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Australian Greenhouse Office

National Greenhouse Gas Inventory 2003

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This document and supporting methodology workbooks are available on the Internet at the following address:

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

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

http://www.ipcc-nggip.iges.or.jp.

Suggestions and comments would be appreciated. They should be addressed to the Manager, Australian National Greenhouse Gas Inventory, Emissions Analysis Team, Australian Greenhouse Office, Department of Environment and Heritage GPO Box 787, Canberra ACT 2601.

May 2005

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Australia's National Greenhouse Gas Inventory Report 2003 has the dual purpose of providing estimates of Australia's net greenhouse gas emissions for the United Nations Framework Convention on Climate Change (UNFCCC) and of tracking Australia's progress towards its internationally agreed target of limiting emissions to 108% of 1990 levels over the period 2008–2012**.**

Australia is committed, as a party to UNFCCC, to updating and publishing annual national greenhouse gas inventories. Inventories have been produced for each year from 1990 to 2003 inclusive.

The 2003 inventory has been compiled using the methods described in the *Australian Methodology for the Estimation of Greenhouse Gas Emissions and Sinks 2003* series. These are available from the Australian Greenhouse Office website. The Australian methodologies conform with the international guidelines adopted by the UNFCCC. In line with international practice, the methodologies used to estimate Australia's national inventory have been improved over time and will continue to be refined as new information emerges and as international practice evolves.

Emissions Estimates for 2003: Kyoto Accounting

For 2003, Australia's net greenhouse gas emissions were estimated to be 550.0 Mt carbon dioxide-equivalent. This amounts to a 1.4% decrease on net emissions in 2002, largely reflecting decreases in emissions from the land use, land use change and forestry sector and from waste. Australia's net emissions in 2003 were 1.1% above 1990 levels.

The combined *energy* subsectors (*stationary energy*, *transport* and *fugitive emissions* from fossil fuel extraction and distribution) were the largest source of net national emissions, contributing 68.0% of the total. This proportion, while significant, is nonetheless less than in many countries due to the relatively large contribution from the *agriculture* (17.7%) and *land use, land use change* and *forestry* sectors (6.3%) to Australia's inventory. Other relatively minor sources include emissions from *industrial processes*, such as from the manufacture of mineral products, and emissions from *waste disposal*.

Emissions Estimates for 2003: UNFCCC Accounting

Under the accounting provisions of the UNFCCC, which are broader in scope than those of the Kyoto Protocol, Australia's net emissions in 2003 totaled 550.1 Mt. By comparison, net emissions were 555.5 Mt in 2002 and 524.5 Mt in 1990.

Acknowledgements

The following have contributed to the preparation of emission estimates at the sectoral level for the 2003 inventory:

Sector	Consultant	Organisation
Energy	Dr Hugh Saddler George Wilkenfeld Mr Matthew Dudley Mr Steven Oliver	Energy Strategies Pty Ltd George Wilkenfeld and Associates Pty Ltd Australian Greenhouse Office Australian Greenhouse Office
Industrial processes and solvents and waste	Mr Charles Jubb	Burnbank Consulting Pty Ltd
Agricultural	Dr Mick Meyer Ms Penny Reyenga	CSIRO Atmospheric Research Australian Greenhouse Office
Land Use, Land Use Chnage & Forestry	Gary Richards	Australian Greenhouse Office
Waste	Mr Mark Hunstone	Australian Greenhouse Office

National Greenhouse Gas Inventory Committee

Ian Carruthers (Chair)	Australian Government
James Golden	Victoria
Ian Galbally	CSIRO
John Isaac	Tasmania
Gordon Macallister	Australian Capital Territory
Roman Mandyczewsky	Western Australia
Keryn Oude-Egberink	Queensland
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Gisela Lamche	Northern Territory
Tom Whitworth	South Australia

Australian Greenhouse Office

Matthew Dudley
Mark Hunstone
Jeremy O'Keefe
Steven Oliver
Penny Reyenga
Rob Sturgiss

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 perfluorocarbon)
C_2F_6	perfluoroethane (a perfluorocarbon)
CH_4	methane
CO	carbon monoxide
CO_2	carbon dioxide
HFCs	hydrofluorocarbons
N_2O	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_2O = 310	HFC-134a = 1,300
CF_4 = 6,500	HFC-143a =3,800
C_2F_6 = 9,200	SF_6 = 23,900.

Conversion Factors

From element basis to molecular mass	From molecular mass to element basis
$C \rightarrow CO_2$: x 44/12 = 3.67	$CO_2 \rightarrow C$: x 12/44 = 0.27
$C \rightarrow CH_4$: x 16/12 = 1.33	$CH_4 \rightarrow C$: x 12/16 = 0.75
$N \rightarrow N_2O$: x 44/28 = 1.57	$N_2O \rightarrow N$: 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).

UNFCCC or Kyoto Reporting

In general, the estimates presented relate to the accounting provisions of both the Kyoto Protocol and the UNFCCC. However, the estimates from the *land use, land use change and forestry* sector differ under each of the two accounting approaches and, as appropriate, the applicable accounting provision has been identified. Identification of the accounting approach has also been made at the aggregate emission level.

PART A
National Greenhouse Gas Inventory
2003

CHAPTER 1
INTRODUCTION AND INVENTORY CONTEXT

1.1 BACKGROUND INFORMATION ON GREENHOUSE GAS INVENTORIES

Australia's *National Greenhouse Gas Inventory 2003* has the dual purpose of providing estimates of Australia's net greenhouse gas emissions for the United Nations Framework Convention on Climate Change (UNFCCC) and of tracking Australia's progress towards its internationally agreed target of limiting emissions to 108% of 1990 levels over the period 2008–2012.

The *2003 Inventory* covers sources of greenhouse gas emissions and removals by sinks resulting from human (anthropogenic) activities for the major greenhouse gases—carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), perfluorocarbons (PFCs), hydrofluorocarbons (HFCs) and sulphur hexafluoride (SF_6). Also covered in ancillary fashion are the indirect greenhouse gases—carbon monoxide (CO), oxides of nitrogen (NO_X), and non-methane volatile organic compounds (NMVOCs). Sulphur dioxide (SO_2), an aerosol precursor, is also included because emissions of this gas influence global warming.

The *2003 Inventory* has been compiled in accordance with the *Revised 1996 Intergovernmental Panel on Climate Change (IPCC) Guidelines for National Greenhouse Gas Inventories* (IPCC 1997) and the IPCC *Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories* (IPCC 2000) and *Good Practice Guidance on Land Use, Land Use Change and Forestry (2003).* The aim is to ensure that the estimates of emissions are accurate, transparent, consistent through time and comparable with those produced in the inventories of other countries.

The structure of this national inventory report has been organised to conform with UNFCCC reporting guidelines. Part A provides estimates of Australia's total net emissions in 2003 and identifies trends in emissions between 1990 and 2003 for each of the sectors and for the main greenhouse gases. Part A also provides, *inter alia*, details of recalculations of emissions estimates, background on inventory preparation processes; estimation methodologies and data quality in order to facilitate international review and comparisons with the inventories of other countries.

The newly revised UNFCCC Common Reporting Format tables and appendix tables are presented in Part B. The tables include revised emissions estimates for the years 1990 to 2002, reflecting end-of-series averaging effects, some revised data, refinements to some sectoral methodologies and the inclusion of minor additional sources in the industrial process and agricultural sectors.

The emissions trends tables according to the Kyoto accounting provisions are presented in Part C.

1.2 Institutional arrangements

The Australian inventory is supported by a set of institutional arrangements which is designed to facilitate close co-ordination of the compilation of the inventory, efficient emissions data management, broadly based quality assurance processes and secure and reliable data collections.

The compilation of Australia's greenhouse gas inventory is undertaken centrally by the Australian Greenhouse Office (AGO). For this inventory, the AGO has introduced the Australian Greenhouse Emissions Information System (AGEIS) into the inventory production process. This is an important innovation for the Australian inventory. In particular, the AGEIS centralises emissions estimation, inventory compilation, reporting and data storage processes into a single system. It has consolidated Australia's emissions estimation methodologies and fully integrated quality control procedures into the compilation process. The centralisation of the database also facilitates the maintenance of high transparency levels for the inventory, with emissions data from the AGEIS database publicly accessible through a dynamic web interface at www.greenhouse.gov.au/ageis.

Quality assurance processes for the national inventory report are broadly based. A key element of these arrangements is the National Greenhouse Gas Inventory Committee, which comprises representatives of the Australian, State and Territory governments and has been in place since the early 1990s. The Committee is the principal mechanism of review for the report prior to its release. The report is also circulated prior to submission to other Australian government departments and agencies and relevant state experts through the National Greenhouse Gas Inventory Committee.

Originally, expert working groups developed the Australian emission estimation methodologies. Their work has been subsequently reviewed by a wide range of technical experts in research institutions, governments and industry on a rolling basis and in accordance with the AGO's Inventory Improvement Plan. Any resulting modifications or refinements to the methodology are adopted following consultation with the National Greenhouse Gas Inventory Committee.

Reliability of data collection processes is an important consideration for inventory preparation to ensure reliable and time series consistent emissions data. The Australian inventory is well served in this regard. The major sources of activity data are published by key national economic statistics agencies. The Australian Bureau of Statistics (ABS) is the national statistical agency with legislative backing for its collection powers. It is the source of agricultural activity and some energy related data. Energy consumption data are sourced from the Australian Bureau of Agricultural and Resource Economics, which publishes data from a survey of energy use that has operated for 30 years and which are used to fulfill Australia's reporting requirements to the International Energy Agency.

New data collection arrangements have also been put in place for this inventory through agreements with State and Territory government waste agencies to support the provision of data for the estimation of emissions from solid waste disposal. Data to support the estimates of emissions from HFCs, an area of weakness in the past, has also been sourced for the first time from compulsory reporting by importers under the *Ozone Protection and Synthetic Greenhouse Gas Management Act 2003*.

1.3 Brief description of the process of inventory preparation

The UNFCCC guidelines require a brief description of the inventory preparation process. Central to Australia's inventory compilation is the use of the AGEIS. Key steps in the process (with indicative dates in parentheses) include:

1. Activity data collection – conducted annually by a panel of external consultants and by the Australian Greenhouse Office (AGO) (June-December).

2. Activity data entry into the AGEIS - by the AGO through predefined data entry templates (January).

3. Activity data verification and quality control - the AGO uses the AGEIS to systematically report a range of diagnostic statistics on the activity data to facilitate identification and correction of anomalous entries to ensure time-series consistency and consistency across sectoral emissions estimates.

4. A designated analyst records an assessment of the quality of the activity data in the system, where questions arise.

5. The data quality is checked and internally audited by designated AGO staff to provide quality control.

6. Emissions estimation – the AGEIS is used to generate emission estimates for all inventory years using consistent methodologies.

7. Emissions estimates verification – the AGO repeats the range of tests on emissions estimates generated by the AGEIS to ensure time-series consistency and consistency across sectoral emissions estimates and accuracy of recalculations.

8. Checking and internal audit procedures on emission estimates by designated AGO staff to provide QC and QA.

9. Automated population of reporting (CRF) tables (February).

10. The compiled inventory is circulated to Australian Government departments and State and Territory governments for comment prior to public release (March - April).

11. The inventory is available for public release.

The AGEIS is also used to store completed datasets and provides a database of emission estimates and background data that is publicly accessible at www.ageis.greenhouse.gov.au.

1.4 Brief general description of methodologies and data sources

Greenhouse gas emissions are generated from a large number of processes and from a range of often diffuse sources. Emissions are not usually monitored directly but are generally estimated through the application of models and methodologies that link emissions to data on observable activities. The Australian methodology for estimating greenhouse gas emissions and sinks uses a combination of country-specific and IPCC methodologies and emission factors. Australia predominantly uses tier 2 approaches to estimate emissions.[1] These methods are consistent with the *Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories* (IPCC 1997) and are comparable with international practice.

The Australian methodologies have been documented in a series of workbooks to ensure transparency. The 2003 inventory relies on the methodologies described in *Australian Methodology for the Estimation of Greenhouse Gas Emissions and Sinks 2003*. These workbooks should be considered to be part of the National Inventory Report. A subset of the information reported in the *Australian Methodology for the Estimation of Greenhouse Gas Emissions and Sinks 2003* is provided under the sectoral chapters and in Annex 3 of this report.

A summary of key emission factors is provided each year in the Australian Greenhouse Office (AGO) Factors and Methods Workbook and is available, along with a compilation of the current methodology for each sector, from the AGO website at <http://www.greenhouse.gov.au>.

The inventory is prepared using a mix of sources for activity data including published data from national statistical agencies and AGO collections. The principal data sources are set out in Table 1.

Table 1: Principal data sources for the estimation of Australia's inventory

Category (UNFCCC sector)	Principal data sources
Energy sector (1A1, 1A2, 1A4, 1A5)	Australian Bureau of Agricultural and Resource Economics (ABARE), AGO collections
Energy sector (1A3)	ABARE, Australian Transport and Economic Data Centre.
Energy sector (1B)	Coal Services Pty Ltd, Australian Petroleum Exploration Association
Industrial processes (2) and solvents (3) HFCs	AGO collection Australian Government Department of Environment and Heritage
Agriculture (4)	Australian Bureau of Statistics
Land use, land use change and forestry (5)	National Carbon Accounting System, AGO
Waste (6)	State and Territory government waste agencies

Reporting Year

The Australian inventory is reported for Australian fiscal years as key data sources such as the national energy and agricultural statistics obtained from national statistical agencies (the Australian Bureau of Agricultural and Resource Economics and the Australian Bureau of Statistics) are published on this basis. The year 2003 refers to the Australian fiscal year from 1 July 2002 to 30 June 2003, and a similar format is used for other years. Time series

1 An explanation of the 'Tier' concept is provided in the Glossary.

consistency is maintained. The estimates of emissions and removals in the Land Use Change and Forestry sector, where inventory-specific monitoring systems have been put in place, are produced on a calendar year basis.

The use of fiscal year data is consistent with *Good Practice* as the use of these data conforms to the normal practice of Australia's national statistical agencies and leads to more accurate emission estimates.

Relationship between Inventory Rules for the UNFCCC and the Kyoto Protocol

Separate estimates of Australia's net emissions have been compiled according to the inventory reporting requirements of the UNFCCC and of those applying under the Kyoto Protocol.

The UNFCCC requires parties to report on all anthropogenic (human-induced) emissions of greenhouse gases and removals from sinks where adequate data are available. That is, the UNFCCC provides for comprehensive reporting of greenhouse gas sources, sectors and sinks.

The reporting requirements of the Kyoto Protocol in some respects have a more limited scope.

First, inventories prepared under the Kyoto guidelines require reporting of anthropogenic emissions of the six greenhouse gases or groups of gases where GWPs are available (CO_2, CH_4, N_2O, PFCs, HFCs and SF_6) across all sectors. Indirect gases without GWPs, such as CO, are not reported.

Second, the Kyoto Protocol makes provision for countries to choose whether 1990 or 1995 is used as the base year for the synthetic gases (HFCs, PFCs, SF_6), whereas under the UNFCCC emissions of the synthetic gases should be included for all years of the inventory.

Third, the accounting rules for the *land use, land use change and forestry* sector, as set out in Article 3.3 of the Kyoto Protocol, provide for developed countries to account for only a limited set of forestry activities—namely afforestation, reforestation, and deforestation activities that have taken place on land, but only since 1990. Under Article 3.4, countries 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 Kyoto Protocol also establishes a specific approach for the calculation of developed countries' base year estimates in the *land use, land use change and forestry* sector, which in turn provides the basis for a component of each country's 'assigned amount'. Article 3.7 states that countries with a net source of emissions from the *land use change and forestry* sector in 1990 should include emissions from land use change in the baseline used for calculating their assigned amounts. In fact, as this sector was a net source in 1990, the operation of this provision requires Australia to report land use change emissions in the base year, 1990, and for all other years. Consequently, and unlike other *land use change and forestry* activities, the estimates of Australia's emissions from *land use change* (called *deforestation* under the Kyoto protocol) are the same under the accounting provisions of both the UNFCCC and Kyoto Protocol in all years.

1.5 Brief description of key source categories

National greenhouse gas inventory sources and sink categories have been 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, land use change and forestry
6. Waste.

At various places in the inventory, sectors are disaggregated to subsectors (e.g. 1.A. *Fuel combustion*, or 4.D. *Agricultural soils*), and sometimes more detailed disaggregations are provided (e.g. 1.A.3.b. *Road transportation*).

The *Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories* (IPCC 2000, the IPCC *Good Practice* report) 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 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 42 key sources through the level assessment, with an additional three categories identified through the trends assessment. *Public electricity* (solid fuel), *enteric fermentation* (cattle), *forest and grassland conversion* (CO_2) and road transportation (passenger cars) are the most significant of the key source categories—contributing 55% of emissions. More details are provided in Annex 1.

Gases

The National Greenhouse Gas Inventory Report presents emissions for each gas as carbon dioxide equivalents (CO_2-e). As greenhouse gases vary in their radiative activity and in their atmospheric residence time, converting emissions into CO_2-e allows the integrated effect of emissions of the various gases to be compared. The conversion of emission data to CO_2-e is done using the concept of global warming potentials (GWPs).

GWPs represent the relative warming effect (i.e. cumulative radiative forcing[2]) of a unit mass of the gas when compared with the same mass of CO_2 over a specific period. The CO_2-e emissions are calculated by multiplying the 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 international agreement 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 CO_2, 21 for CH_4, 310 for N2O, 6,500 for the PFC perfluoromethane (CF4), 9,200 for the PFC perfluoroethane (C_2F_6), and 23,900 for SF_6).

The indirect effects of a number of gases (e.g. CO, NO_X, and NMVOCs) cannot currently be characterised 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.

1.6 Information on the QA/QC Plan

Australia's QA/QC plan revolves around the central role of the Australian Greenhouse Emissions Information System (AGEIS) in the inventory preparation process. Key tier 1 QA/QC procedures for the inventory compilation process have been systematically built into the operation of the AGEIS. Systematic and auditable checks are undertaken *inter alia* to reduce the risks of errors associated with the input of activity data, missing data, the implementation of estimation methodologies, recalculations and the time series consistency of generated emission estimates (listed as 'AGEIS data verification' checks in Table 2).

These day-to-day operational checks are supported by broader processes. The development phase of the AGEIS project has generated considerable spin-offs for the quality of the Australian inventory. In particular the implementation of emissions estimation methodologies has been comprehensively and meticulously reviewed as part of the process of migration from a fragmented spreadsheet environment to a centralised SQL server environment. The result has been the identification of a number of anomalies in the implementation of estimation methods under the old spreadsheet system, resulting in recalculations to Australia's past emission estimates (which are reported in chapter 10). While sometimes important at an individual variable level, in aggregate the recalculations have not had a significant effect on Australia's overall emissions. Nonetheless, the process has significantly reduced the risk of an important source of both potential errors and time series inconsistencies and has raised the overall quality of the inventory.

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

Table 2: Australian implementation of tier 1 quality control checks

Tier 1 QC activity: Checks *	**Implementation**
Assumptions and criteria for the selection of activity data and emissions factors are documented	*Australian Methodology for the Estimation of Greenhouse Gas Emissions and Sinks 2003*
Transcription errors in data input and reference	AGEIS data verification
Emissions are calculated correctly	AGEIS development phase/ AGEIS data verification
Parameter and emission units are correctly recorded and that appropriate conversion factors are used	AGEIS data verification
Integrity of database files	AGEIS development phase
Consistency in data between source categories	AGEIS data verification
Movement of inventory data among processing steps is correct	AGEIS development phase/ data verification
Uncertainties in emissions and removals are estimated or calculated correctly	On-going review using CSIRO protocols
Review of internal documentation	On going development to link into AGEIS
Methodological and data changes resulting in recalculations	AGEIS data verification
Completeness tasks	AGEIS data verification
Compare estimates to previous estimates	AGEIS data verification

* Source: IPCC 2000, Table 8.1

Tier 2 QA/QC checks are also implemented. Quality control of the activity data is managed by the source agencies. In particular, the Australian Bureau of Statistics (ABS), publishes assessments of data quality and quantitative estimates of sampling errors for the agricultural activity data. Energy activity data are produced by the Australian Bureau of Agricultural and Resource Economics on the basis of its annual Fuel and Electricity Survey, which was recently reviewed and ‘benchmarked’ by the ABS in its role of national statistics co-ordinator. Where the initial collection of activity data is undertaken by external consultants for the AGO, QC checks are required to be performed under the contractual arrangements that apply.

The estimates of uncertainty surrounding emissions data are reported in Annex 7. Consistent with required IPCC tier 1 QC checks, these estimates are currently being reviewed under protocols developed by the Commonwealth Scientific and Industrial Research Organisation Atmospheric Research Division (CSIRO).

Quality assurance functions are performed internally within the AGO and externally through the National Greenhouse Gas Inventory Committee. An important QA function is the ongoing review of estimation methodologies used to compile the Australian inventory. In 2004, detailed reviews of Australia's methodology have been concluded for the solid waste disposal, synthetic gas and the prescribed burning of savannas sectors (all key cateogories) which have led to recalculations of emission estimates (reported in chapter 10). Minor reviews have led to the inclusion of additional sources, such as carbon dioxide emissions from synthetic rutile production, methane emissions from animal wastes in open pasture management conditions and sulphur hexafluouride emissions.

Further methodology reviews will be conducted in 2005 in accordance with the AGO's Inventory Improvement Plan (and as outlined in chapter 10.4). This work will focus on key source categories, sectors where emissions have relatively higher uncertainties attached to them, and where the payoffs in terms of reduced uncertainty for the inventory overall might be expected to be greatest.

The development of this inventory and national inventory report has also taken into account UNFCCC Expert Review processes, which aim to review and improve the quality of all Annex I inventories in an open and facilitative manner on an annual basis. Suggested modifications to the national inventory report and cross cutting issues raised are listed in Table 3.

Table 3: Cross cutting issues for modification identified in previous national inventory reports and by the expert review team

Identified area for improvement [a]	Response
18. Recalculations for refinements to the waste, prescribed burning of savannas and synthetic gas methodologies and new data for the energy and LUCF sectors.	Implemented.
19a Application of the NIR outline as recommended by the UNFCCC guidelines	Implemented
19b Provision of more information on institutional arrangements and QA/QC procedures	Implemented
19c Improvement of completeness	New data is provided in this inventory for the first time for all sources of HFC emissions; emissions from synthetic rutile production, sulphur hexaflouride and methane emissions from free range cattle and sheep under the manure management category.
19d Inclusion of more information on methods applied from the Australian Methodology Workbooks	See Annex 3. The complete series *Australian Methodology for the Estimation of Greenhouse Gas Emissions and Sinks 2003* has also been submitted as part of the NIR submission.
19e Provision of the Energy sector reference approach calculations for the years 1990-1999.	Reference approach tables for 1990 have been reported.
Inclusion of LUCF CRF sectoral background data tables	Implemented

[a] UNFCCC, 2005, 'Report of the Individual Review of the Greenhouse Gas Inventory Submitted in the year 2004: Australia', UNFCCC expert review team (paragraphs 18, 19).

Proper documentation is a critical component of the QA/QC plan. Activity data entered into AGEIS is labelled and traceable to its source. For the 2002 inventory, Australia's methodologies were documented in a comprehensive series *Australian Methodology for the Estimation of Greenhouse Gas Emissions and Sinks 2002*. The *2003 Inventory* is accompanied by a revised and updated series, *Australian Methodology for the Estimation of Greenhouse Gas Emissions and Sinks 2003*. The introduction of the AGEIS has enabled the closer linking of emission estimates with the documentation of the estimation methodologies, now available on-line, and will provide for the establishment of links with source documents and literature describing the empirical basis for chosen emission factors and methods. Key source documents will be archived in an online library that will link to methodology documents (to be undertaken in 2005).

1.7 General uncertainty evaluation

Uncertainty is inherent within any kind of estimation—be it an estimate of the national greenhouse gas emissions, or the national gross domestic product. Managing these uncertainties, and reducing them over time, is recognised by the IPCC *Good Practice* report as an important element of inventory preparation and development. While it is in some cases possible to continuously monitor emissions, it is not usually practical or economical to do so. This leads to estimations based on samples or studies being used which carry a degree of additional uncertainty attached to them. Uncertainty also arises from the limitations of the measuring instruments, and the complexity of modeling highly variable sources of emissions over space and time, particularly for some biological sources.

Australia has conducted uncertainty analysis across the sectors of *energy, industrial processes, agriculture, land use change* and *waste*, in line with the IPCC *Good Practice* guidelines. While some sectors have a relatively low uncertainty attached to them, as the relationship between the source and emissions is well documented and understood, other areas carry an inherently high uncertainty, partly due to the very nature of the processes involved (e.g. biological processes).

Emission estimate uncertainties tend to be low for carbon dioxide from energy consumption as well as from some industrial process emissions. Uncertainty surrounding estimates from these sources are typically low (plus or minus 4-5%). Uncertainty surrounding estimates of emissions are higher for agriculture, land use change and forestry and synthetic gases. A medium band of uncertainty applies to estimates from fugitive emissions, most industrial processes and non-CO2 gases in the energy sector.

The sectoral estimates presented in Annex 7 show that the uncertainty ranges reported for the various components of the Australian inventory are largely consistent with the typical uncertainty ranges expected for each sector, as identified in the IPCC *Good Practice Report*.

At an aggregate level, using IPCC good practice methods (tier 1), the uncertainty surrounding the Australian inventory estimate overall for 2003 is estimated at plus or minus 5.2%, a decline on the uncertainty of the 1990 inventory (6.3%). These estimates should be considered preliminary, given that the uncertainty estimates for sectoral emissions are under review and as the Australian Greenhouse Office is moving to undertake a tier 2 analysis of uncertainty using more flexible Monte Carlo analyses (see Annex 7).

1.8 General assessment of completeness

Greenhouse gases emanate from a wide variety of sources and through a large range of processes. For the most part estimates are generated from published sources of activity data. This is true for the most significant component of the inventory—emissions from fossil fuel combustion—where data collection processes are well established for either energy policy or taxation reasons. Where published data are not readily available, such as for some industries in the industrial processes sector, the AGO conducts comprehensive surveys of industry in order to obtain the necessary data.

A few minor sources are not included within the inventory, due to either a lack of available information or methodology. These sources are considered to be insignificant, however, when compared with the inventory as a whole.

The assessment of completeness is used to help identify areas where methodologies can be developed, and where additional sources of data may be sought.

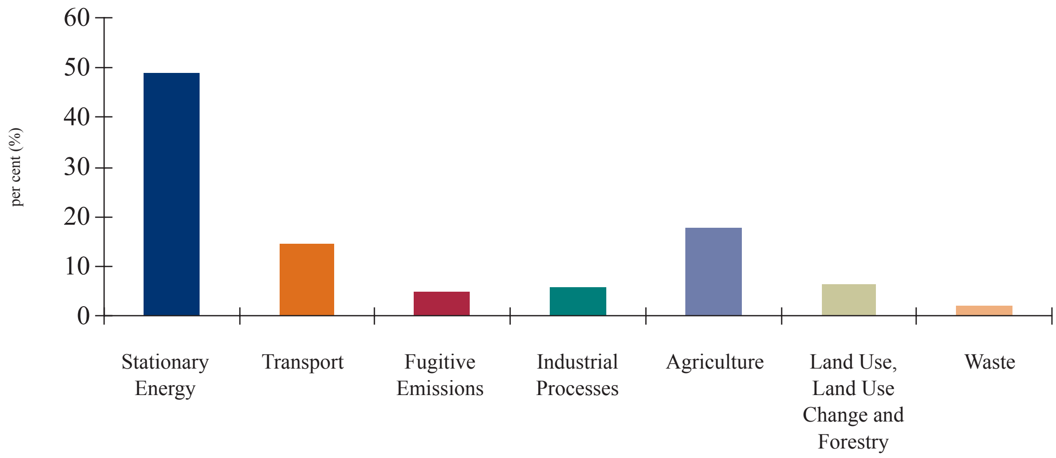
For this inventory, complete data on halocarbon use; sulphur hexafluoride emissions; carbon dioxide from synthetic rutile production; methane from certain livestock wastes; and limestone and dolomite use by certain metal industries are included for the first time. Altogether, these additional sources add less than 1% to the inventory in 1990. Completeness is assessed more fully in Annex 5.

Chapter 2
Australia's Net Greenhouse Gas Emissions

2.1 Emissions in 2003

In 2003, Australia's net greenhouse gas emissions using the Kyoto accounting provisions were 550.0 million tonnes (Mt), CO_2-equivalent (CO_2-e). The combined energy sectors were the largest source of greenhouse gas emissions comprising 68.0% (374.3 Mt CO_2-e) of emissions (Figure 1). This proportion is less than in many countries, however, due to the relatively large contribution from the *agriculture* (17.7%) and *land use, land use change and forestry* sectors (6.3%) to Australia's inventory. Other relatively minor sources include emissions from *industrial processes*, such as from the manufacture of mineral products, and emissions from *waste disposal*.

Figure 1. Contribution to total net CO_2-e emissions by sector (Kyoto accounting), 2003



The national emissions from the *energy* sector (including *stationary energy, transport* and *fugitive* emissions) comprise mainly emissions of carbon dioxide (Table 4). Consequently, at the level of individual greenhouse gases, the energy sector is the major contributor to carbon dioxide emissions at 85.5% (345.8 Mt). *Agriculture* is the main contributor of methane (67.9%, 3.5 Mt) and nitrous oxide (77.1%, 0.08 Mt) emissions.

Carbon dioxide is the most important of the greenhouse gases in Australia's inventory with a share of 73.6% (404.6 Mt) of the total CO_2-e emissions, followed by methane, which comprises 19.7% (108.5 Mt CO_2-e). The remaining gases make up 6.7% (37.0 Mt CO_2-e) of Australia's greenhouse gas emissions.

Table 4: Australian net greenhouse gas emissions by sector (Kyoto accounting), 2003

Sector and Subsector	CO_2		CH_4		N_2O		CO_2-e (b)	
	Mt	**%**	**Mt**	**%**	**Mt**	**%**	**Mt**	**%**
1 All energy (combustion + fugitive)	**345.8**		**1.07**		**0.02**		**374.3**	
Stationary energy	**266.0**	**65.7**	**0.1**	**1.1**	**0.003**	**3.0**	**268.1**	**48.7**
Transport	**74.03**	**18.3**	**0.03**	**0.6**	**0.02**	**16.6**	**79.8**	**14.5**
Fugitive emissions from fuel	**5.8**	**1.4**	**1.0**	**19.0**	**0.0001**	**0.1**	**26.4**	**4.8**
2 Industrial Processes	**25.9**	**6.4**	**0.003**	**0.1**	**0.0**	**0.1**	**32.3**	**5.9**
3 Solvent and other product use[a]	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**
4 Agriculture	**NA**	**NA**	**3.5**	**67.9**	**0.076**	**77.1**	**97.3**	**17.7**
5 Land use, land use change and forestry	**32.9**	**8.1**	**0.1**	**1.4**	**0.0**	**1.4**	**34.8**	**6.3**
6 Waste	**0.0**	**0.0**	**0.5**	**9.9**	**0.002**	**1.8**	**11.4**	**2.1**
Total net emissions	**404.6**	**100.0**	**5.2**	**100.0**	**0.10**	**100.0**	**550.0**	**100.0**

(a) 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.

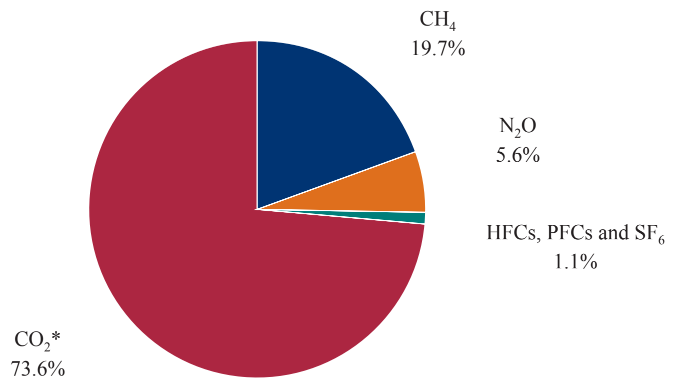
(b) HFCs, PFCs and SF_6 are not separately reported here but are included in the CO_2-e totals

Table 5: Australian net greenhouse gas emissions by gas, 2003

Greenhouse gas	Mt	GWP	Mt CO_2-e	% of total
Kyoto accounting				
CO_2[a]	404.6	1	404.6	73.6
CH_4	5.2	21	108.5	19.7
N_2O	0.1	310	30.7	5.6
HFCs	(b)	>1,300	4.3	0.8
PFCs	(c)	>6,500	1.5	0.3
SF_6	0.0	23,900	0.5	0.1
Total CO_2-e	NA	NA	550.0	100.0
UNFCCC accounting				
CO_2[a]	402.3	1	402.3	73.1
CH_4	5.3	21	110.3	20.1
N_2O	0.1	310	31.2	5.7
HFCs	(b)	(b)	4.3	0.8
PFCs	(c)	(c)	1.5	0.3
SF_6	0.0	23,900	0.5	0.1
NOx	2.5	NA	NA	NA
CO	24.3	NA	NA	NA
NMVOC	2.5	NA	NA	NA
SO_2	2.8	NA	NA	NA
Total CO_2-e	NA	NA	550.1	100.0

(a) Includes confidential CO_2 and N_2O data from nitric acid, ammonia and magnesia production and soda ash production and use. (b) HFC-23 (GWP = 11,700), HFC-125 (GWP = 2,800), HFC-134a (GWP= 1,300) and HFC-143a (GWP = 3,800).(c) CF_4 (GWP = 6,500) and C_2F_6 (GWP = 9,200).

Figure 2. Contribution to total net CO_2-e emissions by gas (Kyoto accounting), 2003



*Includes confidential N_2O emissions from nitric acid production reports as CO_2-e.

2.2 Emission trends

Kyoto Accounting

Under the Kyoto accounting rules, Australia's net emissions in 2003 were 550.0 Mt, an decrease of 7.9 Mt or 1.4% over net emissions recorded in 2002. Contributing sectors to the decline in emissions over this period included *land use, land use change and forestry* (26.8%[3]), *fugitive* emissions from fossil fuel (9.5%), *waste* (3.0%) and *agriculture* (1.3%). Sectors increasing included *stationary energy* (2.4%), transport (0.9%) and *industrial processes* (7.7%).

Net emissions in 2003 were 1.1% above 1990 levels (Figure 3). The largest sectoral increase in greenhouse gas emissions over the 1990 to 2003 period, of 37.2% (72.7 Mt CO_2-e), occurred in the *stationary energy* sector, driven in part by increasing population, household incomes and export increases from the resources sector. *Transport* is the next largest growth sector with an increase of 28.8% (17.9 Mt CO_2-e). The main driver for the increase in *transport* emissions is continuing growth in household incomes and numbers of vehicles. Offsetting growth in these sectors has been a strong decline in net emissions from the *land use, land use change and forestry* sector and, in particular, reductions in land clearing. Trends in emissions from each sector are discussed further in chapters 3-9.

Of the individual greenhouse gases, net emissions of carbon dioxide increased by 0.4% between 1990 and 2003. Methane emissions declined by 4.4%; nitrous oxide emissions increased by 39.8%; HFC emissions increased by 282.6%; and PFC and sulphur hexafluoride emissions fell by 55.3%. Annual emissions of each gas and from each sector for the years 1990 to 2003 are reported in Part C.

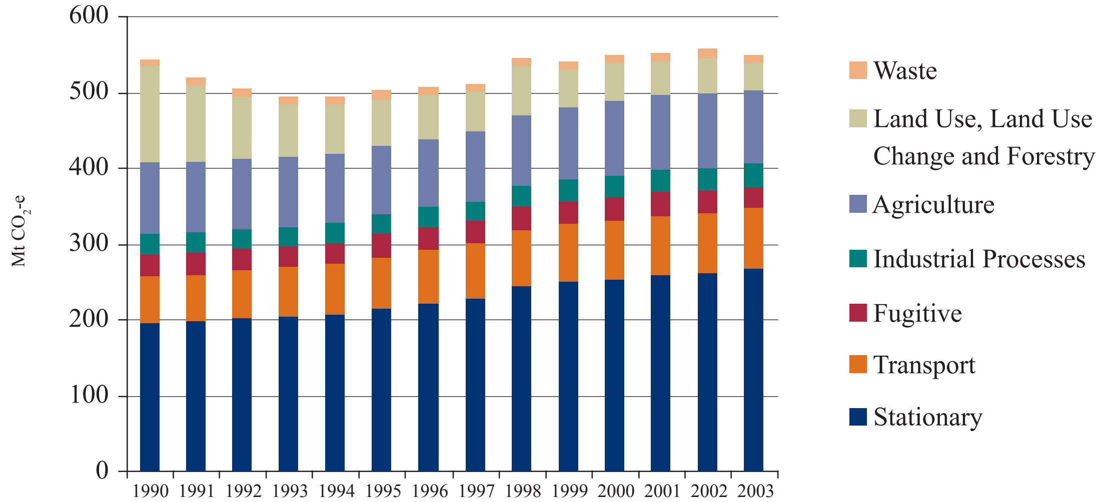
3 This is based on interim estimates for both 2002 and 2003—see Section 7.2.2.

Table 6: Change in total net CO_2-e emissions by gas (Kyoto accounting), 1990–2003

Greenhouse gases	1990 Mt CO_2-e	2003 Mt CO_2-e	1990 % of Total	2003 % of Total	Changes Mt	% Change in emissions
CO_2 [(a)]	403.1	404.6	74.1	73.6	1.5	0.4
CH_4	113.4	108.5	20.8	19.7	-4.9	-4.4
N_2O	22.0	30.7	4.0	5.6	8.7	39.8
HFCs	1.1	4.3	0.2	0.8	3.2	282.6
PFCs and SF_6	4.5	2.0	0.8	0.4	-2.5	-55.3
Total CO_2-e	544.1	550.0	100.0	100.0	6.0	1.1

(a) Includes confidential CO_2 and N_2O data from nitric acid, ammonia and magnesia production and soda ash production and use.

Figure 3: Trends in CO_2-e emissions and removals by sector (Kyoto accounting), 1990–2003



UNFCCC Accounting

Under the inventory accounting rules for the UNFCCC, net national emissions in 2003 were 550.1 Mt CO_2-e, compared with 555.5 Mt CO_2-e in 2002 and 524.5 Mt CO_2-e in 1990. The estimated total is more than the national estimate under the Kyoto accounting provisions by 0.03 Mt CO_2-e because of the inclusion of additional emissions categories and different forest sinks in the *land use change and forestry* sector. Annual emissions of each gas and from each sector for the years 1990 to 2003 are reported in Common Reporting Format Table 10 (*see* Part B).

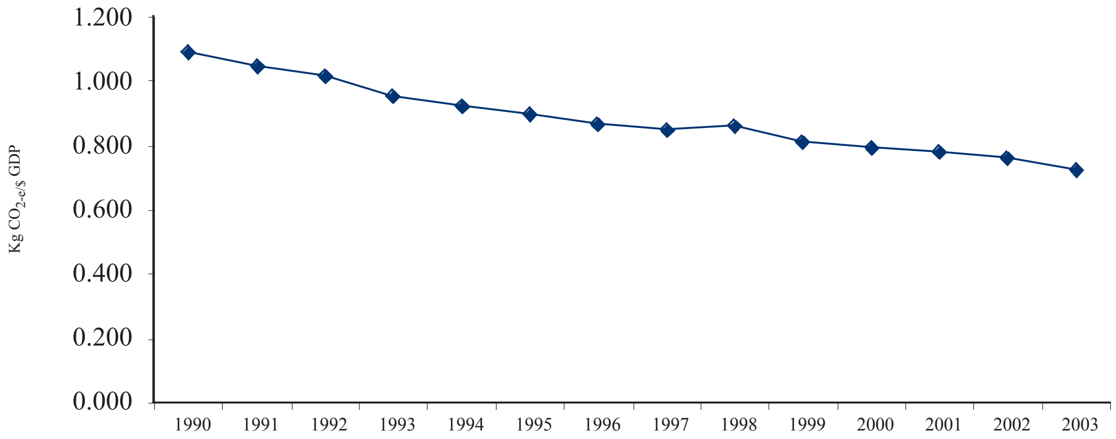
The indirect greenhouse gases NO_x, CO, NMVOC and SO_2 are also reported under the UNFCCC guidelines, but as they have not been allocated global warming potentials they are not included within Australia's total aggregated emissions. The estimated emissions from these gases are shown in Table 5, but where the other greenhouses gases have been converted into CO_2-equivalents, the CO_2-equivalents for these gases are shown as NA (not applicable). Compared with 1990, there has been an increase in the emissions of all indirect gases.

Greenhouse Gas Emissions Intensity (Kyoto accounting)

The greenhouse gas emissions intensity of the Australian economy has declined relative to 1990. Emissions per dollar of GDP were 33.4% lower in 2003 than in 1990 (Figure 4).[4] The falling trend in emissions per unit of GDP reflects both the result of specific emissions management actions across sectors and structural changes in the economy. Some of the decline relates specifically to outcomes in certain sectors. In particular, the decline in emissions from the *land use* sector contributes around one-third of the decrease in emissions intensity while the changing mix of production within the livestock industries in *agriculture* has limited emissions growth in that sector over the last 12 years. Some part of the decline is due to structural changes in the economy—with stronger growth in the services sector than in the more energy intensive *manufacturing* sector.

Australia has reduced its emissions when expressed in per capita terms over the period of 1990 to 2003 by 13.3% from 32.1 tonnes CO_2-e in 1990 to 27.8 tonnes in 2003. Australia's per capita emission level reflects a number of factors: (i) the dominance of the use of coal as a fuel in the electricity industry where, by contrast, there is no nuclear power produced and hydro-electric power options are limited; (ii) the presence of net emissions from the *land use, land use change and forestry* sector; and (iii) the impact of international trade patterns, which result in the production in Australia of many goods with high associated emission levels—that is, resource and agricultural products—that are destined for export and consumption in other countries.

Figure 4: Greenhouse gas emissions (Kyoto accounting) per dollar of GDP, 1990–2003



4 In 2002–03 Australian dollars, emissions intensity fell from 1.1 to 0.7 kg CO_2-e per dollar of GDP.

CHAPTER 3
ENERGY

3.1 OVERVIEW

Total emissions from the *energy* sector for 2003 were estimated to be 374.3 Mt CO_2-e (Table 7). *Energy industries* were the main contributor, accounting for 55.9% of emissions from the energy sector. Other significant contributors to total energy emissions were *transport* (21.3%), and *manufacturing industries and construction* (10.5%).

Energy sector emissions increased by 30.8% (88.2 Mt) between 1990 and 2003. Emissions from the sector increased by 4.2 Mt (1.1%) from 370.1 Mt in 2002. The main contributor to the increase in emissions was energy industries, which contributed an additional 6.3 Mt CO_2-e.

Table 7: Energy sector CO_2-e emissions, 2003

Greenhouse gas source and sink categories	CO_2-e emissions (Gg)				% Total net national emissions
	CO_2	CH_4	N_2O	Total	
Total net national emissions (Kyoto)	404,577	108,468	30,701	550,049	100.0
1 ENERGY	**345,771**	**22,463**	**6,050**	**374,283**	**68.0**
A. Fuel combustion activities (National approach)	**340,004**	**1,845**	**6,027**	**347,877**	**63.2**
1 Energy industries	**208,303**	**219**	**655**	**209,177**	**38.0**
a Electricity and heat production	189,518	188	623	190,329	34.6
b Petroleum refining	6,626	2	16	6,644	1.2
c Manufacture of solid fuels	12,158	29	16	12,204	2.2
2 Manufacturing industries and construction	**39,117**	**42**	**202**	**39,361**	**7.2**
3 Transport	**74,033**	**639**	**5,097**	**79,772**	**14.5**
a Civil aviation	5,197	4	50	5,251	1.0
b Road transportation	66,307	582	5,029	71,919	13.1
c Railways	1,482	1	13	1,497	0.3
d Navigation (domestic)	1,004	51	5	1,060	0.2
e Other transportation	41	0	0	41	0.0
4 Other sectors	**17,280**	**943**	**66**	**18,289**	**3.3**
5 Other	**1,271**	**1**	**5**	**1,277**	**0.2**
a Lubricants	637	NA	NA	637	0.1
b Mobile (military)	634	1	5	640	0.1
B. Fugitive emissions from fuels	**5,766**	**20,618**	**22**	**26,406**	**4.8**
1 Solid fuels	NE	16,534	NA	16,534	3.0
2 Oil and natural gas	5,766	4,083	22	9,872	1.8

Stationary Energy

Stationary energy principally comprises fossil fuel combustion in *electricity and heat production* and *manufacturing and construction industries*. Total estimated emissions from stationary energy combustion were 268.1 Mt CO_2-e in 2003, equal to 48.7% of net national emissions.

The *energy industries* subsector includes fuel combustion in electricity generation, petroleum refining, gas production and solid fuel manufacture. *Electricity and heat production* (1.A.1.a) contributed 190.3 Mt CO_2-e or 71.0% of *stationary energy* emissions in 2003. This category includes emissions from electricity generation only because heat production as defined by the IPCC does not occur in Australia. Estimated emissions from the remaining *energy industries* subsectors were 18.8 Mt in 2003.

The *manufacturing industries and construction* subsector (1.A.2) emissions were 39.4 Mt CO_2-e in 2003. This subsector includes direct emissions from fuel combustion in manufacturing industries, ferrous and non-ferrous metals production, plastics production, construction and non-energy mining. These calculations do not fully reflect the greenhouse impact of these industries, as the emissions generated from the production of electricity used in these industries are included under electricity and heat production (1.A.1.a).

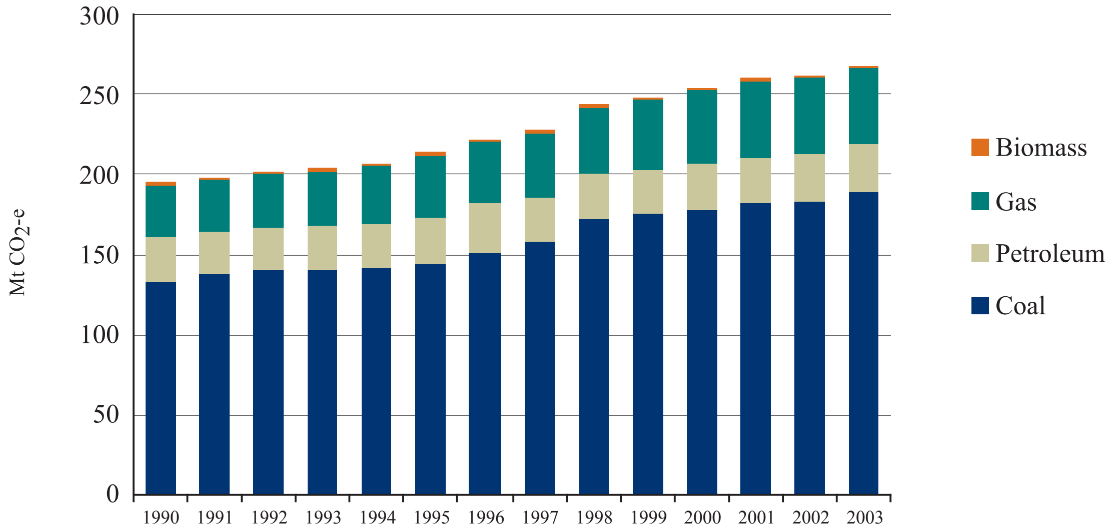
Estimated emissions from *other* sectors (1.A.4) were 18.3 Mt CO_2-e in 2003. This subsector comprises direct fuel combustion in the residential, commercial and institutional sectors, including energy used in mobile equipment in *agriculture*, *forestry* and *fishing* industries. However, as with *manufacturing*, much of the greenhouse impact of these sectors arises from their large consumption of electricity, which is not reflected in this figure alone (reported under 1.A.1.a). Other (1.A.5) includes emissions from *lubricants* (0.6 Mt) and *military transport* (0.6 Mt). Emissions from *lubricants* arise from the combustion of engine oil in vehicles.

The use of feedstocks within chemicals production resulted in 2.7 Mt CO_2 being stored in products such as plastics and was therefore deducted from the estimate of emissions from the *energy* sector. A further deduction of 16.1 Mt was made for CO_2 not emitted in the energy sector due to the non-energy use of fuels. Of this, 3.6 Mt CO_2 were stored in products, such as lubricants and bitumen, and 12.4 Mt CO_2 were emissions reported elsewhere in other sectors within the inventory. Coke and natural gas, used as reductants within iron and steel production, were the most significant non-energy uses of fuels, resulting in the reporting of 10.8 Mt CO_2 within the *industrial processes* sector. There is also a small use of fuels in aluminium production and the balance is reported as *fugitive* emissions.

Trends

Emissions from *stationary energy* increased by 37.2% (72.7 Mt) between 1990 and 2003, including an increase in emissions from coal combustion of 42.3% (56.4 Mt) in the same period (Figure 5). Although coal accounted for the highest absolute increase in emissions over this period, emissions related to natural gas have shown the largest relative growth, increasing by 44.9% (14.9 Mt) between 1990 and 2003. Emissions from oil increased by 8.1% (2.2 Mt) in the same period. The increase in coal-related emissions accounts for 77.6% of the overall increase in emissions, with gas accounting for 20.5%, oil 3.0% and biomass decreasing 1.0%. Between 2002 and 2003 emissions from *stationary energy* increased by 2.4% (6.3 Mt).

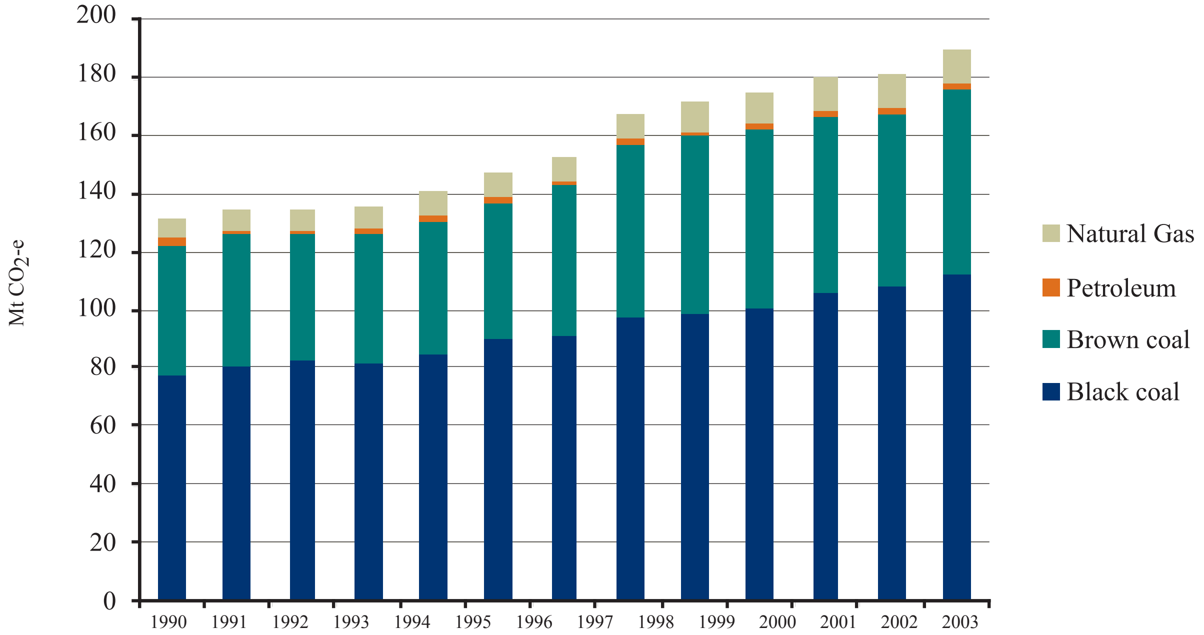
Figure 5: Total CO_2-e emissions from stationary energy combustion by fuel, 1990–2003



Electricity generation emissions increased by 5.6 Mt (3.0%) from 2002 to 2003, and by 61.2 Mt (47.4%) from 1990 to 2003 (Figure 6). The 2002 to 2003 electricity generation emissions increase were higher than the increase in fuel use. Underpinning these changes were shifts in the fuel mix – the coal share of total fuel use increased from 86.4% to 87.6%, with the share of brown coal of the total coal use increasing from 34.6% to 35.3%. Natural gas share of total fuel use declined from 11.6% to 10.6%.

Emissions from *stationary energy* subsectors, other than *electricity*, increased by 2.1 Mt (0.9%) between 2002 and 2003, and increased overall by 11.5 Mt (17.4%) from 1990 to 2003. Emissions from the *manufacturing industries and construction* subsector decreased 0.6% (0.2 Mt) between 2002 and 2003, and increased by 4.7% (1.8 Mt) from 1990 to 2003.

Figure 6: CO_2-e emissions from electricity generation by fossil fuels, 1990–2003



(a) The 1999 through to 2003 inventories report small quantities of biofuel (wood, bagasse and landfill gas) use, but these accounted for less than 0.04% of electricity generation sector emissions.

Transport

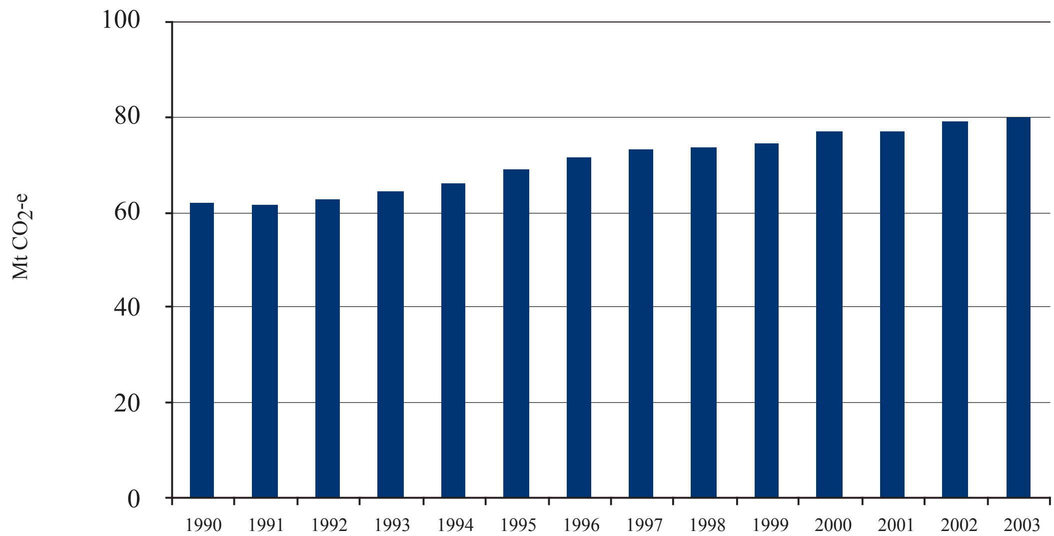
In 2003 *transport* contributed 79.8 Mt CO_2-e or 14.5% of Australia's net emissions. *Road transportation* is the major source with this sector, contributing 90% (71.9 Mt), of which 62.2% (44.8 Mt) were from *passenger cars*. *Domestic aviation* contributed 6.6% (5.3 Mt), *domestic navigation* 1.3% (1.1 Mt), and *railways* 1.9% (1.5 Mt)—not counting the emissions from generating the electricity used by rail, which are included in the *stationary energy* sector emissions.

Fuel used in *international transport* (*international aviation and marine 'bunkers'*) is by international agreement reported separately from the national total net emissions. In 2003, international bunker fuels generated 8.9 Mt of emissions.

Trends

Transport emissions increased by 28.8% on the 1990 level, and increased by 1% on the 2002 level (Figure 7). Over this period *transport* emissions increased by about 2% annually, making this one of the fastest growing source of emissions of the inventory.

Figure 7: Total transport emissions, 1990–2003

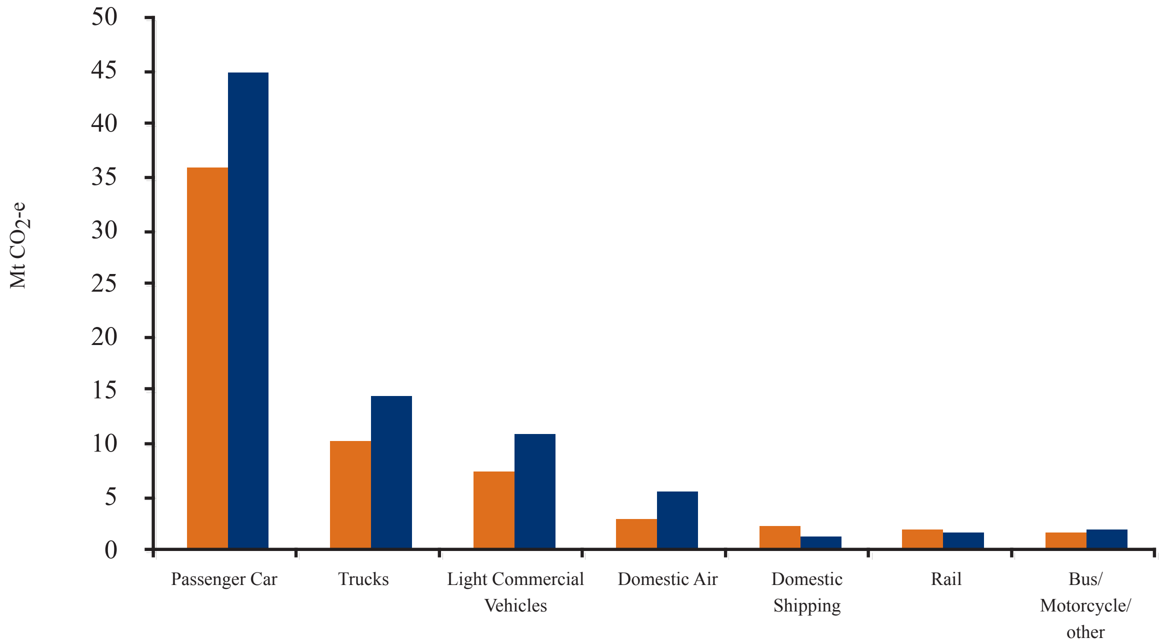


Emissions from *road transportation* increased by 31.1% (17.0 Mt) between 1990 and 2003, and increased by 1.6% (1.2 Mt) from 2002 to 2003 (Figure 7). Between 1990 and 2003 emissions from *passenger cars* increased from 35.7 Mt to 44.8 Mt, an increase of 25.2% (9.1 Mt). Emissions of nitrous oxide are the fastest growing source in this sector, reflecting growth in activity and also the influence of technological change, as the importance of vehicles fitted with 3 way catalytic increases in the overall passenger car fleet (as 3 way catalytic converters reduce NOx emissions but raise nitrous oxide emissions compared with other technologies).

Estimates of *civil aviation* (*domestic air transport*) emissions were 0.6% higher in 2003 than in 2002 and 78.9% (2.3 Mt) higher than the 1990 level. Emissions have grown strongly in this sector, although emissions in the 1990 base year were unusually low because of an extensive dispute with airline pilots in that year and this has contributed to the magnitude of the change.

Emissions from *domestic shipping* (*navigation*) in 2003 were 55% (1.2 Mt) lower than in 1990, and 29% (0.5 Mt) lower than in 2002. 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.

Figure 8: Comparison of transport emissions by subcategory, 1990–2003



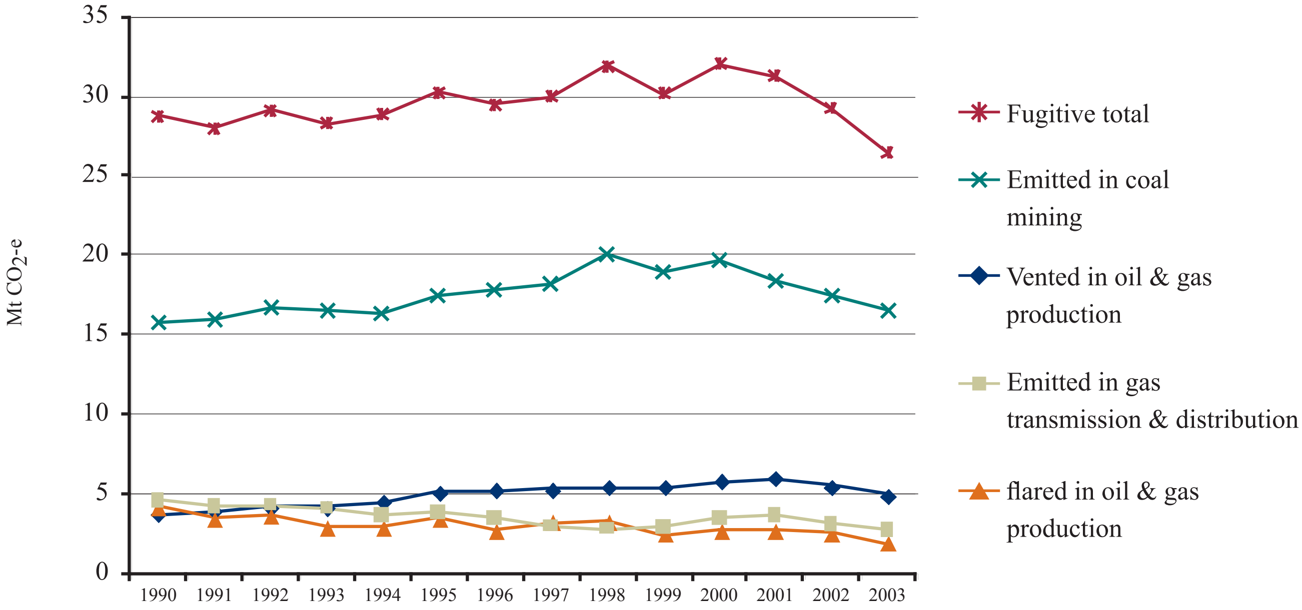
Fugitive Emissions

Total estimated *fugitive emissions* for 2003 were 26.4 Mt CO_2-e, representing 4.8% of net national emissions. Net *solid fuel* emissions, all of which are associated with coal mining and handling, contributed 62.6% (16.5 Mt) of *fugitive* emissions. *Oil and natural gas production, processing and distribution* account for the remaining 37.4% (9.9 Mt) of *fugitive* emissions.

Trends

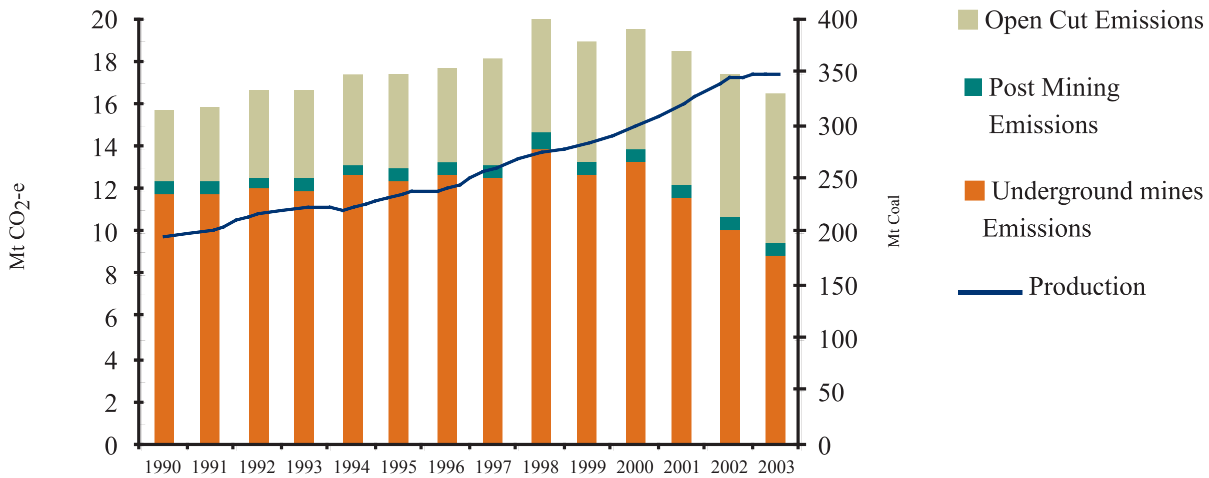
Overall *fugitive* emissions decreased by 8.2% (2.4 Mt) between 1990 and 2003, and decreased by 9.5% (2.8 Mt) from 2002 to 2003 (Figure 9). From 2002 to 2003 fugitive emissions from *solid fuels* decreased by 0.9 Mt (5.3%) and *oil and natural gas* emissions decreased by 15.8% (1.8 Mt).

Figure 9: CO_2-e fugitive emissions by category, 1990–2003



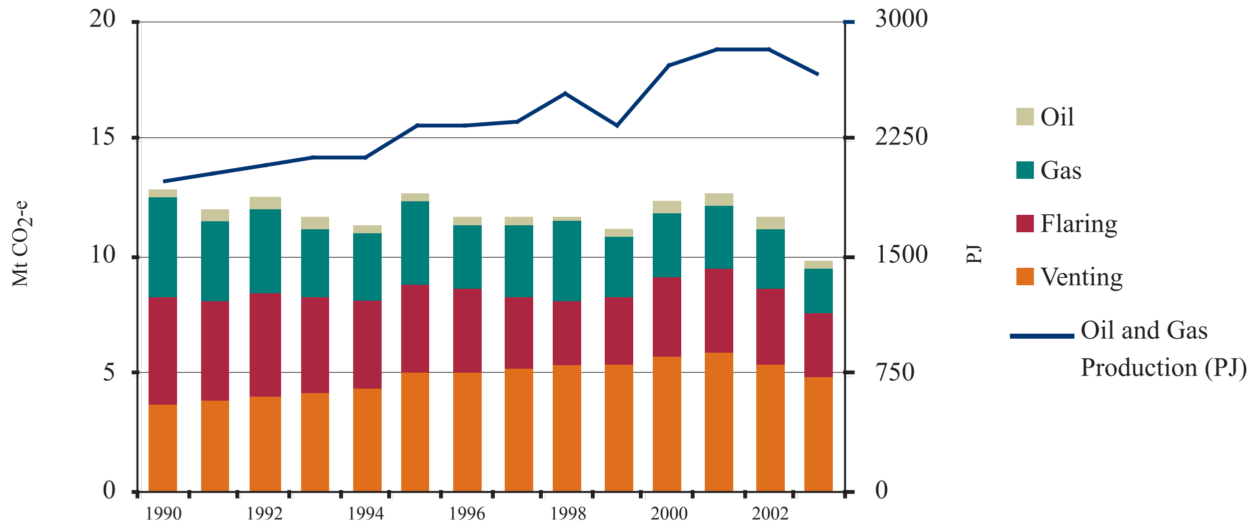
Solid fuel emissions increased by 4.5% (0.7 Mt) between 1990 and 2003. Emissions tend to fluctuate from year to year, depending on the volume of coal mined and the share of gassy underground mines in total production. Mine production of coal has increased from 195 Mt in 1990 to 348 Mt in 2003, an increase of 79%. Since 1990, methane emissions have not grown as fast as activity and, since 1998, there has been a decrease in emissions reflecting a decrease in Class A (gassy) mines and growth in Class B (non-gassy) mines and surface mines (Figure 10). In addition, technologies to recover and utilise or flare CH_4 have been increasingly adopted.

