Carbon Oxidised	F=(DxE) Actual CO ₂ Emission (Gg)
Liquid Fossil						
	Aviation Turbine Fuel	3209.2	118.1	69.7	0.99	8149.3
	Marine Diesel Fuel	118.7	4.7	69.7	0.99	324.3
	Fuel Oil	723.0	29.5	73.6	0.99	2149.5
Total			152.3			10623.1

STANDARD DATA TABLE 1—2001

Energy 1A: Fuel combustion activities—IPCC reference approach (part 3)

MODULE: ENERGY						
SUBMODULE: CO ₂ FROM ENERGY						
WORKSHEET: AUXILIARY WORKSHEET 1-1						
ESTIMATING CARBON STORED IN PRODUCTS OR REPORTED ELSEWHERE						
Fuel types	Estimated Fuel Quantities (PJ)	Fraction of Carbon Stored	Quantity not Oxidised (PJ)	Quantity Reported Elsewhere (PJ)	CO ₂ Emission Factor (Gg/PJ)	CO ₂ "Not Emitted in this Sector" (Gg)
Coal by-products as feedstock	4.9	0.75	3.7	0.0	81.0	298
Coke used in reduction of iron ore			0.0	80.4	117.1	9412
Petroleum products as feedstock			17.0	0.0	NA	1152
Refinery Flaring ^a			0.0	4.9	68.6	335
Petroleum Coke for anodes ^b			0.0	10.4	80.7	842
Solvents ^c	9.7	0.75	7.3	2.4	66.0	640
Lubricants	21.6	0.6	13.0	0.0	73.3	950
Bitumen	28.4	1.0	28.4	0.0	80.7	2289
Ethane as feedstock			14.3	0.0	NA	830
Natural gas used in reduction of iron ore			0.0	21.5	51.1	1100
Natural Gas leakage ^a			0.0	10.7	51.4	551

- Emissions from these sources are accounted in the Fugitive Fuels Inventory.
- Emissions from this source are accounted in the Industrial Processes Inventory.
- Solvents which are not oxidised are accounted in the Industrial Processes Inventory; solvents which are oxidised are accounted for in the Wastes Inventory.

STANDARD DATA TABLE 1—2001

Energy 1A: Fuel combustion activities—IPCC reference approach (part 4)

RECONCILIATION					
Fuel types		IPCC reference		Detailed technology	
		Energy (PJ)	CO ₂ (Gg)	Energy (PJ)	CO ₂ (Gg)
Coal		1986.7	178976.2	2003.7	180984.4
Petroleum		1520.2	101555.8	1514.3	100818.1
Natural gas		930.8	47626.3	930.1	47600.1
Total energy combustion		4437.7	328158.3	4448.1	329402.6

APPENDIX TABLE 2 INDUSTRIAL PROCESSES

2A. MINERAL PRODUCTS	PAGE
Tables 2A-2 Production of Lime	B-112
Tables 2A-3 Limestone and Dolomite Use	B-113
2D. OTHER PRODUCTION	
Tables 2D-2 Food and Drink	B-114

APPENDIX TABLE 2—2001

Mineral products 2A-2

Module		Industrial Processes		
Submodule		Production of Lime		
Worksheet		2-2		
Sheet		1 of 1 CO ₂ Emissions		
Lime Type	A Quantity of Lime Produced (kt)	B Emission Factor (t CO ₂ /t quicklime or dolomitic lime produced)	C CO ₂ Emitted (t) C = (A x B)	D CO ₂ Emitted (Gg) D = (C/10 ³)
Quicklime	1489.22	0.682	1015224.58	1015.22
Dolomitic Lime*	NA	NA	NA	NA
Total (Gg):				1015.22

*There is no commercial dolomitic lime production in Australia. In-house dolomitic lime produced and used jointly with dolomite is included with dolomite.

APPENDIX TABLE 2—2001

Mineral products 2A-3

Module	Industrial Processes			
Submodule	Limestone and Dolomite Use			
Worksheet	2-3			
Sheet	1 of 1 CO ₂ Emissions			
Material Type	A	B	C	D
	Quantity of Limestone or Dolomite Used (kt)	Emission Factor (t CO ₂ /t limestone or dolomite used)	CO ₂ Emitted (t) C = (A x B)	CO ₂ Emitted (Gg) D = C/10 ³
Limestone	1315.62	0.396	520984.73	520.98
Dolomite	519.40	0.453	235364.75	235.36
Total (Gg):				756.35

APPENDIX TABLE 2—2001

Other production 2D-2

Module	Industrial Processes			
Submodule	Food and Drink			
Worksheet	2-13			
Sheet	1 of 2 Alcoholic Beverage Production – NMVOC Emissions			
STEP 1				
Alcoholic Beverage Type	A Quantity of Alcoholic Beverage Produced (hl)	B Emission Factor (kg NMVOC/hl beverage produced)	C NMVOC Emitted (kg) C = (A x B)	D NMVOC Emitted (Gg) D = C/10 ⁶
Beer	17460000	0.035	611100	0.611
Red wine	3053500	0.08	244280	0.244
White wine	3497600	0.035	122416	0.122
Total (Gg):				0.978

Module	Industrial Processes			
Submodule	Food and Drink			
Worksheet	2-13			
Sheet	2 of 2 Bread and Other Food Production – NMVOC Emissions			
STEP 2				
Food Production Type	A Quantity of Food Produced (kt)	B Emission Factor (kg NMVOC/t food produced)	C NMVOC Emitted (t) C = (A x B)	D NMVOC Emitted (Gg) D = C/10 ³
Bread	1060	1.66	1759.6	1.76
Sugar	4162	10	41620	41.62
Meat and Poultry	3819	0.3	1145.7	1.15
Total (Gg):				44.53

APPENDIX TABLE 3 AGRICULTURE

4A. ENTERIC FERMENTATION	PAGE
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APPENDIX TABLE 3—2001

Enteric fermentation 4A-1 (sheet 1): Number of beef cattle

State	Region	Bulls >1	Bulls <1	Steers <1	Cows 1 to 2	Cows >2	Cows <1	Steers >1
NSW/ACT		99843	37792	837886	671809	2183304	746837	1219636
Tas		8381	3279	65143	45077	155808	56472	92300
WA	South West	18518	7728	194951	110974	385685	151366	178864
	Pilbara	7932	1849	59522	62449	168795	50719	71109
	Kimberley	13859	3082	45259	66053	218561	44044	140045
SA		21357	6554	163149	126383	389185	148345	195285
Vic		44541	15069	390406	272237	866116	349446	496882
Qld		193172	47964	1238984	1400835	3903502	1176260	3126848
NT		40122	20050	180774	306771	673751	183141	302310

Source: Australian Bureau of Statistics

APPENDIX TABLE 3—2001

Enteric fermentation 4A-1 (sheet 2): Number of dairy cattle

State	Milking Cows	Heifers >1	Heifers <1	House Cows	Dairy Bulls >1	Dairy Bulls <1
NSW/ACT	267776	91043	63870	0	4302	1453
Tas	147709	30102	29340	0	1810	839
WA	71623	29906	23626	0	978	307
SA	123608	37569	27947	0	1890	542
Vic	1377496	292725	274802	0	19172	6557
Qld	186363	57083	41125	0	2855	850
NT	0	0	0	0	0	0

Source: Australian Bureau of Statistics

Enteric fermentation 4A-1 (sheet 3): Average milk production

State	Milking Cows (kg/head/year)
NSW/ACT	4682
Tas	3685
WA	5467
SA	5293
Vic	4696
Qld	4065
NT	4065

Source: Australian Dairy Corporation

APPENDIX TABLE 3—2001

Enteric fermentation 4A-1 (sheet 4): Number of feedlot cattle

State	Feedlot Cattle Class/Average Time on Feed	Annual Turnoff	Annual Equivalent Numbers	
			Numbers Accounting for Time on Feed	Total
NSW	domestic/75 days	462271	94987	
	export/140 days	38229	14663	
	japan ox/ 250 days	201871	138268	247918
Tas	domestic/75 days	0	0	
	export/140 days	0	0	
	japan ox/ 250 days	0	0	0
WA	domestic/75 days	48445	9955	
	export/140 days	4006	1537	
	japan ox/ 250 days	21156	14490	25981
SA	domestic/75 days	65944	13550	
	export/140 days	5453	2092	
	japan ox/ 250 days	28797	19724	35366
Vic	domestic/75 days	79826	16403	
	export/140 days	6601	2532	
	japan ox/ 250 days	34860	23876	42811
Qld	domestic/75 days	613765	126116	
	export/140 days	50757	19468	
	japan ox/ 250 days	268027	183580	329165
NT	domestic/75 days	0	0	
	export/140 days	0	0	
	japan ox/ 250 days	0	0	0

Source: Australian Lotfeeders Association

APPENDIX TABLE 3—2001

Enteric fermentation 4A-3 (sheet 1): Number of sheep

State	Sheep > 1				Sheep <1	
	Rams	Wethers	Maiden Ewes (intended for breeding)	Breeding Ewes	Other Ewes	Lambs and Hoggets
NSW/ACT	349972	9309372	3564134	15954418	1112731	10706828
Tas	32004	944511	281899	1196781	157274	671778
WA	169150	4262219	2163309	9832564	772349	5929808
SA	96523	2042033	1050498	5464537	215717	3715380
Vic	181434	5648358	1763419	8639719	561125	5477821
Qld	101524	3307098	707052	2806813	269869	1467714
NT	0	0	0	0	0	0

Source: Australian Bureau of Statistics

Enteric fermentation 4A-3 (sheet 2): Average greasy wool production and clean wool yield

State	Greasy Wool Production Sheep >1 (kg/head/year)	Greasy Wool Production Sheep <1 (kg/head/year)	Clean Wool Yield (%)
NSW/ACT	4.53	1.86	66.90
Tas	3.70	1.13	70.70
WA	4.23	1.56	62.80
SA	5.01	1.81	62.90
Vic	4.28	1.46	67.40
Qld	4.56	2.12	64.40
NT	0.00	0.00	0.00

Sources: Australian Bureau of Statistics and Wool International. Note that the partitioning between sheep and lambs for wool production is made on past years data as is clean wool yield.

APPENDIX TABLE 3—2001

Enteric fermentation 4A-8 (sheet 1): Number of pigs

State	Boars	Breeding Sows	Gilts—Intended for Breeding	Other Pigs (suckers/weaners, growers and finishers)
NSW/ACT	5218	92026	10101	737656
Tas	199	2587	662	18655
WA	2026	34076	4183	246027
SA	0	2629	49071	6645
Vic	2986	55247	8848	490266
Qld	3439	59782	8913	524674
NT	33	306	52	1964

Source: Australian Bureau of Statistics

APPENDIX TABLE 3—2001

Enteric fermentation 4A-10 (sheet 1): Number of livestock excluding cattle, sheep and pigs

State	Goats	Horses	Deer	Buffalo	Donkeys/ Mules	Emus/ Ostriches	Alpacas	Camels	Poultry
NSW/ACT	191903	69685	47242	0	0	85434	2108	0	36240339
Tas	2583	3229	6423	0	0	2009	186	0	297324
WA	48409	13889	9045	0	0	35918	0	591	7930918
SA	16096	9398	21717	0	0	9122	2013	0	9786816
Vic	17566	32410	32036	0	0	45292	0	10	24717652
Qld	110218	86014	15477	0	193	26565	0	0	13645897
NT	0	9373	0	7327	6	0	0	2305	230847

Source: Australian Bureau of Statistics

APPENDIX TABLE 3—2001

Rice cultivation 4C-1 (sheet 1): Areas under cultivation in New South Wales

Nominated Year Y_m	Year	Summer Crop A_{jkl} (ha)	Winter Crop A_{jkl} (ha)	Total Crop Area A_{jkl} (ha)
Y_{m-1}	2000	131846	0	131846
Y_m	2001	184230	0	184230
Y_{m+1}	2002	147268	0	147268
ave Y_m	2001	154448	0	154448

Rice cultivation 4C-1 (sheet 2): Areas under cultivation in Victoria

Nominated Year Y_m	Year	Summer Crop A_{jkl} (ha)	Winter Crop A_{jkl} (ha)	Total Crop Area A_{jkl} (ha)
Y_{m-1}	2000	NE	0	0
Y_m	2001	1840	0	1840
Y_{m+1}	2002	1600	0	1600
ave Y_m	2001	1720	0	1720

Rice cultivation 4C-1 (sheet 3): Areas under cultivation in Western Australia

Nominated Year Y_m	Year	Summer Crop A_{jkl} (ha)	Winter Crop A_{jkl} (ha)	Total Crop Area A_{jkl} (ha)
Y_{m-1}	2000	0	0	0
Y_m	2001	5	0	5
Y_{m+1}	2002	0	0	0
ave Y_m	2001	2	0	2

Rice cultivation 4C-1 (sheet 4): Areas under cultivation in Queensland

Nominated Year Y_m	Year	Summer Crop A_{jkl} (ha)	Winter Crop A_{jkl} (ha)	Total Crop Area A_{jkl} (ha)
Y_{m-1}	2000	0	0	0
Y_m	2001	0	0	0
Y_{m+1}	2002	0	0	0
ave Y_m	2001	0	0	0

Rice cultivation 4C-1 (sheet 5): Areas under cultivation in Northern Territory

Nominated Year Y_m	Year	Summer Crop A_{jkl} (ha)	Winter Crop A_{jkl} (ha)	Total Crop Area A_{jkl} (ha)
Y_{m-1}	2000	0	0	0
Y_m	2001	0	0	0
Y_{m+1}	2002	0	0	0
ave Y_m	2001	0	0	0

Rice cultivation 4C-1 (sheet 6): CH₄ emissions

State i	Area A_{jkl} (ha)	Emission Factor E_{ijk} (kg CH ₄ /ha)	CH ₄ Emission Total _{ijkl} (Gg CH ₄)
NSW	154448	225.00	34.75
VIC	1720	225.00	0.39
WA	2	225.00	0.00
QLD	0	225.00	0.00
NT	0	225.00	0.00
Total	156170	225.00	35.14

APPENDIX TABLE 3—2001

Agricultural soils 4D-1 (sheet 1): Areas of agricultural lands

Nominated Year	Year	Crops A_{jkl} (ha)	Improved Pasture A_{jkl} (ha)
Y_m			
Y_{m-1}	2000	23768612	24782905
Y_m	2001	24519962	26666928
Y_{m+1}	2002	NE	NE
ave Y_m	2001	24144287	25724917

Agricultural soils 4D-1 (sheet 2): N₂O emissions due to soil disturbance

System	Area A_{jkl} (ha)	Emission Factor ($E_{pijkl} - E_{nijkl}$) (kg N/ha/year)	Conversion Factor C_i	N ₂ O Emissions Total _{ijkl} (Gg N ₂ O/year)
Crop	24144287	0.29	1.57	11.00
Pasture	25724917	0.29	1.57	11.72
Total	49869203			22.73

Agricultural soils 4D-1 (sheet 3): N₂O emissions due to fertilizer use

Nominated Year	Year	Total N Fertilizer Applied M_{jkl} (Gg N)	Emission Factor E_{ijk} (%)	Conversion Factor C_i	N ₂ O Emissions Total _{ijkl} (Gg N ₂ O/year)
Y_m					
Y_{m-1}	2000	1003	1.25	1.57	19.7
Y_m	2001	1065	1.25	1.57	20.9
Y_{m+1}	2002	971	1.25	1.57	19.1
ave Y_m	2001	1013			19.90

APPENDIX TABLE 3—2001

Agricultural soils 4D-2 (sheet 1): N₂O emissions due to animal urine

Animals k	Waste Deposited M _{jkl} (Gg N)	Emission Factor E _{ijk} (%)	Conversion Factor C _i	N ₂ O Emission Total _{ijkl} (Gg N ₂ O)
Cattle				
beef	628.7	0.4	1.57	4.0
dairy	339.1	0.4	1.57	2.1
feedlot	NA	0.4	1.57	NA
Sheep	603.6	0.4	1.57	3.8
Pigs	NA	0.4	1.57	NA
Poultry	NA	0.4	1.57	NA
Other	10.4	0.4	1.57	0.1
Total	1581.8			9.94

Agricultural soils 4D-2 (sheet 2): N₂O emissions due to animal faeces

Animals k	Waste Deposited M _{jkl} (Gg N)	Emission Factor E _{ijk} (%)	Conversion Factor C _i	N ₂ O Emission Total _{ijkl} (Gg N ₂ O)
Cattle				
beef	303.1	0.50	1.57	2.4
dairy	72.8	0.50	1.57	0.6
feedlot	NA	0.50	1.57	NA
Sheep	202.6	0.50	1.57	1.6
Pigs	NA	0.50	1.57	NA
Poultry	1.8	0.50	1.57	0.0
Other	4.2	0.50	1.57	0.0
Total	584.6			4.6

APPENDIX TABLE 3—2001

Agricultural soils 4D-2 (sheet 3): N₂O emissions due to manure application

Animals k	Waste deposited M _{ijkl} (Gg N)	Emission factor E _{ijk} (%)	Conversion factor C _i	N ₂ O emission Total _{ijkl} (Gg N ₂ O)
Cattle				
beef	NA	1.80	1.57	NA
dairy	30.0	1.80	1.57	0.8
feedlot	58.2	1.80	1.57	1.6
Sheep	NA	1.80	1.57	NA
Pigs	31.7	1.80	1.57	0.9
Poultry	58.7	1.80	1.57	1.7
Other	NA	1.80	1.57	NA
Total	178.6			5.1

Agricultural soils 4D-2 (sheet 4): Annual N₂O emissions from agricultural (cultivated) soils

Process	Emission (Gg N ₂ O)
Soil disturbance	22.73
Fertiliser application	20.00
Animal waste	19.59
Total	62.31

APPENDIX TABLE 3—2001

Prescribed burning of savanna and temperate grassland 4E (sheet 1): Area of land burnt

Nominated Y_m	Year	State							
		NSW	Tas	WA	SA	Vic	Qld	NT	ACT
		A_{jkl} (ha)							
Y_{m-8}	1993	21772	4343	7790000	7557	11500	6300000	8750000	0
Y_{m-7}	1994	382398	7574	14990000	207875	17900	6300000	18700000	0
Y_{m-6}	1995	89112	28134	14790000	88338	17502	6300000	22900000	0
Y_{m-5}	1996	90480	18662	19382000	3707	7564	7500000	25000000	0
Y_{m-4}	1997	131068	2585	13658703	191670	15131	3802000	17773000	0
Y_{m-3}	1998	NE	5017	22248007	26000	7965	4619892	20123786	0
Y_{m-2}	1999	16380	1428	6249527	24600	18979	4937760	18494009	0
Y_{m-1}	2000	5528	7425	23016105	441168	8958	11028530	27210118	0
Y_m	2001	NE	9198	41712369	18680	32925	4094655	35735514	0
Y_{m+1}	2002	NE	7623	20628180	13036	21912	3537424	45611920	0
ave Y_m	2001	105248	9199	18446489	102263	16034	5842026	24029835	0

APPENDIX TABLE 3—2001

Prescribed burning of savanna and temperate grassland 4E (sheet 2): Biomass burnt

State I	Area Burnt A_{jkl} (ha)	Fuel Load F_{jkl} (Mg/ha)	Burning efficiency Z_{jk}	Mass of Fuel Burnt M_{jkl} (Gg)
NSW	105248	6.9	0.72	523
Tas	9199	9.0	0.72	60
WA	18446489	7.7	0.72	102267
SA	102263	3.0	0.72	221
Vic	16034	11.7	0.72	135
Qld	5842026	3.0	0.72	12619
NT	24029835	5.8	0.72	100349
ACT	0	11.1	0.72	0
Total	48551094			216173

APPENDIX TABLE 3—2001

Prescribed burning of savanna and temperate grassland 4E (sheet 3)

Gas i	CH₄	N₂O	NO_x	CO	NM VOC
Mass of fuel burnt (M _f Gg)	216173	216173	216173	216173	216173
Carbon mass fraction (CC _j)	0.46	0.46	0.46	0.46	0.46
Elemental N:C ratio (NC _j)		0.02	0.02		
Emission factor (E _{ij})	0.0035	0.0076	0.21	0.078	0.0091
Elemental to molecular mass conversion factor (C _i)	1.33	1.57	3.29	2.33	1.17
Emission Total_{ij} (Gg)	464.05	23.75	1372.27	18098.02	1055.72

APPENDIX TABLE 3—2001

Field burning of agricultural residues 4F-1 (sheet 1): Crop production of wheat

Nominated Year	Year	Production P_{jkl} (Gg/year)	Residue to Crop Ratio R_{jk}	Fraction of Residue Remaining at Time of Burning S_{jk}	Dry Matter Content DM_{jk}	Burning Efficiency Z_{jk}	Fraction Burnt F_{jk}	Mass of Residue M_{jkl} (Gg)
Y_m								
Y_{m-1}	2000	24757	1.50	0.5	0.9	0.96	0.23	3690
Y_m	2001	22108	1.50	0.5	0.9	0.96	0.23	3295
Y_{m+1}	2002	NE	1.50	0.5	0.9	0.96	0.23	NA
ave Y_m	2001	23433						3492

APPENDIX TABLE 3—2001

Field burning of agricultural residues 4F-1 (sheet 2): Emissions from on-site agricultural waste burning from wheat

Gas _i	CH ₄	N ₂ O	NO _x	CO	NM VOC
Mass of fuel burnt (M _f Gg)	3492	3492	3492	3492	3492
Carbon mass fraction (CC _i)	0.40	0.40	0.40	0.40	0.40
Elemental N:C ratio (NC _i)		0.008	0.008		
Emission factor (E _{ij})	0.0035	0.0076	0.2100	0.0780	0.0091
Elemental to molecular mass conversion factor (C _i)	1.33	1.57	3.29	2.33	1.17
Emission Total_{ij} (Gg)	6.52	0.13	7.71	254.25	14.83

APPENDIX TABLE 3—2001

Field burning of agricultural residues 4F-1 (sheet 3): Crop production of cereals