Figure 10: Fugitive CO_2-e emissions from coal mining, 1990–2003



Oil and natural gas fugitive emissions decreased by 23.8% (3.1 Mt) between 1990 and 2003 (Figure 11). This compares with a 43% increase in production activity. The decrease 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 2002 and 2003, emissions from oil-related activities increased by 8.4% (0.1 Mt) and emissions from gas-related activities decreased by 26.5% (0.1 Mt). Emissions from venting decreased by 10.9% (0.6 Mt) from 2002 to 2003 although, compared with 1990, emissions were higher by 33.0% (1.2 Mt). Flaring-related emissions decreased by 13.7% (0.4 Mt) from 2002 to 2003 consistent with a longer-term trend. Emissions were lower than 1990 levels by 41.7% (1.9 Mt).

Figure 11: Fugitive CO_2-e emissions from oil and gas production, 1990–2003



3.2 Source Category 1A1 - Energy Industries

3.2.1 Source category description

This category includes emissions from fuel combustion within electricity generation, petroleum refining and other energy manufacturing industries such as coke ovens, briquette production, coal mining oil and gas extraction, and natural gas production, transmission and distribution.

Electricity generation includes power for supply to the grid (whether the power stations are owned by public or private corporations) and also the generation of electricity at mines, mineral processing and manufacturing sites, where data are available on the electricity generated and fuels consumed. Where it is not possible to identify the quantity of fuel consumed – for example, in electricity generation at industrial sites, the fuel consumed and the associated emissions are allocated to the industry involved and hence not included in the emissions for this sub-category. Public heat production does not occur in Australia.

The fundamental reporting unit in this sector is the individual power station. Emissions from each large power station (over about 0.5 PJ fuel use) are calculated separately, using specific activity data and specific emission factors where possible.

There are between 40 and 50 such power stations in Australia at present (the number depends on how generating units at the same site are treated). In 2003, electricity generators consumed 1239 PJs of black coal, 676 PJs of brown coal and 232 PJs of natural gas.

3.2.2 Methodology

Emissions from Energy Industries 1.A.1 are predominantly estimated using tier 2 approaches. A tier 3 approach has been used for directly monitored SO_2 emissions in Petroleum Refining.

A tier 2 approach is largely used for the key category of electricity generation, in which emission factors for fuels such as coal may vary from source-to-source, and over time. Data on fuel use and emission factors are requested directly from operational organisations of major power stations connected to the main transmission grids and power stations not connected to the main transmission grids but operated by the same organisations. The energy use of the power stations for which data were not obtained directly, non-reporting organisations of the major power stations and those not connected to the main transmission grids which are operated by other organisations, are inferred from the difference between the total of reported values and Australian Bureau of Agricultural and Resource Economics (ABARE) energy statistics.

For the remaining categories within Energy 1.A.1, the main source of activity data is the national survey of energy consumption by industry sector and fuel type, compiled by the ABARE. Country-specific approaches have been used in cases where they are feasible and more accurate than the IPCC default emission and oxidation factors or methodologies. An example is the black coal CO_2 emission factor of 91.8 Gg/PJ, as advised by the steel industry to be applicable to coke oven operations. Non-CO_2 emission factors have been calculated using a sectoral equipment-weighted average approach.

More information is given in Annex 3. A full description of the methodologies and emission factors is presented in the *Australian Methodology for the Estimation of Greenhouse Gas Emissions and Sinks 2003: Energy (Stationary Sources)* (NGGIC 2005a).

3.2.3 Uncertainties and Time Series consistency

The tier 1 uncertainty analysis in Annex 7 provides estimates of uncertainty according to IPCC source category and gas.

Time series variability of GHG implied emission factors are likely to be influenced by changes in fuel mix within categories, and changes of actual fuel emission factors. Notable examples of where such variations occur in Energy 1.A.1 are set out below:

1.A.1.c Manufacture of Solid Fuels and Other Energy Industries - CO_2 from solid fuels.

The implied emission factor (IEF) declines by 12% between 1990 and 1999. This can be explained by the relative rise of coal byproducts - coke oven gas as a fuel (with a low relatively low emission factor of 37 Gg/PJ) at the expense of black coal.

1.A.1.a Public Electricity – CO_2 from biomass

Biomass combustion for electricity consists of a growing proportion of biogas from landfill. Biogas has a relatively low CO_2 emissions factor compared to other biomass fuel, hence Australia's CO_2 biomass IEF is relatively low.

No major deviations are evident in emission and activity data trends.

3.2.4 Source specific QA/QC

This source category is covered by the general QA/QC of the greenhouse gas inventory in section 1.6. The reference approach for the Energy sector, reported in Annex 4, provides a quality control check for this sector.

3.2.5 Recalculations since the 2002 Inventory

A recalculation for 2002 was performed following release of updated ABARE national energy statistics. In addition, an improvement in quality control was gained through the process of translating the previous calculation system to the AGEIS system. A number of minor calculation errors have now been rectified.

A recalculation was performed for 1.A.1.c Natural Gas Production and Distribution for the years 1995 to 2002. This was required due to a reduction in the gas leakage proportion of unaccounted for gas in 1.B.2.b. Natural gas distribution (See 3.7.5 Fugitive Emissions - recalculations). The reduction in fugitive emissions in the natural gas distribution system in turn lead to a corresponding increase in natural gas activity data for stationary combustion.

Recalculations have resulted in an increase of 3.6 Mt CO_2-e for 1.A.1 in 2002, mostly attributable to the update of ABARE national energy statistics.

3.2.6 Planned Improvements

The activity data used for the 2003 inventory report were modeled estimates using ABARE's *Australian Energy: National and State Projections to 2019-20* (Akmal et al. 2004). A recalculation for 2003 inventory year will be undertaken for the 2004 inventory report, following the release of the ABARE 2003 national fuel consumption statistics.

3.3 Source Category 1A2 - Manufacturing industries and Construction

3.3.1 Source Category Description

This source category includes emissions from fuel combustion in manufacturing, construction and non-energy mining. This includes both stationary and mobile equipment such as earth moving and mining equipment.

The use of reductants such as coke and natural gas within the 1.A.2.a Iron and Steel are regarded primarily as a chemical process rather than fuel combustion under IPCC reporting guidelines. Consumption and emissions from this source are therefore reported under the Industrial Processes sector rather than the Energy sector.

Similarly, for 1.A.2. Non-Ferrous Metals, the quantity of petroleum coke used to produce carbon anodes for aluminum production is deducted from fuel consumption. This is done in order to eliminate double counting as the oxidation of carbon anodes in aluminium production is regarded as a process emission, and therefore reported under the Industrial Processes sector.

3.3.2 Methodology

The methodology for 1.A.2 are estimated using predominantly tier 2 approaches. Emissions estimated from activity data are based on the national survey of energy consumption by industry sector and fuel type compiled by the ABARE. CO_2 emission factors consist of defaults and country-specific where they are feasible and more accurate than the IPCC defaults. Non-CO_2 emission factors have been calculated using a sectoral equipment-weighted average approach.

Direct industry advice on the use of CO_2 emissions factors has been adopted on the use of coal by-products within 1.A.2.c Chemicals, black coal within 1.A.2.a Iron and Steel, and natural gas in general. Data is also obtained directly from chemical companies in order to estimate the quantity of carbon sequestered in products from feedstocks, with emissions estimates adjusted accordingly.

3.3.3 Uncertainties and Time Series consistency

The tier 1 uncertainty analysis in Annex 7 provides estimates of uncertainty according to IPCC source category and gas.

Time series variability of GHG implied emission factors are likely to be influenced by changes in fuel mix within categories, and changes of actual fuel emission factors. Notable examples of where such variations occur in Manufacturing Industries and Construction 1.A.2 are set out below:

1.A.2.a Iron and Steel – CO_2

The use of coke in iron and steel was shifted to Industrial Processes sector in 2001 in accordance with the IPCC guidelines. This left two remaining solid fuels: coal and coke oven gas, of which coke oven gas is now the dominant fuel used, and has a low CO_2 emission factor of 37Gg/PJ. This had the effect of producing a relatively low CO_2 IEF for solid fuels. Likewise, the liquid fuels CO_2 IEF is also relatively low, being driven by the large and increasing use of LPG.

1.A.2.c Chemicals

Emissions and IEFs for Chemicals are influenced by the mix of end products which sequester carbon. The production mix of the Australian chemicals industry has changed over time, resulting in a variable trend.

3.3.4 Source specific QA/QC

This source category is covered by the general QA/QC of the greenhouse gas inventory in section 1.6.

3.3.5 Recalculations since the 2002 Inventory

A recalculation for 2002 was performed following release of updated ABARE national energy statistics. In addition, an improvement in quality control was gained through the process of translating the previous calculation system to the AGEIS system. A number of minor calculation errors have now been rectified.

Ethane had previously been classified as a liquid fuel. It has now been allocated as a gaseous fuel to conform with the CRF table structure. This change has no implication for overall emissions.

Recalculations have resulted in a decrease of 3.9 Mt CO_2-e for 1.A.2 in 2002, mostly attributable to the update of ABARE national energy statistics.

3.3.6 Planned Improvements

The activity data used for the 2003 inventory report were modeled estimates using ABARE's *Australian Energy: National and State Projections to 2019-20* (Akmal et al. 2004). A recalculation for 2003 inventory year will be undertaken for the 2004 inventory report, following the release of the ABARE 2003 national fuel consumption statistics.

3.4 Source Category 1.A.3 - Transport

3.4.1 Source Category Description

This source category includes emissions from the transport sector, comprising the civil aviation, road transportation, marine navigation, railways and 'other' categories.

3.4.2 Methodology

Like other energy sub-sectors, the methodology for 1.A.3 is based on the application of 'bottom up' approaches to the estimation of emissions. Tier 2 approaches are employed for the estimation of emission from civil aviation, which takes account of fuel consumed, landing and take off cycles and Australian fleet characteristics, and emissions from passenger cars, which is based on fuel consumed and on vehicle fleet characteristics. In the case of passenger cars, the dominant source of emissions from this sector, non-CO_2 emission estimates depend on vehicle technologies and on the average age of each vehicle class in the Australian passenger car fleet.

More detail is provided in Annex 3. The full description of the methodology is provided in *Australian Methodology for the Estimation of Greenhouse Gas Emissions and Sinks 2003: Energy (Transport)* (NGGIC 2005b).

3.4.3 Uncertainties and Time Series consistency

The tier 1 uncertainty analysis in Annex 7 provides estimates of uncertainty according to IPCC source category and gas. Time series consistency is ensured by use of consistent models, model parameters and datasets for the calculations of emissions estimates. Where changes to emission factors or methodologies occur, a full time series recalculation is undertaken.

3.4.4 Source specific QA/QC

This source category is covered by the general QA/QC of the greenhouse gas inventory in section 1.6.

3.4.5 Recalculations since the 2002 Inventory

A recalculation for 2002 was performed following release of updated ABARE national energy statistics. In addition, an improvement in quality control was gained through the process of translating the previous calculation system to the AGEIS system. A number of minor calculation errors have now been rectified.

Recalculations have resulted in a decrease of 0.1 Mt CO_2-e for 1.A.3 in 2002, mostly attributable to the update of ABARE national energy statistics.

3.4.6 Planned Improvements

A review of transport methodologies is planned for 2006.

The activity data used for the 2003 inventory report were modeled estimates using ABARE's *Australian Energy: National and State Projections to 2019-20* (Akmal et al. 2004). A recalculation for 2003 inventory year will be undertaken for the 2004 inventory report, following the release of the ABARE 2003 national fuel consumption statistics.

3.5 Source categories 1A4 - Other Sectors and 1A5 - Other (not elsewhere classified)

3.5.1 Source category Description

The source category – *1.A.4 Other Sectors* is an aggregation of the following sources:

- Commercial/Institutional – a diverse category which includes direct emissions from water utilities, accommodation, communications, finance, insurance, property and business services, government and defense, education, health and wholesale and retail trade.

- Residential – emissions from fuel combustion in households, including lawnmowers.

- Agriculture, forestry and fisheries – emissions from fixed and mobile equipment.

The source category *Other 1.A.5* consists of emissions arising from the oxidation of lubricants, as well as fuel used in mobile equipment within defence operations.

3.5.2 Methodology

The methodology for 1.A.4 consists of a mix of tier 1 and 2 approaches. CO_2 emission factors consist of defaults and country-specific factors where they are more accurate than the IPCC defaults. Non-CO_2 emission factors have been calculated using a sectoral equipment-weighted average approach.

Residential firewood use is obtained from the ABARE national energy statistics, and is the largest source of CH_4 emissions within the Stationary Energy sector contributing 0.9Mt CO_2-e in 2003. Emissions are estimated using a detailed tier 2 approach which incorporates Australian specific conditions. Emission factors are based on factors such as equipment type and certification, wood type, moisture content and user behaviour (Todd 2003).

A default tier 1 approach is used to estimate emissions from lawnmowers and defence related activities (air, sea and road). There are no fuel consumption statistics for these activities, instead allocation factors are used to derive this data from known consumption statistics. These allocation factors along with the default emission factors are provided in Annex 3.

3.5.3 Uncertainties and Time Series consistency

The tier 1 uncertainty analysis in Annex 7 provides estimates of uncertainty according to IPCC source category and gas.

Time series variability of GHG implied emission factors are likely to be influenced by changes in fuel mix within categories, and changes of actual fuel emission factors.

1.A.4. Residential – biomass combustion

This category is characterised by the use of wood in residential woodheaters. Emissions are modeled using an advanced tier 2 approach which takes into account factors such as wood heater technology and replacement of older models, user operation and Australian wood. The CO_2 IEF has an increasing trend over time. This is due to both the gradual update in later model heaters and improved user operation arising from awareness campaigns. Both these factors result in improved combustion and less ash/soot, which acts to increase the CO_2 EIF, but also results in more efficient use of fuel. In addition, these factors also produce a declining trend in non-CO_2 IEFs as evident for CH4.

3.5.4 Source specific QA/QC

This source category is covered by the general QA/QC of the greenhouse gas inventory in section 1.6.

3.5.5 Recalculations since the 2002 Inventory

A recalculation for 2002 was performed following release of updated ABARE national energy statistics. In addition, an improvement in quality control was gained through the process of translating the previous calculation system to the AGEIS system. A number of minor calculation errors have now been rectified.

Recalculations have resulted in an increase of 0.7 Mt CO_2-e for 1.A.4 in 2002, mostly attributable to the update of ABARE national energy statistics.

3.5.6 Planned Improvements

The activity data used for the 2003 inventory report were modeled estimates using ABARE's *Australian Energy: National and State Projections to 2019-20* (Akmal et al. 2004). A recalculation for 2003 inventory year will be undertaken for the 2004 inventory report, following the release of the ABARE 2003 national fuel consumption statistics.

3.6 Source Category 1B1 – solid fuels

3.6.1 Source category description

This source category covers fugitive emissions from the production, transport and handling of coal. It does not include emissions arising from the conversion of coal into coke.

Most of Australia's resources and production of black coal are located in New South Wales and Queensland. There is also a very small quantity of bituminous black coal mined in Tasmania. In Victoria, large quantities of brown coal are mined in open cut operations. The CH_4 content of this coal is negligible. Sub-bituminous coal is mined in Western Australia and South Australia. In both States the coal is close to brown coal in its characteristics, and CH_4 emissions are negligible.

3.6.2 Methodology

Methane emissions from *coal mining* are based on a country-specific tier 2 approach where the emission factors (m^3 CH_4/tonne coal produced) are based on measurement from Australian mines. Estimation of emissions is based on grouping Australian mines into a small number of categories of broadly similar mines. Emission factors or, in some cases, emission equations have been developed for each mine category based on the available empirical data, ie actual measurements of emissions from representative mines in each category.

Annual raw coal production data is used for each specific mine and are obtained from the statistical publications of Coal Services Pty Ltd. Recovered mine methane quantities are subtracted from overall underground emissions. A full description of the methodologies and emission factors is presented in *Australian Methodology for the Estimation of Greenhouse Gas Emissions and Sinks 2003: Energy (Fugitive Emissions)* (NGGIC 2005c).

3.6.3 Uncertainties and Time Series consistency

The tier 1 uncertainty analysis in Annex 7 provides estimates of uncertainty according to IPCC source category and gas.

Time series variability of methane implied emission factors from coal mining activities are influenced by changes in the mix of production between gassy and non-gassy underground mines, open cut and underground mines, and the quantity of methane recovered. This is evident in a declining trend of the methane IEF for underground mines which reflects increased production from non-gassy mines and falling production from gassy mines. The implied emission factor for all coal mining activities has also declined since 1990, reflecting the additional influence of a relative increase of open cut mine production compared to underground production.

The trend in production data is variable over time, reflecting the effects of opening and closure of large mines, commodity price and global demand.

3.6.4 Source specific QA/QC

This source category is covered by the general QA/QC of the greenhouse gas inventory in section 1.6.

3.6.5 Recalculations since the 2002 Inventory

No recalculations were performed.

3.6.6 Planned Improvements

All relevant data are kept under constant review.

3.7 Source Category 1B2 – oil and natural gas

3.7.1 Source category description

The IPCC guidelines define a two level hierarchical structure for source categories related to the oil and gas industries. At the top level of the hierarchy are:

- emissions related to oil (1B2a),
- emissions relating to gas (1B2b); and
- venting and flaring emissions relating to both oil and gas (1B2c).

The main emission sources included in the first two categories are leakage, evaporation and accidental releases, ie uncontrolled sources. Emissions from venting and flaring are activities that are managed as part of normal operations at field processing facilities and oil refineries.

3.7.2 Methodology

Emissions from venting and flaring, the other significant emissions source in this sector, are based on emissions estimates published by the Australian Petroleum Production and Exploration Association (APPEA). APPEA estimate flaring emissions using country-specific emission factors applied to a measured activity parameter (volume flared). Venting emissions are reported from measured data (tier 3). Emissions from Natural Gas Distribution and Transmission are based on country-specific emission factors and activity data derived from statistics published by the Australian Gas Association. Oil and natural gas production activity data are obtained from the Department of Industry Tourism and Resources monthly series, Australian Petroleum Statistics.

A full description of the methodologies and emission factors is presented in *Australian Methodology for the Estimation of Greenhouse Gas Emissions and Sinks 2003: Energy (Fugitive Emissions)* (NGGIC 2005c).

3.7.3 Uncertainties and Time Series consistency

The tier 1 uncertainty analysis in Annex 7 provides estimates of uncertainty according to IPCC source category and gas.

Time series consistency is maintained through the use of consistent methodologies and data over time. The oil and gas production and distribution emissions levels are relatively stable over time, while emissions from venting and flaring tend to be more variable, reflecting the impact of large projects.

3.7.4 Source specific QA/QC

This source category is covered by the general QA/QC of the greenhouse gas inventory in section 1.6.

3.7.5 Recalculations since the 2002 Inventory

1.B.2.b Natural gas distribution - unaccounted for gas (UAG) factor

In previous submissions 90% of unaccounted for gas (UAG) from the natural gas distribution network had been allocated as fugitive leaks, based on a studies from the early 1990s. The progressive upgrade of the gas distribution infrastructure in response to a variety of drivers, including greenhouse gas emissions concerns, necessitated a review of the 90% UAG ratio. Analysis of industry data indicates that a figure in the range of 50-60% is more realistic for current circumstances. Accordingly, the new estimate for leakage under UAG adopts a figure of 55% from 2003 onwards.

The previous value of 0.90 was utilised to estimate emissions for all years up to and including 1994. The transition to the value of 0.55 to apply from 2003 has been ramped in on a linear basis starting with 1995. This approach reflects the progressive upgrade of the gas distribution infrastructure.

Recalculations have resulted in a decrease of 1.2 Mt CO_2-e for 1.B.2 in 2002.

3.7.6 Planned Improvements

All relevant data are kept under constant review.

Chapter 4
Industrial processes

4.1 Overview

Total net emissions estimated from industrial processes were 32.3 Mt CO_2-e in 2003, or 5.9% of net national emissions (Table 8).

Greenhouse gas emissions from industrial processes are principally a by-product of various production processes. For example, high temperature processing of calcium carbonate to produce quicklime gives rise to CO_2 emissions. The main determinant of industrial processes emissions from year to year is the quantity of the relevant product that is produced.

Table 8: Industrial processes sector CO_2-e emissions, 2003

Greenhouse gas source and sink categories	CO_2-e emissions (Gg)					%Total net national emissions
	CO_2	CH_4	N_2O	HFC/ PFC/SF_6	Total	
Total net national emissions (Kyoto)	404,577	108,468	30,701	6,302	550,049	100.0
2 INDUSTRIAL PROCESSES	**20,202**	**70**	**20**	**6,302**	**32,306**	5.9
A Mineral products	5,384	NE	NE	NA	5,384	1.0
B Chemical industry	952	9	IE	NA	961	0.2
C Metal production	13,866	61	20	1,472	15,419	2.8
D Other production	NE	NA	NA	NA	NE	NA
E Production of halocarbons and sulphur hexafluoride	NO	NO	NO	NO	NO	NA
F Consumption of Halocarbons and sulphur hexafluoride	NA	NA	NA	4,830	4,830	0.9
G Other [(a)]	C	C	C	NA	5,711	1.0

(a) Includes confidential emissions from soda ash production and use (CO_2), magnesia production (CO_2), nitric acid production (N_2O) and ammonia production (CO_2).

Metal production contributed 47.7% (15.4 Mt CO_2-e) of the sector's emissions, mineral products contributed 16.7% (5.4 Mt CO_2-e), *chemical industries* contributed 3.0% (1.0 Mt CO2-e), and the *consumption of halocarbons* (HFCs) contributed 15.0% (4.8 Mt CO_2-e).

Metal production emissions are mostly attributable to iron and steel production with 70.9% (10.9 Mt CO_2-e), and aluminium smelting with 29.1% (4.5 Mt CO_2-e). Cement (clinker) production accounted for 63.2% (3.4 Mt CO_2-e) of emissions from mineral products, followed by lime production at 19.3% (1.0 Mt CO_2-e), and limestone and dolomite use at 17.5% (0.9 Mt CO_2-e). Magnesia production data and emissions are confidential and are included with the confidential emissions reported.

Activity data for soda ash production and use, magnesia production, 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 CO_2-e emissions. Total emissions from this subsector are 5.7 Mt CO_2-e.

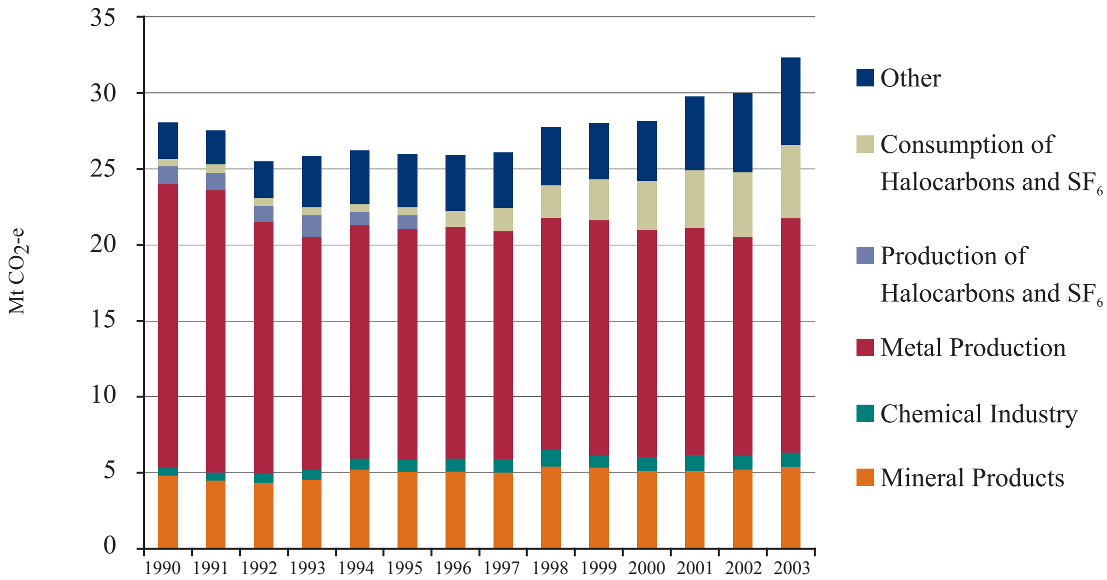
The main gas emitted by *industrial processes* is carbon dioxide, contributing 62.5% (20.2 Mt) of the sector's emissions in 2003. PFCs contributed 4.6% (1.5 Mt), HFCs contributed 13.3% (4.3 Mt), SF_6 contributed 1.6% (0.5 Mt), nitrous oxide contributed 0.1% (0.02 Mt), and methane 0.2% (0.07 Mt). CO_2-e emissions from the subsectors where data are confidential contributed 17.7% (5.7 Mt).

Trends

Net emissions from industrial processes increased by 15.2% (4.3 Mt CO_2-e) from 1990 to 2003 and increased by 7.7% (2.3 Mt CO_2-e) from 2002 to 2003 (Figure 12).

Net emissions from *mineral products* increased by 11.6% (0.6 Mt CO_2-e) from 1990 to 2003 due to increased production of cement clinker and lime. From 2002 to 2003, net emissions increased by 3.2% (0.2 Mt CO_2-e) as a result of an increase in lime production.

Figure 12: Emissions from industrial processes by subsector, 1990–2003



Net emssions from *metal production* declined by 17.5% (3.3 Mt CO_2-e) from 1990 to 2003. This was due to a 62.6% (2.5 Mt CO_2-e) reduction in perfluorocarbon (PFC) emissions from aluminium smelting as a result of technological improvements in process control and monitoring, and a 14.2% (1.8 Mt CO_2-e) fall in emissions from crude steel production. These reductions have been partly offset by growth in emissions of CO_2 from aluminium production and hot briquetted iron production. From 2002 to 2003, net *metal production* emissions increased by 7.7% (1.1 Mt CO_2-e).

HCFC-22 was produced in Australia from 1990 to 1995 and the fugitive emissions of HFC-23 from this production peaked at 1.5 Mt CO_2-e in 1993 before declining to zero in 1996 when HCFC-22 production ceased. The use of HFCs in Montreal Protocol Industries commenced in 1994, and estimated emissions from this source have increased to 4.3 Mt. Emissions of SF_6 from the electricity supply industry occur throughout the time series and are estimated to have maintained a constant level from 1990 to 2003.

4.2 Source Category 2.A Mineral products

4.2.1 Source category description

Cement Production (UNFCCC category 2.A.1)

Carbon dioxide is produced during the manufacture of portland clinker, an intermediate product from which cement is made. Calcium carbonate ($CaCO_3$) from calcium rich raw materials such as limestone, chalk and natural cement rock is heated at temperatures of approximately 1500° C in cement kilns to form lime (CaO) and carbon dioxide in a process known as calcination. In addition to $CaCO_3$, the raw materials used in cement production may also contain small quantities of magnesium carbonate ($MgCO_3$). On heating, $MgCO_3$ decomposes to generate CO_2. There is significant use of supplementary cementitious materials in Australian cement (up to 19% fly ash and or granulated blast furnace slag).

There are 3 clinker producers in Australia; Adelaide Brighton, Blue Circle Southern Cement and Cement Australia. Activity data are reported to the AGO by the Cement Industry Federation of which these three producers are members.

Lime Production (2.A.2)

Lime is an important chemical having major uses in metallurgy (steel, copper, gold, aluminium and silver), other industrial applications (water softening, pH control, sewage sludge stabilisation), and construction (soil stabilisation, asphalt additive and masonry lime). Carbon dioxide is emitted during the pyroprocessing of raw materials in the production of lime (ie calcining).

There are six producers of Lime in Australia; Pacific Lime, Blue Circle Southern Cement, Adelaide Brighton Cement, Cockburn Cement, Loongana Lime and Unimin. All producers provided production data for this inventory, except in one case where lime production was estimated based on production data for previous years.

Limestone and Dolomite Use (2.A.3)

Limestone ($CaCO_3$) and dolomite ($CaCO_3.MgCO_3$) are basic raw materials having commercial applications in a number of industries including metallurgy (for example, iron and steel), glass manufacture, agriculture, construction and environmental pollution control. In industrial applications involving the heating of limestone or dolomite at high temperatures, CO_2 is generated.

All CO_2 emissions associated with limestone and dolomite use, with the exception of the components emitted from cement, lime and iron and steel production, are accounted for under Limestone and Dolomite Use. Emissions from use in cement and lime production are accounted for under 2A1 and 2A2. Limestone and Dolomite use in iron and steel production are accounted for under the 2.A.3 source category.

Seven companies use limestone or dolomite in their production processes and all provide data for the Inventory; Bluescope, Onesteel, Xstrata, Pilkington ACI, Amcor Packaging Temco and Tyco Foundries.

Soda Ash Production and Use (2.A.4)

Soda ash (sodium carbonate, Na_2CO) is used as a raw material in a large number of industries including glass manufacture, soap and detergents, pulp and paper manufacture and water treatment. In Australia, commercial soda ash is manufactured using the Solvay process. CO_2 is generated in two pyrolysis processes. The CO_2 generated is captured, compressed and directed to Solvay precipitating towers for consumption in a mixture of brine (aqueous NaCl) and ammonia.

Soda ash is produced by one company, Penrice Soda Products, located in South Australia. Production data and emissions are confidential. Emissions estimates from soda ash are aggregated with confidential emissions from magnesia, ammonia and nitric acid production and reported under 'confidential remissions reported as CO_2-equivalent'.

Asphalt Roofing (2.A.5)

There is negligible use of asphalt for roofing purposes in Australia.

Road Paving With Asphalt (2.A.6)

Cutback bitumen is the most common form of primer used in Australia to protect roads from excessive wear. Cutback bitumen primers and primer binders are manufactured from refined bitumen, which are "cutback" (i.e. blended) with petroleum solvents. NMVOC emissions occur during the mixing of bitumen batches, stockpiling, application and curing of the road surface.

Other (2.A.7)

Magnesia Production

Magnesia is produced from calcination of magnesite (magnesium carbonate ore), with the main emission arising from this source being CO_2. Emissions are estimated from magnesia production, the fractional purity of magnesia produced, and the stoichiometry of the chemical process.

Two companies produce magnesia in Australia; Causmag and Qmag. Both of these companies provided production data for the 2003 Inventory. Magnesia production and emissions are confidential and are reported under 'confidential remissions reported as CO_2-equivalent'.

4.2.2 Methodology

For all source categories in the *mineral products* sub-sector, IPCC tier 2 methodologies and country specific emission factors have been applied. 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.

A full description of the methodologies and emission factors is presented in the Australian *Methodology for the Estimation of Greenhouse Gas Emissions and Sinks 2003: Industrial Process Emissions* (NGGIC 2005d).

The main sources of *mineral products* activity data are the Cement Industry Federation, and companies involved in lime and limestone production.

4.2.3 Uncertainties and Time Series consistency

The tier 1 uncertainty analysis in Annex 7 provides estimates of uncertainty according to IPCC source category and gas.

Time series consistency is ensured by use of consistent models, model parameters and datasets for the calculations of emissions estimates. Where changes to emission factors or methodologies occur, a full time series recalculation is undertaken.

4.2.4 Source specific QA/QC

This source category is covered by the general QA/QC of the greenhouse gas inventory in Section 1.6. Data are obtained direct from companies and are subject to verification against known published sources. The level of co-operation of Australian companies is very high. In one or two instances, however, where data cannot be obtained directly, AGO estimates have been developed based on information on total and company specific estimates of market supplies and demand.

Australia's cement production emissions estimates are based on clinker production, in line with IPCC guidelines. Comparison between the 2002 reported clinker production and cement production for Australia reported by the United Nations shows a difference of approximately 14%. This difference is due to the high level of use of supplementary cementitious materials (fly ash and granulated blast furnace slag) in Australian cement.

4.2.5 Recalculations since the 2002 Inventory

Estimates of in-house lime are now sourced direct from Queensland Alumina Ltd (QAL). The estimates based on QAL data replace previous AGO estimates. All emissions from 1990 have been recalculated. The average magnitude of the recalculation is a 5% reduction (0.1 Mt) in CO_2 emissions.

Enhanced coverage of limestone and dolomite use has also been implemented for this inventory, with data obtained from lead smelting, copper smelting, foundries, glass production, ferromanganese production and silicomanganese production companies. All emissions from 1990 have been recalculated. The average magnitude of the recalculation is a small 4% increase (0.04 Mt) in CO_2 emissions.

The previously reported estimate of carbon dioxide uptake in the production of soda ash has not been included in this inventory, pending further research to quantify this effect. The impact on the inventory of this change is small.

4.2.6 Planned Improvements

Activity data and emission factors are kept under review.

4.3 Source Category 2B Chemical Industry

4.3.1 Source category description

Ammonia Production (UNFCCC Category 2.B.1)

The overall manufacturing process for ammonia production involves a series of stages to remove impurities such as sulphur, carbon monoxide, carbon dioxide and water from the natural gas feedstock and the generation and reaction of hydrogen and nitrogen. The multi stage process involved in ammonia production (from natural gas feedstock) results in the industrial process emissions of CO_2, NMVOC, and CO in addition to ammonia and sulphur compounds.

Ammonia is produced by four producers in Australia; Wesfarmers, Incitec, Western Mining Corporation and Queensland Nitrates. All companies provided production data for the 2003 Inventory. Ammonia production data and emissions are confidential and are reported along with other confidential sources under 'Confidential emissions reported as CO_2 equivalent'.

Nitric Acid Production (2.B.2)

The manufacture of nitric acid (HNO_3) generates nitrous oxide (N_2O) as a by-product of the high temperature catalytic oxidation of ammonia (NH_3). Nitric acid is produced by three producers in Australia; Wesfarmers, Incitec and QLD Nitrate. All companies provided data for the 2003 Inventory. Nitric acid production data and emissions are confidential and are reported under 'confidential emissions reported as CO_2 equivalent'.

Adipic Acid Production (2.B.3)

There is no adipic acid production occurring in Australia.

Carbide Production (2.B.4)

Silicon carbide and calcium carbide are not produced in Australia. Imported calcium carbide is used to produce acetylene and is also used in small quantities as a flux in electric arc furnace steel production. At present complete data to estimate emissions are not available.

Other (2.B.5)

Synthetic Rutile

Rutile is titanium dioxide, which is naturally occurring in Australia. Synthetic rutile can be produced from naturally occurring ilmenite, which is a complex oxide with iron. Rutile is used in the manufacture of titanium dioxide pigment, which is used in paints, plastic goods, inks and paper.

Synthetic rutile is produced in Australia by Iluka Resources and the Ti-West Joint Venture. Data was obtained directly from Iluka Resources while the balance has been estimated from various Statistics Digests published by the WA Department of Minerals and Energy and information on capacity available from company websites.

Polymers and Other Chemicals

The manufacture of organic chemicals results in process emissions of NMVOC. Other gases such as CO_2, CH_4, N_2O, NO_x and CO may also be generated depending on the manufacturing process.

Complete time series of emissions of CH_4 and NMVOCs are included in the inventory for butadiene, carbon black, ethyl benzene, ethylene, ethylene oxide, formaldehyde, HDPE, LDPE, LLDPE, propylene, polypropylene, polystyrene, styrene, polyvinyl chloride, and styrene butadiene rubber. Disaggregated production and emissions data for these sources are confidential. Emissions estimates are aggregated at the polymers and other chemicals source category level.

There are approximately 15 companies producing a large range of polymers and other chemicals in Australia. Production data are supplied by individual companies. Disaggregated production and emissions data for individual chemicals are confidential.

4.3.2 Methodology

Emissions estimates from ammonia production are derived using an IPCC tier 2 methodology and default emission factors. Nitric acid production emissions are based on a tier 2 method and country specific emission factors which are based on continuous plant monitoring. A tier 2 method and a mixture of default and country specific emission factors are used for polymers and other chemicals.

A full description of the methodologies and emission factors is presented in the *Australian Methodology for the Estimation of Greenhouse Gas Emissions and Sinks 2003: Industrial Process Emissions* (NGGIC 2005d).

The main sources of data are Wesfarmers, Orica (Incitec), Queensland Nitrates and companies involved in polymers and other chemicals manufacture.

4.3.3 Uncertainties and Time Series consistency

The tier 1 uncertainty analysis in Annex 7 provides estimates of uncertainty according to IPCC source category and gas. Time series consistency is ensured by use of consistent models, model parameters and datasets for the calculations of emissions estimates. Where changes to emission factors or methodologies occur, a full time series recalculation is undertaken.

4.3.4 Source specific QA/QC

This source category is covered by the general QA/QC of the greenhouse gas inventory in Section 1.6. Data are obtained direct from companies and are subject to verification against known published sources. The level of co-operation of Australian companies is very high.

4.3.5 Recalculations since the 2002 Inventory

The coverage of ammonia producers was enhanced for this inventory to include an ammonia production plant, Queensland Fertiliser Operations (QFO) at Phosphate Hill, Queensland, for the first time. All relevant data on QFO have been provided and ammonia production coverage is complete.

4.3.6 Planned Improvements

Activity data and emission factors are kept under review.

4.4 Source Category 2C metal production

4.4.1 Source category description

Iron and Steel Production (UNFCCC Category 2.C.1)

Iron and Steel production emission sources relate to the in-house production of metallurgical coke and lime, the use of limestone and dolomite as flux in iron, steel and ferro-alloy production and fugitive gas leaks associated with the distribution of coke oven gas and other products within industrial premises. In-house lime production is accounted for under 2.A.2 and Limestone and Dolomite use is accounted for under 2.A.3.

Metallurgical coke is an essential material in iron and steel production where it serves a number of major functions including the provision of a porous support for furnace ingredients, as a combustion ingredient producing the reducing atmosphere required for ore refinement and as a chemical reductant. Emissions from the use of coke as a reductant are reported in this sector, whereas emissions from combustion of coke for energy are reported under sector 1.A.

There are 2 major producers of iron and steel in Australia; Onesteel and Blue Scope. Integrated iron and steel production occurs in New South Wales and South Australia and there is a hot briquetted iron (HBI) plant that uses natural gas as a reductant in Western Australia. Both companies provided data for the inventory process.

Ferroalloys Production (2.C.2)

There is no ferroalloys activity occurring in Australia.

Aluminium Production (2.C.3)

Aluminium is produced by the electrolysis of alumina in a series of complex electrode reactions. The overall reaction results in aluminium being produced at the cathode and carbon dioxide at the anode.

PFC emissions result from anode effects (process upsets). The emission factor is an average across smelters. Individual smelters use plant emission factors based on empirical models from like plants and consistent with the requirements of the IPCC Good Practice Guidance.

There are three main companies operating aluminium smelters in Australia; Alcoa, Tomago Aluminium and Comalco. The Australian Aluminium Council provided emission factor data for the 2003 Inventory and production data were obtained from ABARE Commodity Statistics.

SF_6 used in Aluminium and Magnesium Foundries (2.C.4)

The inventory includes experimental quantities of SF_6 used between 1996 and 2000 as a cover gas in magnesium foundries preparatory to the development of a commercial magnesium casting plant (which was not, ultimately, commercially viable).

Other Metals Production (2.C.5)

The other metals source category includes copper, lead, nickel, silver and zinc. The production processes involve the smelting of sulphur containing metallic ores. Ore composition and stoichiometric relationships have been used to derive SO_2 emission estimates for the inventory.

There are approximately 10 companies involved in the production of other metals in Australia. Production data are sourced from ABARE Commodity Statistics.

4.4.2 Methodology

A mixture of tier 1 and tier 2 methodologies and country specific emission factors are used to derive emissions from the metal products source category. 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.

A full description of the methodologies and emission factors is presented in the Australian *Methodology for the Estimation of Greenhouse Gas Emissions and Sinks 2003: Industrial Process Emissions* (NGGIC 2005d).

4.4.3 Uncertainties and Time Series consistency

The tier 1 uncertainty analysis in Annex 7 provides estimates of uncertainty according to IPCC source category and gas. Time series consistency is ensured by use of consistent models, model parameters and datasets for the calculations of emissions estimates. Where changes to emission factors or methodologies occur, a full time series recalculation is undertaken.

4.4.4 Source specific QA/QC

This source category is covered by the general QA/QC of the greenhouse gas inventory in Section 1.6. Data are obtained direct from companies and are subject to verification against known published sources. The level of co-operation of Australian companies is very high.

4.4.5 Recalculations since the 2002 Inventory

Iron and Steel

Iron and steel data were revised for this inventory and are based on coke consumption reported in ABARE (2004). The coke consumption data for 2002 used for the previous submission were based on preliminary ABARE data. The recalculation has resulted in a 7.3% (0.7 Mt) reduction in the iron and steel CO_2-equivalent emissions estimate for 2002.

Aluminium production

A full recalculation of emissions from aluminium has occurred as a result of two factors. First, an emissions removals estimate from the alumina production process has been excluded pending further research to better quantify this process. Second, a revision to the CO_2 emissions factor related to anode consumption has also been implemented based on newly available plant level data from the Australian aluminium industry. The average magnitude of recalculation is a 5% increase (0.2 Mt) in CO_2-equivalent emissions over the time series.

4.4.6 Planned Improvements

Activity data and emission factors are kept under review.

4.5 Source Category 2D Other Production

4.5.1 Source Category Description

The manufacture of beer, wine, alcoholic spirits, and bread involve the use of fermentation processes. In accordance with IPCC guidelines, the fermentation of sugar by industry is not considered to be a net source of CO_2 emissions. NMVOC emissions from food and drink production, however, are included in the inventory. Production data for meat and poultry, beer and wine are obtained from ABS data. Production data for sugar are obtained from ABARE (2004).

4.5.2 Methodology

Food and drink emissions are based on tier 2 methods and IPCC default and country specific methodologies. 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.

A full description of the methodologies and emission factors is presented in the *Australian Methodology for the Estimation of Greenhouse Gas Emissions and Sinks 2003: Industrial Process Emissions* (NGGIC 2005d).

4.5.3 Uncertainties and Time Series Consistency

The tier 1 uncertainty analysis in Annex 7 provides estimates of uncertainty according to IPCC source category and gas. Time series consistency is ensured by use of consistent models, model parameters and datasets for the calculations of emissions estimates. Where changes to emission factors or methodologies occur, a full time series recalculation is undertaken.

4.5.4 Source specific QA/QC

This source category is covered by the general QA/QC of the greenhouse gas inventory in Section 1.6.

4.5.5 Recalculations since the 2002 Inventory

Nil.

4.5.6 Planned Improvements

Activity data and emission factors are kept under review.

4.6 Source Category Production and consumption of halocarbons and SF_6 (UNFCCC category 2E and 2F)

4.6.1 Source category description

Production of Halocarbons and SF_6 (2.E)

HCFC-22 was produced in Australia from 1990 to 1995.

Consumption of Halocarbons and SF_6 (2.F)

This sub-sector comprises emissions of synthetic gases from their use in refrigeration and air conditioning, foam blowing, fire extinguishers, aerosols, solvents and other uses.

4.6.2 Methodology

For the production of HCFC-22, the IPCC tier 1 default methodology and an IPCC default emission factor of 0.04t of HFC-23 per tonne of HCFC-22 has been used. This factor is at the upper limit of the default range and is considered appropriate given the age of the facility at the time of production.

For emissions from consumption of synthetic gases, the introduction of legislation in the form of the *Ozone Protection and Synthetic Greenhouse Gas Management Act* (2003) has generated for the first time a reliable and accurate source of potential synthetic greenhouse gas emissions data. The *Act* includes provisions for Montreal Protocol industries to report bulk imports of HFCs and PFCs and quantities of HFCs and PFCs in pre-charged equipment.

Bulk import of HFC 134a, Other HFCs and Exotic HFCs are assigned to a particular end-use category to which IPCC default leakage rates are applied (initial losses, lifetime losses and end of life losses) to give an emissions profile over time.

Back-casting of potential emissions is required and this is straightforward as the starting points for the transition from ozone depleting substances to synthetic greenhouse gases are well known. A linear growth rate is used up to the point where the new potential data become available.

Emissions from SF_6 use in the electricity supply and distribution industry have been included for the first time in this inventory. Emissions estimates are based on the number of high voltage substations in Australia. Each substation is assumed to hold a charge of 40 tonnes of SF_6 and experience an annual leakage rate of 0.5%.

A full description of the methodologies and emission factors is presented in the *Australian Methodology for the Estimation of Greenhouse Gas Emissions and Sinks 2003: Industrial Process Emissions* (NGGIC 2005d).

4.6.3 Uncertainties and Time Series consistency

The tier 1 uncertainty analysis in Annex 7 provides estimates of uncertainty according to IPCC source category and gas. Time series consistency is ensured by use of consistent models, model parameters and datasets for the calculations of emissions estimates. Where changes to emission factors or methodologies occur, a full time series recalculation is undertaken.

4.6.4 Source specific QA/QC

This source category is covered by the general QA/QC of the greenhouse gas inventory in Section 1.6. Data are obtained by the Department of Environment and Heritage from companies under licensing arrangements established under the *Ozone Protection and Synthetic Greenhouse Gas Management Act* (2003) and is subject to verification against known published sources (the Australian Bureau of Statistics data on imports of HFC-134a).

4.6.5 Recalculations since the 2002 Inventory

HFC consumption in refrigeration and air conditioning has been recalculated based on data obtained under the new legislation and other Montreal Protocol sources have also been included for the first time in this inventory and the adoption of IPCC defaults for key parameters. In addition to the new Montreal Protocol industry sources, emissions of SF6 from the electricity supply industry have been included for the first time.

4.6.6 Planned Improvements

Activity data and emission factors are kept under review. Estimates of emissions from the use of synthetic gases have been based on the preliminary data from the collection processes established under the *Ozone Protection and Synthetic Greenhouse Gas Management Act* (2003). In next year's submission, these estimates will be recalculated following the completion of a full year's data collection under these processes.

Chapter 5
Solvent and other product use

5.1 Overview

Activities in the *Solvent and other products use* source category results in emissions of NMVOCs. Total net emissions estimated from *solvents and other products* were 0.15 Mt NMVOC in 2003, or 8.0% of net national NMVOC emissions (Table 9). The main determinant of *solvent and other product* use emissions from year to year is the quantity of the relevant product that is produced or used.

Table 9: Solvent and other product use NMVOC emissions , 2003

Greenhouse gas source and sink categories	NMVOC emissions (Gg)	%Total net national NMVOC emissions
Total net national NMVOC emissions	**1,883**	100.0
3 SOLVENT AND OTHER PRODUCT USE	**151**	8.0
A Paint application	71	3.8
B Degreasing and dry cleaning	36	1.9
C Chemical products manufacture and processing	1	0.1
D Other	43	2.3
Domestic and commercial aerosol products	8	1.4
Other domestic and commercial products	9	0.4
Consumer cleaning products	26	0.5

Paint application contributed 47.4% (0.07 Mt NMVOC) of the sector's emissions, *degreasing and dry cleaning* contributed 23.7% (0.04 Mt NMVOC), *chemical products manufacture and processing* contributed 0.6% (0.001 Mt NMVOC), and the *other* contributed 28.3% (0.04 Mt NMVOC).

5.2.1 Source Category Description

Surface coating operations involve the application of paint, varnish, lacquer or paint primer for decorative or protective purposes. Thinning solvents are normally used to dilute surface coating formulations or for cleaning purposes. Surface cleaning or degreasing operations involve the removal of materials such as oils, grease, waxes and moisture from surfaces. Chemical products manufacture and processing covers paint and ink manufacturing. General solvent use and consumer cleaning by the domestic and commercial sectors covers a large range of products including Domestic and Commercial Aerosol Products; Other Domestic and Commercial Products; and, Consumer Cleaning Products.

5.2.2 Methodology

The general approach to estimating emissions of NMVOCs from *solvent and other product use* is to use IPCC default or US EPA per capita emission factors applied to population estimates. Paint production data obtained from the Australian Paint Manufacturers Federation are used for the calculation of emissions from paint application and chemical products manufacture and processing.

A full description of the methodologies and emission factors is presented in the *Australian Methodology for the Estimation of Greenhouse Gas Emissions and Sinks 2003: Solvent and Other Product Use* (NGGIC 2005e).

5.2.3 Uncertainties and Time Series consistency

The tier 1 uncertainty analysis in Annex 7 provides estimates of uncertainty according to IPCC source category and gas. Time series consistency is ensured by use of consistent models, model parameters and datasets for the calculations of emissions estimates.

5.2.4 Source specific QA/QC

This source category is covered by the general QA/QC of the greenhouse gas inventory in Section 1.6

5.2.5 Recalculations since the 2002 Inventory

Nil.

5.2.6 Planned Improvements

Activity data and emission factors are kept under review.

CHAPTER 6
AGRICULTURE

6.1 OVERVIEW

Agriculture produced an estimated 97.3 Mt CO_2-e emissions or 17.7% of net national emissions in 2003 (Table 10). The *agriculture* sector is the dominant national source of both methane and nitrous oxide—accounting for 67.9 % (75.7 Mt CO_2-e) and 77.1% (24.3 Mt CO_2-e) respectively of the net national emissions for these two gases. These emissions principally consisted of methane from *livestock, manure management* and *savanna burning*, and nitrous oxide from *manure management, savanna burning* and *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).

Greenhouse gas emissions from *livestock*, which are the sum of the *enteric fermentation* and manure management subsectors, declined by 5.0% (3.5 Mt) between 1990 and 2003, and by 0.9% (0.6 Mt) from 2002 to 2003. In contrast, there as been a 30.1% (7.2 Mt) increase in emissions from the remaining *agriculture* subsectors between 1990 and 2003. The net result of these trends is an increase of 4.0% (3.7 Mt) in greenhouse gas emissions from *agriculture* between 1990 and 2003, but a 1.3% (1.3 Mt) decrease from 2002 to 2003.

Table 10: Agriculture sector CO_2-e emissions, 2003

Greenhouse gas source and sink categories	CO_2-e emissions (Gg)				%Total net national emissions
	CO_2	CH_4	N_2O	Total	
Total net national emissions (Kyoto)	404,577	108,468	30,701	550,049	100
4 AGRICULTURE		73,625	23,656	97,281	17.7
A Enteric fermentation		62,748		62,748	11.4
B Manure management		2,048	1,286	3,334	0.6
C Rice cultivation		400		400	0.1
D Agricultural soils		NE	18,716	18,716	3.4
E Prescribed burning of savannas		8,220	3,564	11,784	2.1
F Field burning of agricultural residues		209	89	298	0.1

LIVESTOCK

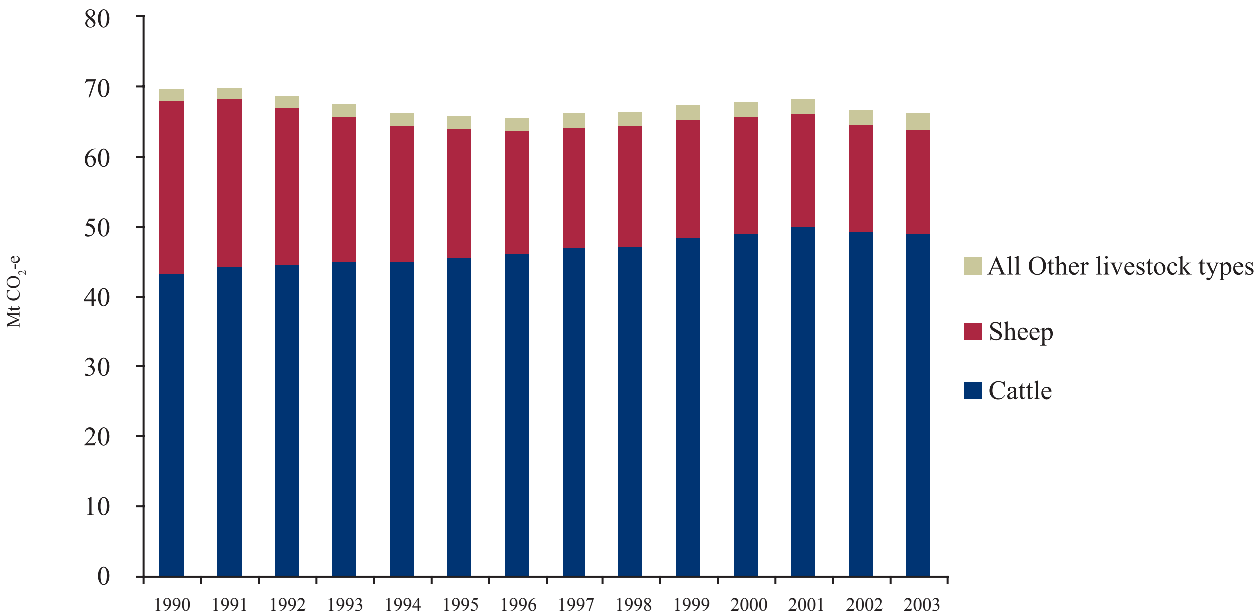
Livestock emissions were 66.1 Mt CO_2-e in 2003, which represents 67.9% of the *agriculture* sector's emissions and 12.0% of net national emissions.

TRENDS

Livestock related emissions in 2003 were 5.0% (3.5 Mt) lower than in 1990 and 0.6 Mt CO_2-e (0.9%) lower than in 2002 (Figure 13). Between 1990 and 2003, cattle numbers have gradually increased from 24.8 million to 26.7 million (7.2%). This growth in cattle numbers is tending to drive up livestock emissions, particularly as emissions per head from cattle are about 12 times that per head of sheep. Against this trend, sheep numbers, after having peaked in 1990 at 173 million, have declined to 99 million (-42.3%) in 2003 due largely to reduced returns to the industry. The combined effect of these two trends is that *livestock* emissions peaked in 1991, declined between 1991 and 1996 and subsequently rose until 2001. Declines in all animal populations with the exception of feedlot cattle have occurred since then, although it is too early to interpret this as a reversal of the upward trend of the late 1990s in light of the widespread drought conditions in this period.

The relative contribution of CH_4 and N_2O to Livestock emissions has been relatively stable. N_2O emissions increased by 147% (0.8 Mt CO_2-e) from 1990 to 2003 due to increasing intensification of the livestock industries (319% and 47% increase in feedlots and poultry respectively). However, this results in little change to aggregate emissions because N_2O is such a small component (2%) of livestock emissions.

Figure 13: CO_2-e emissions from livestock, 1990–2003



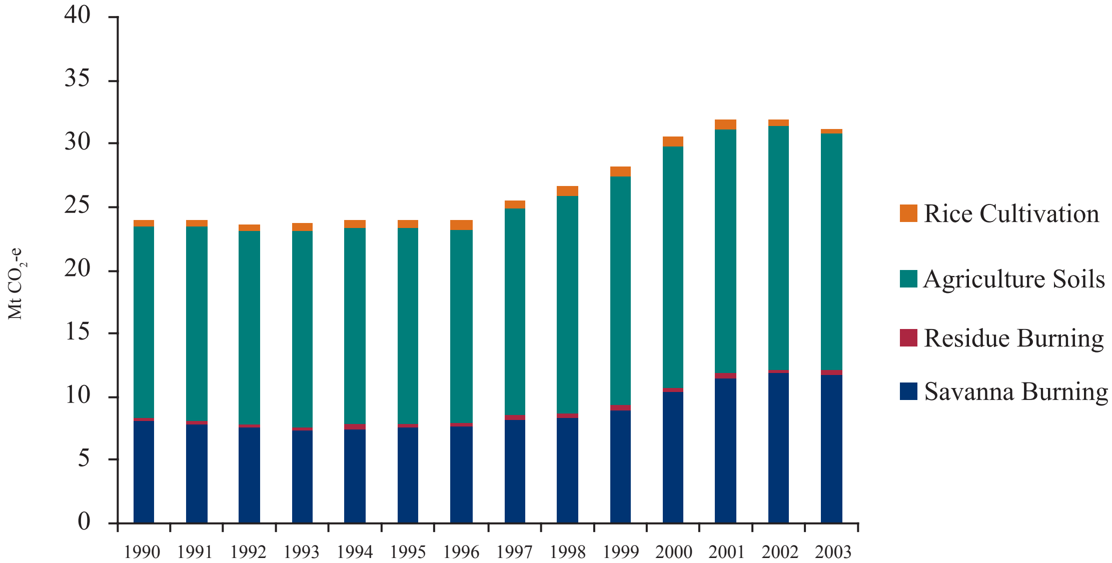
Other Agriculture

Total estimated emissions from the *other agriculture* subsectors in 2003 were 31.2 Mt CO_2-e. These include emissions from *rice cultivation* (0.4 Mt), *agricultural soils* (18.7 Mt), *prescribed burning of savannas* (11.8 Mt) and *field burning of agricultural residues* (0.3 Mt) (see Table 10).

Trends

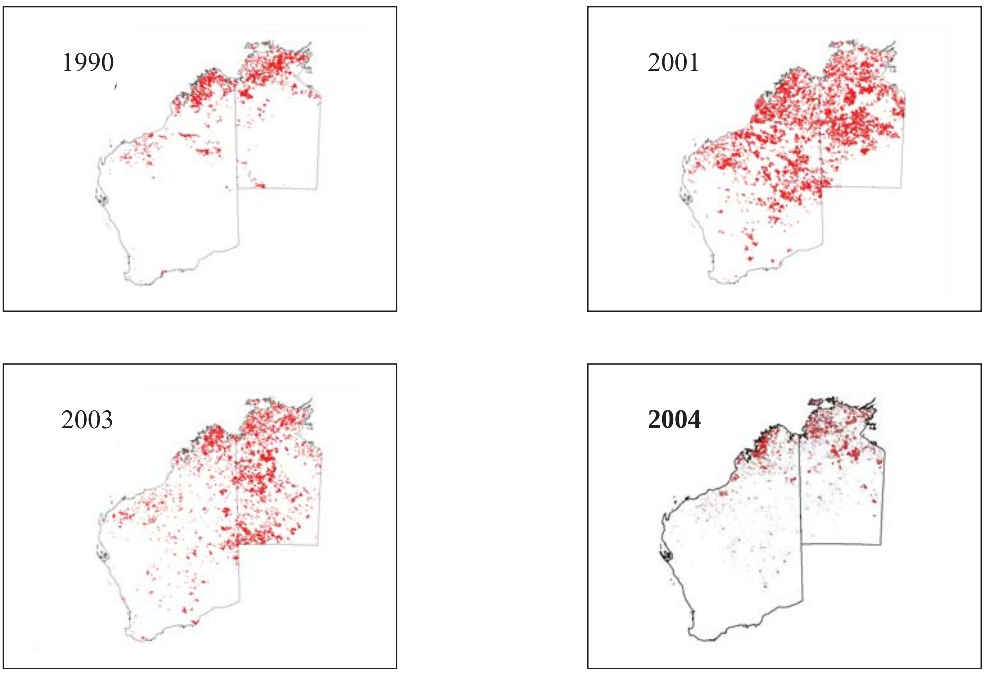
Emissions from agricultural land cultivation and burning of savanna and crop residues in 2003 were 30.1% (7.2 Mt) higher than in 1990 but 2.4% (0.8 Mt) lower than in 2002. The increase since 1990 is principally a result of larger areas of savanna burnt since the mid-1990s compared to earlier years, and an increase in emissions from agricultural soils due to the growing use of synthetic fertilisers. The decrease from 2002 to 2003 is due to the drought across Australia continuing into a second year, leading to further declines in agricultural production and making less water available for irrigation so that emissions from agricultural soils and rice cultivation in particular fell.

Figure 14: Total emissions of other agriculture subsectors, 1990–2003



Savanna burning emissions are estimated to have increased by 46.6% (3.7 Mt) between 1990 and 2003. The higher emissions reflect higher fire activity (area burnt) rising from low levels in the late 1980s and early 1990s to a cyclical peak in 2001, followed by decreases over 2002–2004. The changes are visible in the fire scar images for the two largest jurisdictions, Western Australia and the Northern Territory (Figure 15). The cause of the upward decadal trend in fire activity to 2001 has been an increase in annual rainfall in the preceding seasons that promotes vegetation growth and fuel accumulation, and is most probably the result of natural variability within a long term climate cycle (Meyer, 2004).

Figure 15: Savanna fires in NT and WA: 1990, 2001, 2003 and 2004



6.2 Livestock (UNFCCC categories 4A, 4B)

6.2.1 Source Category Description

Emissions from livestock industries are reported under the enteric fermentation (4A) and manure management (4B) categories. In Australia, the principal species comprise beef cattle and sheep, with breeds chosen to operate within pasture and paddock management systems and, in many cases, in dry or semi-arid climatic conditions. Typical animal performance, as a consequence, tends to vary significantly from those of other Annex I countries.

6.2.2 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 99% of the national greenhouse emissions from *livestock*. Emissions are estimated based on feed intake, which is calculated from information on liveweights, liveweight gain, milk or wool production and feed digestibility. Variations in animal performance due to regional climatic conditions, management techniques and herd characteristics are taken into account.

A tier 1 approach using both country-specific and IPCC default emission factors is used to estimate *enteric* methane emissions for all other livestock classes, such as horses, goats, buffalo, deer, emu and alpaca. These are a small component (less than 1%) of the national *livestock* emissions.

For range-kept beef cattle and sheep, emissions from *manure management* are estimated using emission factors (kg CH_4/ kg manure dry matter) developed from González-Avalos and Ruiz-Suárez (2001) as these are based on the manure of animals kept under conditions similar to those in Australia. For other livestock, emissions are calculated using the IPCC tier 2 approach and are based on an estimate of the volatile organic fraction of manure, the potential capacity of this material to produce methane, 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 nitrogen balance technique, while pig excretion rates are based on an industry nutrient balance model. Emissions of nitrous oxide are a function of this excretion, the manure management systems used, and the IPCC default emission factors.

More information is provided in Annex 3 and a full description of the methodologies and emission factors are presented in *Australian Methodology for the Estimation of Greenhouse Gas Emissions and Sinks 2003: Agriculture* (NGGIC, 2005f).

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.feedlots.com.au>), and industry statistics for milk production (<http://www.dairyaustralia.com.au >).

6.2.3 Uncertainties and Time Series consistency

The tier 1 uncertainty analysis in Annex 7 provides estimates of uncertainty according to IPCC source category and gas. Time series consistency is ensured by the use of consistent methods and full recalculations in the event of any refinement to methodology.

6.2.4 Source Specific QA/QC

The Australian Bureau of Statistics (ABS) is the national statistical agency of Australia and is the key provider of activity data for this source category. ABS has in place 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. Sampling errors are also evaluated.

Data quality used in the inventory is also kept under review by the AGO. In particular, specific review of data quality has led to a revision in milk production data utilised for this inventory. This source category is also covered by the general QA/QC procedures detailed in Section 1.6.

6.2.5 Recalculations since the 2002 Inventory

Emissions for the most recent year in the *agriculture* sector are recalculated each year due to the recalculation of the three-year average of emissions once the third year of data becomes available.

Dairy Cattle

Preliminary estimates of average annual milk production have been updated by Dairy Australia for the years 2001 and 2002.

Beef Cattle and Sheep – Manure Management CH_4

In this inventory a new source of emissions has been estimated for the first time. Previously, the assessment of Australian experts was that the IPCC methodology and default values overestimated emissions for range-kept beef and sheep livestock and that consequently they were not applicable to Australian conditions. For this inventory, emissions from these animals have been estimated using emission factors from González-Avalos and Ruiz-Suárez (2001) based on manure of animals kept under conditions similar to those experienced in Australia.

6.2.6 Source Specific Planned Improvements

Issues identified in the expert review of Australia's 2002 Inventory will be investigated for the next inventory.

6.3 Other agriculture – Non-Livestock industries (UNFCCC categories 4C, 4D, 4E, 4F)

6.3.1 Source Category Description

Sources include methane emissions from rice cultivation (4C), nitrous oxide emissions from agricultural soils (4D), methane and nitrous oxide emissions from the burning of savannas (4E) and agricultural crop residues (4F). Emissions of nitrous oxide from agricultural soils derive from a number of sources and are classified by the IPCC as 4.D.1 'Direct'; 4.D.2, 'Animal Production' and 4.D.3 'Indirect'. The methodology to estimate emissions in this sector is necessarily complex in order to be able to estimate emissions from the full range of sources. Emissions derive from three principal sources – animal wastes, synthetic fertilisers and from cultivation or soil disturbance. In Australia's inventory, soil disturbance includes both direct emission sources – N-fixing crops, crop residues and cultivation of histosols (although the presence of histosols in agricultural lands in Australia is likely to be negligible) – and indirect emissions from atmospheric deposition.

6.3.2 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. More information is provided in Annex 3 and a full description of the methodologies and emission factors is presented in *Australian Methodology for the Estimation of Greenhouse Gas Emissions and Sinks 2003: Agriculture* (NGGIC, 2005f).

Emissions from *rice cultivation* (4.C) are estimated using the IPCC tier 1 methodology and a country-specific emission factor. The methodologies for *prescribed burning of savannas* (4.E), and *field burning of agricultural residues* (4.F) closely correspond to the IPCC tier 2 methodologies but with modifications relevant to Australian conditions and the available data. Australia utilises a comprehensive, country specific approach to the estimation of nitrous oxide emissions from sources other than from fertilisers, animal wastes and animal production, estimated in a term classified as 'soil disturbance'. This term captures emissions from nitrogen fixation by plants, indirect emissions from atmospheric deposition and cultivation and provides a complete, transparent and time-series consistent estimate of emissions from this source based on a series of peer-reviewed Australian empirical studies (see Annex 3 for more information).

The main sources of data for the other (non-livestock) agriculture subsectors 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), the Satellite Remote Sensing Services Group of the WA Department of Land Information for the AVHRR imagery of savanna fire scars, and the state government authorities responsible for fire control in private land, state forests, crown land and national parks.

6.3.3 Uncertainties and Time Series consistency

The tier 1 uncertainty analysis in Annex 7 provides estimates of uncertainty according to IPCC source category and gas. Time series consistency is ensured by the use of consistent methods and full time series recalculations for all refinements to methodology.

6.3.4 Source Specific QA/QC

The principal source of data for this sector is the Australian Bureau of Statistics (ABS) Agricultural Survey and Census. The ABS is the national statistical agency of Australia and undertakes its own quality assurance and control programmes. Data quality is assessed by the ABS and sampling errors evaluated.

Data quality in this sector is also kept under review by the AGO. This source category is covered by the general QA/QC of the greenhouse inventory in Section 1.6.

Nitrous oxide emissions from soils comprise three terms – direct emissions from the use of fertilisers, emissions from animal production and a third term ‘soil disturbance’. The ‘soil disturbance’ term is a country specific, whole-of-system approach that nonetheless makes it difficult for reviewers to compare the Australian estimate for ‘soil disturbance’ with the disaggregated estimates reported by other parties. Additional QA/QC activity is required.

Fortunately, the UNFCCC (2004) has provided comparisons across parties of emissions from agricultural soils at an aggregated level. While not ideal for this purpose, the UNFCCC analysis provides a useful basis for making a broad comparison across party emissions estimates for this category. The UNFCCC reported estimates of nitrous oxide emissions from agricultural soils made by individual parties and the estimates of emissions that would have been reported had parties used the IPCC default emission factors.

The results for Australia and for the Annex I countries taken as a group are presented in Table 11. The results show that, for this category as a whole, Australia’s estimates of emissions (62.21 Gg) are within the range of estimates produced using IPCC default factors (21.7-144.26 Gg). Australia’s results are on the lower end of the IPCC range, and are less than the estimate that would have occurred had the mid point of the IPCC default factors been applied (91.49 Gg). This result is to be expected given the dry, extremely nitrogen-deficient soils that predominate in Australia, but this result—that use of IPCC defaults would give higher emission estimates—is even stronger for the Annex I parties reporting as a whole. While the estimate of emissions for Australia would have been higher by 1.47 times had IPCC default factors been applied: - for the Annex I group as whole, emissions would have been 2.33 times higher. This comparison suggests that the Australian estimates for the category as a whole are, if anything, conservative. Nonetheless, further work in this field is needed.

Table 11: Comparison of Australian estimates of nitrous oxide emissions from soils with those reported by Annex I countries as a whole: 2001

Party	Party estimate	Medium estimate using IPCC defaults	Range estimate using IPCC default range	Ratio of IPCC default estimate to Party estimate
	Gg	Gg	Gg	
	(1)	(2)	(3)	(2)/(1)
Australia	62.21	91.49	21.7-144.26	1.47
Annex I	2158.63	5309.59	1068.87- 12419.79	2.33

Source UNFCCC 2004.

6.3.5 Recalculations since the 2002 Inventory

Emissions for the most recent year in the *agriculture* sector are recalculated each year due to the recalculation of the three-year average of emissions once the third year of data becomes available.

The methodology for the estimation of emissions from the *prescribed burning of savannas* has been refined for this inventory following a review of recent empirical research and an extension of satellite-based activity data (Meyer, 2004). Time-dependent emission factors have been introduced for the major states where savanna burning occurs, Western Australia and the Northern Territory, based on fuel loads and burning efficiencies disaggregated by savanna grassland and savanna woodland. The nitrogen to carbon ratio has also been re-evaluated and revised downwards to a value similar to that used in earlier inventories.

The time series of satellite-based mapping of fire scars has been extended back to include the 1990 baseline to ensure consistency in activity data. Analysis of satellite data (high resolution AVHRR imagery) for the period 1990–1992 has enabled the construction of a longer consistent time series of fire scars (Figure 15), which replaces previous estimates based on the local records and expert judgement of state fire authorities. The time series confirms the previously estimated upward trend in fire activity over the 1990s to a cyclical peak in 2001, with a subsequent decline in fire activity over the period 2001-2004.

6.3.6 Planned Improvements

Australia is reviewing its methodology for estimating emissions from agricultural soils. This is a sector that has high uncertainties attached to emissions estimates, and for which certain elements are key categories. In particular, methodologies for estimating emissions from the application of fertilisers and minimum tillage are being examined. Additional research is also being conducted into the estimation of prescribed burning of savannas, including analysis of the seasonal variation in fuel loads and burning efficiencies. Analysis of nitrous oxide emissions from leaching will also be undertaken.

CHAPTER 7
LAND USE, LAND USE CHANGE AND FORESTRY

7.1 OVERVIEW

This chapter provides an inventory emissions report following, first, the international accounting rules that apply to Australia's 108% target and, second, using the accounting rules that operate for the UN Framework Convention on Climate Change. The principal difference lies in the treatment of net emissions from *Forest lands*.

KYOTO ACCOUNTING

According to the Kyoto accounting provisions, *land use, land use change and forestry* activities constituted an estimated net source of 34.8 Mt CO_2-e in 2003, representing 6.3% of the net national emissions (Table 12).

The preliminary estimate for land use change (or deforestation) emissions in 2003 is 49.6 Mt, compared with an estimated 126.2 Mt in 1990 and 60.6 Mt in 2002. The estimates for both 2002 and 2003 should be considered as being interim only, as they will be revised with the next update of estimates using the National Carbon Accounting System.

Reforestation activities (plantations established since 1990) are estimated to have sequestered approximately 14.8 Mt of CO_2 in 2003, an estimated increase of 1.8 Mt from 2002. Strictly speaking, under Kyoto target rules the greenhouse sinks credits are accounted for in 2008–12 only. However, their inclusion in the 2003 inventory account facilitates an understanding of Australia's emissions trends in relation to the 108% Kyoto target.

Table 12: Land use, land use change and forestry net CO_2-e emissions, 2003 (Kyoto accounting)

Greenhouse gas source and sink categories	CO_2-e emissions (Gg)				%Total net national emissions
	CO_2	CH_4	N_2O	Total	
Total net national emissions (Kyoto)	404,577	108,468	30,701	550,049	100
5 LAND USE, LAND USE CHANGE AND FORESTRY[(a)]	**32,877**	**1,525**	**417**	**34,819**	**6.3**
Afforestation and reforestation	–14,798			–14,798	-2.7
Land use change (deforestation)[(b)]	47,675	1,525	417	49,617	9.0

(a) A negative sign denotes a sink. (b) The results for deforestation for 2002 and 2003 will be revised when areas of deforestation are confirmed following the next update of estimates using the National Carbon Accounting System.

TRENDS

The preliminary estimate of emissions from *forest converted to grasslands*, of 49.6 Mt, is 76.6 Mt lower than emissions from this source in 1990 (see Figure 16). Since 1990 the annual rates of *forest conversion* have decreased substantially reflecting both the effects of changing market and climatic conditions and of regulatory impacts with consequent reductions in estimated emissions from burning and decay of above-ground biomass and below-ground carbon. There is also a diminishing effect of extensive past land use change on decay of above-ground biomass and below-ground carbon.

UNFCCC Accounting

According to the UNFCCC accounting provisions the net emissions from the *land use, land use change and forestry* sector were 34.8 Mt CO_2-e in 2003 (Table 13).

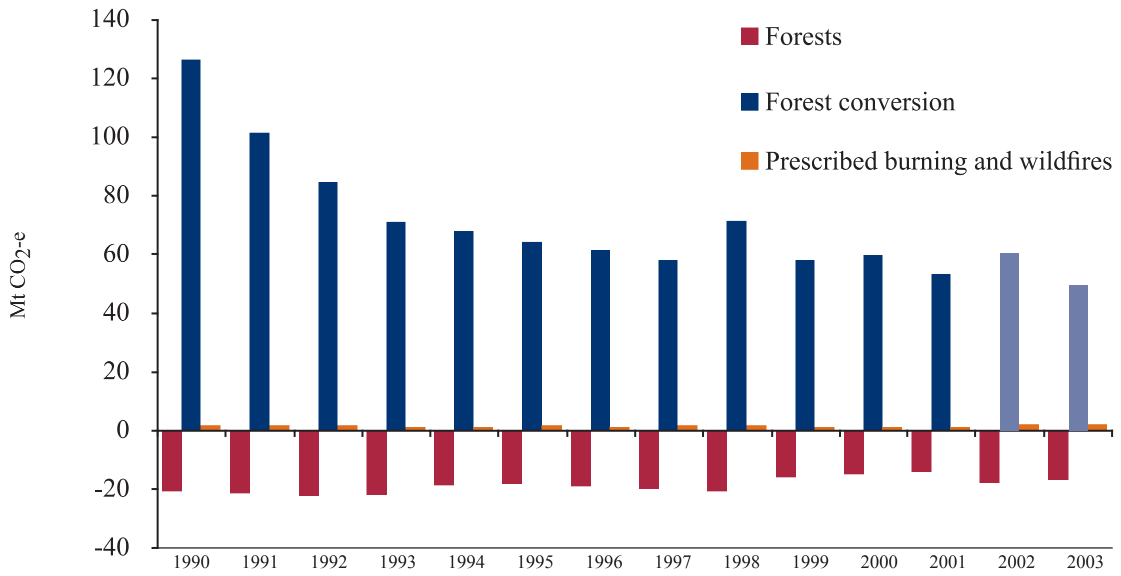
Table 13: Land use, land use change and forestry net CO_2-e emissions, 2003 (UNFCCC accounting)

Greenhouse gas source and sink categories	CO_2-e emissions (Gg)			
	CO_2	CH_4	N_2O	Total (includes CO_2)
5 LAND USE, LAND USE CHANGE AND FORESTRY[(a)]	**30,582**	**3,351**	**914**	**34,847**
A. Forest lands remaining forest lands[(b)]	–17,094	1,826	497	–14,770
B. Forest converted to croplands[(c)]	IE	IE	IE	IE
C. Forest converted to grasslands[(d)]	47,675	1,525	417	49,617

(a) A negative sign denotes a sink. (b) Includes emissions from prescribed burning and wildfires. (c) Emissions are included under 5C. (d) The results for 2002 and 2003 will be revised when areas of forest conversion are confirmed following the next update of estimates using the National Carbon Accounting System.

Forest lands (5A) includes CO_2 removals through growth of managed native forests and plantations and emissions from commercial harvest and fuelwood consumption. These subsectors are estimated to have constituted a net sink of 17.1 Mt CO_2-e in 2003. *Forests lands* also includes non-CO_2 gas emissions from prescribed burning and wildfire in forests. Estimated emissions for these subsectors were 2.3 Mt CO_2-e in 2003.

Figure 16: Total net CO_2-e emissions from land use change and forestry, 1990–2003 (UNFCCC accounting)



Note: The results for forest conversion for 2002 and 2003 will be revised when areas of forest conversion are confirmed following the next update of estimates using the National Carbon Accounting System.

Trends

Overall the total *land use change and forestry* emissions declined from 106.6 Mt CO_2-e in 1990 to 34.8 Mt CO_2-e in 2003, representing an 71.8% decrease.

The preliminary estimate of emissions from *forest converted to grasslands*, of 49.6 Mt, is exactly the same as for deforestation under the Kyoto accounting provisions.

Within UNFCCC *forest lands* (5A), emissions from *commercial forest harvesting* increased by 36.3% (12.8 Mt) to 48.2 Mt CO_2-e from 1990 to 2003, while emissions from *fuelwood consumption* decreased by 7.8% (0.9 Mt) to 10.2 Mt CO_2-e. Over the same period, sinks from *forest growth* increased by 11.8% (8.0 Mt) to 75.5 Mt CO_2-e. Emissions from biomass burning in forests (prescribed burning and wildfires) increased by 49.7% (0.8 Mt) to 2.3 Mt CO_2-e between 1990 and 2003.

The combined effect of these changes is a reduction in the *forest lands* net sink of 24.4% (4.8 Mt) to 14.8 Mt CO_2-e from 1990 to 2003.

7.2.1 Source Category Description

New UNFCCC category descriptions based on land use types and changes of land use between the categories have been introduced for this inventory. The new categories replace the old UNFCCC reporting system that was loosely based around the description of particular emissions and removals processes. The principal categories reported in the Australian inventory are forests and the conversion of forests to grass and crop lands.

Forest conversion to croplands (5B) and *grasslands (5C)* comprises emissions and removals arising from the removal of forest with a minimum of 20% canopy cover, a minimum height of two metres and a minimum area of 0.2 hectares. It includes emissions due to the decay of cleared vegetation and from soil disturbed in the clearing process, and removals due to the subsequent regrowth of vegetation. It also includes non-CO_2 gas emissions from the burning of cleared vegetation.

For Australia's 108% Kyoto target, the treatment of emissions from land use change activities (deforestation) is the same as reported for inventory accounting under the UNFCCC.

The Australian forestry industry manages both native forests and plantations and estimates of emissions and removals are derived from both types of production system. The conversion of forests into agricultural land is undertaken for the purpose of either developing grasslands for grazing or for rotation between cropping and grazing. It is rare for forests to be converted solely for the purpose of cropping alone.

No estimates are reported for liming. Australian agricultural lands consist of mineral soils in character, with organic soils restricted almost entirely to wilderness areas, and no estimates are made of emissions from the cultivation of histosols.

7.2.2 Methodology

The methodology, emission factors and other parameters used to compile the *land use, land use change and forestry estimates* are fully documented in the *Australian Methodology for the Estimation of Greenhouse Gas Emissions and Sinks 2003: Land Use and Land Use Change (NGGI 2005g): Australian Methodology for the Estimation of Greenhouse Gas Emissions and Sinks 2003: (Plantations) (NGGICh); Australian Methodology for the Estimation of Greenhouse Gas Emissions and Sinks 2003: (Forest Conversion) (NGGICi); as well as AGO (2002 and 2005b).*

The estimates of emissions from land use change are estimated within the National Carbon Accounting System (NCAS). The National Carbon Accounting System is a model-based accounting system supported by resource inventories, field studies and extensive multi-temporal remote sensing methods (see Annex 3). The reported estimate for 2003 is preliminary and has been estimated as the average of the NCAS-modelled 2002 and 2003 estimates, providing a smoothing of the trend in emissions from this source for the last year of the series until final estimates for that year are confirmed in the next NCAS update.

The approach to estimating carbon accumulation in forest plantations will evolve and be refined as the NCAS develops. In this inventory the system employs growth increment tables based on the work of Turner and James (2001), as developed from the National Forest Inventory (NFI 1997), while areas of relevant plantation types have been derived from Australia's National Plantation Inventory establishment estimates.

7.2.3 Uncertainties and Time Series Consistency

Analysis of the uncertainties of the emission estimates is presented in Annex 7. Time series consistency is maintained through the use of consistent models and data and the use of recalculations of the entire time series in the event of any changes to methodology or data sources.

7.2.4 Source Specific QA/QC

This source category is covered by the general QA/QC of the greenhouse inventory in Section 1.6. Independent quality assurance of the newly incorporated plantation forest modeling was provided by the Commonwealth Scientific and Industrial Research Organisation (CSIRO).

7.2.5 Recalculations since the 2002 Inventory

Estimates of carbon accumulation in plantations within the category forest lands for the period 1990-2003 have been recalculated for this inventory using models described in Richards and Brack (2004) and NGGIC (2005h).

Estimates of emissions from forest conversion into grasslands have been revised for the years 1990-2002, reflecting completion of the analysis of newly available remote sensing data and deployment of corrections for terrain illumination.

With the introduction of the new UNFCCC reporting categories, based on land use, a previously estimated sink related to the activity of *minimum tillage and pasture improvement,* has been subsumed into the development work of the National Carbon Accounting System. The previous estimate, reported under the old 5.D category, minimum tillage and pasture improvement, was based on limited data (both activity and removal estimates) and is no longer reported.

7.2.6 Source Specific Planned Improvements

Future improvements to the Australian inventory are concentrated in this sector, reflecting the sector's importance to the inventory (forest conversion is a key category), current state of uncertainties over emissions estimates and the potential for further benefits from additional effort.

Modeling capabilities are being developed through the National Carbon Accounting System. The next significant stage of development for forest plantations will be the use of the NCAS multi-temporal remote sensing program to spatially define the location of the plantation estate through time (since 1972), and the NCAS soil carbon modelling capabilities and non-CO_2 gases which may arise from activities such as fertiliser application, burning and decomposition.

Chapter 8
Waste

8.1 Overview

Total estimated waste emissions for 2003 were 11.4 Mt CO_2-e, or 2.1% of total net national emissions (Table 14). The majority of these emissions were from *solid waste disposal on land*, contributing 8.1 Mt or 71.8% of *waste* emissions. *Wastewater handling* contributed a further 3.2 Mt (28.1%) of *waste* emissions while *waste incineration* contributed 0.02 Mt (0.1%). *Waste* emissions are predominantly methane-generated from anaerobic decomposition of organic matter. Small amounts of carbon dioxide and nitrous oxide are generated through the *incineration of solvents* and the *decomposition of human* wastes respectively.

Table 14: Waste CO_2-e emissions, 2003

Greenhouse gas source and sink categories	CO_2-e emissions (Gg)				%Total net national emissions
	CO_2	CH_4	N_2O	Total	
Total net national emissions (Kyoto)	404,577	108,468	30,701	550,049	100
6 WASTE	**16**	**10,771**	**559**	**11,361**	2.1
A. Solid waste disposal on land	NE	8,141	NE	8,141	1.5
B. Wastewater handling	NE	2,645	559	3,203	0.6
C. Waste incineration	16	NA	NE	16	0.003
D. Other waste	NA	NA	NA	NA	NA

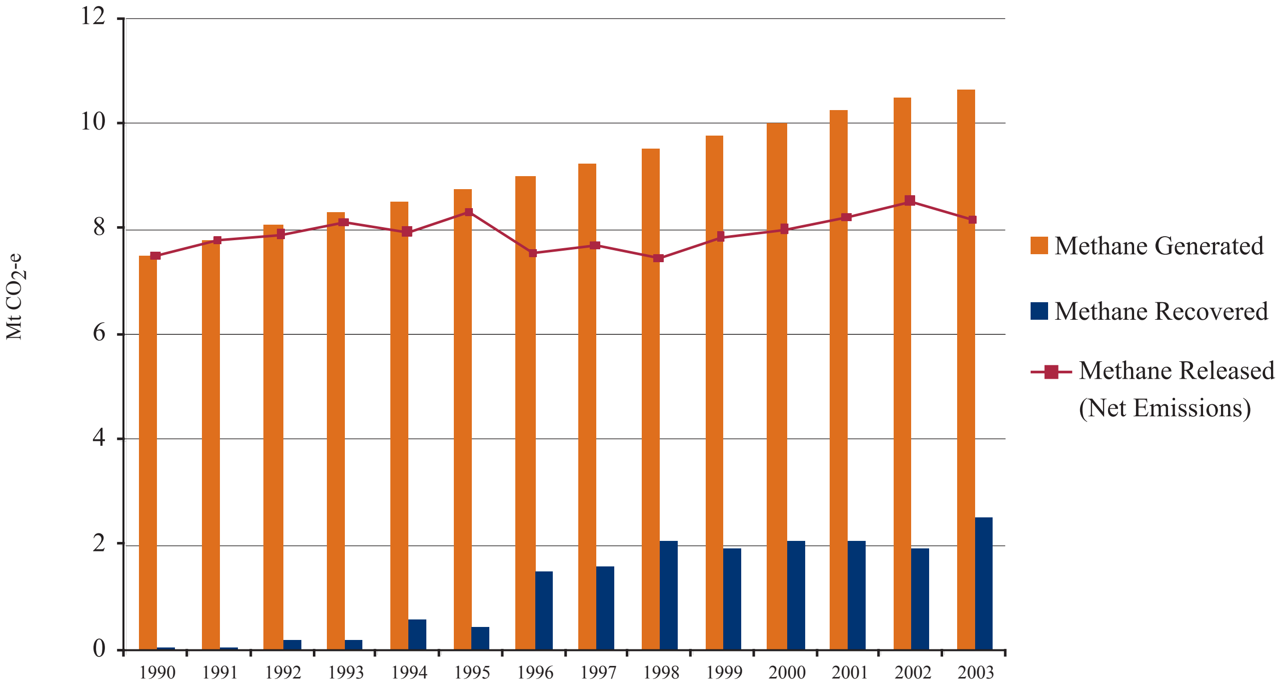
Trends

Waste emissions were 11.1% (1.1 Mt CO_2-e) higher in 2003 than they were in 1990 and 3.0% (0.3 Mt CO_2-e) lower than in 2002.

Emissions from municipal *solid waste disposal on land* increased by 9.0% (0.7 Mt CO_2-e) over the period 1990 to 2003 (Figure 17), and decreased by 4.5% (0.4 Mt CO_2-e) since 2002. As waste degradation is a slow process, estimates of methane generation for 2003 reflect waste disposal from up to 30 years earlier.

Rates of methane recovery from solid waste have improved substantially since 1993, increasing from a negligible amount to 2.5 Mt CO_2-e of methane in 2003.

Figure 17: Emissions from solid waste disposal on land, 1990–2003



Wastewater handling emissions increased by 16.7% (0.5 Mt CO_2-e) over the period 1990 to 2003, with an increase of 1.2% (0.04 Mt CO_2-e) since 2002. Estimates for *wastewater handling* emissions are based on population changes; hence estimates for methane generation from sewage and recovery from wastewater plants and estimates of nitrous oxide emissions from human sewage increase at the same rate as population growth.

8.2.1 Source Category Description

6.A Solid Waste Disposal on Land

The anaerobic decomposition of organic matter in a landfill is a complex process that requires several groups of microorganisms to act in a synergistic manner under favourable conditions. Emissions emanate from deposited waste for a long period (30 years in the Australian inventory). The final products of anaerobic decomposition are CH_4 and CO_2. Emissions of CO_2 generated from solid waste disposal are considered to be from biomass sources and therefore are not included in the inventory. Management of landfill sites is generally a municipal activity, with activity data collected by State Government agencies.

6.B Wastewater Handling

The anaerobic decomposition of organic matter in wastewater results in emissions of CH_4. In Australia wastewater is usually treated at municipal wastewater treatment plants, which receive wastewater from:

- domestic premises;
- commercial establishments; and
- industrial processing plants.

Municipal wastewater treatment plants in Australia treat a major portion of the domestic sewage and commercial wastewater, and a significant part of industrial wastewater.

6.C Incineration

Blue Scope Steel (formerly BHP) incinerates a quantity of solvent generated through the various metal product coating and finishing processes employed. Incineration is used as a method to minimise emissions of solvents and VOCs to the atmosphere and leads to emissions of CO_2. Emissions from this source have been based on data estimated by the AGO for the last two years.

8.2.2 Methodology

Emissions from *solid waste disposal on land* are estimated using the IPCC (tier 2) First Order Decay methodology. The quantity of methane released is estimated based on the quantity of waste landfilled in the 30 years prior to the inventory year and the methane potential of landfilled waste. Solid waste to landfill data used for the emission estimates are provided by State and Territory Government agencies responsible for waste management. See Annex 3 for more information. Data on CH_4 recovery from *solid waste disposal* sites are obtained from the main companies involved in landfill gas recovery projects.

Methane releases and recovery from *wastewater* are estimated using a combination of IPCC default and country-specific emission factors. The methodology is a country-specific equivalent to a tier 2 methodology. Nitrous oxide emissions are derived using the IPCC default methodology (tier 1).

Carbon dioxide emissions from incineration of solvents are estimated by deriving the energy content of the mass of solvent, and using a CO_2 emission factor per petajoule of solvent.

A full description of the methodologies and emission factors are presented in *Australian Methodology for the Estimation of Greenhouse Gas Emissions and Sinks 2003: Waste* (NGGIC 2005j).

8.2.3 Uncertainties and Time Series Consistency

The tier 1 uncertainty analysis in Annex 7 provides estimates of uncertainty according to IPCC source category and gas. Time series consistency is ensured by use of consistent models, model parameters and datasets for the calculations of emissions estimates. Where changes to emission factors or methodologies occur, a full time series recalculation is undertaken.

8.2.4 Source Specific QA/QC

The waste sector source categories are covered by the general QA/QC of the greenhouse gas inventory in Section 1.6. Data provided by waste agencies are compared with known published data sources.

The IPCC Good Practice Guidance recommends using the IPCC check method for wastewater as a means of providing a reference point for comparing the results of a country's inventory.

The IPCC check method produces results that are approximately 21% lower than those produced using Australia's methodology. This is attributable to the fact that the check method does not include any emissions from industrial wastewater treated at Municipal Wastewater Treatment Plants (MWTP). As some industrial wastewater is treated at MWTPs, estimates of methane generated should exceed those obtained from the "check method".

8.2.5 Recalculations since the 2002 Inventory

Solid Waste Disposal

A review of the methodology for estimating emissions from solid waste disposal was completed in 2004 and resulted in a shift in approach from a national derivative of the regression model developed in the United States (Doorn and Barlaz 1995) to the IPCC tier 2 First Order Decay model. IPCC default parameters, waste to landfill data obtained from the relevant State and Territory Government agencies and recovery and flaring estimates obtained directly from companies are used to calculate emissions from solid waste. The net effect of these revisions to the model and input data is a reduction in CH_4 emissions of around 45% over the 1990 to 2002 time series. The trend remains largely unchanged as a result of the recalculation, although the effects of actions of recycling will be better reflected in emission estimates over time.

Wastewater

Following advice from the UNFCCC expert review of Australia's 2002 inventory submission, the IPCC default value of 0.25 kg CH_4/kg Chemical Oxygen Demand (COD) has been adopted for this inventory (IPCC 1997). Biochemical Oxygen Demand (BOD) is used in Australia as the measure of organic content in wastewater and, in order to ensure these estimates are compatible with the default factors, these estimates have been converted to an equivalent measure of COD using a scaling factor of 2, derived from IPCC 2000.

8.2.6 Source Specific Planned Improvements

An Australian based study of decay of wood waste in landfills (Gardner 2002) has suggested that the Degradable Organic Carbon dissimilation rate (DOCf) of wood waste in Australia is significantly lower than that recommended in the IPCC Good Practice Guidance (0.1 compared with the recommended value of 0.5-0.6). The work of Gardner is based on empirical research of waste in landfills, as opposed to the optimal conditions assumed under laboratory experiments that form the basis for the IPCC defaults. The Gardner estimates are much lower than the range of DOC_f values suggested in other studies and further investigation will be required before an Australian DOC_f value for wood waste can be finalised. In addition to the focus on wood waste, Australian based DOC_f values for other types of waste may be considered should data be available.

Following comments by the UNFCCC Expert Review during the review of Australia's 2002 inventory, the approach used to estimate emissions from wastewater treatment will be reviewed in 2005. It is anticipated that a review of parameters and consideration of alternative estimation approaches will better reflect the types of wastewater treatment processes being employed in Australia.

For the previous two inventory submissions, the quantity of solvent incinerated has been estimated. Alternative sources of solvent incineration data will be investigated for the next inventory submission.

Chapter 9
Other (UNFCCC Sector 7)

Australia does not report any emissions under the UNFCCC category 7, ‘Other’.

Chapter 10
Recalculations and Improvements

National greenhouse gas inventories have been produced for a comparatively short time, especially when compared with other major national statistics, such as gross domestic product. Emissions processes are pervasive and complex and, consequently, emissions estimation techniques and data sources for the Australian inventory are still evolving, particularly in some sectors. Internationally, this is also the case for the inventories of other countries. In addition, the IPCC guidelines on national inventory preparation themselves are currently being revised (scheduled for completion in 2006).

The development of improved estimation techniques is a resource intensive exercise and the IPCC encourages the allocation of development resources into priority areas. In Australia, a number of recalculations have been undertaken for the 2003 inventory and these are summarised in section 10.1-10.3 below. The development effort behind these recalculations has been undertaken in line with the Inventory Improvement Plan for the Australian inventory. This plan is aimed at reducing existing emission estimate uncertainties as much as possible, with development focused on key source categories, sources with high uncertainties and where implementation of new methods is feasible (for example, as a result of new data becoming available). The Australian improvement plan also seeks to respond to international expert reviews and revisions to international guidelines on inventory preparation. Further recalculations are likely for the 2006 submission and these are set out in section 10.4.

10.1-10.3 Recalculations in the 1990-2002 Time Series

Estimates of emissions presented in past inventory reports have been recalculated for a number of reasons including end-of-series averaging effects (for the *agriculture* sector), revisions of data, the inclusion of additional sources of data or from refinements in the estimation methodology. To ensure the accuracy of the estimates, and to maintain consistency of the series through time, recalculations of past emission estimates are undertaken for all previous years.

Within the 1990–2002 time series there have been a number of sectors where recalculations have been undertaken. Details of the reasons for these recalculations have been given in the sectoral chapters. The principal sectors where recalculations have been necessary are set out in Table 15.

Table 15: Principal Recalculations for the 2003 inventory

	Category	**Principal Reason**
1A	Energy	Revised fuel consumption data
1B	Fugitives	Revised natural gas pipeline leakage rates
2A	Limestone and dolomite use	Improved data coverage to include a range of metals processing industries
2A	Soda ash production	Exclusion of production sink
2B	Synthetic rutile and titanium dioxide production	Inclusion of new source
2B	Ammonia production	Improved data coverage

	Category	Principal Reason
2C	Alumina production	Exclusion of production sink
2F	SF_6 emissions	New methodology for estimating emissions in all years
2F	Halocarbons	Inclusion of complete data sources and refined methodology
4A-F	Agriculture	Recalculations due to 3 year averaging of reported emissions
4B	Manure management	Inclusion of methane sources from manure from cattle and sheep in pasture and paddock management regimes
4E	Prescribed burning of savannas	Use of time-series consistent data sources and refined methodology
5A	Forest lands remaining forests (plantations)	New data and refined methodology
5B	Forest conversion	New remote sensing data and refinements to methodology
6A	Solid waste	New State-based agency data and use of IPCC default methodology
6B	Wastewater treatment	Update for IPCC 1997 emission factors
1-6	General	Minor corrections with the introduction of the national emission estimation system (AGEIS)

The number of recalculations is high for this inventory due to the availability of new and better data and methodologies after a period of relative stability for the inventory. The result is an improvement in the accuracy, completeness, comparability and time-series consistency of Australia's inventory. The net effect of the recalculations at the aggregate emission level, however, is relatively minor – see Table 16.

Table 16: Previous and latest estimates of emissions, 1990–2003 (UNFCCC accounting)

Year	Net Mt CO_2-e emissions			Difference	
	Previously published [(a)]	Latest estimates		Mt CO_2-e	% of Previous value
1990	515.9	524.5		8.7	1.7
1991	493.5	501.2		7.7	1.6
1992	479.1	486.2		7.0	1.5
1993	483.4	475.5		-7.9	-1.6
1994	489.1	479.8		-9.3	-1.9
1995	489.0	487.8		-1.2	-0.3
1996	493.8	492.6		-1.2	-0.2
1997	502.1	498.5		-3.6	-0.7
1998	530.3	532.2		1.9	0.4
1999	528.2	534.0		5.8	1.1
2000	529.6	545.3		15.6	3.0
2001	527.7	549.7		22.0	4.2
2002	539.2	555.5		16.4	3.0

(a) AGO (2004)

The net effect of the recalculations on the estimates of individual sectors is also reported in Part B CRF Table 8.

The overall effect of the recalculations is to increase the estimate of Australia's greenhouse emissions for 1990 by 8.7 Mt, and to increase the 2002 estimate by 16.4 Mt (3.0%) – Table 16.

10.4 Planned Improvements

Future refinements will be informed by the ongoing technical review of sectoral methodologies and data sources undertaken by the Australian Greenhouse Office as part of Australia's efforts to comply with inventory good practice. Priorities for the inventory development process have been informed by analysis of key sources and key trends; by analysis of the level of uncertainty surrounding existing emission estimates; and the comments received from previous international reviews of Australia's inventory.

Table 17 clearly shows the links between the inventory development programme and both the key source analysis presented in Annex 1 and the uncertainty analysis presented in Annex 7. A key area for development is in the land use, land use change and forestry sector, where the full details are set out in the *National Carbon Accounting System, Development Plan 2004-2008*, published by the Australian Greenhouse Office in January 2005 (AGO 2005a).

Table 17: Summary of Planned Improvements to the Australian Inventory

Category	Key source?	Sectoral uncertainty estimate	Description	Projected completion date
Energy				
1.A3 Road Transport – passenger cars (N_2O)	Yes	44%	Review of non-CO_2 emission factors and methodology	2006
1.B.1 Fugitive emissions – mining (CH_4)	Yes	21%	Review of emissions from mining	2006
Industrial processes				
2.F HFCs	Yes	-	Incorporation of new data on HFCs and SF_6	2006
Agriculture				
4.A Enteric fermentation - cattle (CH_4)	Yes	6%	Review of methodology Field research into emission factors	2006 Post 2006
4.B Manure management – cattle (N_2O)	Yes	11%	Review of methodology	2006
4.E Burning of savannas (CH_4)	Yes	120%	Field research into fire dynamics and fuel loads	Post 2006
4.E Burning of savannas (N_2O)	Yes	131%	Field research into fire dynamics and fuel loads	Post 2006
4.D Agricultural soils (N_2O)	Yes	102%	Review of methodologies for fertiliser application and conservation practices	Post 2006
LULUCF				
5. Forestry (CO_2, N_2O)	Yes	40%	Full incorporation of plantations into the NCAS Incorporation of N cycle capability	2006 Post 2006
Waste				
6.A Solid waste disposal (CH_4)	Yes	50%	Review of methodology for wood decay	2006
6.B Wastewater (CH_4)	No	50%	Review of wastewater biological loads	2006

Sources: Annex 1, Annex 7. AGO 2005.

Annex 1
Key source Analysis

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 UNFCCC 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 *public electricity* (solid fuel), *enteric fermentation (cattle)*, *forest and grassland conversion* (CO_2) and *road transportation* (passenger cars) as the most significant of the key source categories—on a level basis. On a trends basis, the only difference to the most important four categories is that *enteric fermentation (sheep)* replaces *enteric fermentation (cattle).*

Table 18: Key source categories for Australia's inventory—level assessment

A	IPCC Source Category	B Direct Greenhouse Gas	C Base Year Estimate	D Current Year Estimate	E Level Assessment	F Cumulative Total
1.A.1.a	Solid Fuels	CO2	118049.19	175878.45	0.31	31.14%
4.A.1	Cattle	CH4	42643.05	47694.85	0.08	39.58%
5.B	Forest and Grassland Conversion	CO2	122225.44	47675.07	0.08	48.02%
1.A.3.b.i.	Passenger Car	CO2	33967.01	39585.24	0.07	55.03%
4.D	Agricultural Soils	N2O	15178.92	18716.27	0.03	58.34%
4.A.3	Sheep	CH4	24563.18	14762.83	0.03	60.96%
1.A.1.a	Gaseous Fuels	CO2	7981.34	11980.93	0.02	63.08%
2.C.1	Iron and Steel Production	CO2	12647.92	10844.36	0.02	65.00%
1.A.3.b.ii.	Light Trucks	CO2	7157.60	10638.94	0.02	66.88%
1.B.1.a.i.	Underground Mines	CH4	12339.10	9427.98	0.02	68.55%
1.A.1.c	Gaseous Fuels	CO2	4596.31	8819.68	0.02	70.11%
1.A.4	Gaseous Fuels	CO2	6401.88	8777.98	0.02	71.67%
1.A.3.b.iii.	Heavy Duty Trucks	CO2	5684.08	8491.94	0.02	73.17%
4.E	Prescribed Burning of Savannas	CH4	5608.26	8220.15	0.01	74.62%
1.A.4	Liquid Fuels	CO2	5499.75	8196.82	0.01	76.08%
6.A	Solid Waste Disposal on Land	CH4	7472.31	8141.48	0.01	77.52%
1.B.1.a.ii.	Surface Mining	CH4	3477.26	7106.09	0.01	78.78%
1.A.3.b.iii.	Medium Duty Trucks	CO2	4573.38	5900.51	0.01	79.82%
1.A.2.f	Liquid Fuels	CO2	5008.49	5794.28	0.01	80.85%
2.G.	Other (please specify)	CO2	2364.10	5711.34	0.01	81.86%
1.A.1.b	Liquid Fuels	CO2	5192.70	5563.40	0.01	82.84%
1.A.2.b	Solid Fuels	CO2	4979.37	5392.78	0.01	83.80%
1.A.2.b	Gaseous Fuels	CO2	4136.57	5352.40	0.01	84.74%
1.A.3.a	Jet Kerosene	CO2	2626.28	4987.84	0.01	85.63%
1.A.2.f	Gaseous Fuels	CO2	4200.42	4741.51	0.01	86.47%
1.A.3.b.i.	Passenger Car	N2O	1397.97	4734.02	0.01	87.30%
2.F.1	Refrigeration and Air Conditioning Equipment	HFC	0.00	4219.23	0.01	88.05%
4.E	Prescribed Burning of Savannas	N2O	2431.79	3564.33	0.01	88.68%
2.A.1	Cement Production	CO2	3214.42	3401.08	0.01	89.28%

1.A.2.c	Gaseous Fuels	CO2	1577.86	3358.98	0.01	89.88%
1.B.2.c.	Venting	CO2	1966.46	3349.38	0.01	90.47%
2.C.3	Aluminium Production	CO2	2017.94	3021.72	0.01	91.01%
1.A.2.f	Solid Fuels	CO2	3030.06	2894.24	0.01	91.52%
1.A.2.b	Liquid Fuels	CO2	3043.16	2696.61	0.00	92.00%
6.B	Waste-water Handling	CH4	2267.04	2644.26	0.00	92.47%
1.A.1.c	Liquid Fuels	CO2	945.31	2138.16	0.00	92.84%
1.B.2.c.	Flaring	CO2	3601.38	2102.78	0.00	93.22%
4.B	Manure Management	CH4	1539.63	2047.53	0.00	93.58%
1.B.2.b.	Natural Gas	CH4	4206.10	1867.54	0.00	93.91%
1.A.1.a	Liquid Fuels	CO2	2641.20	1658.96	0.00	94.20%
1.B.2.c.	Venting	CH4	1733.89	1571.47	0.00	94.48%
5.B	Forest and Grassland Conversion	CH4	3102.38	1524.93	0.00	94.75%

Table 19: Key source categories for Australia's inventory—trend assessment

	A IPCC Source Category	B Direct Green-house Gas	C Base Year Estimate	D Current Year Estimate	E Trend Assessment	F % Contribution to Trend	G Cumulative Total of Column F
5.B	Forest and Grassland Conversion	CO2	122225.44	47675.07	0.14	0.34	34.42%
1.A.1.a	Solid Fuels	CO2	118049.19	175878.45	0.09	0.23	57.58%
4.A.3	Sheep	CH4	24563.18	14762.83	0.02	0.05	62.24%
1.A.3.b.i.	Passenger Car	CO2	33967.01	39585.24	0.01	0.02	64.12%
2.F.1	Refrigeration and Air Conditioning Equipment	HFC	0.00	4219.23	0.01	0.02	65.95%
1.A.1.c	Gaseous Fuels	CO2	4596.31	8819.68	0.01	0.02	67.71%
1.A.1.a	Gaseous Fuels	CO2	7981.34	11980.93	0.01	0.02	69.31%
1.B.1.a.ii.	Surface Mining	CH4	3477.26	7106.09	0.01	0.02	70.83%
4.A.1	Cattle	CH4	42643.05	47694.85	0.01	0.01	72.32%
1.B.1.a.i.	Underground Mines	CH4	12339.10	9427.98	0.01	0.01	73.79%
1.A.3.b.i.	Passenger Car	N2O	1397.97	4734.02	0.01	0.01	75.21%
2.G.	Other (please specify)	CO2	2364.10	5711.34	0.01	0.01	76.63%
1.A.3.b.ii.	Light Trucks	CO2	7157.60	10638.94	0.01	0.01	78.02%
4.D	Agricultural Soils	N2O	15178.92	18716.27	0.01	0.01	79.31%
2.C.3	Aluminium Production	PFC	3938.28	1472.05	0.00	0.01	80.44%
1.A.3.b.iii.	Heavy Duty Trucks	CO2	5684.08	8491.94	0.00	0.01	81.57%
1.B.2.b.	Natural Gas	CH4	4206.10	1867.54	0.00	0.01	82.65%
1.A.4	Liquid Fuels	CO2	5499.75	8196.82	0.00	0.01	83.73%
4.E	Prescribed Burning of Savannas	CH4	5608.26	8220.15	0.00	0.01	84.78%
2.C.1	Iron and Steel Production	CO2	12647.92	10844.36	0.00	0.01	85.77%
1.A.3.a	Jet Kerosene	CO2	2626.28	4987.84	0.00	0.01	86.75%
1.A.4	Gaseous Fuels	CO2	6401.88	8777.98	0.00	0.01	87.68%
1.A.2.c	Gaseous Fuels	CO2	1577.86	3358.98	0.00	0.01	88.42%
5.B	Forest and Grassland Conversion	CH4	3102.38	1524.93	0.00	0.01	89.16%
1.B.2.c.	Flaring	CO2	3601.38	2102.78	0.00	0.01	89.87%
1.A.2.c	Liquid Fuels	CO2	2759.48	1445.90	0.00	0.01	90.49%
1.A.3.d.ii	Navigation (domestic)	CO2	2299.51	1004.14	0.00	0.01	91.09%

1.B.2.c.	Venting	CO2	1966.46	3349.38	0.00	0.01	91.66%
1.A.1.c	Liquid Fuels	CO2	945.31	2138.16	0.00	0.01	92.16%
1.A.3.b.iii.	Medium Duty Trucks	CO2	4573.38	5900.51	0.00	0.01	92.66%
1.A.1.a	Liquid Fuels	CO2	2641.20	1658.96	0.00	0.00	93.13%
1.A.2.b	Gaseous Fuels	CO2	4136.57	5352.40	0.00	0.00	93.59%
4.E	Prescribed Burning of Savannas	N2O	2431.79	3564.33	0.00	0.00	94.04%
2.C.3	Aluminium Production	CO2	2017.94	3021.72	0.00	0.00	94.44%
1.A.4	Biomass	CH4	1711.22	881.00	0.00	0.00	94.83%

Table 20: Key source categories for Australia's inventory—summary

A IPCC Source Categories		B Direct Greenhouse Gas	C Key Source Category Flag	D If Colum C is Yes, Criteria for Identification	E Comments
	Energy				
1.A.1.a	Public Electricity and Heat Production - Gaseous Fuels	CO2		Level, Trend	
1.A.1.a	Public Electricity and Heat Production - Liquid Fuels	CO2		Level, Trend	
1.A.1.b	Petroleum Refining - Liquid Fuels	CO2		Level	
1.A.1.c	Manufacture of Solid Fuels and Other Energy Industries - Gaseous Fuels	CO2		Level, Trend	
1.A.1.c	Manufacture of Solid Fuels and Other Energy Industries - Liquid Fuels	CO2		Level, Trend	
1.A.2.b	Non-Ferrous Metals - Gaseous Fuels	CO2		Level, Trend	
1.A.2.b	Non-Ferrous Metals - Solid Fuels	CO2		Level	
1.A.2.b	Non-Ferrous Metals - Liquid Fuels	CO2		Level	
1.A.2.c	Chemicals - Gaseous Fuels	CO2		Level, Trend	
1.A.2.c	Chemicals - Liquid Fuels	CO2		Trend	
1.A.2.f	Other - Liquid Fuels	CO2		Level	
1.A.2.f	Other - Gaseous Fuels	CO2		Level	
1.A.2.f	Other - Solid Fuels	CO2		Level	
1.A.3.a	Civil Aviation - Jet Kerosene	CO2		Level, Trend	
1.A.3.b.i.	Road Transportation - Passenger Car	CO2		Trend	
1.A.3.b.i.	Road Transportation - Passenger Car	N2O		Level, Trend	
1.A.3.b.ii.	Road Transportation - Light Trucks	CO2		Level, Trend	
1.A.3.b.iii.	Road Transportation - Heavy Duty Trucks	CO2		Level, Trend	
1.A.3.b.iii.	Road Transportation - Medium Duty Trucks	CO2		Level, Trend	
1.A.3.d.ii	Navigation (domestic)	CO2		Trend	
1.A.4	Other Sectors - Liquid Fuels	CO2		Level, Trend	
1.A.4	Other Sectors - Biomass	CO2		Level, Trend	
1.A.4	Other Sectors - Gaseous Fuels	CH4		Trend	
1.B.1.a.i.	Fugitive Emissions - Underground Mines	CH4		Level, Trend	
1.B.1.a.ii.	Fugitive Emissions - Surface Mining	CH4		Level, Trend	
1.B.2.b.	Oil and Natural Gas - Natural Gas	CH4		Level, Trend	
1.B.2.c.	Oil and Natural Gas - Flaring	CO2		Level, Trend	
1.B.2.c.	Oil and Natual Gas Venting	CO2		Level, Trend	

1.B.2.c.	Oil and Natual Gas Venting	CH4	Level	
2.A.1	Cement Production	CO2	Level	
2.C.1	Iron and Steel Production	CO2	Level, Trend	
2.C.3	Aluminium Production	PFC	Trend	
2.C.3	Aluminium Production	CO2	Level, Trend	
2.F.1	Refrigeration and Air Conditioning Equipment	HFC	Level, Trend	
2.G.	Confidential Emissions Reported as CO2e	CO2	Level, Trend	
4.A.1	Enteric Fermantation - Cattle	CH4	Level, Trend	
4.A.3	Enteric Fermentation - Sheep	CH4	Level, Trend	
4.B	Manure Management	CH4	Level	
4.D	Agricultural Soils	N2O	Level, Trend	
4.E	Prescribed Burning of Savannas	CH4	Level, Trend	
4.E	Prescribed Burning of Savannas	N2O	Trend	
4.E	Prescribed Burning of Savannas	N2O	Level	
5.B	Forest and Grassland Conversion	CO2	Level, Trend	
5.B	Forest and Grassland Conversion	CH4	Level, Trend	
6.A	Solid Waste Disposal on Land	CH4	Level	
6.B	Waste-water Handling	CH4	Level	

Annex 2
Methodology and Data for Estimating CO_2 Emissions from Fossil Fuel Combustion

Information under this heading has been reported in a broader methodology discussion that has been developed in Annex 3.

Annex 3
Other detailed methodological descriptions

The full Australian methodology for the estimation of this inventory is documented in *Australian Methodology for the Estimation of Greenhouse Gas Emissions and Sinks 2003*, which is available on the Australian Greenhouse Office website at www.greenhouse.gov.au. These documents should be considered as part of Australia's submission to the UNFCCC.

This Annex provides additional information to that provided in chapters 3-9 on the methodologies adopted for the most important key categories in Australia's inventory. These categories are taken from:

- Stationary energy (1.A1, 1.A2 and 1A4b);
- Transport (1.A3);
- Fugitive emissions (1.B1);
- Agriculture (4A, 4B, 4D and 4.E);
- Land use change (5B and 5C); and
- Solid waste disposal on land (6.A).

More details for other sectors may be found in the relevant chapters of the main report.

1.A1, 1A2 Stationary Energy

The full Australian methodology for the estimation of this inventory is available in Australian Methodology for the Estimation of Greenhouse Gas Emissions and Sinks 2003: Energy (Stationary Energy). This section provides additional information to that provided in chapter 3 on the major key categories in this sector – carbon dioxide emissions from stationary energy sources (1.A.1 and 1.A.2) and the closely related categories of emissions of other greenhouse gases.

The methodology for estimating emissions from fossil fuel combustion in the stationary energy sectors 1.A1 and 1.A2 is consistent with the IPCC tier 2 approach. The estimate of emissions of carbon dioxide used for each fuel, j, in each economic sector, i, is estimated by:

$$E_{ijc} = (F_{ij} \times EF_{jc} \times P_{ij} /100) - S_{ij} \times 44/12 \qquad (1)$$

where

Eijc is the amount of CO_2 emitted from fuel *j* in economic sector *i* (in Gg);
Fij is the amount of fuel *j* combusted in sector *i* (in PJ);
EFjc is the CO_2 emission factor (in Gg CO_2/PJ) for fuel *j*;
Pj is the oxidation factor (in percent) of fuel *j*; and
Sij is the amount of carbon sourced from fuel *j* which is stored in sector *i* (in Gg).

And for non-CO_2 gases, where the emission factors are technology dependent, emissions are estimated by:

$$E_{ijk} = F_{ij} \times Ef_{ijk} \qquad (2)$$

where:

Eijk is the amount greenhouse gas *k* emitted from combustion of fuel type *j*, in economic sector *i* (in Gg);
Fij is the amount of fuel type *j* combusted in sector *i* (in PJ);
Efijk is the technology weighted emission factor (in Gg/PJ) for greenhouse gas *k*, from fuel type j in sector *i*.

For both CO_2 and non-CO_2 gases, total national emissions are calculated by summing across all fuels and all economic sectors the estimated emissions from each fuel in each economic sector.

Activity data

The data on energy consumption by fuel and economic sector are estimated by the Australian Bureau of Agricultural and Resource Economics (ABARE), which compiles estimates of Australian energy use for the purpose of meeting Australia's reporting commitments to the International Energy Agency. These estimates are compiled from an annual fuel and electricity survey conducted by the Bureau, supplemented by a variety of other sources of information. The statistics provide a comprehensive and detailed "bottom-up" quantification of energy use in Australia. To ensure internal consistency, the data are reconciled with "top-down" statistics on the supply and use of all major fuels in Australia collected from the suppliers of those fuels, ie the coal, oil, gas and electricity industries.

Australia's statistical agencies report the national energy statistics in terms of petajoules measured on a gross calorific value (GCV). These energy estimates are the most transparent, consistent and reliable data available and, consequently, the activity data and emission factors are also expressed in terms of GCV. These estimates may be converted into Net Calorific Value equivalents using the International Energy Agency's default conversion factors.

ABARE also collects statistics of energy use by equipment (technology) type. These have been used to compile the technology weighted sectoral emission factors for non-CO2 greenhouse gases (see below).

ABARE report energy consumption for economic sectors is defined using the Australia New Zealand Standard Industrial Classification (ANZSIC) developed by Australia's national statistical agency, the Australian Bureau of Statistics. The mapping of ANZSIC codes against IPCC classifications is given in Table 21.

Table 21: Relationship between IPCC source categories and ASIC sectors

<table>
<tr><th colspan="2">IPCC Source Category</th><th colspan="4">ANZSIC Subdivision/Group/Class</th></tr>
<tr><td></td><td></td><td>Division</td><td>Sub-division</td><td>Group/Class</td><td>Description</td></tr>
<tr><td rowspan="3">1 Energy Industries</td><td>a Electricity and heat production</td><td>D Electricity, Gas and Water Supply</td><td>36</td><td>361</td><td>Electricity supply</td></tr>
<tr><td>b Petroleum refining</td><td>C Manufacturing</td><td>25</td><td>251</td><td>Petroleum refining</td></tr>
<tr><td>c Solid fuel transformation and other energy industries</td><td>B Mining
B Mining
C Manufacturing
D Electricity, Gas and Water Supply
I Transport and Storage</td><td>11
12
27
36
65</td><td>2711 (part)
362
6501 (part)</td><td>Coal mining (incl. briquette production)
Oil and gas extraction (incl. gas processing and LNG production)
Coke ovens associated with Basic iron and steel manufacturing
Gas supply
Pipeline transport of gas</td></tr>
<tr><td rowspan="7">2 Manufacturing Industries and Construction</td><td>f Other (part)</td><td>B Mining</td><td>13, 14, 15</td><td></td><td>Metal ore mining, Other mining, Services to mining</td></tr>
<tr><td>e Food Processing, Beverages and Tobacco</td><td>C Manufacturing</td><td>21</td><td></td><td>Food, beverages, tobacco manufacturing</td></tr>
<tr><td>f Other (part) (all other manuf.)</td><td></td><td>22</td><td></td><td>Textiles, clothing , footwear and leather manufacturing</td></tr>
<tr><td>d Pulp, Paper and Print</td><td></td><td>23</td><td></td><td>Wood and paper product manufacturing.</td></tr>
<tr><td>d Pulp, Paper and Print</td><td></td><td>24</td><td></td><td>Printing, publishing and recorded media</td></tr>
<tr><td>c Chemicals</td><td></td><td>25</td><td>252</td><td>Petroleum and coal product manufacturing</td></tr>
</table>

IPCC Source Category		ANZSIC Subdivision/Group/Class			
	c Chemicals		25	253	Basic chemical manufacturing
	c Chemicals		25	254	Other chemical product manufacturing
	c Chemicals		25	255	Rubber product manufacturing
	c Chemicals		25	256	Plastic product manufacturing
	f Other (part) (non-metallic mineral products)		26	261	Glass and glass product manufacturing
	f Other (part)		26	262	Ceramic product manufacturing
	f Other (part		26	263	Cement, lime, plaster and concrete product manufacturing
	f Other (part)		26	264	Non-metallic mineral product manufacturing n.e.c.
	a Iron and Steel		27	271	Iron and steel manufacturing (excl. Coke ovens)
	b Non-Ferrous Metals		27	272	Basic non-ferrous metal manufacturing
	f Other (part) (all other manuf.)		27	273, 274, 275, 276	All other metal product manufacturing
	f Other (part)		28		Machinery and equipment manufacturing
	f Other (part)		29		Other manufacturing
	f Other (part)	E Construction	41, 42		Construction
4 Other Sectors	a Commercial, Institutional		37		Water supply, sewerage and drainage services
		Division F	45, 46, 47		Wholesale trade
		Division G	51, 52, 53		Retail trade
		Division H	57		Accommodation, cafes and restaurants
		Division I Transport and Storage	66		Services to transport
		Division I Transport and Storage	67		Storage
		Division J	71		Communication services
		Division K	73, 74, 75		Finance and insurance
		Division L	77, 78		Property and business services
		Division M	81, 82		Government administration and defence
		Division N	84		Education

IPCC Source Category		ANZSIC Subdivision/Group/Class			
		Division O	86, 87		Health and community services
		Division P	91, 92, 93		Cultural and recreational services
		Division Q	95, 96		Personal and other services
	b Residential				Residential
	c Agriculture, forestry, and fishing		01		Agriculture
			02		Services to agriculture, hunting and trapping
			03		Forestry and logging
			04		Commercial fishing
5 Other					Combustion of solvents, lubricants and greases Military transport

Note: (a) This comprises only electricity generated at single purpose power stations. Accounting for all fossil fuel combustion associated with co-generation occurs in the industry sector within which co-generation occurs. There is no public generation of distributed heat in Australia.

Emission Factors for CO_2

Emission factors for CO_2 depend only on the chemical composition of the fossil fuel concerned under the IPCC methodology. For fuels having well defined and/or stable chemical composition, CO_2 emission factors can be specified with considerable accuracy. This is particularly the case for natural gas and for petroleum products, with the exception of fuel oil, which may vary considerably in composition and to a lesser degree for coals, which can vary in their composition of both combustible components (carbon, volatiles) and non-combustible components (ash, moisture).

Approximately 80% of all coal consumed in Australia is used by the electricity generation industry. CO_2 emission factors for coal used by the electricity industry are estimated for individual power stations and reported in *Australian Methodology for the Estimation of Greenhouse Gas Emissions and Sinks 2003: Energy (Stationary Energy)*. For other uses of coal, such as the steel industry, representative CO_2 emission factors are reported in Table 22.

Most of the emission factors for marketable petroleum products were taken from OECD (1991), which are consistent with IPCC default values. Emission factors for natural gas depend on the composition of individual gas fields and are also reported in *Australian Methodology for the Estimation of Greenhouse Gas Emissions and Sinks 2003: Energy (Stationary Energy)*. The data required to estimate these factors has been published by the Australian Gas Association.

Table 22: Emission Factors for CO_2 (CGU)

Fuel Type	Fuel	CO_2 emission factor (Gg CO_2/PJ)
Coal derived fuels	Coal used in public electricity generation	A
	Coal used in steel industry	91.8
	Black coal used by other industry	90.0
	Brown coal used by industry	88.3
	Coke	119.5
	Coal by-products (gaseous)	37.0
	Coal by-products (coal tar and BTX)	81.0
	Brown coal briquettes	105.0
Petroleum fuels	LPG	59.4
	Naphtha	66.0
	Aviation gasoline	68.0
	Kerosene	69.7
	Aviation turbine fuel	69.7
	Power Kerosene	69.7
	Heating oil	69.7
	ADO	69.7
	IDF	69.7
	Refinery fuel	68.1
	Petroleum products nec	68.6
	Fuel oil	73.6
	Solvents	66.0
	Lubricants and greases	73.7
	Bitumen	80.7
Gases	Natural gas	A
	Natural gas (Basic chemicals sector)	A
	Ethane	56.5
	Town gas	59.4
Biomass	Wood and wood waste	94.0
	For Residential subsector	See Table 31
Fuels	Bagasse	96.8

Sources: OECD (1991); ABARE, industry advice, IPCC default (1997).

A: see *Australian Methodology for the Estimation of Greenhouse Gas Emissions and Sinks 2003: Energy (Stationary Energy)*.

The oxidation factor is defined as the proportion of carbon contained in a fuel which is oxidised to CO_2. Oxidation factors are IPCC default values (IPCC (1997)) - see Table 23: Oxidation factors for CO_2 (non-electricity).

Table 23: Oxidation factors for CO_2 (non-electricity)

Fuel	Utilisation category	Oxidation Factor
Black Coal	All Categories	98.0%[a]
Brown Coal	All Categories	98.0%[a]
Coal By-products	Other than Basic Chemicals and Petroleum and Coal Products nec	99.5%
	Basic Chemicals and Petroleum and Coal Products nec	99.0%
Coke	All Categories	98.0%[a]
Petroleum	All Categories	99.0%[a]
Gas	All Categories	99.5%[a]
Biomass	Accommodation, Cultural and Personal (Division H, P & Q)	95.0%
	Residential	100%
	All Other Categories	98.0%

Sources: (a) IPCC (1997, Volume 3)

The oxidation factors listed for coal by-products are a result of the assumption that in all relevant sub-categories, other than Basic Chemicals and Petroleum and Coal Products nec, coal by-products are gaseous fuels. Hence consumption of coal by-products in these categories have an identical oxidation factor to that used for natural gas. Within the Basic Chemicals and Petroleum and Coal Products nec sub-categories the assumption is that the fuel is either BTX or coal tar and hence the IPCC default petroleum factor has been applied.

The oxidation factor for combustion of biomass for Residential is combined with the associated CO_2 emission factor, and is therefore effectively 100%. The oxidation applied to the combustion of biomass has been set at 98.0% for all sub-categories other than the Residential and Accommodation, Cultural and Personal (Division H, P & Q) categories. Less efficient combustion in these sectors has been assumed and hence a lower oxidation factor applied.

Non-CO_2 Emission Factors

In addition to emissions of CO_2, the combustion of fuel in stationary sources results in the emission of CH_4, N_2O, NO_X, CO, and NMVOCs. Of these, methane and nitrous oxide account for around 6% of emissions on a carbon dioxide equivalent basis in this sector. The magnitude of these emissions is dependent on a large number of factors including fuel type, equipment design and emission control technology and is therefore inherently more complex and more uncertain than estimates of CO_2 emissions.

The non-CO_2 factors are derived from IPCC default values for uncontrolled emissions from various source categories, corrected for control technologies in use in Australia. The emission factors for non-CO_2 greenhouse gases for various equipment types are summarised in Table 24. In the absence of evidence to differentiate N_2O factors, it is assumed that the N_2O emission factors are dependent on fuel type only.

Data on the quantities of energy used by each type of equipment are provided by ABARE, disaggregated by ANZSIC Group and by major fuel type (coal, oil, gas, biomass). These data are used to compile a set of weighted emission factors for each type of fuel used in each economic sector, accurately reflecting the mix of equipment types in which that fuel is used in that sector.

Table 24: Equipment Type Emission Factors for Non-CO_2 Greenhouse Gases (Mg/PJ)

	Sector	Fuel	Equipment type	CH_4	N_2O	NO_x	CO	NMVOC
	Electricity Generation/Utility							
1		Natural Gas	Boiler	0.1	0.1	226	16	0.6
2		Residual Oil	Boiler	0.8	0.6	186	14	2.1
3		Distillate Oil	Boiler	0.04	0.6	64	13	1.4
4		Black Coal	Tangentially Fired	0.9	0.8	306	11	1.7
5		Black Coal	Pulverised Wall	0.9	0.8	462	11	1.7
6		Brown Coal	Tangentially Fired	0.9	1.4	136	17	1.7
4		Natural Gas	Turbine	8.0	0.1	190	46	2.4
7		Natural Gas	Internal Combustion	240	0.1	1,331	340	80
8		Fuel Oil	Internal Combustion	4.0	0.6	1,322	349	45
9		Diesel	Internal Combustion	4.0	0.6	1,322	349	45
	Other Energy Transformation and Industrial							
10		Natural Gas	Boiler	1.2	0.1	58	14	1.1
11		Residual Oil	Boiler	2.8	0.6	154	14	0.8
12		Distillate Oil	Boiler	0.1	0.6	53	13	0.5
13		Black Coal	Boiler	1.3	0.8	287	105	1.0
14		Wood	Boiler	4.2	4.1	75	680	6.8
15		Bagasse	Boiler	10	4.1	84	1,625	16.3
16		Natural Gas	Kiln	1.0	0.1	1,010	75	1.1
17		Fuel Oil	Kiln	1.0	0.6	502	75	0.8
18		Black Coal	Kiln	1.0	0.8	502	75	1.0
19		Black Coal	Coke Oven	1.0	0.8	287	201	1.0
20		Natural Gas	Dryer	1.0	0.1	58	10	1.1
21		Fuel Oil	Dryer	1.0	0.6	160	15	0.8
22		Black Coal	Dryer	1.0	0.8	215	170	1.7
	Commercial							
23		Natural Gas	Boiler	1.1	0.1	41	8.5	2.2
24		Residual Oil	Boiler	1.3	0.6	154	14	3.2
25		Distillate Oil	Boiler	0.6	0.6	53	13	0.9
26		Black Coal	Boiler	1.3	0.8	157	126	1.0
27		Wood	Boiler	3.4	4.1	19	330	5.6
	Residential							
28		Natural Gas	Heater	1.6	0.1	39	16	3.1
29		Black Coal	Hot Water Heater	105	0.8	190	5,753	209
32		LPG	Furnace	0.8	0.1	67	7.9	1.6
33		Distillate Oil	Furnace	4.7	0.6	48	13	1.9
	General							
34		Gas	Miscellaneous	1.1	0.1	41	8.5	2.2
35		Oil	Miscellaneous	1.3	0.6	154	14	3.2
36		Black Coal	Miscellaneous	1.3	0.8	157	126	1.0

Source: See Workbook 1.1 1998 (Table 6, page 30)

SO_2 Emission Factors

For the public electricity industry, specific SO_2 emission data were obtained from each power station operator. Within the petroleum refining sub-category the SO_2 emissions are not directly calculated but are sourced from the Australian National Pollutant Inventory Database. For other sectors, the emission factors are derived from data from the Australian Institute for Petroleum, the Australian Gas Association and the Australian Government Department of Industry, Tourism and Resources.

Table 25: SO_2 emission factors

Fuel	SO_2 emission factors (Gg SO_2/PJ)
Black coal	0.37
Brown coal	0.15
LPG	0.002
Aviation gasoline	0.006
Motor spirit	0.006
Kerosene	0.057
Heating oil	0.057
ADO	0.057
IDF	0.057
Fuel oil	1.282
Natural gas	0.002

Source: Australian Institute for Petroleum, National Pollutant Inventory (petroleum refining), Department of Industry, Technology and Resources (for default coal values) and Australian Gas Association.

1.A.3 Transport

The full Australian methodology for the estimation of this inventory is available in *Australian Methodology for the Estimation of Greenhouse Gas Emissions and Sinks 2003: Energy (Transport)*. The rest of this section provides additional information on two major key categories in the sector – civil aviation (1.A.3a) and road transport (1.A.3b).

1.A.3a Civil Aviation

The methodology for the estimation of emissions from aviation is a tier 2 method that requires the separate estimation of emissions from domestic and international flights and is based on data on energy consumption, landing/takeoff cycles (LTO's) and cruise emissions.

Data on the yearly avtur consumption for the domestic and international aircraft are taken from ABARE and are derived from Department of Industry Tourism and Resources' data on sales to each specific class. The data required for the total yearly LTO for the domestic and international aircraft are available from Avstats, Department of Transport and Regional Services. Emission factors for LTO cycles are derived from Australian data while the emission factors for cruising are IPCC default values. These are provided at Tables 26 and 27 respectively.

Table 26: Emissions per LTO (kg per LTO)

	CH_4 (kg)	N_2O (kg)	NOx (kg)	CO (kg)	NMVOC (kg)
Domestic Fleet	0.14	0.10	8.14	11.89	1.23
International Fleet	0.50	0.10	53.28	25.86	4.50

Source: F Carnovale (1995). IPCC (1997).

Table 27: Cruise Emission Factors

Kg of emission/Mg of fuel					
	CH_4	N_2O	NOx	CO	NMVOC
Domestic Fleet	0	0.1	11	7	0.7
International Fleet	0	0.1	17	5	2.7

Source: IPCC 1997.

1.A.3.b Road Transportation

Emissions from road transport are estimated using tier 2 approaches. Estimates of the proportion of total consumption of each fuel, by each vehicle type (cars, trucks etc) for the Road Transport Sector have been calculated from analysis by Apelbaum Consulting Group contained in the *Australian Transport Facts* developed for the Australian Transport Energy Data and Analysis Centre (ACG, 2003), and Australian Gas Association data.

1.A.3.bi Passenger vehicles

Passenger vehicles using petrol or automotive gasoline are classified by age of vehicle. They are split according to year of manufacture into the following classes:

- pre-1976;
- 1976- 1985;
- 1985-1997;
- post-1997.

As well as allowing for vehicle deterioration with age, dividing the vehicle fleet in this manner is a proxy for differences in emissions control technology. Vehicles manufactured and sold in Australia before 1976 are assumed to have no emissions control equipment. The 1976-1985 group uses a variety of non-catalytic control (such as exhaust gas recirculation) and the 1985-1997 and the post-1997 groups use catalytic control. Estimates of the proportion of total distance travelled and the average rates of fuel consumption by petrol passenger vehicles for each age band are based on unpublished data from the Australian Bureau of Statistics Survey of Motor Vehicle Usage.

While emissions are calculated for each age band, the CO_2 emission factors and oxidation factors for each fuel are not age dependent and can be summarised in Table 28.

Table 28: CO_2 Emission Factors and Liquid Fuel Energy Densities by Fuel Type

Fuel Type	Proportion of Fuel Oxidised[a]	CO_2 Emission Factor[a] (g/MJ)	SO_2 Emission Factor (g/MJ)	Energy Density[b] (MJ/L)
Automotive Gasoline	0.99	66.0	0.057	34.2
Automotive Diesel Oil	0.99	69.7	0.057	38.6
Liquefied Petroleum Gas	0.99	59.4	0.057	25.7
Aviation Gasoline	0.99	68.0	0.057	33.1
Aviation Turbine Fuel	0.99	69.7	0.057	36.8
Industrial Diesel Fuel	0.99	69.7	0.057	39.6
Fuel Oil	0.99	73.6	1.282	40.8
Natural Gas	1.00	54.4	0.0023	25.0
Black Coal	0.99	90.0	0.37	N/A

N/A not applicable

Notes: Values are expressed in GCV terms

Figures for automotive gasoline refer to both leaded and unleaded forms

Sources: a. IPCC 1997, OECD 1991, b ABARE.