Crop	Year	Y _m		Production P _{jd} (Gg/yr)	Residue to Crop Ratio R _{jk}	Fraction of Residue Remaining at Time of Burning S _{jk}	Dry Matter Content DM _{jk}	Burning Efficiency Z _{jk}	Fraction Burnt F _{jk}	Mass of Residue M _{jd} (Gg)	Emissions (Gg)						
		2000	2001	2002							C emitted	N emitted	CH ₄	N ₂ O	NO _x	CO	NM VOC
Wheat	2001	24757	22108	NE	1.50	0.5	0.9	0.96	0.23	3492	1396.97	11.18	6.52	0.13	7.71	254.25	14.83
Barley	2001	5032	6743	NE	1.50	0.5	0.8	0.96	0.23	780	312.00	2.50	1.46	0.03	1.72	56.78	3.31
Maize	2001	406	345	NE	1.50	1.0	0.8	0.96	0.30	130	54.50	0.97	0.25	0.01	0.67	9.92	0.58
Oats	2001	1118	1050	NE	1.50	0.5	0.8	0.96	0.23	144	57.43	0.46	0.27	0.01	0.32	10.45	0.61
Rye	2001	NE	NE	NE	1.50	0.5	0.8	0.96	0.23	NE	NE	NE	NE	NE	NE	NE	NE
Rice	2001	1084	1643	NE	1.31	1.0	0.8	0.96	0.82	1118	469.50	7.27	2.19	0.09	5.01	85.45	4.98
Millet	2001	57	27	NE	1.50	0.5	0.8	0.96	0.23	6	2.22	0.02	0.01	0.00	0.01	0.40	0.02
Sorghum	2001	2116	1935	NE	1.50	0.5	0.8	0.96	0.23	268	107.34	0.86	0.50	0.01	0.59	19.54	1.14
Triticale	2001	764	841	NE	1.50	0.5	0.8	0.96	0.23	106	42.53	0.34	0.20	0.00	0.23	7.74	0.45
Total										6044			11.40	0.28	16.28	444.53	25.93

APPENDIX TABLE 3—2001

Field burning of agricultural residues 4F-4 (sheet 1): Crop production of sugar cane

Nominated Year	Year	Production P_{jkl} (Gg/yr)	Residue to Crop Ratio R_{jk}	Fraction of Residue Remaining at Time of Burning S_{jk}	Dry Matter Content DM_{jk}	Burning Efficiency Z_{jk}	Fraction Burnt F_{jk}	Mass of Residue M_{jkl} (Gg)
Y_m								
Y_{m-1}	2000	39865	0.25	1.0	0.20	0.96	0.39	744.4
Y_m	2001	28388	0.25	1.0	0.20	0.96	0.43	590.8
Y_{m+1}	2002	32482	0.25	1.0	0.20	0.96	0.40	624.8
ave Y_m	2001	33578	0.25	1.0	0.20	0.96	0.41	653.3

APPENDIX TABLE 3—2001

Field burning of agricultural residues 4F-4 (sheet 2)
Emissions from on-site agricultural waste burning from sugar cane

Gas _i	CH ₄	N ₂ O	NO _x	CO	NMVOC
Mass of fuel burnt (M _f Gg)	653	653	653	653	653
Carbon mass fraction (CC _i)	0.40	0.40	0.40	0.40	0.40
Elemental N:C ratio (NC _i)		0.025	0.025		
Emission factor (E _{ij})	0.0035	0.0076	0.2100	0.0780	0.0091
Elemental to molecular mass conversion factor (C _i)	1.33	1.57	3.29	2.33	1.17
Emission Total_{ij} (Gg)	1.22	0.08	4.51	47.56	2.77

APPENDIX TABLE 4 LAND USE CHANGE AND FORESTRY

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APPENDIX TABLE 4—2001

Changes in forest and other woody biomass stocks 5A

Module Land Use Change and Forestry					
Submodule Changes in Forest and Other Woody Biomass Stocks					
WORKSHEET 5-1					
SHEET 1 of 3					
STEP 1					
	A	B	C	D	E
	Area of Forest/ Biomass Stocks (kha)	Annual Growth Rate (t dm/ha)	Annual Biomass Increment (kt dm)	Carbon Fraction of Dry Matter	Total Carbon Uptake Increment (kt C)
State Forests and Other Tenure			$C=(A \times B)$		$E=(C \times D)$
Forest Type					
Rainforests	1333	1.15	1536	0.5	768
Tall Dense Eucalypt	3235	4.81	15546	0.5	7773
Medium Dense	6705	1.90	12716	0.5	6358
Medium Sparse	2029	0.35	716	0.5	358
Callitris	295	0.51	150	0.5	75
Coniferous Plantation	980	7.10	6956	0.5	3478
Broadleaf Plantation	570	8.65	4932	0.5	2466
Other Forests	1289	0.47	606	0.5	303
				Total	21579
				CO ₂ -e	79122

APPENDIX TABLE 4—2001

Changes in forest and other woody biomass stocks 5A

Module		Land Use Change and Forestry							
Submodule		Changes in Forest and Other Woody Biomass Stocks							
WORKSHEET 5-1									
SHEET 2 of 3									
		STEP 2							
Harvest Categories (specify)		F	G	H	I	J	K	L	M
		Commercial Harvest (if applicable) (1000 m ³ roundwood)	Biomass Conversion/ Expansion Ratio (if applicable) (t dm/m ³)	Total Biomass Removed in Commercial Harvest in Inventory Year ^a (kt dm)	Total Traditional Fuelwood Consumed (kt dm)	Total Other Wood Use (kt dm)	Total Biomass Consumpt. (kt dm)	Wood Removed from Forest Clearing (kt dm)	Total Biomass Consumpt. from Stocks (kt dm)
				H=(F×G)			K=(H+I+J)		M=K-L
Hardwood		11 334	1.19	13 442		NE			
Softwood		12 874	0.82	10 502		NE			
Total		24 208		23 943	6 976		30 920	127	30 792

a. The Australian methodology applies different decay times to different woodproducts.

APPENDIX TABLE 4—2001

Changes in forest and other woody biomass stocks 5A

Module Land Use Change and Forestry			
Submodule Changes in Forest and Other Woody Biomass Stocks			
WORKSHEET 5-1			
SHEET 3 of 3			
STEP 3		STEP 4	
N	O	P	Q
Carbon Fraction	Annual Carbon Release (kt C)	Net Annual Carbon Uptake (+) or Release (-) (kt C)	Convert to CO ₂ Annual Emission (-) or Removal (+) (Gg CO ₂)
	O=(MxN)	P=(E-O)	Q=(Px[44/12])
0.5	15396	6183	22669
CO ₂ -e	56 453		

APPENDIX TABLE 4—2001

Forest and grassland conversion 5B (sheet 1): Rates of forest conversion and reclearing (hectares)

Year	National		NSW		NT		QLD		SA		TAS		VIC		WA	
	Conversion	Reclearing	Conversion	Reclearing	Conversion	Reclearing	Conversion	Reclearing	Conversion	Reclearing	Conversion	Reclearing	Conversion	Reclearing	Conversion	Reclearing
1990	374004	160142	41454	15989	4479	2487	241626	92498	14914	4788	9842	1949	11351	6486	50260	35932
1991	261199	154027	38637	19287	4362	2581	168307	96865	8850	3780	5983	1255	8119	5603	26839	24634
1992	247762	159880	26345	16844	3113	1823	178193	110120	7684	4140	4955	1130	8104	6636	19283	19150
1993	277582	200531	26588	21471	2004	1207	212612	144001	6132	5240	5049	1119	6784	7345	18362	20087
1994	262274	184334	25035	19975	2040	1161	198995	130423	6166	5131	5095	1138	6551	7104	18339	19338
1995	203082	155123	17939	15337	3716	2220	151715	103455	4367	4031	4815	998	4862	6294	15622	22741
1996	202868	153714	17615	15013	4805	2950	151619	101729	4102	3976	4383	810	4822	6187	15479	23007
1997	197178	150185	17451	15014	4321	2649	146704	98766	4077	3898	4361	803	4802	6137	15421	22875
1998	185199	149260	14093	15982	2774	1653	143613	100936	4384	4574	3647	708	4171	7806	12493	17581
1999	176207	146456	13919	15987	2534	1500	136058	98446	4398	4723	2914	611	4110	7923	12262	17257
2000	120096	126531	11167	13051	1198	712	88729	82569	3597	4401	893	282	3043	6660	11485	18833
2001	120303	127430	10991	12909	1162	705	88450	82072	3798	4745	896	282	2912	6698	12076	19996

APPENDIX TABLE 4—2001

Forest and grassland conversion 5B (sheet 2): CO₂-equivalent emissions by vegetation type, 1990 and 2001

Major Vegetation Group	1990 (Gg CO ₂ -e)	2001 (Gg CO ₂ -e)
Rainforest and Vine Thickets	3602	781
Eucalyptus Tall Open Forest	2721	1333
Eucalyptus Open Forest	25581	7898
Eucalyptus Low Open Forest	735	305
Eucalyptus Woodland	32104	9576
Acacia Forest and Woodland	23790	5787
Callitris Forest and Woodland	1142	239
Casuarina Forest and Woodland	953	215
Melaleuca Forest and Woodland	1438	158
Other Forests and Woodlands	418	141
Eucalyptus Open Woodland	8915	3407
Tropical Eucalyptus Woodland/Grassland	986	218
Acacia Open Woodland	1252	352
Mallee Woodland and Shrubland	5800	-672
Low Closed Forest and Closed Shrubland	541	145
Acacia Shrubland	1046	508
Other Shrublands	236	124
Heath	945	649
Other	2590	728

APPENDIX TABLE 4—2001

CO₂ Emissions and removals from soils 5D

Module	Land Use Change and Forestry		
Submodule	Pasture Improvement and Minimum Tillage		
WORKSHEET	5-4		
SHEET	1 of 1 CO ₂ Uptake from Pasture Improvement and Minimum Tillage		
A	B	C	D
Average Increase in Area of Minimum Tillage over 25 Years (kha/y)	Average Increase in Area of Pasture Over 25 Years Other than Associated with Forest and Grassland Conversion (kha/y)	Increase in Soil Carbon in Inventory Year (kt C/y)	Net Influx (Gg CO ₂ /y)
		$C = A \times 50 \times 0.15 + B \times (62.5 - 50) \times 0.25$	$D = C \times 44/12$
129	59	1 152	4 224
		CO ₂ -e	4 224

APPENDIX TABLE 4—2001

Other 5E (sheet 1): Total forest fuel burnt as a result of prescribed burning

State	Area burnt A _{jkl} (ha)	Fuel load F _{ljk} (Mg/ha)	Burning efficiency Z _{jk}	Mass of fuel burnt M _{jkl} (Gg)
NSW	139305	18.2	0.42	1065
Tas	14095	20.0	0.42	118
WA	242088	12.0	0.42	1220
SA	76	9.6	0.42	0
Vic	95623	17.9	0.42	719
Qld	93582	9.7	0.42	381
NT	0	4.1	0.42	0
ACT	191	17.6	0.42	1
Total	584961			3505

APPENDIX TABLE 4—2001

Other 5E (sheet 2): Emissions from prescribed burning

Gas i	CH ₄	N ₂ O	NO _x	CO	NMVOC
Mass of fuel burnt (M _f Gg)	3 505	3 505	3 505	3 505	3 505
Carbon mass fraction (CC _f)	0.46	0.46	0.46	0.46	0.46
Elemental N:C ratio (NC _f)		0.011	0.011		
Emission factor (E _{ij})	0.0054	0.0077	0.15	0.091	0.022
Elemental to molecular mass conversion factor (C _i)	1.33	1.57	3.29	2.33	1.17
Emission Total_{ij} (Gg)	11.61	0.21	8.74	342.37	41.39

APPENDIX TABLE 4—2001

Other 5E (sheet 3): Total forest fuel burnt as a result of wildfires

State i	Area burnt A _{jkl} (ha)	Fuel load F _{ljk} (Mg/ha)	Burning efficiency Z _{jk}	Mass of fuel burnt M _{jkl} (Gg)
NSW	140164	36.4	0.72	3673
Tas	27440	40.0	0.72	790
WA	201369	33.4	0.72	4843
SA	18	19.2	0.72	0
Vic	30639	35.8	0.72	790
Qld	34813	19.4	0.72	486
NT	0	7.2	0.72	0
ACT	231	35.2	0.72	6
Total	434675			10588

APPENDIX TABLE 4—2001

Other 5E (sheet 4): Emissions from wildfires

Gas i	CH₄	N₂O	NO_x	CO	NMVOC
Mass of fuel burnt (M _j Gg)	10588	10588	10588	10588	10588
Carbon mass fraction (CC _j)	0.46	0.46	0.46	0.46	0.46
Elemental N:C ratio (NC _j)		0.011	0.011		
Emission factor (E _{ij})	0.0054	0.0077	0.15	0.091	0.022
Elemental to molecular mass conversion factor (C _i)	1.33	1.57	3.29	2.33	1.17
Emission Total_{ij} (Gg)	35.07	0.65	26.41	1034.20	125.01

APPENDIX TABLE 5 WASTE

6A. SOLID WASTE DISPOSAL ON LAND	PAGE
6B. WASTEWATER HANDLING	B-148
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Solid waste disposal on land 6A

1. The Worksheet has been modified to accord with the Australian Methodology.

APPENDIX TABLE 5—2001

Wastewater handling 6B

Module	Waste				
Submodule	Indirect Nitrous Oxide Emissions from Human Sewage				
WORKSHEET	6-4				
SHEET	1 of 1				
	A	B	C	D	E
	Per Capita Protein Consumption (protein in kg/person/yr)	Population (millions)	Fraction of Nitrogen in Protein Frac_{NPR} (kg N/kg protein)	Emission Factor EF_6 (kg N_2O -N/kg sewage-N produced)	Total Annual N_2O Emissions (Gg N_2O /yr)
					$E = (A \times B \times C \times D) \times 44/28 \times 10^{-6}$
Total	36.281	19.485	0.16	0.01	1.777

APPENDIX TABLE 6 SUMMARY 1A 1990–2000

	PAGE
1A Summary Report for National Greenhouse Gas Inventories—1990	B-152
1A Summary Report for National Greenhouse Gas Inventories—1991	B-155
1A Summary Report for National Greenhouse Gas Inventories—1992	B-158
1A Summary Report for National Greenhouse Gas Inventories—1993	B-161
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APPENDIX 6—2001

1990 Summary 1.A Summary report for National Greenhouse Gas Inventories (IPCC Table 7A)
(Sheet 1 of 3)

Australia
1990
Submission 2003

GREENHOUSE GAS SOURCE AND SINK CATEGORIES		CO ₂ emissions	CO ₂ removals	CH ₄	N ₂ O	HFCs			PFCs			SF ₆		NO _x	CO	NMVOC	SO ₂		
						CO ₂ equivalent (Gg)						(Gg)						(Gg)	
						P			A			P	A					P	A
						P	A		P	A		P	A					P	A
Total National Emissions and Removals		363,230.98	0.00	5,804.78	77.08	NE	1,126.27	NE	3,938.28	NE	0.0000	NE	0.0000	2,288.76	22,272.00	2,417.48	1,596.36		
1. Energy		258,622.51		1,197.86	7.95									1,339.85	5,390.99	876.28	636.82		
A. Fuel Combustion	Reference Approach	0.00																	
	Sectoral Approach	252,659.80		113.77	7.84									1,337.71	5,378.56	718.69	636.82		
1. Energy Industries		141,805.68		1.90	1.41									458.14	41.40	6.61	435.70		
2. Manufacturing Industries and Construction		37,384.55		1.55	0.68									289.33	231.54	10.42	124.60		
3. Transport		59,726.89		26.25	5.49									512.97	4,137.06	573.01	66.73		
4. Other Sectors		12,485.74		84.03	0.24									73.18	961.27	127.93	9.44		
5. Other		1,256.94		0.05	0.01									4.09	7.29	0.72	0.35		
B. Fugitive Emissions from Fuels		5,962.71		1,084.09	0.12									2.14	12.43	157.59	NE		
1. Solid Fuels		NE		753.16	NE									NE	NE	NE	NA		
2. Oil and Natural Gas		5,962.71		330.93	0.12									2.14	12.43	157.59	NE		
2. Industrial Processes ⁽¹⁾		19,238.10		2.85	0.09	NE	1,126.27	NE	3,938.28	NE	0.00	48.651	8.877	54.744	959.54	959.54	959.54		
A. Mineral Products		4,763.45		NA	NA							NE	NE	NE	15.044	NE	NE		
B. Chemical Industry		NE		NE	0.00	NA	NA	NA	NA	NA	NA	NE	NE	NE	NE	NE	NE		
C. Metal Production		14,474.64		2.85	0.09							3,938.28	8.88	0.11	39.592	39.592	39.592		
D. Other Production		NE										NE	NE	NE	NE	NE	NE		
E. Production of Halocarbons and SF ₆							1,126.27		NO	NO	NO								
F. Consumption of Halocarbons and SF ₆						NE	NE	NE	NE	NE	NE								
G. Other		NA		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA		

P = Potential emissions based on Tier 1 approach of the IPCC Guidelines.

A = Actual emissions based on Tier 2 approach of the IPCC Guidelines.

(1) Excludes confidential Soda Ash Production and Use, Ammonia Production and Nitric Acid Production emissions representing 1732.0 Gg CO₂-e

APPENDIX 6—2001

1990 Summary 1.A Summary report for National Greenhouse Gas Inventories (IPCC Table 7A)
(Sheet 2 of 3)

Australia
1990
Submission 2003

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	CO ₂ emissions	CO ₂ removals	CH ₄	N ₂ O	CO ₂ equivalent (Gg)						(Gg)					
					HFCs			PFCs			SF ₆		NO _x	CO	NMVOC	SO ₂
					P	A		P	A		P	A				
3. Solvent and Other Product Use	NA			NE							NA	NA	152.95		NA	NA
4. Agriculture	NA	NA	3,578.97	64.25							791.77	10,569.39	616.55		NA	NA
A. Enteric Fermentation			3,212.78													
B. Manure Management			71.82	1.70										NA		
C. Rice Cultivation			23.36											NA		
D. Agricultural Soils	NA	NA	NE	48.84										NA		
E. Prescribed Burning of Savannas			262.24	13.42							775.48	10227.36	596.60			
F. Field Burning of Agricultural Residues			8.77	0.28							16.29	342.03	19.95			
G. Other			NA	NA							NA	NA	NA	NA	NA	NA
5. Land-Use Change and Forestry	85,370.4	0.00	320.18	3.24							108.50	6,302.75	714.06		NA	NA
A. Changes in Forest and Other Woody Biomass Stocks	0.00	-24,598.42														
B. Forest and Grassland Conversion	114192.33	0.00	262.24	2.17							64.87	4,594.06	507.52			
C. Abandonment of Managed Lands	NA	0.00														
D. CO ₂ Emissions and Removals from Soil	0.00	-4,223.54														
E. Other	0.00	0.00	57.94	1.07							43.63	1,708.69	206.54		NA	NA
6. Waste	0.00		704.92	1.56							NE	NE	2.90		NE	NE
A. Solid Waste Disposal on Land	NE		648.73								NE	NE	2.61			
B. Wastewater Handling			56.19	1.56							NE	NE	0.29			
C. Waste Incineration	0.00		NA	NA							NE	NE	NE		NE	NE
D. Other	NA		NA	NA							NA	NA	NA		NA	NA
7. Other (please specify)		NA	NA	NA		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

APPENDIX 6—2001

1990 Summary 1.A Summary report for National Greenhouse Gas Inventories (IPCC Table 7A)
(Sheet 3 of 3)

Australia
1990
Submission 2003

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	CO ₂ emissions	CO ₂ removals	CH ₄	N ₂ O	CO ₂ equivalent (Gg)										(Gg)				NMVOC	SO ₂
					HFCs		PFCs		SF ₆		NO _x	CO								
					P	A	P	A	P	A										
Memo Items: ⁽⁷⁾																				
International Bunkers	6,400.97		0.13	0.19									77.95	9.12	5.26	38.83				
Aviation	4,345.12		0.02	0.13									23.27	7.20	3.56	0.82				
Marine	2,055.85		0.11	0.06									54.68	1.92	1.70	38.01				
Multilateral Operations	NE		NE	NE									NE	NE	NE	NE				
CO ₂ Emissions from Biomass	15,112.99																			

⁽⁷⁾ Memo Items are not included in the national totals.

APPENDIX 6—2001

1991 Summary 1.A Summary report for National Greenhouse Gas Inventories (IPCC Table 7A)
(Sheet 1 of 3)

Australia
1991
Submission 2003

GREENHOUSE GAS SOURCE AND SINK CATEGORIES		CO ₂ emissions	CO ₂ removals	CH ₄	N ₂ O	HFCs			PFCs			SF ₆			NO _x	CO	NMVOC	SO ₂
						P	A		P	A		P	A					
							CO ₂ equivalent (Gg)			CO ₂ equivalent (Gg)								
							(Gg)											
Total National Emissions and Removals		341,284.72	0.00	5,773.86	78.27	NE	1,126.27	NE	3,941.47	NE	0.00000	2,255.48	21,355.22	2,307.68	1,638.33			
1. Energy		260,716.76		1,173.98	8.85							1,320.41	5,117.59	842.89	634.63			
A. Fuel Combustion	Reference Approach	0.00																
	Sectoral Approach	254,971.64		115.33	8.75													
1. Energy Industries		145,296.14		1.92	1.47													
2. Manufacturing Industries and Construction		36,829.60		1.52	0.66													
3. Transport		59,076.56		25.74	6.35													
4. Other Sectors		12,558.60		86.11	0.25													
5. Other		1,210.75		0.04	0.01													
B. Fugitive Emissions from Fuels		5,745.12		1,058.65	0.11													
1. Solid Fuels		NE		760.91	NE													
2. Oil and Natural Gas		5,745.12		297.75	0.11													
2. Industrial Processes ⁽¹⁾		18,882.92		2.63	0.09	NE	1,126.27	NE	3,941.47	NE	0.00	48,386	8,828	51,466	1,003.70			
A. Mineral Products		4,477.14		NA	NA	NA	NA	NA	NA	NA	NA	NE	NE	14,530	NE			
B. Chemical Industry		NE		NE	0.00	NA	NA	NA	NA	NA	NA	NE	NE	NE	NE			
C. Metal Production		14,405.78		2.63	0.09				3,941.47		0.00	48,39	8.83	0.11	1,003.70			
D. Other Production		NE										NE	NE	36,829	NE			
E. Production of Halocarbons and SF ₆							1,126.27		NO		NO							
F. Consumption of Halocarbons and SF ₆						NE	NE	NE	NE	NE	NE							
G. Other		NA		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA		

P = Potential emissions based on Tier 1 approach of the IPCC Guidelines.

A = Actual emissions based on Tier 2 approach of the IPCC Guidelines.

(1) Excludes confidential Soda Ash Production and Use, Ammonia Production and Nitric Acid Production emissions representing 1593.44 Gg CO₂-e

APPENDIX 6—2001

1991 Summary 1.A Summary report for National Greenhouse Gas Inventories (IPCC Table 7A)
(Sheet 2 of 3)

Australia
1991
Submission 2003

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	CO ₂ emissions	CO ₂ removals	CH ₄	N ₂ O	CO ₂ equivalent (Gg)						(Gg)						NO _x	CO	NMVOC	SO ₂
					HFCs ⁽¹⁾			PFCs ⁽¹⁾			SF ₆									
					P	A		P	A		P	A								
3. Solvent and Other Product Use	NA			NE										NA	NA	145.85	NA			
4. Agriculture	NA	NA	3,589.60	64.77										785.46	10,484.82	611.61	NA			
A. Enteric Fermentation			3,224.01																	
B. Manure Management			71.81	1.88												NA				
C. Rice Cultivation			24.94													NA				
D. Agricultural Soils	NA	NA	NE	49.29												NA				
E. Prescribed Burning of Savannas			260.34	13.33										769.87	10153.35	592.28				
F. Field Burning of Agricultural Residues			8.50	0.27										15.59	331.47	19.34				
G. Other			NA	NA										NA	NA	NA	NA			
5. Land-Use Change and Forestry	61,685.0	0.00	287.03	2.98										101.22	5,743.98	652.89	NA			
A. Changes in Forest and Other Woody Biomass Stocks	0.00	-24,084.18																		
B. Forest and Grassland Conversion	89992.76	0.00	227.26	1.88										56.22	3,981.31	439.82				
C. Abandonment of Managed Lands	NA	0.00																		
D. CO ₂ Emissions and Removals from Soil	0.00	-4,223.54																		
E. Other	0.00	0.00	59.77	1.10										45.01	1,762.66	213.07	NA			
6. Waste	0.00		720.62	1.58										NE	NE	2.96	NE			
A. Solid Waste Disposal on Land	NE		663.71												NE	2.67				
B. Wastewater Handling			56.91	1.58										NE	NE	0.29				
C. Waste Incineration	0.00		NA	NA										NE	NE	NE	NE			
D. Other	NA		NA	NA										NA	NA	NA	NA			
7. Other (please specify)		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA			
NA		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA			

APPENDIX 6—2001

1991 Summary 1.A Summary report for National Greenhouse Gas Inventories (IPCC Table 7A)
(Sheet 3 of 3)

Australia
1991
Submission 2003

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	CO ₂ emissions	CO ₂ removals	CH ₄	N ₂ O	CO ₂ equivalent (Gg)										(Gg)			
					HFCs		PFCs		SF ₆		NO _x	CO	NMVOC	SO ₂				
					P	A	P	A	P	A								
Memo Items: ⁽⁷⁾																		
International Bunkers	6,378.80		0.11	0.19								73.83	9.16	5.25	36.01			
Aviation	4,520.39		0.02	0.13								24.21	7.50	3.70	0.85			
Marine	1,858.42		0.09	0.05								49.62	1.66	1.55	35.16			
Multilateral Operations	NE		NE	NE								NE	NE	NE	NE	NE	NE	
CO ₂ Emissions from Biomass	14,965.58																	

⁽⁷⁾ Memo Items are not included in the national totals.

APPENDIX 6—2001

1992 Summary 1.A Summary report for National Greenhouse Gas Inventories (IPCC Table 7A)
(Sheet 1 of 3)

Australia
1992
Submission 2003

GREENHOUSE GAS SOURCE AND SINK CATEGORIES		CO ₂ emissions	CO ₂ removals	CH ₄	N ₂ O	HFCs			PFCs			SF ₆			NO _x	CO	NMVOC	SO ₂
						P	A	CO ₂ equivalent (Gg)	P	A	CO ₂ equivalent (Gg)	P	A	CO ₂ equivalent (Gg)				
Total National Emissions and Removals		327,936.46	0.00	5,720.90	78.01	NE	1,053.94	NE	3,935.10	NE	0.0000	NE	0.0000	2,215.78	20,049.79	2,171.16	1,744.81	
1. Energy		265,401.81		1,225.86	9.65									1,327.47	4,999.89	827.25	628.96	
A. Fuel Combustion	Reference Approach	0.00																
	Sectoral Approach	259,560.87		117.87	9.55									1,325.44	4,988.32	673.35	628.96	
1. Energy Industries		148,512.17		2.01	1.50									479.24	42.47	6.75	445.88	
2. Manufacturing Industries and Construction		36,707.28		1.47	0.60									285.03	205.67	10.35	113.51	
3. Transport		60,194.18		26.02	7.18									482.49	3,726.60	522.26	60.16	
4. Other Sectors		12,894.80		88.32	0.25									74.65	1,006.92	133.27	9.08	
5. Other		1,252.43		0.04	0.01									4.03	6.65	0.71	0.33	
B. Fugitive Emissions from Fuels		5,840.95		1,108.00	0.11									2.03	11.57	153.90	NE	
1. Solid Fuels		NE		791.41	NE									NE	NE	NE	NE	
2. Oil and Natural Gas		5,840.95		316.59	0.11									2.03	11.57	153.90	NE	
2. Industrial Processes ⁽¹⁾		16,642.72		2.89	0.07	NE	1,053.94	NE	3,935.10	NE	0.00	NE	0.00	40.471	7.384	47.102	1,115.85	
A. Mineral Products		4,299.14		NE	NA		NA		NA	NA		NA	NA	NE	NE	13.829	NE	
B. Chemical Industry		NE		NE	0.00	NA	NA	NA	NA	NA		NA	NA	NE	NE	NE	NE	
C. Metal Production		12,343.58		2.89	0.07					3,935.10			0.00	40.47	7.38	0.09	1,115.85	
D. Other Production		NE												NE	NE	33.182	NE	
E. Production of Halocarbons and SF ₆							1,053.94			NO	NO							
F. Consumption of Halocarbons and SF ₆						NE	NE	NE	NE	NE	NE	NE	NE					
G. Other		NA		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

P = Potential emissions based on Tier 1 approach of the IPCC Guidelines.

A = Actual emissions based on Tier 2 approach of the IPCC Guidelines.

(1) Excludes confidential Soda Ash Production and Use, Ammonia Production and Nitric Acid Production emissions representing 1715.43 Gg CO₂-e

APPENDIX 6—2001

1992 Summary 1.A Summary report for National Greenhouse Gas Inventories (IPCC Table 7A)
(Sheet 2 of 3)

Australia
1992
Submission 2003

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	CO ₂ emissions	CO ₂ removals	CH ₄	N ₂ O	CO ₂ equivalent (Gg)						(Gg)						
					HFCs			PFCs			SF ₆			NO _x	CO	NMVOC	SO ₂
					P	A		P	A		P	A					
3. Solvent and Other Product Use	NA			NE							NA	NA	143.89		NA		
4. Agriculture	NA	NA	3,522.37	64.12							759.77	10,149.77	592.07		NA		
A. Enteric Fermentation			3,163.37														
B. Manure Management			73.22	2.07										NA			
C. Rice Cultivation			25.53											NA			
D. Agricultural Soils	NA	NA	NE	48.90										NA			
E. Prescribed Burning of Savannas			251.59	12.88							743.98	9811.90	572.36				
F. Field Burning of Agricultural Residues			8.66	0.27							15.79	337.87	19.71				
G. Other			NA	NA							NA	NA	NA		NA		
5. Land-Use Change and Forestry	45,892.0	0.00	240.75	2.57							88.06	4,892.75	557.82		NA		
A. Changes in Forest and Other Woody Biomass Stocks	0.00	-24,543.87															
B. Forest and Grassland Conversion	74659.43	0.00	184.37	1.52							45.61	3,229.96	356.82				
C. Abandonment of Managed Lands	NA	0.00															
D. CO ₂ Emissions and Removals from Soil	0.00	-4,223.54															
E. Other	0.00	0.00	56.38	1.04							42.46	1,662.79	201.00		NA		
6. Waste	0.00		729.02	1.60							NE	NE	3.03		NE		
A. Solid Waste Disposal on Land	NE		671.42									NE	2.73				
B. Wastewater Handling			57.61	1.60							NE	NE	0.29				
C. Waste Incineration	0.00		NA	NA							NE	NE	NE		NE		
D. Other	NA	NA	NA	NA							NA	NA	NA		NA		
7. Other (please specify)	NA	NA	NA	NA		NA	NA	NA	NA	NA	NA	NA	NA		NA		
NA	NA	NA	NA	NA		NA	NA	NA	NA	NA	NA	NA	NA		NA		

APPENDIX 6—2001

1992 Summary 1.A Summary report for National Greenhouse Gas Inventories (IPCC Table 7A)
(Sheet 3 of 3)

Australia
1992
Submission 2003

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	CO ₂ emissions	CO ₂ removals (Gg)	CH ₄	N ₂ O	CO ₂ equivalent (Gg)										(Gg)			SO ₂
					HFCs		PFCs		SF ₆		NO _x	CO	NMVOC					
					P	A	P	A	P	A								
Memo Items: ⁽⁷⁾																		
International Bunkers	6,584.40		0.11	0.19									73.35	9.58	5.41	34.31		
Aviation	4,795.71		0.02	0.14									25.68	7.94	3.93	0.90		
Marine	1,788.69		0.09	0.05									47.66	1.63	1.48	33.41		
Multilateral Operations	NE		NE	NE									NE	NE	NE	NE	NE	
CO ₂ Emissions from Biomass	13,665.67																	

⁽⁷⁾ Memo Items are not included in the national totals.

APPENDIX 6—2001

1993 Summary 1.A Summary report for National Greenhouse Gas Inventories (IPCC Table 7A)
(Sheet 1 of 3)

Australia
1993
Submission 2003

GREENHOUSE GAS SOURCE AND SINK CATEGORIES		CO ₂ emissions	CO ₂ removals	CH ₄	N ₂ O	HFCs			PFCs			SF ₆		NO _x	CO	NMVOC	SO ₂
						CO ₂ equivalent (Gg)											
						P	A	P	A	P	A	P	A				
(Gg)																	
Total National Emissions and Removals		332,695.42	0.00	5,662.46	80.80	NE	1,446.59	NE	2,833.07	NE	0.0000	2,272.11	20,731.25	2,236.92	1,796.29	632.56	
1. Energy		268,804.61		1,186.31	10.55							1,347.25	4,955.58	821.68			
A. Fuel Combustion	Reference Approach	0.00															
	Sectoral Approach	262,957.26		119.16	10.44												
1. Energy Industries		149,790.74		2.06	1.49												
2. Manufacturing Industries and Construction		37,143.37		1.58	0.67												
3. Transport		61,358.05		26.64	8.01												
4. Other Sectors		13,375.86		88.84	0.26												
5. Other		1,289.24		0.04	0.01												
B. Fugitive Emissions from Fuels		5,847.35		1,067.14	0.10												
1. Solid Fuels		NE		791.02	NE												
2. Oil and Natural Gas		5,847.35		276.12	0.10												
2. Industrial Processes ⁽¹⁾		16,706.14		3.01	0.07	NE	1,446.59	NE	2,833.07	NE	0.00	39,531	7,213	60,026	1,163.73		
A. Mineral Products		4,507.25		NA	NA	NA						NE	NE	NE	15,441	NE	
B. Chemical Industry		NE		NE	0.00	NA	NA	NA	NA	NA	NA	NE	NE	NE	NE	NE	
C. Metal Production		12,198.89		3.01	0.07				2,833.07		0.00	39,531	7,213	0.09	1,163.73	NE	
D. Other Production		NE										NE	NE	NE	44,497	NE	
E. Production of Halocarbons and SF ₆							1,446.59		NO		NO						
F. Consumption of Halocarbons and SF ₆						NE	NE	NE	NE	NE	NE						
G. Other		NA		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

P = Potential emissions based on Tier 1 approach of the IPCC Guidelines.

A = Actual emissions based on Tier 2 approach of the IPCC Guidelines.

(1) Excludes confidential Soda Ash Production and Use, Ammonia Production and Nitric Acid Production emissions representing 1726.78 Gg CO₂-e

APPENDIX 6—2001

1993 Summary 1.A Summary report for National Greenhouse Gas Inventories (IPCC Table 7A)
(Sheet 2 of 3)

Australia
1993
Submission 2003

GREENHOUSE GAS SOURCE AND SINK CATEGORIES		CO ₂ emissions	CO ₂ removals	CH ₄	N ₂ O	CO ₂ equivalent (Gg)										(Gg)				NMVOC	SO ₂
						HFCs		PFCs		SF ₆		NO _x	CO	P	A						
						P	A	P	A	P	A										
3. Solvent and Other Product Use		NA			NE							NA	NA	146.27	NA	NA					
4. Agriculture		NA	NA	3,471.66	65.89							793.84	10,608.71	618.84	NA	NA					
A. Enteric Fermentation				3,095.01																	
B. Manure Management				76.12	2.32										NA						
C. Rice Cultivation				28.51											NA						
D. Agricultural Soils		NA	NA	NE	49.83										NA						
E. Prescribed Burning of Savannas				262.73	13.45							776.93	10246.40	597.71							
F. Field Burning of Agricultural Residues				9.29	0.29							16.91	362.31	21.13							
G. Other				NA	NA							NA	NA	NA	NA	NA					
5. Land-Use Change and Forestry		47,184.7	0.00	256.68	2.69							91.50	5,159.74	587.01	NA	NA					
A. Changes in Forest and Other Woody Biomass Stocks		0.00	-24,154.58																		
B. Forest and Grassland Conversion		75562.79	0.00	201.29	1.66							49.79	3,526.39	389.57							
C. Abandonment of Managed Lands		NA	0.00																		
D. CO ₂ Emissions and Removals from Soil		0.00	-4,223.54																		
E. Other		0.00	0.00	55.39	1.02																
6. Waste		0.00		744.81	1.61																
A. Solid Waste Disposal on Land		NE		686.63								NE	NE	NE	3.09	NE					
B. Wastewater Handling				58.17	1.61							NE	NE	NE	2.80						
C. Waste Incineration		0.00			NA							NE	NE	NE	0.30	NE					
D. Other		NA	NA	NA	NA							NA	NA	NA	NA	NA					
7. Other (please specify)			NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA					
NA		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA					

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1993 Summary 1.A Summary report for National Greenhouse Gas Inventories (IPCC Table 7A)
(Sheet 3 of 3)

Australia
1993
Submission 2003

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	CO ₂ emissions	CO ₂ removals	CH ₄	N ₂ O	CO ₂ equivalent (Gg)										(Gg)				NMVOC	SO ₂
					HFCs		PFCs		SF ₆		NO _x	CO	P	A	P	A				
					P	A	P	A	P	A										
Memo Items: ⁽⁷⁾																				
International Bunkers	6,987.84		0.11	0.20											75.49	10.26	5.74	34.28		
Aviation	5,199.38		0.02	0.15											27.85	8.62	4.26	0.98		
Marine	1,788.46		0.09	0.05											47.64	1.64	1.48	33.30		
Multilateral Operations	NE		NE	NE											NE	NE	NE	NE		
CO ₂ Emissions from Biomass	15,318.35																			

⁽⁷⁾ Memo Items are not included in the national totals.

APPENDIX 6—2001

1994 Summary 1.A Summary report for National Greenhouse Gas Inventories (IPCC Table 7A)
(Sheet 1 of 3)

Australia
1994
Submission 2003

GREENHOUSE GAS SOURCE AND SINK CATEGORIES		CO ₂ emissions	CO ₂ removals	CH ₄	N ₂ O	HFCs			PFCs			SF ₆			NO _x	CO	NMVOC	SO ₂
						P	A	CO ₂ equivalent (Gg)	P	A	CO ₂ equivalent (Gg)	P	A	CO ₂ equivalent (Gg)				
Total National Emissions and Removals		340,556.46	0.00	5,595.66	82.84	NE	936.01	NE	1,847.57	NE	0.0000	NE	0.0000	0.0000	2,317.58	21,127.39	2,277.76	1,864.40
1. Energy		272,700.18		1,174.69	11.44										1,361.15	4,906.35	825.71	637.86
A. Fuel Combustion	Reference Approach	0.00																
	Sectoral Approach	267,127.62		117.66	11.35										1,359.28	4,896.31	653.11	637.86
1. Energy Industries		150,850.78		2.09	1.51										489.08	43.92	6.94	457.48
2. Manufacturing Industries and Construction		38,645.38		1.63	0.68										304.94	246.24	11.71	117.06
3. Transport		62,765.30		27.43	8.89										481.14	3,591.68	501.89	53.81
4. Other Sectors		13,491.90		86.46	0.26										79.43	1,007.48	131.82	9.13
5. Other		1,374.24		0.05	0.02										4.69	6.98	0.75	0.38
B. Fugitive Emissions from Fuels		5,572.57		1,057.04	0.09										1.86	10.04	172.59	NE
1. Solid Fuels		NE		777.46	NE										NE	NE	NE	NA
2. Oil and Natural Gas		5,572.57		279.58	0.09										1.86	10.04	172.59	NE
2. Industrial Processes⁽¹⁾		18,615.55		3.32	0.08	NE	936.01	NE	1,847.57	NE	0.00	NE	0.00	0.00	43.719	7.977	62.551	1,226.54
A. Mineral Products		5,210.39		NA	NA										NE	NE	16.726	NE
B. Chemical Industry		NE		NE	0.00	NA	NA	NA	NA	NA	NA	NA	NA	NA	NE	NE	NE	NE
C. Metal Production		13,405.16		3.32	0.08										43.72	7.98	0.10	1,226.54
D. Other Production		NE													NE	NE	45.728	NE
E. Production of Halocarbons and SF ₆							811.70		NO		NO							
F. Consumption of Halocarbons and SF ₆						NE	124.31		NE	NE	NE							
G. Other		NA		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

P = Potential emissions based on Tier 1 approach of the IPCC Guidelines.

A = Actual emissions based on Tier 2 approach of the IPCC Guidelines.

(1) Excludes confidential Soda Ash Production and Use, Ammonia Production and Nitric Acid Production emissions representing 1859.71 Gg CO₂-e

APPENDIX 6—2001

1994 Summary 1.A Summary report for National Greenhouse Gas Inventories (IPCC Table 7A)
(Sheet 2 of 3)

Australia
1994
Submission 2003

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	CO ₂ emissions	CO ₂ removals	CH ₄	N ₂ O	HFCs						PFCs						SF ₆			NO _x	CO	NMVOC	SO ₂
					CO ₂ equivalent (Gg)						CO ₂ equivalent (Gg)						SF ₆						
					P	A	P	A	P	A	P	A	P	A	P	A							
3. Solvent and Other Product Use	NA			NE												NA	NA	150.12	NA	NA			
4. Agriculture	NA	NA	3,411.52	66.97												820.69	10,952.38	638.89	NA	NA			
A. Enteric Fermentation			3,023.12																				
B. Manure Management			78.71	2.56														NA	NA				
C. Rice Cultivation			28.87															NA	NA				
D. Agricultural Soils	NA	NA	NE	50.21														NA	NA				
E. Prescribed Burning of Savannas			271.68	13.91												803.39	10595.41	618.07					
F. Field Burning of Agricultural Residues			9.15	0.30												17.30	356.96	20.82					
G. Other			NA	NA												NA	NA	NA	NA	NA			
5. Land-Use Change and Forestry	49,240.7	0.00	264.27	2.72												92.02	5,260.69	597.34	NA	NA			
A. Changes in Forest and Other Woody Biomass Stocks	0.00	-23,173.16																					
B. Forest and Grassland Conversion	76637.42	0.00	211.55	1.75												52.33	3,706.17	409.43					
C. Abandonment of Managed Lands	NA	0.00																					
D. CO ₂ Emissions and Removals from Soil	0.00	-4,223.54																					
E. Other	0.00	0.00	52.71	0.97												39.69	1,554.52	187.91	NA	NA			
6. Waste	0.00		741.86	1.63												NE	NE	3.15	NE	NE			
A. Solid Waste Disposal on Land	NE		683.07														NE	2.86					
B. Wastewater Handling			58.79	1.63												NE	NE	0.30					
C. Waste Incineration	0.00		NA	NA												NE	NE	NE	NE	NE			
D. Other	NA	NA	NA	NA												NA	NA	NA	NA	NA			
7. Other (please specify)		NA	NA	NA		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA			
NA		NA	NA	NA		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA			

APPENDIX 6—2001

1994 Summary 1.A Summary report for National Greenhouse Gas Inventories (IPCC Table 7A)
(Sheet 3 of 3)

Australia
1994
Submission 2003

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	CO ₂ emissions	CO ₂ removals (Gg)	CH ₄	N ₂ O	CO ₂ equivalent (Gg)						(Gg)						SO ₂
					HFCs		PFCs		SF ₆		NO _x	CO	NMVOC				
					P	A	P	A	P	A							
Memo Items: ⁽⁷⁾																	
International Bunkers	7,365.97		0.13	0.22									82.33	10.70	6.05		38.70
Aviation	5,353.94		0.02	0.16									28.68	8.88	4.38		1.01
Marine	2,012.03		0.10	0.06									53.65	1.83	1.67		37.69
Multilateral Operations	NE		NE	NE									NE	NE	NE		NE
CO ₂ Emissions from Biomass	15,435.31																

⁽⁷⁾ Memo Items are not included in the national totals.