For non-CO_2 emissions, emission factors for each vehicle age class are estimated allowing for the penetration of 3 way catalytic converters (Environment Protection Authority of Victoria); the deterioration of performance as vehicle kilometres travelled increases (*Dr* in Table 29 - based on analysis conducted by the Environmental Protection Authority of NSW, 1995) and on the technology-specific emission factors reported in IPCC 1997 (*ZKL* in Table 29). The IPCC presents a summary of N_2O emissions from passenger vehicles using 3-way catalysts (new and aged), 2-way catalysts and no catalysts from Canadian, US and European emission tests. The no catalyst values are used for the pre-1976 Australian fleet and the 1976-85 age groupings and post-1997 fleets use a mix of 3 way and 2 way catalyst factors, depending on levels of market penetration of the new technology.

Table 29: Passenger Vehicle Non-Carbon Dioxide Emission Factors

Passenger Vehicle Age Class	CH4		N_2O
	ZKL_{ijk} g/km	Dr_{ijk} g/km/VKT	g/km
post-1997[d]	0.0148	8.43E-07	0.122
1985-1997[a]	0.0496	1.49E-06	0.048
1985-1997[b]	0.0560	8.43E-07	0.122
1976 – 1985	0.0906	4.76E-07	0.0037
Pre 1976	0.145	6.35E-07	0.0037

a 2-way catalyst

b 3-way catalyst

c Post 1985 CH4 represents 16% of total hydrocarbon emissions, and all pre 1985 CH4 represents 6% of total hydrocarbon emissions

d The average of the 1985 -1997 values for 2-way and 3-way catalysts are multiplied by the ratio of emission standards.

The comprehensive list of estimated emission factors for the road transport sector, taking into account the range of factors listed above, is given in Table 30.

Table 30: Road Category Non Carbon Dioxide Emission Factors

		EMISSION FACTOR (g/km)				
	Fuel Type	CH_4	N_2O	NOx	CO	NMVOC
Passenger Cars						
	Petrol					
	Post 1997	0.072	0.122	0.594	4.10	0.26
	1986 – 1997	0.201	0.107	1.85	18.27	1.05
	1976 – 1985	0.162	0.0037	2.37	33.95	2.54
	Pre 1976	0.241	0.0037	2.46	45.75	3.77
	ADO	0.010	0.010	1.03	1.08	0.530
	LPG	0.087	0.0079	1.94	21.60	1.69
	NG	0.968	0.004	0.704	0.408	0.074
Light Trucks						
	Petrol	0.163	0.012	1.654	17.358	1.091
	ADO	0.01	0.014	1.18	1.08	0.53
	LPG	0.089	0.014	2.23	21.6	1.69
	NG	1.006	0.004	0.732	0.424	0.077
Medium Trucks						
	Petrol	0.026	0.009	2.524	10.871	1.043
	ADO	0.157	0.025	5.200	6.438	1.152
	LPG	0.220	0.020	4.830	24.000	4.210
	NG	0.828	0.008	9.835	1.639	0.082
Heavy Trucks						
	Petrol	0.026	0.009	2.524	10.871	1.043
	ADO	0.157	0.025	5.200	6.438	1.152
	LPG	0.22	0.02	4.83	24	4.21
	NG	1.68	0.02	19.96	3.33	0.17
Buses						
	Petrol	0.15	0.005	3.91	48.61	3.47
	ADO	0.03	0.025	4.9	2.88	1.56
	LPG	0.12	0.011	2.76	24	2.41
	NG	1.41	0.014	16.756	2.793	0.14
Motorcycles						
	Petrol	0.15	0.002	0.21	19.27	4.58

Note:The emission factors for NOx, CO and NMVOCs (scaled to allow for the presence of exhaust carbonyls as well as hydrocarbons) are based on an air emissions inventory compiled by the Environment Protection Authority of Victoria (Carnovale et al. 1991), adjusted using data on average fleet characteristics from the Survey of Motor Vehicle Use Australia (ABS). These average emission factors relate to dynamometer drive cycles used to test compliance with Australian vehicle regulatory standards. The tests include allowances for the variation of exhaust emissions with speed, acceleration and cold engine starts, and the results have been averaged to be representative of national driving conditions. The passenger car light duty trucks CH4 and N2O emission factors are derived from Australian (Weeks et al. 1993) and US (Hoekman 1992) vehicle test data.

Sources: BTCE estimates based on Carnovale et al. (1991) and ABS, with supplementary information from

a. OECD (1991),

b. Hoekman (1992),

c. Weeks et al. (1993) and

d. Petrol fuelled passenger vehicle emission factors are calculated annually based on deterioration rates in Table 29.

1A4b Residential wood heating

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. The Australian methodology incorporates appliance type and certification, wood type and moisture content and user behaviour factors (see Todd 2003).

Table 31: Residential biomass emission factors

Inventory	Greenhouse Gas Emission Factor (Mg/PJ)						
Year	CO_2	CH_4	N_2O	CO	NO_x	NMVOC	SO_2
1990	70,373.9	1,100.1	2.3	11,751.6	16.9	1,393.5	1.1
1991	70,423.4	1,097.4	2.3	11,731.9	16.9	1,390.1	1.1
1992	70,472.9	1,094.7	2.3	11,712.3	17.0	1,386.7	1.1
1993	70,934.9	1,069.7	2.3	11,528.9	17.3	1,355.0	1.1
1994	71,703.1	1,028.2	2.2	11,224.1	17.9	1,302.3	1.1
1995	72,453.2	987.6	2.2	10,926.4	18.4	1,250.9	1.1
1996	73,185.3	947.9	2.1	10,635.8	18.9	1,200.7	1.1
1997	73,899.3	909.3	2.1	10,352.5	19.5	1,151.8	1.1
1998	75,031.0	848.1	2.0	9,903.4	20.3	1,074.2	1.1
1999	76,117.5	789.3	1.9	9,472.2	21.1	999.7	1.1
2000	77,158.8	732.9	1.9	9,058.9	21.8	928.4	1.1
2001	78,155.0	679.0	1.8	8,663.6	22.5	860.1	1.1
2002	78,470.1	661.9	1.8	8538.5	22.8	838.5	1.1
2003	78,785.3	644.9	1.8	8413.4	23.0	816.9	1.1

1.B Fugitives

The full Australian methodology for the estimation of this inventory is available in *Australian Methodology for the Estimation of Greenhouse Gas Emissions and Sinks 2003: Energy (Fugitive Emissions)*, National Greenhouse Gas Inventory Committee, Canberra. The rest of this section provides additional information to that presented in Chapter 3 for the major key category in the sector – underground mines (1.B.1).

1.B.1 Emissions from Underground Mines

Estimates of methane emissions from coal mining are derived from coal production data and the empirical work of Williams et al. (1992) and Williams, Lama and Saghafi (1996), which relate methane emissions to methane concentrations and coal production for two groups of underground mines - designated Class A ("gassy") and Class B ("non-gassy") – and for surface mines.

The production of coal from Class A and Class B mines in Australia is calculated using information on the classification and the annual production of each specific underground mine. The production data for each mine are published annually in the statistical publications of Coal Services Pty Ltd, the New South Wales Department of Minerals, and the Queensland Coal Board.

Emissions are estimated as the average of the results from the application of two empirical models. For Class A mines:

$$E_{a1} = (4.95 \times QTY_a \times IN\text{-}SITU_{1990} + 5.58) \times Ca \qquad (1B1\_1)$$

$$E_{a2} = (4.01 \times QTY_a \times IN\text{-}SITU_{1994}) \qquad (1B1\_2)$$

where:

E_{a1} is the total CH_4 emissions (**in Gg**) from Class A underground mines calculated using algorithm (1B1_1);
QTY_a is the annual quantity of raw black coal mined in class A underground mines (in Mt);
$IN\text{-}SITU_{1990}$ is the average coal seam methane content (in m3/t) for Class A black coal mines in 1990 ;
C_a is the volume-to-mass conversion factor (in kg/m3) for Class A mine emissions ; and
4.95 and 5.58 are constants.
E_{a2} is the total CH_4 emissions (**in Gg**) from Class A underground mines. calculated using algorithm (1B1_2);
QTY_a is the annual quantity of raw black coal mined in class A underground mines (in Mt);
$IN\text{-}SITU_{1994}$ is the average coal seam methane content (in m3/t) for Class A black coal mines in 1994 ; and
4.01 is a constant.

Similarly to Class A mines, the relationship established between coal production and CH4 emissions from mining for the entire group of Class B mines is the average of the estimates produced by the following:

$$E_{b4} = (102 \times QTY_b + 88) \times 6307 \times C_a \times 10^{-6} \qquad (1B1\_4)$$

$$E_{b5} = 0.67 \times QTY_b \qquad (1B1\_5)$$

where:

E_{b4} is the total CH_4 emissions (in Gg) from Class B underground mines, calculated using algorithm (1B1_4);

QTY_b is the annual quantity of raw black coal mined in Class B underground mines (in million tonnes);

C_a is the volume-to-mass conversion factor for Class B mine emissions (in kg/m3). This is the same as for Class A mine emissions; and

102, 88 and 6307 are constants.

E_{b5} is the total CH_4 emissions (in Gg) from Class B underground mines, calculated using algorithm 1B1_5;

QTY_b is the annual quantity of raw black coal mined in Class B underground mines (in million tonnes); and

0.67 is a constant.

4. Agriculture

The full Australian methodology for this sector is available in *Australian Methodology for the Estimation of Greenhouse Gas Emissions and Sinks 2003: Agriculture*. This section provides additional information to that provided in chapter 6 on the methodology for the major key categories in this sector – enteric fermentation (4.A), manure management (4.B), agricultural soils (4.D) and prescribed burning of savannas (4E) the closely related sector.

4.A Enteric fermentation

The methodology for key source categories, including cattle and sheep, have been constructed using tier 2 approaches consistent with the *IPCC Guidelines and Good Practice Guidance*. Australia's methodologies and emission factors, nonetheless, are country-specific so as to control for the differences in climatic conditions, feed quality and agricultural practices that prevail in Australia compared with those in most other Annex I countries.

Consistent with the IPCC Guidelines, Australia's approach provides for an enhanced characterisation of key livestock species to enable differentiation between animal performance based on management regime, age and gender, and seasonal conditions. The livestock populations are segregated by region where differences are apparent in animal performance due to differences in regional feed quality, climatic conditions or management regimes.

Table 32: Key structural characteristics of Australia's estimation approach

Livestock species and management regime	Enhanced population characteristics	Seasonal	Region-specific models	Manure management systems
Dairy cattle	7	Yes	8	4
Beef Cattle – management – pasture & paddock	7	Yes	10	1
Beef Cattle – management – feedlot	3	No	8	1
Sheep	6	Yes	8	1
Pigs	4	No	8	5
Goats	1	No	1	1
Horses	1	No	1	1
Alpacas	1	No	1	1
Deer	1	No	1	1
Ostriches and emus	1	No	1	1
Buffalo	1	No	1	1
Camels and Llamas	1	No	1	1
Mules and asses	1	No	1	1
Poultry	2	No	8	3

Source: Australian Methodologies for the Estimation of Greenhouse Gases and Sinks 2003: Agriculture.

The regions include the 8 Australian States and Territories and, in addition, Western Australia is divided into three regions for beef cattle – the South-West, the Pilbara and the Kimberleys.

Overall, estimates are made for emissions from 1,700 variables differentiated by species, animal performance characteristics, management type, climate, region and season.

Australia's tier 2 approaches specify the interactions between a number of important variables including the links between emissions and liveweight and liveweight gain, feed intake and digestibility. Australia has utilised the results of peer-reviewed literature appropriate to Australian conditions to parameterise these relationships, as set out below.

The quantity of feed intake for cattle is determined by equations reported in Minson and McDonald (1987), which estimate feed intake relative to liveweight and liveweight gain of cattle. By setting the liveweight gain component of their equation to zero to calculate maintenance intake, it is possible to estimate the relative feed intake of cattle.

Two methods are used to estimate enteric fermentation emissions, based on the estimated feed intake. For cattle grazing on pasture in temperate regions in Australia, emissions are determined using equations reported by Blaxter and Clapperton (1965). This approach requires the estimation of gross energy intake and then calculates the proportion of this energy that is converted into methane, based on the digestibility at maintenance of the feed energy and the level of feed intake relative to that required for maintenance.

For tropical cattle – comprising those in Queensland, the Northern Territory and the Kimberley region - the methane emissions are determined using equations reported in Kurihara et al. (1999), since these researchers have found that methane conversion rates for tropical breeds in tropical conditions were significantly higher than the IPCC defaults or those calculated by Blaxter and Clapperton (1965).

Variations on the above methodologies are necessary for feedlot and for dairy cattle. For cattle in feedlot, emissions are estimated for three classes of cattle, depending on the duration of housing, and the composition of feed quality and equations reported in Moe and Tyrrell (1979). For dairy cattle, the energy requirements for milk production are additionally accounted for, based on milk production data and the relationships between energy requirements and milk production reported in SCA (1990).

The other major source of enteric fermentation emissions in Australia is from sheep. In this case, emissions are determined using equations estimated by Howden et al (1994), who found a close relationship between feed intake and methane emissions based on Australian data, and equations on feed intake from AFRC 1990, Minson and McDonald 1987, White et al 1983 and SCA 1990. Account is taken of seasonal conditions and the need for milk production during the lambing season.

For non-key source categories, simple tier 1 approaches are used with emission factors applied to the whole of Australia using Australian data where available (Howden 1991, for deer) and IPCC defaults in other cases.

4.B Manure Management

The Australian estimates of emissions for manure management for key source categories are estimated using country-specific approaches based on enhanced animal characteristics and specification of manure management systems. Harmonised estimation of the multiple sources of emissions from livestock production – including from enteric fermentation, manure management and nitrous oxide emissions from agricultural soils – is ensured by using the same estimation systems and core input data across the various emission sources.

Methane production from manure is calculated for dairy cattle, beef cattle in feedlots, pigs and poultry. For each of these animal types, a common methodology was adopted, based on the general approach of the IPCC Guidelines (1997, vol. 3). For beef cattle and sheep on pasture range and paddock systems emissions are estimated using emission factors derived from González-Avalos and Ruiz-Suárez (2001). Estimation of key intermediate variables such as volatile solids is harmonised with the estimation of variables required for enteric fermentation. Methane conversion factors are derived from empirical studies appropriate to Australian conditions and IPCC default factors.

The general methodology for estimating nitrogen excretion from livestock wastes is based on equations from SCA (1990) and Freer *et al*. (1997). This methodology is consistent with the IPCC Guidelines and takes a mass balance approach where $N_{output} = N_{input} - N_{storage}$. The total N output is then split into urinary and faecal components. The methodology for estimating N_2O emissions from the nitrogen in the animal wastes is based on IPCC 1997.

Piggeries are a major source of nitrogen emissions. The Australian emission estimates are based on a specific model developed by Casey et al 1996 and take account of Australian animal characteristics, intakes, diet composition and wastage rates.

The data required to support the estimation methodologies for enteric fermentation and manure management are available from the Australian Greenhouse Emissions Information System and from the *Australian Methodology for the Estimation of Greenhouse Gas Emissions and Sinks 2003: Agriculture*. Livestock numbers and wool production are sourced from Australia's national statistical agency, the Australian Bureau of Statistic (ABS) census/survey data collected on 30 June in the relevant year. Data on the number of feedlot cattle are sourced from the Australian Lot Feeders Association (ALFA) quarterly survey. Milk production statistics are sourced from the Australian Dairy Corporation. Information on animal liveweights, liveweight gains, pasture digestibility etc. was provided on the basis of expert advice from industry groups, extension officers and researchers and on the basis of both published and unpublished data. The most recent update of this information was undertaken for the external expert review of the sector completed in 2003.

4D Agricultural Soils

Emissions of nitrous oxide from agricultural soils derive from a number of sources and are classified by the IPCC as 4.D.1 'Direct'; 4.D.2, 'Animal Production' and 4.D.3 'Indirect'.

The methodology to estimate emissions in this sector is necessarily complex in order to be able to estimate emissions from the full range of sources. Emissions derive from three principal sources – animal wastes, fertilisers and from cultivation or soil disturbance.

Nitrous oxide is emitted from soil through the metabolism of urine and faeces deposited directly on pastures by grazing animals, or from animal manure derived principally from dairies, feedlots, piggeries and poultry houses and applied to crops and pastures as organic fertiliser. A harmonised and consistent approach to the estimation of emissions from these sources compared with those under enteric fermentation and manure management systems is implemented. Emissions from the nitrogen in livestock urine deposited on pasture are derived from Australian data presented in Galbally et al., 1994 and Bouwman (1994). This factor, (0.4%), is low compared to IPCC defaults (0.5%-3%) but entirely appropriate from a statistical point of view given the extremely high uncertainties in this field reported in the IPCC Good Practice Guidance (IPCC 2000) and the dry, nitrogen deficient condition of Australian soils. For other sources of emissions from animal wastes there are no Australian studies. Given the range of empirical results from international studies, resulting from widely varying conditions, external expert advice provided emission factors of 1.8% and 0.5% for nitrous oxide emissions from animal waste (manure) spread on pastures and crops, and faeces voided in the field by grazing livestock respectively.

Direct emissions from fertiliser use are estimated using the IPCC default emission factor. Indirect emissions, and emissions from other sources are estimated using a comprehensive country-specific ‘soil disturbance’ methodology. When rates of nitrous oxide emission from unfertilised agricultural soils are compared with rates from soils supporting the original pristine vegetation, the agricultural soils are commonly found to sustain a higher emission rate. The enhancement in emission results from the combined effects of a number of activities: (1) soil disturbance, (2) inputs of nitrogen from wet and dry deposition, (3) the build-up of nitrogen in the soil from nitrogen–rich crop residues from previously fertilised crops and pastures including legumes fertilised though their symbiotic association with nitrogen fixing bacteria and (4) metabolism of fertiliser nitrogen applied to crops and pastures in previous years and immobilised in the soil.

These four processes are considered individually in the current IPCC guidelines (IPCC, 1997). The Australian methodology provides a composite estimate for the combined effect of the four processes derived from empirical studies of Australian conditions. The estimate of the enhanced rate of nitrous oxide emissions from cultivated soils relative to undisturbed ecosystems, of 0.29kgN/Ha, is derived from studies undertaken by Khalil et al. (1990), Galbally et al. (1996) and Meyer et al. (1997a) on emission rates of nitrous oxide from undisturbed natural ecosystems and studies by Galbally et al., 1996 on wheat and Galbally et al., 1994 on ungrazed legume pasture.

While this whole-of-system approach make it difficult for reviewers to compare the estimate for ‘soil disturbance’ with the disaggregated estimates reported by other parties, it nonetheless provides a complete, transparent and time-series consistent estimate of emissions from this source based on peer-reviewed Australian empirical studies.

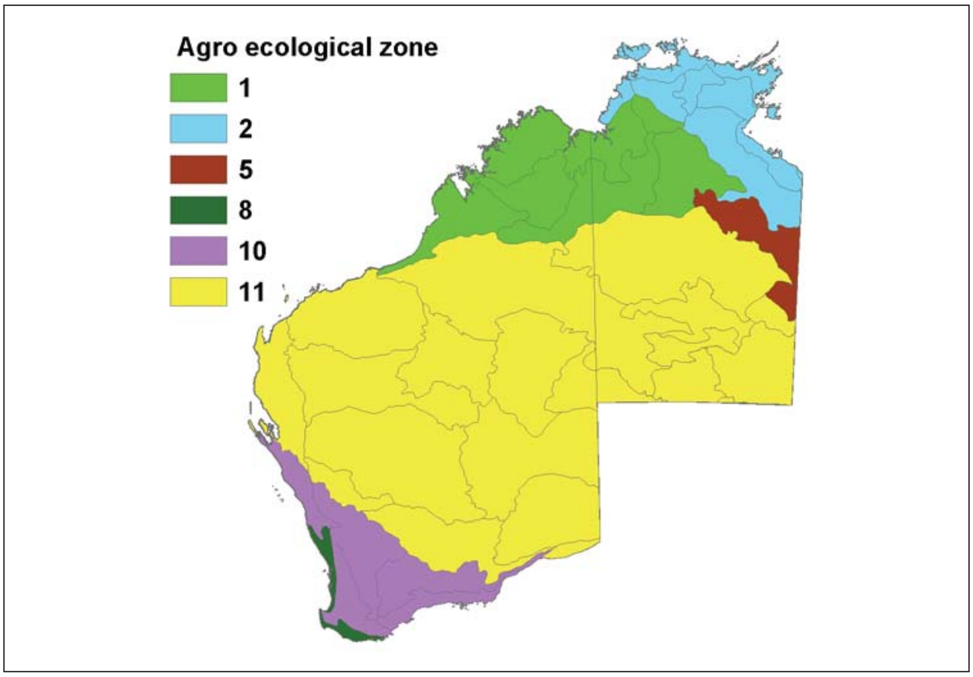
4E Prescribed Burning of Savannas Agricultural Soils

The methodology for estimating emissions from *prescribed burning of savannas* (4.E) closely correspond to the IPCC tier 2 methodologies but with modifications relevant to Australian conditions and the available data.

The *savanna burning* methodology employs a regional analysis based on the two broad vegetation classes of savanna grassland and savanna woodland in Western Australia (WA) and the Northern Territory (NT), using separate activity data and parameters for each region. Together WA and NT accounted for 85–91% of reported emissions and 65–91% of the annual area burnt over 1990–2003. Savannas and temperate grasslands within each of the other states are treated as homogenous so that each has a single set of activity data and parameters.

The savanna grassland and woodland regions in WA and NT are defined in the inventory in terms of the agroecological zones of the Interim Biogeographic Regionalisation for Australia (IBRA) version 4.1. Savanna woodlands in the Top End are defined as agroecological zones 1 and 2 and savanna grasslands in the Centre as agroecological zones 5 and 11, as shown in Figure 18.

Figure 18: Agroecological zones of WA and NT from IBRA 4.1



Separate standard fuel loads are estimated for savanna grasslands (Carter et al., 2000, Dyer et al., 2001, and Carter and Henry, 2003) and savanna woodlands in WA and NT (Russell-Smith et al., 2004). These are then weighted by the areas of grassland and woodland that burnt each year in each state/territory to estimate separate average fuel loads for WA and for NT, respectively. Similarly, separate burning efficiencies are estimated for grasslands and woodlands based on recent research (Russell-Smith et al., 2004, and Price et al., 2003) and then average area-weighted WA and NT burning efficiencies are calculated.

The aea of savanna burning is estimated by an analysis of fire scars using satellite data (high resolution AVHRR imagery) for NT and WA, supplemented by state fire authority estimates for the remaining States and Territories.

5. Land Use, Land Use Change and Forestry

The full Australian methodology for this sector is available in the *Australian Methodology for the Estimation of Greenhouse Gas Emissions and Sinks 2003: Land Use, Land Use Change* *and Forestry*. The Australian Inventory is presented to meet the accounting provision 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. Table 33 outlines the methodology papers used to compile each account.

Table 33: Methodology papers required to document LULUCF estimates

Source Category	Methodology Paper
UNFCCC Accounting	
5.A.1 Forest Lands: Forest lands remaining forest lands	
- Managed native forests	NGGIC (2005g)
- Plantation forests	NGGIC (2005h)
- Prescribed burning and wildfires	NGGIC (2005g)
5.C. 2 Grasslands: Forest lands converted to grasslands	NGGIC (2005i) – AGO (2002)
Kyoto Accounting	
Afforestation and Reforestation	Richards and Brack (2004)
Land Use Change (deforestation)	NGGIC (2005i) – AGO (2002)

5C Forest Conversion (Land Use Change)

This section outlines the methods used to prepare Australia's emissions estimates for Land Use Change for 1988-2003, based on results from the National Carbon Accounting System (NCAS). Land Use Change is a reporting category under the 1996 Guidelines of the Intergovernmental Panel on Climate Change (IPCC). The 1990 Land Use Change amount is included in the 1990 Kyoto Protocol baseline. Land Use Change is calculated on the same basis as Deforestation for the purposes of Article 3.3 of the Kyoto Protocol. Under the 2003 Good Practice Guidance to the 1996 Guidelines, Land Use Change (for Deforestation) is now reported under the Forest to Grassland and Forest to Cropland conversion categories.

The estimates presented in this report update the previously released results initially for the 1988-1998 period and subsequently the 1988 – 2001 period reported in *Greenhouse Gas Emissions from Land Use Change in Australia: Results of the National Carbon Accounting System* (Australian Greenhouse Office, August 2002 and August 2003 respectively). The first update to 2001 accommodated the following changes:

- completed the national land area coverage;
- incorporated non-CO2 greenhouse gases from biomass burning; and
- refined methods in response to new data and Continuous Improvement and Verification activities.

The current update, to include 2003, reflects updates in the time-series data, such as climate surfaces, crop yields and forest productivity, and improved methods of land cover change identification. The changes to the Landsat satellite data analysis for land cover change identification include the acquisition of approximately 800 high resolution (1 m) images to supplement existing ground calibration and verification data, and the use of terrain corrections (using digital elevation models) to remove erroneous classification due to terrain illumination arising from variable sun angles during data acquisition.

Accounting of greenhouse gas emissions from Land Use Change relates to a specific set of circumstances based on deliberate forest conversion and subsequent land use activity. Once a land unit is drawn into the accounting framework by forest conversion (as a Land Use Change activity) it remains inside the framework from that time onwards.

In the first instance, Land Use Change requires a forest conversion, that is, land with vegetation meeting the definition of a forest (potentially a minimum 20 per cent canopy cover, at least 2 metres in height and minimum area of 0.2 hectares) is converted from that forested condition by direct human action. Commercial forest activity is excluded, unless post-harvest activity involves a change in land use, e.g. to pasture or cropping. Plantations are not included in the land use change accounting framework unless there is interceding change in land use prior to planting.

Natural and indirect changes to forest, caused by events such as dieback, salinisation and droughting are not included in the accounting framework (as a Land Use Change activity). Fires are generally excluded, unless they result in loss of forest cover and the subsequent land use (such as grazing or cropping) suppresses the opportunity for forest regeneration. Where emissions from fires are excluded, no forest regrowth is counted as a removal from post-fire regrowth.

The NCAS utilises remotely sensed information on land unit history to attribute various activities to Land Use Change. This allows activities qualifying as Land Use Change to be identified from within those activities generally described as land clearing, forestry and natural phenomena (such as fire). The NCAS land unit history: accounts for condition prior to forest conversion, identifies the land unit converted, determines from prior and subsequent condition, its qualification as a Land Use Change; and tracks the subsequent land use including return to a forest condition (regrowth) after the interceding Land Use Change. Even with a return to a forested condition, land units remain within the accounting framework, and all regrowth and any reclearing is accounted for.

A detailed summary of the methodology for constructing Australia's emissions estimates for forest land conversion can be found in *Greenhouse Gas Emissions from Land Use Change in Australia: An Integrated Application of the National Carbon Accounting System (Australian Greenhouse Office, 2002) or in Australian Methodology for the Estimation of Greenhouse Gas Emissions and Sinks 2003: Land use, land use change and forestry (forest land conversion).*

A spatially explicit approach has been taken in the NCAS to ensure it is also capable of meeting the accounting requirements of land use, land use change and forestry activity covered by Articles 3.3 and 3.4 of the Kyoto Protocol. Principal considerations for the design of the NCAS included the requirements:

- to address NGGI reporting for the UNFCCC, as well as those related to Articles 3.3 and 3.4 of the Kyoto Protocol;
- for both retrospective (to define the 1990 baseline year condition) and current spatially and temporally disaggregated accounting, as well as scenario projections capabilities;
- to address all sectors of activity in land systems, including all carbon pools and all greenhouse gases affected by prescribed activities; and
- to develop a single national information base which forms the national greenhouse account.

The most detailed calibration and verification of the remote sensing and modelling work undertaken for the NCAS has focused to date on the areas of Australia capable of sustaining vegetation that meets the definition of a forest applied during the current analyses (woody vegetation potentially reaching 2 meters in height, 20 per cent canopy cover and having a minimum spatial extent of 0.2 hectares). The delineation of a forest conforms to the Marrakech rules for the Kyoto Protocol. The full national land area is considered in this analysis with reporting of all activities relevant to the IPCC category 5B (Forest and grassland conversion). Previous analyses only considered areas where major land use change activities were known to occur.

Land cover change is monitored continentally, commencing in the 1970s, as a multi-temporal, fine-resolution data series which (*inter alia*) identifies through time, for any land unit, forest conversion that is attributable to direct human actions and consequent regrowth. To date, it uses 13 national coverages of Australia, built from satellite data held in archives in the USA and Australia, to give 12 sequences of land cover change from approximately 1972 to end 2003.

The approach provides a 25 m pixel (16 pixels per ha) resolution nationally. Geographic registration and calibration consistency provides the ability to 'drill' through time on a pixel-by-pixel basis. The fine grain enables the land cover change history of discrete land units to be identified through time. Change in land cover nationally is also determined as the sum of each of the pixels showing loss of forest cover. As further time steps are added to the sequence of national land cover change analyses to maintain currency, results of continuous improvement programs can be implemented for the whole time series.

The rate of change in land-based carbon stocks after land cover change varies according to subsequent land uses, management practices, climate and the nature of the soil. The land use and management systems that affect soil carbon stocks after deforestation are determined via periodic review. Areas such as public forest tenures that are outside the Land Use Change (Forest and grassland conversion) accounting requirements are also identified.

The land use and management information is collected with the Interim Biogeographic Regionalisation of Australia (IBRA) used as a primary stratification, and with soil type used as a sub-stratum. Information collected for each region and soil type included crop type and regime by management type and by time. This analysis identified and described 141 different grazing and cropping systems. The information collected is held within the relational database of the *FullCAM* accounting model, and is drawn upon during model applications.

Rates of change in carbon stock over time are affected by prevailing climate. So spatially and temporally disaggregated information on climate is required to inform carbon accounting. Weather station data on rainfall, minimum, maximum and average temperatures, evaporation and frost days for the period 1968 to 2004 has been obtained from the Bureau of Meteorology. This weather station data is interpolated according to mathematical functions reflecting influences on weather to produce monthly climate maps for each attribute, at 1km resolution. These are taken as spatial grids into the *FullCAM* model.

The carbon sequestered into crop biomass needs to be accounted for as a carbon stock (sink), and also affects the rates of change in soil carbon under cropping and grazing systems. Relevant data on crop yield, the allocation of growth to various crop components, the natural shedding of plant material (turnover), and decomposition – all of which affect both litter and soil carbon pools - are collated. Data were assembled for each Biogeographic region by soil type, crop type and cropping system over time, and is also included in the relational database underpinning the *FullCAM* model.

Both the UNFCCC and the Kyoto Protocol require accounting for losses of biomass carbon following the removal of forest cover, as well as carbon sequestered through any subsequent regrowth of forest. Mapped estimates of biomass at maturity (undisturbed condition), biomass consequent to disturbance, and rates of regrowth are estimated. The partitioning of tree biomass to allow for differential rates of growth, natural shedding, decomposition and the impact of management regimes is done according to major forest type groupings. These groupings are also used to estimate the amount of carbon stored in forest litter.

Forest biomass is determined using a derivative form of the *3-PG* model to provide relative indices of growth potential on a 1 km grid scale nationally for each month since 1970, taking into account the impact of modifiers such as soil fertility, vapour pressure deficit, soil water content and temperature.

Soil carbon losses after forest conversion and with subsequent crop / pasture management and forest regrowth must be monitored over time to provide temporally and spatially disaggregated accounting capabilities. Mapped estimates of pre-disturbance soil carbon contents to a depth of 30 cm, as well as maps of clay content and soil type have been prepared. The work program includes model calibration and verification, and correction factors providing comparability between historic site sampling results from a variety of analytic laboratories typically using different methods. The soil carbon modelling used is underpinned by the *Roth-C* soil carbon model.

The requirements of the Kyoto Protocol to account for all carbon pools, disaggregated both temporally and spatially, demands integrated spatial modelling at a fine-scale resolution. While meeting the requirements of the Kyoto Protocol, this approach also allows for aggregation to a national scale as required for reporting under the UNFCCC. The *FullCAM* accounting model is an integrated suite of calibrated models for biomass, litter and soil carbon into a geographic information system along with multi-temporal remotely sensed land cover change data.

NCAS provided considerable investment into the calibration and verification of each model for the range of conditions and management practices present throughout Australia.

Uncertainty and Sensitivity Analyses have been an important part of the development of the NCAS program. Development of the NCAS was undertaken with the clear understanding that data holdings were open to improvement and that the significance of data limitations could be assessed only in a functional integrated system. Recognition of variability in data provided for a proper focus on matters of accuracy and bias rather than on potentially unachievable precision. Over a large sample (many billion 25 m model applications), a national inventory derived from an aggregation of fine-scale events can provide a robust central estimate provided inputs are not biased. Uncertainty analysis, and results of the calibration and verification of models give no cause to suspect there is bias in inputs.

The calculation of non-CO_2 greenhouse gas emissions has been undertaken according to previously derived ratios against loss of carbon due to biomass burning. Under the 1996 IPCC Guidelines, the only non-CO_2 gases to be reported under Land Use Change are those due to biomass burning. The *FullCAM* model also calculates the amount of carbon lost due to biomass burning, including both that from the initial forest conversion and from ongoing burning of biomass associated with crop and pasture burning.

6. Solid waste disposal on land

The Australian methodology for the estimation of emissions from disposal of waste to landfill combines waste data provided by State government waste agencies; IPCC default methodologies for the conversion of waste to methane emissions over time and company data on the recovery of methane.

Landfill waste decays and emits methane over several decades, depending on its composition and the landfill conditions, so methane emissions in any one year will depend on the waste that has been landfilled over many preceding years. For example, to estimate methane emissions in 1990, data on total waste tonnes and composition is required for each year from 1961 to 1990 inclusive, assuming a thirty year decay period or “batch life”.

A time series for waste in each State was constructed using recent data from the States, and other historic sources where available. Actual waste tonnes reported by the States comprise all or part of the most recent years’ figures. Backcasting has been undertaken to derive a time series back to 1960, allowing for a 30- year decay time or batch life.
The following State and Territory government agencies provided waste data for the 2003 Inventory:

- NSW Environment Protection Authority
- Ecorecycle Victoria
- QLD Environment Protection Authority
- Darwin City Council
- SA Environment Protection Authority
- WA Department of Environment
- Hobart City Council
- ACT Department of Urban Services.

Where historical data points are no longer available, an annual 0.73% growth rate in waste per capita was used to backcast the waste to landfill. This growth rate is based on surveys and analysis conducted by the Bureau of Industry Economics (Jubb, Wilkinson and Watts, 1994) and Maunsell (1994) providing continuity with the method used in submissions up to 2004.

Streams and Mix of waste

Waste to landfill data is disaggregated into three major waste streams:

- municipal solid waste;
- commercial and industrial waste; and,
- construction and demolition waste.

State data have been used to determine the stream percentages (Table 34). Where historical data cease, the streams have been held constant back to 1960. As no stream data is currently available for the Northern Territory, the stream percentages for Queensland have been used.

Table 34: State waste stream percentages 2003

	NSW(1)	VIC(2)	QLD(3)	NT(3)	SA(4)	WA(5)	TAS(6)	ACT(7)
Municipal Solid Waste	33%	36%	43%	43%	36%	27%	41%	24%
Commercial and Industrial	44%	24%	22%	22%	19%	16%	46%	25%
Construction and Demolition	23%	40%	35%	35%	46%	57%	13%	51%

Sources: (1) NSW Environment Protection Authority
(2) Ecorecycle Victoria
(3) QLD Environment Protection Authority
(4) SA Environment Protection Authority
(5) WA Department of Environment
(6) Hobart City Council
(7) ACT Department of Urban Services

Each stream is further disaggregated into a mix of waste categories. The categories considered are as follows:

- food;
- paper;
- garden and green;
- wood; and,
- other.

Table 35: Waste mix percentage by stream

	Municipal Solid Waste	Commercial & Industrial	Construction & Demolition
Food	18%	12%	0%
Paper	12%	20%	1%
Garden and Green	18%	6%	2%
Wood	3%	16%	8%
Other	50%	47%	89%

Derived from: (a) Nolan ITU 1995, (b) EcoRecycle 2000, (c) SA Environment Protection Authority 2000 (d) QLD Environment Protection Authority 2002 (e) NSW Environment Protection Authority 2003

A single mix of waste for each stream has been estimated, to apply every year to each State. This is the weighted average of the available data on mix for a given stream, combining information for Australia as a whole and over the complete time series.

Methodology for estimating methane generated

The IPCC tier 2 First Order Decay Model is used to calculate emissions from solid waste. The model applies an exponential decay function to each layer of waste disposed over 30 years. The methane generated in any one year is the total methane generated by the 30 layers of waste. The Model is expressed in equations 6.A.1, 6.A.2 and 6.A.3.

$$L_0 = MCF \times DOC \times DOC_F \times F \times 16 / 12 \qquad 6.A.1$$

Where:

L_0 is the CH_4 generation potential (Gg CH_4/Gg waste)

MCF is the CH_4 correction factor (fraction – assumed to equal 1)

DOC is the Degradable organic carbon (fraction) (Gg C/Gg waste).

DOC_F is the fraction of DOC dissimilated

F is the Fraction by volume of CH_4 in landfill gas

16 / 12 is the Conversion factor from C to CH_4

Values for DOC and DOCF for each waste mix category used in equation 6.A.1 are listed in table 36. The source for these parameters is IPCC (1997).

Table 36: DOC and DOCF values used in the First Order Decay Model

	DOC	DOC_F
Food	0.15	0.60
Paper	0.40	0.60
Garden and Green	0.17	0.60
Wood	0.30	0.50
Other	-	-

$$E_{lfgen} = \sum x\ [(A \times k \times MSW_T(x) \times MSW_F(x) \times L_0(x)) \times {}^{e-k(t-x)}] \qquad 6.A.2$$
$$\text{for } x = \text{initial year to } t$$

Where:

E_{lfgen} is CH_4 generated in year t
t is the year of inventory
x is the years for which input data should be added (30 Years)
A is a normalisation factor which corrects the summation and equals $(1 – e^{-k}) / k$
k is the CH4 generation rate constant (1/yr). The constant k is related to the time taken for the DOC in waste to decay to half its initial mass (the ‘half life’ or t½) as follows: k = ln2 / t½. A half-life of 12 years (k value of 0.058) is used in Australia’s Inventory (NGGIC 1998).
MSWT (x) is the Total municipal solid waste (MSW) generated in year x (Gg/yr)
MSWF (x) is the Fraction of MSW disposed at SWDS in year x
Sum the obtained results for all years (x).

$$E_{lfnet} = [E_{lfgen} – R(t)] \times (1 – OX) \qquad 6.A.3$$

Where:

E_{lfnet} is net CH_4 released in year t

R(t) is the amount of recovered CH4 in inventory year t (Gg/yr)

OX is the Oxidation factor (fraction)

Methane recovered (R(t)) must be subtracted from the amount generated before applying the oxidation factor, because only landfill gas that is not captured is subject to oxidation in the upper layer of the landfill. Methane recovery for flaring and power is estimated for Australia from a survey of the main landfill power and flaring operators.

It is assumed that all solid waste disposal on land in Australia is disposed to anaerobic or managed landfills (not open dumps or unmanaged sites), hence a methane correction factor of 1 applies.

The IPCC Guidelines specify that the emissions of CO_2 generated from biomass sources should not be incorporated into the greenhouse gas inventory. This is due to the assumption that over time regrowth of biomass (for example, crops and forests) equals consumption. Emissions of CO_2 from waste are not therefore treated as a net emission of greenhouse gas. CO_2 produced from the flaring of methane from wastes is also considered as having been derived from biomass sources. Only CO_2 generated from the incineration of waste that contains fossil fuels (for example, paints) and fossil fuel based products (for example, plastics) is included in this methodology.

Annex 4
CO_2 Reference approach for the Energy Sector

Estimation of CO_2 using the IPCC Reference Approach

The reference approach estimate CO_2 emissions from *fuel combustion activities* (covering both *stationary energy* and *transport*). It is calculated using a top-down approach based on national energy statistics for production, imports, exports and stock change. The energy consumption data and methodology differ to some degree from that used for the bottom-up, sectoral approach. However, the reference approach can be considered as a further means of quality control supporting the National (sectoral) emissions total.

Comparison of Australian Methodology with IPCC Reference Approach

Total CO_2 emissions estimated using Australia's National approach methodology are 340.0 Mt. Total CO_2 emissions estimated using the reference approach are 333.9 Mt. This is an overall 1.79 % difference between the two methods. The main reasons underlying the difference are:

1) An artefact caused by deficiencies in the design of Tables 1.A(b) and 1.A(d). The CRF does not 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. This explains why the extent of non-reconciliation is different for energy and for CO_2.

2) The discrepancy for liquid fuels is caused by the unreliability of the Reference Approach figure, which in turn derives from the crude oil density values used to convert reported indigenous production and imports in volumetric units into energy units, as required by the CRF.

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.

Annex 5
Assessment of Completeness

Greenhouse gases emanate from a wide variety of sources and through a large range of processes. For the most part estimates are generated from published sources of activity data. This is true for the most significant component of the inventory—emissions from fossil fuel combustion—where data collection processes are well established for either energy policy or taxation reasons. Where published data are not readily available, such as for some industries in the industrial processes sector, the AGO conducts comprehensive surveys of industry in order to obtain the necessary data.

A few minor sources are not included within the inventory, due to either a lack of available information or methodology (Table 37). These sources are considered to be insignificant, however, when compared with the inventory as a whole. A full assessment of the completeness of the inventory can be found in the Part B CRF Table 9.

Table 37: Greenhouse Gases and Source not estimated in the Australian inventory

Sector	Source Category	Gas	Reason
1. Energy	1.A.5.a Lubricants	CH_4, N_2O	No national methodology
1. Energy	1.B.2.b Natural Gas: (i) Production/Processing and (iii) Other Leakage	CO_2	No data available
2. Industrial Processes	2.A.6. Mineral Products: Road Paving with Asphalt	CO_2	No data available
2. Industrial Processes	2.B.4. Chemical Industry: Carbide Production	CO_2	There is no carbide production in Australia. Acetylene is produced from imported calcium carbide. Complete data on acetylene use are unavailable.
4. Agriculture	4.B Manure Management: 4.B.2, 4.B.4 - 4.B.7	CH_4	Manure of free-ranging animals does not produce significant quantities of CH_4 under Australian conditions. No data are available to use the Gonzalez-Avalos and Ruiz-Suarez (2001) emission factors for these species.
4. Agriculture	4.D.3. N leaching and runoff	N_2O	No national emissions data are available
4. Agriculture	4.F. Field Burning of Agricultural Residues 4.F.2-3	CH_4, N_2O	No data available on amount of residue burnt
5. Land Use Change and Forestry	5.D. Liming	CO_2	No data available
6. Waste	6.C Waste Incineration: Solvents	CH_4, N_2O	No data available

The assessment of completeness is used to help identify areas where methodologies can be developed, and where additional sources of data may be sought. In this inventory, a number of important missing sources have been captured for the first time. These include estimates of carbon dioxide from titanium dioxide production, synthetic gas emissions from sources other than from refrigeration and air conditioning and methane from certain livestock wastes. Together, these sources add 1.0 Mt or 0.2% to the inventory in 2002.

ANNEX 6
ADDITIONAL INFORMATION: 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.
anaerobic	a process relying on bacteria that can live without oxygen
anthropogenic	resulting from human activities – In the inventory, *anthropogenic emissions* are distinguished from *natural emissions*.
bagasse	the fibrous residue of the sugar cane milling process which is used as a fuel in sugar mills
briquettes	a composition fuel manufactured from brown coal which is crushed, dried and moulded under high pressure without the addition of binders.
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 ($CaCO_3.MgCO_3$) 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.
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 handfed 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 – Products include those imported for refinery intake and those returned from the petrochemical industry to the refining industry, such as naphtha.

flaring	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 uses 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 include 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_2O), 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.
hydrofluorocarbons (HFCs)	used as substitutes for chlorofluorocarbons (CFCs) and hydrochlorofluorocarbons (HCFCs)
industrial diesel fuel (IDF)	a petroleum product primarily consumed in the rail and water transport sectors.
Intergovernmental Panel on Climate Change (IPCC)	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.
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.
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
natural gas	consists primarily of methane (around 9%, 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.
NMVOC	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)
PFC	perfluorocarbons, chemical compounds containing carbon and fluorine atoms only (e.g. CF_4 and C_2F_6)
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 (1.A).
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 *municipal solid waste* (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), *commercial and industrial waste*, and *building and demolition waste*
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. Tier 1 methods are generally very simple (activity multiplied by default emissions factor) and require less data and expertise than the most complicated Tier 3 methods. Tier 2 and 3 methods generally require more 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.
town gas	includes all manufactured gases that are typically reticulated to consumers, including synthetic natural gas, reformed natural gas, tempered LPG, and tempered natural gas
uncertainty	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 (e.g. 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 etc.
United Nations Framework Convention on Climate Change (UNFCCC)	entered into force in 1994 – Parties to the convention have agreed to work towards achieving the its ultimate aim of stabilising ‘greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system’.
venting	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.

ANNEX 7
UNCERTAINTY ANALYSIS

Uncertainty is inherent within any kind of estimation—be it an estimate of the national greenhouse gas emissions, or the national gross domestic product. While it is in some cases possible to continuously monitor emissions, it is not usually practical or economical to do so. This leads to estimations based on samples or studies being used which carry a degree of additional uncertainty attached to them. Uncertainty also arises from the limitations of the measuring instruments, and over the complexities of the modelling of key relationships between observed variables and emissions.

Australia has conducted an uncertainty analysis for the *energy, industrial processes, agriculture, land use change* and *waste* sectors in line with the IPCC *Good Practice* guidelines. Monte Carlo and Latin Hypercube approaches were used to estimate emission uncertainty in some sectors, which is equivalent to the UNFCCC Tier 2 methodology.

The uncertainties for individual sectors are reported in more detail below. The estimated uncertainties tend to be low for carbon dioxide from energy consumption as well as from some industrial process emissions. Uncertainty surrounding estimates from these sources are typically as low as plus or minus 4-5%. Uncertainty surrounding estimates of emissions are higher for agriculture, land use change and forestry, reflecting inherently high uncertainty due to the very nature of the processes involved (e.g. biological processes). A medium band of uncertainty applies to estimates from fugitive emissions, most industrial processes and non-CO_2 gases in the energy sector. The ranges presented are broadly consistent with the typical uncertainty ranges expected for each sector, as identified in the IPCC *Good Practice Report*.

Assessing uncertainty is, itself, a difficult exercise, especially in the absence of quantitative data. The estimates of uncertainty for the Australian inventory are currently being reviewed under protocols developed by the Australian CSIRO Atmospheric Research Division and, in some cases, will be likely to be revised for the next submission.

The estimates of uncertainty surrounding the emissions estimates for individual sectors may be combined to present an estimate of the overall uncertainty for the inventory as a whole. The results of the application of the IPCC Tier 1 approach to estimating the uncertainty of the inventory as a whole are presented in Table 38. As indicated in the *IPCC Good Practice Guidance* this approach is valid as long as a number of restrictive assumptions are met. An alternative, more flexible approach, which relies on Monte Carlo analysis and a more detailed specification of the sources of uncertainty, is currently under consideration for development by the Australian Greenhouse Office for use in future national inventory reports. This analysis would be equivalent to the IPCC Tier 2 approach. As a consequence, and given the review of sectoral uncertainties also being currently undertaken, the estimates presented in Table 38 should be considered to be preliminary.

The Tier 1 results presented in Table 38 show that the estimated uncertainty surrounding the aggregate inventory estimate for 2003 to be +- 5.2 %. This estimate will be revised for the next submission, to reflect the impact of the CSIRO review, the re-assessment of uncertainties following the introduction of much improved methodologies, in particular for solid waste disposal and for savanna burning, and the introduction of more sophisticated modeling techniques.

The estimated uncertainty for the emission estimate for 2003 is lower than the estimate for the inventory estimate for 1990, of 6.3%, which is suggestive of a trend towards greater certainty over time for the Australian inventory. This conclusion is likely to be robust and is not likely to be sensitive to the revisions to uncertainty assessments to be undertaken for next year's submission.

Table 38: General Reporting Table for Uncertainty

IPCC Source category	Gas	Base year emissions (Gg)	2003 emissions (Gg)	Combined uncertainty	Contribution to Uncertainty in total inventory
Energy industries	CO_2	**128672**	**189518**	5	**2.96**
	CH_4	**28**	**188**	4	**0.000**
	N_2O	**413**	**623**	15	**0.000**
Petroleum refining	CO_2	**5769**	**6626**	4	**0.002**
	CH_4	**2**	**2**	9	**0.000**
	N_2O	**15**	**16**	12	**0.000**
Solid Fuels	CO_2	**7365**	**12158**	4	**0.008**
	CH_4	**10**	**29**	9	**0.000**
	N_2O	**9**	**16**	12	**0.000**
Manufacturing & Construction	CO_2	**37356**	**39117**	4	**0.081**
	CH_4	**31**	**42**	9	**0.000**
	N_2O	**203**	**202**	12	**0.000**
Transport	CO_2	**59724**	**74033**	4	**0.290**
	CH_4	**556**	**640**	24	**0.001**
	N_2O	**1631**	**5099**	42	**0.152**
Other sectors	CO_2	**12485**	**17280**	4	**0.016**
	CH_4	**1765**	**943**	9	**0.000**
	N_2O	**75**	**66**	12	**0.000**
Other nec	CO_2	**1181**	**1271**	16.4	**0.001**
Other nec	CH_4	1	1	25.4	**0.000**
	N_2O	4	5	44.7	**0.000**
Fugitives	CO_2	5962	5766	4	**0.002**
	CH_4	22765	20617	14	**0.275**
	N_2O	3	22	4	**0.000**
Industrial Processes	CO_2	22539	25913	6	**0.080**
	CH_4	69	69	9	**0.000**
	N_2O	26	20	16	**0.000**
	Syn. gases	5585	6302	29	**0.110**
Enteric fermentation	CH_4	67512	62748	5.5	**0.393**
Manure Management	CH_4	1539	2047	10.5	**0.002**
	N_2O	521	1286	10.5	**0.001**
Rice Cultivation	CH_4	490	400	21	**0.000**
Agricultural Soils	N_2O	15178	18716	110	**14.003**

Savanna Burning	CH_4	5608	8220	120	**3.215**
	N_2O	2431	3564	130	**0.709**
Agricultural Residues	CH_4	184	209	50	**0.000**
	N_2O	87	89	51	**0.000**
Forest lands	CO_2, CH_4, N_2O	-19531	-14769	40	**1.153**
Forest conversion	CO_2	126225	47765	20	**3.015**
Waste	CH_4	9739	10785	50	**0.961**
	N_2O	478	558	50	**0.003**
TOTAL		524498	550167		27.443
TOTAL UNCERTAINTY IN INVENTORY					**5.239**

Source: Australian Greenhouse Office.

In the following sections the analysis of uncertainty at the sectoral level is reported in greater detail.

Energy

Stationary energy

Uncertainty analyses were conducted for emissions from three sectors: 1.A.1.a. *Electricity*, 1.A.1.b. *Petroleum refining* and 1.A.1.c. *Manufacture of solid fuels and other energy industries* (Table 39). The overall uncertainty in estimated emissions from *electricity generation* was ±5%. The highest uncertainty was for N_2O emissions, with an associated uncertainty of up to ±16%. However, as emissions of N_2O (and CH_4) account for only a small fraction, 0.4%, of the subsector's total emissions, there is a negligible impact on overall uncertainty for this sector.

Table 39: Quantified uncertainty values for key stationary energy subcategories(a)

Greenhouse gas source and sink category	Uncertainty (%)			
	CO_2	CH_4	N_2O	Total CO_2-e
1. ENERGY				
A Fuel combustion activities				
1.A.1.a. Electricity	±5	**±9**	**±15**	**±5**
Black coal	±6	±9	±15	±6
Brown coal	±4	±9	±15	±4
Petroleum	±4	±9	±7	±4
Natural gas	±4	±9	±16	±4
Biomass	NA	±9	±4	±4
Biogas	NA	±9	±16	±4
1.A.1.b. Petroleum refining	±4	**±9**	**±12**	**±4**
Petroleum	±4	±9	±12	±4
Gas	±4	±9	±12	±4
1.A.1.c 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 1.A.1.b. *Petroleum refining* and 1.A.1.c. *Manufacture of solid fuels and other energy industries* sectors was ±4%. Again, the uncertainty associated with emissions of N_2O and CH_4 has negligible impact on overall uncertainty. An uncertainty analysis on minor, mobile source categories of the stationary energy sector gave uncertainty values ranging from ±16.4% to ±24.5% for CO_2, from ±25.4% to ±63.9% for CH_4, and ±44.7% to ±64.2% for N_2O (Table 40).

Table 40: Quantified uncertainty values for mobile source categories(a)

Greenhouse gas source and sink category	Uncertainty (%)		
	CO_2	CH_4	N_2O
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.

Transport

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 ±4% for CO_2, ±24% for CH_4, and ±42% for N_2O. Uncertainties in the emissions from individual source categories ranged from ±1% to ±24% for CO_2, ±23% to ±59% for CH_4, and ±32% to ±63% for N_2O. The largest source of uncertainty is in the emission factors.

Table 41: Emissions and quantified uncertainty values for key transport subcategories(a)

Greenhouse gas source and sink category	Uncertainty (%)		
	CO_2	CH_4	N_2O
1.A.3. Transport	**±4**	**±24**	**±42**
	±4	±23	±41
a. Civil aviation	**±9**	**±52**	**±52**
b. Road transport	**±4**	**±25**	**±42**
i. Passenger cars	±6	±31	±44
ii. Light trucks	±7	±38	±41
iii. Medium trucks	±9	±41	±60
iv. Heavy trucks	±10	±44	±61
v. Buses	±8	±36	±53
vi. Motorcycles	±10	±43	±61
c. Railways	**±5**	**±39**	**±39**
d. Navigation	**±8**	**±59**	**±32**
e. Other transportation	**±24**	**±46**	**±63**
International bunkers			
Aviation	±10	±58	±59
Marine	±4	±47	±52

(a) Uncertainty reported at 95% confidence limits.

Fugitives

An uncertainty analysis was conducted for *fugitive emissions* of CO_2, CH_4 and N_2O. 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 judgement.

The overall uncertainty for *fugitive* emissions was estimated to be ±11% (Table 42). The estimated uncertainty for *solid fuels* CH_4 was ±19%. Uncertainties in oil and natural gas emissions were estimated to be ±4% for CO_2, ±5% for CH_4 and ±4% for N_2O.

Table 42: Quantified uncertainty values for key fugitive emissions subcategories(a)

Greenhouse gas source and sink category	Uncertainty (%)			
	CO_2	CH_4	N_2O	CO_2-e
1. ENERGY				
B. Fugitive emissions	**±4**	**±14**	**±4**	**±11**
1.B.1. Solid fuels	**NE**	**±19**	**NE**	**±19**
1B1ai Underground mines	NE	±21	NE	±21
Underground activities	NE	±21	NE	±21
Post mining	NE	±17	NE	±17
1.B.1.a.i.i. Surface mining	NE	±17	NE	±17
1.B.2. Oil and natural gas	**±4**	**±5**	**±4**	**±4**
1.B.2.a. Oil	±8	±5	±8	±7
1.B.2.b. Natural gas	±9	±9	NA	±9
1.B.2.c. Venting and flaring	±4	±4	±4	±4

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

Industrial Processes

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 CO_2 emissions from the *industrial processes* sector of ±6% (Table 43). The overall uncertainty for CO_2 emissions from *metal products* is estimated to be ±7%. Uncertainty in these estimates is the major determinant of uncertainty in aggregate emissions for *industrial processes*.

Table 43: Quantified uncertainties for industrial processes subsectors using the IPCC approach

Greenhouse gas source and sink categories	Uncertainty (%)			
	CO_2	CH_4	N_2O	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	NE

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 ±6% and the Latin Hypercube analysis gave an uncertainty of ±5% (Table 44). The uncertainty in the *industrial processes* subsectors ranged from ±7% to ±29%.

Table 44: Quantified uncertainty values for key industrial processes subsectors using different techniques(a)

Greenhouse gas source and sink categories	Uncertainty (%)	Derivation
2 INDUSTRIAL PROCESSES		
A.1. Cement production (CO_2)	±7	Based on IPCC approach
	±7	Monte Carlo
	±7	Latin Hypercube
A.2. Lime production (CO_2)	±14	Based on IPCC approach
	±14	Monte Carlo
	±15	Latin Hypercube
A.3. limestone use (CO_2)	±11	Based on IPCC approach
	±11	Monte Carlo
	±12	Latin Hypercube

A.3. dolomite use (CO_2)	±11 ±11 ±11	Based on IPCC approach Monte Carlo Latin Hypercube
B.2. Nitric acid (N_2O)	±16 ±15 ±16	Based on IPCC approach Monte Carlo Latin Hypercube
C.1. Iron and steel (CO_2)	±10 ±11 ±10	Based on IPCC approach Monte Carlo Latin Hypercube
C.1. Aluminium production (CO_2)	±7 ±7 ±7	Based on IPCC approach Monte Carlo Latin Hypercube
C.1. Aluminium production (CF_4 as CO_2-e)	NE ±29 ±27	Based on IPCC approach Monte Carlo Latin Hypercube
C.1. Aluminium production (C_2F_6 as CO_2-e)	NE ±27 ±28	Based on IPCC approach Monte Carlo Latin Hypercube
Total CO_2-e for these subsectors	NE ±6 ±5	Based on IPCC approach Monte Carlo Latin Hypercube

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

Agriculture

Livestock

An uncertainty analysis was undertaken for the livestock subsectors, addressing both CH_4 and N_2O 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 45) while the uncertainty in the *manure management* emissions was in the order of 10%. For total CO_2-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.

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

Table 45: Relative uncertainty in emission estimates for the livestock subsector[(a)]

Greenhouse gas source and sink categories	Uncertainty (%)	
	CH_4	N_2O
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.

Other Agriculture

Estimates of uncertainties in the emissions for the *other agriculture* subsectors were determined using a Latin Hypercube analysis (Table 46). 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, including approximately –34 to +50% for methane in the *field burning of residues* subsector and –52% to +110% for nitrous oxide from *agricultural soils*. By way of comparison, estimates presented in the IPCC *Good Practice* guidelines indicate uncertainties of up to +55% and +500% for these sectors respectively as being likely to be typical. 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 three-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 46: Relative uncertainty in emission estimates for other agriculture subsectors(a)

Greenhouse gas source and sink categories	Uncertainty (%)				
	CH_4	N_2O	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.

Land Use Change and Forestry

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 47). Sensitivity and uncertainty analyses specific to the *forest and grassland conversion* subsector are documented in AGO (2002).

Table 47: 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%.

Waste

The level of uncertainty associated with *landfill* methane recovery is lower than the level of uncertainty associated with methane generated (gross emissions) from *solid waste* and methane generated and recovered from *wastewater*. Landfill recovery data are obtained from organisations operating landfill gas recovery projects. The amounts of methane 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%. Comparisons against 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, methane potential and methane recovered are approximately normally distributed with 95% confidence intervals of ±20%, overall uncertainty derived from Latin Hypercube random sampling was ±23.6%. Using these assumptions and assessing uncertainty for all years from 1990 to 2000 simultaneously, uncertainty ranged from ±20.4% in 1990 to ±23.6% in 2000. These results suggest that the overall uncertainty for *solid waste disposal* is likely to be less than ±50%. The uncertainty analysis will be refined once an expert review of the sector is undertaken.

Table 48: Relative uncertainty in emission estimates for key waste subsectors

Greenhouse gas source and sink categories	Uncertainty (%)				
	CH_4	N_2O	NO_x	CO	NMVOC
6. Waste					
A. Solid waste disposal on land	± 50%	NA	NA	NA	NA

Annex 8
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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
2003
2005

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	CO_2	CH_4	N_2O	NO_X	CO	NMVOC	SO_2
				(Gg)			
Total Energy	**345,770.51**	**1,069.66**	**19.52**	**1,603.13**	**4,030.00**	**740.80**	**810.29**
A. Fuel Combustion Activities (Sectoral Approach)	**340,004.36**	**87.862**	**19.44**	**1,601.76**	**4,022.42**	**562.57**	**810.29**
1. Energy Industries	**208,302.60**	**10.447**	**2.11**	**698.39**	**71.74**	**8.86**	**668.64**
a. Public Electricity and Heat Production	189,518.35	8.953	2.01	579.73	49.83	6.28	640.68
b. Petroleum Refining	6,626.14	0.090	0.05	46.45	5.60	0.09	17.05
c. Manufacture of Solid Fuels and Other Energy Industries	12,158.11	1.404	0.05	72.20	16.31	2.49	10.91
2. Manufacturing Industries and Construction	**39,117.20**	**1.986**	**0.65**	**344.68**	**234.70**	**11.33**	**100.61**
a. Iron and Steel	2,356.81	0.054	0.01	30.71	4.54	0.22	6.73
b. Non-Ferrous Metals	13,441.79	0.280	0.09	85.70	14.50	0.44	61.52
c. Chemicals	5,816.34	0.201	0.03	53.47	24.92	1.57	4.47
d. Pulp, Paper and Print	1,852.44	0.106	0.08	5.56	12.46	0.21	4.28
e. Food Processing, Beverages and Tobacco	2,219.79	0.822	0.36	11.06	136.84	1.50	3.56
f. Other *(please specify)*	13,430.02	0.524	0.09	158.17	41.43	7.38	20.04
All Other Manufacturing	900.38	0.0346	0.0030	4.17	4.67	0.34	0.47
Construction	1,908.05	0.1432	0.0158	24.96	9.58	2.64	1.86
Non-metallic Mineral Products	5,169.74	0.1228	0.0316	63.72	14.97	0.84	9.78
Mining (non-energy)	5,451.86	0.2235	0.0391	65.32	12.21	3.56	7.92
3. Transport	**74,033.42**	**30.475**	**16.45**	**444.46**	**3,054.11**	**457.92**	**33.87**
a. Civil Aviation	5,197.02	0.21	0.16	17.16	83.18	2.84	0.62
b. Road Transportation	66,307.43	27.73	16.22	385.36	2,830.60	430.89	27.06
c. Railways	1,482.87	0.06	0.04	32.88	4.34	1.53	1.23
d. Navigation	1,004.14	2.45	0.02	8.82	131.48	21.97	4.95
e. Other Transportation *(please specify)*	41.95	0.02	0.00	0.24	4.49	0.69	0.01
Off road vehicles	41.95	0.02	0.00	0.24	4.49	0.69	0.01

ENERGY

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

Australia
2003
2005

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	CO_2	CH_4	N_2O	NO_X	CO	NMVOC	SO_2
	(Gg)						
4. Other Sectors	**17,280.43**	**44.91**	**0.21**	**110.15**	**654.47**	**83.64**	**6.98**
a. Commercial/Institutional	4,308.14	0.07	0.02	5.11	1.77	0.19	2.06
b. Residential	7,773.86	44.19	0.14	7.64	617.25	71.31	0.67
c. Agriculture/Forestry/Fisheries	5,198.42	0.64	0.05	97.39	35.46	12.14	4.25
5. Other *(please specify)*	**1,270.71**	**0.046**	**0.02**	**4.09**	**7.41**	**0.82**	**0.19**
a. Stationary	636.96	NE	NE	NE	NE	NE	NE
Lubricants	636.96	NE	NE	NE	NE	NE	NE
b. Mobile	633.75	0.05	0.02	4.09	7.41	0.82	0.19
Military Transport	633.75	0.05	0.02	4.09	7.41	0.82	0.19
B. Fugitive Emissions from Fuels	**5,766.16**	**981.80**	**0.07**	**1.37**	**7.58**	**178.22**	**NA**
1. Solid Fuels	**NE**	**787.34**	**NE**	**NE**	**NE**	**NE**	**NA**
a. Coal Mining	NE	787.34	NE	NE	NE	NE	
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	**5,766.16**	**194.46**	**0.07**	**1.37**	**7.58**	**178.22**	**NE**
a. Oil	309.09	4.64	0.01	0.25	1.11	109.44	NE
b. Natural Gas	4.92	88.93				14.74	NE
c. Venting and Flaring	5,452.15	100.89	0.06	1.12	6.48	54.04	NE
Venting	3,349.38	74.83				42.87	NE
Flaring	2,102.78	26.06	0.06	1.12	6.48	11.17	NE
d. Other *(please specify)*	NA	NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA	NA	NA
Memo Items:							
International Bunkers	**8,837.18**	**0.14**	**0.26**	**94.89**	**12.89**	**7.27**	**43.69**
Aviation	6,615.32	0.03	0.20	35.43	10.96	5.42	1.25
Marine	2,221.86	0.11	0.06	59.46	1.93	1.85	42.44
Multilateral Operations	NE	NE	NE	NE	NE	NE	NE
CO_2 Emissions from Biomass	**15,947.94**						

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

Australia
2003
2005

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	AGGREGATE ACTIVITY DATA		IMPLIED EMISSION FACTORS [2]				EMISSIONS		
	Consumption		CO_2	CH_4	N_2O		CO_2	CH_4	N_2O
	(TJ)	[1]	(t/TJ)	(kg/TJ)	(kg/TJ)		(Gg)	(Gg)	(Gg)
1.A. Fuel Combustion	**4,741,331.18**	GCV					**340,004.36**	**87.86**	**19.44**
Liquid Fuels	1,542,322.67	GCV	67.49	22.26	10.96		102,884.95	33.93	16.71
Solid Fuels	2,079,510.53	GCV	91.01	0.87	1.00		189,250.98	1.81	2.08
Gaseous Fuels	932,922.38	GCV	51.31	6.19	0.11		47,868.42	5.78	0.10
Biomass	186,575.61	GCV	85.48	248.40	2.97	[3]	15,948.03	46.35	0.55
Other Fuels	NA	GCV	NA	NA	NA		NA	NA	NA
1.A.1. Energy Industries	**2,514,227.18**	GCV					**208,302.60**	**10.45**	**2.11**
Liquid Fuels	136,809.16	GCV	68.42	1.91	0.60		9,360.53	0.26	0.08
Solid Fuels	1,936,573.20	GCV	91.44	0.78	1.02		177,078.71	1.51	1.98
Gaseous Fuels	425,089.82	GCV	51.43	12.08	0.11		21,863.36	5.14	0.05
Biomass	15,755.00	GCV	54.32	224.46	0.33	[3]	855.88	3.54	0.01
Other Fuels	NA	GCV	NA	NA	NA		NA	NA	NA
a. Public Electricity and Heat Production	2,187,451.72	GCV					189,518.35	8.95	2.01
Liquid Fuels	23,912.13	GCV	69.38	3.50	0.60		1,658.96	0.08	0.01
Solid Fuels	1,915,874.90	GCV	91.80	0.78	1.02		175,878.45	1.49	1.96
Gaseous Fuels	231,909.69	GCV	51.66	16.57	0.13		11,980.93	3.84	0.03
Biomass	15,755.00	GCV	54.32	224.46	0.33	[3]	855.88	3.54	0.01
Other Fuels	NA	GCV	NA	NA	NA		NA	NA	NA
b. Petroleum Refining	102,693.30	GCV					6,626.14	0.09	0.05
Liquid Fuels	81,918.30	GCV	67.91	0.83	0.60		5,563.40	0.07	0.05
Solid Fuels	NA	GCV	NA	NA	NA		NA	NA	NA
Gaseous Fuels	20,775.00	GCV	51.15	1.06	0.10		1,062.74	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	224,082.16	GCV					12,158.11	1.40	0.05
Liquid Fuels	30,978.73	GCV	69.02	3.56	0.60		2,138.16	0.11	0.02
Solid Fuels	20,698.30	GCV	57.99	1.01	0.80		1,200.26	0.02	0.02
Gaseous Fuels	172,405.13	GCV	51.16	7.38	0.10		8,819.68	1.27	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
[2] Accurate estimation of CH_4 and N_2O 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.