APPENDIX 6—2001

1995 Summary 1.A Summary report for National Greenhouse Gas Inventories (IPCC Table 7A)
(Sheet 1 of 3)

Australia
1995
Submission 2003

GREENHOUSE GAS SOURCE AND SINK CATEGORIES		CO ₂ emissions	CO ₂ removals	CH ₄	N ₂ O	HFCs			PFCs			SF ₆			NO _x	CO	NMVOC	SO ₂			
						CO ₂ equivalent (Gg)						(Gg)									
						CO ₂ equivalent (Gg)			CO ₂ equivalent (Gg)			CO ₂ equivalent (Gg)							CO ₂ equivalent (Gg)		
						P	A		P	A		P	A						P	A	
Total National Emissions and Removals		338,396.03	0.00	5,658.23	84.20	NE	977.42	NE	1,309.06	NE	0.0000	NE	0.0000	2,383.85	21,488.00	2,273.39	1,758.63				
1. Energy		282,424.83		1,290.37	12.39									1,359.75	4,870.55	828.15	679.05				
A. Fuel Combustion	Reference Approach	0.00																			
	Sectoral Approach	276,710.00		115.84	12.29									1,357.89	4,860.18	645.23	679.05				
1. Energy Industries		156,807.47		2.25	1.55									454.40	44.86	7.27	493.80				
2. Manufacturing Industries and Construction		39,169.22		1.76	0.74									313.30	273.41	13.14	113.53				
3. Transport		65,366.69		28.42	9.72									502.22	3,547.78	495.67	63.25				
4. Other Sectors		13,961.17		83.36	0.25									81.64	986.76	128.33	7.97				
5. Other		1,405.45		0.05	0.02									6.34	7.38	0.82	0.50				
B. Fugitive Emissions from Fuels		5,714.83		1,174.53	0.09									1.86	10.37	182.93	NE				
1. Solid Fuels		NE		832.39	NE									NE	NE	NE	NA				
2. Oil and Natural Gas		5,714.83		342.14	0.09									1.86	10.37	182.93	NE				
2. Industrial Processes ⁽¹⁾		18,596.36		3.42	0.08	NE	977.42	NE	1,309.06	NE	0.00	NE	0.00	44.979	8.207	69.068	1,079.58				
A. Mineral Products		5,008.05		NA	NA									NE	NE	16.306	NE				
B. Chemical Industry		NE		NE	0.00	NA	NA	NA	NA	NA	NA	NA	NA	NE	NE	NE	NE				
C. Metal Production		13,588.31		3.42	0.08									44.98	8.21	0.10	1,079.58				
D. Other Production		NE												NE	NE	52.663	NE				
E. Production of Halocarbons and SF ₆							NO		NO		NO										
F. Consumption of Halocarbons and SF ₆						NE	977.42	NE	NE	NE	NE										
G. Other		NA		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA				

P = Potential emissions based on Tier 1 approach of the IPCC Guidelines.

A = Actual emissions based on Tier 2 approach of the IPCC Guidelines.

(1) Excludes confidential Soda Ash Production and Use, Ammonia Production and Nitric Acid Production emissions representing 1816.93 Gg CO₂-e

APPENDIX 6—2001

1995 Summary 1.A Summary report for National Greenhouse Gas Inventories (IPCC Table 7A)
(Sheet 2 of 3)

Australia
1995
Submission 2003

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	CO ₂ emissions	CO ₂ removals	CH ₄	N ₂ O	HFCs						PFCs			SF ₆		NO _x	CO	NMVOC	SO ₂
					P	A	CO ₂ equivalent (Gg)				P	A	P	A					
	(Gg)																		
3. Solvent and Other Product Use	NA			NE												NA	NA	143.01	NA
4. Agriculture	NA	NA	3,412.97	67.62												894.28	11,930.29	695.93	NA
A. Enteric Fermentation			2,996.53																
B. Manure Management			79.64	2.65														NA	
C. Rice Cultivation			30.89															NA	
D. Agricultural Soils	NA	NA	NE	49.50														NA	
E. Prescribed Burning of Savannas			296.36	15.17															
F. Field Burning of Agricultural Residues			9.55	0.31														674.22	
G. Other			NA	NA													NA	NA	NA
5. Land-Use Change and Forestry	37,358.0	0.00	228.96	2.46												84.84	4,678.94	534.01	NA
A. Changes in Forest and Other Woody Biomass Stocks	0.00	-22,380.22																	
B. Forest and Grassland Conversion	63961.77	0.00	173.18	1.43												42.84	3,033.90	335.16	
C. Abandonment of Managed Lands	NA	0.00																	
D. CO ₂ Emissions and Removals from Soil	0.00	-4,223.54																	
E. Other	0.00	0.00	55.78	1.03												42.00	1,645.05	198.85	NA
6. Waste	16.83		722.51	1.65												NE	NE	3.22	NE
A. Solid Waste Disposal on Land	NE		663.00														NE	2.92	
B. Wastewater Handling			59.51	1.65												NE	NE	0.30	
C. Waste Incineration	16.83		NA	NA												NE	NE	NE	NE
D. Other	NA		NA	NA												NA	NA	NA	NA
7. Other (please specify)	NA	NA	NA	NA		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
NA			NA	NA		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

APPENDIX 6—2001

1995 Summary 1.A Summary report for National Greenhouse Gas Inventories (IPCC Table 7A)
(Sheet 3 of 3)

Australia
1995
Submission 2003

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	CO ₂ emissions	CO ₂ removals (Gg)	CH ₄	N ₂ O	CO ₂ equivalent (Gg)								(Gg)				NMVOC	SO ₂
					HFCs		PFCs		SF ₆		NO _x	CO						
					P	A	P	A	P	A								
Memo Items: ⁽⁷⁾																		
International Bunkers	8,532.60		0.16	0.25								102.72	12.10	7.02	51.40			
Aviation	5,857.66		0.02	0.17								31.37	9.69	4.80	1.10			
Marine	2,674.93		0.14	0.07								71.36	2.41	2.22	50.30			
Multilateral Operations	NE		NE	NE								NE	NE	NE	NE			
CO ₂ Emissions from Biomass	17,071.01																	

⁽⁷⁾ Memo Items are not included in the national totals.

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1996 Summary 1.A Summary report for National Greenhouse Gas Inventories (IPCC Table 7A)
(Sheet 1 of 3)

Australia
1996
Submission 2003

GREENHOUSE GAS SOURCE AND SINK CATEGORIES		CO ₂ emissions	CO ₂ removals	CH ₄	N ₂ O	HFCs			PFCs			SF ₆		NO _x	CO	NMVOC	SO ₂
						P	A	CO ₂ equivalent (Gg)	P	A	CO ₂ equivalent (Gg)	P	A				
Total National Emissions and Removals		344,309.22	0.00	5,648.05	85.08	NE	602.54	NE	1,205.39	NE	0.0004	NE	0.0004	2,473.00	21,605.51	2,201.94	1,816.58
1. Energy		292,173.10		1,279.15	13.22									1,423.46	4,815.12	820.13	694.49
A. Fuel Combustion	Reference Approach	0.00															
	Sectoral Approach	286,922.57		114.03	13.12									1,421.65	4,804.79	634.98	694.49
1. Energy Industries		163,334.69		2.29	1.61									493.18	47.35	7.25	508.33
2. Manufacturing Industries and Construction		40,314.68		1.78	0.75									321.73	267.03	13.15	111.55
3. Transport		67,710.68		29.43	10.49									516.21	3,515.63	488.78	66.22
4. Other Sectors		14,044.93		80.47	0.25									83.06	967.22	124.94	7.80
5. Other		1,517.59		0.06	0.02									7.47	7.56	0.87	0.59
B. Fugitive Emissions from Fuels		5,250.53		1,165.12	0.10									1.81	10.32	185.15	NE
1. Solid Fuels		NE		846.98	NE									NE	NE	NE	NA
2. Oil and Natural Gas		5,250.53		318.14	0.10									1.81	10.32	185.15	NE
2. Industrial Processes ⁽¹⁾		18,671.59		3.43	0.08	NE	602.54	NE	1,205.39	NE	0.00	NE	0.00	44,744	8,164	16,452	1,122.09
A. Mineral Products		5,076.15		NA	NA									NE	NE	16,352	NE
B. Chemical Industry		NE		NE	0.00	NA	NA	NA	NA	NA	NA	NA	NA	NE	NE	NE	NE
C. Metal Production		13,595.44		3.43	0.08									44.74	8.16	0.10	1,122.09
D. Other Production		NE												NE	NE	0.000	NE
E. Production of Halocarbons and SF ₆							NO		NO		NO						
F. Consumption of Halocarbons and SF ₆						NE	602.54	NE	NE	NE	NE	NE	NE				
G. Other		NA		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

P = Potential emissions based on Tier 1 approach of the IPCC Guidelines.

A = Actual emissions based on Tier 2 approach of the IPCC Guidelines.

(1) Excludes confidential Soda Ash Production and Use, Ammonia Production and Nitric Acid Production emissions representing 1970.11 Gg CO₂-e

APPENDIX 6—2001

1996 Summary 1.A Summary report for National Greenhouse Gas Inventories (IPCC Table 7A)
(Sheet 2 of 3)

Australia
1996
Submission 2003

GREENHOUSE GAS SOURCE AND SINK CATEGORIES		CO ₂ emissions	CO ₂ removals	CH ₄	N ₂ O	CO ₂ equivalent (Gg)						(Gg)				NMVOC	SO ₂
						HFCs			PFCs			SF ₆		NO _x	CO		
						P	A		P	A		P	A				
3. Solvent and Other Product Use		NA			NE							NA	NA	134.87	NA		
4. Agriculture		NA	NA	3,417.62	67.77							923.92	12,338.21	719.73	NA		
A. Enteric Fermentation				2,987.28													
B. Manure Management				80.53	2.71									NA			
C. Rice Cultivation				33.44										NA			
D. Agricultural Soils		NA	NA	NE	49.06									NA			
E. Prescribed Burning of Savannas				306.04	15.66							904.99	11935.41	696.23			
F. Field Burning of Agricultural Residues				10.33	0.33							18.92	402.80	23.50			
G. Other				NA	NA							NA	NA	NA	NA		
5. Land-Use Change and Forestry		33,451.0	0.00	216.86	2.34							80.88	4,444.01	507.47	NA		
A. Changes in Forest and Other Woody Biomass Stocks		0.00	-22,431.63														
B. Forest and Grassland Conversion		60106.18	0.00	163.00	1.35							40.32	2,855.51	315.45			
C. Abandonment of Managed Lands		NA	0.00														
D. CO ₂ Emissions and Removals from Soil		0.00	-4,223.54														
E. Other		0.00	0.00	53.86	1.00							40.56	1,588.51	192.02	NA		
6. Waste		13.53		731.00	1.67							NE	NE	3.29	NE		
A. Solid Waste Disposal on Land		NE		670.70									NE	2.98			
B. Wastewater Handling				60.29	1.67							NE	NE	0.31			
C. Waste Incineration		13.53		NA	NA							NE	NE	NE	NE		
D. Other		NA	NA	NA	NA							NA	NA	NA	NA		
7. Other (please specify)			NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA		
NA		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA		

APPENDIX 6—2001

1996 Summary 1.A Summary report for National Greenhouse Gas Inventories (IPCC Table 7A)
(Sheet 3 of 3)

Australia
1996
Submission 2003

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	CO ₂ emissions	CO ₂ removals (Gg)	CH ₄	N ₂ O	CO ₂ equivalent (Gg)										(Gg)				SO ₂
					HFCs		PFCs		SF ₆		NO _x	CO	NMVOC						
					P	A	P	A	P	A									
Memo Items: ⁽⁷⁾																			
International Bunkers	9,030.65		0.16	0.26											106.68	12.76	7.45	53.83	
Aviation	6,311.70		0.02	0.19											33.80	10.44	5.17	1.19	
Marine	2,718.95		0.14	0.08											72.88	2.32	2.27	52.64	
Multilateral Operations	NE		NE	NE											NE	NE	NE	NE	NE
CO ₂ Emissions from Biomass	17,114.32																		

⁽⁷⁾ Memo Items are not included in the national totals.

APPENDIX 6—2001

1997 Summary 1.A Summary report for National Greenhouse Gas Inventories (IPCC Table 7A)
(Sheet 1 of 3)

Australia
1997
Submission 2003

GREENHOUSE GAS SOURCE AND SINK CATEGORIES		CO ₂ emissions	CO ₂ removals	CH ₄	N ₂ O	HFCs			PFCs			SF ₆			NO _x	CO	NMVOC	SO ₂
						P	A	CO ₂ equivalent (Gg)	P	A	CO ₂ equivalent (Gg)	P	A	CO ₂ equivalent (Gg)				
Total National Emissions and Removals		348,489.26	0.00	5,757.25	90.32	NE	907.09	NE	1,050.67	NE	0.0003	NE	0.0003	2,623.21	22,591.89	2,321.28	1,804.13	
1. Energy		299,491.76		1,321.40	14.02									1,505.60	4,812.34	813.52	668.42	
A. Fuel Combustion	Reference Approach	0.00																
	Sectoral Approach	294,443.08		115.57	13.95									1,503.97	4,803.31	625.23	668.42	
1. Energy Industries		169,403.10		4.70	1.72									523.13	55.44	6.17	482.15	
2. Manufacturing Industries and Construction		39,855.61		2.36	0.80									361.03	294.15	13.65	111.72	
3. Transport		69,060.28		30.39	11.16									526.94	3,492.96	482.43	66.41	
4. Other Sectors		14,585.63		78.06	0.25									85.37	953.08	122.10	7.54	
5. Other		1,538.46		0.06	0.02									7.52	7.67	0.88	0.59	
B. Fugitive Emissions from Fuels		5,048.68		1,205.83	0.07									1.62	9.03	188.29	NE	NE
1. Solid Fuels		NE		865.54	NE									NE	NE	NE	NE	NA
2. Oil and Natural Gas		5,048.68		340.28	0.07									1.62	9.03	188.29	NE	NE
2. Industrial Processes⁽¹⁾		18,661.15		3.37	0.08	NE	907.09	NE	1,050.67	NE	0.00	NE	0.00	44,590	8,136	75,618	1,135.72	
A. Mineral Products		5,008.60		NA	NA									NE	NE	17.123	NE	NE
B. Chemical Industry		NE		NE	0.00	NA	NA	NA	NA	NA	NA	NA	NA	NE	NE	NE	NE	NE
C. Metal Production		13,652.55		3.37	0.08									44.59	8.14	0.10	1,135.72	
D. Other Production		NE												NE	NE	58.395	NE	NE
E. Production of Halocarbons and SF ₆							NO		NO		NO							
F. Consumption of Halocarbons and SF ₆						NE	907.09	NE	NE	NE	NE							
G. Other		NA		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

P = Potential emissions based on Tier 1 approach of the IPCC Guidelines.

A = Actual emissions based on Tier 2 approach of the IPCC Guidelines.

(1) Excludes confidential Soda Ash Production and Use, Ammonia Production and Nitric Acid Production emissions representing 1958.03 Gg CO₂-e

APPENDIX 6—2001

1997 Summary 1.A Summary report for National Greenhouse Gas Inventories (IPCC Table 7A)
(Sheet 2 of 3)

Australia
1997
Submission 2003

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	CO ₂ emissions	CO ₂ removals	CH ₄	N ₂ O	HFCs						PFCs			SF ₆			NO _x	CO	NMVOC	SO ₂
					P	A	P	A	P	A	P	A	P	A						
	(Gg)					CO ₂ equivalent (Gg)									(Gg)					
		NA			NE												NA	NA	138.29	NA
3. Solvent and Other Product Use	NA																			
4. Agriculture	NA	NA	3,470.68	72.13													989.96	13,242.60	772.49	NA
A. Enteric Fermentation			3,012.87																	
B. Manure Management			83.88	2.82															NA	
C. Rice Cultivation			34.38																NA	
D. Agricultural Soils	NA	NA	NE	52.17															NA	
E. Prescribed Burning of Savannas			327.82	16.78													969.42	12785.14	745.80	
F. Field Burning of Agricultural Residues			11.73	0.36													20.53	457.46	26.69	
G. Other			NA	NA													NA	NA	NA	NA
5. Land-Use Change and Forestry	30,319.4	0.00	219.68	2.40													83.07	4,528.81	517.75	NA
A. Changes in Forest and Other Woody Biomass Stocks	0.00	-22,517.90																		
B. Forest and Grassland Conversion	57060.86	0.00	162.87	1.35													40.29	2,853.25	315.20	
C. Abandonment of Managed Lands	NA	0.00																		
D. CO ₂ Emissions and Removals from Soil	0.00	-4,223.54																		
E. Other	0.00	0.00	56.82	1.05													42.78	1,675.57	202.54	NA
6. Waste	16.94		742.12	1.69													NE	NE	3.62	NE
A. Solid Waste Disposal on Land	NE		681.08															NE	3.30	
B. Wastewater Handling			61.04	1.69													NE	NE	0.33	
C. Waste Incineration	16.94		NA	NA													NE	NE		
D. Other	NA		NA	NA													NA	NA		NA
7. Other (please specify)																	NA	NA		NA
NA	NA	NA	NA	NA													NA	NA	NA	NA

APPENDIX 6—2001

1997 Summary 1.A Summary report for National Greenhouse Gas Inventories (IPCC Table 7A)
(Sheet 3 of 3)

Australia
1997
Submission 2003

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	CO ₂ emissions	CO ₂ removals (Gg)	CH ₄	N ₂ O	CO ₂ equivalent (Gg)										(Gg)					SO ₂
					HFCs		PFCs		SF ₆		NO _x	CO	NMVOC							
					P	A	P	A	P	A										
Memo Items: ⁽⁷⁾																				
International Bunkers	9,020.41		0.16	0.26											101.92	13.08	7.41		48.08	
Aviation	6,501.21		0.03	0.19											34.82	10.77	5.32		1.22	
Marine	2,519.20		0.13	0.07											67.10	2.31	2.09		46.86	
Multilateral Operations	NE		NE	NE											NE	NE	NE		NE	
CO ₂ Emissions from Biomass	18,692.47																			

⁽⁷⁾ Memo Items are not included in the national totals.

APPENDIX 6—2001

1998 Summary 1.A Summary report for National Greenhouse Gas Inventories (IPCC Table 7A)
(Sheet 1 of 3)

Australia
1998
Submission 2003

GREENHOUSE GAS SOURCE AND SINK CATEGORIES		CO ₂ emissions	CO ₂ removals	CH ₄	N ₂ O	HFCs			PFCs			SF ₆		NO _x	CO	NMVOC	SO ₂
						CO ₂ equivalent (Gg)						(Gg)					
						CO ₂ equivalent (Gg)			CO ₂ equivalent (Gg)			(Gg)					
						P	A		P	A		P	A				
Total National Emissions and Removals		372,753.24	0.00	5,836.68	94.53	NE	1,311.25	NE	1,396.99	NE	0.0002	2,677.83	22,566.97	2,292.53	1,792.93		
1. Energy		315,517.98		1,405.04	15.00							1,557.07	4,815.74	793.97	710.09		
A. Fuel Combustion	Reference Approach	0.00															
	Sectoral Approach	310,229.01		111.08	14.90							1,555.57	4,808.24	617.39	710.09		
1. Energy Industries		184,779.29		5.03	1.92							589.37	59.15	8.66	532.63		
2. Manufacturing Industries and Construction		40,222.52		2.43	0.81							364.10	311.52	14.51	107.52		
3. Transport		69,122.80		31.23	11.90							508.23	3,520.72	478.26	61.87		
4. Other Sectors		14,785.31		72.33	0.24							87.00	909.29	115.11	7.51		
5. Other		1,319.08		0.06	0.02							6.87	7.55	0.86	0.55		
B. Fugitive Emissions from Fuels		5,288.97		1,293.96	0.11							1.50	7.50	176.59	NE		
1. Solid Fuels		NE		954.70	NE							NE	NE	NE	NA		
2. Oil and Natural Gas		5,288.97		339.25	0.11							1.50	7.50	176.59	NE		
2. Industrial Processes ⁽¹⁾		18,943.26		3.60	0.08	NE	1,311.25	NE	1,396.99	NE	0.00	42.917	7.830	76.031	1,082.85		
A. Mineral Products		5,433.39		NA	NA							NE	NE	NE	NE		
B. Chemical Industry		NE		NE	0.00	NA	NA	NA	NA	NA	NA	NE	NE	NE	NE		
C. Metal Production		13,509.87		3.60	0.08				1,396.99		0.00	42.92	7.83	0.10	1,082.85		
D. Other Production		NE										NE	NE	59.257	NE		
E. Production of Halocarbons and SF ₆							NO		NO		NO						
F. Consumption of Halocarbons and SF ₆						NE	1,311.25	NE	NE	NE	NE						
G. Other		NA		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA		

P = Potential emissions based on Tier 1 approach of the IPCC Guidelines.

A = Actual emissions based on Tier 2 approach of the IPCC Guidelines.

(1) Excludes confidential Soda Ash Production and Use, Ammonia Production and Nitric Acid Production emissions representing 2132.86 Gg CO₂-e

APPENDIX 6—2001

1998 Summary 1.A Summary report for National Greenhouse Gas Inventories (IPCC Table 7A)
(Sheet 2 of 3)

Australia
1998
Submission 2003

GREENHOUSE GAS SOURCE AND SINK CATEGORIES		CO ₂ emissions	CO ₂ removals	CH ₄	N ₂ O	HFCs				PFCs				SF ₆		NO _x	CO	NMVOC	SO ₂		
						CO ₂ equivalent (Gg)								P						A	
						P	A	P	A	P	A	P	A								
3. Solvent and Other Product Use		NA			NE											NA	NA	137.63	NA		
4. Agriculture		NA	NA	3,481.74	75.41											996.81	13,348.54	778.67	NA		
A. Enteric Fermentation				3,017.06																	
B. Manure Management				87.91	3.14													NA			
C. Rice Cultivation				34.50														NA			
D. Agricultural Soils		NA	NA	NE	55.01													NA			
E. Prescribed Burning of Savannas				329.98	16.89											975.79	12869.13	750.70			
F. Field Burning of Agricultural Residues				12.29	0.36											21.01	479.42	27.97			
G. Other				NA	NA											NA	NA	NA	NA		
5. Land-Use Change and Forestry		38,274.9	0.00	212.32	2.33											81.04	4,394.86	502.82	NA		
A. Changes in Forest and Other Woody Biomass Stocks		0.00	-22,709.30																		
B. Forest and Grassland Conversion		65207.71	0.00	155.92	1.29											38.57	2,731.52	301.76			
C. Abandonment of Managed Lands		NA	0.00																		
D. CO ₂ Emissions and Removals from Soil		0.00	-4,223.54																		
E. Other		0.00	0.00	56.40	1.04											42.47	1,663.34	201.06	NA		
6. Waste		17.13		733.98	1.71											NE	NE	3.42	NE		
A. Solid Waste Disposal on Land		NE		672.20													NE	3.10			
B. Wastewater Handling				61.77	1.71											NE	NE	0.31			
C. Waste Incineration		17.13		NA	NA											NE	NE	NE	NE		
D. Other		NA		NA	NA											NA	NA	NA	NA		
7. Other (please specify)			NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA		
NA		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA		

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1998 Summary 1.A Summary report for National Greenhouse Gas Inventories (IPCC Table 7A)
(Sheet 3 of 3)

Australia
1998
Submission 2003

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	CO ₂ emissions	CO ₂ removals	CH ₄	N ₂ O	CO ₂ equivalent (Gg)										(Gg)				SO ₂
					HFCs		PFCs		SF ₆		NO _x	CO	NMVOC						
					P	A	P	A	P	A									
Memo Items: ⁽⁷⁾																			
International Bunkers	9,473.01		0.14	0.28									98.44	13.96	7.80	43.35			
Aviation	7,232.89		0.03	0.22									38.71	11.93	5.94	1.36			
Marine	2,240.12		0.12	0.06									59.73	2.03	1.86	41.98			
Multilateral Operations	NE		NE	NE									NE	NE	NE	NE			
CO ₂ Emissions from Biomass	19,321.49																		

⁽⁷⁾ Memo Items are not included in the national totals.

APPENDIX 6—2001

1999 Summary 1.A Summary report for National Greenhouse Gas Inventories (IPCC Table 7A)
(Sheet 1 of 3)

Australia
1999
Submission 2003

GREENHOUSE GAS SOURCE AND SINK CATEGORIES		CO ₂ emissions	CO ₂ removals	CH ₄	N ₂ O	HFCs			PFCs			SF ₆		NO _x	CO	NMVOC	SO ₂										
						CO ₂ equivalent (Gg)						(Gg)															
						P			A			P						A			P			A			
Total National Emissions and Removals		369,594.83	0.00	5,819.27	100.27	NE	1,694.44	NE	981.99	NE	0.0002	NE	0.0002	2,778.14	23,589.71	2,336.18	1,885.12										
1. Energy		324,580.67		1,298.78	15.88									1,562.27	4,712.94	785.32	732.90										
A. Fuel Combustion	Reference Approach	0.00																									
	Sectoral Approach																										
1. Energy Industries		318,846.67		108.47	15.80									1,560.74	4,705.05	607.91	732.90										
2. Manufacturing Industries and Construction		189,112.04		7.47	1.95									594.79	69.08	11.40	530.83										
3. Transport		43,600.70		2.43	0.82									380.27	294.92	13.70	135.77										
4. Other Sectors		69,969.79		31.58	12.77									491.34	3,466.27	473.34	58.50										
5. Other		14,931.69		66.93	0.24									88.65	867.29	108.64	7.34										
		1,232.45		0.05	0.02									5.69	7.50	0.83	0.46										
B. Fugitive Emissions from Fuels		5,734.00		1,190.31	0.07									1.53	7.89	177.41	NE										
1. Solid Fuels		NE		903.33	NE									NE	NE	NE	NA										
2. Oil and Natural Gas		5,734.00		286.99	0.07									1.53	7.89	177.41	NE										
2. Industrial Processes ⁽¹⁾		19,550.80		3.36	0.08	NE	1,694.44	NE	981.99	NE	0.00	NE	0.00	44,996	8,210	70,455	1,152.22										
A. Mineral Products		5,355.99		NA	NA									NE	NE	16,726	NE										
B. Chemical Industry		NE		NE	0.00	NA	NA	NA	NA	NA	NA	NA	NA	NE	NE	NE	NE										
C. Metal Production		14,194.80		3.36	0.08									45.00	8.21	0.10	1,152.22										
D. Other Production		NE												NE	NE	53,629	NE										
E. Production of Halocarbons and SF ₆							NO		NO		NO																
F. Consumption of Halocarbons and SF ₆						NE	1,694.44	NE	NE	NE	NE																
G. Other		NA		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA										

P = Potential emissions based on Tier 1 approach of the IPCC Guidelines.

A = Actual emissions based on Tier 2 approach of the IPCC Guidelines.

(1) Excludes confidential Soda Ash Production and Use, Ammonia Production and Nitric Acid Production emissions representing 2019.63 Gg CO₂-e

APPENDIX 6—2001

1999 Summary 1.A Summary report for National Greenhouse Gas Inventories (IPCC Table 7A)
(Sheet 2 of 3)

Australia
1999
Submission 2003

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	CO ₂ emissions	CO ₂ removals	CH ₄	N ₂ O	HFCs						PFCs						SF ₆				NO _x	CO	NMVOC	SO ₂
					CO ₂ equivalent (Gg)						CO ₂ equivalent (Gg)													
					P	A	P	A	P	A	P	A	P	A	P	A	P	A	P	A				
3. Solvent and Other Product Use	NA			NE																NA	NA	138.19	NA	NA
4. Agriculture	NA	NA	3,553.24	80.33																1,092.86	14,616.79	852.65	NA	NA
A. Enteric Fermentation			3,056.58																					
B. Manure Management			89.93	3.37																			NA	
C. Rice Cultivation			31.94																				NA	
D. Agricultural Soils	NA	NA	NE	58.04																			NA	
E. Prescribed Burning of Savannas			362.62	18.56																1072.32	14142.15	824.96		
F. Field Burning of Agricultural Residues			12.17	0.36																20.55	474.64	27.69		
G. Other			NA	NA																NA	NA	NA	NA	NA
5. Land-Use Change and Forestry	25,445.9	0.00	206.20	2.25																78.01	4,251.76	486.09		NA
A. Changes in Forest and Other Woody Biomass Stocks	0.00	-23,298.18																						
B. Forest and Grassland Conversion	52967.60	0.00	152.80	1.26																37.80	2,676.85	295.72		
C. Abandonment of Managed Lands	NA	0.00																						
D. CO ₂ Emissions and Removals from Soil	0.00	-4,223.54																						
E. Other	0.00	0.00	53.40	0.99																40.21	1,574.91	190.37		NA
6. Waste	17.49		757.68	1.73																NE	NE	3.48		NE
A. Solid Waste Disposal on Land	NE		695.17																		NE	NE	3.17	
B. Wastewater Handling			62.51	1.73																NE	NE	0.32		
C. Waste Incineration	17.49		NA	NA																NE	NE	NE		NE
D. Other	NA		NA	NA																NA	NA	NA		NA
7. Other (please specify)	NA	NA	NA	NA		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

APPENDIX 6—2001

1999 Summary 1.A Summary report for National Greenhouse Gas Inventories (IPCC Table 7A)
(Sheet 3 of 3)

Australia
1999
Submission 2003

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	CO ₂ emissions	CO ₂ removals	CH ₄	N ₂ O	CO ₂ equivalent (Gg)										(Gg)			SO ₂												
					HFCs		PFCs		SF ₆		NO _x	CO	NMVOC																	
					P	A	P	A	P	A																				
Memo Items: ⁽⁷⁾																														
International Bunkers	9,752.78		0.15	0.29											105.62	14.05	8.05	49.91												
Aviation	7,268.09		0.03	0.22											38.89	11.98	5.97	1.37												
Marine	2,484.69		0.12	0.07											66.72	2.07	2.08	48.54												
Multilateral Operations	NE		NE	NE											NE	NE	NE	NE												
CO ₂ Emissions from Biomass	19,580.00																													

⁽⁷⁾ Memo Items are not included in the national totals.

APPENDIX 6—2001

2000 Summary 1.A Summary report for National Greenhouse Gas Inventories (IPCC Table 7A)
(Sheet 1 of 3)

Australia
2000
Submission 2003

GREENHOUSE GAS SOURCE AND SINK CATEGORIES		CO ₂ emissions	CO ₂ removals	CH ₄	N ₂ O	HFCs			PFCs			SF ₆			NO _x	CO	NMVOC	SO ₂
						CO ₂ equivalent (Gg)			CO ₂ equivalent (Gg)			CO ₂ equivalent (Gg)						
						P	A		P	A		P	A					
Total National Emissions and Removals		365,526.10	0.00	5,943.37	106.92	NE	2,084.83	NE	1,103.21	NE	0.0001			2,964.25	25,181.96	2,441.61	2,391.16	
1. Energy		330,222.67		1,361.00	16.79									1,584.33	4,574.78	809.22	746.25	
A. Fuel Combustion	Reference Approach	331,945.81																
	Sectoral Approach	323,734.22		105.10	16.71									1,582.65	4,565.56	594.98	746.25	
1. Energy Industries		192,390.72		9.17	1.97									624.73	65.25	8.21	556.17	
2. Manufacturing Industries and Construction		42,588.54		2.46	0.79									374.23	303.69	15.66	121.97	
3. Transport		72,095.17		31.58	13.69									487.75	3,360.31	467.64	62.09	
4. Other Sectors		15,383.96		61.83	0.23									90.42	828.62	102.62	5.58	
5. Other		1,275.82		0.05	0.02									5.52	7.70	0.84	0.45	
B. Fugitive Emissions from Fuels		6,488.46		1,255.90	0.09									1.68	9.22	214.24	NE	
1. Solid Fuels		NE		935.15	NE									NE	NE	NE	NA	
2. Oil and Natural Gas		6,488.46		320.76	0.09									1.68	9.22	214.24	NE	
2. Industrial Processes ⁽¹⁾		18,744.66		2.90	0.07	NE	2,084.83	NE	1,103.21	NE	0.00			46.391	7.912	76.578	1,644.91	
A. Mineral Products		5,150.78		NA	NA									NE	NE	18.244	NE	
B. Chemical Industry		NE		NE	0.00		NA	NA	NA	NA	NA	NA	NA	NE	NE	NE	NE	
C. Metal Production		13,593.88		2.90	0.073794									46.39	7.91	0.10	1,644.91	
D. Other Production		NE												NE	NE	58.236	NE	
E. Production of Halocarbons and SF ₆							NO		NO		NO							
F. Consumption of Halocarbons and SF ₆						NE	2,084.83	NE	NE	NE	NE							
G. Other		NA		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	

P = Potential emissions based on Tier 1 approach of the IPCC Guidelines.

A = Actual emissions based on Tier 2 approach of the IPCC Guidelines.

(1) Excludes confidential Soda Ash Production and Use, Ammonia Production and Nitric Acid Production emissions representing 2076.35 Gg CO₂-e

APPENDIX 6—2001

2000 Summary 1.A Summary report for National Greenhouse Gas Inventories (IPCC Table 7A)
(Sheet 2 of 3)

Australia
2000
Submission 2003

GREENHOUSE GAS SOURCE AND SINK CATEGORIES		CO ₂ emissions	CO ₂ removals	CH ₄	N ₂ O	HFCs				PFCs				SF ₆		NO _x	CO	NMVOC	SO ₂		
						CO ₂ equivalent (Gg)								P						A	
						P	A	P	A	P	A	P	A								
3. Solvent and Other Product Use		NA			NE											NA	NA	144.36	NA		
4. Agriculture		NA	NA	3,631.21	86.35											1,266.08	16,912.12	986.54	NA		
A. Enteric Fermentation				3,071.22																	
B. Manure Management				91.05	3.60													NA			
C. Rice Cultivation				35.30														NA			
D. Agricultural Soils		NA	NA	NE	60.84													NA			
E. Prescribed Burning of Savannas				421.13	21.55											1245.33	16423.97	958.06			
F. Field Burning of Agricultural Residues				12.52	0.36											20.74	488.15	28.48			
G. Other				NA	NA											NA	NA	NA	NA		
5. Land-Use Change and Forestry		16,542.5	0.00	179.21	1.95											67.46	3,687.14	421.36	NA		
A. Changes in Forest and Other Woody Biomass Stocks		0.00	-23,349.21																		
B. Forest and Grassland Conversion		44115.21	0.00	133.47	1.10											33.02	2,338.21	258.31			
C. Abandonment of Managed Lands		NA	0.00																		
D. CO ₂ Emissions and Removals from Soil		0.00	-4,223.54																		
E. Other		0.00	0.00	45.74	0.85																
6. Waste		16.30		769.05	1.75																
A. Solid Waste Disposal on Land		NE		705.75													NE	3.55	NE		
B. Wastewater Handling				63.30	1.75											NE	NE	0.32			
C. Waste Incineration		16.30		NA	NA											NE	NE	NE	NE		
D. Other		NA		NA	NA											NA	NA	NA	NA		
7. Other (please specify)		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA		
NA		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA		

APPENDIX 6—2001

2000 Summary 1.A Summary report for National Greenhouse Gas Inventories (IPCC Table 7A)
(Sheet 3 of 3)

Australia
2000
Submission 2003

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	CO ₂ emissions	CO ₂ removals	CH ₄	N ₂ O	CO ₂ equivalent (Gg)						(Gg)			NO _x	CO	NMVOC	SO ₂	
					HFCs		PFCs		SF ₆		A	P	A					
					P	A	P	A	P	A								
Memo Items: ⁽⁷⁾																		
International Bunkers	10,099.67		0.16	0.30									113.81	14.31	8.35	56.42		
Aviation	7,330.88		0.03	0.22									39.24	12.09	6.02	1.38		
Marine	2,768.79		0.13	0.08									74.57	2.22	2.33	55.04		
Multilateral Operations	NE		NE	NE									NE	NE	NE	NE	NE	
CO ₂ Emissions from Biomass	19,290.31																	

⁽⁷⁾ Memo Items are not included in the national totals.

PART C

KYOTO ACCOUNTING TRENDS TABLES

TABLE 1 EMISSIONS TRENDS (CO₂)—KYOTO ACCOUNTING
(Sheet 1 of 6)

Australia
2001
Submission 2003

GREENHOUSE GAS SOURCE AND SINK CATEGORIES												
Base year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
(Gt)												
1. Energy	258,622.51	260,716.76	265,401.81	268,804.61	272,700.18	282,424.83	292,173.10	299,491.76	315,517.98	324,580.67	330,222.67	336,326.38
A. Fuel Combustion (Sectoral Approach)	252,659.80	254,971.64	259,560.87	262,957.26	267,127.62	276,710.00	286,922.57	294,443.08	310,229.01	318,846.67	323,734.22	329,402.62
1. Energy Industries	141,805.68	145,296.14	148,512.17	149,790.74	150,850.78	156,807.47	163,334.69	169,403.10	184,779.29	189,112.04	192,390.72	198,168.52
2. Manufacturing Industries and Construction	37,384.55	36,829.60	36,707.28	37,143.37	38,645.38	39,169.22	40,314.68	39,855.61	40,222.52	43,600.79	42,588.54	42,034.59
3. Transport	59,726.89	59,076.56	60,194.18	61,358.05	62,765.30	65,366.69	67,710.68	69,060.28	69,122.80	69,969.79	72,095.17	72,260.40
4. Other Sectors	12,485.74	12,538.60	12,894.80	13,375.86	13,491.90	13,961.17	14,044.93	14,585.63	14,785.31	14,931.69	15,383.96	15,585.94
5. Other	1,256.94	1,210.75	1,252.43	1,289.24	1,374.24	1,405.45	1,517.59	1,538.46	1,319.08	1,232.45	1,275.82	1,353.17
B. Fugitive Emissions from Fuels	5,962.71	5,962.71	5,840.95	5,847.35	5,572.57	5,714.83	5,250.53	5,048.68	5,288.97	5,734.00	6,488.46	6,923.76
I. Solid Fuel	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
2. Oil and Natural Gas	5,962.71	5,962.71	5,840.95	5,847.35	5,572.57	5,714.83	5,250.53	5,048.68	5,288.97	5,734.00	6,488.46	6,923.76
2. Industrial Processes	19,238.10	18,882.92	16,642.72	16,706.14	18,615.55	18,596.36	18,671.59	18,661.15	18,943.26	19,550.80	18,744.66	18,211.90
A. Mineral Products ⁽¹⁾	4,763.45	4,763.45	4,299.14	4,507.25	5,210.39	5,008.05	5,076.15	5,008.60	5,433.39	5,555.99	5,150.78	5,099.94
B. Chemical Industry ⁽¹⁾	C	C	C	C	C	C	C	C	C	C	C	C
C. Metal Production	14,474.64	14,405.78	12,343.58	12,198.89	13,405.16	13,588.31	13,595.44	13,652.55	13,509.87	14,194.80	13,593.88	13,111.96
D. Other Production	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
E. Production of Halocarbons and SF ₆												
F. Consumption of Halocarbons and SF ₆												
G. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
3. Solvent and Other Product Use	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
4. Agriculture	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
A. Enteric Fermentation	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
B. Manure Management	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
C. Rice Cultivation	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
D. Agricultural Soils	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
E. Prescribed Burning of Savannas	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
F. Field Burning of Agricultural Residues	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
G. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
5. Land Use, Land-Use Change and Forestry	114,192.33	89,539.61	73,730.79	74,160.53	74,885.11	61,665.00	57,157.60	52,870.51	59,618.69	45,857.28	33,938.16	23,084.39
A. Afforestation and reforestation ⁽²⁾	0.00	-453.15	-928.64	-1,402.26	-1,752.32	-2,296.77	-2,948.58	-4,190.35	-5,589.02	-7,110.32	-10,177.06	-11,128.14
B. Land use change (deforestation)	114,192.33	89,992.76	74,659.43	75,562.79	76,637.42	63,961.77	60,106.18	57,060.86	65,207.71	52,967.60	44,115.21	34,212.53
6. Waste	NE	NE	NE	NE	NE	16.83	13.53	16.94	17.13	17.49	16.30	16.30
A. Solid Waste Disposal on Land	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
B. Waste-water Handling	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
C. Waste Incineration	NE	NE	NE	NE	NE	16.83	13.53	16.94	17.13	17.49	16.30	16.30
D. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
7. Other (please specify)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total Emissions/Removals with LULUCF	392,052.93	369,139.29	355,775.32	359,671.28	366,200.84	362,703.02	368,015.82	371,040.36	394,097.06	390,006.23	382,921.79	377,638.96
Total Emissions without LULUCF	277,860.61	279,599.68	282,044.54	285,510.75	291,315.73	301,038.02	310,858.22	318,169.85	334,478.37	344,148.95	348,983.64	354,554.58
Memo Items:												
International Bankers	6,400.97	6,378.80	6,584.40	6,987.84	7,365.97	8,532.60	9,030.65	9,020.41	9,473.01	9,752.78	10,099.67	10,625.28
Aviation	4,345.12	4,320.39	4,795.71	5,199.38	5,353.94	5,857.66	6,311.70	6,301.21	7,232.89	7,268.09	7,330.88	8,151.32
Marine	2,055.85	1,858.42	1,788.69	1,788.46	2,012.03	2,674.93	2,718.95	2,519.20	2,240.12	2,484.69	2,768.79	2,473.96
Multilateral Operations	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
CO ₂ Emissions from Biomass	16,514.85	16,641.90	15,141.52	16,799.68	17,618.70	18,447.90	18,437.02	20,275.50	20,492.97	20,145.07	20,146.07	18,254.75

1. Specified emissions from Ammonia Production, Nitric Acid Production, and Soda Ash Production and Use are Confidential. These emissions are reported in Table 10a5 as Confidential emissions reported as CO₂-e.

2. Greenhouse sinks credits are accounted for in 2008–12 only. The values provided are only an indicative estimate of sequestration in reforestation activities.

TABLE 1 EMISSIONS TRENDS (CH₄)—KYOTO ACCOUNTING
(Sheet 2 of 6)

Australia
2001
Submission 2003

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Base Year											
	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
(Gt)												
Total Emissions	5,746.84	5,714.09	5,664.52	5,607.08	5,542.95	5,602.44	5,594.18	5,700.44	5,780.28	5,765.86	5,897.63	5,916.91
1. Energy	1,197.86	1,173.98	1,225.86	1,186.31	1,174.69	1,290.37	1,279.15	1,321.40	1,405.04	1,298.78	1,361.00	1,301.18
A. Fuel Combustion (Sectoral Approach)	113.77	113.77	117.87	119.16	117.66	115.84	114.03	115.57	111.08	108.47	105.10	98.41
1. Energy Industries	1.90	1.92	2.06	2.06	2.09	2.25	2.29	2.70	5.03	7.47	9.17	9.08
2. Manufacturing Industries and Construction	1.55	1.53	1.47	1.58	1.63	1.76	1.78	2.36	2.43	2.43	2.46	2.33
3. Transport	26.25	25.74	26.02	26.64	27.43	28.42	29.43	30.39	31.23	31.58	31.58	30.03
4. Other Sectors	84.03	86.11	88.32	88.84	87.46	83.36	80.47	78.06	72.33	66.93	61.83	56.93
5. Other	0.05	0.04	0.04	0.04	0.05	0.05	0.06	0.06	0.06	0.05	0.05	0.05
B. Fugitive Emissions from Fuels	1,084.09	1,038.65	1,108.00	1,067.14	1,057.04	1,174.53	1,165.12	1,205.83	1,293.96	1,190.31	1,255.90	1,202.76
1. Solid Fuel	753.16	760.91	791.41	791.02	777.46	832.39	846.98	865.54	954.70	903.33	935.15	878.36
2. Oil and Natural Gas	330.93	297.75	316.59	276.12	279.58	342.14	318.14	340.28	339.25	286.99	320.76	324.40
2. Industrial Processes	2.85	2.63	2.89	3.01	3.32	3.42	3.43	3.37	3.60	3.36	2.90	2.76
A. Mineral Products	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
B. Chemical Industry	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
C. Metal Production	2.85	2.63	2.89	3.01	3.32	3.42	3.43	3.37	3.60	3.36	2.90	2.76
D. Other Production	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
E. Production of Halocarbons and SF ₆												
F. Consumption of Halocarbons and SF ₆												
G. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
3. Solvent and Other Product Use	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
4. Agriculture	3,578.97	3,589.60	3,522.37	3,471.66	3,411.52	3,412.97	3,417.62	3,470.68	3,481.74	3,553.24	3,631.21	3,707.88
A. Enteric Fermentation	3,212.78	3,212.78	3,224.01	3,095.01	3,023.12	2,996.53	2,987.38	3,012.87	3,017.06	3,056.58	3,071.22	3,104.98
B. Manure Management	71.82	71.81	73.22	76.12	78.71	79.64	80.53	83.88	87.91	89.93	91.05	91.10
C. Rice Cultivation	23.36	24.94	25.53	28.51	28.87	30.89	33.44	34.38	34.50	31.94	35.30	35.14
D. Agricultural Soils	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
E. Prescribed Burning of Savannas	262.24	260.34	251.59	262.23	271.68	296.36	306.04	327.82	329.98	362.62	421.13	464.05
F. Field Burning of Agricultural Residues	8.77	8.50	8.66	9.29	9.15	9.55	10.33	11.73	12.29	12.17	12.52	12.63
G. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
5. Land Use, Land-Use Change and Forestry	262.24	227.26	184.37	201.29	211.55	173.18	163.00	162.87	155.92	152.80	133.47	119.00
A. Afforestation and reforestation	262.24	227.26	184.37	201.29	211.55	173.18	163.00	162.87	155.92	152.80	133.47	119.00
B. Land use change (deforestation)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
6. Waste	704.92	720.62	729.02	744.81	741.86	722.51	731.00	742.12	735.98	757.68	769.05	786.10
A. Solid Waste Disposal on Land	648.73	663.71	671.42	686.63	683.07	663.00	670.70	681.08	672.20	695.17	705.75	721.94
B. Waste-water Handling	56.19	56.91	57.61	58.17	58.79	59.51	60.29	61.04	61.77	62.51	63.30	64.16
C. Waste Incineration	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
D. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
7. Other (please specify)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Memo Items:												
International Bankers	0.13	0.13	0.11	0.11	0.13	0.16	0.16	0.16	0.14	0.15	0.16	0.15
Aviation	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.03	0.03	0.03	0.03
Marine	0.11	0.11	0.09	0.09	0.14	0.14	0.14	0.13	0.12	0.12	0.13	0.12
Multilateral Operations	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
CO₂ Emissions from Biomass												