ENERGY

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

Australia
2003
2005

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	AGGREGATE ACTIVITY DATA		IMPLIED EMISSION FACTORS [2]			EMISSIONS		
	Consumption		CO_2	CH_4	N_2O	CO_2	CH_4	N_2O
	(TJ)	[1]	(t/TJ)	(kg/TJ)	(kg/TJ)	(Gg)	(Gg)	(Gg)
1.A.2 Manufacturing Industries and Construction	**732,226.12**	GCV				**39,117.20**	**1.99**	**0.65**
Liquid Fuels	154,274.49	GCV	67.08	3.91	0.57	10,348.90	0.60	0.09
Solid Fuels	136,346.12	GCV	84.71	1.19	0.73	11,549.44	0.16	0.10
Gaseous Fuels	336,251.63	GCV	51.21	1.08	0.10	17,218.86	0.36	0.03
Biomass	105,353.86	GCV	94.24	8.13	4.10 [3]	9,928.78	0.86	0.43
Other Fuels	NA	GCV	NA	NA	NA	NA	NA	NA
a. Iron and Steel	45,684.17	GCV				2,356.81	0.05	0.01
Liquid Fuels	1,626.51	GCV	67.29	6.05	0.46	109.45	0.01	0.00
Solid Fuels	17,540.34	GCV	50.79	1.07	0.28	890.87	0.02	0.00
Gaseous Fuels	26,517.31	GCV	51.15	0.94	0.09	1,356.49	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	203,658.09	GCV				13,441.79	0.28	0.09
Liquid Fuels	37,641.34	GCV	71.64	2.17	0.60	2,696.61	0.08	0.02
Solid Fuels	59,074.86	GCV	91.29	1.24	0.80	5,392.78	0.07	0.05
Gaseous Fuels	104,631.26	GCV	51.15	1.10	0.10	5,352.40	0.12	0.01
Biomass	2,310.63	GCV	92.12	4.20	4.10 [3]	212.86	0.01	0.01
Other Fuels	NA	GCV	NA	NA	NA	NA	NA	NA
c. Chemicals	102,612.12	GCV				5,816.34	0.20	0.03
Liquid Fuels	26,115.63	GCV	55.37	4.42	0.45	1,445.90	0.12	0.01
Solid Fuels	11,184.60	GCV	90.43	1.24	0.80	1,011.46	0.01	0.01
Gaseous Fuels	65,311.89	GCV	51.43	1.10	0.10	3,358.98	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	45,626.78	GCV				1,852.44	0.11	0.08
Liquid Fuels	1,944.82	GCV	68.82	2.15	0.60	133.84	0.00	0.00
Solid Fuels	8,400.00	GCV	88.20	1.30	0.80	740.88	0.01	0.01
Gaseous Fuels	19,112.96	GCV	51.15	1.19	0.10	977.72	0.02	0.00
Biomass	16,169.00	GCV	92.12	4.20	4.10 [3]	1,489.49	0.07	0.07
Other Fuels	NA	GCV	NA	NA	NA	NA	NA	NA
e. Food Processing, Beverages and Tobacco	123,468.44	GCV				2,219.79	0.82	0.36
Liquid Fuels	2,526.64	GCV	66.81	2.20	0.60	168.81	0.01	0.00
Solid Fuels	6,969.68	GCV	88.84	1.30	0.80	619.22	0.01	0.01
Gaseous Fuels	27,988.88	GCV	51.15	1.14	0.10	1,431.77	0.03	0.00
Biomass	85,983.23	GCV	94.72	9.01	4.10 [3]	8,144.36	0.78	0.35
Other Fuels	NA	GCV	NA	NA	NA	NA	NA	NA
f. Other *(please specify)*	211,176.52	GCV				13,430.02	0.52	0.09
Liquid Fuels	84,419.55	GCV	68.64	4.59	0.60	5,794.28	0.39	0.05
Solid Fuels	33,176.64	GCV	87.24	1.10	0.78	2,894.24	0.04	0.03
Gaseous Fuels	92,689.32	GCV	51.15	1.04	0.10	4,741.51	0.10	0.01
Biomass	891.00	GCV	92.12	4.20	4.10 [3]	82.08	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
2003
2005

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	AGGREGATE ACTIVITY DATA		IMPLIED EMISSION FACTORS [2]			EMISSIONS		
	Consumption		CO_2	CH_4	N_2O	CO_2	CH_4	N_2O
	(TJ)	[1]	(t/TJ)	(kg/TJ)	(kg/TJ)	(Gg)	(Gg)	(Gg)
1.A.3 Transport	**1,115,782.64**	GCV				**74,033.42**	**30.47**	**16.45**
Gasoline	704,622.88	GCV	65.72	33.68	22.08	46,310.82	23.73	15.56
Diesel	332,166.04	GCV	69.03	8.87	2.22	22,928.27	2.95	0.74
Natural Gas	100.00	GCV	51.41	111.11	1.00	5.14	0.01	0.00
Solid Fuels	3,557.00	GCV	89.18	32.03	1.00	317.20	0.11	0.00
Biomass	NA	GCV	NA	NA	NA [3]	NA	NA	NA
Other Fuels	75,336.73	GCV	59.36	48.76	2.01	4,471.99	3.67	0.15
a. Civil Aviation	75,391.61	GCV				5,197.02	0.21	0.16
Aviation Gasoline	3,105.47	GCV	67.36	57.03	0.90	209.18	0.18	0.00
Jet Kerosene	72,286.15	GCV	69.00	0.45	2.21	4,987.84	0.03	0.16
b. Road Transportation	1,004,546.07	GCV				66,307.43	27.73	16.22
Gasoline	629,231.26	GCV	65.34	37.38	24.46	41,113.80	23.52	15.39
Diesel Oil	306,354.81	GCV	69.00	9.31	2.24	21,139.11	2.85	0.69
Natural Gas	100.00	GCV	51.41	111.11	1.00	5.14	0.01	0.00
Biomass	NA	GCV	NA	NA	NA [3]	NA	NA	NA
Other Fuels *(please specify)*	68,860.00	GCV				4,049.38	1.35	0.15
LPG	68,860.00	GCV	58.81	19.57	2.11	4,049.38	1.35	0.15
c. Railways	21,492.00	GCV				1,482.87	0.06	0.04
Solid Fuels	NA	GCV	NA	NA	NA	NA	NA	NA
Liquid Fuels	21,492.00	GCV	69.00	3.00	2.00	1,482.87	0.06	0.04
Other Fuels *(please specify)*	NA	GCV				NA	NA	NA
NA	NA	GCV	NA	NA	NA	NA	NA	NA
d. Navigation	13,710.88	GCV				1,004.14	2.45	0.02
Coal	3,557.00	GCV	89.18	32.03	1.00	317.20	0.11	0.00
Residual Oil	2,714.92	GCV	72.96	3.00	2.00	198.09	0.01	0.01
Gas/Diesel Oil	962.23	GCV	68.84	3.99	2.00	66.24	0.004	0.002
Other Fuels *(please specify)*	6,476.73	GCV				422.61	2.33	0.01
Gasoline	6,420.73	GCV	65.34	360.00	0.90	419.53	2.31	0.01
Natural Gas	56.00	GCV	55.08	260.36	1.07	3.08	0.01	0.00
e. Other Transportation	642.07	GCV				41.95	0.02	0.00
Liquid Fuels	642.07	GCV	65.34	30.00	0.90	41.95	0.02	0.00
Solid Fuels	NA	GCV	NA	NA	NA	NA	NA	NA
Gaseous Fuels	NA	GCV	NA	NA	NA	NA	NA	NA

ENERGY

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

Australia
2003
2005

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	AGGREGATE ACTIVITY DATA		IMPLIED EMISSION FACTORS [2]				EMISSIONS		
	Consumption		CO_2	CH_4	N_2O		CO_2	CH_4	N_2O
	(TJ)	[1]	(t/TJ)	(kg/TJ)	(kg/TJ)		(Gg)	(Gg)	(Gg)
1.A.4 Other Sectors	**361,231.91**	GCV					**17,280.43**	**44.91**	**0.21**
Liquid Fuels	121,306.04	GCV	67.57	22.11	0.61		8,196.82	2.68	0.07
Solid Fuels	3,034.20	GCV	100.73	6.91	0.80		305.63	0.02	0.00
Gaseous Fuels	171,424.93	GCV	51.21	1.47	0.10		8,777.98	0.25	0.02
Biomass	65,466.74	GCV	78.87	640.82	1.80	[3]	5,163.36	41.95	0.12
Other Fuels	NA	GCV	NA	NA	NA		NA	NA	NA
a. Commercial/Institutional	73,550.00	GCV					4,308.14	0.07	0.02
Liquid Fuels	25,476.59	GCV	67.71	0.66	0.60		1,725.01	0.02	0.02
Solid Fuels	2,870.05	GCV	100.87	1.30	0.80		289.50	0.00	0.00
Gaseous Fuels	44,787.83	GCV	51.21	1.12	0.12		2,293.63	0.05	0.01
Biomass	415.53	GCV	92.12	3.70	4.10	[3]	38.28	0.00	0.00
Other Fuels	NA	GCV	NA	NA	NA		NA	NA	NA
b. Residential	212,186.09	GCV					7,773.86	44.19	0.14
Liquid Fuels	20,414.63	GCV	62.58	99.13	0.68		1,277.53	2.02	0.01
Solid Fuels	164.16	GCV	98.24	105.00	0.80		16.13	0.02	0.00
Gaseous Fuels	126,556.10	GCV	51.20	1.60	0.10		6,480.20	0.20	0.01
Biomass	65,051.21	GCV	78.79	644.89	1.78	[3]	5,125.08	41.95	0.12
Other Fuels	NA	GCV	NA	NA	NA		NA	NA	NA
c. Agriculture/Forestry/Fisheries	75,495.82	GCV					5,198.42	0.64	0.05
Liquid Fuels	75,414.82	GCV	68.88	8.51	0.60		5,194.28	0.64	0.05
Solid Fuels	NA	GCV	NA	NA	NA		NA	NA	NA
Gaseous Fuels	81.00	GCV	51.15	1.10	0.10		4.14	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)	**17,865.33**	GCV					**1,270.71**	**0.05**	**0.02**
Liquid Fuels	17,865.33	GCV	71.13	2.58	0.99		1,270.71	0.0461	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

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
CO_2 from Fuel Combustion Activities - Reference Approach (IPCC Worksheet 1-1)
(Sheet 1 of 1)

Australia
2003
2005

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	1,232.81	1,083.26	774.71		12.52	1,528.84	1,000.00	GCV	1,528,839.43	18.60	28,436.41	0.00	28,436.41	0.99	103,224.18
		Orimulsion	PJ	NO	NO	NO		NA	0.00	NA	GCV	0.00	NA	0.00	NO	0.00	NA	0.00
		Natural Gas Liquids	PJ	144.90	NO	NO		1.55	143.35	1,000.00	GCV	143,346.49	16.06	2,302.07	0.00	2,302.07	0.99	8,356.51
	Secondary Fuels	Gasoline	PJ		49.12	42.96	0.00	-0.78	6.94	1,000.00	GCV	6,939.02	18.03	125.09	0.00	125.09	0.99	454.08
		Jet Kerosene	PJ		8.27	20.20	95.87	1.21	-109.01	1,000.00	GCV	-109,010.64	19.01	-2,072.19	0.00	-2,072.19	0.99	-7,522.06
		Other Kerosene	PJ		0.00	0.07	0.00	-0.05	-0.02	1,000.00	GCV	-23.04	19.01	-0.44	0.00	-0.44	0.99	-1.59
		Shale Oil	PJ		NO	NO		NA	0.00	NA	GCV	0.00	NA	0.00	NO	0.00	NA	0.00
		Gas / Diesel Oil	PJ		49.42	36.52	4.86	-0.45	8.48	1,000.00	GCV	8,479.26	19.01	161.18	NA	0.00	0.99	0.00
		Residual Fuel Oil	PJ		24.91	11.63	25.89	-3.01	-9.60	1,000.00	GCV	-9,601.19	20.07	-192.72	0.00	-192.72	0.99	-699.58
		LPG	PJ		15.58	84.03		NA	-68.45	1,000.00	GCV	-68,451.76	16.20	-1,108.92	NA	0.00	0.99	0.00
		Ethane	PJ		0.00	0.00		0.00	0.00	1,000.00	GCV	0.00	15.41	0.00	267.16	-267.16	1.00	-979.59
		Naphtha	PJ		0.00	0.00		0.00	0.00	1,000.00	GCV	0.00	17.98	0.00	NA	0.00	1.00	0.00
		Bitumen	PJ		1.58	0.08		0.25	1.24	1,000.00	GCV	1,244.07	22.01	27.38	733.74	-706.36	1.00	-2,589.97
		Lubricants	PJ		2.13	6.31	0.00	-1.28	-2.90	1,000.00	GCV	-2,901.88	20.10	-58.33	259.16	-317.49	1.00	-1,164.12
		Petroleum Coke	PJ		9.16	0.00		0.00	9.16	1,000.00	GCV	9,163.27	22.01	201.68	201.68	0.00	1.00	0.00
		Refinery Feedstocks	PJ		NA	NA		NA	0.00	NA	GCV	0.00	NA	0.00	NO	0.00	NA	0.00
		Other Oil	PJ		3.42	8.37		-4.26	-0.69	1,000.00	GCV	-693.04	18.60	-12.89	503.75	-516.64	1.00	-1,894.34
Liquid Fossil Totals												1,507,329.99		27,808.32	1,965.48	26,790.58		97,183.52
Solid Fossil	Primary Fuels	Anthracite	PJ	NO	NO	NO		NA	0.00	NA	GCV	0.00	NA	0.00	NO	0.00	NA	0.00
		Coking Coal	PJ	NA	NA	NA		NA	0.00	NA	GCV	0.00	NA	0.00	2,625.75	-2,625.75	1.00	-9,627.75
		Other Bit. Coal	PJ	7,403.20	0.00	5,920.70	0.00	NE	1,482.50	1,000.00	GCV	1,482,500.00	24.70	36,612.27	0.00	36,612.27	1.00	134,244.99
		Sub-bit. Coal	PJ	NA	NA	NA	NA	NA	0.00	NA	GCV	0.00	NA	0.00	NA	0.00	NA	0.00
		Lignite	PJ	676.50	0.00	0.00		0.00	676.50	1,000.00	GCV	676,500.00	25.25	17,082.83	0.00	17,082.83	1.00	62,637.03
		Oil Shale	PJ	0.00	0.00	0.00		0.00	0.00	NA	GCV	0.00	NA	0.00	NA	0.00	NA	0.00
		Peat	PJ	NO	NO	NO		NA	0.00	NA	GCV	0.00	NA	0.00	NO	0.00	NA	0.00
	Secondary Fuels	BKB & Patent Fuel	PJ		0.00	0.00		NE	0.00	1,000.00	GCV	0.00	28.64	0.00	0.00	0.00	0.99	0.00
		Coke Oven/Gas Coke	PJ		0.00	0.00		NE	0.00	1,000.00	GCV	0.00	32.59	0.00	0.00	0.00	0.99	0.00
Solid Fuel Totals												2,159,000.00		53,695.10	2,625.75	51,069.34		187,254.26
Gaseous Fossil		Natural Gas (Dry)	PJ	1,430.29	0.00	425.73		0.00	1,004.56	1,000.00	GCV	1,004,559.63	14.02	14,082.10	515.25	13,566.85	1.00	49,496.38
Total												**4,670,889.61**		**95,585.52**	**5,106.48**	**91,426.77**		**333,934.16**
Biomass total												186,575.61		4,675.76	0.00	4,675.76		16,813.05
		Solid Biomass	PJ	171.69	0.00	0.00		0.00	171.69	1,000.00	GCV	171,692.61	26.02	4,467.13	0.00	4,467.13	0.98	16,051.89
		Liquid Biomass	NA	0.00	0.00	0.00		0.00	0.00	1,000.00	GCV	0.00	25.64	0.00	0.00	0.00	0.98	0.00
		Gas Biomass	PJ	14.88	NA	NA		NA	14.88	1,000.00	GCV	14,883.00	14.02	208.63	0.00	208.63	1.00	761.16

[1] Gross calorific values

TABLE 1.A(c) COMPARISON OF CO_2 EMISSIONS FROM FUEL COMBUSTION
(Sheet 1 of 1)

Australia
2003
2005

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)	1,507.33	97,183.52	1,524.46	102,884.95	-1.12	-5.54
Solid Fuels (excluding international bunkers)	2,159.00	187,254.26	2,079.51	189,250.98	3.82	-1.06
Gaseous Fuels	1,004.56	49,496.38	932.92	47,868.42	7.68	3.40
Other [2]	NA	NA	NA	NA	NA	NA
Total [2]	**4,670.89**	**333,934.16**	**4,536.89**	**340,004.36**	**2.95**	**-1.79**

[1] "National approach" is used to indicate the approach (if different from the Reference approach) followed by the Party to estimate its CO_2 emissions from fuel combustion reported in the national GHG inventory.
[2] Emissions from biomass are not included.

Note: In addition to estimating CO_2 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 there is a 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 does not 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. This explains why the extent of non-reconciliation is different for energy and for CO_2.
2) The large discrepancy for liquid fuels is caused by the unreliability of the Reference Approach figure, which in turn derives from the crude oil density values used to convert reported indigenous production and imports in volumetric units into energy units, as required by the CRF.
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.

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

Australia
2003
2005

FUEL TYPE	ACTIVITY DATA AND RELATED INFORMATION: Fuel quantity (TJ)	ACTIVITY DATA AND RELATED INFORMATION: Fraction of carbon stored	IMPLIED EMISSION FACTOR: Carbon emission factor (t C/TJ)	ESTIMATE: of carbon stored in non energy use of fuels (Gg C)
Naphtha	0.00	NA	NA	NA
Lubricants	21,606.40	0.60	19.99	259.16
Bitumen	33,337.88	1.00	22.01	733.74
Coal Oils and Tars (from Coking Coal)	7,426.94	0.75	22.09	123.05
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	16,549.90	NA	NA	267.16
Other *(please specify)*				
Natural gas distribution leakage	4,974.48	NA	NA	69.75
Natural gas used in reduction of iron ore	31,940.00	NA	NA	445.50
Coke used in reduction of iron ore	78,358.52	NA	NA	2,502.70
Petroleum Products Used as Feedstocks	18,071.83	NA	NA	337.02
Oil Refinery Flaring	NE	NA	NE	NE
Petroleum Coke for Anodes	9,163.27	NA	NA	201.68
Solvents	9,262.75	0.75	24.00	166.73

Additional information

FUEL TYPE	CO_2 not emitted ($Gg\ CO_2$)	Subtracted from energy sector *(specify source category)*
Naphtha	0.00	NA
Lubricants	950.25	1.A.5. Other
Bitumen	2,690.37	1.A.5. Other
Coal Oils and Tars (from Coking Coal)	451.19	1.A.2.c. Chemicals
Natural Gas	0.00	NA
Gas/Diesel Oil	0.00	NA
LPG	0.00	NA
Butane	0.00	NA
Ethane	979.59	1.A.2.c. Chemicals
Other *(please specify)*		
Natural gas distribution leakage	255.75	1.A.1.c. Manufacture of Solid Fuels and Other Energy Industries
Natural gas used in reduction of iron ore	1,633.51	1.A.2.a. Iron and Steel
Coke used in reduction of iron ore	9,176.57	1.A.2.a. Iron and Steel
Petroleum Products Used as Feedstocks	1,235.74	1.A.2.c. Chemicals
Oil Refinery Flaring	0.00	1.A.1.b. Petroleum Refining
Petroleum Coke for Anodes	739.48	1.A.2.b. Non-Ferrous Metals
Solvents	611.34	1.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)]
9,176.57	2.C.1. Iron and Steel Production
1,633.51	2.C.1. Iron and Steel Production
0.00	1.B.2.a. Oil: iv. Refining / Storage
739.48	2.C.3. Aluminium Production
203.78	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.

ENERGY

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

Australia
2003
2005

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	ACTIVITY DATA	IMPLIED EMISSION FACTOR		EMISSIONS	
	Amount of fuel produced (Mt)	CH_4 (kg/t)	CO_2 (kg/t)	CH_4 (Gg)	CO_2 (Gg)
1. B. 1. a. Coal Mining and Handling	338.77			787.34	NE
i. Underground Mines	82.24	5.46	NE	448.95	NE
Mining Activities		5.16	NE	424.54	NE
Post-Mining Activities		0.30	NE	24.42	NE
ii. Surface Mines	256.53	1.32	NE	338.39	NE
Mining Activities		1.32	NE	338.39	NE
Post-Mining Activities		NE	NE	NE	NE
1. B. 1. b. Solid Fuel Transformation	IE	IE	NA	IE	NA
1. B. 1. c. Other ***(please specify)***				NA	NA
NA	NA	NA	NA	NA	NA

Additional information [a]

Description	Value
Amount of CH_4 drained (recovered) and utilized or flared (Gg)	C
Number of active underground mines	46
Number of mines with drainage (recovery) systems	4

[a] For underground mines.

Documentation box:
Run-of-mine data used
1.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, Natural Gas and Other Sources
(Sheet 1 of 1)

Australia
2003
2005

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	ACTIVITY DATA			IMPLIED EMISSION FACTORS			EMISSIONS		
	Description	Unit	Value	CO_2 (kg/unit)	CH_4 (kg/unit)	N_2O (kg/unit)	CO_2 (Gg)	CH_4 (Gg)	N_2O (Gg)
1. B. 2. a. Oil							**309.09**	**4.64**	**0.01**
i. Exploration	*NA*	NA	NA	NA	NA		78.28	1.29	0.00
ii. Production[(4)]	*Crude oil and ORF produced*	PJ	1,232.90	NA	929.92		NA	1.15	
iii. Transport	*Quantity shipped*	PJ	202.49	NA	745.00		NA	0.15	
iv. Refining / Storage	*Oil refined*	PJ	1,652.54	139,668.80	1,240.09		230.81	2.05	0.01
v. Distribution of oil products	*Petrol, Diesel and Avgas sales*	PJ	1,184.50	NA	NA		NA	NA	
vi. Other	*NA*	NA	NA	NA	NA		NA	NA	
1. B. 2. b. Natural Gas							**4.92**	**88.93**	
Exploration	*NA*	NA	NA	NA	NA		NA	NA	
i. Production[(4)] / Processing	*Gas produced*	PJ	1,423.80	NE	1,121.30		NE	1.60	
ii. Transmission	*Gas transmitted*	PJ	756.00	648.85	11,326.30		0.49	8.56	
Distribution	*Utility sales*	PJ	443.08	9,992.40	177,780.84		4.43	78.77	
iii. Other Leakage	*NE*	NE	NE	NE	NE		**NE**	**NE**	
at industrial plants and power stations	*NE*	NE	NE	NE	NE		NE	NE	
in residential and commercial sectors	*NE*	NE	NE	NE	NE		NE	NE	
1. B. 2. c. Venting							**3,349.38**	**74.83**	
i. Oil	*NA*	NA	NA	NA	NA		NA	NA	
ii. Gas	*PJ gas produced*	PJ	1,423.80	2,352,420.28	52,557.94		3,349.38	74.83	
iii. Combined	*NA*	NA	NA	NA	NA		NA	NA	
Flaring							**2,102.78**	**26.06**	**0.06**
i. Oil	*IE*	IE	IE	IE	IE	IE	IE	IE	IE
ii. Gas	*IE*	IE	IE	IE	IE	IE	IE	IE	IE
iii. Combined	*PJ gas and oil produced*	PJ	2,656.70	791,499.79	9,808.60	22.77	2,102.78	26.06	0.06
1.B.2.d. Other *(please specify)*							**NA**	**NA**	**NA**
NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Additional information

Description	Value	Unit
Pipelines length (km)	NA	NA
Number of oil wells	NA	NA
Number of gas wells	NA	NA
Gas throughput	NA	NA
Oil throughput	NA	NA
Other relevant information *(specify)*	NA	NA
NA	NA	NA

Documentation box:

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

Australia
2003
2005

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	ACTIVITY DATA	IMPLIED EMISSION FACTORS			EMISSIONS		
	Consumption (TJ)	CO_2 (t/TJ)	CH_4 (kg/TJ)	N_2O (kg/TJ)	CO_2 (Gg)	CH_4 (Gg)	N_2O (Gg)
Marine Bunkers	**30,751.00**				**2,221.86**	**0.11**	**0.06**
Gasoline	NA	NA	NA	NA	NA	NA	NA
Gas/Diesel Oil	4,863.88	69.00	7.00	2.00	335.62	0.03	0.01
Residual Fuel Oil	25,887.12	72.86	3.00	2.00	1,886.24	0.08	0.05
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	**95,870.00**				**6,615.32**	**0.03**	**0.20**
Jet Kerosene	95,870.00	69.00	0.28	2.06	6,615.32	0.03	0.20
Gasoline	NA	NA	NA	NA	NA	NA	NA
Multilateral Operations	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**

Additional information

Fuel consumption	Allocation (percent)	
	Domestic	International
Marine	30.84	69.16
Aviation	44.02	55.98

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
2003
2005

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	CO_2	CH_4	N_2O	HFCs		PFCs		SF_6		NO_x	CO	NMVOC	SO_2
				P	A	P	A	P	A				
	(Gg)			CO_2 equivalent (Gg)				(Gg)					
Total Industrial Processes	**25,913.69**	**3.32**	**0.07**	**NE**	**4,309.02**	**NE**	**1,472.05**	**NE**	**0.02**	**65.76**	**8.69**	**79.51**	**1,994.53**
A. Mineral Products	**5,384.17**	**NE**	**NE**							**NE**	**NE**	**15.67**	**NE**
1. Cement Production	3,401.08												NE
2. Lime Production	1,040.10												
3. Limestone and Dolomite Use	942.99												
4. Soda Ash Production and Use	IE												
5. Asphalt Roofing	NO										NO	NO	
6. Road Paving with Asphalt	NE									NE	NE	15.67	NE
7. Other *(please specify)*	IE	NA	NA							NE	NE	NE	NE
Glass production	NE	NA	NA							NA	NA	NA	NA
Magnesia Production	IE	NA	NA							NA	NA	NA	NA
B. Chemical Industry	**952.11**	**0.44**	**IE**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NE**	**NE**	**5.07**	**NE**
1. Ammonia Production	IE	NA								NE	NE	NE	NE
2. Nitric Acid Production			IE							NE			
3. Adipic Acid Production			NO							NO	NO	NO	
4. Carbide Production	NO	NO									NO	NO	NO
5. Other *(please specify)*	952.11	0.44	NE	NA	NA	NA	NA	NA	NA	NA	NA	5.07	NA
Synthetic Rutile and Titanium Dioxide	952.11	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Polymers and other chemicals[1]	NE	0.44	NE	NA	NA	NA	NA	NA	NA	NA	NA	5.07	NA
C. Metal Production	**13,866.07**	**2.88**	**0.07**	**NA**	**NA**	**NA**	**1,472.05**	**NA**	**NE**	**65.76**	**8.69**	**0.11**	**1,994.53**
1. Iron and Steel Production	10,844.36	2.88	0.07							65.76	8.69	0.11	28.92
2. Ferroalloys Production	NA	NA								NA	NA	NA	NA
3. Aluminium Production	3,021.72	NA					1,472.05			NE	NE	NE	47.38
4. SF_6 Used in Aluminium and Magnesium Foundries									NE				
5. Other *(please specify)*	NE	NE	NE	NA	NA	NA	NA	NA	NA	NE	NE	NE	1,918.23
Copper, lead, zinc, nickel and silver	NE	NE	NE	NA	NA	NA	NA	NA	NA	NE	NE	NE	1,918.23

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.

[1] Includes emissions from butadiene, carbon black, ethyl benzene, ethylene, ethylene oxide, formaldehyde, HDPE, LDPE, propylene, polypropylene, polystyrene, styrene, polyvinyl chloride, and styrene butadiene rubber.

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

Australia
2003
2005

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	CO_2	CH_4	N_2O	HFCs[(1)]		PFCs[(1)]		SF_6		NO_x	CO	NMVOC	SO_2
				P	A	P	A	P	A				
	(Gg)			CO_2 equivalent (Gg)						(Gg)			
D. Other Production	**NE**									**NE**	**NE**	**58.64**	**NE**
1. Pulp and Paper										NE	NE	NE	NE
2. Food and Drink[(2)]	NE											58.64	
E. Production of Halocarbons and SF_6					**NO**		**NO**		**NO**				
1. By-product Emissions					NO		NO		NO				
Production of HCFC-22					NO								
Other					NA		NA		NA				
2. Fugitive Emissions					NO		NO		NO				
3. Other *(please specify)*					NA		NA		NA				
					NA		NA		NA				
F. Consumption of Halocarbons and SF_6				**NE**	**4,309.02**	**NE**	**NE**	**NE**	**0.02**				
1. Refrigeration and Air Conditioning Equipment				NE	4,219.23	NE	NE	NO	NO				
2. Foam Blowing				NE	10.51	NO	NO	NO	NO				
3. Fire Extinguishers				NE	2.11	NE	NE	NO	NO				
4. Aerosols/ Metered Dose Inhalers				NE	0.00	NO	NO	NO	NO				
5. Solvents				NE	77.17	NO	NO	NO	NO				
6. Semiconductor Manufacture				NE	0.00	NO	NO	NO	NO				
7. Electrical Equipment				NO	NO	NO	NO	NE	0.02				
8. Other *(please specify)*				NA	NA	NA	NA	NA	NA				
NA				NA	NA	NA	NA	NA	NA				
G. Other *(please specify)*	**5,711.34**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**
Confidential emissions reported as CO_2e[(1)]	5,711.34	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

(1) Speciated emissions from Soda Ash Production and Use, Magnesia Production, Ammonia Production and Nitric Acid Production are Confidential. These emissions are reported as CO_2-e emissions.

TABLE 2(I).A-G SECTORAL BACKGROUND DATA FOR INDUSTRIAL PROCESSES
Emissions of CO_2, CH_4 and N_2O
(Sheet 1 of 2)

Australia
2003
2005

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	ACTIVITY DATA		IMPLIED EMISSION FACTORS			EMISSIONS[2]					
	Production/Consumption quantity		CO_2	CH_4	N_2O	CO_2		CH_4		N_2O	
	Description	(kt)	(t/t)	(t/t)	(t/t)	(Gg)	[1]	(Gg)	[1]	(Gg)	[1]
A. Mineral Products						**5,384.17**	**NA**	**NA**	**NA**	**NA**	**NA**
1. Cement Production	Clinker production	6,565.79	0.52			3,401.08	NA				
2. Lime Production	Commercial and in-house	1,534.61	0.68			1,040.10	NA				
3. Limestone and Dolomite Use	Used in minerals and metals	2,278.08	0.41			942.99	NA				
4. Soda Ash						IE	NA				
Soda Ash Production	Soda ash production	C	IE			IE	NA				
Soda Ash Use	Soda ash use	C	IE			IE	NA				
5. Asphalt Roofing	NO	NA	NO			NO	NO				
6. Road Paving with Asphalt	Bitumen used in spray sealing	290.27	NE			NE	NE				
7. Other (*please specify*)						IE	NE	NA	NA	NA	NA
Glass Production	NE	NE	NE			NE	NE				
Magnesia Production	Production	C	IE	NA	NA	IE	NA	NA	NA	NA	NA
B. Chemical Industry						**952.11**	**NA**	**0.44**	**NA**	**IE**	**NA**
1. Ammonia Production	Production	C	IE	NA	NE	IE	NE	NA	NA	NE	NE
2. Nitric Acid Production	Production	C			IE					IE	NA
3. Adipic Acid Production	NO	NO			NO					NO	NO
4. Carbide Production	NO	NO	NE	NE		NE	NO	NE	NO		
Silicon Carbide	NO	NO	NO	NO		NO	NO	NO	NO		
Calcium Carbide	Consumption	NE	NE	NE		NE	NE	NE	NE		
5. Other (*please specify*)						952.11	NE	**0.44**	NE	NE	NE
Carbon Black	Production	C		C				C	NE		
Ethylene	Production	C	NE	C	NE	NE	NE	C	NE	NE	NE
Dichloroethylene	NE	NE		NE				NE	NE		
Styrene	Production	C		C				C	NE		
Methanol	NE	NE		NE				NE	NE		
Synthetic Rutile and Titanium Dioxide	Production	677.27	1.41	NA	NE	952.11	NA	NA	NA	NE	NA

[1] Adjusted emissions, to account for emission recovery, oxidation, destruction, transformation

INDUSTRIAL PROCESSES

TABLE 2(I).A-G SECTORAL BACKGROUND DATA FOR INDUSTRIAL PROCESSES
Emissions of CO_2, CH_4 and N_2O
(Sheet 2 of 2)

Australia
2003
2005

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	ACTIVITY DATA		IMPLIED EMISSION FACTORS			EMISSIONS[2]					
	Production/Consumption Quantity		CO_2	CH_4	N_2O	CO_2		CH_4		N_2O	
	Description [1]	(kt)	(t/t)	(t/t)	(t/t)	(Gg)	[2]	(Gg)	[2]	(Gg)	[2]
C. Metal Production						**13,866.07**	NA	**2.88**	NA	**0.07**	NA
1. Iron and Steel Production	Crude steel (BF/BOS)	6,282.00	1.73			10,844.36	NA	2.88	NA	0.07	
Steel	Crude steel (BF/BOS)	6,282.00	NA			NA	NA				
Pig Iron	Natural gas (PJ)	33.5	51.15	0.00		1,713.69	NA	0.03	NA	0.003	
Sinter	NA	NA	NA	NA		NA	NA	NA	NA		
Coke	Coke (PJ)	77.97	117.11	0.04		9,130.67	NA	2.85	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		
3. Aluminium Production	Primary aluminium	1,855.00	1.63	NA		3,021.72	NA	NA	NA		
4. SF_6 Used in Aluminium and Magnesium Foundries											
5. Other *(please specify)*						NE	NA	NE	NA	NE	NA
Copper, lead, zinc, nickel and silver	NE	NE	NE	NE	NE	NE	NA	NE	NA	NE	NA
D. Other Production						**NE**	NE				
1. Pulp and Paper											
2. Food and Drink	Bread, wine, beer, sugar, meat	NE	NE			NE	NE				
G. Other *(please specify)*						**5,711.34**	NA	**NA**	NA	**NA**	NA
Confidential emissions reported as CO_2e	C	C	C	NA	NA	5,711.34	NA	NA	NA	NA	NA

Documentation box:
2.G Other - Confidential emissions reported as CO_2-e - Speciated emissions from Soda Ash Production and Use, Magnesia Production, Ammonia Production and Nitric Acid Production are Confidential. These emissions are reported as CO_2-e emissions.

TABLE 2(II) SECTORAL REPORT FOR INDUSTRIAL PROCESSES - EMISSIONS OF HFCs, PFCs AND SF_6
(Sheet 1 of 2)

Australia
2003
2005

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	CF_4	C_2F_6	C_3F_8	C_4F_{10}	$c\text{-}C_4F_8$	C_5F_{12}	C_6F_{14}	Total PFCs	SF_6
	(t)[2]																						
Total Actual Emissions of Halocarbons (by chemical) and SF_6	**NE**	**NE**	**NE**	**NE**	**105.22**	**NE**	**2,703.60**	**NE**	**NE**	**107.88**	**NE**	**NE**	**NE**		**191.30**	**24.84**	**NE**	**NE**	**NE**	**NE**	**NE**		**21.80**
C. Metal Production															**191.30**	**24.84**	NE	NE	NE	NE	NE		**NE**
Aluminium Production															191.30	24.84	NE	NE	NE	NE	NE		
SF_6 Used in Aluminium Foundries																							NO
SF_6 Used in Magnesium Foundries																							NE
E. Production of Halocarbons and SF_6	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**		**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**		**NO**
1. By-product Emissions	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO		NO	NO	NO	NO	NO	NO	NO		NO
Production of HCFC-22	NO																						
Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO		NO	NO	NO	NO	NO	NO	NO		NO
2. Fugitive Emissions	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO		NO	NO	NO	NO	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	NA	NA	NA	NA	NA	NA		NA	NA	NA	NA	NA	NA	NA		NA
F(a). Consumption of Halocarbons and SF_6 (actual emissions - Tier 2)	**NE**	**NE**	**NE**	**NE**	**105.22**	**NE**	**2,703.60**	**NE**	**NE**	**107.88**	**NE**	**NE**	**NE**	89792.87	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**		**21.80**
1. Refrigeration and Air Conditioning Equipment	NE	NE	NE	NE	105.22	NE	2,703.60	NE	NE	107.88	NO	NE	NE		NE	NE	NE	NE	NE	NE	NE		NO
2. Foam Blowing [1]	C	NO	C	NO	NO	C	C	C	NE	C	NO	NO	C	10511.00	NO	NO	NO	NO	NO	NO	NO		NO
3. Fire Extinguishers [1]	C	NO	C	NO	NE	C	C	C	NO	C	C	NE	C	2114.38	NE	NE	NE	NE	NE	NE	NE		NO
4. Aerosols/Metered Dose Inhalers	NO	NO	NO	NO	NO	NO	NE	NE	NO	NO	NE	NO	NO		NO	NO	NO	NO	NO	NO	NO		NO
5. Solvents [1]	C	NO	C	C	NO	C	C	C	NO	C	NO	NO	C	77167.48	NO	NO	NO	NO	NO	NO	NO		NO
6. Semiconductor Manufacture	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO		NO	NO	NO	NO	NO	NO	NO		NO
7. Electrical Equipment																							21.80
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	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	NA	NA	NA	NA	NA	NA		NA	NA	NA	NA	NA	NA	NA		NA

[1] Disaggregated emissions for 2.F.2, 2.F.3, and 2.F.5 are confidential and are listed as a CO2-e value in the "Total HFCs" column.

[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].

INDUSTRIAL PROCESSES

TABLE 2(II) SECTORAL REPORT FOR INDUSTRIAL PROCESSES - EMISSIONS OF HFCs, PFCs AND SF_6
(Sheet 2 of 2)

Australia
2003
2005

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	CF_4	C_2F_6	C_3F_8	C_4F_{10}	$c\text{-}C_4F_8$	C_5F_{12}	C_6F_{14}	Total PFCs	SF_6
	(t)(2)																						
F(p). Total Potential Emissions of Halocarbons (by chemical) and SF_6 (3)	**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**	**294.61**	**NE**	**3,514.69**	**NE**	**NE**	**409.94**	**NE**	**NE**	**NE**	**4,309.02**	**1,243.48**	**228.57**	**NE**	**NE**	**NE**	**NE**	**NE**	**1,472.05**	**521.02**
C. Metal Production															1,243.48	228.57	NO	NO	NO	NO	NO	1,472.05	NE
E. Production of Halocarbons and SF_6	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	0.00	NO
F(a). Consumption of Halocarbons and SF_6	NE	NE	NE	NE	294.61	NE	3,514.69	NE	NE	409.94	NE	NE	NE	4,309.02	NE	NE	NE	NE	NE	NE	NE	0.00	521.02
G. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.00	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	294.61	NE	3,514.69	NE	NE	409.94	NE	NE	NE	4,309.02	NE	NE	NE	NE	NE	NE	NE	0.00	521.02
Potential emissions - F(p) (7) (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	0.00	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) SECTORAL REPORT FOR INDUSTRIAL PROCESSES - EMISSIONS OF HFCs, PFCs AND SF_6
(Sheet 2 of 2)

Australia
2003
2005

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	CF_4	C_2F_6	C_3F_8	C_4F_{10}	$c\text{-}C_4F_8$	C_5F_{12}	C_6F_{14}	Total PFCs	SF_6
	(t)[2]																						
F(p). Total Potential Emissions of Halocarbons (by chemical) and SF_6 [3]	**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**	**294.61**	**NE**	**3,514.69**	**NE**	**NE**	**409.94**	**NE**	**NE**	**NE**	**4,309.02**	**1,243.48**	**228.57**	**NE**	**NE**	**NE**	**NE**	**NE**	**1,472.05**	**521.02**
C. Metal Production															1,243.48	228.57	NO	NO	NO	NO	NO	1,472.05	NE
E. Production of Halocarbons and SF_6	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	0.00	NO
F(a). Consumption of Halocarbons and SF_6	NE	NE	NE	NE	294.61	NE	3,514.69	NE	NE	409.94	NE	NE	NE	4,309.02	NE	NE	NE	NE	NE	NE	NE	0.00	521.02
G. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.00	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	294.61	NE	3,514.69	NE	NE	409.94	NE	NE	NE	4,309.02	NE	NE	NE	NE	NE	NE	NE	0.00	521.02
Potential emissions - F(p) (7) (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	0.00	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 SF_6
(Sheet 1 of 1)

Australia
2003
2005

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	ACTIVITY DATA		IMPLIED EMISSION FACTORS(2)	EMISSIONS(2)	
	Description (1)	(t)	(kg/t)	(t)	(3)
C. PFCs and SF_6 from Metal Production					
PFCs from Aluminium Production					
CF_4	Primary aluminium	1,855,000.00	0.10	191.30	NA
C_2F_6	Primary aluminium	1,855,000.00	0.01	24.84	NA
SF_6				NO	NA
Aluminium Foundries	*(SF6 consumption)*	NO	NO	NO	NA
Magnesium Foundries	*(SF6 consumption)*	NO	NO	NO	NA
E. Production of Halocarbons and SF_6					
1. By-product Emissions					
Production of HCFC-22	NO	NA			
HFC-23			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

Documentation box:

TABLE 2(II).F SECTORAL BACKGROUND DATA FOR INDUSTRIAL PROCESSES
Consumption of Halocarbons and SF_6
(Sheet 1 of 2)

Australia
2003
2005

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	ACTIVITY DATA *Amount of fluid*			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	From disposal
	(t)			(% per annum)			(t)		
1 Refrigeration									
Air Conditioning Equipment									
Domestic Refrigeration *(Specify chemical)*									
NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
Commercial Refrigeration									
NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
Transport Refrigeration									
NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
Industrial Refrigeration									
NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
Stationary Air-Conditioning									
NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
Mobile Air-Conditioning									
NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
2 Foam Blowing									
Hard Foam									
NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
Soft Foam									
NE	NE	NE	NE	NE	NE	NE	NE	NE	NE

TABLE 2(II).F SECTORAL BACKGROUND DATA FOR INDUSTRIAL PROCESSES
Consumption of Halocarbons and SF_6
(Sheet 2 of 2)

Australia
2003
2005

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	ACTIVITY DATA *Amount of fluid*			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	From disposal
	(t)			(% per annum)			(t)		
3 Fire Extinguishers									
NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
4 Aerosols									
Metered Dose Inhalers									
NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
Other									
NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
5 Solvents									
NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
6 Semiconductors									
NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
7 Electric Equipment									
NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
8 Other *(please specify)*									
NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Documentation box:

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

Australia
2003
2005

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	CO_2	N_2O	NMVOC
	(Gg)		
Total Solvent and Other Product Use	**NA**	**NE**	**150.66**
A. Paint Application	**NA**	**NA**	**71.34**
B. Degreasing and Dry Cleaning	**NA**	**NA**	**35.76**
C. Chemical Products, Manufacture and Processing			**0.89**
D. Other *(please specify)*	NA	NE	42.67
Domestic and Commercial Aerosol Products	NA	NE	25.68
Other Domestic and Commercial Products	NA	NE	7.90
Consumer Cleaning Products	NA	NE	9.09

SOLVENT AND OTHER PRODUCT USE

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

Australia
2003
2005

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	ACTIVITY DATA		IMPLIED EMISSION FACTORS	
	Description	(kt)	CO_2 (t/t)	N_2O (t/t)
A. Paint Application	Production	**296.74**	**NA**	**NA**
B. Degreasing and Dry Cleaning	Population	**NA**	**NA**	**NA**
C. Chemical Products, Manufacture and Processing				
D. Other ***(please specify)***				
Domestic and Commercial Aerosol Products	Population	NA	NA	NE
Other Domestic and Commercial Products	Population	NA	NA	NE
Consumer Cleaning Products	Population	NA	NA	NE

Documentation box:

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

Australia
2003
2005

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	CH_4	N_2O	NO_x	CO	NMVOC
	(Gg)				
Total Agriculture	**3,505.95**	**76.31**	**680.77**	**15,618.20**	**911.15**
A. Enteric Fermentation	**2,988.00**				
1. Cattle	2,271.18				
Dairy Cattle	351.73				
Non-Dairy Cattle	1919.45				
2. Buffalo	0.61				
3. Sheep	702.99				
4. Goats	1.73				
5. Camels and Llamas	0.16				
6. Horses	4.90				
7. Mules and Asses	0.00				
8. Swine	4.06				
9. Poultry	NE				
10. Other *(please specify)*	2.37				
Alpaca	0.04				
Deer	1.46				
Ostriches/Emus	0.87				
B. Manure Management	**97.50**	**4.15**			**NA**
1. Cattle	30.99				
Dairy Cattle	27.50				
Non-Dairy Cattle	3.49				
2. Buffalo	NE				
3. Sheep	0.19				
4. Goats	NE				
5. Camels and Llamas	NE				
6. Horses	NE				
7. Mules and Asses	NE				
8. Swine	64.19				
9. Poultry	2.13				

AGRICULTURE

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

Australia
2003
2005

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	CH_4	N_2O	NO_x	CO	NMVOC
	(Gg)				
B. Manure Management (continued)					
10. Anaerobic Lagoons		0.07			NA
11. Liquid Systems		0.00			NA
12. Solid Storage and Dry Lot		2.45			NA
13. Other *(please specify)*	NA	1.62			NA
Digester	NA	0.00			NA
Poultry with bedding	NA	1.56			NA
Poultry without bedding	NA	0.06			NA
C. Rice Cultivation	19.05				**NA**
1. Irrigated	19.05				NA
2. Rainfed	NO				NA
3. Deep Water	NO				NA
4. Other *(please specify)*	NA				NA
NA	NA				NA
D. Agricultural Soils	**NE**	**60.38**			**NA**
1. Direct Soil Emissions	NE	24.19			NA
2. Animal Production	NE	13.94			NA
3. Indirect Emissions	NA	NE			NA
4. Other *(please specify)*	NA	22.24			NA
Soil Disturbance	NA	22.24			NA
E. Prescribed Burning of Savannas	**391.44**	**11.50**	**664.17**	**15,230.77**	**888.55**
F. Field Burning of Agricultural Residues	**9.96**	**0.29**	**16.60**	**387.43**	**22.60**
1 . Cereals	8.76	0.21	12.16	340.68	19.87
2. Pulse	NE	NE	NE	NE	NE
3 . Tuber and Root	NE	NE	NE	NE	NE
4 . Sugar Cane	1.20	0.08	4.43	46.75	2.73
5 . Other *(please specify)*	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

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

Australia
2003
2005

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	ACTIVITY DATA AND OTHER RELATED INFORMATION			IMPLIED EMISSION FACTORS [(4)]
	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
Dairy Cattle	3,090	235.4	7.3	113.82
Non-Dairy Cattle	24,177	132.5	9.1	79.39
2. Buffalo	11	NA	NA	55.00
3. Sheep	102,709	16.8	6.2	6.84
4. Goats	346	NA	NA	5.00
5. Camels and Llamas	3	NA	NA	46.00
6. Horses	272	NA	NA	18.00
7. Mules and Asses	0	NA	NA	10.00
8. Swine	2,799	31.3	0.7	1.45
9. Poultry	85,901	NA	NA	NE
10. Other *(please specify)*				
Alpaca	4	NA	NA	10.00
Deer	136	NA	NA	10.70
Ostriches/Emus	175	NA	NA	5.00

Additional information (for Tier 2)

Disaggregated list of animals		Dairy Cattle	Non-Dairy Cattle - Free Range	Other *(specify)* Non-Dairy Cattle - Feedlot	Sheep	Swine
Indicators:						
Weight	(kg)	483.76	383.30	520.90	45.12	60.60
Feeding situation [(c)]		Pasture	Pasture	Stall-fed	Pasture	Stall-fed
Milk yield	(kg/day)	13.91	NA	NA	NA	NA
Work	(hrs/day)	NA	NA	NA	NA	NA
Pregnant	(%)	NA	NA	NA	NA	NA
Digestibility of feed	(%)	76.20	60.06	80.00	60.82	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 for the estimation of Greenhouse Gas Emissions and Sinks 2003: Agriculture. 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
CH_4 Emissions from Manure Management
(Sheet 1 of 1)

Australia
2003
2005

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	ACTIVITY DATA AND OTHER RELATED INFORMATION: Population size (1000 head)	Allocation by climate region (%): Cool	Temperate	Warm	Typical animal mass (kg)	VSdaily excretion (kg dm/head/day)	CH_4 producing potential (Bo) (CH_4 m[3]/kg VS)	IMPLIED EMISSION FACTORS CH_4 (kg CH_4/head/yr)
1. Cattle	NA	NA	NA	NA	NA	NA	NA	NA
Dairy Cattle	3,090	0.0	92.0	8.0	483.8	2.8	0.2	8.90
Non-Dairy Cattle - Feedlot	925	0.0	44.8	55.2	520.9	2.0	0.2	2.81
2. Buffalo	11	0.0	0.0	100.0	NA	NA	NA	NE
3. Sheep	102,709	0.0	94.4	5.6	45.1	NA	NA	0.00
4. Goats	346	0.0	65.9	34.1	NA	NA	NA	NE
5. Camels and Llamas	3	0.0	13.7	86.3	NA	NA	NA	NE
6. Horses	272	0.0	51.5	48.5	NA	NA	NA	NE
7. Mules and Asses	0	0.0	0.0	100.0	NA	NA	NA	NE
8. Swine	2,799	0.0	76.5	23.5	60.6	0.3	0.5	22.93
9. Poultry	85,901	0.0	83.3	16.7	1.1	0.0	0.3	0.02

[(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)).

Additional information

Animal category	Indicator	Climate region	Animal waste management system: Anaerobic lagoon	Liquid system	Daily spread	Solid storage and dry lot	Pasture range paddock	Other
Dairy Cattle	Allocation(%)	Cool	NA	NA	NA	NA	NA	NA
		Temperate	4.89	0.39	1.33	0.00	93.39	0.00
		Warm	2.53	0.00	5.90	0.00	91.58	0.00
	MCF[(b)]	Cool	NA	NA	NA	NA	NA	NA
		Temperate	90.00	35.00	0.50	NA	1.00	NA
		Warm	90.00	65.00	1.00	NA	2.00	NA
Non-Dairy Cattle	Allocation(%)	Cool	NA	NA	NA	NA	NA	NA
		Temperate	NA	NA	NA	100.00	NA	NA
		Warm	NA	NA	NA	100.00	NA	NA
	MCF[(b)]	Cool	NA	NA	NA	NA	NA	NA
		Temperate	NA	NA	NA	1.50	NA	NA
		Warm	NA	NA	NA	5.00	NA	NA
Swine	Allocation(%)	Cool	NA	NA	NA	NA	NA	NA
		Temperate	70.55	0.00	24.22	4.67	0.00	0.57
		Warm	92.03	1.49	1.49	4.98	0.00	0.00
	MCF[(b)]	Cool	NA	NA	NA	NA	NA	NA
		Temperate	90.00	35.00	0.50	1.50	NA	10.00
		Warm	90.00	65.00	1.00	5.00	NA	10.00

[(a)] MCF = Methane Conversion Factor (IPCC Guidelines, (Volume 3. Reference Manual, p. 4.9)).

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 as part of the dairy herd. Animal mass for Non-Dairy Cattle is the weighted average for Feedlot Cattle. See below for summary details for Free Range cattle.

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

Methane emission from free-ranging cattle and sheep are estimated using emission factors (kg Ch_4 /kg manure) developed from González-Avalos and Ruiz-Suárez (2001) as these are based on the manure of animals kept under conditions similar to those in Australia.

	Pop	Allocation			Mass	VS	Bo	IEF
Non-Dairy Cattle - Free-range:	23252	0.0	47.8	52.21	377.8	NA	NA	0.04

TABLE 4.B(b) SECTORAL BACKGROUND DATA FOR AGRICULTURE
N_2O Emissions from Manure Management
(Sheet 1 of 1)

Australia
2003
2005

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	ACTIVITY DATA AND OTHER RELATED INFORMATION								IMPLIED EMISSION FACTORS	
	Population size	Nitrogen excretion	Nitrogen excretion per animal waste management system (kg N/yr)						Emission factor per animal waste management system	
	(1000s)	(kg N/head/yr)	Anaerobic lagoon	Liquid system	Daily spread	Solid storage and dry lot	Pasture range and paddock	Other	(kg N_2O-N/kg N)	
Non-Dairy Cattle - Free Range	23,252	39.7	NA	NA	NA	NA	922,881,708.5	NA	Anaerobic lagoon	0.001
Dairy Cattle	3,090	140.7	20,593,377	1,592,035	7,059,801	NA	405,539,169	NA	Liquid system	0.001
Sheep	102,709	7.0	NA	NA	NA	NA	721,967,267	NA	Solid storage and dry lot	0.020
Swine	2,799	12.1	25,671,765	118,156	6,430,365	1,610,503	NA	149,130	Other	0.018
Poultry	85,901	0.7	NA	NA	NA	NA	1,764,539	57,053,440		
Other *(please specify)*										
Feedlot Cattle	925	82.7	NA	NA	NA	76,515,442	NA	NA		
Goats, horses, deer, buffalo, donkeys, mules, emus, ostriches, alpacas, camels	948	NA	NA	NA	NA	NA	16,795,934	NA		
Total per AWMS[(1)]			**46,265,142**	**1,710,191**	**13,490,166**	**78,125,945**	**2,068,948,618**	**57,202,571**		

[(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 and the handling of the waste differ. Nitrous oxide emissions from managed manure systems arises only from feedlot cattle. All manure from free-range cattle is excreted in the paddock and produce no manure management nitrous oxide emissions.
Nitrogen excretion rates for the aggregated livestock classes are reported in the Australian Methodology for Estimation of Greenhouse Gas Emissions and Sinks 2003: Agriculture

AGRICULTURE

TABLE 4.C SECTORAL BACKGROUND DATA FOR AGRICULTURE
Rice Cultivation
(Sheet 1 of 1)

Australia
2003
2005

GREENHOUSE GAS SOURCE AND SINK CATEGORIES		ACTIVITY DATA AND OTHER RELATED INFORMATION			IMPLIED EMISSION FACTOR	EMISSIONS
		Harvested area	Organic amendments added		CH_4	CH_4
		$(10^9\ m^2/yr)$	type	(t/ha)	(g/m^2)	(Gg)
1. Irrigated						**19.05**
Continuously Flooded		0.85	NA	NA	22.50	19.05
Intermittently Flooded	Single Aeration	NO	NO	NO	NO	NO
	Multiple Aeration	NO	NO	NO	NO	NO
2. Rainfed						**NO**
Flood Prone		NO	NO	NO	NO	NO
Drought Prone		NO	NO	NO	NO	NO
3. Deep Water						**NO**
Water Depth 50-100 cm		NO	NO	NO	NO	NO
Water Depth > 100 cm		NO	NO	NO	NO	NO
4. Other *(please specify)*						**NA**
NA		NA	NA	NA	NA	NA
Upland Rice		NO				
Total		0.85				

Documentation box:
When dissagregating by more than one region within a country, provide additional information in the documentation box.
Where available, provide activity data and scaling factors by soil type and rice cultivar.

AGRICULTURE

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

Australia
2003
2005

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	ACTIVITY DATA AND OTHER RELATED INFORMATION		IMPLIED EMISSION FACTORS		EMISSIONS
	Description	Value	Unit (2)		(Gg N_2O)
Direct Soil Emissions	**N input to soils (kg N/yr)**				**24.19**
Synthetic Fertilizers	Use of synthetic fertilizers (kg N/yr)	951,955,589	(kg N2O-N/kg N)	0.013	18.702
Animal Wastes Applied to Soils	Nitrogen input from manure applied to soils (kg N/yr)	194,177,778	(kg N2O-N/kg N)	0.018	5.491
N-fixing Crops	Dry pulses and soybeans produced (kg dry biomass/yr)	IE	(kg N2O-N/kg dry biomass)	IE	IE
Crop Residue	Dry production of other crops (kg dry biomass/yr)	IE	(kg N2O-N/kg dry biomass)	IE	IE
Cultivation of Histosols	Area of cultivated organic soils (ha)	IE	(kg N2O-N/ha)	IE	IE
Animal Production	**N excretion on pasture range and paddock (kg N/yr)**	**2,068,756,798**	**(kg N2O-N/kg N)**	**0.004**	**13.94**
Indirect Emissions					**NE**
Atmospheric Deposition	Volatized N (NH_3 and NOx) from fertilizers and animal wastes (kg N/yr)	IE	(kg N2O-N/kg N)	IE	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 N2O-N/kg N)	NE	NE
Other *(please specify)*					**22.24**
Soil Disturbance	Area of improved pasture and crops (ha)	48,821,954	(kg N2O-N/ha)	0.290	22.245

Additional information

Fraction	Description	Value
$Frac_{BURN}$	Fraction of crop residue burned	NA
$Frac_{FUEL}$	Fraction of livestock N excretion in excrements burned for fuel	NA
$Frac_{GASF}$	Fraction of synthetic fertilizer N applied to soils that volatilizes as NH_3 and NOx	NA
$Frac_{GASM}$	Fraction of livestock N excretion that volatilizes as NH_3 and NOx	NA
$Frac_{GRAZ}$	Fraction of livestock N excreted and deposited onto soil during grazing	NA
$Frac_{LEACH}$	Fraction of N input to soils that is lost through leaching and runoff	NA
$Frac_{NCRBF}$	Fraction of N in non-N-fixing crop	NA
$Frac_{NCRO}$	Fraction of N in N-fixing crop	NA
$Frac_{R}$	Fraction or crop residue removed from the field as crop	NA

Documentation box:

Emissions from soil disturbance are the difference between N_2O emissions from pasture and cropping systems and the emissions from the natural ecosystem they replaced. The category accounts for N_2O 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 for Estimation of Greenhouse Gas Emissions and Sinks 2003: Agriculture.

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 N_2O from the manure management systems.

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

Australia
2003
2005

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	(kg/t dm)		(Gg)	
						CH_4	N_2O	CH_4	N_2O
(specify ecological zone)								391.44	11.50
NSW	41.45	6.90	1.00	205.91	0.01	3.58	0.11	0.74	0.02
Tas	12.50	9.00	1.00	80.98	0.01	2.15	0.06	0.17	0.01
WA	18,027.99	7.41	1.00	69,558.01	0.01	2.15	0.06	149.58	4.39
SA	87.06	3.00	1.00	188.04	0.01	2.15	0.06	0.40	0.01
Vic	25.00	11.70	1.00	210.56	0.01	2.15	0.06	0.45	0.01
Qld	7,097.32	3.00	1.00	15,330.21	0.01	2.15	0.06	32.97	0.97
NT	21,553.86	8.16	1.00	96,314.98	0.01	2.15	0.06	207.12	6.08
ACT	0.00	11.10	1.00	0.00	0.01	0.00	0.00	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 areas of fire scars measured from satellite imagery. Fuel loads reported are fine fuels susceptible to burning, and also include heavier fuels for savanna woodland in WA and NT.
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 volatilized. Fraction oxidized is 0.72 for NSW, Tas, SA, Vic, Qld and ACT for all years, and 0.45 for WA and 0.42 for NT for 2003 (averages for savanna grassland and savanna woodland).

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

Australia
2003
2005

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 of residue	Fraction burned in fields	Biomass burned (Gg dm)	Nitrogen fraction in biomass of residues	CH_4 (kg/t dm)	N_2O (kg/t dm)	CH_4 (Gg)	N_2O (Gg)
1. Cereals									**8.76**	**0.21**
Wheat	17,215,629.40	1.50	0.90	0.12	2,565.82	0.00	1.87	0.04	4.80	0.10
Barley	6,072,300.65	1.50	0.80	0.12	804.46	0.00	1.87	0.04	1.50	0.03
Maize	381,950.75	1.50	0.80	0.30	132.00	0.01	1.96	0.09	0.26	0.01
Oats	1,195,377.80	1.50	0.80	0.12	158.36	0.00	1.87	0.04	0.30	0.01
Rye	NE	1.50	0.80	0.12	0.00	0.00	NE	NE	NE	NE
Rice	815,156.80	1.31	0.80	0.82	668.15	0.01	1.96	0.08	1.31	0.05
Other *(please specify)*									0.59	0.01
Millet	29,760.10	1.50	0.80	0.12	3.94	0.00	1.87	0.04	0.01	0.00
Sorghum	1742677.15	1.50	0.80	0.12	230.87	0.00	1.87	0.04	0.43	0.01
Triticale	593,304.85	1.50	0.80	0.12	78.60	0.00	1.87	0.04	0.15	0.00
2. Pulse									**NE**	**NE**
Dry bean	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
Peas	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
Soybeans	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
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	**35,350,551**	**0.25**	**0.20**	**0.38**	**642.76**	**0.01**	**1.87**	**0.12**	**1.20**	**0.08**
5 Other *(please specify)*									**NA**	**NA**
NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Documentation Box:

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

Australia
2003
2005

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	CO_2 emissions	CO_2 removals	Net CO_2 emissions/ removals	CH_4	N_2O	NO_x	CO
	(Gg)						
Total Land-Use Change and Forestry	**106,082.87**	**-75,501.35**	**30,581.52**	**159.59**	**2.95**	**119.91**	**4,695.59**
A. Changes in Forest and Other Woody Biomass Stocks	**58,407.80**	**-75,501.35**	**-17,093.55**				
1. Tropical Forests	IE	IE	0.00				
2. Temperate Forests	IE	IE	0.00				
3. Boreal Forests	IE	IE	0.00				
4. Grasslands/Tundra	IE	IE	0.00				
5. Other *(please specify)*	58,407.80	-75,501.35	-17,093.55				
Harvested Wood [1]	IE	IE	0.00				
Managed Native Forest	NA	-57,328.10	-57,328.10				
Plantations	NA	-18,173.25	-18,173.25				
Commercial Harvest	48,198.85	NA	48,198.85				
Fuelwood Consumed	10,208.95	NA	10,208.95				
B. Forest and Grassland Conversion	**47,675.07**			**72.62**	**1.34**	**54.56**	**2,136.55**
1. Tropical Forests	IE			IE	IE	IE	IE
2. Temperate Forests	IE			IE	IE	IE	IE
3. Boreal Forests	IE			IE	IE	IE	IE
4. Grasslands/Tundra	IE			IE	IE	IE	IE
5. Other *(please specify)*	47,675.07			72.62	1.34	54.56	2,136.55
a) Above Ground	34,788.60			72.62	1.34	54.56	2,136.55
b) Below Ground [1]	12,886.47			NA	NA	NA	NA
C. Abandonment of Managed Lands	**NA**	**NA**	**0.00**				
1. Tropical Forests	NA	NA	0.00				
2. Temperate Forests	NA	NA	0.00				
3. Boreal Forests	NA	NA	0.00				
4. Grasslands/Tundra	NA	NA	0.00				
5. Other *(please specify)*	NA	NA	0.00				
NA	NA	NA	0.00				
D. CO_2 Emissions and Removals from Soil	**NE**	**NE**	**0.00**				
Cultivation of Mineral Soils	NE	NE	0.00				
Cultivation of Organic Soils	NE	NE	0.00				
Liming of Agricultural Soils	NE	NE	0.00				
Forest Soils	NE	NE	0.00				
Other *(please specify)*	NA	NA	0.00				
NA	NA	NA	0.00				
E. Other *(please specify)*	**NA**	**NA**	**0.00**	**86.97**	**1.60**	**65.35**	**2,559.03**
Prescribed Burning and Wildfire in Forests	NA	NA	0.00	86.97	1.60	65.35	2,559.03

[1] The reporting of CO_2 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
2003
2005

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	CO_2	CH_4	N_2O	NO_x	CO	NMVOC	SO_2
	(Gg)						
Total Waste	**16.30**	**513.61**	**1.80**	**NE**	**NE**	**1.89**	**NE**
A. Solid Waste Disposal on Land	**NE**	**387.69**		**NA**	**NA**	**1.56**	
1. Managed Waste Disposal on Land	NE	387.69		NA	NA	1.56	
2. Unmanaged Waste Disposal Sites	NA	NA		NA	NA	NA	
3. Other *(please specify)*	NA	NA		NA	NA	NA	
NA	NA	NA		NA	NA	NA	
B. Wastewater Handling		**125.92**	**1.80**	**NA**	**NA**	**0.33**	
1. Industrial Wastewater		71.72	NE	NA	NA	0.15	
2. Domestic and Commercial Wastewater		54.20	1.80	NA	NA	0.18	
3. Other *(please specify)*		NA	NA	NA	NA	NA	
NA		NA	NA	NA	NA	NA	
C. Waste Incineration	**16.30**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**
D. Other *(please specify)*	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**
NA	NA	NA	NA	NA	NA	NA	NA

WASTE

Australia
2003
2005

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

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 (3) (Gg)
1 Managed Waste Disposal on Land	19,287.47	1.00	NE	119.82	0.02	NE	387.69	NE
2 Unmanaged Waste Disposal Sites	NA	NA	NA	NA	NA	NA	NA	NA
- deep (>5 m)	NA	NA	NA	NA	NA	NA	NA	NA
- shallow (<5 m)	NA	NA	NA	NA	NA	NA	NA	NA
3 Other *(please specify)*							NA	NA
NA	NA	NA	NA	NA	NA	NA	NA	NA

Additional information

Description	Value
Total population (1000s)	19,752.13
Urban population (1000s)	NA
Waste generation rate (kg/capita/day)	2.68
Fraction of MSW disposed to SWDS	1.00
Fraction of DOC in MSW	NA
Fraction of wastes incinerated	NE
Fraction of wastes recycled	NA
CH4 oxidation factor (b)	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)	30.00
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.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_2O (kg/t waste)	CO_2 (3) (Gg)	CH_4 (Gg)	N_2O (Gg)
Waste Incineration *(please specify)*	NA				16.30	NE	NE
(biogenic) (3)	NA	NA	NA	NA	NA	NA	NA
(plastics and other non-biogenic waste) (3)	5.61	NA	NA	NA	NA	NA	NA
Solvents	NA	NA	NE	NE	16.30	NE	NE

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) CH_4 recovered and flared or utilized.