TABLE 1 EMISSIONS TRENDS (N₂O)—KYOTO ACCOUNTING
(Sheet 3 of 6)

Australia
2001
Submission 2003

GREENHOUSE GAS SOURCE AND SINK CATEGORIES		Base year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
			(Gg)											
Total Emissions		76.01	76.01	77.17	76.97	79.78	81.87	83.17	84.09	89.27	93.49	99.28	106.08	109.99
1. Energy		7.95	7.95	8.85	9.65	10.55	11.44	12.39	13.22	14.02	15.00	15.88	16.79	17.16
A. Fuel Combustion (Sectoral Approach)		7.84	7.84	8.75	9.55	10.44	11.35	12.29	13.12	13.95	14.90	15.80	16.71	17.07
1. Energy Industries		1.41	1.41	1.47	1.50	1.49	1.51	1.55	1.61	1.72	1.92	1.95	1.97	2.03
2. Manufacturing Industries and Construction		0.68	0.68	0.66	0.60	0.67	0.68	0.74	0.75	0.80	0.81	0.82	0.79	0.74
3. Transport		5.49	5.49	6.35	7.18	8.01	8.89	9.72	10.49	11.16	11.90	12.77	13.69	14.05
4. Other Sectors		0.24	0.24	0.25	0.25	0.26	0.26	0.25	0.25	0.25	0.24	0.24	0.23	0.23
5. Other		0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
B. Fugitive Emissions from Fuels		0.12	0.12	0.11	0.11	0.10	0.09	0.09	0.10	0.07	0.11	0.07	0.09	0.09
1. Solid Fuel		NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
2. Oil and Natural Gas		0.12	0.12	0.11	0.11	0.10	0.09	0.09	0.10	0.07	0.11	0.07	0.09	0.09
2. Industrial Processes		0.09	0.09	0.09	0.07	0.07	0.08	0.08	0.08	0.08	0.08	0.08	0.07	0.07
A. Mineral Products		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
B. Chemical Industry ⁽¹⁾		C	C	C	C	C	C	C	C	C	C	C	C	C
C. Metal Production		0.09	0.09	0.09	0.07	0.07	0.08	0.08	0.08	0.08	0.08	0.08	0.07	0.07
D. Other Production		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
E. Production of Halocarbons and SF ₆		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
F. Consumption of Halocarbons and SF ₆		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
G. Other		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
3. Solvent and Other Product Use		NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
4. Agriculture		64.25	64.25	64.77	64.12	65.89	66.97	67.62	67.77	72.13	75.41	80.33	86.35	90.00
A. Enteric Fermentation		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
B. Manure Management		1.70	1.70	1.88	2.07	2.32	2.56	2.65	2.71	2.82	3.14	3.37	3.60	3.68
C. Rice Cultivation		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
D. Agricultural Soils		48.84	48.84	49.29	48.90	49.83	50.21	49.50	49.06	52.17	55.01	58.04	60.84	62.21
E. Prescribed Burning of Savannas		13.42	13.42	13.33	12.88	13.45	13.91	15.17	15.66	16.78	16.89	18.56	21.55	23.75
F. Field Burning of Agricultural Residues		0.28	0.28	0.27	0.27	0.29	0.30	0.31	0.33	0.36	0.36	0.36	0.36	0.36
G. Other		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
5. Land Use, Land-Use Change and Forestry		2.17	2.17	1.88	1.52	1.66	1.75	1.43	1.35	1.35	1.29	1.26	1.10	0.98
A. Afforestation and reforestation		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
B. Land use change (deforestation)		2.17	2.17	1.88	1.52	1.66	1.75	1.43	1.35	1.35	1.29	1.26	1.10	0.98
6. Waste		1.56	1.56	1.58	1.60	1.61	1.63	1.65	1.67	1.69	1.71	1.73	1.75	1.78
A. Solid Waste Disposal on Land		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
B. Waste-water Handling		1.56	1.56	1.58	1.60	1.61	1.63	1.65	1.67	1.69	1.71	1.73	1.75	1.78
C. Waste Incineration		NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
D. Other		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
7. Other (please specify)		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
NA		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Memo Items:														
International Bankers		0.19	0.19	0.19	0.19	0.20	0.22	0.25	0.26	0.26	0.28	0.29	0.30	0.31
Aviation		0.13	0.13	0.13	0.14	0.15	0.16	0.17	0.19	0.19	0.22	0.22	0.22	0.24
Marine		0.06	0.06	0.05	0.05	0.05	0.06	0.07	0.08	0.07	0.06	0.07	0.08	0.07
Multilateral Operations		NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
CO₂ Emissions from Biomass														

1. Speciated emissions from Ammonia Production, Nitric Acid Production, and Soda Ash Production and Use are Confidential. These emissions are reported in Table 10:5 as Confidential emissions reported as CO₂-e.

TABLE 1 EMISSION TRENDS (HFCs, PFCs and SF₆)—KYOTO ACCOUNTING
(Sheet 4 of 6)

Australia
2001
Submission 2003

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Base year ⁽¹⁾	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
	(Gg)												
Emissions of HFCs – CO ₂ equivalent (Gg)	1,126.27	1,126.27	1,126.27	1,053.94	1,446.59	936.01	977.42	602.54	907.09	1,311.25	1,694.44	2,084.83	2,344.90
HFC-23	0.10	0.10	0.10	0.09	0.12	0.07	0.06	NO	NO	NO	NO	NO	NO
HFC-32	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
HFC-41	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
HFC-43-10mee	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
HFC-125	NE	NE	NE	NE	NE	0.02	0.03	0.05	0.05	0.06	0.07	0.08	0.08
HFC-134	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
HFC-134a	NE	NE	NE	NE	NE	0.00	0.05	0.22	0.42	0.69	0.94	1.19	1.39
HFC-152a	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
HFC-143	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
HFC-143a	NE	NE	NE	NE	NE	0.02	0.03	0.05	0.06	0.07	0.07	0.09	0.08
HFC-227ea	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
HFC-236fa	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
HFC-245ea	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
Emissions of PFCs – CO ₂ equivalent (Gg)	3,938.28	3,938.28	3,941.47	3,935.10	2,833.07	1,847.57	1,309.06	1,205.39	1,050.67	1,396.99	981.99	1,103.21	1,527.04
CF ₄	NE	0.51	0.51	0.51	0.37	0.24	0.17	0.16	0.14	0.18	0.13	0.14	0.20
C ₂ F ₆	NE	0.07	0.07	0.07	0.05	0.03	0.02	0.02	0.02	0.02	0.02	0.02	0.03
C ₃ F ₈	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
C ₄ F ₁₀	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
e-C ₄ F ₈	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
C ₃ F ₁₂	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
C ₆ F ₁₄	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
Emissions of SF ₆ – CO ₂ equivalent (Gg)	NE	NE	NE	NE	NE	NE	NE	8.60	5.98	3.66	3.59	2.39	NE
SF ₆	NE	NE	NE	NE	NE	NE	NE	0.00	0.00	0.00	0.00	0.00	NE

Chemical	GWP
HFCs	
HFC-23	11700
HFC-32	650
HFC-41	150
HFC-43-10mee	1300
HFC-125	2800
HFC-134	1000
HFC-134a	1300
HFC-152a	140
HFC-143	300
HFC-143a	3800
HFC-227ea	2900
HFC-236fa	6300
HFC-245ca	560
PFCs	
CF ₄	6500
C ₂ F ₆	9200
C ₃ F ₈	7000
C ₄ F ₁₀	7000
e-C ₄ F ₈	8700
C ₃ F ₁₂	7500
C ₆ F ₁₄	7400
SF ₆	23900

1. Australia is yet to decide whether a 1990 or 1995 baseline will be used for synthetic greenhouse gases under the Kyoto Protocol. The 1990 estimates are included to enable indicative trends analysis only.

TABLE 1 EMISSION TRENDS (SUMMARY)—KYOTO ACCOUNTING
(Sheet 5 of 6)

Australia
2001
Submission 2003

GREENHOUSE GAS EMISSIONS	Base year: ⁽¹⁾										
	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Net CO ₂ emissions/removals	392,052.93	369,139.29	353,775.32	359,671.28	366,200.84	362,703.02	368,015.82	371,040.36	394,097.06	390,006.23	382,921.79
CO ₂ emissions (without LUCF)	277,860.61	278,599.68	282,044.54	285,510.75	291,315.73	301,038.02	310,858.22	318,169.85	334,478.37	344,148.95	348,983.64
Confidential emissions reported as CO ₂ -e ⁽²⁾	1,732.00	1,593.44	1,715.43	1,726.78	1,859.71	1,816.93	1,970.11	1,958.03	2,132.86	2,019.63	2,076.35
CH ₄	120,683.63	119,995.91	118,954.84	117,748.60	116,402.00	117,651.32	117,477.87	119,709.18	121,385.91	121,083.12	123,850.20
N ₂ O	23,562.63	23,921.80	23,859.45	24,731.98	25,378.71	25,782.83	26,067.00	27,673.90	28,982.27	30,776.96	32,883.79
HFCs	1,126.27	1,126.27	1,053.94	1,446.59	936.01	977.42	602.54	907.09	1,311.25	1,694.44	2,084.83
PFCs	3,938.28	3,938.28	3,935.10	2,833.07	1,847.57	1,309.06	1,205.39	1,050.67	1,394.99	981.99	1,103.21
SF ₆	NE	NE	NE	NE	NE	NE	8.60	5.98	3.66	3.59	2.39
Total (with net CO ₂ emissions/removals)	543,095.75	519,718.18	505,294.07	508,158.28	512,624.84	510,240.58	515,347.34	522,345.21	549,310.01	546,565.96	544,922.57
Total (without CO ₂ from LUCF)	428,903.42	430,178.57	431,563.28	433,997.76	437,739.73	448,575.58	458,189.74	469,474.70	489,691.32	500,708.69	510,984.41

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Base year										
	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
1. Energy	286,243.09	288,115.39	294,137.40	296,986.38	300,915.69	313,362.45	323,134.50	331,587.72	349,674.62	356,777.21	364,009.32
2. Industrial Processes	26,121.36	25,625.94	23,430.11	22,797.63	23,352.73	22,796.32	22,554.85	22,678.20	23,887.35	24,345.77	24,095.12
3. Solvent and Other Product Use	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
4. Agriculture	95,074.37	95,460.91	93,847.46	93,330.48	92,402.82	92,635.93	92,777.66	95,245.64	96,494.49	99,519.86	103,025.26
5. Land Use, Land-Use Change and Forestry	120,371.03	94,894.21	78,074.86	78,903.27	79,869.64	65,745.38	60,998.06	56,707.93	63,292.40	49,457.46	37,082.87
6. Waste	15,285.90	15,621.73	15,804.24	16,140.52	16,083.95	15,700.50	15,882.27	16,125.72	15,961.15	16,465.66	16,709.99
7. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

1. Australia is yet to decide whether a 1990 or 1995 baseline will be used for synthetic greenhouse gases under the Kyoto Protocol. The 1990 estimates are included to enable indicative trends analysis only.
2. Includes confidential emissions of CO₂ from Ammonia Production (2B1) and Soda Ash Production and Use (2A4), and N₂O from Nitric Acid Production (2B2).

TABLE 1 EMISSIONS TRENDS (CO₂e)—KYOTO ACCOUNTING
(Sheet 6 of 6)

Australia
2001
Submission 2003

GREENHOUSE GAS SOURCE AND SINK CATEGORIES		Base year ⁽¹⁾	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
			(Gg)											
1. Energy		286,243.09	286,243.09	288,115.39	294,137.40	296,986.38	300,915.69	313,362.45	323,134.50	331,587.72	349,674.62	356,777.21	364,009.32	368,971.79
A. Fuel Combustion (Sectoral Approach)		257,478.85	257,478.85	260,105.15	264,995.26	268,607.11	273,116.90	282,953.04	293,385.71	301,195.07	317,179.36	326,023.91	331,120.30	336,761.08
1. Energy Industries		142,283.89	142,283.89	145,792.61	149,020.09	150,296.69	151,362.82	157,335.68	163,881.70	170,033.76	185,479.71	189,873.98	193,195.15	198,987.82
2. Manufacturing Industries and Construction		37,628.27	37,628.27	37,066.87	36,923.72	37,383.32	38,888.87	39,436.62	40,584.96	40,153.22	40,525.77	43,907.13	42,886.28	42,313.57
3. Transport		61,979.86	61,979.86	61,586.86	62,966.05	64,401.43	66,098.47	68,978.19	71,581.10	73,158.36	74,592.28	77,000.89	77,000.89	77,246.68
4. Other Sectors		14,325.20	14,325.20	14,443.22	14,827.69	15,321.11	15,386.62	15,789.98	15,812.35	16,303.08	16,380.01	16,411.29	16,755.24	16,852.52
5. Other		1,261.63	1,261.63	1,215.59	1,257.71	1,294.56	1,380.12	1,412.58	1,525.59	1,546.64	1,326.59	1,239.23	1,282.74	1,360.48
B. Fugitive Emissions from Fuels		28,764.25	28,764.25	28,010.24	29,142.15	28,289.27	27,798.79	30,409.41	29,748.79	30,392.65	32,995.26	30,753.30	32,889.02	32,210.71
1. Solid Fuel		15,816.36	15,816.36	15,979.04	16,619.63	16,611.41	16,326.61	17,480.17	17,786.50	18,176.44	20,048.78	18,969.85	19,638.07	18,445.52
2. Oil and Natural Gas		12,947.88	12,947.88	12,031.20	12,522.52	11,677.86	11,472.19	12,929.24	11,962.29	12,216.22	12,446.49	11,783.44	13,250.95	13,765.20
2. Industrial Processes		26,121.36	26,121.36	25,625.94	23,430.11	22,797.63	23,352.73	22,796.32	22,554.85	22,678.20	23,887.35	24,345.77	24,095.12	24,916.24
A. Mineral Products		4,763.45	4,763.45	4,477.14	4,299.14	4,507.25	5,210.39	5,008.05	5,076.15	5,008.60	5,433.39	5,355.99	5,150.78	5,099.94
B. Chemical Industry		1,732.00	1,732.00	1,593.44	1,715.43	1,726.78	1,859.71	1,816.93	1,970.11	1,958.03	2,132.86	2,019.63	2,076.35	2,754.06
C. Metal Production		18,499.64	18,499.64	18,429.10	16,361.61	15,117.02	15,346.62	14,993.92	14,897.44	14,798.30	15,006.19	15,272.13	14,780.76	14,717.35
D. Other Production		NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
E. Production of Halocarbons and SF ₆		1,126.27	1,126.27	1,126.27	1,053.94	1,446.59	811.70	718.85	NO	NO	NO	NO	NO	NO
F. Consumption of Halocarbons and SF ₆		NE	NE	NE	NE	NE	124.31	258.57	611.15	913.07	1,314.91	1,698.03	2,087.22	2,344.90
G. Other		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
3. Solvent and Other Product Use		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
4. Agriculture		95,074.37	95,074.37	95,460.91	93,847.46	93,330.48	92,402.82	92,635.93	92,777.66	95,245.64	96,494.49	99,519.86	105,025.26	105,766.47
A. Enteric Fermentation		67,468.47	67,468.47	67,704.15	66,430.81	64,995.27	63,485.50	62,927.20	62,732.85	63,270.17	63,338.32	64,188.14	64,495.65	65,204.54
B. Manure Management		2,035.60	2,035.60	2,092.34	2,179.13	2,318.67	2,445.89	2,492.60	2,531.81	2,636.94	2,821.01	2,932.97	3,027.60	3,053.71
C. Rice Cultivation		490.50	490.50	523.78	536.08	598.63	606.24	648.74	702.28	722.05	724.47	670.72	741.34	737.90
D. Agricultural Soils		15,140.27	15,140.27	15,280.50	15,159.54	15,446.11	15,564.23	15,345.53	15,209.67	16,174.12	17,054.53	17,993.55	18,860.84	19,285.67
E. Prescribed Burning of Savannas		9,667.99	9,667.99	9,598.03	9,275.25	9,685.99	10,015.91	10,925.88	11,282.61	12,085.87	12,652.26	13,368.67	15,525.68	17,108.16
F. Field Burning of Agricultural Residues		271.55	271.55	262.12	266.65	285.82	285.05	296.50	318.43	356.30	370.90	365.81	374.14	376.49
G. Other		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
5. Land Use, Land-Use Change and Forestry		120,371.03	120,371.03	94,894.21	78,074.86	78,903.27	79,869.64	65,745.38	60,998.06	56,707.93	63,292.40	49,457.46	37,082.87	25,888.16
A. Afforestation and reforestation ⁽²⁾		0.00	0.00	-453.15	-928.64	-1,402.26	-1,752.32	-2,296.77	-2,948.58	-4,190.35	-5,589.02	-7,110.32	-10,177.06	-11,128.14
B. Land use change (deforestation)		120,371.03	120,371.03	95,347.36	79,003.50	80,305.54	81,621.96	68,042.15	63,946.64	60,898.28	68,881.42	56,567.78	47,259.93	37,016.30
6. Waste		15,285.90	15,285.90	15,621.73	15,804.24	16,140.52	16,083.95	15,700.50	15,882.27	16,125.72	15,961.15	16,465.66	16,709.99	17,075.34
A. Solid Waste Disposal on Land		13,623.32	13,623.32	13,937.81	14,099.77	14,419.29	14,344.40	13,922.98	14,084.77	14,302.69	14,116.30	14,598.63	14,820.66	15,160.68
B. Waste-water Handling		1,662.58	1,662.58	1,683.92	1,704.47	1,721.23	1,739.55	1,760.69	1,783.97	1,806.09	1,827.72	1,849.54	1,873.02	1,898.35
C. Waste Incineration		NE	NE	NE	NE	NE	NE	16.83	13.53	16.94	17.13	17.49	16.30	16.30
D. Other		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
7. Other (please specify)		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
NA		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total Emissions/Removals with LUCF		543,095.75	543,095.75	519,718.18	505,294.07	508,158.28	512,624.84	510,240.58	515,347.34	522,345.21	549,210.01	546,565.96	544,922.57	542,618.01
Total Emissions without LUCF		422,724.72	422,724.72	424,823.97	427,219.21	429,255.01	432,755.19	444,495.20	454,349.28	465,637.28	486,017.61	497,108.51	507,839.69	516,729.85
Memo Items:														
International Bankers		6,461.40	6,461.40	6,438.86	6,646.42	7,053.59	7,435.31	8,613.12	9,115.69	9,105.41	9,562.31	9,844.63	10,194.71	10,725.41
Aviation		4,385.62	4,385.62	4,562.49	4,840.41	5,247.80	5,403.82	5,912.32	6,370.59	6,561.81	7,300.53	7,336.08	7,399.42	8,227.70
Marine		2,075.79	2,075.79	1,876.37	1,806.01	1,805.78	2,031.49	2,700.80	2,745.10	2,543.60	2,261.79	2,508.55	2,795.29	2,497.71
Multilateral Operations		NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
CO₂ Emissions from Biomass		16,514.85	16,514.85	16,641.90	15,141.52	16,799.68	17,618.70	18,447.90	18,437.02	20,275.30	20,492.97	20,145.07	20,146.07	18,254.75

1. Australia is yet to decide whether a 1990 or 1995 baseline will be used for synthetic greenhouse gases under the Kyoto Protocol. The 1990 estimates are included to enable indicative trends analysis only.
2. Greenhouse sinks credits are accounted for in 2008–12 only. The values provided are only an indicative estimate of sequestration in reforestation activities.

PART D

2001 METHODOLOGY SUPPLEMENTS

Workbook for Fuel Combustion Activities (Stationary Sources), Workbook 1.1, 2001 Supplement

*Workbook for Fugitive Fuel Emissions (Fuel Production, Transmission, Storage and Distribution),
Workbook 2.1, 2001 Supplement*

Workbook for Transport (Mobile Sources), Workbook 3.1, 2001 Supplement

Workbook for Industrial Emissions, Workbook 7.1, 2001 Supplement

WORKBOOK FOR FUEL COMBUSTION ACTIVITIES (STATIONARY SOURCES)

Workbook 1.1 2001 Supplement

1 INTRODUCTION

There are a number of changes to the methodology for the 2001 National Greenhouse Gas Inventory. These changes relate to:

- revision of emission factors
- methodology changes
- reallocation of emissions between sectors.

2 REVISED EMISSION FACTORS

2.1 Amalgamation of mobile equipment emission factors

The Australian Bureau of Agricultural and Resource Economics (ABARE) provide the main source of activity data for the Stationary Energy sector. Previously ABARE undertook further analysis of the Fuel and Electricity survey data to separate the energy used in mobile equipment in the stationary combustion sector. In previous Inventory years there were 36 instances of mobile source activity in the sector (Table 1). Since 2001, ABARE are no longer able to provide separate data on mobile equipment.