(3) Under Waste Disposal, CO_2 emissions should be reported only when the disposed wastes are combusted at the disposal site which might constitute a management practice. CO_2 emissions from non-biogenic wastes are included in the totals, while the CO_2 emissions from biogenic wastes are not included in the totals.

Documentation box:

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

Australia
2003
2005

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_2O	CH_4		N_2O
	Wastewater	Sludge	Wastewater	Sludge	Wastewater	Sludge		Wastewater	Sludge	
	(Gg DC[1]/yr)		(Gg)		(kg/kg DC)	(kg/kg DC)	(kg/kg DC)	(Gg)	(Gg)	(Gg)
Industrial Wastewater	NE	NE	4.00	NE	NE	NE	NE	71.72	NE	NE
Domestic and Commercial Wastewater	NE	NE	56.33	NE	NE	NE	NE	54.20	NE	NA
Other *(please specify)*								0.00	0.00	0.00
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 (1000s)	Protein consumption (protein in kg/person/yr)	N fraction (kg N/kg protein)	N_2O (kg N_2O-N/kg sewage N produced)	N_2O (Gg)
N_2O from human sewage	19,752	36.28	0.16	0.01	1.80

[1] DC - degradable organic component. DC indicators are COD (Chemical Oxygen Demand) for industrial wastewater and BOD (Biochemical Oxygen Demand) for Domestic/Commerc wastewater/sludge (IPCC Guidelines (Volume 3. Reference Manual, pp. 6.14, 6.18)).
[2] Actual emissions (after recovery)

Documentation box:

Additional information

	Domestic	Industrial
Total wastewater (m^3):	NE	NE
Treated wastewater (%):	NE	NE

Wastewater streams:	Wastewater output (m^3)	DC ($kgCOD/m^3$)
Industrial wastewater	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
	DC (kg BOD/1000 person/yr)	
Domestic and Commercial	22,500	
Other		NA
NA		NA

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

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

Australia
2003
2005

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	CO_2 emissions	CO_2 removals	CH_4	N_2O	HFCs		PFCs		SF_6		NO_x	CO	NMVOC	SO_2
					P	A	P	A	P	A				
	(Gg)				CO_2 equivalent (Gg)						(Gg)			
Total National Emissions and Removals	**402,282.03**	**0.00**	**5,252.12**	**100.64**	**NE**	**4,309.02**	**NE**	**1,472.05**	**NE**	**0.02**	**2,469.57**	**24,352.48**	**2,451.66**	**2,804.83**
1. Energy	**345,770.51**		**1,069.66**	**19.52**							**1,603.13**	**4,030.00**	**740.80**	**810.29**
A. Fuel Combustion — Reference Approach	333,934.16													
Sectoral Approach	340,004.36		87.86	19.44							1,601.76	4,022.42	562.57	810.29
1. Energy Industries	208,302.60		10.45	2.11							698.39	71.74	8.86	668.64
2. Manufacturing Industries and Construction	39,117.20		1.99	0.65							344.68	234.70	11.33	100.61
3. Transport	74,033.42		30.47	16.45							444.46	3,054.11	457.92	33.87
4. Other Sectors	17,280.43		44.91	0.21							110.15	654.47	83.64	6.98
5. Other	1,270.71		0.05	0.02							4.09	7.41	0.82	0.19
B. Fugitive Emissions from Fuels	5,766.16		981.80	0.07							1.37	7.58	178.22	0.00
1. Solid Fuels	NE		787.34	NE							NE	NE	NE	NA
2. Oil and Natural Gas	5,766.16		194.46	0.07							1.37	7.58	178.22	NE
2. Industrial Processes	**25,913.69**		**3.32**	**0.07**	**NE**	**4,309.02**	**NE**	**1,472.05**	**NE**	**0.02**	**65.76**	**8.69**	**79.51**	**1,994.53**
A. Mineral Products	5,384.17		NE	NE							NE	NE	15.67	NE
B. Chemical Industry	952.11		0.44	IE	NA	NA	NA	NA	NA	NA	NE	NE	5.07	NE
C. Metal Production	13,866.07		2.88	0.07				1,472.05		NE	65.76	8.69	0.11	1,994.53
D. Other Production	NE										NE	NE	58.64	NE
E. Production of Halocarbons and SF_6						NO		NO		NO				
F. Consumption of Halocarbons and SF_6					NE	4,309.02	NE	NE	NE	0.02				
G. Other	5,711.34		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.

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

Australia
2003
2005

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	CO_2 emissions	CO_2 removals	CH_4	N_2O	HFCs [1]		PFCs[1]		SF_6		NO_x	CO	NMVOC	SO_2
					P	A	P	A	P	A				
	(Gg)				CO_2 equivalent (Gg)				(Gg)					
3. Solvent and Other Product Use	**NA**			**NE**							**NA**	**NA**	**150.66**	NA
4. Agriculture	**NA**	**NA**	**3,505.95**	**76.31**							680.77	15,618.20	911.15	NA
A. Enteric Fermentation			2,988.00											
B. Manure Management			97.50	4.15									NA	
C. Rice Cultivation			19.05										NA	
D. Agricultural Soils	NA	NA	NE	60.38									NA	
E. Prescribed Burning of Savannas			391.44	11.50							664.17	15230.77	888.55	
F. Field Burning of Agricultural Residues			9.96	0.29							16.60	387.43	22.60	
G. Other			NA	NA							NA	NA	NA	NA
5. Land-Use Change and Forestry	**30,581.52**	**0.00**	**159.59**	**2.95**							**119.91**	**4,695.59**	**567.66**	**NE**
A. Changes in Forest and Other Woody Biomass Stocks	0.00	-17,093.55												
B. Forest and Grassland Conversion	47,675.07		72.62	1.34							54.56	2,136.55	258.29	
C. Abandonment of Managed Lands	NA	NA												
D. CO_2 Emissions and Removals from Soil	NE	NE												
E. Other	NA	NA	86.97	1.60							65.35	2,559.03	309.36	NE
6. Waste	**16.30**		**513.61**	**1.80**							**NE**	**NE**	**1.89**	**NE**
A. Solid Waste Disposal on Land	NE		387.69									NA	1.56	
B. Wastewater Handling			125.92	1.80							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

(4) According to the IPCC Guidelines (Volume 3. Reference Manual, pp. 4.2, 4.87), CO_2 emissions from agricultural soils are to be included under Land-Use Change and Forestry (LUCF). At the same time, the Summary Report 7A (Volume 1. Reporting Instructions, Tables.27) allows for reporting CO_2 emissions or removals from agricultural soils, either in the Agriculture sector, under D. Agricultural Soils or in the Land-Use Change and Forestry sector under D. Emissions and Removals from Soil. Parties may choose either way to report emissions or removals from this source in the common reporting format, but the way they have chosen to report should be clearly indicated, by inserting explanatory comments to the corresponding cells of Summary 1.A and Summary 1.B. Double-counting of these emissions or removals should be avoided. Parties should include these emissions or removals consistently in Table8(a) (Recalculation - Recalculated data) and Table10 (Emission trends).

(5) Please do not provide an estimate of both CO_2 emissions and CO_2 removals. "Net" emissions (emissions - removals) of CO_2 should be estimated and a single number placed in either the CO_2 emissions or CO_2 removals column, as appropriate. Please note that for the purposes of reporting, the signs for uptake are always (-) and for emissions (+).

(6) Note that CO_2 from Waste Disposal and Incineration source categories should only be included if it stems from non-biogenic or inorganic waste streams.

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

Australia
2003
2005

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	CO_2 emissions	CO_2 removals	CH_4	N_2O	HFCs		PFCs		SF_6		NO_x	CO	NMVOC	SO_2
					P	A	P	A	P	A				
	(Gg)				CO_2 equivalent (Gg)						(Gg)			
Memo Items: [(1)]														
International Bunkers	**8,837.18**		**0.14**	**0.26**							**94.89**	**12.89**	**7.27**	**43.69**
Aviation	6,615.32		0.03	0.20							35.43	10.96	5.42	1.25
Marine	2,221.86		0.11	0.06							59.46	1.93	1.85	42.44
Multilateral Operations	**NE**		**NE**	**NE**							**NE**	**NE**	**NE**	**NE**
CO_2 Emissions from Biomass	**15,947.94**													

[(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
2003
2005

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	CO_2 emissions	CO_2 removals	CH_4	N_2O	HFCs P	HFCs A	PFCs P	PFCs A	SF_6 P	SF_6 A	NO_x	CO	NMVOC	SO_2
	(Gg)				CO_2 equivalent (Gg)						(Gg)			
Total National Emissions and Removals	**402,282.03**	**0.00**	**5,252.12**	**100.64**	**NA**	**4,309.02**	**NA**	**1,472.05**	**NA**	**0.02**	**2,469.57**	**24,352.48**	**2,451.66**	**2,804.83**
1. Energy	**345,770.51**		**1,069.66**	**19.52**							**1,603.13**	**4,030.00**	**740.80**	**810.29**
A. Fuel Combustion — Reference Approach	333,934.16													
Sectoral Approach	340,004.36		87.86	19.44							1,601.76	4,022.42	562.57	810.29
B. Fugitive Emissions from Fuels	5,766.16		981.80	0.07							1.37	7.58	178.22	0.00
2. Industrial Processes	**25,913.69**		**3.32**	**0.07**	**NE**	**4,309.02**	**NE**	**1,472.05**	**NE**	**0.02**	**65.76**	**8.69**	**79.51**	**1,994.53**
3. Solvent and Other Product Use	**NA**			**NE**							**NA**	**NA**	**150.66**	**NA**
4. Agriculture	**NA**	**NA**	**3,505.95**	**76.31**							**680.77**	**15,618.20**	**911.15**	**NA**
5. Land-Use Change and Forestry	**30,581.52**	**0.00**	**159.59**	**2.95**							**119.91**	**4,695.59**	**567.66**	**NE**
6. Waste	**16.30**		**513.61**	**1.80**							**NE**	**NE**	**1.89**	**NE**
7. Other	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**
Memo Items:														
International Bunkers	**8,837.18**		**0.14**	**0.26**							**94.89**	**12.89**	**7.27**	**43.69**
Aviation	6,615.32		0.03	0.20							35.43	10.96	5.42	1.25
Marine	2,221.86		0.11	0.06							59.46	1.93	1.85	42.44
Multilateral Operations	**NE**		**NE**	**NE**							**NE**	**NE**	**NE**	**NE**
CO_2 Emissions from Biomass	**15,947.94**													

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

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

SUMMARY 2 SUMMARY REPORT FOR CO_2 EQUIVALENT EMISSIONS (Sheet 1 of 1)

Australia
2003
2005

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	CO_2	CH_4	N_2O	HFCs	PFCs	SF_6	Total
	CO_2 equivalent (Gg)						
Total (Net Emissions)	**402,282.03**	**110,294.50**	**31,198.65**	**4,309.02**	**1,472.05**	**521.02**	**550,077.28**
1. Energy	**345,770.51**	**22,462.86**	**6,049.71**				**374,283.09**
A. Fuel Combustion (Sectoral Approach)	340,004.36	1,845.10	6,027.44				347,876.89
1. Energy Industries	208,302.60	219.38	654.92				209,176.90
2. Manufacturing Industries and Construction	39,117.20	41.71	202.47				39,361.38
3. Transport	74,033.42	639.97	5,098.77				79,772.15
4. Other Sectors	17,280.43	943.07	65.82				18,289.32
5. Other	1,270.71	0.97	5.46				1,277.14
B. Fugitive Emissions from Fuels	5,766.16	20,617.77	22.27				26,406.19
1. Solid Fuels	NE	16,534.08	0.00				16,534.08
2. Oil and Natural Gas	5,766.16	4,083.69	22.27				9,872.12
2. Industrial Processes	**25,913.69**	**69.63**	**20.27**	**4,309.02**	**1,472.05**	**521.02**	**32,305.69**
A. Mineral Products	5,384.17	NA	NA				5,384.17
B. Chemical Industry	952.11	9.17	IE	NA	NA	NA	961.28
C. Metal Production	13,866.07	60.46	20.27		1,472.05	NE	15,418.85
D. Other Production	NE						NE
E. Production of Halocarbons and SF_6				NO	NO	NO	NO
F. Consumption of Halocarbons and SF_6				4,309.02	NE	521.02	4,830.04
G. Other	5,711.34	NA	NA	NA	NA	NA	5,711.34
3. Solvent and Other Product Use	**NA**		**NE**				**NE**
4. Agriculture	**NA**	**73,624.87**	**23,655.77**				**97,280.64**
A. Enteric Fermentation		62,748.00					62,748.00
B. Manure Management		2,047.53	1,286.11				3,333.64
C. Rice Cultivation		400.09					400.09
D. Agricultural Soils(2)	NA	NE	18,716.27				18,716.27
E. Prescribed Burning of Savannas		8,220.15	3,564.33				11,784.48
F. Field Burning of Agricultural Residues		209.10	89.07				298.17
G. Other		NA	NA				NA
5. Land-Use Change and Forestry	**30,581.52**	**3,351.40**	**914.26**				**34,847.19**
6. Waste	**16.30**	**10,785.74**	**558.64**				**11,360.68**
A. Solid Waste Disposal on Land	NE	8,141.48					8,141.48
B. Wastewater Handling		2,644.26	558.64				3,202.89
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	**8,837.18**	**2.90**	**80.17**				**8,920.25**
Aviation	6,615.32	0.56	61.10				6,676.97
Marine	2,221.86	2.35	19.07				2,243.27
Multilateral Operations	**NE**	**NE**	**NE**				**NE**
CO_2 Emissions from Biomass	**15,948.03**						**15,948.03**

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	CO_2 emissions	CO_2 removals	Net CO_2 emissions / removals	CH_4	N_2O	Total emissions
Land-Use Change and Forestry	CO_2 equivalent (Gg)					
A. Changes in Forest and Other Woody Biomass Stocks	58,407.80	-75,501.35	-17,093.55			-17,093.55
B. Forest and Grassland Conversion	47,675.07		47,675.07	1,524.93	416.80	49,616.80
C. Abandonment of Managed Lands	NA	NA	0.00			0.00
D. CO_2 Emissions and Removals from Soil	NE	NE	0.00			0.00
E. Other	NA	NA	0.00	1,826.47	497.46	2,323.93
Total CO_2 Equivalent Emissions from Land-Use Change and Forestry	106,082.87	-75,501.35	30,581.52	3,351.40	914.26	34,847.19

Total CO_2 Equivalent Emissions without Land-Use Change and Forestry	515,230.09
Total CO_2 Equivalent Emissions with Land-Use Change and Forestry	550,077.28

Land-Use Change and Forestry. Note that these totals will differ from the totals reported in Table 10s5 if Parties report non-CO2 emissions from LUCF.

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

Australia
2003
2005

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	CO_2		CH_4		N_2O		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**	**D, 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	D, CS	T2	CS	T2	CS						
B. Fugitive Emissions from Fuels	T2	CS	T2	CS	T2	CS						
1. Solid Fuels	NE	NE	T2	CS	NE	NE						
2. Oil and Natural Gas	T2	CS	T2	CS	T2	CS						
2. Industrial Processes	**T1, T2**	**CS, D**	**T1, T2**	**CS, D**	**T1, T2**	**CS, D**	**M**	**D**	**T1c**	**CS**	**T2**	**CS**
A. Mineral Products	T2	CS	NE	NA	NE	NA						
B. Chemical Industry	T1,T2	CS,D	T1	CS,D	T1	D	NE	NA	NA	NA	NE	NE
C. Metal Production	T2	CS	T2	CS	T2	CS			T1c	CS	T2	CS
D. Other Production	NE	NA										
E. Production of Halocarbons and SF_6							NO	NO	NO	NO	NO	NO
F. Consumption of Halocarbons and SF_6							M	D	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
2003
2005

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	CO_2		CH_4		N_2O		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**						
4. Agriculture	**NE**	**NE**	**CS, T1**	**CS,D**	**CS**	**CS,D**						
A. Enteric Fermentation			CS, T1	CS								
B. Manure Management			CS	CS, D	CS	D						
C. Rice Cultivation			T1	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,M**	**CS**	**CS**	**CS**	**CS**	**CS**						
A. Changes in Forest and Other Woody Biomass Stocks	CS	CS										
B. Forest and Grassland Conversion	M	CS	CS	CS	CS	CS						
C. Abandonment of Managed Lands	NA	NA										
D. CO_2 Emissions and Removals from Soil	NE	NE										
E. Other	CS	CS	CS	CS	CS	CS						
6. Waste	**T2**	**CS**	**T2**	**D**	**T1**	**D**						
A. Solid Waste Disposal on Land	NA	NA	T2	D								
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	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). 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). 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.

TABLE 7 OVERVIEW TABLE[(1)] FOR NATIONAL GREENHOUSE GAS INVENTORIES - COMPLETENESS AND QUALITY OF ESTIMATES
(Sheet 1 of 3)

Australia
2003
2005

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	CO_2		CH_4		N_2O		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	PART	H-L	PART	M-L	PART	M-L							PART	M-L	PART	M-L	PART	M-L	ALL	H
A. Fuel Combustion Activities																				
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	L
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	PART	L
B. Fugitive Emissions from Fuels	PART	L	PART	M	PART	L							ALL	L	ALL	L	ALL	L	NA	NA
1. Solid Fuels	NE	NE	PART	M	NE	NE														
2. Oil and Natural Gas	PART	L	PART	M	ALL	L							ALL	L	ALL	L	ALL	L	NA	NA
2 Industrial Processes	PART	M	PART	L	PART	L	NE	NA	All	M	PART	H	NE	NA	NE	NA	PART	M	PART	M
A. Mineral Products	ALL	M	NE	NA	NE	NA							NE	NA	NE	NA	PART	M	NE	NA
B. Chemical Industry	PART	M	PART	L	PART	M	NE	NA	NA	NA			NE	NA	NE	NA	PART	M	NE	NA
C. Metal Production	PART	H	ALL	L	PART	L			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							NA	NA	NA	NA	NA	NA								

(1) This table is intended to be used by Parties to summarize their own assessment of completeness (e.g. partial, full estimate, not estimated) and quality (high, medium, low) of major source/sink inventory estimates. The latter could be understood as a quality assessment of the uncertainty of the estimates.

TABLE 7 OVERVIEW TABLE FOR NATIONAL GREENHOUSE GAS INVENTORIES - COMPLETENESS AND QUALITY OF ESTIMATES
(Sheet 2 of 3)

Australia
2003
2005

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	CO_2		CH_4		N_2O		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 [(2)]							NE	NA	NA	NA	NE	NA								
Actual [(3)]							PART	M	NA	NA	NE	NA								
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**			**NE**	**NA**							**NE**	**NA**	**NE**	**NA**	**ALL**	**L**	**NE**	**NA**
4 Agriculture	**NA**	**NA**	**ALL**	**M**	**ALL**	**L**							**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		

[(2)] Potential emissions based on Tier 1 approach of the IPCC Guidelines.
[(3)] Actual emissions based on Tier 2 approach of the IPCC Guidelines.

TABLE 7 OVERVIEW TABLE FOR NATIONAL GREENHOUSE GAS INVENTORIES - COMPLETENESS AND QUALITY OF ESTIMATES
(Sheet 3 of 3)

Australia
2003
2005

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	CO_2		CH_4		N_2O		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	NA	NA																		
D. CO_2 Emissions and Removals from Soil	NE	NE																		
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	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
Memo Items:																				
International Bunkers	**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**
CO_2 Emissions from Biomass	**ALL**	**M**																		

TABLE 8(a) RECALCULATION - RECALCULATED DATA

Recalculated year: 1990

(Sheet 1 of 2)

Australia
2003
2005

GREENHOUSE GAS SOURCE AND SINK CATEGORIES		CO_2			CH_4			N_2O		
		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)		(%)
Total National Emissions and Removals		**364,980.20**	**382,027.73**	**4.67**	**121,938.20**	**114,633.00**	**-5.99**	**23,900.36**	**22,291.51**	**-6.73**
1. Energy		**258,622.51**	**258,514.98**	**-0.04**	**25,155.07**	**25,166.75**	**0.05**	**2,465.51**	**2,385.98**	**-3.23**
1.A.	Fuel Combustion Activities	252,659.80	252,552.25	-0.04	2,389.20	2,392.46	0.14	2,429.84	2,350.00	-3.29
1.A.1.	Energy Industries	141,805.68	141,805.68	0.00	39.88	39.70	-0.46	438.33	436.87	-0.33
1.A.2.	Manufacturing Industries and Construction	37,384.55	37,355.76	-0.08	32.46	31.26	-3.69	211.26	203.45	-3.69
1.A.3.	Transport	59,726.89	59,724.27	0.00	551.33	555.97	0.84	1,701.64	1,631.07	-4.15
1.A.4.	Other Sectors	12,485.74	12,485.07	-0.01	1,764.58	1,764.58	0.00	74.88	74.88	0.00
1.A.5.	Other	1,256.94	1,181.47	-6.00	0.95	0.95	0.00	3.74	3.74	0.00
1.B.	Fugitive Emissions from Fuels	5,962.71	5,962.73	0.00	22,765.87	22,774.29	0.04	35.67	35.98	0.87
1.B.1.	Solid fuel	NE	NE		15,816.36	15,816.36	0.00	NE	NE	
1.B.2.	Oil and Natural Gas	5,962.71	5,962.73	0.00	6,949.51	6,957.93	0.12	35.67	35.98	0.87
2. Industrial Processes		**20,975.74**	**22,359.30**	**6.60**	**69.12**	**69.12**	**0.00**	**26.78**	**26.78**	**0.03**
2.A.	Mineral Products	4,763.45	4,825.64	1.31	NA	NA		NA	NA	
2.B.	Chemical Industry	C	503.70	100.00	9.19	9.19	0.00	C	IE	
2.C.	Metal Production	14,471.28	14,665.86	1.34	59.93	59.93	0.00	26.78	26.78	0.03
2.D.	Other Production	NE	NE							
2.G.	Other [1]	1,741.00	2,364.10	35.79	NA	NA		NA	NA	
3. Solvent and Other Product Use		**NA**	**NA**					**NE**	**NE**	
4. Agriculture		**NA**	**NA**		**75,186.99**	**75,335.52**	**0.20**	**19,921.73**	**18,219.59**	**-8.54**
4.A.	Enteric Fermentation				67,497.11	67,512.63	0.02			
4.B.	Manure Management				1,508.17	1,539.63	2.09	527.50	521.49	-1.14
4.C.	Rice Cultivation				490.50	490.50	0.00			
4.D.	Agricultural Soils	NA	NA		NE	NE		15,145.90	15,178.92	0.22
4.E.	Prescribed Burning of Savannas				5,507.04	5,608.26	1.84	4,160.95	2,431.79	-41.56
4.F.	Field Burning of Agricultural Residues				184.17	184.50	0.18	87.38	87.40	0.02
4.G.	Other				NA	NA		NA	NA	
5. Land-Use Change and Forestry (net)		**85,370.37**	**101,141.87**	**18.47**	**6,723.70**	**4,322.26**	**-35.72**	**1,003.77**	**1,180.21**	**17.58**
5.A.	Changes in Forest and Other Woody Biomass Stocks	-24,598.42	-21,083.58	-14.29						
5.B.	Forest and Grassland Conversion	114,192.33	122,225.44	7.03	5,506.96	3,102.38	-43.66	671.74	847.96	26.23
5.C.	Abandonment of Managed Lands	NA	NA							
5.D.	CO_2 Emissions and Removals from Soil	-4,223.54	NE	-100.00						
5.E.	Other	NA	NA		1,216.73	1,219.88	0.26	332.03	332.25	0.06

[1] Includes confidential emissions of N_2O from Nitric Acid Production and CO_2 from Ammonia Production, Soda Ash production and use and Magnesia Production reported as CO_2-equivalents
These emission were previously not reported at the sectoral level but have been reported here to enable comparison with the current submissions

TABLE 8(a) RECALCULATION - RECALCULATED DATA

Recalculated year: 1990

(Sheet 2 of 2)

Australia
2003
2005

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	CO_2 Previous submission	CO_2 Latest submission	CO_2 Difference	CH_4 Previous submission	CH_4 Latest submission	CH_4 Difference	N_2O Previous submission	N_2O Latest submission	N_2O Difference
	CO_2 equivalent (Gg)		(%)	CO_2 equivalent (Gg)		(%)	CO_2 equivalent (Gg)		(%)
6. Waste	**11.58**	**11.58**	**0.02**	**14,803.33**	**9,739.35**	**-34.21**	**482.57**	**478.94**	**-0.75**
6.A. Solid Waste Disposal on Land	NE	NE		13,623.32	7,472.31	-45.15			
6.B. Wastewater Handling				1,180.01	2,267.04	92.12	482.57	478.94	-0.75
6.C. Waste Incineration	11.58	11.58	0.02	NE	NE		NE	NE	
6.D. Other	NA	NA		NA	NA		NA	NA	
7. Other *(please specify)*	**NA**	**NA**		**NA**	**NA**		**NA**	**NA**	
	NA	NA		NA	NA		NA	NA	
Memo Items:									
International Bunkers	**6,400.97**	**6,400.97**	**0.00**	**2.63**	**2.65**	**0.79**	**57.81**	**57.69**	**-0.20**
Multilateral Operations	**NE**	**NE**		**NE**	**NE**		**NE**	**NE**	
CO_2 Emissions from Biomass	**16,514.85**	**15,112.99**	**-8.49**						

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	HFCs Previous submission	HFCs Latest submission	HFCs Difference	PFCs Previous submission	PFCs Latest submission	PFCs Difference	SF_6 Previous submission	SF_6 Latest submission	SF_6 Difference
	CO_2 equivalent (Gg)		(%)	CO_2 equivalent (Gg)		(%)	CO_2 equivalent (Gg)		(%)
Total Actual Emissions	**1,126.27**	**1,126.27**	**0.00**	**3,938.28**	**3,938.28**	**0.00**	**NE**	**521.02**	**100.00**
2.C.3. Aluminium Production				3,938.28	3,938.28	0.00	NA	NA	
2.E. Production of Halocarbons and SF_6	1,126.27	1,126.27	0.00	NO	NO		NO	NO	
2.F. Consumption of Halocarbons and SF_6	NE	NE		NE	NE		NE	521.02	100.00
Other	NA	NA		NA	NA		NA	NA	
Potential Emissions from Consumption of HFCs/PFCs and SF_6	**NA**	**NA**		**NA**	**NA**		**NA**	**NA**	

	Previous submission	Latest submission	Difference
	CO_2 equivalent (Gg)		(%)
Total CO_2 Equivalent Emissions with Land-Use Change and Forestry	515,883.32	524,537.82	1.68
Total CO_2 Equivalent Emissions without Land-Use Change and Forestry	422,785.48	417,893.48	-1.16

TABLE 8(a) RECALCULATION - RECALCULATED DATA

Recalculated year: 1991

(Sheet 1 of 2)

Australia
2003
2005

GREENHOUSE GAS SOURCE AND SINK CATEGORIES		CO_2			CH_4			N_2O		
		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)		(%)
Total National Emissions and Removals		**342,895.57**	**358,700.87**	**4.61**	**121,284.23**	**114,253.08**	**-5.80**	**24,268.65**	**22,668.61**	**-6.59**
1. Energy		**260,716.76**	**260,571.13**	**-0.06**	**24,653.62**	**24,647.95**	**-0.02**	**2,745.01**	**2,714.02**	**-1.13**
1.A.	Fuel Combustion Activities	254,971.64	254,826.01	-0.06	2,421.93	2,416.26	-0.23	2,711.57	2,680.42	-1.15
1.A.1.	Energy Industries	145,296.14	145,296.14	0.00	40.30	40.11	-0.48	456.17	454.60	-0.34
1.A.2.	Manufacturing Industries and Construction	36,829.60	36,722.04	-0.29	31.89	30.21	-5.28	205.38	196.43	-4.36
1.A.3.	Transport	59,076.56	59,097.02	0.03	540.59	536.79	-0.70	1,969.71	1,949.09	-1.05
1.A.4.	Other Sectors	12,558.60	12,557.97	0.00	1,808.30	1,808.31	0.00	76.32	76.32	0.00
1.A.5.	Other	1,210.75	1,152.85	-4.78	0.84	0.84	0.01	3.99	3.99	0.00
1.B.	Fugitive Emissions from Fuels	5,745.12	5,745.12	0.00	22,231.69	22,231.69	0.00	33.44	33.60	0.46
1.B.1.	Solid fuel	NE	NE		15,979.04	15,979.04	0.00	NE	NE	
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	33.60	0.46
2. Industrial Processes		**20,482.18**	**21,818.53**	**6.52**	**63.69**	**68.39**	**7.39**	**26.63**	**26.64**	**0.03**
2.A.	Mineral Products	4,477.14	4,508.72	0.71	NA	NA		NA	NA	
2.B.	Chemical Industry	C	477.77	100.00	8.48	8.48	0.00	C	IE	
2.C.	Metal Production	14,402.08	14,598.62	1.36	55.21	59.91	8.52	26.63	26.64	0.03
2.D.	Other Production	NE	NE							
2.G.	Other [(1)]	1,602.97	2,233.42	39.33	NA	NA		NA	NA	
3. Solvent and Other Product Use		**NA**	**NA**					**NE**	**NE**	
4. Agriculture		**NA**	**NA**		**75,406.35**	**75,455.40**	**0.07**	**20,083.58**	**18,347.94**	**-8.64**
4.A.	Enteric Fermentation				67,728.92	67,736.04	0.01			
4.B.	Manure Management				1,507.97	1,541.17	2.20	584.38	578.04	-1.09
4.C.	Rice Cultivation				523.78	523.78	0.00			
4.D.	Agricultural Soils	NA	NA		NE	NE		15,284.72	15,311.99	0.18
4.E.	Prescribed Burning of Savannas				5,467.19	5,475.57	0.15	4,130.84	2,374.25	-42.52
4.F.	Field Burning of Agricultural Residues				178.48	178.83	0.20	83.63	83.66	0.03
4.G.	Other				NA	NA		NA	NA	
5. Land-Use Change and Forestry (net)		**61,685.04**	**76,299.63**	**23.69**	**6,027.62**	**4,008.75**	**-33.49**	**924.67**	**1,094.48**	**18.36**
5.A.	Changes in Forest and Other Woody Biomass Stocks	-24,084.18	-21,503.85	-10.71						
5.B.	Forest and Grassland Conversion	89,992.76	97,803.48	8.68	4,772.45	2,750.46	-42.37	582.14	751.77	29.14
5.C.	Abandonment of Managed Lands	NA	NA							
5.D.	CO_2 Emissions and Removals from Soil	-4,223.54	NE	-100.00						
5.E.	Other	NA	NA		1,255.17	1,258.29	0.25	342.52	342.71	0.05

[(1)] Includes confidential emissions of N_2O from Nitric Acid Production and CO_2 from Ammonia Production, Soda Ash production and use and Magnesia Production reported as CO_2-equivalents
These emission were previously not reported at the sectoral level but have been reported here to enable comparison with the current submissions

TABLE 8(a) RECALCULATION - RECALCULATED DATA

Recalculated year: 1991

(Sheet 2 of 2)

Australia
2003
2005

GREENHOUSE GAS SOURCE AND SINK CATEGORIES		CO_2 Previous submission	CO_2 Latest submission	CO_2 Difference	CH_4 Previous submission	CH_4 Latest submission	CH_4 Difference	N_2O Previous submission	N_2O Latest submission	N_2O Difference
		CO_2 equivalent (Gg)		(%)	CO_2 equivalent (Gg)		(%)	CO_2 equivalent (Gg)		(%)
6. Waste		**11.58**	**11.58**	**0.00**	**15,132.96**	**10,072.59**	**-33.44**	**488.76**	**485.53**	**-0.66**
6.A.	Solid Waste Disposal on Land	NE	NE		13,937.81	7,774.35	-44.22			
6.B.	Wastewater Handling				1,195.15	2,298.23	92.30	488.76	485.53	-0.66
6.C.	Waste Incineration	11.58	11.58	0.00	NE	NE		NE	NE	
6.D.	Other	NA	NA		NA	NA		NA	NA	
7. Other *(please specify)*		**NA**	**NA**		**NA**	**NA**		**NA**	**NA**	
		NA	NA		NA	NA		NA	NA	
Memo Items:										
International Bunkers		**6,378.80**	**6,378.80**	**0.00**	**2.38**	**2.40**	**0.63**	**57.68**	**57.60**	**-0.14**
Multilateral Operations		**NE**	**NE**		**NE**	**NE**		**NE**	**NE**	
CO_2 Emissions from Biomass		**16,641.90**	**14,964.91**	**-10.08**						

GREENHOUSE GAS SOURCE AND SINK CATEGORIES		HFCs Previous submission	HFCs Latest submission	HFCs Difference	PFCs Previous submission	PFCs Latest submission	PFCs Difference	SF_6 Previous submission	SF_6 Latest submission	SF_6 Difference
		CO_2 equivalent (Gg)		(%)	CO_2 equivalent (Gg)		(%)	CO_2 equivalent (Gg)		(%)
Total Actual Emissions		**1,126.27**	**1,126.27**	**0.00**	**3,941.47**	**3,941.47**	**0.00**	**NE**	**521.02**	**100.00**
2.C.3.	Aluminium Production				3,941.47	3,941.47	0.00	NA	NA	
2.E.	Production of Halocarbons and SF_6	1,126.27	1,126.27	0.00	NO	NO		NO	NO	
2.F.	Consumption of Halocarbons and SF_6	NE	NE		NE	NE		NE	521.02	100.00
	Other	NA	NA		NA	NA		NA	NA	
Potential Emissions from Consumption of HFCs/PFCs and SF_6		**NA**	**NA**		**NA**	**NA**		**NA**	**NA**	

	Previous submission	Latest submission	Difference
	CO_2 equivalent (Gg)		(%)
Total CO_2 Equivalent Emissions with Land-Use Change and Forestry	493,516.19	501,211.33	1.56
Total CO_2 Equivalent Emissions without Land-Use Change and Forestry	424,878.86	419,808.46	-1.19

TABLE 8(a) RECALCULATION - RECALCULATED DATA

Recalculated year: 1992

(Sheet 1 of 2)

Australia
2003
2005

GREENHOUSE GAS SOURCE AND SINK CATEGORIES		CO_2			CH_4			N_2O		
		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)		(%)
Total National Emissions and Removals		**329,701.89**	**344,459.45**	**4.48**	**120,182.43**	**113,512.90**	**-5.55**	**24,235.57**	**22,669.27**	**-6.46**
1. Energy		**265,401.81**	**265,312.30**	**-0.03**	**25,743.13**	**25,721.24**	**-0.09**	**2,992.46**	**2,964.41**	**-0.94**
1.A.	Fuel Combustion Activities	259,560.87	259,471.35	-0.03	2,475.18	2,468.83	-0.26	2,959.21	2,931.01	-0.95
1.A.1.	Energy Industries	148,512.17	148,512.17	0.00	42.25	42.09	-0.38	465.67	464.38	-0.28
1.A.2.	Manufacturing Industries and Construction	36,707.28	36,680.49	-0.07	30.90	29.70	-3.90	185.53	177.58	-4.29
1.A.3.	Transport	60,194.18	60,188.94	-0.01	546.34	541.36	-0.91	2,225.53	2,206.59	-0.85
1.A.4.	Other Sectors	12,894.80	12,894.10	-0.01	1,854.81	1,854.80	0.00	78.08	78.08	0.00
1.A.5.	Other	1,252.43	1,195.65	-4.53	0.88	0.88	-0.01	4.40	4.40	0.00
1.B.	Fugitive Emissions from Fuels	5,840.95	5,840.95	0.00	23,267.95	23,252.42	-0.07	33.25	33.40	0.47
1.B.1.	Solid fuel	NE	NE		16,619.63	16,604.39	-0.09	NE	NE	
1.B.2.	Oil and Natural Gas	5,840.95	5,840.95	0.00	6,648.32	6,648.02	0.00	33.25	33.40	0.47
2. Industrial Processes		**18,396.48**	**19,893.48**	**8.14**	**69.20**	**69.20**	**0.00**	**22.28**	**22.28**	**0.01**
2.A.	Mineral Products	4,299.14	4,329.46	0.71	NA	NA		NA	NA	
2.B.	Chemical Industry	C	633.84	100.00	8.56	8.56	0.00	C	IE	
2.C.	Metal Production	12,342.86	12,537.79	1.58	60.64	60.65	0.00	22.28	22.28	0.01
2.D.	Other Production	NE	NE							
2.G.	Other [1]	1,754.48	2,392.39	36.36	NA	NA		NA	NA	
3. Solvent and Other Product Use		**NA**	**NA**					**NE**	**NE**	
4. Agriculture		**NA**	**NA**		**74,004.74**	**74,043.88**	**0.05**	**19,930.71**	**18,242.86**	**-8.47**
4.A.	Enteric Fermentation				66,465.79	66,465.79	0.00			
4.B.	Manure Management				1,537.62	1,572.42	2.26	669.44	662.59	-1.02
4.C.	Rice Cultivation				536.08	540.22	0.77			
4.D.	Agricultural Soils	NA	NA		NE	NE		15,184.62	15,204.68	0.13
4.E.	Prescribed Burning of Savannas				5,283.33	5,283.15	0.00	3,991.92	2,290.82	-42.61
4.F.	Field Burning of Agricultural Residues				181.93	182.31	0.21	84.72	84.77	0.06
4.G.	Other				NA	NA		NA	NA	
5. Land-Use Change and Forestry (net)		**45,892.02**	**59,242.08**	**29.09**	**5,055.84**	**3,472.75**	**-31.31**	**795.40**	**948.05**	**19.19**
5.A.	Changes in Forest and Other Woody Biomass Stocks	-24,543.87	-22,346.12	-8.95						
5.B.	Forest and Grassland Conversion	74,659.43	81,588.21	9.28	3,871.79	2,285.71	-40.97	472.28	624.74	32.28
5.C.	Abandonment of Managed Lands	NA	NA							
5.D.	CO_2 Emissions and Removals from Soil	-4,223.54	NE	-100.00						
5.E.	Other	NA	NA		1,184.05	1,187.04	0.25	323.12	323.30	0.06

[1] Includes confidential emissions of N_2O from Nitric Acid Production and CO_2 from Ammonia Production, Soda Ash production and use and Magnesia Production reported as CO_2-equivalents
These emission were previously not reported at the sectoral level but have been reported here to enable comparison with the current submissions

TABLE 8(a) RECALCULATION - RECALCULATED DATA

Recalculated year: 1992

(Sheet 2 of 2)

Australia
2003
2005

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	CO_2 Previous submission	CO_2 Latest submission	CO_2 Difference	CH_4 Previous submission	CH_4 Latest submission	CH_4 Difference	N_2O Previous submission	N_2O Latest submission	N_2O Difference
	CO_2 equivalent (Gg)		(%)	CO_2 equivalent (Gg)		(%)	CO_2 equivalent (Gg)		(%)
6. Waste	**11.58**	**11.58**	**0.00**	**15,309.51**	**10,205.82**	**-33.34**	**494.73**	**491.68**	**-0.62**
6.A. Solid Waste Disposal on Land	NE	NE		14,099.77	7,878.50	-44.12			
6.B. Wastewater Handling				1,209.74	2,327.32	92.38	494.73	491.68	-0.62
6.C. Waste Incineration	11.58	11.58	0.00	NE	NE		NE	NE	
6.D. Other	NA	NA		NA	NA		NA	NA	
7. Other *(please specify)*	**NA**	**NA**		**NA**	**NA**		**NA**	**NA**	
	NA	NA		NA	NA		NA	NA	
Memo Items:									
International Bunkers	**6,584.40**	**6,584.40**	**0.00**	**2.35**	**2.35**	**-0.01**	**59.67**	**59.68**	**0.01**
Multilateral Operations	**NE**	**NE**		**NE**	**NE**		**NE**	**NE**	
CO_2 Emissions from Biomass	**15,141.52**	**13,664.99**	**-9.75**						

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	HFCs Previous submission	HFCs Latest submission	HFCs Difference	PFCs Previous submission	PFCs Latest submission	PFCs Difference	SF_6 Previous submission	SF_6 Latest submission	SF_6 Difference
	CO_2 equivalent (Gg)		(%)	CO_2 equivalent (Gg)		(%)	CO_2 equivalent (Gg)		(%)
Total Actual Emissions	**1,053.94**	**1,053.94**	**0.00**	**3,935.10**	**3,935.10**	**0.00**	**NE**	**521.02**	**100.00**
2.C.3. Aluminium Production				3,935.10	3,935.10	0.00	NA	NA	
2.E. Production of Halocarbons and SF_6	1,053.94	1,053.94	0.00	NO	NO		NO	NO	
2.F. Consumption of Halocarbons and SF_6	NE	NE		NE	NE		NE	521.02	100.00
Other	NA	NA		NA	NA		NA	NA	
Potential Emissions from Consumption of HFCs/PFCs and SF_6	**NA**	**NA**		**NA**	**NA**		**NA**	**NA**	

	Previous submission	Latest submission	Difference
	CO_2 equivalent (Gg)		(%)
Total CO_2 Equivalent Emissions with Land-Use Change and Forestry	479,108.93	486,151.67	1.47
Total CO_2 Equivalent Emissions without Land-Use Change and Forestry	427,365.67	422,488.79	-1.14

Australia
2003
2005

TABLE 8(a) RECALCULATION - RECALCULATED DATA

Recalculated year: 1993

(Sheet 1 of 2)

GREENHOUSE GAS SOURCE AND SINK CATEGORIES		CO_2			CH_4			N_2O		
		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)		(%)
Total National Emissions and Removals		**335,018.52**	**336,264.59**	**0.37**	**118,949.29**	**111,204.85**	**-6.51**	**25,123.49**	**23,188.43**	**-7.70**
1. Energy		**268,804.61**	**268,734.92**	**-0.03**	**24,912.47**	**24,906.00**	**-0.03**	**3,269.30**	**3,243.29**	**-0.80**
1.A.	Fuel Combustion Activities	262,957.26	262,887.57	-0.03	2,502.46	2,495.37	-0.28	3,237.38	3,211.07	-0.81
1.A.1.	Energy Industries	149,790.74	149,790.74	0.00	43.32	43.14	-0.42	462.62	461.16	-0.31
1.A.2.	Manufacturing Industries and Construction	37,143.37	37,115.64	-0.07	33.27	31.96	-3.93	206.68	198.02	-4.19
1.A.3.	Transport	61,358.05	61,381.12	0.04	559.43	553.82	-1.00	2,483.96	2,467.75	-0.65
1.A.4.	Other Sectors	13,375.86	13,375.24	0.00	1,865.57	1,865.57	0.00	79.68	79.68	0.00
1.A.5.	Other	1,289.24	1,224.84	-5.00	0.87	0.87	0.00	4.45	4.45	0.00
1.B.	Fugitive Emissions from Fuels	5,847.35	5,847.35	0.00	22,410.00	22,410.63	0.00	31.92	32.23	0.97
1.B.1.	Solid fuel	NE	NE		16,611.41	16,611.41	0.00	NE	NE	
1.B.2.	Oil and Natural Gas	5,847.35	5,847.35	0.00	5,798.60	5,799.22	0.01	31.92	32.23	0.97
2. Industrial Processes		**19,017.66**	**20,929.54**	**10.05**	**70.03**	**70.03**	**0.00**	**21.77**	**21.76**	**-0.03**
2.A.	Mineral Products	4,507.25	4,538.74	0.70	NA	NA		NA	NA	
2.B.	Chemical Industry	C	663.91	100.00	6.73	6.73	0.00	C	IE	
2.C.	Metal Production	12,201.96	12,383.54	1.49	63.29	63.29	0.00	21.77	21.76	-0.03
2.D.	Other Production	NE	NE							
2.G.	Other [(1)]	2,308.45	3,343.34	44.83	NA	NA		NA	NA	
3. Solvent and Other Product Use		**NA**	**NA**					**NE**	**NE**	
4. Agriculture		**NA**	**NA**		**72,935.66**	**72,556.32**	**-0.52**	**20,499.80**	**18,551.57**	**-9.50**
4.A.	Enteric Fermentation				65,026.00	65,026.00	0.00			
4.B.	Manure Management				1,598.65	1,635.06	2.28	761.08	755.35	-0.75
4.C.	Rice Cultivation				598.63	602.42	0.63			
4.D.	Agricultural Soils	NA	NA		NE	NE		15,479.29	15,495.16	0.10
4.E.	Prescribed Burning of Savannas				5,517.29	5,097.01	-7.62	4,168.69	2,210.11	-46.98
4.F.	Field Burning of Agricultural Residues				195.09	195.81	0.37	90.73	90.95	0.23
4.G.	Other				NA	NA		NA	NA	
5. Land-Use Change and Forestry (net)		**47,184.67**	**46,588.54**	**-1.26**	**5,390.22**	**3,204.08**	**-40.56**	**833.02**	**874.63**	**5.00**
5.A.	Changes in Forest and Other Woody Biomass Stocks	-24,154.58	-21,920.19	-9.25						
5.B.	Forest and Grassland Conversion	75,562.79	68,508.74	-9.34	4,227.12	2,038.03	-51.79	515.62	557.05	8.03
5.C.	Abandonment of Managed Lands	NA	NA							
5.D.	CO_2 Emissions and Removals from Soil	-4,223.54	NE	-100.00						
5.E.	Other	NA	NA		1,163.09	1,166.05	0.25	317.40	317.59	0.06

[(1)] Includes confidential emissions of N_2O from Nitric Acid Production and CO_2 from Ammonia Production, Soda Ash production and use and Magnesia Production reported as CO_2-equivalents
These emission were previously not reported at the sectoral level but have been reported here to enable comparison with the current submissions

TABLE 8(a) RECALCULATION - RECALCULATED DATA

Recalculated year: 1993

(Sheet 2 of 2)

Australia
2003
2005

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	CO_2			CH_4			N_2O		
	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)		(%)
6. Waste	**11.58**	**11.58**	**0.00**	**15,640.92**	**10,468.43**	**-33.07**	**499.60**	**497.17**	**-0.49**
6.A. Solid Waste Disposal on Land	NE	NE		14,419.29	8,115.11	-43.72			
6.B. Wastewater Handling				1,221.64	2,353.32	92.64	499.60	497.17	-0.49
6.C. Waste Incineration	11.58	11.58	0.00	NE	NE		NE	NE	
6.D. Other	NA	NA		NA	NA		NA	NA	
7. Other *(please specify)*	**NA**	**NA**		**NA**	**NA**		**NA**	**NA**	
	NA	NA		NA	NA		NA	NA	
Memo Items:									
International Bunkers	**6,987.84**	**6,987.84**	**0.00**	**2.40**	**2.35**	**-1.74**	**63.35**	**63.58**	**0.36**
Multilateral Operations	**NE**	**NE**		**NE**	**NE**		**NE**	**NE**	
CO_2 Emissions from Biomass	**16,799.68**	**15,317.65**	**-8.82**						

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	HFCs			PFCs			SF_6		
	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)		(%)
Total Actual Emissions	**1,446.59**	**1,446.59**	**0.00**	**2,833.07**	**2,833.07**	**0.00**	**NE**	**521.02**	**100.00**
2.C.3. Aluminium Production				2,833.07	2,833.07	0.00	NA	NA	
2.E. Production of Halocarbons and SF_6	1,446.59	1,446.59	0.00	NO	NO		NO	NO	
2.F. Consumption of Halocarbons and SF_6	NE	NE		NE	NE		NE	521.02	100.00
Other	NA	NA		NA	NA		NA	NA	
Potential Emissions from Consumption of HFCs/PFCs and SF_6	**NA**	**NA**		**NA**	**NA**		**NA**	**NA**	

	Previous submission	Latest submission	Difference
	CO_2 equivalent (Gg)		(%)
Total CO_2 Equivalent Emissions with Land-Use Change and Forestry	483,370.96	475,458.55	-1.64
Total CO_2 Equivalent Emissions without Land-Use Change and Forestry	429,963.05	424,791.29	-1.20

B58 NATIONAL GREENHOUSE GAS INVENTORY 2003

TABLE 8(a) RECALCULATION - RECALCULATED DATA

Recalculated year: 1994

(Sheet 1 of 2)

Australia
2003
2005

GREENHOUSE GAS SOURCE AND SINK CATEGORIES		CO_2			CH_4			N_2O		
		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)		(%)
Total National Emissions and Removals		**343,025.46**	**342,328.24**	**-0.20**	**117,521.51**	**110,511.88**	**-5.96**	**25,769.42**	**23,740.28**	**-7.87**
1. Energy		**272,700.18**	**272,645.90**	**-0.02**	**24,668.53**	**25,728.45**	**4.30**	**3,546.98**	**3,535.17**	**-0.33**
1.A.	Fuel Combustion Activities	267,127.62	267,073.34	-0.02	2,470.77	2,464.28	-0.26	3,518.52	3,506.55	-0.34
1.A.1.	Energy Industries	150,850.78	150,825.59	-0.02	43.99	43.76	-0.53	468.04	466.79	-0.27
1.A.2.	Manufacturing Industries and Construction	38,645.38	38,553.82	-0.24	34.13	33.51	-1.82	209.36	212.15	1.33
1.A.3.	Transport	62,765.30	62,912.11	0.23	576.05	570.42	-0.98	2,757.11	2,743.61	-0.49
1.A.4.	Other Sectors	13,491.90	13,491.27	0.00	1,815.63	1,815.63	0.00	79.08	79.08	0.00
1.A.5.	Other	1,374.24	1,290.55	-6.09	0.96	0.96	0.00	4.92	4.92	0.01
1.B.	Fugitive Emissions from Fuels	5,572.57	5,572.57	0.00	22,197.77	23,264.16	4.80	28.46	28.62	0.54
1.B.1.	Solid fuel	NE	NE		16,326.61	17,392.34	6.53	NE	NE	
1.B.2.	Oil and Natural Gas	5,572.57	5,572.57	0.00	5,871.16	5,871.83	0.01	28.46	28.62	0.54
2. Industrial Processes		**21,072.97**	**22,906.82**	**8.70**	**78.19**	**78.19**	**0.00**	**24.06**	**24.07**	**0.02**
2.A.	Mineral Products	5,210.39	5,237.80	0.53	NA	NA		NA	NA	
2.B.	Chemical Industry	C	672.51	100.00	8.37	8.37	0.00	C	IE	
2.C.	Metal Production	13,402.91	13,494.29	0.68	69.82	69.82	0.00	24.06	24.07	0.02
2.D.	Other Production	NE	NE							
2.G.	Other [(1)]	2,459.67	3,502.23	42.39	NA	NA		NA	NA	
3. Solvent and Other Product Use		**NA**	**NA**					**NE**	**NE**	
4. Agriculture		**NA**	**NA**		**71,646.17**	**71,202.20**	**-0.62**	**20,849.48**	**18,811.12**	**-9.78**
4.A.	Enteric Fermentation				63,489.39	63,489.39	0.00			
4.B.	Manure Management				1,653.10	1,690.53	2.26	842.99	836.69	-0.75
4.C.	Rice Cultivation				606.24	606.24	0.00			
4.D.	Agricultural Soils	NA	NA		NE	NE		15,602.96	15,616.59	0.09
4.E.	Prescribed Burning of Savannas				5,705.22	5,223.12	-8.45	4,310.69	2,264.79	-47.46
4.F.	Field Burning of Agricultural Residues				192.21	192.92	0.37	92.84	93.06	0.24
4.G.	Other				NA	NA		NA	NA	
5. Land-Use Change and Forestry (net)		**49,240.72**	**46,763.93**	**-5.03**	**5,549.58**	**3,178.48**	**-42.73**	**843.99**	**867.69**	**2.81**
5.A.	Changes in Forest and Other Woody Biomass Stocks	-23,173.16	-18,594.96	-19.76						
5.B.	Forest and Grassland Conversion	76,637.42	65,358.90	-14.72	4,442.63	2,068.67	-53.44	541.91	565.42	4.34
5.C.	Abandonment of Managed Lands	NA	NA							
5.D.	CO_2 Emissions and Removals from Soil	-4,223.54	NE	-100.00						
5.E.	Other	NA	NA		1,106.96	1,109.81	0.26	302.08	302.27	0.06

[(1)] Includes confidential emissions of N_2O from Nitric Acid Production and CO_2 from Ammonia Production, Soda Ash production and use and Magnesia Production reported as CO_2-equivalents
These emission were previously not reported at the sectoral level but have been reported here to enable comparison with the current submissions

TABLE 8(a) RECALCULATION - RECALCULATED DATA

Recalculated year: 1994

(Sheet 2 of 2)

Australia
2003
2005

GREENHOUSE GAS SOURCE AND SINK CATEGORIES		CO_2			CH_4			N_2O		
		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)		(%)
6. Waste		**11.58**	**11.58**	**0.00**	**15,579.04**	**10,324.57**	**-33.73**	**504.91**	**502.23**	**-0.53**
6.A.	Solid Waste Disposal on Land	NE	NE		14,344.40	7,947.33	-44.60			
6.B.	Wastewater Handling				1,234.64	2,377.24	92.55	504.91	502.23	-0.53
6.C.	Waste Incineration	11.58	11.58	0.00	NE	NE		NE	NE	
6.D.	Other	NA	NA		NA	NA		NA	NA	
7. Other *(please specify)*		**NA**	**NA**		**NA**	**NA**		**NA**	**NA**	
		NA	NA		NA	NA		NA	NA	
Memo Items:										
International Bunkers		**7,365.97**	**7,361.83**	**-0.06**	**2.64**	**2.58**	**-2.03**	**66.70**	**66.96**	**0.39**
Multilateral Operations		**NE**	**NE**		**NE**	**NE**		**NE**	**NE**	
CO_2 Emissions from Biomass		**17,618.70**	**16,227.76**	**-7.89**						

GREENHOUSE GAS SOURCE AND SINK CATEGORIES		HFCs			PFCs			SF_6		
		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)		(%)
Total Actual Emissions		**936.01**	**819.19**	**-12.48**	**1,847.57**	**1,847.57**	**0.00**	**NE**	**521.02**	**100.00**
2.C.3.	Aluminium Production				1,847.57	1,847.57	0.00	NA	NA	
2.E.	Production of Halocarbons and SF_6	811.70	811.70	0.00	NO	NO		NO	NO	
2.F.	Consumption of Halocarbons and SF_6	124.31	7.49	-93.98	NE	NE		NE	521.02	100.00
	Other	NA	NA		NA	NA		NA	NA	
Potential Emissions from Consumption of HFCs/PFCs and SF_6		**NA**	**NA**		**NA**	**NA**		**NA**	**NA**	

	Previous submission	Latest submission	Difference
	CO_2 equivalent (Gg)		(%)
Total CO_2 Equivalent Emissions with Land-Use Change and Forestry	489,099.98	479,768.17	-1.91
Total CO_2 Equivalent Emissions without Land-Use Change and Forestry	433,465.68	428,958.07	-1.04

TABLE 8(a) RECALCULATION - RECALCULATED DATA

Recalculated year: 1995

(Sheet 1 of 2)

Australia
2003
2005

GREENHOUSE GAS SOURCE AND SINK CATEGORIES		CO_2			CH_4			N_2O		
		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)		(%)
Total National Emissions and Removals		**340,800.92**	**349,585.85**	**2.58**	**119,652.61**	**111,523.75**	**-6.79**	**26,289.06**	**23,918.50**	**-9.02**
1. Energy		**282,424.83**	**282,511.43**	**0.03**	**27,097.86**	**26,946.48**	**-0.56**	**3,839.76**	**3,821.86**	**-0.47**
1.A.	Fuel Combustion Activities	276,710.00	276,797.06	0.03	2,432.71	2,430.79	-0.08	3,810.33	3,792.28	-0.47
1.A.1.	Energy Industries	156,807.47	156,805.91	0.00	47.22	47.22	0.01	481.00	481.09	0.02
1.A.2.	Manufacturing Industries and Construction	39,169.22	39,134.40	-0.09	36.98	35.82	-3.12	230.41	222.41	-3.47
1.A.3.	Transport	65,366.69	65,490.09	0.19	596.85	596.08	-0.13	3,014.65	3,004.51	-0.34
1.A.4.	Other Sectors	13,961.17	13,961.21	0.00	1,750.56	1,750.56	0.00	78.25	78.25	0.00
1.A.5.	Other	1,405.45	1,405.45	0.00	1.11	1.11	0.00	6.02	6.02	0.00
1.B.	Fugitive Emissions from Fuels	5,714.83	5,714.37	-0.01	24,665.15	24,515.69	-0.61	29.42	29.58	0.53
1.B.1.	Solid fuel	NE	NE		17,480.17	17,480.17	0.00	NE	NE	
1.B.2.	Oil and Natural Gas	5,714.83	5,714.37	-0.01	7,184.98	7,035.52	-2.08	29.42	29.58	0.53
2. Industrial Processes		**21,001.25**	**23,077.74**	**9.89**	**79.78**	**79.78**	**0.00**	**24.76**	**24.76**	**0.02**
2.A.	Mineral Products	5,008.05	5,047.73	0.79	NA	NA		NA	NA	
2.B.	Chemical Industry	C	798.51	100.00	7.99	7.99	0.00	C	IE	
2.C.	Metal Production	13,586.03	13,774.00	1.38	71.79	71.79	0.00	24.76	24.76	0.02
2.D.	Other Production	NE	NE							
2.G.	Other [(1)]	2,407.17	3,457.50	43.63	NA	NA		NA	NA	
3. Solvent and Other Product Use		**NA**	**NA**					**NE**	**NE**	
4. Agriculture		**NA**	**NA**		**71,622.46**	**70,851.33**	**-1.08**	**21,150.22**	**18,763.08**	**-11.29**
4.A.	Enteric Fermentation				62,875.98	62,995.06	0.19			
4.B.	Manure Management				1,673.73	1,724.94	3.06	926.79	930.23	0.37
4.C.	Rice Cultivation				648.74	648.74	0.00			
4.D.	Agricultural Soils	NA	NA		NE	NE		15,425.05	15,446.58	0.14
4.E.	Prescribed Burning of Savannas				6,223.56	5,281.75	-15.13	4,702.32	2,290.21	-51.30
4.F.	Field Burning of Agricultural Residues				200.45	200.84	0.20	96.05	96.06	0.00
4.G.	Other				NA	NA		NA	NA	
5. Land-Use Change and Forestry (net)		**37,358.01**	**43,979.84**	**17.73**	**4,808.19**	**2,935.28**	**-38.95**	**763.28**	**801.15**	**4.96**
5.A.	Changes in Forest and Other Woody Biomass Stocks	-22,380.22	-18,212.18	-18.62						
5.B.	Forest and Grassland Conversion	63,961.77	62,192.02	-2.77	3,636.77	1,760.89	-51.58	443.61	481.30	8.49
5.C.	Abandonment of Managed Lands	NA	NA							
5.D.	CO_2 Emissions and Removals from Soil	-4,223.54	NE	-100.00						
5.E.	Other	NA	NA		1,171.42	1,174.39	0.25	319.67	319.86	0.06

[(1)] Includes confidential emissions of N_2O from Nitric Acid Production and CO_2 from Ammonia Production, Soda Ash production and use and Magnesia Production reported as CO_2-equivalents
These emission were previously not reported at the sectoral level but have been reported here to enable comparison with the current submissions

TABLE 8(a) RECALCULATION - RECALCULATED DATA

Recalculated year: 1995

(Sheet 2 of 2)

Australia
2003
2005

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	CO_2			CH_4			N_2O		
	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)		(%)
6. Waste	**16.83**	**16.83**	**0.00**	**16,044.33**	**10,710.88**	**-33.24**	**511.05**	**507.64**	**-0.67**
6.A. Solid Waste Disposal on Land	NE	NE		14,794.69	8,308.01	-43.84			
6.B. Wastewater Handling				1,249.64	2,402.87	92.28	511.05	507.64	-0.67
6.C. Waste Incineration	16.83	16.83	0.00	NE	NE		NE	NE	
6.D. Other	NA	NA		NA	NA		NA	NA	
7. Other *(please specify)*	**NA**	**NA**		**NA**	**NA**		**NA**	**NA**	
	NA	NA		NA	NA		NA	NA	
Memo Items:									
International Bunkers	**8,532.60**	**8,532.60**	**0.00**	**3.37**	**3.29**	**-2.30**	**77.15**	**77.56**	**0.54**
Multilateral Operations	**NE**	**NE**		**NE**	**NE**		**NE**	**NE**	
CO_2 Emissions from Biomass	**18,447.90**	**17,071.01**	**-7.46**						

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	HFCs			PFCs			SF_6		
	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)		(%)
Total Actual Emissions	**977.42**	**923.87**	**-5.48**	**1,309.06**	**1,309.06**	**0.00**	**NE**	**521.02**	**100.00**
2.C.3. Aluminium Production				1,309.06	1,309.06	0.00	NA	NA	
2.E. Production of Halocarbons and SF_6	718.85	718.85	0.00	NO	NO		NO	NO	
2.F. Consumption of Halocarbons and SF_6	258.57	205.02	-20.71	NE	NE		NE	521.02	100.00
Other	NA	NA		NA	NA		NA	NA	
Potential Emissions from Consumption of HFCs/PFCs and SF_6	**NA**	**NA**		**NA**	**NA**		**NA**	**NA**	

	Previous submission	Latest submission	Difference
	CO_2 equivalent (Gg)		(%)
Total CO_2 Equivalent Emissions with Land-Use Change and Forestry	489,029.07	487,782.04	-0.26
Total CO_2 Equivalent Emissions without Land-Use Change and Forestry	446,099.60	440,065.77	-1.35

TABLE 8(a) RECALCULATION - RECALCULATED DATA

Recalculated year: 1996

(Sheet 1 of 2)

Australia
2003
2005

GREENHOUSE GAS SOURCE AND SINK CATEGORIES		CO_2			CH_4			N_2O		
		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)		(%)
Total National Emissions and Removals		**346,902.13**	**355,985.62**	**2.62**	**118,539.48**	**110,302.60**	**-6.95**	**26,538.67**	**24,003.88**	**-9.55**
1. Energy		**292,173.10**	**292,261.49**	**0.03**	**26,862.10**	**26,613.26**	**-0.93**	**4,099.30**	**4,083.46**	**-0.39**
1.A.	Fuel Combustion Activities	286,922.57	287,011.70	0.03	2,394.56	2,392.82	-0.07	4,068.57	4,052.58	-0.39
1.A.1.	Energy Industries	163,334.69	163,386.78	0.03	48.18	48.34	0.32	498.83	498.86	0.01
1.A.2.	Manufacturing Industries and Construction	40,314.68	40,323.12	0.02	37.30	36.13	-3.14	232.99	223.08	-4.25
1.A.3.	Transport	67,710.68	67,739.23	0.04	618.05	617.32	-0.12	3,252.37	3,246.25	-0.19
1.A.4.	Other Sectors	14,044.93	14,044.97	0.00	1,689.81	1,689.81	0.00	77.61	77.61	0.00
1.A.5.	Other	1,517.59	1,517.59	0.00	1.22	1.22	0.00	6.77	6.77	0.00
1.B.	Fugitive Emissions from Fuels	5,250.53	5,249.79	-0.01	24,467.54	24,220.44	-1.01	30.72	30.88	0.50
1.B.1.	Solid fuel	NE	NE		17,786.50	17,786.50	0.00	NE	NE	
1.B.2.	Oil and Natural Gas	5,250.53	5,249.79	-0.01	6,681.03	6,433.94	-3.70	30.72	30.88	0.50
2. Industrial Processes		**21,261.51**	**23,513.21**	**10.59**	**81.53**	**81.53**	**0.00**	**24.63**	**24.63**	**0.03**
2.A.	Mineral Products	5,076.15	5,091.60	0.30	NA	NA		NA	NA	
2.B.	Chemical Industry	C	837.18	100.00	9.55	9.55	0.00	C	IE	
2.C.	Metal Production	13,592.48	13,953.45	2.66	71.97	71.97	0.00	24.63	24.63	0.03
2.D.	Other Production	NE	NE							
2.G.	Other [1]	2,592.87	3,630.99	40.04	NA	NA		NA	NA	
3. Solvent and Other Product Use		**NA**	**NA**					**NE**	**NE**	
4. Agriculture		**NA**	**NA**		**71,690.83**	**70,771.82**	**-1.28**	**21,170.72**	**18,595.07**	**-12.17**
4.A.	Enteric Fermentation				62,652.50	62,746.53	0.15			
4.B.	Manure Management				1,692.39	1,741.91	2.93	934.19	901.18	-3.53
4.C.	Rice Cultivation				702.28	704.74	0.35			
4.D.	Agricultural Soils	NA	NA		NE	NE		15,279.15	15,267.65	-0.08
4.E.	Prescribed Burning of Savannas				6,426.76	5,361.37	-16.58	4,855.86	2,324.73	-52.13
4.F.	Field Burning of Agricultural Residues				216.89	217.27	0.17	101.53	101.50	-0.04
4.G.	Other				NA	NA		NA	NA	
5. Land-Use Change and Forestry (net)		**33,453.99**	**40,197.40**	**20.16**	**4,554.09**	**2,880.28**	**-36.75**	**726.21**	**786.16**	**8.25**

Australia
2003
2005

TABLE 8(a) RECALCULATION - RECALCULATED DATA

Recalculated year: 1996

(Sheet 2 of 2)

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	CO_2			CH_4			N_2O		
	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)		(%)
6. Waste	**13.53**	**13.53**	**0.00**	**15,350.94**	**9,955.72**	**-35.15**	**517.81**	**514.56**	**-0.63**
6.A. Solid Waste Disposal on Land	NE	NE		14,084.77	7,520.11	-46.61			
6.B. Wastewater Handling				1,266.17	2,435.61	92.36	517.81	514.56	-0.63
6.C. Waste Incineration	13.53	13.53	0.00	NE	NE		NE	NE	
6.D. Other	NA	NA		NA	NA		NA	NA	
7. Other *(please specify)*	**NA**	**NA**		**NA**	**NA**		**NA**	**NA**	
	NA	NA		NA	NA		NA	NA	
Memo Items:									
International Bunkers	**9,030.65**	**9,030.65**	**0.00**	**3.35**	**3.24**	**-3.41**	**81.69**	**82.31**	**0.76**
Multilateral Operations	**NE**	**NE**		**NE**	**NE**		**NE**	**NE**	
CO_2 Emissions from Biomass	**18,437.02**	**17,114.32**	**-7.17**						

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	HFCs			PFCs			SF_6		
	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)		(%)
Total Actual Emissions	**602.54**	**546.17**	**-9.36**	**1,205.39**	**1,205.39**	**0.00**	**8.60**	**529.62**	**6,055.56**
2.C.3. Aluminium Production				1,205.39	1,205.39	0.00	NA	NA	
2.E. Production of Halocarbons and SF_6	NE	NO		NO	NO		NO	NO	
2.F. Consumption of Halocarbons and SF_6	602.54	546.17	-9.36	NE	NE		NE	521.02	100.00
Other	NA	NA		NA	NA		8.60	8.60	0.00
Potential Emissions from Consumption of HFCs/PFCs and SF_6	**NA**	**NA**		**NA**	**NA**		**NA**	**NA**	

	Previous submission	Latest submission	Difference
	CO_2 equivalent (Gg)		(%)
Total CO_2 Equivalent Emissions with Land-Use Change and Forestry	493,796.82	492,573.29	-0.25
Total CO_2 Equivalent Emissions without Land-Use Change and Forestry	455,062.53	448,709.45	-1.40

TABLE 8(a) RECALCULATION - RECALCULATED DATA

Recalculated year: 1997

(Sheet 1 of 2)

Australia
2003
2005

GREENHOUSE GAS SOURCE AND SINK CATEGORIES		CO_2			CH_4			N_2O		
		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)		(%)
Total National Emissions and Removals		**351,053.40**	**358,151.70**	**2.02**	**120,795.03**	**112,182.93**	**-7.13**	**28,278.71**	**25,546.56**	**-9.66**
1. Energy		**299,491.76**	**299,109.36**	**-0.13**	**27,749.41**	**27,296.99**	**-1.63**	**4,346.55**	**4,336.31**	**-0.24**
1.A.	Fuel Combustion Activities	294,443.08	294,061.74	-0.13	2,427.02	2,425.00	-0.08	4,324.97	4,314.74	-0.24
1.A.1.	Energy Industries	169,403.10	169,466.13	0.04	98.71	98.50	-0.21	531.95	531.99	0.01
1.A.2.	Manufacturing Industries and Construction	39,855.61	39,407.24	-1.13	49.52	49.30	-0.43	248.09	243.41	-1.89
1.A.3.	Transport	69,060.28	69,063.96	0.01	638.20	636.60	-0.25	3,459.89	3,454.29	-0.16
1.A.4.	Other Sectors	14,585.63	14,585.65	0.00	1,639.36	1,639.36	0.00	78.09	78.09	0.00
1.A.5.	Other	1,538.46	1,538.76	0.02	1.23	1.23	0.00	6.95	6.95	0.04
1.B.	Fugitive Emissions from Fuels	5,048.68	5,047.62	-0.02	25,322.39	24,872.00	-1.78	21.57	21.57	0.00
1.B.1.	Solid fuel	NE	NE		18,176.44	18,176.44	0.00	NE	NE	
1.B.2.	Oil and Natural Gas	5,048.68	5,047.62	-0.02	7,145.96	6,695.56	-6.30	21.57	21.57	0.00
2. Industrial Processes		**21,222.30**	**23,366.19**	**10.10**	**79.76**	**79.76**	**0.00**	**24.54**	**24.55**	**0.03**
2.A.	Mineral Products	5,008.60	5,023.59	0.30	NA	NA		NA	NA	
2.B.	Chemical Industry	C	877.27	100.00	9.03	9.03	0.00	C	IE	
2.C.	Metal Production	13,649.53	13,863.72	1.57	70.73	70.73	0.00	24.54	24.55	0.03
2.D.	Other Production	NE	NE							
2.G.	Other [1]	2,564.16	3,601.60	40.46	NA	NA		NA	NA	
3. Solvent and Other Product Use		**NA**	**NA**					**NE**	**NE**	
4. Agriculture		**NA**	**NA**		**72,770.66**	**71,748.21**	**-1.41**	**22,641.16**	**19,866.41**	**-12.26**
4.A.	Enteric Fermentation				63,154.17	63,259.13	0.17			
4.B.	Manure Management				1,763.81	1,817.58	3.05	1,034.97	1,001.61	-3.22
4.C.	Rice Cultivation				722.05	723.17	0.16			
4.D.	Agricultural Soils	NA	NA		NE	NE		16,294.45	16,282.47	-0.07
4.E.	Prescribed Burning of Savannas				6,884.31	5,701.72	-17.18	5,201.57	2,472.31	-52.47
4.F.	Field Burning of Agricultural Residues				246.32	246.61	0.12	110.17	110.01	-0.15
4.G.	Other				NA	NA		NA	NA	
5. Land-Use Change and Forestry (net)		**30,322.40**	**35,659.21**	**17.60**	**4,613.37**	**2,925.27**	**-36.59**	**742.80**	**798.40**	**7.49**
5.A.	Changes in Forest and Other Woody Biomass Stocks	-22,514.92	-19,856.09	-11.81						
5.B.	Forest and Grassland Conversion	57,060.86	55,515.30	-2.71	3,420.22	1,729.93	-49.42	417.20	472.83	13.34
5.C.	Abandonment of Managed Lands	NA	NA							
5.D.	CO_2 Emissions and Removals from Soil	-4,223.54	NE	-100.00						
5.E.	Other	NA	NA		1,193.15	1,195.34	0.18	325.60	325.56	-0.01

[1] Includes confidential emissions of N_2O from Nitric Acid Production and CO_2 from Ammonia Production, Soda Ash production and use and Magnesia Production reported as CO_2-equivalents
These emission were previously not reported at the sectoral level but have been reported here to enable comparison with the current submissions

TABLE 8(a) RECALCULATION - RECALCULATED DATA

Recalculated year: 1997

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Australia
2003
2005

GREENHOUSE GAS SOURCE AND SINK CATEGORIES		CO_2			CH_4			N_2O		
		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)		(%)
6. Waste		**16.94**	**16.94**	**0.00**	**15,581.83**	**10,132.70**	**-34.97**	**523.66**	**520.90**	**-0.53**
6.A.	Solid Waste Disposal on Land	NE	NE		14,301.35	7,667.07	-46.39			
6.B.	Wastewater Handling				1,280.48	2,465.63	92.55	523.66	520.90	-0.53
6.C.	Waste Incineration	16.94	16.94	0.00	NE	NE		NE	NE	
6.D.	Other	NA	NA		NA	NA		NA	NA	
7. Other *(please specify)*		**NA**	**NA**		**NA**	**NA**		**NA**	**NA**	
		NA	NA		NA	NA		NA	NA	
Memo Items:										
International Bunkers		**9,020.41**	**9,059.30**	**0.43**	**3.29**	**3.15**	**-4.33**	**81.71**	**82.83**	**1.38**
Multilateral Operations		**NE**	**NE**		**NE**	**NE**		**NE**	**NE**	
CO_2 Emissions from Biomass		**20,275.50**	**18,998.78**	**-6.30**						

GREENHOUSE GAS SOURCE AND SINK CATEGORIES		HFCs			PFCs			SF_6		
		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)		(%)
Total Actual Emissions		**907.09**	**1,026.48**	**13.16**	**1,050.67**	**1,050.67**	**0.00**	**5.98**	**527.00**	**8,720.00**
2.C.3.	Aluminium Production				1,050.67	1,050.67	0.00	NA	NA	
2.E.	Production of Halocarbons and SF_6	NE	NO		NO	NO		NO	NO	
2.F.	Consumption of Halocarbons and SF_6	907.09	1,026.48	13.16	NE	NE		NE	521.02	100.00
	Other	NA	NA		NA	NA		5.98	5.98	0.00
Potential Emissions from Consumption of HFCs/PFCs and SF_6		**NA**	**NA**		**NA**	**NA**		**NA**	**NA**	

	Previous submission	Latest submission	Difference
	CO_2 equivalent (Gg)		(%)
Total CO_2 Equivalent Emissions with Land-Use Change and Forestry	502,090.88	498,485.33	-0.72
Total CO_2 Equivalent Emissions without Land-Use Change and Forestry	466,412.31	459,102.45	-1.57

TABLE 8(a) RECALCULATION - RECALCULATED DATA

Recalculated year: 1998

(Sheet 1 of 2)

Australia
2003
2005

GREENHOUSE GAS SOURCE AND SINK CATEGORIES		CO_2			CH_4			N_2O		
		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)		(%)
Total National Emissions and Removals		**375,537.77**	**387,989.29**	**3.32**	**122,493.74**	**113,784.07**	**-7.11**	**29,603.87**	**26,895.55**	**-9.15**
1. Energy		**315,517.98**	**315,606.46**	**0.03**	**29,505.84**	**28,882.41**	**-2.11**	**4,650.80**	**4,661.84**	**0.24**
1.A.	Fuel Combustion Activities	310,229.01	310,318.95	0.03	2,332.77	2,335.75	0.13	4,617.59	4,628.47	0.24
1.A.1.	Energy Industries	184,779.29	184,861.38	0.04	105.73	106.00	0.26	594.69	594.75	0.01
1.A.2.	Manufacturing Industries and Construction	40,222.52	40,223.79	0.00	51.12	50.87	-0.49	252.13	247.54	-1.82
1.A.3.	Transport	69,122.80	69,129.34	0.01	655.89	658.86	0.45	3,688.58	3,703.99	0.42
1.A.4.	Other Sectors	14,785.31	14,785.34	0.00	1,518.83	1,518.83	0.00	75.87	75.87	0.00
1.A.5.	Other	1,319.08	1,319.10	0.00	1.19	1.19	0.00	6.31	6.31	0.00
1.B.	Fugitive Emissions from Fuels	5,288.97	5,287.51	-0.03	27,173.08	26,546.66	-2.31	33.21	33.37	0.47
1.B.1.	Solid fuel	NE	NE		20,048.78	20,048.78	0.00	NE	NE	
1.B.2.	Oil and Natural Gas	5,288.97	5,287.51	-0.03	7,124.30	6,497.88	-8.79	33.21	33.37	0.47
2. Industrial Processes		**21,724.80**	**24,092.05**	**10.90**	**83.07**	**83.07**	**0.00**	**23.62**	**23.63**	**0.03**
2.A.	Mineral Products	5,433.39	5,438.55	0.09	NA	NA		NA	NA	
2.B.	Chemical Industry	C	1,082.03	100.00	7.37	7.37	0.00	C	IE	
2.C.	Metal Production	13,506.97	13,770.70	1.95	75.70	75.70	0.00	23.62	23.63	0.03
2.D.	Other Production	NE	NE							
2.G.	Other [(1)]	2,784.44	3,800.76	36.50	NA	NA		NA	NA	
3. Solvent and Other Product Use		**NA**	**NA**					**NE**	**NE**	
4. Agriculture		**NA**	**NA**		**73,040.15**	**71,953.22**	**-1.49**	**23,677.71**	**20,880.38**	**-11.81**
4.A.	Enteric Fermentation				63,234.89	63,234.89	0.00			
4.B.	Manure Management				1,848.37	1,893.83	2.46	1,125.94	1,084.88	-3.65
4.C.	Rice Cultivation				724.47	724.59	0.02			
4.D.	Agricultural Soils	NA	NA		NE	NE		17,169.47	17,150.11	-0.11
4.E.	Prescribed Burning of Savannas				6,974.27	5,841.72	-16.24	5,269.54	2,533.02	-51.93
4.F.	Field Burning of Agricultural Residues				258.15	258.18	0.01	112.76	112.38	-0.34
4.G.	Other				NA	NA		NA	NA	
5. Land-Use Change and Forestry (net)		**38,277.86**	**48,273.66**	**26.11**	**4,458.75**	**2,943.79**	**-33.98**	**722.62**	**803.47**	**11.19**
5.A.	Changes in Forest and Other Woody Biomass Stocks	-22,706.31	-20,808.86	-8.36						
5.B.	Forest and Grassland Conversion	65,207.71	69,082.52	5.94	3,274.31	1,757.80	-46.32	399.40	480.45	20.29
5.C.	Abandonment of Managed Lands	NA	NA							
5.D.	CO_2 Emissions and Removals from Soil	-4,223.54	NE	-100.00						
5.E.	Other	NA	NA		1,184.44	1,185.99	0.13	323.22	323.02	-0.06

[(1)] Includes confidential emissions of N_2O from Nitric Acid Production and CO_2 from Ammonia Production, Soda Ash production and use and Magnesia Production reported as CO_2-equivalents
These emission were previously not reported at the sectoral level but have been reported here to enable comparison with the current submissions

TABLE 8(a) RECALCULATION - RECALCULATED DATA

Recalculated year: 1998

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Australia
2003
2005

GREENHOUSE GAS SOURCE AND SINK CATEGORIES		CO_2			CH_4			N_2O		
		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)		(%)
6. Waste		**17.13**	**17.13**	**0.00**	**15,405.93**	**9,921.59**	**-35.60**	**529.12**	**526.24**	**-0.54**
6.A.	Solid Waste Disposal on Land	NE	NE		14,112.10	7,430.69	-47.35			
6.B.	Wastewater Handling				1,293.83	2,490.90	92.52	529.12	526.24	-0.54
6.C.	Waste Incineration	17.13	17.13	0.00	NE	NE		NE	NE	
6.D.	Other	NA	NA		NA	NA		NA	NA	
7. Other *(please specify)*		**NA**	**NA**		**NA**	**NA**		**NA**	**NA**	
		NA	NA		NA	NA		NA	NA	
Memo Items:										
International Bunkers		**9,473.01**	**9,449.69**	**-0.25**	**2.98**	**2.81**	**-5.89**	**86.32**	**86.92**	**0.70**
Multilateral Operations		**NE**	**NE**		**NE**	**NE**		**NE**	**NE**	
CO_2 Emissions from Biomass		**20,492.97**	**19,321.49**	**-5.72**						

GREENHOUSE GAS SOURCE AND SINK CATEGORIES		HFCs			PFCs			SF_6		
		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)		(%)
Total Actual Emissions		**1,311.25**	**1,622.81**	**23.76**	**1,396.99**	**1,396.99**	**0.00**	**3.66**	**524.68**	**14,248.37**
2.C.3.	Aluminium Production				1,396.99	1,396.99	0.00	NA	NA	
2.E.	Production of Halocarbons and SF_6	NE	NO		NO	NO		NO	NO	
2.F.	Consumption of Halocarbons and SF_6	1,311.25	1,622.81	23.76	NE	NE		NE	521.02	100.00
	Other	NA	NA		NA	NA		3.66	3.66	0.00
Potential Emissions from Consumption of HFCs/PFCs and SF_6		**NA**	**NA**		**NA**	**NA**		**NA**	**NA**	

	Previous submission	Latest submission	Difference
	CO_2 equivalent (Gg)		(%)
Total CO_2 Equivalent Emissions with Land-Use Change and Forestry	530,347.28	532,213.39	0.35
Total CO_2 Equivalent Emissions without Land-Use Change and Forestry	486,888.05	480,192.47	-1.38

TABLE 8(a) RECALCULATION - RECALCULATED DATA

Recalculated year: 1999

(Sheet 1 of 2)

Australia
2003
2005

GREENHOUSE GAS SOURCE AND SINK CATEGORIES		CO_2			CH_4			N_2O		
		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)		(%)
Total National Emissions and Removals		**372,258.66**	**388,823.09**	**4.45**	**121,901.38**	**113,000.29**	**-7.30**	**31,396.73**	**28,476.25**	**-9.30**
1. Energy		**324,580.67**	**324,728.21**	**0.05**	**27,274.46**	**26,594.57**	**-2.49**	**4,922.08**	**4,934.75**	**0.26**
1.A.	Fuel Combustion Activities	318,846.67	318,995.66	0.05	2,277.90	2,230.76	-2.07	4,899.34	4,912.01	0.26
1.A.1.	Energy Industries	189,112.04	189,208.33	0.05	156.89	107.80	-31.29	605.04	604.80	-0.04
1.A.2.	Manufacturing Industries and Construction	43,600.70	43,597.54	-0.01	51.12	50.69	-0.85	255.31	250.34	-1.95
1.A.3.	Transport	69,969.79	70,015.95	0.07	663.23	665.62	0.36	3,959.26	3,977.15	0.45
1.A.4.	Other Sectors	14,931.69	14,941.39	0.06	1,405.56	1,405.55	0.00	74.04	74.04	0.00
1.A.5.	Other	1,232.45	1,232.46	0.00	1.10	1.10	0.00	5.68	5.68	0.00
1.B.	Fugitive Emissions from Fuels	5,734.00	5,732.55	-0.03	24,996.56	24,363.81	-2.53	22.74	22.74	0.00
1.B.1.	Solid fuel	NE	NE		18,969.85	18,969.85	0.00	NE	NE	
1.B.2.	Oil and Natural Gas	5,734.00	5,732.55	-0.03	6,026.71	5,393.96	-10.50	22.74	22.74	0.00
2. Industrial Processes		**22,214.82**	**24,209.15**	**8.98**	**77.74**	**77.74**	**0.00**	**24.77**	**24.77**	**0.02**
2.A.	Mineral Products	5,355.99	5,353.54	-0.05	NA	NA		NA	NA	
2.B.	Chemical Industry	C	777.81	100.00	7.19	7.19	0.00	C	IE	
2.C.	Metal Production	14,192.74	14,396.98	1.44	70.56	70.56	0.00	24.77	24.77	0.02
2.D.	Other Production	NE	NE							
2.G.	Other [(1)]	2,666.08	3,680.81	38.06	NA	NA		NA	NA	
3. Solvent and Other Product Use		**NA**	**NA**					**NE**	**NE**	
4. Agriculture		**NA**	**NA**		**74,318.94**	**73,115.29**	**-1.62**	**25,217.24**	**22,202.48**	**-11.96**
4.A.	Enteric Fermentation				64,020.92	64,024.23	0.01			
4.B.	Manure Management				1,892.35	1,945.68	2.82	1,281.37	1,240.25	-3.21
4.C.	Rice Cultivation				670.72	670.74	0.00			
4.D.	Agricultural Soils	NA	NA		NE	NE		18,174.45	18,155.68	-0.10
4.E.	Prescribed Burning of Savannas				7,479.37	6,218.91	-16.85	5,651.18	2,696.57	-52.28
4.F.	Field Burning of Agricultural Residues				255.57	255.74	0.06	110.24	109.98	-0.24
4.G.	Other				NA	NA		NA	NA	
5. Land-Use Change and Forestry (net)		**25,445.69**	**39,868.25**	**56.68**	**4,330.25**	**2,865.81**	**-33.82**	**697.45**	**782.21**	**12.15**
5.A.	Changes in Forest and Other Woody Biomass Stocks	-23,298.37	-15,745.54	-32.42						
5.B.	Forest and Grassland Conversion	52,967.60	55,613.79	5.00	3,208.77	1,740.92	-45.75	391.41	475.84	21.57
5.C.	Abandonment of Managed Lands	NA	NA							
5.D.	CO_2 Emissions and Removals from Soil	-4,223.54	NE	-100.00						
5.E.	Other	NA	NA		1,121.48	1,124.89	0.30	306.04	306.38	0.11

[(1)] Includes confidential emissions of N_2O from Nitric Acid Production and CO_2 from Ammonia Production, Soda Ash production and use and Magnesia Production reported as CO_2-equivalents
These emission were previously not reported at the sectoral level but have been reported here to enable comparison with the current submissions

TABLE 8(a) RECALCULATION - RECALCULATED DATA

Recalculated year: 1999

(Sheet 2 of 2)

Australia
2003
2005

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	CO_2 Previous submission	CO_2 Latest submission	CO_2 Difference	CH_4 Previous submission	CH_4 Latest submission	CH_4 Difference	N_2O Previous submission	N_2O Latest submission	N_2O Difference
	CO_2 equivalent (Gg)		(%)	CO_2 equivalent (Gg)		(%)	CO_2 equivalent (Gg)		(%)
6. Waste	**17.49**	**17.49**	**0.00**	**15,899.99**	**10,346.88**	**-34.93**	**535.20**	**532.04**	**-0.59**
6.A. Solid Waste Disposal on Land	NE	NE		14,591.29	7,828.52	-46.35			
6.B. Wastewater Handling				1,308.69	2,518.36	92.43	535.20	532.04	-0.59
6.C. Waste Incineration	17.49	17.49	0.00	NE	NE		NE	NE	
6.D. Other	NA	NA		NA	NA		NA	NA	
7. Other *(please specify)*	**NA**	**NA**		**NA**	**NA**		**NA**	**NA**	
	NA	NA		NA	NA		NA	NA	
Memo Items:									
International Bunkers	**9,752.78**	**9,718.28**	**-0.35**	**3.11**	**3.05**	**-1.89**	**88.74**	**88.35**	**-0.44**
Multilateral Operations	**NE**	**NE**		**NE**	**NE**		**NE**	**NE**	
CO_2 Emissions from Biomass	**20,145.07**	**19,580.00**	**-2.80**						

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	HFCs Previous submission	HFCs Latest submission	HFCs Difference	PFCs Previous submission	PFCs Latest submission	PFCs Difference	SF_6 Previous submission	SF_6 Latest submission	SF_6 Difference
	CO_2 equivalent (Gg)		(%)	CO_2 equivalent (Gg)		(%)	CO_2 equivalent (Gg)		(%)
Total Actual Emissions	**1,694.44**	**2,185.74**	**28.99**	**981.99**	**981.99**	**0.00**	**3.59**	**524.61**	**14,533.33**
2.C.3. Aluminium Production				981.99	981.99	0.00	NA	NA	
2.E. Production of Halocarbons and SF_6	NE	NO		NO	NO		NO	NO	
2.F. Consumption of Halocarbons and SF_6	1,694.44	2,185.74	28.99	NE	NE		NE	521.02	100.00
Other	NA	NA		NA	NA		3.59	3.59	0.00
Potential Emissions from Consumption of HFCs/PFCs and SF_6	**NA**	**NA**		**NA**	**NA**		**NA**	**NA**	

	Previous submission	Latest submission	Difference[1]
	CO_2 equivalent (Gg)		(%)
Total CO_2 Equivalent Emissions with Land-Use Change and Forestry	528,236.79	533,991.97	1.09
Total CO_2 Equivalent Emissions without Land-Use Change and Forestry	497,763.41	490,475.70	-1.46

TABLE 8(a) RECALCULATION - RECALCULATED DATA

Recalculated year: 2000

(Sheet 1 of 2)

Australia
2003
2005

GREENHOUSE GAS SOURCE AND SINK CATEGORIES		CO_2			CH_4			N_2O		
		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)		(%)
Total National Emissions and Removals		**368,417.75**	**395,148.56**	**7.26**	**124,517.38**	**115,625.86**	**-7.14**	**33,492.63**	**30,135.90**	**-10.02**
1. Energy		**330,222.67**	**329,368.25**	**-0.26**	**28,581.06**	**27,685.09**	**-3.13**	**5,205.58**	**5,220.19**	**0.28**
1.A.	Fuel Combustion Activities	323,734.22	322,882.35	-0.26	2,207.11	2,209.66	0.12	5,178.97	5,193.57	0.28
1.A.1.	Energy Industries	192,390.72	192,527.49	0.07	192.64	193.09	0.24	611.79	611.87	0.01
1.A.2.	Manufacturing Industries and Construction	42,588.54	41,590.84	-2.34	51.61	51.49	-0.23	246.13	242.72	-1.38
1.A.3.	Transport	72,095.17	72,095.22	0.00	663.26	665.48	0.33	4,242.46	4,260.38	0.42
1.A.4.	Other Sectors	15,383.96	15,392.97	0.06	1,298.50	1,298.50	0.00	72.78	72.78	0.00
1.A.5.	Other	1,275.82	1,275.82	0.00	1.10	1.10	0.00	5.82	5.82	0.00
1.B.	Fugitive Emissions from Fuels	6,488.46	6,485.90	-0.04	26,373.96	25,475.43	-3.41	26.61	26.61	0.00
1.B.1.	Solid fuel	NE	NE		19,638.07	19,638.07	0.00	NE	NE	
1.B.2.	Oil and Natural Gas	6,488.46	6,485.90	-0.04	6,735.88	5,837.36	-13.34	26.61	26.61	0.00
2. Industrial Processes		**21,506.98**	**23,698.80**	**10.19**	**70.01**	**70.01**	**0.00**	**22.87**	**22.88**	**0.03**
2.A.	Mineral Products	5,150.78	5,155.38	0.09	NA	NA		NA	NA	
2.B.	Chemical Industry	C	888.02	100.00	9.21	9.21	0.00	C	IE	
2.C.	Metal Production	13,591.08	13,761.22	1.25	60.80	60.80	0.00	22.87	22.88	0.03
2.D.	Other Production	NE	NE							
2.G.	Other [(1)]	2,765.12	3,894.19	40.83	NA	NA		NA	NA	
3. Solvent and Other Product Use		**NA**	**NA**					**NE**	**NE**	
4. Agriculture		**NA**	**NA**		**75,969.07**	**74,595.80**	**-1.81**	**27,118.54**	**23,602.99**	**-12.96**
4.A.	Enteric Fermentation				64,316.79	64,356.06	0.06			
4.B.	Manure Management				1,915.91	1,976.88	3.18	1,361.01	1,314.40	-3.42
4.C.	Rice Cultivation				741.34	741.36	0.00			
4.D.	Agricultural Soils	NA	NA		NE	NE		19,048.48	19,030.14	-0.10
4.E.	Prescribed Burning of Savannas				8,732.17	7,258.26	-16.88	6,597.76	3,147.24	-52.30
4.F.	Field Burning of Agricultural Residues				262.85	263.24	0.15	111.29	111.20	-0.08
4.G.	Other				NA	NA		NA	NA	
5. Land-Use Change and Forestry (net)		**16,671.80**	**42,065.20**	**152.31**	**3,763.39**	**2,752.78**	**-26.85**	**604.02**	**751.47**	**24.41**
5.A.	Changes in Forest and Other Woody Biomass Stocks	-23,219.88	-15,214.05	-34.48						
5.B.	Forest and Grassland Conversion	44,115.21	57,279.25	29.84	2,802.83	1,787.41	-36.23	341.89	488.55	42.90
5.C.	Abandonment of Managed Lands	NA	NA							
5.D.	CO_2 Emissions and Removals from Soil	-4,223.54	NE	-100.00						
5.E.	Other	NA	NA		960.56	965.37	0.50	262.13	262.93	0.31

[(1)] Includes confidential emissions of N_2O from Nitric Acid Production and CO_2 from Ammonia Production, Soda Ash production and use and Magnesia Production reported as CO_2-equivalents
These emission were previously not reported at the sectoral level but have been reported here to enable comparison with the current submissions

TABLE 8(a) RECALCULATION - RECALCULATED DATA

Recalculated year: 2000

(Sheet 2 of 2)

Australia
2003
2005

GREENHOUSE GAS SOURCE AND SINK CATEGORIES		CO_2			CH_4			N_2O		
		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)		(%)
6. Waste		**16.30**	**16.30**	**0.00**	**16,133.84**	**10,522.17**	**-34.78**	**541.62**	**538.37**	**-0.60**
6.A.	Solid Waste Disposal on Land	NE	NE		14,809.45	7,973.82	-46.16			
6.B.	Wastewater Handling				1,324.39	2,548.35	92.42	541.62	538.37	-0.60
6.C.	Waste Incineration	16.30	16.30	0.00	NE	NE		NE	NE	
6.D.	Other	NA	NA		NA	NA		NA	NA	
7. Other *(please specify)*		**NA**	**NA**		**NA**	**NA**		**NA**	**NA**	
		NA	NA		NA	NA		NA	NA	
Memo Items:										
International Bunkers		**10,099.67**	**10,099.67**	**0.00**	**3.36**	**3.38**	**0.78**	**91.69**	**91.54**	**-0.16**
Multilateral Operations		**NE**	**NE**		**NE**	**NE**		**NE**	**NE**	
CO_2 Emissions from Biomass		**20,146.07**	**19,263.31**	**-4.38**						

GREENHOUSE GAS SOURCE AND SINK CATEGORIES		HFCs			PFCs			SF_6		
		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)		(%)
Total Actual Emissions		**2,084.83**	**2,716.33**	**30.29**	**1,103.21**	**1,103.21**	**0.00**	**2.39**	**523.41**	**21,800.00**
2.C.3.	Aluminium Production				1,103.21	1,103.21	0.00	NA	NA	
2.E.	Production of Halocarbons and SF_6	NE	NO		NO	NO		NO	NO	
2.F.	Consumption of Halocarbons and SF_6	2,084.83	2,716.33	30.29	NE	NE		NE	521.02	100.00
	Other	NA	NA		NA	NA		2.39	2.39	0.00
Potential Emissions from Consumption of HFCs/PFCs and SF_6		**NA**	**NA**		**NA**	**NA**		**NA**	**NA**	

	Previous submission	Latest submission	Difference
	CO_2 equivalent (Gg)		(%)
Total CO_2 Equivalent Emissions with Land-Use Change and Forestry	529,618.19	545,253.26	2.95
Total CO_2 Equivalent Emissions without Land-Use Change and Forestry	508,578.98	499,683.81	-1.75

TABLE 8(a) RECALCULATION - RECALCULATED DATA

Recalculated year: 2001

(Sheet 1 of 2)

Australia
2003
2005

GREENHOUSE GAS SOURCE AND SINK CATEGORIES		CO_2			CH_4			N_2O		
		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)		(%)
Total National Emissions and Removals		**364,687.18**	**397,546.96**	**9.01**	**124,553.10**	**115,821.90**	**-7.01**	**34,522.76**	**30,969.05**	**-10.29**
1. Energy		**335,381.45**	**336,310.48**	**0.28**	**27,327.30**	**26,359.35**	**-3.54**	**5,323.38**	**5,340.94**	**0.33**
1.A.	Fuel Combustion Activities	328,457.69	329,389.08	0.28	2,069.29	2,055.01	-0.69	5,294.44	5,312.00	0.33
1.A.1.	Energy Industries	197,223.59	198,354.42	0.57	190.05	191.28	0.65	624.87	628.75	0.62
1.A.2.	Manufacturing Industries and Construction	42,034.59	42,035.99	0.00	48.74	48.32	-0.86	230.24	225.70	-1.97
1.A.3.	Transport	72,260.40	72,052.04	-0.29	633.78	618.70	-2.38	4,362.16	4,380.38	0.42
1.A.4.	Other Sectors	15,585.94	15,593.57	0.05	1,195.62	1,195.62	0.00	70.96	70.96	0.00
1.A.5.	Other	1,353.17	1,353.07	-0.01	1.10	1.09	-0.56	6.21	6.21	0.01
1.B.	Fugitive Emissions from Fuels	6,923.76	6,921.39	-0.03	25,258.01	24,304.34	-3.78	28.94	28.94	0.00
1.B.1.	Solid fuel	NE	NE		18,445.52	18,445.52	0.00	NE	NE	
1.B.2.	Oil and Natural Gas	6,923.76	6,921.39	-0.03	6,812.50	5,858.82	-14.00	28.94	28.94	0.00
2. Industrial Processes		**21,742.04**	**24,305.76**	**11.79**	**65.20**	**65.20**	**0.00**	**20.43**	**20.44**	**0.05**
2.A.	Mineral Products	5,157.40	5,146.66	-0.21	NA	NA		NA	NA	
2.B.	Chemical Industry	C	1,017.98	100.00	7.29	7.29	0.00	C	IE	
2.C.	Metal Production	13,107.52	13,331.54	1.71	57.91	57.91	0.00	20.43	20.44	0.05
2.D.	Other Production	NE	NE							
2.G.	Other [1]	3,477.12	4,809.58	38.32	NA	NA		NA	NA	
3. Solvent and Other Product Use		**NA**	**NA**					**NE**	**NE**	
4. Agriculture		**NA**	**NA**		**77,192.89**	**75,815.43**	**-1.78**	**28,057.66**	**24,298.89**	**-13.40**
4.A.	Enteric Fermentation				64,721.56	64,811.65	0.14			
4.B.	Manure Management				1,959.42	2,028.03	3.50	1,369.94	1,319.19	-3.70
4.C.	Rice Cultivation				737.82	737.83	0.00			
4.D.	Agricultural Soils	NA	NA		NE	NE		19,394.07	19,412.31	0.09
4.E.	Prescribed Burning of Savannas				9,504.24	7,967.43	-16.17	7,181.11	3,454.75	-51.89
4.F.	Field Burning of Agricultural Residues				269.85	270.48	0.24	112.54	112.65	0.09
4.G.	Other				NA	NA		NA	NA	
5. Land-Use Change and Forestry (net)		**7,547.39**	**36,914.41**	**389.10**	**3,479.19**	**2,798.12**	**-19.58**	**572.32**	**763.78**	**33.45**
5.A.	Changes in Forest and Other Woody Biomass Stocks	-22,441.59	-14,223.89	-36.62						
5.B.	Forest and Grassland Conversion	34,212.53	51,138.31	49.47	2,498.95	1,747.73	-30.06	304.82	477.70	56.71
5.C.	Abandonment of Managed Lands	NA	NA							
5.D.	CO_2 Emissions and Removals from Soil	-4,223.54	NE	-100.00						
5.E.	Other	NA	NA		980.24	1,050.39	7.16	267.50	286.08	6.95

[1] Includes confidential emissions of N_2O from Nitric Acid Production and CO_2 from Ammonia Production, Soda Ash production and use and Magnesia Production reported as CO_2-equivalents
These emission were previously not reported at the sectoral level but have been reported here to enable comparison with the current submissions

TABLE 8(a) RECALCULATION - RECALCULATED DATA

Recalculated year: 2001

(Sheet 2 of 2)

Australia
2003
2005

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	CO_2			CH_4			N_2O		
	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)		(%)
6. Waste	**16.30**	**16.30**	**0.00**	**16,488.52**	**10,783.80**	**-34.60**	**548.97**	**545.00**	**-0.72**
6.A. Solid Waste Disposal on Land	NE	NE		15,146.15	8,204.09	-45.83			
6.B. Wastewater Handling				1,342.37	2,579.71	92.18	548.97	545.00	-0.72
6.C. Waste Incineration	16.30	16.30	0.00	NE	NE		NE	NE	
6.D. Other	NA	NA		NA	NA		NA	NA	
7. Other *(please specify)*	**NA**	**NA**		**NA**	**NA**		**NA**	**NA**	
	NA	NA		NA	NA		NA	NA	
Memo Items:									
International Bunkers	**10,625.28**	**10,625.28**	**0.00**	**3.14**	**3.10**	**-1.32**	**96.99**	**97.19**	**0.21**
Multilateral Operations	**NE**	**NE**		**NE**	**NE**		**NE**	**NE**	
CO_2 Emissions from Biomass	**20,147.07**	**18,254.75**	**-9.39**						

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	HFCs			PFCs			SF_6		
	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)		(%)
Total Actual Emissions	**2,344.90**	**3,257.79**	**38.93**	**1,555.97**	**1,555.97**	**0.00**	**0.00**	**521.02**	**100.00**
2.C.3. Aluminium Production				1,555.97	1,555.97	0.00	NA	NA	
2.E. Production of Halocarbons and SF_6	NE	NO		NO		100.00	NO	NO	
2.F. Consumption of Halocarbons and SF_6	2,344.90	3,257.79	38.93	NE		100.00	NE	521.02	100.00
Other	NA	NA		NA		100.00	NE	NE	
Potential Emissions from Consumption of HFCs/PFCs and SF_6	**NA**	**NA**		**NA**	**NA**		**NA**	**NA**	

	Previous submission	Latest submission	Difference
	CO_2 equivalent (Gg)		(%)
Total CO_2 Equivalent Emissions with Land-Use Change and Forestry	527,663.89	549,672.69	4.17
Total CO_2 Equivalent Emissions without Land-Use Change and Forestry	516,064.99	509,196.37	-1.33

TABLE 8(a) RECALCULATION - RECALCULATED DATA

Recalculated year: 2002

(Sheet 1 of 2)

Australia
2003
2005

GREENHOUSE GAS SOURCE AND SINK CATEGORIES		CO2 Previous submission	CO2 Latest submission	CO2 Difference	CH4 Previous submission	CH4 Latest submission	CH4 Difference	N2O Previous submission	N2O Latest submission	N2O Difference
		CO_2 equivalent (Gg)		(%)	CO_2 equivalent (Gg)		(%)	CO_2 equivalent (Gg)		(%)
Total National Emissions and Removals		**375,316.96**	**404,438.62**	**7.76**	**124,286.16**	**113,716.89**	**-8.50**	**35,300.40**	**31,573.11**	**-10.56**
1. Energy		**340,141.90**	**339,668.02**	**-0.14**	**25,786.11**	**24,574.19**	**-4.70**	**5,422.25**	**5,827.28**	**7.47**
1.A.	Fuel Combustion Activities	333,679.70	333,208.63	-0.14	2,078.79	1,882.94	-9.42	5,396.26	5,801.29	7.51
1.A.1.	Energy Industries	198,870.90	202,001.04	1.57	192.85	218.07	13.08	627.02	632.45	0.87
1.A.2.	Manufacturing Industries and Construction	43,248.67	39,364.06	-8.98	48.13	41.78	-13.20	223.69	201.58	-9.89
1.A.3.	Transport	74,086.56	73,520.69	-0.76	656.31	653.74	-0.39	4,467.02	4,895.15	9.58
1.A.4.	Other Sectors	16,042.85	16,983.78	5.87	1,180.29	968.24	-17.97	71.70	66.01	-7.94
1.A.5.	Other	1,430.71	1,339.07	-6.41	1.21	1.12	-7.83	6.83	6.10	-10.70
1.B.	Fugitive Emissions from Fuels	6,462.20	6,459.38	-0.04	23,707.32	22,691.25	-4.29	25.99	25.99	0.00
1.B.1.	Solid fuel	NE	NE		17,456.28	17,456.28	0.00	NE	NE	
1.B.2.	Oil and Natural Gas	6,462.20	6,459.38	-0.04	6,251.04	5,234.97	-16.25	25.99	25.99	0.00
2. Industrial Processes		**22,045.57**	**24,125.76**	**9.44**	**64.71**	**64.58**	**-0.20**	**20.27**	**18.83**	**-7.12**
2.A.	Mineral Products	5,179.52	5,215.57	0.70	NA	NA		NA	NA	
2.B.	Chemical Industry	C	935.85	100.00	7.65	7.65	0.00	C	IE	
2.C.	Metal Production	13,117.61	12,737.94	-2.89	57.05	56.92	-0.23	20.27	18.83	-7.12
2.D.	Other Production	NE	NE							
2.G.	Other [(1)]	3,748.43	5,236.40	39.70	NA	NA		NA	NA	
3. Solvent and Other Product Use		**NA**	**NA**					**NE**	**NE**	
4. Agriculture		**NA**	**NA**		**77,115.28**	**74,401.80**	**-3.52**	**28,528.50**	**24,210.05**	**-15.14**
4.A.	Enteric Fermentation				64,229.55	63,298.87	-1.45			
4.B.	Manure Management				2,005.79	2,045.37	1.97	1,375.81	1,316.48	-4.31
4.C.	Rice Cultivation				590.57	589.29	-0.22			
4.D.	Agricultural Soils	NA	NA		NE	NE		19,471.15	19,223.66	-1.27
4.E.	Prescribed Burning of Savannas				10,015.40	8,239.36	-17.73	7,567.32	3,572.66	-52.79
4.F.	Field Burning of Agricultural Residues	NA			273.96	228.91	-16.44	114.22	97.26	-14.85
4.G.	Other				NA	NA		NA	NA	
5. Land-Use Change and Forestry (net)		**13,113.19**	**40,628.55**	**209.83**	**4,302.11**	**3,535.96**	**-17.81**	**773.96**	**964.69**	**24.64**
5.A.	Changes in Forest and Other Woody Biomass Stocks	-21,827.14	-17,781.78	-18.53						
5.B.	Forest and Grassland Conversion	39,163.87	58,410.33	49.14	2,650.89	1,689.13	-36.28	323.36	461.68	42.78
5.C.	Abandonment of Managed Lands	NA	NA							
5.D.	CO_2 Emissions and Removals from Soil	-4,223.54	NE	-100.00						
5.E.	Other	NA	NA		1,651.22	1,846.83	11.85	450.60	503.00	11.63

[(1)] Includes confidential emissions of N_2O from Nitric Acid Production and CO_2 from Ammonia Production, Soda Ash production and use and Magnesia Production reported as CO_2-equivalents
These emission were previously not reported at the sectoral level but have been reported here to enable comparison with the current submissions

TABLE 8(a) RECALCULATION - RECALCULATED DATA

Recalculated year: 2002

(Sheet 2 of 2)

Australia
2003
2005

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	CO_2			CH_4			N_2O		
	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)		(%)
6. Waste	**16.30**	**16.30**	**0.00**	**17,017.95**	**11,140.36**	**-34.54**	**555.42**	**552.26**	**-0.57**
6.A. Solid Waste Disposal on Land	NE	NE		15,659.82	8,526.30	-45.55			
6.B. Wastewater Handling	NA			1,358.13	2,614.06	92.47	555.42	552.26	-0.57
6.C. Waste Incineration	16.30	16.30	0.00	NE	NE		NE	NE	
6.D. Other	NA	NA		NA	NA		NA	NA	
7. Other *(please specify)*	**NA**	**NA**		**NA**	**NA**		**NA**	**NA**	
	NA	NA		NA	NA		NA	NA	
Memo Items:									
International Bunkers	**11,100.74**	**8,603.39**	**-22.50**	**2.73**	**2.89**	**5.60**	**103.48**	**77.93**	**-24.68**
Multilateral Operations	**NE**	**NE**		**NE**	**NE**		**NE**	**NE**	
CO_2 Emissions from Biomass	**17,600.23**	**15,465.63**	**-12.13**						

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	HFCs			PFCs			SF_6		
	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)		(%)
Total Actual Emissions	**2,744.46**	**3,762.47**	**37.09**	**1,507.17**	**1,507.17**	**0.00**	**NE**	**521.02**	**100.00**
2.C.3. Aluminium Production				1,507.17	1,507.17	0.00	NA	NA	
2.E. Production of Halocarbons and SF_6	NE	NO		NO	NO		NO	NO	
2.F. Consumption of Halocarbons and SF_6	2,744.46	3,762.47	37.09	NE	NE		NE	521.02	100.00
Other	NA	NA		NA	NA		NE	NE	
Potential Emissions from Consumption of HFCs/PFCs and SF_6	**NA**	**NA**		**NA**	**NA**		**NA**	**NA**	

	Previous submission	Latest submission	Difference
	CO_2 equivalent (Gg)		(%)
Total CO_2 Equivalent Emissions with Land-Use Change and Forestry	539,155.14	555,519.29	3.04
Total CO_2 Equivalent Emissions without Land-Use Change and Forestry	520,965.88	510,390.09	-2.03

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

Australia
2003
2005

Specify the sector and source/sink category where changes in estimates have occurred:		GHG	RECALCULATION DUE TO			
			CHANGES IN:			Addition/removal/ replacement of source/sink categories
			Methods	Emission factors	Activity data	
1.A	Fuel Combustion Activites	CO_2, CH_4, N_2O, CO, NO_X, NMVOC, SO_2			Revised national energy consumption data for 2002.	
1.A.1.c	Manufacture of Solids Fuels and Other Energy Industries - Natural Gas Production and Distribution	CO_2, CH_4, N_2O, CO, NO_X, NMVOC, SO_2			Reduction in the gas leakage proportion of unaccounted for gas in 1.B.2.b. Natural gas distribution leads to a corresponding increase in natural gas activity data for stationary combustion.	
1.A.2	Manufacturing Industries and Construction	CO_2, CH_4, N_2O, CO, NO_X, NMVOC, SO_2			Ethane had previously been classified as a liquid fuel. It has now been allocated as a gaseous fuel to conform with the CRF table structure.	
1.A.3	Transport				Revision to time series natural gas consumption statistics. Corrections to a number of fuel consumption statistics, fuel consumption rates and allocation factors	
1.B.2.b	Fugitive Emissions From Fuels	CO_2, CH_4, NMVOC	Due to progressive upgrade of the gas distribution infrastructure the allocation of unaccounted for (UAG) from the natural gas distribution network as fugitive leaks has been revised from 90% to 55% from 2003 onwards. The change has been ramped in on a linear basis starting with 1995.			
2.A.2	Lime Production	CO2			Improved data on in-house lime production	
2.A.3	Limestone and Dolomite Use	CO2			Improved data on limestone and dolomite and greater source coverage	
2.A.4	Soda Ash Pruduction and Use	CO2				Removal of soda ash production sink
2.B.1	Ammonia Production	CO2			Improved data coverage with the addition of a previously omitted plant	
2.B.2	Nitric Acid Production	N2O		Improved emission factor based on analysis by a significant producer		
2.C.3	Aluminium Production	CO2		Emission factor changed to reflect smelter-level activity data		Removal of alumina production sink
2.F.	Consumption of Halocarbons and SF6	HFCs	Equipment vintaging model	IPCC default leakage rates	Data now provided under the Ozone Protection and Synthetic Greenhouse Gas Management Act (2003)	
2.F.	Consumption of Halocarbons and SF6	SF6				Electrical equipment estimates based on numbers of high voltage switch gear and assumed charge of 40 tonnes and an annual leakage rate of 0.5%
4.A - 4.F	Agriculture	CH4 and N2O			The inventory component is calculated as a three year average between the year of interest and the two years immediately adjacent. Consequently the value reported in the 2004 Submission for 2002, which was the average of years 2001 and 2002 (the only data available), has now been recalculated as the average of years 2001, 2002 and 2003.	
4.A	Enteric Fermentation	CH_4			Update of preliminary average milk production estimates for years 2001 and 2002	
4.B	Manure Management	CH_4, N_2O	Correction to MCF for dairy cattle		Update of preliminary average milk production estimates for years 2001 and 2002	CH4 emissions are now estimated for free-range beef cattle and sheep
4.E	Prescribed Burning of Savannas	CH_4 and N_2O	Revised estimates of state/territory fuel loads, N:C ratio and burning efficiencies based on recent studies. NT and WA fuel load estimates are annual area burnt-weighted averages for woodlands and grasslands.		Revised data on area burnt for 1983-2002 for NT and WA, for 1999-2002 for QLD, and for 2000-2002 for VIC. Data on area burnt in NT and WA disagggregated into woodland and grassland.	
4.F	Field Burning of Agricultural Residues	CH_4, N_2O, NO_x, CO and NMVOC		Revised estimate for fraction of crop burnt for rice.		
5.A	Changes in Forest and Other Woody Bioma	CO_2, CH_4, N_2O, NO_x and CO	Refined method based on model of Richards and Brack 2004			
5.B	Forest and Grassland Conversion	CO_2, CH_4, N_2O, NO_x and CO			Revised estimates for the area of forest conversion for the years 1990-2002, reflecting completion of analysis of newly available remote sensing data and deployment of corrections for terrain illumination. These estimates supersede preliminary estimates for 2000-2002 in the previous submission.	
6.A	Managed Solid Waste Disposal on Land	CH_4	Emissions now estimated using the IPCC First Order Decay Model		Waste to landfill and composition data supplied by State and Territory Governments	
6.B	Wastewater Handling	CH4		CH4 emission factor revised to be consistent with Good Practice Guidance (IPCC 2000)		

Documentation box: Use the documentation box to report the justifications of the changes as to improvements in the accuracy, completeness and consistency of the inven
In most of the sectors a number of minor calculation errors were rectified through the process of translating the previous calculation system to the AGEIS system.

TABLE 9 COMPLETENESS - (INFORMATION ON NOTATION KEYS)
(Sheet 1 of 2)

Australia
2003
2005

GHG	Sector[2]	Source/sink category[2]	Explanation
Sources and sinks not reported (NE)[1]			
CO_2	1. Energy	1.B.1.a Coal Mining	No data or IPCC methodology available
	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.B.4. Chemical Industry: Carbide Production	There is no carbide production in Australia. Acetylene is produced from imported calcium carbide. Complete data on acetylene use are unavailable.
	2. Industrial Processes	2.B.5. Chemical Industry: Other - polymers and other chemicals	Data on some sources are unavailable.
	2. Industrial Processes	2.C.5. Metal Production: Other	No methodology developed. Metals production is predominantly from sulfide ores rather than
	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 CO_2 emissions and Removals from 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.
	2. Industrial Processes	2.B.5. Chemical Industry: Synthetic Rutile and TiO_2	No data are available.
	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.4 - 4.B.7	Manure of free-ranging animals does not 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. No data are available to use the Gonzalez-Avalos and Ruiz-Suarez (2001) emission factors for these species.
	4. Agriculture	4.D Agricultural Soils: 4.D.1 - 4.D.2	No data or IPCC methodology available
	4. Agriculture	4.F. Field Burning of Agricultural Residues 4.F.2-3	No data available on amount of residue burnt
	6. Waste	6.C Waste Incineration: Solvents	No methodology available
	Memo Items	Multilateral Operations	No data or methodology available
N_2O	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.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 Use	3.D. Other	No data are available.
	4. Agriculture	4.D.3 N leaching and runoff	No national data are available.
	4. Agriculture	4.F. Field Burning of Agricultural Residues 4.F.2-3	No data available on amount of residue burnt
	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.1 - 2.F.4	No reliable data are available for some of the HFCs.
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. SF6 Used in Aluminium and Magnesium Foundries	No longer used as a cover gas in trial magnesium casting plant, however small quantity are

GHG	Source/sink category	Allocation as per IPCC Guidelines	Allocation used by the Party	Explanation
Sources and sinks reported elsewhere (IE)[3]				
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 seperately. They are reported as a combined figure
	2. Industrial Processes	2.A.4 Soda Ash Production and Use	2.G Other	Emissions from this source are confidential. Emissions are aggregated with other confidential emissions from Industrial Processes and reported as CO_2-e
	2. Industrial Processes	2.A.7 Other: Magnesia Production	2.G Other	Emissions from this source are confidential. Emissions are aggregated with other confidential emissions from Industrial Processes and reported as CO_2-e
	2. Industrial Processes	2.B.1 Ammonia Production	2.G Other	Emissions from this source are confidential. Emissions are aggregated with other confidential emissions from Industrial Processes and reported as CO_2-e
	5. Land Use Change and Forestry	5.A.1-4: Temperate, tropical and boreal forests and grassland/tundra	5.A.5 Other	Data are currently unavailable in a format that allows allocation of emissions 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 seperately. 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_2O	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 seperately. They are reported as a combined figure
	2. Industrial Processes	2.B.2 Nitric Acid Production	2.G Other	Emissions from this source are confidential. Emissions are aggregated with other confidential emissions from 2.B Chemical Industries and reported as CO2-e
	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
	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
2003
2005

Additional GHG emissions reported						
GHG	**Source category**	**Emissions (Gg)**	**Estimated GWP value (100-year horizon)**	**Emissions CO_2 equivalent (Gg)**	**Reference to the data source of GWP value**	**Explanation**
NOx	Energy	1,603.13	NA	NA	NA	Methodology described in Australian methodology workbooks
CO	Energy	4,030.00	NA	NA	NA	Methodology described in Australian methodology workbooks
NMVOC	Energy	740.80	NA	NA	NA	Methodology described in Australian methodology workbooks
SO2	Energy	810.29	NA	NA	NA	Methodology described in Australian methodology workbooks
NOx	Industrial Processes	65.76	NA	NA	NA	Methodology described in Australian methodology workbooks
CO	Industrial Processes	8.69	NA	NA	NA	Methodology described in Australian methodology workbooks
NMVOC	Industrial Processes	79.51	NA	NA	NA	Methodology described in Australian methodology workbooks
SO2	Industrial Processes	1,994.53	NA	NA	NA	Methodology described in Australian methodology workbooks
NMVOC	Solvents	150.66	NA	NA	NA	Methodology described in Australian methodology workbooks
NOx	Agriculture	680.77	NA	NA	NA	Methodology described in Australian methodology workbooks
CO	Agriculture	15,618.20	NA	NA	NA	Methodology described in Australian methodology workbooks
NMVOC	Agriculture	911.15	NA	NA	NA	Methodology described in Australian methodology workbooks
NOx	Land Use Change and Forestry	119.91	NA	NA	NA	Methodology described in Australian methodology workbooks
CO	Land Use Change and Forestry	4,695.59	NA	NA	NA	Methodology described in Australian methodology workbooks
NMVOC	Land Use Change and Forestry	567.66	NA	NA	NA	Methodology described in Australian methodology workbooks
NMVOC	Waste	1.89	NA	NA	NA	Methodology described in Australian methodology workbooks

TABLE 10 EMISSIONS TRENDS (CO_2)
(Sheet 1 of 5)

Australia
2003
2005

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Base year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
	(Gg)														
1. Energy	**258,514.98**	**258,514.98**	**260,571.13**	**265,312.30**	**268,734.92**	**272,645.90**	**282,511.43**	**292,261.49**	**299,109.36**	**315,606.46**	**324,728.21**	**329,368.25**	**336,310.48**	**339,668.02**	**345,770.51**
A. Fuel Combustion (Sectoral Approach)	252,552.25	252,552.25	254,826.01	259,471.35	262,887.57	267,073.34	276,797.06	287,011.70	294,061.74	310,318.95	318,995.66	322,882.35	329,389.08	333,208.63	340,004.36
1. Energy Industries	141,805.68	141,805.68	145,296.14	148,512.17	149,790.74	150,825.59	156,805.91	163,386.78	169,466.13	184,861.38	189,208.33	192,527.49	198,354.42	202,001.04	208,302.60
2. Manufacturing Industries and Construction	37,355.76	37,355.76	36,722.04	36,680.49	37,115.64	38,553.82	39,134.40	40,323.12	39,407.24	40,223.79	43,597.54	41,590.84	42,035.99	39,364.06	39,117.20
3. Transport	59,724.27	59,724.27	59,097.02	60,188.94	61,381.12	62,912.11	65,490.09	67,739.23	69,063.96	69,129.34	70,015.95	72,095.22	72,052.04	73,520.69	74,033.42
4. Other Sectors	12,485.07	12,485.07	12,557.97	12,894.10	13,375.24	13,491.27	13,961.21	14,044.97	14,585.65	14,785.34	14,941.39	15,392.97	15,593.57	16,983.78	17,280.43
5. Other	1,181.47	1,181.47	1,152.85	1,195.65	1,224.84	1,290.55	1,405.45	1,517.59	1,538.76	1,319.10	1,232.46	1,275.82	1,353.07	1,339.07	1,270.71
B. Fugitive Emissions from Fuels	5,962.73	5,962.73	5,745.12	5,840.95	5,847.35	5,572.57	5,714.37	5,249.79	5,047.62	5,287.51	5,732.55	6,485.90	6,921.39	6,459.38	5,766.16
1. Solid Fuels	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
2. Oil and Natural Gas	5,962.73	5,962.73	5,745.12	5,840.95	5,847.35	5,572.57	5,714.37	5,249.79	5,047.62	5,287.51	5,732.55	6,485.90	6,921.39	6,459.38	5,766.16
2. Industrial Processes	**22,359.30**	**22,359.30**	**21,818.53**	**19,893.48**	**20,929.54**	**22,906.82**	**23,077.74**	**23,513.21**	**23,366.19**	**24,092.05**	**24,209.15**	**23,698.80**	**24,305.76**	**24,125.76**	**25,913.70**
A. Mineral Products	4,825.64	4,825.64	4,508.72	4,329.46	4,538.74	5,237.80	5,047.73	5,091.60	5,023.59	5,438.55	5,353.54	5,155.38	5,146.66	5,215.57	5,384.17
B. Chemical Industry	503.70	503.70	477.77	633.84	663.91	672.51	798.51	837.18	877.27	1,082.03	777.81	888.02	1,017.98	935.85	952.11
C. Metal Production	14,665.86	14,665.86	14,598.62	12,537.79	12,383.54	13,494.29	13,774.00	13,953.45	13,863.72	13,770.70	14,396.98	13,761.22	13,331.54	12,737.94	13,866.07
D. Other Production	NE	NE	NE	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	2,364.10	2,364.10	2,233.42	2,392.39	3,343.34	3,502.23	3,457.50	3,630.99	3,601.60	3,800.76	3,680.81	3,894.19	4,809.58	5,236.40	5,711.34
3. Solvent and Other Product Use	**NA**	**NA**	**NA**	**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**	**NA**	**NA**	**NA**
A. Enteric Fermentation	NA	NA	NA	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	NA	NA	NA
C. Rice Cultivation	NA	NA	NA	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	NA	NA	NA
E. Prescribed Burning of Savannas	NA	NA	NA	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	NA	NA	NA
G. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
5. Land-Use Change and Forestry	**101,141.87**	**101,141.87**	**76,299.63**	**59,242.08**	**46,588.54**	**46,763.93**	**43,979.84**	**40,197.40**	**35,659.21**	**48,273.66**	**39,868.25**	**42,065.20**	**36,914.41**	**40,628.55**	**30,581.52**
A. Changes in Forest and Other Woody Biomass Stocks	-21,083.58	-21,083.58	-21,503.85	-22,346.12	-21,920.19	-18,594.96	-18,212.18	-19,115.50	-19,856.09	-20,808.86	-15,745.54	-15,214.05	-14,223.89	-17,781.78	-17,093.55
B. Forest and Grassland Conversion	122,225.44	122,225.44	97,803.48	81,588.21	68,508.74	65,358.90	62,192.02	59,312.90	55,515.30	69,082.52	55,613.79	57,279.25	51,138.31	58,410.33	47,675.07
C. Abandonment of Managed Lands	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
D. CO_2 Emissions and Removals from Soil	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
E. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
6. Waste	**11.58**	**11.58**	**11.58**	**11.58**	**11.58**	**11.58**	**16.83**	**13.53**	**16.94**	**17.13**	**17.49**	**16.30**	**16.30**	**16.30**	**16.30**
A. Solid Waste Disposal on Land	NE	NE	NE	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	NA	NA	NA
C. Waste Incineration	11.58	11.58	11.58	11.58	11.58	11.58	16.83	13.53	16.94	17.13	17.49	16.30	16.30	16.30	16.30
D. Other	NA	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
Total Emissions/Removals with LUCF	**382,027.73**	**382,027.73**	**358,700.87**	**344,459.45**	**336,264.59**	**342,328.24**	**349,585.85**	**355,985.62**	**358,151.70**	**387,989.29**	**388,823.09**	**395,148.56**	**397,546.96**	**404,438.62**	**402,282.04**
Total Emissions without LUCF	**280,885.87**	**280,885.87**	**282,401.24**	**285,217.36**	**289,676.04**	**295,564.31**	**305,606.00**	**315,788.22**	**322,492.48**	**339,715.63**	**348,954.84**	**353,083.36**	**360,632.54**	**363,810.08**	**371,700.52**
Memo Items:															
International Bunkers	**6,400.97**	**6,400.97**	**6,378.80**	**6,584.40**	**6,987.84**	**7,361.83**	**8,532.60**	**9,030.65**	**9,059.30**	**9,449.69**	**9,718.28**	**10,099.67**	**10,625.28**	**8,603.39**	**8,837.12**
Aviation	4,345.12	4,345.12	4,520.39	4,795.71	5,199.38	5,349.80	5,857.66	6,311.70	6,540.10	7,232.89	7,268.09	7,330.88	8,151.32	6,392.44	6,615.32
Marine	2,055.85	2,055.85	1,858.42	1,788.69	1,788.46	2,012.03	2,674.93	2,718.95	2,519.20	2,216.80	2,450.19	2,768.79	2,473.96	2,210.95	2,221.80
Multilateral Operations	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**
CO_2 Emissions from Biomass	**15,112.99**	**15,112.99**	**14,964.91**	**13,664.99**	**15,317.65**	**16,227.76**	**17,071.01**	**17,114.32**	**18,998.78**	**19,321.49**	**19,580.00**	**19,263.31**	**18,254.75**	**15,465.63**	15,947.94

TABLE 10 EMISSIONS TRENDS (CH_4)
(Sheet 2 of 5)

Australia
2003
2005

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Base year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
	(Gg)														
Total Emissions	**5,458.71**	**5,458.71**	**5,440.62**	**5,405.38**	**5,295.47**	**5,262.47**	**5,310.65**	**5,252.50**	**5,342.04**	**5,418.29**	**5,380.97**	**5,505.99**	**5,515.33**	**5,415.09**	**5,252.12**
1. Energy	**1,198.42**	**1,198.42**	**1,173.71**	**1,224.82**	**1,186.00**	**1,225.16**	**1,283.17**	**1,267.30**	**1,299.86**	**1,375.35**	**1,266.41**	**1,318.34**	**1,255.21**	**1,170.20**	**1,069.66**
A. Fuel Combustion (Sectoral Approach)	113.93	113.93	115.06	117.56	118.83	117.35	115.75	113.94	115.48	111.23	106.23	105.22	97.86	89.66	87.86
1. Energy Industries	1.89	1.89	1.91	2.00	2.05	2.08	2.25	2.30	4.69	5.05	5.13	9.19	9.11	10.38	10.45
2. Manufacturing Industries and Construction	1.49	1.49	1.44	1.41	1.52	1.60	1.71	1.72	2.35	2.42	2.41	2.45	2.30	1.99	1.99
3. Transport	26.47	26.47	25.56	25.78	26.37	27.16	28.38	29.40	30.31	31.37	31.70	31.69	29.46	31.13	30.47
4. Other Sectors	84.03	84.03	86.11	88.32	88.84	86.46	83.36	80.47	78.06	72.33	66.93	61.83	56.93	46.11	44.91
5. Other	0.05	0.05	0.04	0.04	0.04	0.05	0.05	0.06	0.06	0.06	0.05	0.05	0.05	0.05	0.05
B. Fugitive Emissions from Fuels	1,084.49	1,084.49	1,058.65	1,107.26	1,067.17	1,107.82	1,167.41	1,153.35	1,184.38	1,264.13	1,160.18	1,213.12	1,157.35	1,080.54	981.80
1. Solid Fuels	753.16	753.16	760.91	790.69	791.02	828.21	832.39	846.98	865.54	954.70	903.33	935.15	878.36	831.25	787.34
2. Oil and Natural Gas	331.33	331.33	297.75	316.57	276.15	279.61	335.02	306.38	318.84	309.42	256.86	277.97	278.99	249.28	194.46
2. Industrial Processes	**3.29**	**3.29**	**3.26**	**3.30**	**3.33**	**3.72**	**3.80**	**3.88**	**3.80**	**3.96**	**3.70**	**3.33**	**3.10**	**3.08**	**3.32**
A. Mineral Products	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
B. Chemical Industry	0.44	0.44	0.40	0.41	0.32	0.40	0.38	0.45	0.43	0.35	0.34	0.44	0.35	0.36	0.44
C. Metal Production	2.85	2.85	2.85	2.89	3.01	3.32	3.42	3.43	3.37	3.60	3.36	2.90	2.76	2.71	2.88
D. Other Production	NA	NA	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	NA	NA
3. Solvent and Other Product Use	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**
4. Agriculture	**3,587.41**	**3,587.41**	**3,593.11**	**3,525.90**	**3,455.06**	**3,390.58**	**3,373.87**	**3,370.09**	**3,416.58**	**3,426.34**	**3,481.68**	**3,552.18**	**3,610.26**	**3,542.94**	**3,505.95**
A. Enteric Fermentation	3,214.89	3,214.89	3,225.53	3,165.04	3,096.48	3,023.30	2,999.76	2,987.93	3,012.34	3,011.19	3,048.77	3,064.57	3,086.27	3,014.23	2,988.00
B. Manure Management	73.32	73.32	73.39	74.88	77.86	80.50	82.14	82.95	86.55	90.18	92.65	94.14	96.57	97.40	97.50
C. Rice Cultivation	23.36	23.36	24.94	25.72	28.69	28.87	30.89	33.56	34.44	34.50	31.94	35.30	35.13	28.06	19.05
D. Agricultural Soils	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
E. Prescribed Burning of Savannas	267.06	267.06	260.74	251.58	242.71	248.72	251.51	255.30	271.51	278.18	296.14	345.63	379.40	392.35	391.44
F. Field Burning of Agricultural Residues	8.79	8.79	8.52	8.68	9.32	9.19	9.56	10.35	11.74	12.29	12.18	12.54	12.88	10.90	9.96
G. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
5. Land-Use Change and Forestry	**205.82**	**205.82**	**190.89**	**165.37**	**152.58**	**151.36**	**139.78**	**137.16**	**139.30**	**140.18**	**136.47**	**131.08**	**133.24**	**168.38**	**159.59**
A. Changes in Forest and Other Woody Biomass Stocks	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
B. Forest and Grassland Conversion	147.73	147.73	130.97	108.84	97.05	98.51	83.85	83.18	82.38	83.70	82.90	85.11	83.23	80.43	72.62
C. Abandonment of Managed Lands	NA	NA	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	NA	NA
E. Other	58.09	58.09	59.92	56.53	55.53	52.85	55.92	53.98	56.92	56.48	53.57	45.97	50.02	87.94	86.97
6. Waste	**463.78**	**463.78**	**479.65**	**485.99**	**498.50**	**491.65**	**510.04**	**474.08**	**482.51**	**472.46**	**492.71**	**501.06**	**513.51**	**530.49**	**513.61**
A. Solid Waste Disposal on Land	355.82	355.82	370.21	375.17	386.43	378.44	395.62	358.10	365.10	353.84	372.79	379.71	390.67	406.01	387.69
B. Waste-water Handling	107.95	107.95	109.44	110.82	112.06	113.20	114.42	115.98	117.41	118.61	119.92	121.35	122.84	124.48	125.92
C. Waste Incineration	NE	NE	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	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
Memo Items:															
International Bunkers	**0.13**	**0.13**	**0.11**	**0.11**	**0.11**	**0.12**	**0.16**	**0.15**	**0.15**	**0.13**	**0.15**	**0.16**	**0.15**	**0.14**	**0.14**
Aviation	0.02	0.02	0.02	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	0.11	0.09	0.09	0.09	0.10	0.14	0.14	0.13	0.11	0.12	0.13	0.12	0.11	0.11
Multilateral Operations	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**
CO_2 Emissions from Biomass															

TABLE 10 EMISSIONS TRENDS (N_2O)
(Sheet 3 of 5)