With separate activity data no longer available, the technology weighted non-CO₂ emission factors have been recalculated to integrate the mobile equipment (see Appendix C). The technology weightings were based on the 1997 activity levels—the most recent year that equipment share was recalculated. For each category and fuel that included mobile activity, for the four gases CH₄, NO_x, CO and NMVOC, the amalgamated emission factor is calculated as:

$$AmalgamatedEF = \frac{Mobile(Activity \times EF) + Stationary(Activity \times EF)}{TotalActivity}$$

Table 1. Category and fuels previously including mobile source activities

Category	Fuel
Agriculture, Forestry, Fishing	Aviation gasoline, ADO
11 Coal Mining	ADO
12 Oil and Gas Mining	ADO, Petroleum products nec
14 All other mining	ADO
21 Food, beverages, tobacco	ADO, Natural gas, IDF
22 Textiles, Clothing, Footwear	LPG
23-24 Wood, paper and printing	ADO, LPG
253 Basic Chemicals	ADO, LPG
254-256 Other chemical, rubber and plastic	ADO, LPG
252 Petroleum and coal products nec	ADO, LPG
262 Ceramics	ADO, LPG
263 Cement, lime plaster and concrete	ADO, LPG
264 Non-metallic mineral products nec	ADO, LPG
2711 (part) Rest of Basic Iron and Steel	ADO, LPG
272-273 Basic non-ferrous metals	ADO, LPG
274-276 Other metal products	ADO, LPG, Natural gas
28 Machinery and equipment	ADO, LPG
37 Water, sewerage and drainage	ADO
Div. E Construction	ADO
65-67 Other Transport, Services and Storage	Natural gas

2.2 Residential wood heating (1A4b)

Residential firewood use in Australia is substantial, with about 15% of households choosing firewood as their main heating fuel and a further 7% using it for secondary heating. Approximately 4.5 million tonnes of firewood is burnt annually in the residential sector. The proportion of households choosing firewood as their main heating fuel peaked in the early 1990s and has decreased slowly since then. New appliances, with lower emissions of some greenhouse gas species, came on the market in the early 1990s and they have gradually been replacing older, non-certified heater models. Poor user behaviour, which significantly increases emissions of pollutants, has been the target of education campaigns and, in the past few years, programs are aimed specifically at households with excessive visible smoke. This has led to improved appliance use.

In the past, US EPA emission factors have been used to estimate wood heater emissions in the absence of any Australian based emissions factors. A recent characterisation of emissions from solid-fuel-burning appliances (Gras *et al.* 2002) has provided the basis for the development of an Australian-specific methodology for emission estimation from residential wood-heating.

The new methodology was developed to provide a time series of residential wood heater emission factor under Australian conditions (Todd 2003). The revised set of emission factors are given in Table 2 below. The improved approach incorporates factors such as appliance type and certification, wood type and moisture content and user behaviour. The methodology is summarised in the algorithm below:

$$E_{k,n} = F_n \times S \times W \times fn_k \{ \sum_l PEF_n \}$$

Where:

$E_{k,n}$ = emission of greenhouse gas k in year n

F_n = amount of fuel combusted (i.e. firewood use) in year n

S = softwood use correction factor

W = wet wood correction factor

fn_k = formula linking the greenhouse gas emission factor for gas k to the particulate emission factor.

PEF_n = weighted particulate emission factor for year n , which is summed over the mix of appliances and operator behaviour for that year, with $l = 1$ to 8

l(1) certified woodheater correctly operated

l(2) certified woodheater carelessly operated

l(3) certified woodheater very badly operated

l(4) non-certified woodheater correctly operated

l(5) non-certified woodheater carelessly operated

l(6) non-certified woodheater very badly operated

l(7) masonry open fireplace

l(8) factory built (metal) open fireplace

Table 2. Residential biomass emission factors

Inventory Year	Greenhouse Gas Emission Factor (Mg/PJ)						
	CO ₂	CH ₄	N ₂ O	CO	NO _x	NMVOC	SO ₂
1990	70373.9	1100.1	2.3	11751.6	16.9	1393.5	1.1
1991	70423.4	1097.4	2.3	11731.9	16.9	1390.1	1.1
1992	70472.9	1094.7	2.3	11712.3	17.0	1386.7	1.1
1993	70934.9	1069.7	2.3	11528.9	17.3	1355.0	1.1
1994	71703.1	1028.2	2.2	11224.1	17.9	1302.3	1.1
1995	72453.2	987.6	2.2	10926.4	18.4	1250.9	1.1
1996	73185.3	947.9	2.1	10635.8	18.9	1200.7	1.1
1997	73899.3	909.3	2.1	10352.5	19.5	1151.8	1.1
1998	75031.0	848.1	2.0	9903.4	20.3	1074.2	1.1
1999	76117.5	789.3	1.9	9472.2	21.1	999.7	1.1
2000	77158.8	732.9	1.9	9058.9	21.8	928.4	1.1
2001	78155.0	679.0	1.8	8663.6	22.5	860.1	1.1

3 METHODOLOGY CHANGES

3.1 Other (1A5) – lubricants

Since the 1998 Inventory a quantity of recycled lubricating oil (5.43 PJ) had been added to the activity data for the Lubricants subsector. It was assumed that recycled oil was used as a burner fuel and hence this amount was added to the net Lubricants and greases subsector. It is now considered that this results in double counting as the recycled oil is used as fuel oil and is already accounted for in the other sectors of ABARE's Fuel and Electricity Survey. The erroneous addition of recycled lubricating oil has been removed in recalculations for all effected inventory years.

4 REALLOCATION OF EMISSIONS BETWEEN SECTORS

4.1 Iron and steel (1A2a)

The methodology for estimating emissions arising out of the use of reductants (coke and natural gas) in iron and steel production remains unchanged, however, these emissions are now reported in the Industrial Processes Metal Production subsector 2C1.

5. REFERENCES

- Gras, J., Meyer, C., Weeks, I., Gillett, R., Galbally, I., Todd, J., Carnovale, F., Joynt, R., Hinwood, A., Berko, H. and Brown, S. (2002) *Emissions from Domestic Solid Fuel Burning Appliances*, Technical Report No. 5, Environment Australia, Canberra. (available at www.ea.gov.au/atmosphere/airtoxics)
- Todd, J.J (2003) *Estimating Greenhouse Gas Emissions from Residential Firewood Use Australia 1989/90 to 2000/01*, Report for Energy Strategies Pty Ltd and the Australian Greenhouse Office, Eco-Energy Options.

APPENDIX A—NATURAL GAS EMISSION FACTORS

Table A.1. Natural gas CO₂ emission factors, 2000 and 2001^(a)

Pipeline	Combustion (kg CO ₂ /GJ)	Weighted state average (QLD, WA):
Longford, Melbourne (Victoria)	51.0	
Moomba, Sydney, Adelaide (NSW, SA)	50.8	
Roma, Brisbane (Qld)	51.6	51.1
Denison Trough, Gladstone (Qld)	50.3	
Dampier, Perth (WA)	52.2	52.2
Dongarra, Perth (WA)	51.4	
Amadeus, Darwin (NT)	51.9	
Australia (weighted average)	51.4	

(a) In previous years, emission factors for both combustion and fugitive natural gas emissions have been calculated from pipeline gas composition data, published by the Australian Gas Association. However, as from 2001 the Association no longer collect this data from its members. Approaches made directly to the major natural gas producers and suppliers throughout Australia where unsuccessful with the exception of one major supplier in WA. As no other sources of 2001 data were available, it was assumed that all natural gas emission factors for 2001 were unchanged from 2000.

APPENDIX B—EMISSION FACTORS FOR ELECTRICITY GENERATION

Table B.1. CO₂ emission factors and oxidation factors power stations 2000–2001

Power Station	State	Fuel	Gg CO ₂ /PJ		Oxidation factor
			Main fuel	Oil	
Bayswater (a)	NSW	black coal	92.31	73.60	100%
Eraring (a)	NSW	black coal	88.30	73.60	100%
Mt Piper (a)	NSW	black coal	88.72	68.94	100%
Liddell (a)	NSW	black coal	89.70	70.15	100%
Munmorah (a)	NSW	black coal	90.13	70.32	100%
Vales Point (a)	NSW	black coal	89.98	68.79	100%
Wallerawang (a)	NSW	black coal	85.78	68.94	100%
Appin/Tower (a)	NSW	waste gas	51.40	-	99.5%
Smithfield (a)	NSW	natural gas	51.40	-	100%
Redbank (a)	NSW	black coal	92.00	73.60	100%
Hazelwood (a)	Vic	brown coal	94.00	-	98%
Loy Yang A (a)	Vic	brown coal	92.50	-	99%
Loy Yang B (a)	Vic	brown coal	94.40	-	99%
Morwell (a)	Vic	brown coal	92.10	78.80	99%
Yallourn (a)	Vic	brown coal	94.27	78.80	99%
Anglesea	Vic	brown coal	98.80	-	99%
Yarra (b)(c)	Vic	natural gas	51.00	-	99.5%
Jeeralang A & B (b)	Vic	natural gas	50.60	78.8	99.5%
Callide (b)	Qld	black coal	94.60	70.10	99%
Gladstone (b)	Qld	black coal	92.10	70.10	99%
Stanwell (b)	Qld	black coal	90.80	44.90	99%
Swanbank (b)	Qld	black coal	83.50	70.10	99%
Tarong (b)	Qld	black coal	89.70	55.30	99%
Mica Creek (b)	Qld	natural gas	51.40	-	99.5%
Muja A/B (a)	WA	black coal	93.80	73.60	99%
Muja C/D (a)	WA	black coal	93.80	73.60	99%
Bunbury (a)	WA	black coal	93.80	-	99%
Kwinana A (a)	WA	black coal	93.80	-	99%
Kwinana C (a)	WA	black coal	93.80	-	99%
Collie (a)	WA	black coal	93.80	73.60	99%
Kwinana B (a)	WA	natural gas	51.80	-	99.5%
Kwinana GT (a)	WA	natural gas	52.50	-	99.5%
Geraldton (a)	WA	natural gas	52.50	-	99.5%
Kalgoorlie (a)	WA	natural gas	52.50	69.7	99.5%
Mungarra (a)	WA	natural gas	52.50	-	99.5%
Pinjar (a)	WA	natural gas	52.50	69.7	99.5%
TIWest (a)	WA	natural gas	51.80	-	99.5%
Worsley (a)	WA	natural gas	52.50	-	99.5%

Table B.1. CO₂ emission factors and oxidation factors power stations 2000–2001 (continued)

Power Station	State	Fuel	Gg CO ₂ /PJ		Oxidation factor
			Main fuel	Oil	
Northern (a)	SA	brown coal	96.40	73.60	99%
Torrens Island (a)	SA	natural gas	50.80	73.6	99.5%
Osborne (a)	SA	natural gas	50.80	-	99.5%
Ladbroke Grove (a)	SA	natural gas	50.80	-	99.5%
Bell Bay (b)	Tas	fuel oil	73.60	-	99%
Channel Island (a)	NT	natural gas	51.40	-	99.5%

(a) Personal communication with power station operating companies. (b) Value from previous year retained as default (c) Yarra previously operated as Newport

Table B.4. Emission factors for non-CO₂ greenhouse gases for main fuel used in major thermal power stations in operation 2000–2001 (Mg/PJ)

Power Station	State	Equipment Type	Fuel	Emission factor Mg/PJ					
				CH ₄	N ₂ O	NO _x	CO	NMVOC	SO ₂
Bayswater	NSW	PW	black coal	0.9	0.8	220	11	1.7	370
Eraring	NSW	PW	black coal	0.9	0.8	220	11	1.7	370
Mt Piper	NSW	PW	black coal	0.9	0.8	220	11	1.7	370
Liddell	NSW	TF	black coal	0.9	0.8	260	11	1.7	370
Munmorah	NSW	TF	black coal	0.9	0.8	221	11	1.7	370
Vales Point	NSW	TF	black coal	0.9	0.8	260	11	1.7	370
Wallerawang	NSW	TF	black coal	0.9	0.8	260	11	1.7	370
Hazelwood	Vic	TF	brown coal	0.5	1.4	151	14	1.7	150
Loy Yang A	Vic	TF	brown coal	0.5	1.4	136	18	1.7	150
Loy Yang B	Vic	TF	brown coal	0.7	1.4	136	11.7	1.7	509
Morwell	Vic	TF	brown coal	0.5	1.4	151	14	1.7	150
Yallourn	Vic	TF	brown coal	0.5	1.4	106	20	1.7	150
Yarra (b)	Vic	GB	natural gas	0.1	0.1	97	35	0.6	150
Jeeralang A&B (a)	Vic	GT	natural gas	5.4	0.1	130	29	0.6	2.3
Callide	Qld	PW	black coal	0.9	0.8	469	11	1.7	370
Gladstone	Qld	PW	black coal	0.9	0.8	523	11	1.7	370
Stanwell	Qld	PW	black coal	0.7	0.8	316	9	1.7	377
Swanbank	Qld	PW	black coal	0.9	0.8	127	11	1.7	370
Tarong (a)	Qld	PW	black coal	0.9	0.8	411	13	1.7	261
Mica Creek	Qld	GT	natural gas	8.0	0.1	190	46	2.4	2.3
Muja A/B	WA	PW	black coal	0.9	0.8	462	11	1.7	370
Muja C/D	WA	TF	black coal	0.9	0.8	306	11	1.7	370
Bunbury	WA	PW	black coal	0.9	0.8	462	11	1.7	370
Kwinana A	WA	PW	black coal	1.0	0.3	320	11	1.0	370
Kwinana C	WA	TF	black coal	1.0	0.3	258	11	1.0	370
Collie (a)	WA	TF	black coal	0.9	0.8	462	11	1.7	370
Kwinana B	WA	GB	natural gas	0.1	0.1	226	16	0.6	2.3
Kwinana GT	WA	GT	natural gas	8.0	0.1	190	46	2.4	2.3
Geraldton	WA	GT	natural gas	8.0	0.1	190	46	2.4	2.3
Kalgoorlie	WA	GT	natural gas	8.0	0.1	190	46	2.4	2.3
Mungarra	WA	GT	natural gas	8.0	0.1	190	46	2.4	2.3
Pinjar	WA	GT	natural gas	8.0	0.1	190	46	2.4	2.3
TiWest	WA	GT	natural gas	8.0	0.1	190	46	2.4	2.3
Worsley	WA	GB	natural gas	0.1	0.1	226	16	0.6	2.3
Northern	SA	PW	brown coal	0.9	1.4	136	17	1.7	150
Torrens Island	SA	GB	natural gas	0.1	0.1	117	6	0.6	2.3
Osborne	SA	GT	natural gas	8.0	0.1	190	46	2.4	2.3
Ladbroke Grove	SA	GT	natural gas	8.0	0.1	190	46	2.4	2.3
Bell Bay	Tas	Boiler	fuel oil	0.8	0.6	186	14	2.1	1390
Channel Island	NT	GT	natural gas	8.0	0.1	190	46	2.4	2.3

(a) One or more factors changed from previous year, or new power station added (b) Yarra previously operated as Newport

Notes: Abbreviations for equipment types are: GB Gas Boiler, GT Gas Turbine, IC Internal Combustion, PW Pulverised Wall and TF Tangentially Fired

APPENDIX C—EQUIPMENT WEIGHTED SECTORIAL EMISSION FACTORS FOR NON-CO₂ GASES

Equipment weighted sectorial emission factors for all non-CO₂ gases to be used for the 1999 and all subsequent Inventories are listed in Table C.1 below.

Table C.1. Equipment weighted sectorial emission factor for non-CO₂ gases

Category—Fuel	Equipment Weighted Emission Factor Mg/PJ					
	CH ₄	N ₂ O	CO	NO _x	NMVOC	SO ₂
Agriculture, forestry, fishing						
LPG	1.3	0.6	14.0	154.0	0.5	2.3
Aviation gasoline	8.6	0.6	476.0	1306.0	163.0	8.2
Power kerosene	1.3	0.6	14.0	154.0	0.5	57.0
Heating oil	1.3	0.6	14.0	154.0	0.5	57.0
ADO	8.6	0.6	476.0	1,306.0	163.0	57.0
Natural gas	1.1	0.1	8.5	41.0	2.2	2.3
11 Coal mining						
Black coal	1.1	1.4	97.1	154.0	1.0	370.0
LPG	0.1	0.6	13.0	154.0	5.0	2.3
ADO	3.6	0.6	221.4	1166.3	70.0	57.0
Fuel oil	0.1	0.6	13.0	154.0	5.0	1282.1
1103 Briquette manufacturing						
Brown coal	1.3	0.8	105.0	287.0	1.0	150.0
12 Oil and gas mining						
LPG	4.0	0.6	349.0	1322.0	45.0	2.3
ADO	3.8	0.6	254.6	1234.8	67.4	57.0
Petroleum products nec	4.0	0.6	346.8	1320.0	45.5	57.0
Natural gas	7.3	0.1	42.7	176.3	2.3	2.3
14 All other mining						
Black coal	1.0	0.8	78.0	493.0	1.0	370.0
Coke	1.0	0.8	78.0	493.0	1.0	370.0
Coal byproducts	3.9	0.1	28.0	122.6	1.6	370.0
LPG	1.1	0.6	44.8	330.9	0.8	2.3
Aviation turbine fuel	1.1	0.6	44.8	330.9	0.8	8.2
Heating oil	1.1	0.6	44.8	330.9	0.8	57.0
ADO	3.7	0.6	226.2	1190.4	71.1	57.0
IDF	1.1	0.6	44.8	330.9	0.8	57.0
Fuel oil	0.8	0.6	44.8	330.9	0.8	1282.1
Petroleum products nec	1.1	0.6	44.8	330.9	0.8	57.0
Natural gas	1.1	0.1	14.0	86.2	1.1	2.3
21 Food, beverages, tobacco						
Black coal	1.3	0.8	105.9	207.1	1.0	370.0
Brown coal	1.3	0.8	105.9	207.1	1.0	150.0
Coal byproducts	1.2	0.1	13.6	42.9	1.1	370.0
Brown coal briquettes	1.3	0.8	105.9	207.1	1.0	150.0
Wood, woodwaste	4.2	4.1	680.0	75.0	6.8	NA
Bagasse	9.3	4.1	1625.0	84.0	16.3	NA
LPG	0.6	0.6	13.2	154.2	0.6	2.3

Category—Fuel	Equipment Weighted Emission Factor Mg/PJ					
	CH ₄	N ₂ O	CO	NO _x	NMVOC	SO ₂
ADO	4.9	0.6	329.1	868.2	90.6	57.0
IDF	5.5	0.6	375.5	973.2	103.9	57.0
Fuel oil	0.6	0.6	13.2	154.2	0.6	1282.1
Petroleum products nec	0.6	0.6	13.2	154.2	0.6	57.0
Natural gas	1.1	0.1	11.0	49.5	1.7	2.3
Town gas	1.2	0.1	13.5	58.0	1.1	2.3
22 Textile, clothing, footwear and leather						
Black coal	1.3	0.8	105.0	287.0	1.0	370.0
Brown coal briquettes	1.3	0.8	105.0	287.0	1.0	150.0
LPG	7.5	0.6	1810.1	248.4	135.2	2.3
ADO	0.4	0.6	13.6	155.7	0.6	57.0
IDF	0.4	0.6	13.6	155.7	0.6	57.0
Fuel oil	0.4	0.6	13.6	155.7	0.6	1282.1
Petroleum products nec	0.4	0.6	13.6	155.7	0.6	57.0
Natural gas	1.2	0.1	13.7	58.0	1.1	2.3
Town gas	1.2	0.1	13.7	58.0	1.1	2.3
23–24 Wood, paper and printing						
Black coal	1.3	0.8	105.0	287.0	1.0	370.0
Brown coal	1.3	0.8	105.0	287.0	1.0	150.0
Brown coal briquettes	1.3	1.4	105.0	287.0	1.0	150.0
Wood, woodwaste	4.2	4.1	680.0	75.0	6.8	NA
LPG	1.1	0.6	212.7	165.8	15.5	2.3
Heating oil	0.3	0.6	13.5	155.6	0.6	57.0
ADO	5.7	0.6	390.0	1006.0	108.0	57.0
Fuel oil	0.3	0.6	13.5	155.6	0.6	1282.1
Petroleum products nec	0.3	0.6	13.5	155.6	0.6	57.0
Natural gas	1.2	0.1	13.8	58.4	1.1	2.3
253 Basic chemicals						
Black coal	1.3	0.8	105.0	287.0	1.0	370.0
Coke	1.3	0.8	105.0	287.0	1.0	370.0
Coal byproducts	1.3	0.8	105.0	287.0	1.0	370.0
Brown coal briquettes	1.3	0.8	105.0	287.0	1.0	150.0
LPG	5.8	0.6	1303.1	487.0	93.9	2.3
ADO	1.0	0.6	77.0	505.0	1.6	57.0
IDF	1.0	0.6	75.0	501.7	0.9	57.0
Fuel oil	1.0	0.6	75.0	501.7	0.9	1282.1
Petroleum products nec	1.0	0.6	75.0	501.7	0.9	57.0
Natural gas	1.1	0.1	41.8	492.6	1.1	2.3
Town gas	1.1	0.1	41.8	492.6	1.1	2.3
LESS SEQUESTERED						
from ethane	1.1	0.1	41.8	492.6	1.1	2.3
from petroleum products	1.0	0.6	75.0	501.7	0.9	57.0
254–256 Other chemicals, rubber and plastic						
Black coal	1.3	0.8	105.0	287.0	1.0	370.0
Brown coal briquettes	1.3	0.8	105.0	287.0	1.0	150.0
LPG	6.8	0.6	1581.0	465.8	115.2	2.3
ADO	1.1	0.6	84.6	500.2	5.6	57.0
IDF	0.9	0.6	70.6	477.0	0.9	57.0

Category—Fuel	Equipment Weighted Emission Factor Mg/PJ					
	CH ₄	N ₂ O	CO	NO _x	NMVOC	SO ₂
Fuel oil	0.9	0.6	70.6	477.0	0.9	1282.1
Natural gas	1.2	0.1	22.4	190.6	1.1	2.3
251 Petroleum refining						
Petroleum products nec	0.8	0.6	54.0	383.8	0.8	NA
Natural gas	1.1	0.1	56.6	722.9	1.1	NA
252 Petroleum and coal products nec						
Brown coal	1.0	1.4	77.1	488.5	1.0	150.0
Coal byproducts	1.0	0.8	77.1	488.5	1.0	370.0
Brown coal briquettes	1.0	0.8	77.1	488.5	1.0	150.0
LPG	1.5	0.6	294.5	281.9	20.2	2.3
Lighting kerosene	0.5	0.6	34.5	274.1	0.7	57.0
ADO	4.4	0.6	301.1	823.0	81.2	57.0
IDF	0.5	0.6	34.5	274.1	0.7	57.0
Fuel oil	0.5	0.6	34.5	274.1	0.7	1282.1
Natural gas	1.1	0.1	21.3	199.0	1.1	2.3
261 Glass and glass products						
LPG	1.0	0.6	75.0	502.0	0.9	2.3
ADO	1.0	0.6	75.0	502.0	0.9	57.0
IDF	1.0	0.6	75.0	502.0	0.9	57.0
Fuel oil	1.0	0.6	75.0	502.0	0.9	1282.1
Natural gas	1.0	0.1	75.0	1010.0	1.1	2.3
262 Ceramics						
Black coal	1.0	0.8	75.0	502.0	1.0	370.0
Brown coal	1.0	0.8	75.0	502.0	1.0	150.0
Brown coal briquettes	1.0	0.8	75.0	502.0	1.0	150.0
Wood, woodwaste	4.2	4.1	680.0	75.0	6.8	NA
LPG	8.2	0.6	1932.7	474.1	141.6	2.3
ADO	5.7	0.6	390.0	1006.0	108.0	57.0
IDF	1.0	0.6	73.5	493.7	0.9	57.0
Fuel oil	1.0	0.6	73.5	493.7	0.9	1282.1
Petroleum products nec	1.0	0.6	73.5	493.7	0.9	57.0
Natural gas	1.0	0.1	74.5	1002.1	1.1	2.3
Town gas	1.0	0.1	74.5	1002.1	1.1	2.3
263 Cement, lime, plaster and concrete						
Black coal	1.0	0.8	75.7	500.0	1.0	370.0
Brown coal briquettes	1.0	1.4	75.7	500.0	1.0	150.0
Wood, woodwaste	4.2	4.1	680.0	75.0	6.8	NA
LPG	21.7	0.6	5398.1	435.6	404.0	2.3
Lighting kerosene	0.9	0.6	43.5	322.8	0.9	57.0
Heating oil	0.9	0.6	43.5	322.8	0.9	57.0
ADO	5.3	0.6	359.9	946.6	98.7	57.0
IDF	0.9	0.6	43.5	322.8	0.9	57.0
Fuel oil	0.9	0.6	43.5	322.8	0.9	1282.1
Petroleum products nec	0.9	0.6	43.5	322.8	0.9	57.0
Solvents	0.9	0.6	43.5	322.8	0.9	57.0
Natural gas	1.0	0.1	61.8	815.5	1.1	2.3

Category—Fuel	Equipment Weighted Emission Factor Mg/PJ					
	CH ₄	N ₂ O	CO	NO _x	NMVOC	SO ₂
264 Non-metallic mineral products nec						
Black coal	1.1	0.8	80.0	466.5	1.0	370.0
Coke	1.1	0.8	80.0	466.5	1.0	370.0
LPG	19.7	0.6	4884.1	441.3	365.1	2.3
ADO	5.7	0.6	390.0	1,006.0	108.0	57.0
Fuel oil	0.4	0.6	70.6	477.1	0.9	1282.1
Petroleum products nec	0.4	0.6	70.6	477.1	0.9	57.0
Natural gas	0.9	0.1	67.8	900.1	1.1	2.3
2711 & 2520 (parts) Coke Ovens						
Black coal	1.0	0.8	201.0	287.0	1.0	370.0
Coal byproducts	1.0	0.8	36.7	287.0	1.0	370.0
Fuel oil	1.0	0.6	75.0	502.0	0.9	1282.1
2711 (part) Rest of Basic Iron and Steel						
Black coal	1.1	0.8	82.2	450.5	1.0	370.0
Coke	1.1	0.8	82.2	450.5	1.0	370.0
Coal byproducts	1.1	0.1	36.7	274.0	1.0	370.0
Wood, woodwaste	4.2	4.1	680.0	75.0	6.8	NA
LPG	22.0	0.5	5465.0	437.0	409.0	2.3
ADO	2.5	0.5	175.5	553.6	43.3	57.0
Fuel oil	0.4	0.5	34.7	256.6	0.9	1282.1
Natural gas	0.9	0.1	68.2	914.6	1.1	2.3
Town gas	0.9	0.1	68.2	914.6	1.1	2.3
272–273 Basic non-ferrous metals						
Black coal	1.2	0.8	103.6	316.9	1.0	370.0
Coke	1.2	0.8	103.6	316.9	1.0	370.0
Wood, woodwaste	4.2	4.1	680.0	75.0	6.8	NA
LPG	8.5	0.6	1798.9	340.4	133.2	2.3
Power kerosene	2.0	0.6	38.5	294.0	0.8	57.0
ADO	5.2	0.6	341.0	906.7	93.0	57.0
IDF	2.0	0.6	38.5	294.0	0.8	57.0
Fuel oil	2.0	0.6	38.5	294.0	0.8	1282.1
Petroleum products nec	2.0	0.6	38.5	294.0	0.8	57.0
Natural gas	1.1	0.1	43.6	519.2	1.1	2.3
274–276 Other metal products						
Black coal	1.3	0.8	105.0	157.0	1.0	370.0
LPG	22.0	0.6	5465.0	437.0	409.0	2.3
ADO	1.4	0.6	103.6	547.8	10.6	57.0
IDF	1.0	0.6	75.0	502.0	0.9	57.0
Natural gas	1.1	0.1	8.5	41.0	2.2	2.3
Town gas	1.0	0.1	70.9	949.5	1.1	2.3
28 Machinery and equipment						
Black coal	1.3	0.8	105.0	287.0	1.0	370.0
Brown coal briquettes	1.3	0.8	105.0	287.0	1.0	150.0
LPG	21.1	0.6	5242.0	435.6	392.2	2.3
Heating oil	0.7	0.6	57.3	402.6	0.8	57.0

Category—Fuel	Equipment Weighted Emission Factor Mg/PJ					
	CH ₄	N ₂ O	CO	NO _x	NMVOC	SO ₂
ADO	2.8	0.6	194.3	651.0	44.9	57.0
IDF	0.7	0.6	57.3	402.6	0.8	57.0
Fuel oil	0.7	0.6	57.3	402.6	0.8	1282.1
Natural gas	1.1	0.1	44.9	542.2	1.1	2.3
Town gas	1.1	0.1	44.9	542.2	1.1	2.3
29 Other manufacturing						
Black coal	1.3	0.8	105.0	157.0	1.0	370.0
LPG	0.2	0.6	20.3	100.6	0.5	2.3
ADO	0.2	0.6	20.3	100.6	0.5	57.0
IDF	0.2	0.6	20.3	100.6	0.5	57.0
Natural gas	1.1	0.1	20.3	189.3	1.1	2.3
362 Gas production and distribution						
Natural gas	8.0	0.1	46.0	190.0	2.4	2.3
Town gas	8.0	0.1	46.0	190.0	2.4	2.3
37 Water, sewerage and drainage						
Lighting kerosene	0.1	0.6	13.0	154.0	0.5	57.0
ADO	5.7	0.6	390.0	1,006.0	108.0	57.0
Natural gas	1.2	0.1	14.0	58.0	1.1	2.3
Div. E Construction						
LPG	1.0	0.6	15.0	160.0	0.3	2.3
Lighting kerosene	1.0	0.6	15.0	160.0	0.3	57.0
ADO	5.7	0.6	389.7	1005.4	107.9	57.0
Fuel oil	1.0	0.6	15.0	160.0	0.3	1282.1
Natural gas	1.0	0.1	10.0	58.0	0.3	2.3
Div.F,G Wholesale and Retail Trade						
Wood, woodwaste	3.4	4.1	330.0	75.0	5.6	NA
LPG	0.6	0.6	13.1	53.2	0.9	2.3
ADO	0.6	0.6	13.1	53.2	0.9	57.0
IDF	0.6	0.6	13.1	53.2	0.9	57.0
Fuel oil	0.6	0.6	13.1	53.2	0.9	1282.1
Natural gas	1.1	0.2	15.6	42.3	2.8	2.3
Town gas	1.1	0.2	15.6	42.3	2.8	2.3
62 Railway transport						
Natural gas	1.6	0.1	16.0	39.0	3.1	2.3
65–67 Other Transport, services and storage						
LPG	0.6	0.6	13.0	53.0	1.0	2.3
ADO	0.6	0.6	13.0	53.0	0.9	57.0
IDF	0.6	0.6	13.0	53.0	0.9	57.0
Natural gas	7.8	0.1	45.5	187.9	2.4	2.3
Div. J Communication						
Heating oil	0.6	0.6	13.0	53.0	0.9	57.0
ADO	0.6	0.6	13.0	53.0	0.9	57.0
IDF	0.6	0.6	13.0	53.0	0.9	57.0
Fuel oil	0.6	0.6	13.0	53.0	0.9	1282.1
Natural gas	1.1	0.1	8.5	41.0	2.2	2.3
Div. K,L Finance, insurance, property and busines						
Natural gas	1.1	0.1	8.5	41.0	2.2	2.3

Category—Fuel	Equipment Weighted Emission Factor Mg/PJ					
	CH ₄	N ₂ O	CO	NO _x	NMVOC	SO ₂
Div. M Government administration and defence						
Black coal	1.3	0.8	105.0	287.0	1.0	370.0
Brown coal briquettes	1.3	0.8	105.0	287.0	1.0	150.0
Wood, woodwaste	4.2	4.1	680.0	75.0	6.8	NA
LPG	0.4	0.6	13.0	84.4	0.8	2.3
Heating oil	0.4	0.6	13.0	84.4	0.8	57.0
ADO	0.4	0.6	13.0	84.4	0.8	57.0
IDF	0.4	0.6	13.0	84.4	0.8	57.0
Fuel oil	0.4	0.6	13.0	84.4	0.8	1282.1
Natural gas	1.1	0.1	10.3	46.6	1.8	2.3
Town gas	1.1	0.1	10.3	46.6	1.8	2.3
Div. N,O Education, health and community services						
Black coal	1.3	0.8	105.0	287.0	1.0	370.0
Brown coal briquettes	1.3	0.8	105.0	287.0	1.0	150.0
Wood, woodwaste	4.2	4.1	680.0	75.0	6.8	NA
LPG	0.4	0.6	13.0	53.0	0.7	2.3
Lighting kerosene	0.4	0.6	13.0	53.0	0.7	57.0
Heating oil	0.4	0.6	13.0	53.0	0.7	57.0
ADO	0.4	0.6	13.0	53.0	0.7	57.0
IDF	0.4	0.6	13.0	53.0	0.7	57.0
Fuel oil	0.4	0.6	13.0	53.0	0.7	1282.1
Natural gas	1.1	0.1	10.4	44.8	1.8	2.3
Town gas	1.1	0.1	10.4	44.8	1.8	2.3
Div. H,P,Q Accommodation, cultural and personal						
Black coal	1.3	0.8	105.0	287.0	1.0	370.0
Wood, woodwaste	3.4	4.1	330.0	19.0	5.6	NA
LPG	0.6	0.6	13.0	53.0	0.9	2.3
Aviation gasoline	0.6	0.6	13.0	53.0	0.9	8.2
Aviation turbine fuel	0.6	0.6	13.0	53.0	0.9	8.2
Heating oil	0.6	0.6	13.0	53.0	0.9	57.0
ADO	0.6	0.6	13.0	53.0	0.9	57.0
Fuel oil	0.6	0.6	13.0	53.0	0.9	1282.1
Natural gas	1.1	0.1	9.7	44.8	2.0	2.3
Residential						
Black coal	105.0	0.8	5753.0	190.0	209.0	370.0
Brown coal briquettes	105.0	0.8	5753.0	190.0	209.0	150.0
Wood, woodwaste ^(a)	679.0	1.8	8663.6	22.5	860.1	1.1
LPG	4.7	0.6	13.0	48.0	1.9	2.3
Lighting kerosene	4.7	0.6	13.0	48.0	1.9	57.0
Heating oil	4.7	0.6	13.0	48.0	1.9	57.0
ADO	4.7	0.6	13.0	48.0	1.9	57.0
Natural gas	1.6	0.1	16.0	39.0	3.1	2.3
Town gas	1.6	0.1	16.0	39.0	3.1	2.3

(a) The residential biomass CH₄ emission factor listed is the value used for the 2001 Inventory. Emission factors for other years are listed in section 3 Revised emission factors, above.

**WORKBOOK FOR FUGITIVE FUEL EMISSIONS
(FUEL PRODUCTION, TRANSMISSION, STORAGE AND
DISTRIBUTION)**

**Workbook 2.1
2001 Supplement**

1 INTRODUCTION

This supplement describes the changes to the methodology for Fugitive Fuel (1B) emissions and provides the updated coal production data and emission factors natural gas composition used in compiling the 2001 Inventory.

2 CATEGORISATION OF UNDERGROUND COAL MINES (1B1A)

Emissions from underground mines were recalculated from 1994 onwards in response to the reclassification of the North Goonyella underground coal mine from Class B (non Gassy) to Class A (Gassy). A full listing of categorised mines is provided in Tables 1 and 2.

Table 1. Categorised list of New South Wales underground mines

CLASS A MINES	CLASS B MINES
Appin	Angus Place
Bellambi West	Avon
Brimstone	Awaba
Coal Cliff	Baal Bone
Cooranbong	Berrima
Dartbrook	Bloomfield
Endeavour	Blue Mountains
Cordeaux	Cayon
Gunnedah	Chain Valley
Huntley	Charbon
Kemira	Clarence
Lambton	Cumnock No. 1 (formerly Liddell State)
Lemington No. 1	Elouera (formerly Nebo and Wongawilli)
Metropolitan	Glennies Creek
Munmorah	Great Greta
Myuna (150 m. seam)	Invincible
Nattai	Ivanhoe
Newstan	Kandos No. 3
Newvale No. 1	Liddell
Newvale No. 2	Moonee
Oakdale	Muswellbrook No. 2
South Bulga	Nardell
Tahmoor	New Wallend No. 2 (formerly Gretley)
Teralba	Southland (formerly Pelton/Ellalong)
Tower	Preston Extended
Wambo	Springvale
West Cliff	Ulan
West Wallsend	United
Wyee	Wallarrah
	Western Main

Table 2. Categorised list of Queensland underground mines

CLASS A MINES	CLASS B MINES
Alliance	Bocum
German Creek Central	Bowen No. 2
Moura	Burgowan
North Goonyella	Cook
Oaky Creek No. 1	Crinium
	German Creek Southern
	Gordonstone
	Kenmare
	Kestral
	Laleham No. 1
	M.W. Haencke No. 2
	Moranbar North
	New Hill
	New Hope W. Leases No. 2
	Newlands
	Oakleigh No. 3
	Oaky North
	Rhondda No. 1
	South Blackwater No. 1

3 REVISION OF EMISSION FACTORS AND PRODUCTION DATA

Table 3. Annual production of raw coal by mine category (thousand tonnes)

Mine Category and Location	2000–2001
NSW Class A	31,456
QLD Class A	9,004
TOTAL Class A	40,460
NSW Class B	22,262
QLD Class B	29,317
Underground—TAS	420
Total Class B	51,999
Open Cut—NSW	85,060
Open Cut—QLD	134,562
Underground—WA	0
Open Cut—TAS	48
Open Cut—WA	6,193
Open Cut—SA	3,160

Table 4. Natural Gas Composition and Emission Factors, 2000 and 2001^(a)

Pipeline	Longford, Melbourne (Victoria)	Moomba, Sydney, Adelaide (NSW, SA)	Roma, Brisbane (Qld)	Denison Trough, Gladstone (Qld)	Dampier, Perth (WA)	Dongarra, Perth (WA)	Amadeus, Darwin (NT)	Australia (weighted average)
Kg CO ₂ /GJ (content)	0.9	0.8	0.8	0.7	1.0	1.5	0.0	0.8783
Kg CH ₄ /GJ (content)	15.5	15.6	15.0	16.0	13.9	16.2	12.6	14.9
Kg NMVOC/GJ (content)	2.5	2.4	3.2	1.8	4.3	1.8	5.8	3.2
Weighted state averages:								
Kg CO ₂ /GJ (content)			0.8		1.1			
Kg CH ₄ /GJ (content)			15.1		14.3			
Kg NMVOC/GJ (content)			3.1		3.9			

(a) In previous years, emission factors for both combustion and fugitive natural gas emissions have been calculated from pipeline gas composition data, published by the Australian Gas Association. However, as from 2001 the Association no longer collect this data from its members. Approaches made directly to the major natural gas producers and suppliers throughout Australia where unsuccessful with the exception of one major supplier in WA. As no other sources of 2001 data were available, it was assumed that all natural gas emission factors for 2001 were unchanged from 2000.

4 REFERENCES

Coal Services Pty Ltd and Queensland Department of Natural Resources & Mines (2002) *Australian Black Coal Statistics 2001*. Coal Services Pty Ltd and Queensland Department of Natural Resources & Mines, Brisbane.

Australian Gas Association (2001) *Gas Statistics Australia 2001*. Australian Gas Association, Canberra.

**WORKBOOK FOR TRANSPORT
(MOBILE SOURCES)**

WORKBOOK 3.1

2001 SUPPLEMENT

1 Non-carbon dioxide exhaust emissions from petrol passenger vehicles

In the Workbook for Transport (Mobile Sources), Workbook 3.1 (NGGIC 1996), petrol passenger vehicles are split according to year of manufacture into the following classes:

- (j=1) post-1985
- (j=2) 1976–1985
- (j=3) pre-1976

However, during 1997 and 1998, a new Australian Design Rule ADR 37/01 was introduced to regulate exhaust and evaporative emissions from new petrol passenger vehicles and light commercial vehicles up to 2.7 tonnes gross vehicle mass. Hence, the following year classes should now be used to estimate emissions from petrol passenger vehicles:

- (j=1) post-1997
- (j=2) 1986–1997
- (j=3) 1976–1985
- (j=4) pre-1976

The methodology to calculate petrol consumption and emission factors are the same as that in Workbook 3.1, except that two year classes post-1997 and 1986–1997 are used instead of post-1985. Table 1 lists the deterioration rates and zero-kilometre emissions that should be used to estimate emission factors for petrol passenger vehicles. This table supersedes Table A.3 in Workbook 3.1 Revision 1.

The evaporative emission limits for ADR 37/00 and ADR 37/01 are the same and so the methodology in Workbook 3.1 Revision 1 still applies for estimating evaporative emissions.

Table 1. Passenger Vehicle Emission Factors

Passenger Vehicle Age Class	CH ₄	N ₂ O ^(a)	CO	NO _x	NM VOC
Zero kilometre level emissions ZKL_{ijk} (g/km)					
Post-1997 ^(b)	0.0154	0.122	0.869	0.225	0.0765
1986–1997 ^(c)	0.0520	0.0480	5.46	0.930	0.258
1986–1997 ^(d)	0.0580	0.122	3.85	0.450	0.289
1976–1985	0.0950	0.00370	14.9	1.40	1.26
Pre 1976	0.143	0.00370	24.0	2.46	2.28
Deterioration rate DR_{ij} (kg/km/VKT)					
Post-1997 ^(e)	8.78×10^{-7}		7.82×10^{-5}	8.91×10^{-6}	3.86×10^{-6}
1986–1997 ^(c)	1.55×10^{-6}		1.57×10^{-4}	7.81×10^{-6}	7.77×10^{-6}
1986–1997 ^(d)	8.78×10^{-7}		7.82×10^{-5}	8.91×10^{-6}	3.86×10^{-6}
1976–1985	4.70×10^{-7}		1.27×10^{-4}	6.48×10^{-6}	7.46×10^{-6}
Pre-1976	6.30×10^{-7}		1.45×10^{-4}	0	9.97×10^{-6}

(a) Values listed for N₂O are emission factors $FE(l)_{2ijk}$, which are assumed to be independent of accumulated VKT.

(b) The average of the 1986–1997 values for 2-way and 3-way catalysts are multiplied by the ratio of emission standards (EA 2000). N₂O is assumed to be the same as 1986–1997 3-way catalytic vehicles as post-1997 vehicles predominantly use 3-way catalysts.

(c) 2-way catalyst

(d) 3-way catalyst

(e) Assumed to be the same as 1986–1997 3-way catalytic vehicles (EA 2000).

2 References

EA (2000) *Emissions Estimation Technique Manual for Aggregated Emissions from Motor Vehicles, Version 1.0*, National Pollutant Inventory, Environment Australia, Canberra.

NGGIC (1996) *Australian Methodology for the Estimation of Greenhouse Gas Emissions and Sinks, Workbook for Transport (mobile sources) 3.1*, National Greenhouse Gas Inventory Committee, Australian Greenhouse Office, Canberra.

WORKBOOK FOR INDUSTRIAL EMISSIONS

Workbook 7.1 2001 Supplement

1 Introduction

There are a number of changes to the methodology for the 2001 National Greenhouse Gas Inventory. These changes are a consequence of:

- revision of emission factors
- the need to protect commercial-in-confidence data
- Inclusion of HFCs from refrigeration and airconditioning equipment.

2 Change in emission factors

2.1 Aluminium Production

The Australian aluminium industry has revised estimates of PFC emissions following implementation of the IPCC Good Practice report. This resulted in changes to the average emission factors for CF₄ and C₂F₆ from 1990.

Table 1. Emission factors (kg/t aluminium) for CF₄ and C₂F₆ from aluminium production

Year	CF₄	C₂F₆
1989–90	0.414	0.054
1990–91	0.414	0.054
1991–92	0.414	0.054
1992–93	0.283	0.037
1993–94	0.174	0.023
1994–95	0.132	0.017
1995–96	0.118	0.015
1996–97	0.098	0.013
1997–98	0.114	0.015
1998–99	0.076	0.010
1999–00	0.082	0.011
2000–01	0.111	0.014

3 Confidential data

3.1 Soda Ash Production and Use

Emissions from soda ash production and use are now confidential because production data are confidential. These emissions are relatively small and are included as part of the total CO₂-e emissions from confidential subsectors. Confidential subsectors comprise ammonia production, nitric acid production, and soda ash production and use. Although soda ash production and use are not confidential for years prior to 1999, in the trends analysis they have been allocated to the confidential subsectors for all years (1990 to 2001) so as not to distort comparisons of 1990 totals with 2001 totals.

4 HFCs production and consumption

HCFC-22 was only produced in Australia from 1990 to 1995. The IPCC Tier 1 default methodology and default emission factor (4%) are used to estimate emissions of HFC-23 from the production of HCFC-22.

Historic data on the import and use of HFC in Australia is limited. Burnbank Consulting (2002) has made an estimate of HFC emissions from refrigeration and airconditioning using equipment based models that are consistent with IPCC Tier 2a methodologies. The methodologies used are described in full in the Burnbank Consulting (2002) report.

5 References

NGGIC (1998) *Australian Methodology for the Estimation of Greenhouse Gas Emissions and Sinks, Workbook for Industrial Emissions 7.1*, National Greenhouse Gas Inventory Committee, Canberra.

Burnbank Consulting (2002) *Inventories and projections of ozone depleting substances and synthetic greenhouse gases used in Montreal Protocol industries*. Environment Australia, Canberra.