Australia
2003
2005

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Base year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
	(Gg)														
Total Emissions	**71.91**	**71.91**	**73.12**	**73.13**	**74.80**	**76.58**	**77.16**	**77.43**	**82.41**	**86.76**	**91.86**	**97.21**	**99.90**	**101.85**	**100.64**
1. Energy	**7.70**	**7.70**	**8.75**	**9.56**	**10.46**	**11.40**	**12.33**	**13.17**	**13.99**	**15.04**	**15.92**	**16.84**	**17.23**	**18.80**	**19.52**
A. Fuel Combustion (Sectoral Approach)	7.58	7.58	8.65	9.45	10.36	11.31	12.23	13.07	13.92	14.93	15.85	16.75	17.14	18.71	19.44
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	2.04	2.11
2. Manufacturing Industries and Construction	0.66	0.66	0.63	0.57	0.64	0.68	0.72	0.72	0.79	0.80	0.81	0.78	0.73	0.65	0.65
3. Transport	5.26	5.26	6.29	7.12	7.96	8.85	9.69	10.47	11.14	11.95	12.83	13.74	14.13	15.79	16.45
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	0.21	0.21
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	0.02	0.02
B. Fugitive Emissions from Fuels	0.12	0.12	0.11	0.11	0.10	0.09	0.10	0.10	0.07	0.11	0.07	0.09	0.09	0.08	0.07
1. Solid Fuels	NE	NE	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	0.10	0.10	0.07	0.11	0.07	0.09	0.09	0.08	0.07
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**	**0.06**	**0.07**
A. Mineral Products	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
B. Chemical Industry	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE
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	0.06	0.07
D. Other Production	NA	NA	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	NA	NA
3. Solvent and Other Product Use	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**
4. Agriculture	**58.77**	**58.77**	**59.19**	**58.85**	**59.84**	**60.68**	**60.53**	**59.98**	**64.09**	**67.36**	**71.62**	**76.14**	**78.38**	**78.10**	**76.31**
A. Enteric Fermentation	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
B. Manure Management	1.68	1.68	1.86	2.14	2.44	2.70	3.00	2.91	3.23	3.50	4.00	4.24	4.26	4.25	4.15
C. Rice Cultivation	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
D. Agricultural Soils	48.96	48.96	49.39	49.05	49.98	50.38	49.83	49.25	52.52	55.32	58.57	61.39	62.62	62.01	60.38
E. Prescribed Burning of Savannas	7.84	7.84	7.66	7.39	7.13	7.31	7.39	7.50	7.98	8.17	8.70	10.15	11.14	11.52	11.50
F. Field Burning of Agricultural Residues	0.28	0.28	0.27	0.27	0.29	0.30	0.31	0.33	0.35	0.36	0.35	0.36	0.36	0.31	0.29
G. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
5. Land-Use Change and Forestry	**3.81**	**3.81**	**3.53**	**3.06**	**2.82**	**2.80**	**2.58**	**2.54**	**2.58**	**2.59**	**2.52**	**2.42**	**2.46**	**3.11**	**2.95**
A. Changes in Forest and Other Woody Biomass Stocks	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
B. Forest and Grassland Conversion	2.74	2.74	2.43	2.02	1.80	1.82	1.55	1.54	1.53	1.55	1.53	1.58	1.54	1.49	1.34
C. Abandonment of Managed Lands	NA	NA	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	NA	NA
E. Other	1.07	1.07	1.11	1.04	1.02	0.98	1.03	1.00	1.05	1.04	0.99	0.85	0.92	1.62	1.60
6. Waste	**1.54**	**1.54**	**1.57**	**1.59**	**1.60**	**1.62**	**1.64**	**1.66**	**1.68**	**1.70**	**1.72**	**1.74**	**1.76**	**1.78**	**1.80**
A. Solid Waste Disposal on Land	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
B. Waste-water Handling	1.54	1.54	1.57	1.59	1.60	1.62	1.64	1.66	1.68	1.70	1.72	1.74	1.76	1.78	1.80
C. Waste Incineration	NE	NE	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	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
Memo Items:															
International Bunkers	**0.19**	**0.19**	**0.19**	**0.19**	**0.21**	**0.22**	**0.25**	**0.27**	**0.27**	**0.28**	**0.29**	**0.30**	**0.31**	**0.25**	**0.26**
Aviation	0.13	0.13	0.13	0.14	0.16	0.16	0.18	0.19	0.20	0.22	0.22	0.22	0.25	0.19	0.20
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	0.06	0.06
Multilateral Operations	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**
CO_2 Emissions from Biomass															

TABLE 10 EMISSION TRENDS (HFCs, PFCs and SF_6)
(Sheet 4 of 5)

Australia
2003
2005

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Base year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
	(Gg)														
Emissions of HFCs[(5)] - CO_2 equivalent (Gg)	**1,126.27**	**1,126.27**	**1,126.27**	**1,053.94**	**1,446.59**	**819.19**	**923.87**	**546.17**	**1,026.48**	**1,622.81**	**2,185.74**	**2,716.33**	**3,257.79**	**3,762.47**	**4,309.02**
HFC-23	0.10	0.10	0.10	0.09	0.12	0.07	0.06	C	C	C	C	C	C	C	C
HFC-32	NE	NE	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	NE	NE
HFC-43-10mee	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
HFC-125	NO	NO	NO	NO	NO	0.00	0.00	0.01	0.01	0.02	0.03	0.05	0.06	0.08	0.11
HFC-134	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
HFC-134a	NO	NO	NO	NO	NO	0.01	0.14	0.38	0.70	1.10	1.47	1.80	2.13	2.43	2.70
HFC-152a	NE	NE	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	NE	NE
HFC-143a	NO	NO	NO	NO	NO	0.00	0.00	0.01	0.01	0.02	0.04	0.05	0.06	0.08	0.11
HFC-227ea	NE	NE	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	NE	NE
HFC-245ca	NE	NE	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**	**1,555.97**	**1,507.17**	**1,472.05**
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	0.20	0.19
C_2F_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	0.03	0.02
C_3F_8	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
C_4F_{10}	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
$c\text{-}C_4F_8$	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
C_5F_{12}	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
C_6F_{14}	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
Emissions of SF_6 - CO_2 equivalent (Gg)	**521.02**	**521.02**	**521.02**	**521.02**	**521.02**	**521.02**	**521.02**	**529.62**	**527.00**	**524.68**	**524.61**	**523.41**	**521.02**	**521.02**	**521.02**
SF_6	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02

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_2F_6	9200
C_3F_8	7000
C_4F_{10}	7000
$c\text{-}C_4F_8$	8700
C_5F_{12}	7500
C_6F_{14}	7400
SF_6	23900

[(5)] Includes the following confidential HFC emissions:

Emissions of HFCs - CO_2 equivalent (Gg)	Base year[(1)]	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Confidential HFC emissions	NO	NO	NO	NO	NO	NO	4.54	13.62	22.70	31.77	40.99	52.15	64.00	76.55	89.79

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

Australia
2003
2005

GREENHOUSE GAS EMISSIONS	Base year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
	CO_2 equivalent (Gg)														
Net CO_2 emissions/removals	382,027.73	382,027.73	358,700.87	344,459.45	336,264.59	342,328.24	349,585.85	355,985.62	358,151.70	387,989.29	388,823.09	395,148.56	397,546.96	404,438.62	402,282.04
CO_2 emissions (without LUCF)	280,885.87	280,885.87	282,401.24	285,217.36	289,676.04	295,564.31	305,606.00	315,788.22	322,492.48	339,715.63	348,954.84	353,083.36	360,632.54	363,810.08	371,700.52
CH_4	114,633.00	114,633.00	114,253.08	113,512.90	111,204.85	110,511.88	111,523.75	110,302.60	112,182.93	113,784.07	113,000.29	115,625.86	115,821.90	113,716.89	110,294.50
N_2O	22,291.51	22,291.51	22,668.61	22,669.27	23,188.43	23,740.28	23,918.50	24,003.88	25,546.56	26,895.55	28,476.25	30,135.90	30,969.05	31,573.11	31,198.65
HFCs	1,126.27	1,126.27	1,126.27	1,053.94	1,446.59	819.19	923.87	546.17	1,026.48	1,622.81	2,185.74	2,716.33	3,257.79	3,762.47	4,309.02
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	1,555.97	1,507.17	1,472.05
SF_6	521.02	521.02	521.02	521.02	521.02	521.02	521.02	529.62	527.00	524.68	524.61	523.41	521.02	521.02	521.02
Total (with net CO_2 emissions/removals)	**524,537.82**	**524,537.82**	**501,211.33**	**486,151.67**	**475,458.55**	**479,768.17**	**487,782.04**	**492,573.29**	**498,485.33**	**532,213.39**	**533,991.97**	**545,253.26**	**549,672.69**	**555,519.29**	**550,077.28**
Total (without CO_2 from LUCF)	**423,395.95**	**423,395.95**	**424,911.69**	**426,909.59**	**428,870.00**	**433,004.24**	**443,802.20**	**452,375.89**	**462,826.12**	**483,939.73**	**494,123.72**	**503,188.07**	**512,758.27**	**514,890.74**	**519,495.76**

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Base year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
	CO_2 equivalent (Gg)														
1. Energy	286,067.71	286,067.71	287,933.10	293,997.96	296,884.21	301,909.52	313,279.77	322,958.21	330,742.66	349,150.70	356,257.53	362,273.53	368,010.77	370,069.48	374,283.09
2. Industrial Processes	28,040.78	28,040.78	27,502.32	25,495.02	25,822.01	26,196.85	25,936.24	25,900.56	26,074.64	27,743.21	28,004.00	28,134.64	29,726.18	29,999.83	32,305.69
3. Solvent and Other Product Use	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4. Agriculture	93,555.11	93,555.11	93,803.34	92,286.74	91,107.88	90,013.32	89,614.41	89,366.89	91,614.61	92,833.60	95,317.76	98,198.79	100,114.32	98,611.86	97,280.64
5. Land-Use Change and Forestry	106,644.34	106,644.34	81,402.86	63,662.88	50,667.25	50,810.10	47,716.28	43,863.84	39,382.88	52,020.91	43,516.28	45,569.45	40,476.32	45,129.19	34,847.19
6. Waste	10,229.88	10,229.88	10,569.70	10,709.08	10,977.19	10,838.37	11,235.35	10,483.80	10,670.54	10,464.95	10,896.40	11,076.85	11,345.10	11,708.93	11,360.68
7. Other	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 10 EMISSIONS TRENDS (CO_2-e)
(Sheet 6 of 6)

Australia
2003
Submission 2005

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Base year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
	(Gg)										
1. Energy	**286,067.71**	**286,067.71**	**287,933.10**	**293,997.96**	**296,884.21**	**301,909.52**	**313,279.77**	**322,958.21**	**330,742.66**	**349,150.70**	**356,257.53**
A. Fuel Combustion (Sectoral Approach)	257,294.72	257,294.72	259,922.70	264,871.19	268,594.00	273,044.17	283,020.14	293,457.09	300,801.47	317,283.17	326,138.43
1. Energy Industries	142,282.25	142,282.25	145,790.84	149,018.63	150,295.05	151,336.13	157,334.23	163,933.98	170,096.62	185,562.12	189,920.93
2. Manufacturing Industries and Construction	37,590.47	37,590.47	36,948.68	36,887.76	37,345.62	38,799.48	39,392.64	40,582.33	39,699.95	40,522.21	43,898.56
3. Transport	61,911.31	61,911.31	61,582.90	62,936.89	64,402.68	66,226.14	69,090.68	71,602.80	73,154.84	73,492.19	74,658.71
4. Other Sectors	14,324.53	14,324.53	14,442.60	14,826.98	15,320.49	15,385.98	15,790.01	15,812.39	16,303.10	16,380.05	16,420.99
5. Other	1,186.16	1,186.16	1,157.68	1,200.93	1,230.16	1,296.44	1,412.58	1,525.59	1,546.95	1,326.60	1,239.23
B. Fugitive Emissions from Fuels	28,773.00	28,773.00	28,010.40	29,126.77	28,290.21	28,865.35	30,259.64	29,501.11	29,941.19	31,867.54	30,119.10
1. Solid Fuel	15,816.36	15,816.36	15,979.04	16,604.39	16,611.41	17,392.34	17,480.17	17,786.50	18,176.44	20,048.78	18,969.85
2. Oil and Natural Gas	12,956.64	12,956.64	12,031.36	12,522.38	11,678.80	11,473.01	12,779.46	11,714.61	11,764.75	11,818.76	11,149.24
2. Industrial Processes	**28,040.78**	**28,040.78**	**27,502.32**	**25,495.02**	**25,822.01**	**26,196.85**	**25,936.24**	**25,900.56**	**26,074.64**	**27,743.21**	**28,004.00**
A. Mineral Products	4,825.64	4,825.64	4,508.72	4,329.46	4,538.74	5,237.80	5,047.73	5,091.60	5,023.59	5,438.55	5,353.54
B. Chemical Industry	512.89	512.89	486.24	642.40	670.65	680.87	806.50	846.73	886.30	1,089.40	785.00
C. Metal Production	18,690.86	18,690.86	18,626.64	16,555.81	15,301.67	15,435.75	15,179.62	15,255.45	15,009.67	15,267.02	15,474.30
D. Other Production	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
F. Consumption of Halocarbons and SF_6	521.02	521.02	521.02	521.02	521.02	528.51	726.04	1,075.80	1,553.48	2,147.48	2,710.34
G. Other	2,364.10	2,364.10	2,233.42	2,392.39	3,343.34	3,502.23	3,457.50	3,630.99	3,601.60	3,800.76	3,680.81
3. Solvent and Other Product Use	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**
4. Agriculture	**93,555.11**	**93,555.11**	**93,803.34**	**92,286.74**	**91,107.88**	**90,013.32**	**89,614.41**	**89,366.89**	**91,614.61**	**92,833.60**	**95,317.76**
A. Enteric Fermentation	67,512.63	67,512.63	67,736.04	66,465.79	65,026.00	63,489.39	62,995.06	62,746.53	63,259.13	63,234.89	64,024.23
B. Manure Management	2,061.13	2,061.13	2,119.21	2,235.01	2,390.42	2,527.21	2,655.17	2,643.10	2,819.19	2,978.71	3,185.92
C. Rice Cultivation	490.50	490.50	523.78	540.22	602.42	606.24	648.74	704.74	723.17	724.59	670.74
D. Agricultural Soils	15,178.92	15,178.92	15,311.99	15,204.68	15,495.16	15,616.59	15,446.58	15,267.65	16,282.47	17,150.11	18,155.68
E. Prescribed Burning of Savannas	8,040.04	8,040.04	7,849.82	7,573.97	7,307.12	7,487.91	7,571.96	7,686.10	8,174.04	8,374.74	8,915.48
F. Field Burning of Agricultural Residues	271.90	271.90	262.49	267.08	286.76	285.98	296.90	318.76	356.62	370.56	365.72
G. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
5. Land-Use Change and Forestry	**106,644.34**	**106,644.34**	**81,402.86**	**63,662.88**	**50,667.25**	**50,810.10**	**47,716.28**	**43,863.84**	**39,382.88**	**52,020.91**	**43,516.28**
A. Changes in Forest and Other Woody Biomass Stocks	-21,083.58	-21,083.58	-21,503.85	-22,346.12	-21,920.19	-18,594.96	-18,212.18	-19,115.50	-19,856.09	-20,808.86	-15,745.54
B. Forest and Grassland Conversion	126,175.78	126,175.78	101,305.72	84,498.66	71,103.81	67,992.98	64,434.21	61,537.01	57,718.06	71,320.77	57,830.55
C. Abandonment of Managed Lands	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
D. CO_2 Emissions and Removals from Soil	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
E. Other	1,552.13	1,552.13	1,601.00	1,510.35	1,483.63	1,412.08	1,494.24	1,442.32	1,520.91	1,509.01	1,431.27
6. Waste	**10,229.88**	**10,229.88**	**10,569.70**	**10,709.08**	**10,977.19**	**10,838.37**	**11,235.35**	**10,483.80**	**10,670.54**	**10,464.95**	**10,896.40**
A. Solid Waste Disposal on Land	7,472.31	7,472.31	7,774.35	7,878.50	8,115.11	7,947.33	8,308.01	7,520.11	7,667.07	7,430.69	7,828.52
B. Waste-water Handling	2,745.99	2,745.99	2,783.77	2,818.99	2,850.49	2,879.46	2,910.51	2,950.16	2,986.52	3,017.13	3,050.40
C. Waste Incineration	11.58	11.58	11.58	11.58	11.58	11.58	16.83	13.53	16.94	17.13	17.49
D. Other	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
Total Emissions/Removals with LUCF	**524,537.82**	**524,537.82**	**501,211.33**	**486,151.67**	**475,458.55**	**479,768.17**	**487,782.04**	**492,573.29**	**498,485.33**	**532,213.39**	**533,991.97**
Total Emissions without LUCF	**417,893.48**	**417,893.48**	**419,808.46**	**422,488.79**	**424,791.29**	**428,958.07**	**440,065.77**	**448,709.45**	**459,102.45**	**480,192.47**	**490,475.70**
Memo Items:											
International Bunkers	**6,400.97**	**6,400.97**	**6,378.80**	**6,584.40**	**6,987.84**	**7,361.83**	**8,532.60**	**9,030.65**	**9,059.30**	**9,449.69**	**9,718.28**
Aviation	4,345.12	4,345.12	4,520.39	4,795.71	5,199.38	5,349.80	5,857.66	6,311.70	6,540.10	7,232.89	7,268.09
Marine	2,055.85	2,055.85	1,858.42	1,788.69	1,788.46	2,012.03	2,674.93	2,718.95	2,519.20	2,216.80	2,450.19
Multilateral Operations	**NE**	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
CO_2 Emissions from Biomass	**15,112.99**	**15,112.99**	14,964.91	13,664.99	15,317.65	16,227.76	17,071.01	17,114.32	18,998.78	19,321.49	19,580.00

TABLE 10 EMISSIONS TRENDS (CO_2-e)
(Sheet 6 of 6)

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Base year	2000	2001	2002	2003
1. Energy	**286,067.71**	**362,273.53**	**368,010.77**	**370,069.48**	**374,283.09**
A. Fuel Combustion (Sectoral Approach)	257,294.72	330,285.59	336,756.10	340,892.86	347,876.89
1. Energy Industries	142,282.25	193,332.46	199,174.45	202,851.56	209,176.90
2. Manufacturing Industries and Construction	37,590.47	41,885.05	42,310.01	39,607.42	39,361.38
3. Transport	61,911.31	77,021.09	77,051.12	79,069.58	79,772.15
4. Other Sectors	14,324.53	16,764.25	16,860.15	18,018.02	18,289.32
5. Other	1,186.16	1,282.74	1,360.37	1,346.28	1,277.14
B. Fugitive Emissions from Fuels	28,773.00	31,987.95	31,254.67	29,176.62	26,406.19
1. Solid Fuel	15,816.36	19,638.07	18,445.52	17,456.28	16,534.08
2. Oil and Natural Gas	12,956.64	12,349.87	12,809.16	11,720.34	9,872.12
2. Industrial Processes	**28,040.78**	**28,134.64**	**29,726.18**	**29,999.83**	**32,305.69**
A. Mineral Products	4,825.64	5,155.38	5,146.66	5,215.57	5,384.17
B. Chemical Industry	512.89	897.24	1,025.27	943.50	961.28
C. Metal Production	18,690.86	14,948.10	14,965.85	14,320.86	15,418.86
D. Other Production	NE	NE	NE	NE	NE
E. Production of Halocarbons and SF_6	1,126.27	NO	NO	NO	NO
F. Consumption of Halocarbons and SF_6	521.02	3,239.74	3,778.81	4,283.49	4,830.04
G. Other	2,364.10	3,894.19	4,809.58	5,236.40	5,711.34
3. Solvent and Other Product Use	**NA**	**NA**	**NA**	**NA**	**NA**
4. Agriculture	**93,555.11**	**98,198.79**	**100,114.32**	**98,611.86**	**97,280.64**
A. Enteric Fermentation	67,512.63	64,356.06	64,811.65	63,298.87	62,748.00
B. Manure Management	2,061.13	3,291.28	3,347.22	3,361.86	3,333.64
C. Rice Cultivation	490.50	741.36	737.83	589.29	400.09
D. Agricultural Soils	15,178.92	19,030.14	19,412.31	19,223.66	18,716.27
E. Prescribed Burning of Savannas	8,040.04	10,405.50	11,422.18	11,812.02	11,784.48
F. Field Burning of Agricultural Residues	271.90	374.44	383.13	326.17	298.17
G. Other	NA	NA		NA	NA
5. Land-Use Change and Forestry	**106,644.34**	**45,569.45**	**40,476.32**	**45,129.19**	**34,847.19**
A. Changes in Forest and Other Woody Biomass Stocks	-21,083.58	-15,214.05	-14,223.89	-17,781.78	-17,093.55
B. Forest and Grassland Conversion	126,175.78	59,555.21	53,363.73	60,561.14	49,616.80
C. Abandonment of Managed Lands	NA	NA	NA	NA	NA
D. CO_2 Emissions and Removals from Soil	0.00	0.00	0.00	0.00	0.00
E. Other	1,552.13	1,228.29	1,336.47	2,349.83	2,323.93
6. Waste	**10,229.88**	**11,076.85**	**11,345.10**	**11,708.93**	**11,360.68**
A. Solid Waste Disposal on Land	7,472.31	7,973.82	8,204.09	8,526.30	8,141.48
B. Waste-water Handling	2,745.99	3,086.72	3,124.71	3,166.32	3,202.89
C. Waste Incineration	11.58	16.30	16.30	16.30	16.30
D. Other	NA	NA		NA	NA
7. Other *(please specify)*	**NA**	**NA**	**NA**	**NA**	**NA**
NA	NA	NA	NA	NA	NA
Total Emissions/Removals with LUCF	**524,537.82**	**545,253.26**	**549,672.69**	**555,519.29**	**550,077.28**
Total Emissions without LUCF	**417,893.48**	**499,683.81**	**509,196.37**	**510,390.09**	**515,230.10**
Memo Items:					
International Bunkers	**6,400.97**	**10,099.67**	**10,625.28**	**8,603.39**	**8,837.12**
Aviation	4,345.12	7,330.88	8,151.32	6,392.44	6,615.32
Marine	2,055.85	2,768.79	2,473.96	2,210.95	2,221.80
Multilateral Operations	**NE**	NE	NE	NE	NE
CO_2 Emissions from Biomass	**15,112.99**	19,263.31	18,254.75	15,465.63	15,947.94

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

Australia
2003
2005

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Net CO_2 emissions/ removals[(1), (2)]	CH_4	N_2O	NO_x	CO
	(Gg)				
Total Land-Use Categories	30581.52	159.59	2.95	169.46	6635.82
A. Forest Land	-17093.55	86.97	1.60	65.35	2559.03
1. Forest Land remaining Forest Land	-2295.45	86.97	1.60	65.35	2559.03
2. Land converted to Forest Land	-14798.10	0.00	0.00	NE	NE
B. Cropland	0.00	0.00	0.00	0.00	0.00
1. Cropland remaining Cropland	0.00	0.00	0.00	NE	NE
2. Land converted to Cropland	0.00	0.00	0.00	IE	IE
C. Grassland	47675.07	72.62	1.34	104.11	4076.78
1. Grassland remaining Grassland	0.00	0.00	0.00	IE	IE
2. Land converted to Grassland	47675.07	72.62	1.34	104.11	4076.78
D. Wetlands[(3)]	0.00	0.00	0.00	0.00	0.00
1. Wetlands remaining Wetlands	0.00	0.00	0.00	NE	NE
2. Land converted to Wetlands	0.00	0.00	0.00	NO	NO
E. Settlements [(3)]	0.00	0.00	0.00	0.00	0.00
1. Settlements remaining Settlements	0.00	NE	NE	NE	NE
2. Land converted to Settlements	0.00	NE	NE	NE	NE
F. Other Land[(4)]	0.00	0.00	0.00	0.00	0.00
1. Other Land remaining Other Land		NE	NE	NE	NE
2. Land converted to Other Land	0.00	NE	NE	NE	NE
G. Other *(please specify)* [(5)]	0.00	0.00	0.00	0.00	0.00
Harvested Wood Products [(6)]	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA
Information items[(7)]					
Forest Land converted to Other Land-Use Categories	NA	NA	NA	NA	NA
Grassland converted to Other Land-Use Categories	NA	NA	NA	NA	NA

(1) According to the Revised 1996 IPCC Guidelines, for the purposes of reporting, the signs for removals are always negative (-) and for emissions positive (+). Net changes in carbon stocks are converted to CO_2 by multiplying C by 44/12 and by changing the sign for net CO_2 removals to be negative (-) and for net CO_2 emissions to be positive (+).

(2) CO_2 emissions from liming and biomass burning are included in this column.

(3) Parties do not have to prepare estimates for categories contained in appendices 3a.2, 3a.3 and 3a.4 of the IPCC good practice guidance for LULUCF, although they may do so if they wish and report in this row.

(4) Parties do not have to prepare estimates for this category contained in Chapter 3.7 of the IPCC good practice guidance for LULUCF, although they may do so if they wish and report in this row. This land-use category is to allow the total of identified land area to match the national area.

(5) May include other non-specified sources and sinks.

(6) Parties do not have to prepare estimates for this category contained in appendix 3a.1 of the IPCC good practice guidance for LULUCF, although they may do so if they wish and report in this row.

(7) These items are listed for information only and will not be added to the totals, because they are already included in subcategories 5.A.2 to 5.F.2.

Note: The totals for N_2O (5.A and 5.D), CO_2 (5.B and 5.C) and CO_2, CH_4, N_2O (5.E and 5.F) may not equal the summation of the subcategories included in this table, because these totals include data from tables 5(II), 5(IV) and 5(V), where the subcategories are not available. Emissions of CO_2, CH_4, N_2O from 5.G Other are estimated based on the information provided in the background data tables.

Documentation box:
• Parties should provide detailed explanations on the Land Use, Land-Use Change and Forestry sector in Chapter 7: Land Use, Land-Use Change and Forestry (CRF sector 5) of the NIR. Use this documentation box to provide references to relevant sections of the NIR if any additional information and/or further details are needed to understand the content of this table.
• If estimates are reported under 5.G Other, use this documentation box to provide information regarding activities covered under this category and to provide reference to the section in the NIR where background information can be found.
Emissions from Land converted to Cropland are included within emissions from Land converted to Grassland. Emissions from Grassland remaining Grassland are included within emissions from 4.E Presribed Burning of Savannas in Table 4.E.

TABLE 5.A SECTORAL BACKGROUND DATA FOR LAND USE, LAND-USE CHANGE AND FORESTRY
Forest Land
(Sheet 1 of 1)

Australia
2003
2005

GREENHOUSE GAS SOURCE AND SINK CATEGORIES		ACTIVITY DATA	IMPLIED EMISSION FACTORS					EMISSIONS/REMOVALS				
Land-Use Category	Sub-division[1]	Total area (kha)	Carbon stock change in living biomass per area [2,3]			Net carbon stock change in dead organic matter per area[3]	Net carbon stock change in soils per area [3]	Carbon stock change in living biomass[2,3]			Net carbon stock change in dead organic matter[3]	Net carbon stock change in soils [3]
			Increase	Decrease	Net change			Increase	Decrease	Net change		
			(Mg C/ha)					(Gg C)				
A. Total Forest Land		16549.93	1.24	-0.96	0.28	0.00	0.00	20591.28	-15929.40	4661.88	0.00	0.00
1. Forest Land remaining Forest Land	Harvested Wood	16549.93	1.00	-0.96	0.04	0.00	0.00	16555.43	-15929.40	626.03	0.00	0.00
	Managed Native Forest	14886	1.05	0.00	1.05	IE	NE	15634.94	0.00	15634.94	IE	NE
	Plantations	1664	0.55	0.00	0.55	IE	NE	920.50	0.00	920.50	IE	NE
	Commercial Harvest	NE	NE	NE	NE	IE	NE	0.00	-13145.14	-13145.14	IE	NE
	Fuelwood Consumed	NA	NA	NA	NA	IE	NE	0.00	-2784.26	-2784.26	IE	NE
2. Land converted to Forest Land[4]		0.00	0.00	0.00	0.00	0.00	0.00	4035.85	0.00	4035.85	0.00	0.00
2.1 Cropland converted to Forest Land		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	NA	NE	IE	IE	NE	IE	NE	IE	IE	0.00	IE	NE
2.2 Grassland converted to Forest Land		0.00	0.00	0.00	0.00	0.00	0.00	4035.85	0.00	4035.85	0.00	0.00
	NA	NE	NE	NE	NE	IE	NE	4035.85	0.00	4035.85	IE	NE
2.3 Wetlands converted to Forest Land		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	NA	NO	NO	NO	NO	NO	NO	NO	NO	0.00	NO	NO
2.4 Settlements converted to Forest Land		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	NA	NO	NO	NO	NO	NO	NO	NO	NO	0.00	NO	NO
2.5 Other Land converted to Forest Land		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	NA	NO	NO	NO	NO	NO	NO	NO	NO	0.00	NO	NO

(1) Land categories may be further divided according to climate zone, management system, soil type, vegetation type, tree species, ecological zones or national land classification.

(2) CO_2 emissions and removals (carbon stock increase and decrease) should be listed separately except where, due to the methods used, it is technically impossible to separate information on increases and decreases.

(3) The signs for estimates of increases in carbon stocks are positive (+) and of decreases in carbon stocks are negative (-).

(4) A Party may report aggregate estimates for all conversions of land to forest land when data are not available to report them separately. A Party should specify in the documentation box which types of land conversion are included. Separate estimates for grassland conversion should be provided in table 5 as an information item.

Documentation box: Parties should provide detailed explanations on the Land Use, Land-Use Change and Forestry sector in Chapter 7: Land Use, Land-Use Change and Forestry (CRF sector 5) of the NIR. Use this documentation box to provide references to relevant sections of the NIR if any additional information and/or further details are needed to understand the content of this table.
Removals from Cropland converted to Forest Land are included within removals from Grassland converted to Forest Land. The estimate of removals from Cropland and Grassland converted to Forest Land is Afforestation and Reforestation since 1990. Estimates of carbon stock change in dead organic matter are included within the estimates for living biomass, where applicable. Estimates of carbon stock change in soils are included within the estimates for living biomass, where applicable.

TABLE 5.B SECTORAL BACKGROUND DATA FOR LAND USE, LAND-USE CHANGE AND FORESTRY

Cropland

(Sheet 1 of 1)

Australia
2003
2005

GREENHOUSE GAS SOURCE AND SINK CATEGORIES		ACTIVITY DATA	IMPLIED EMISSION FACTORS					EMISSIONS/REMOVALS				
Land-Use Category	Sub-division [1]	Total area (kha)	Carbon stock change in living biomass per area[2], [3]			Net carbon stock change in dead organic matter per area[3]	Net carbon stock change in soils per area [3]	Carbon stock change in living biomass[2], [3], [4]			Net carbon stock change in dead organic matter[3,5]	Net carbon stock change in soils[3]
			Increase	Decrease	Net change			Increase	Decrease	Net change		
			(Mg C/ha)					(Gg C)				
B. Total Cropland		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1. Cropland remaining Cropland		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	NA	NE	NE	NE	NE	NE	NE	NE	NE	0.00	NE	NE
2. Land converted to Cropland[6]		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.1 Forest Land converted to Cropland		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Above Ground	IE	IE	IE	IE	IE	IE	IE	IE	0.00	IE	IE
	Below Ground	IE	IE	IE	IE	IE	IE	IE	IE	0.00	IE	IE
2.2 Grassland converted to Cropland		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	NA	NE	NE	NE	NE	NE	NE	NE	NE	0.00	NE	NE
2.3 Wetlands converted to Cropland		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	NA	NO	NO	NO	NO	NO	NO	NO	NO	0.00	NO	NO
2.4 Settlements converted to Cropland		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	NA	NO	NO	NO	NO	NO	NO	NO	NO	0.00	NO	NO
2.5 Other Land converted to Cropland		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	NA	NO	NO	NO	NO	NO	NO	NO	NO	0.00	NO	NO

(1) Land categories may be further divided according to climate zone, management system, soil type, vegetation type, tree species, ecological zones or national land classification.

(2) CO_2 emissions and removals (carbon stock increase and decrease) should be listed separately except in cases where, due to the methods used, it is technically impossible to separate information on increases and decreases.

(3) The signs for estimates of increases in carbon stocks are positive (+) and of decreases in carbon stocks are negative (-).

(4) For category 5.B.1 Cropland remaining Cropland this column only includes changes in perennial woody biomass.

(5) No reporting on dead organic matter pools is required for category 5.B.1. Cropland remaining Cropland.

(6) A Party may report aggregate estimates for all land conversions to cropland, when data are not available to report them separately. A Party should specify in the documentation box which types of land conversion are included. Separate estimates for forest and grassland conversion should be provided in table 5 as an information item.

Documentation box: Parties should provide detailed explanations on the Land Use, Land-Use Change and Forestry sector in Chapter 7: Land Use, Land-Use Change and Forestry (CRF sector 5) of the NIR. Use this documentation box to provide references to relevant sections of the NIR if any additional information and/or fu details are needed to understand the content of this table.
Emissions from and area of Forest Land converted to Cropland are included within the estimates for Forest Land converted to Grassland in Table 5.C.

TABLE 5.C SECTORAL BACKGROUND DATA FOR LAND USE, LAND-USE CHANGE AND FORESTRY
Grassland
(Sheet 1 of 1)

Australia
2003
2005

GREENHOUSE GAS SOURCE AND SINK CATEGORIES		ACTIVITY DATA	IMPLIED EMISSION FACTORS					EMISSIONS/REMOVALS				
Land-Use Category	Sub-division (1)	Total area (kha)	Carbon stock change in living biomass per area (2), (3)			Net carbon stock change in dead organic matter per area (2)	Net carbon stock change in soils per area (2)	Carbon stock change in living biomass (2), (3), (4)			Net carbon stock change in dead organic matter (2), (5)	Net carbon stock change in soils (2)
			Increase	Decrease	Net change			Increase	Decrease	Net change		
			(Mg C/ha)					(Gg C)				
C. Total Grassland		128.01	0.00	-101.57	-101.57	0.00	0.00	0.00	-13002.29	-13002.29	0.00	0.00
1. Grassland remaining Grassland		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		NE	NE	NE	NE	NE	NE	NE	NE	0.00	NE	NE
2. Land converted to Grassland (6)		128.01	0.00	-101.57	-101.57	0.00	0.00	0.00	-13002.29	-13002.29	0.00	0.00
2.1 Forest Land converted to Grassland		128.01	0.00	-101.57	-101.57	0.00	0.00	0.00	-13002.29	-13002.29	0.00	0.00
	Above Ground	128.01	0.00	-74.12	-74.12	IE	IE	0.00	-9487.80	-9487.80	IE	IE
	Below Ground	IE	IE	IE	IE	IE	IE	0.00	-3514.49	-3514.49	IE	IE
2.2 Cropland converted to Grassland		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	NA	NE	NE	NE	NE	NE	NE	NE	NE	0.00	NE	NE
2.3 Wetlands converted to Grassland		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	NA	NO	NO	NO	NO	NO	NO	NO	NO	0.00	NO	NO
2.4 Settlements converted to Grassland		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	NA	NO	NO	NO	NO	NO	NO	NO	NO	0.00	NO	NO
2.5 Other Land converted to Grassland		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	NA	NO	NO	NO	NO	NO	NO	NO	NO	0.00	NO	NO

(1) Land categories may be further divided according to climate zone, management system, soil type, vegetation type, tree species, ecological zones or national land classification.

(2) The signs for estimates of increases in carbon stocks are positive (+) and of decreases in carbon stocks are negative (-).

(3) CO_2 emissions and removals (carbon stock increase and decrease) should be listed separately except in cases where, due to the methods used, it is technically impossible to separate information on increases and decreases.

(4) For category 5.C.1 Grassland remaining Grassland this column only includes changes in perennial woody biomass.

(5) No reporting on dead organic matter pools is required for category 5.C.1 Grassland remaining Grassland.

(6) A Party may report aggregate estimates for all land conversions to grassland, when data are not available to report them separately. A Party should specify in the documentation box which types of land conversion are included. Separate estimates for forest conversion should be provided in table 5 as an information item.

Documentation box: Parties should provide detailed explanations on the Land Use, Land-Use Change and Forestry sector in Chapter 7: Land Use, Land-Use Change and Forestry (CRF sector 5) of the NIR. Use this documentation box to provide references to relevant sections of the NIR if any additional information and/or further details are needed to understand the content of this table.
Emissions from Forest Land converted to Grassland include emissions from Forest Land converted to Cropland. Emissions from Forest Land converted to Grassland comprise emissions from initial conversion of Forest Land and net emissions from reclearing of forest that has regenerated on previously converted Forest Land. The 2003 estimates are preliminary and will be revised when emissions are confirmed following the next update of estimates using the National Carbon Accounting System. The area of Forest Land converted to Grassland includes the area of Forest Land converted to Cropland. The 2003 estimate is preliminary and will be revised when areas of forest land conversion are confirmed following the next update of estimates using the National Carbon Accounting System. Estimates of carbon stock change in dead organic matter and soils are included within the estimates for living biomass.

TABLE 5.D SECTORAL BACKGROUND DATA FOR LAND USE, LAND-USE CHANGE AND FORESTRY

Wetlands [1]

(Sheet 1 of 1)

Australia
2003
2005

GREENHOUSE GAS SOURCE AND SINK CATEGORIES		ACTIVITY DATA	IMPLIED EMISSION FACTORS					EMISSIONS/REMOVALS				
Land-Use Category	Sub-division [2]	Total area (kha)	Carbon stock change in living biomass per area [3], [4]			Net carbon stock change in dead organic matter per area[4]	Net carbon stock change in soils per area [4]	Carbon stock change in living biomass[3], [4]			Net carbon stock change in dead organic matter[4]	Net carbon stock change in soils [4]
			Increase	Decrease	Net change			Increase	Decrease	Net change		
			(Mg C/ha)					(Gg C)				
D. Total Wetlands		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1. Wetlands remaining Wetlands		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	NA	NE	NE	NE	NE	NE	NE	NE	NE	0.00	NE	NE
2. Land converted to Wetlands[5]		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.1 Forest Land converted to Wetlands		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	NA	NO	NO	NO	NO	NO	NO	NO	NO	0.00	NO	NO
2.2 Cropland converted to Wetlands		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	NA	NO	NO	NO	NO	NO	NO	NO	NO	0.00	NO	NO
2.3 Grassland converted to Wetlands		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	NA	NO	NO	NO	NO	NO	NO	NO	NO	0.00	NO	NO
2.4 Settlements converted to Wetlands		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	NA	NO	NO	NO	NO	NO	NO	NO	NO	0.00	NO	NO
2.5 Other Land converted to Wetlands		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	NA	NO	NO	NO	NO	NO	NO	NO	NO	0.00	NO	NO

(1) Parties do not have to prepare estimates for categories contained in appendices 3a.2, 3a.3 and 3a.4 of the IPCC good practice guidance for LULUCF, although they may do so if they wish.

(2) Land categories may be further divided according to climate zone, management system, soil type, vegetation type, tree species, ecological zones or national land classification.

(3) CO_2 emissions and removals (carbon stock increase and decrease) should be listed separately except in cases where, due to the methods used, it is technically impossible to separate information on increases and decreases.

(4) The signs for estimates of increases in carbon stocks are positive (+) and of decreases in carbon stocks are negative (-).

(5) A Party may report aggregate estimates for all land conversions to wetlands, when data are not available to report them separately. A Party should specify in the documentation box which types of land conversion are included. Separate estimates for forest and grassland conversion should be provided in table 5 as an information item.

Documentation box: Parties should provide detailed explanations on the Land Use, Land-Use Change and Forestry in Chapter 7: Land Use, Land-Use Change and Forestry (CRF sector 5) of the NIR. Use this documentation box to provide references to relevant sections of the NIR if any additional information and/or further details are needed to understand the content of this table.

ry	Sub-division [2]	Total area (kha)				organic matter per area[4]	change in soils per area [4]				change in dead organic matter[4]	change in soils [4]
			Increase	Decrease	Net change			Increase	Decrease	Net change		
					(Mg C/ha)					(Gg C)		
nts		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
maining Settlements		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	NA	NE	NE	NE	NE	NE	NE	NE	NE	0.00	NE	NE
d to Settlements[6]		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
nd converted to Settlements		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	NA	NE	NE	NE	NE	NE	NE	NE	NE	0.00	NE	NE
converted to Settlements		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	NA	NE	NE	NE	NE	NE	NE	NE	NE	0.00	NE	NE
converted to Settlements		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	NA	NE	NE	NE	NE	NE	NE	NE	NE	0.00	NE	NE
converted to Settlements		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	NA	NE	NE	NE	NE	NE	NE	NE	NE	0.00	NE	NE
d converted to Settlements		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	NA	NE	NE	NE	NE	NE	NE	NE	NE	0.00	NE	NE

: have to prepare estimates for categories contained in appendices 3a.2, 3a.3 and 3a.4 of the IPCC good practice guidance for LULUCF, although they may do so if they wish.

ies may be further divided according to climate zone, management system, soil type, vegetation type, tree species, ecological zones or national land classification.

s and removals (carbon stock increase and decrease) should be listed separately except in cases where, due to the methods used, it is technically impossible to separate information on increases and decreases.

estimates of increases in carbon stocks are positive (+) and of decreases in carbon stocks are negative (-).

5.E.1 Settlements remaining Settlements this column only includes changes in perennial woody biomass.

report aggregate estimates for all land conversions to settlements, when data are not available to report them separately. A Party should specify in the documentation box which types of land conversion are included. Separate estimates for forest and grassland conversion should be provided in table 5 as an

ox: vide detailed explanations on the Land Use, Land-Use Change and Forestry sector in Chapter 7: Land Use, Land-Use Change and Forestry (CRF sector 5) of the NIR. Use this documentation box to provide references to relevant sections of the NIR if any additional information and/or further details are nd the content of this table.

TABLE 5.F SECTORAL BACKGROUND DATA FOR LAND USE, LAND-USE CHANGE AND FORESTRY

Other land[(1)]

(Sheet 1 of 1)

Australia
2003
2005

GREENHOUSE GAS SOURCE AND SINK CATEGORIES		ACTIVITY DATA	IMPLIED EMISSION FACTORS					EMISSIONS/REMOVALS				
Land-Use Category	Sub-division [(2)]	Total area (kha)	Carbon stock change in living biomass per area [(3), (4)]			Net carbon stock change in dead organic matter per area[(4)]	Net carbon stock change in soils per area [(4)]	Carbon stock change in living biomass[(3), (4)]			Net carbon stock change in dead organic matter[(4)]	Net carbon stock change in soils [(4)]
			Increase	Decrease	Net change			Increase	Decrease	Net change		
			(Mg C/ha)					(Gg C)				
F. Total Other Land		0.00	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00
1. Other Land remaining Other Land		NE										
2. Land converted to Other Land[(5)]		0.00	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00
2.1 Forest Land converted to Other Land		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	NA	NE	NE	NE	NE	NE	NE	NE	NE	0.00	NE	NE
2.2 Cropland converted to Other Land		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	NA	NE	NE	NE	NE	NE	NE	NE	NE	0.00	NE	NE
2.3 Grassland converted to Other Land		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	NA	NE	NE	NE	NE	NE	NE	NE	NE	0.00	NE	NE
2.4 Wetlands converted to Other Land		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	NA	NO	NO	NO	NO	NO	NO	NO	NO	0.00	NO	NO
2.5 Settlements converted to Other Land		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	NA	NO	NO	NO	NO	NO	NO	NO	NO	0.00	NO	NO

(1) Parties do not have to prepare estimates for this category contained in Chapter 3.7 of the IPCC good practice guidance for LULUCF, although they may do so if they wish. This land-use category is to allow the total of identified land area to match the national area.

(2) Land categories may be further divided according to climate zone, management system, soil type, vegetation type, tree species, ecological zones or national land classification.

(3) CO_2 emissions and removals (carbon stock increase and decrease) should be listed separately except in cases where, due to the methods used, it is technically impossible to separate information on increases and decreases.

(4) The signs for estimates of increases in carbon stocks are positive (+) and of decreases in carbon stocks are negative (-).

(5) A Party may report aggregate estimates for all land conversions to other land, when data are not available to report them separately. A Party should specify in the documentation box which types of land conversion are included. Separate estimates for forest and grassland conversion should be provided in table 5 as an information item.

Documentation box:
Parties should provide detailed explanations on the Land Use, Land-Use Change and Forestry sector in Chapter 7: Land Use, Land-Use Change and Forestry (CRF sector 5) of the NIR. Use this documentation box to provide references to relevant sections of the NIR if any additional information and/or further details are needed to understand the content of this table.

TABLE 5 (I) SECTORAL BACKGROUND DATA FOR LAND USE, LAND-USE CHANGE AND FORESTRY

Direct N_2O emissions from N fertilization [1]

(Sheet 1 of 1)

Australia
2003
2005

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	ACTIVITY DATA	IMPLIED EMISSION FACTORS	EMISSIONS
Land-Use Category [2]	Total amount of fertilizer applied (Gg N/yr)	N_2O-N emissions per unit of fertilizer (kg N_2O-N/kg N)[3]	N_2O (Gg)
Total for all Land Use Categories	**0.00**	**0.00**	**0.00**
A. Forest Land [4], [5]	0.00	0.00	0.00
1. Forest Land remaining Forest Land	NE	NE	NE
2. Land converted to Forest Land	NE	NE	NE
G. Other *(please specify)*	0.00	0.00	0.00
NA	NA	NA	NA

(1) Direct N_2O emissions from fertilization are estimated using equations 3.2.17 and 3.2.18 of the IPCC good practice guidance for LULUCF based on the amount of fertilizers applied to forest land. The indirect N_2O emissions from forest land are estimated as part of the total indirect emissions (Agriculture sector and Forest Land) in the Agriculture sector based on the total fertilizers used in the country.

(2) N_2O emissions from N fertilization of cropland and grassland are reported in the Agriculture sector; therefore only forest land is included in this table.

(3) In the calculation of the implied emission factor, N_2O emissions are converted to N_2O-N by multiplying by 28/44.

(4) If a Party is not able to separate the fertilizer applied to forest land from that applied to agriculture, it may report all N_2O emissions from fertilization in the Agriculture sector. This should be explicitly indicated in the documentation box.

(5) A Party may report aggregate estimates for all N fertilization on forest land when data are not available to report forest land remaining forest land and land conversion to forest land separately.

Documentation box:
Parties should provide detailed explanations on the Land Use, Land-Use Change and Forestry sector in Chapter 7: Land Use, Land-Use Change and Forestry (CRF sector 5) of the NIR. Use this documentation box to provide references to relevant sections of the NIR if any additional information and/or further details are needed to understand the content of this table.

TABLE 5 (II) SECTORAL BACKGROUND DATA FOR LAND USE, LAND-USE CHANGE AND FORESTRY
N_2O emissions from drainage of soils [1]
(Sheet 1 of 1)

Australia
2003
2005

GREENHOUSE GAS SOURCE AND SINK CATEGORIES		ACTIVITY DATA	IMPLIED EMISSION FACTORS	EMISSIONS
Land-Use Category [2]	**Sub-division [3]**	**Area of drained soils (kha)**	**N_2O-N per area drained [4] (kg N_2O-N/ha)**	**N_2O (Gg)**
Total all Land-Use Categories		**0.00**	**0.00**	**0.00**
A. Forest Land		0.00	0.00	0.00
Organic Soil		0.00	0.00	0.00
	NA	NE	NE	NE
Mineral Soil		0.00	0.00	0.00
	NA	NE	NE	NE
D. Wetlands		0.00	0.00	0.00
Organic Soil		0.00	0.00	0.00
	NA	NE	NE	NE
Mineral Soil		0.00	0.00	0.00
	NA	NE	NE	NE
G. Other *(please specify)*		0.00	0.00	0.00
NA	NA	NA	NA	NA

[1] Methodologies for estimating N_2O emissions from drainage of soils are not addressed in the Revised 1996 IPCC Guidelines, but are addressed for forest soils in Appendix 3a.2 of the IPCC good practice guidance for LULUCF (equation 3a.2.1) and for wetland soils in appendix 3a.3.

[2] N_2O emissions from drained cropland and grassland soils are covered in the Agriculture tables of the CRF under Cultivation of Histosols.

[3] A Party should report further disaggregations of drained soils corresponding to the methods used. Tier 1 disaggregates soils into "nutrient rich" and "nutrient poor" areas, whereas higher-tier methods can further disaggregate into different peatland types, soil fertility or tree species.

[4] In the calculation of the implied emission factor, N_2O emissions are converted to N_2O-N by multiplying by 28/44.

Documentation box: Parties should provide detailed explanations on the Land Use, Land-Use Change and Forestry sector in Chapter 7: Land Use, Land-Use Change and Forestry (CRF sector 5) of the NIR. Use this documentation box to provide references to relevant sections of the NIR if any additional information and/or further details are needed to understand the content of this table.

TABLE 5 (III) SECTORAL BACKGROUND DATA FOR LAND USE, LAND-USE CHANGE AND FORESTRY
N_2O emissions from disturbance associated with land-use conversion to cropland [1]
(Sheet 1 of 1)

Australia
2003
2005

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	ACTIVITY DATA	IMPLIED EMISSION FACTORS	EMISSIONS
Land-Use Category [2]	Land area converted	N_2O-N emissions per area converted [3]	N_2O
	(kha)	(kg N_2O-N/ha)	(Gg)
Total all Land-Use Categories [4]	**0.00**	**0.00**	**0.00**
B. Cropland	0.00	0.00	0.00
2. Lands converted to Cropland [5]	0.00	0.00	0.00
Organic Soils	NE	NE	NE
Mineral Soils	NE	NE	NE
2.1 Forest Land converted to Cropland	0.00	0.00	0.00
Organic Soils	NE	NE	NE
Mineral Soils	NE	NE	NE
2.2 Grassland converted to Cropland	0.00	0.00	0.00
Organic Soils	NE	NE	NE
Mineral Soils	NE	NE	NE
2.3 Wetlands converted to Cropland [6]	0.00	0.00	0.00
Organic Soils	NE	NE	NE
Mineral Soils	NE	NE	NE
2.5 Other Land converted to Cropland	0.00	0.00	0.00
Organic Soils	NE	NE	NE
Mineral Soils	NE	NE	NE
G. Other *(please specify)*	0.00	0.00	0.00
NA	NA	NA	NA

(1) Methodologies for N_2O emissions from disturbance associated with land-use conversion are based on equations 3.3.14 and 3.3.15 of the IPCC good practice guidance for LULUCF. N_2O emissions from fertilization in the preceding land use and new land use should not be reported.

(2) According to the IPCC good practice guidance for LULUCF N_2O emissions from disturbance of soils are only relevant for land conversions to cropland. N_2O emissions from cropland remaining cropland are included in the Agriculture sector of the good practice guidance. The good practice guidance provides methodologies only for mineral soils.

(3) In the calculation of the implied emission factor, N_2O emissions are converted to N_2O-N by multiplying by 28/44.

(4) Parties can separate between organic and mineral soils, if they have data available.

(5) If activity data cannot be disaggregated to all initial land uses, Parties may report some initial land uses aggregated under other lands converted to cropland (indicate in the documentation box what this category includes).

(6) Parties should avoid double counting with N_2O emissions from drainage and from cultivation of organic soils reported in Agriculture under Cultivation of Histosols.

Documentation box:
Parties should provide detailed explanations on the Land Use, Land-Use Change and Forestry sector in Chapter 7: Land Use, Land-Use Change and Forestry (CRF Sector 5) of the NIR. Use this documentation box to provide references to relevant sections of the NIR if any additional information and/or further details are needed to understand the content of this table.

LAND USE, LAND USE CHANGE AND FORESTRY

TABLE 5 (IV) SECTORAL BACKGROUND DATA FOR LAND USE, LAND-USE CHANGE AND FORESTRY
Carbon emissions from agricultural lime application [1]
(Sheet 1 of 1)

Australia
2003
2005

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	ACTIVITY DATA	IMPLIED EMISSION FACTORS	EMISSIONS
Land-Use Category	Total amount of lime applied	Carbon emissions per unit of lime	Carbon
	(Mg/yr)	(Mg C/Mg)	(Gg)
Total all Land-Use Categories [(2), (3), (4)]	0.00	0.00	0.00
B. Cropland [(4)]	0.00	0.00	0.00
Limestone $CaCO_3$	NE	NE	NE
Dolomite $CaMg(CO_3)_2$	NE	NE	NE
		0.00	
C. Grassland [(4)]	0.00	0.00	0.00
Limestone $CaCO_3$	NE	NE	NE
Dolomite $CaMg(CO_3)_2$	NE	NE	NE
		0.00	
G. Other *(please specify)* [(4, 5)]	0.00	0.00	0.00
Limestone $CaCO_3$	NE	NE	NE
Dolomite $CaMg(CO_3)_2$	NE	NE	NE
		0.00	

(1) Carbon emissions from agricultural lime application are addressed in equation 3.3.6 and 3.4.11 of the IPCC good practice guidance for LULUCF.

(2) If Parties are not able to separate liming application for different land-use categories, they should include liming for all land-use categories in the total.

(3) Parties that are able to provide data for lime application to forest land should provide this information under 5.G Other and specify in the documentation box that forest land application is included in this category.

(4) A Party may report agregate estimates for total lime applications when data are not available for limestone and dolomite.

(5) If a Party has data broken down to limestone and dolomite at national level, it can report these data under 5.G Other.

Documentation box: Parties should provide detailed explanations on the Land Use, Land-Use Change and Forestry sector in Chapter 7: Land Use, Land-Use Change and Forestry (CRF sector 5) of the NIR. Use this documentation box to provide references to relevant sections of the NIR if any additional information and/or further details are needed to understand the content of this table.

TABLE 5 (V) SECTORAL BACKGROUND DATA FOR LAND USE, LAND-USE CHANGE AND FORESTRY
Biomass Burning [(1)]
(Sheet 1 of 1)

Australia
2003
2005

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	ACTIVITY DATA			IMPLIED EMISSION FACTOR			EMISSIONS		
	Description[(3)]	Unit	Values	CO_2	CH_4	N_2O	CO_2 [(4)]	CH_4	N_2O
Land-Use Category[(2)]		(ha or kg dm)		(Mg/activity data unit)			(Gg)		
Total for Land-Use Categories	area burned	ha	1493012	0.00	0.11	0.00	0.00	159.59	2.95
A. Forest Land	area burned	ha	1493012	0.00	0.06	0.00	0.00	86.97	1.60
1. Forest land remaining Forest Land	area burned	ha	1493012	0.00	0.06	0.00	0.00	86.97	1.60
Controlled Burning	area burned	ha	574949	NA	0.02	0.00	NA	11.33	0.21
Wildfires	area burned	ha	918063	NA	0.08	0.00	NA	75.65	1.40
2. Land converted to Forest Land							0.00	0.00	0.00
Controlled Burning	NA	NA	NA	NA	NA	NA	NA	NA	NA
Wildfires	NA	NA	NA	NA	NA	NA	NA	NA	NA
B. Cropland							0.00	0.00	0.00
1. Cropland remaining Cropland[(5)]									
Controlled Burning									
Wildfires									
2. Land converted to Cropland							0.00	0.00	0.00
Controlled Burning	IE	IE	IE	IE	IE	IE	IE	IE	IE
Wildfires	NA	NA	NA	NA	NA	NA	NA	NA	NA
2.1. Forest Land converted to Cropland							0.00	0.00	0.00
Controlled Burning	IE	IE	IE	IE	IE	IE	IE	IE	IE
Wildfires	NA	NA	NA	NA	NA	NA	NA	NA	NA
C. Grassland							0.00	72.62	1.34
1. Grassland remaining grassland [(6)]							0.00	0.00	0.00
Controlled Burning	IE	IE	IE	NA	IE	IE	NA	IE	IE
Wildfires	IE	IE	IE	NA	IE	IE	NA	IE	IE
2. Land converted to Grassland							0.00	72.62	1.34
Controlled Burning	IE	IE	IE	IE	IE	IE	IE	72.62	1.34
Wildfires	NA	NA	NA	NA	NA	NA	NA	NA	NA
2.1. Forest Land converted to Grassland							0.00	72.62	1.34
Controlled Burning	IE	IE	IE	IE	IE	IE	IE	72.62	1.34
Wildfires	NA	NA	NA	NA	NA	NA	NA	NA	NA
D. Wetlands [(7)]							0.00	0.00	0.00
1. Wetlands remaining Wetlands							0.00	0.00	0.00
Controlled Burning	NO	NO	NO	NO	NO	NO	NO	NO	NO
Wildfires	NO	NO	NO	NO	NO	NO	NO	NO	NO
2. Land converted to Wetlands							0.00	0.00	0.00
Controlled Burning	NO	NO	NO	NO	NO	NO	NO	NO	NO
Wildfires	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.1. Forest Land converted to Wetlands							0.00	0.00	0.00
Controlled Burning	NO	NO	NO	NO	NO	NO	NO	NO	NO
Wildfires	NO	NO	NO	NO	NO	NO	NO	NO	NO
E. Settlements [(7)]	NE	NE	NE	NA	NE	NE	NA	NE	NE
F. Other Land [(8)]	IE	IE	IE	NA	IE	IE	NA	IE	IE
G. Other *(please specify)*							0.00	0.00	0.00
NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

(1) Methodological guidance on burning can be found in sections 3.2.1.4 and 3.4.1.3 of the IPCC good practice guidance for LULUCF.
(2) Parties should report both Controlled/Prescribed Burning and Wildfires emissions, where appropriate, in a separate manner.
(3) For each category activity data should be selected between area burned or biomass burned. Units for area will be ha and for biomass burned kg dm. The implied emission factor will refer to the selected activity data with an automatic change in the units.

(4) If CO_2 emissions from biomass burning are not already included in tables 5.A - 5.F, they should be reported here. This should be clearly documented in the documentation box and in the NIR. Double counting should be avoided. Parties that include all carbon stock changes in the carbon stock tables (5.A, 5.B, 5.C, 5.D, 5.E and 5.F), should report IE (included elsewhere) in this column.
(5) Biomass burning on cropland remaining cropland is reported in the Agriculture sector.
(6) Only includes emissions from controlled biomass burning on grasslands outside the tropics (prescribed savanna burning is reported under the Agriculture sector).
(7) Parties do not have to prepare estimates for categories contained in appendices 3a.2, 3a.3 and 3a.4 of the IPCC good practice guidance for LULUCF, although they may do so if they wish.

Documentation box:
Parties should provide detailed explanations on the Land Use, Land-Use Change and Forestry sector in Chapter 7: Land Use, Land-Use Change and Forestry (CRF sector 5) of the NIR. Use this documentation box to provide references to relevant sections of the NIR if any additional information and/or further details are needed to understand the content of this table.

Australian biomass burning emissions are estimated for four separate categories: (1) as 5.A.1 Forest Land remaining Forest Land (previously 5.E Prescribed Burning and Wildfire in Forests); (2) as 4.E Prescribed Burning of Savanna; (3) as 4.F Field Burning of Agricultural Residues; and (4) within 5.C.2.1 Forest Land converted to Grassland (previously 5.B Forest and Grassland Conversion), which includes 5.B.2.1 Forest Land converted to Cropland.

Biomass burning emissions from 5.B.2.1 Forest Land converted to Cropland *Controlled Burning* are included within emissions from 5.C.2.1 Forest Land converted to Grassland *Controlled Burning* in this table, separate to CO_2 emissions included within emissions from 5.C.2.1 Forest Land converted to Grassland in Table 5.C. Forest Land is not converted to Cropland by wildfires.
Biomass burning emissions from 5.C.1 Grassland remaining Grassland are reported as emissions from 4.E Prescribed Burning of Savannas in Table 4.E.

Biomass burning emissions from 5.C.2.1 Forest Land converted to Grassland *Controlled Burning* are included in this table, separate to CO_2 emissions in Table 5.C. Forest Land is generally not converted to Grassland by wildfires.

There are no biomass burning emissions from 5.D Wetlands. Biomass burning emissions from land with native vegetation subject to wildfire that could be biologically classified as a 'wetland' is included within emissions from 5.A.1 Forest Land remaining Forest Land and 4.E Prescribed Burning of Savanna in Table 4.E.
Biomass burning emissions from 5.F Other Land (i.e. in the arid centre of Australia) are included within emissions from 4.E Prescribed Burning of Savanna in Table 4.E.

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

Australia
2003
2005

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Net CO_2 emissions/ removals	CH_4	N_2O	HFCs [1]		PFCs[1]		SF_6		NO_x	CO	NMVOC	SO_2
				P	A	P	A	P	A				
	(Gg)			CO_2 equivalent (Gg)						(Gg)			
5. Land Use, Land-Use Change and Forestry	[5] 30581.52	159.59	2.95							169.46	6635.82	0.00	0.00
A. Forest Land	[5] -17093.55	86.97	1.60							65.35	2559.03		
B. Cropland	[5] 0.00	0.00	0.00							0.00	0.00		
C. Grassland	[5] 47675.07	72.62	1.34							104.11	4076.78		
D. Wetlands	[5] 0.00	0.00	0.00							0.00	0.00		
E. Settlements	[5] 0.00	0.00	0.00							0.00	0.00		
F. Other Land	[5] 0.00	0.00	0.00							0.00	0.00		
G. Other	[5] 0.00	0.00	0.00							0.00	0.00		

[5] Note that for the purposes of reporting, the signs for removals are always (-) and for emissions (+).

SUMMARY 2 SUMMARY REPORT FOR CO_2 EQUIVALENT EMISSIONS
(Sheet 1 of 1)

Australia
2003
2005

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	CO_2 [1]	CH_4	N_2O	HFCs [2]	PFCs [2]	SF_6 [2]	Total
	CO_2 equivalent (Gg)						
5. Land Use, Land-Use Change and Forestry[1]	30581.52	3351.40	914.26				34847.19
A. Forest Land	-17093.55	1826.47	497.46				-14769.62
B. Cropland	0.00	0.00	0.00				0.00
C. Grassland	47675.07	1524.93	416.80				49616.80
D. Wetlands	0.00	0.00	0.00				0.00
E. Settlements	0.00	0.00	0.00				0.00
F. Other Land	0.00	0.00	0.00				0.00
G. Other	0.00	0.00	0.00				0.00

[1] For CO_2 emissions from Land-Use Change and Forestry the net emissions/removals are to be reported. Note that for the purposes of reporting, the signs for removals are always (-) and for emissions (+).

LAND USE, LAND USE CHANGE AND FORESTRY

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

Australia
2003
2005

GREENHOUSE GAS SOURCE AND SINK	CO_2		CH_4		N_2O		HFCs		PFCs		SF_6	
CATEGORIES	Method applied	Emission factor	Method applied	Emission factor	Method applied	Emission factor	Method applied	Emission factor	Method applied	Emission factor	Method applied	Emission factor
5. Land Use, Land-Use Change and Forestry												
A. Forest Land	CS	CS	CS	CS	CS	CS	NA	NA	NA	NA	NA	NA
B. Cropland	CS	CS	CS	CS	CS	CS	NA	NA	NA	NA	NA	NA
C. Grassland	CS	CS	CS	CS	CS	CS	NA	NA	NA	NA	NA	NA
D. Wetlands	NE	NE	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA
E. Settlements	NE	NE	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA
F. Other Land	NE	NE	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA
G. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

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)
CR (CORINAIR)
CS (Country Specific)
OTH (Other)

If using more than one method within one source category, list all the relevant methods. Explanations regarding country-specific methods, other methods or any modifications to the default IPCC methods, as well as information regarding the use of different methods per source category where more than one method is indicated, should be provided in the documentation box. Also use the documentation box to explain the use of notation OTH.

Use the following notation keys to specify the emission factor used:

D (IPCC default)
CR (CORINAIR)
CS (Country Specific)
PS (Plant Specific)
OTH (Other)

Where a mix of emission factors has been used, list all the methods in the relevant cells and give further explanations in the documentation box. Also use the documentation box to explain the use of notation OTH.

Documentation box:
- Parties should provide the full information on methodological issues, such as methods and emission factors used, in the relevant sections of Chapters 3 to 9 (see section 2.2 of each of Chapters 3 - 9) of the NIR. Use this documentation box to provide references to relevant sections of the NIR if any additional infor and further details are needed to understand the content of this table.
- Where a mix of methods/emission factors has been used within one source category, use this documentation box to specify those methods/emission factors for the various sub-sources where they have been applied.
- Where the notation OTH (Other) has been entered in this table, use this documentation box to specify those other methods/emission facto

TABLE 7 SUMMARY OVERVIEW FOR KEY CATEGORIES
(Sheet 1 of 1)

Australia
2003
2005

KEY CATEGORIES OF EMISSIONS AND REMOVALS	GAS	CRITERIA USED FOR KEY CATEGORY IDENTIFICATION			Key category excluding LULUCF (1)	Key category including LULUCF (1)	COMMENTS (1)
		L	T	Q			
Specify key categories according to the national level of disaggregation used:							
Forest Conversion	CO2	Level	Trend		Yes	Yes	
Forest conversion	CH4	Level	Trend		Yes	Yes	

Note: L = Level assessment; T = Trend assessment; Q = Qualitative assessment.
(1) The term “key categories” refers to both the key source categories as addressed in the IPCC good practice guidance and the key categories as addressed in the IPCC good practice guidance for LULUCF.

(2) For estimating key categories Parties may chose the disaggregation level presented as an example in table 7.1 of the IPCC good practice guidance (page 7.6) and table 5.4.1 (page 5.31) of the IPCC good practice guidance for LULUCF, the level used in table Summary 1.A of the common reporting format or any other disaggregation level that the Party used to determine its key categories.

Documentation box:

Parties should provide the full information on methodologies used for identifying key categories and the quantitative results from the level and trend assessments (according to tables 7.1–7.3 of the IPCC good practice guidance and tables 5.4.1–5.4.3 of the IPCC good practice guidance for LULUCF) in Annex 1 to the NIR.

See Annex 1 of the NIR for detail.

TABLE 9 COMPLETENESS - (INFORMATION ON NOTATION KEYS)
(Sheet 1 of 1)

Australia
2003
2005

Sources and sinks not reported (NE)[1]			
GHG	Sector[2]	Source/sink category[2]	Explanation
CO_2	5. Land Use, Land-Use Change and Forestry	5.B.1 Cropland remaining Cropland	No data are available.
	5. Land Use, Land-Use Change and Forestry	5.B.2.2 Grassland converted to Cropland	No data are available.
	5. Land Use, Land-Use Change and Forestry	5.C.1 Grassland remaining Grassland	No data are available.
	5. Land Use, Land-Use Change and Forestry	5.C.2.2 Cropland converted to Grassland	No data are available.
	5. Land Use, Land-Use Change and Forestry	5.D.1 Wetlands remaining Wetlands	No data are available.
	5. Land Use, Land-Use Change and Forestry	5.E.1 Settlements remaining Settlements	No data are available.
	5. Land Use, Land-Use Change and Forestry	5.E.2 Land converted to Settlements	No data are available.
	5. Land Use, Land-Use Change and Forestry	5.F.1 Other Land remaining Other Land	No data are available.
	5. Land Use, Land-Use Change and Forestry	5.F.2 Land converted to Other Land	No data are available.
	5. Land Use, Land-Use Change and Forestry	5.B Cropland, 5.C Grassland, 5.G Other - Carbon emissions from agricultural lime application	No data are available.
CH_4	5. Land Use, Land-Use Change and Forestry	5.E Settlements - Biomass Burning (i.e. Wildfires)	No data are available. Wildfires in urban areas occur in Australia.
N_2O	5. Land Use, Land-Use Change and Forestry	5.A Forest Land - Direct N_2O emissions from N fertilization	Under review by NCAS.
	5. Land Use, Land-Use Change and Forestry	5.A Forest Land - N_2O emissions from drainage of soils	No data are available on N leaching. In Australia, soils are characterized by low nutrient levels and there is only a very limited incidence of organic soils.
	5. Land Use, Land-Use Change and Forestry	5.D Wetlands - N_2O emissions from drainage of soils	No data are available on N leaching.
	5. Land Use, Land-Use Change and Forestry	5.B Cropland - N_2O emissions from disturbance associated with land-use conversion to cropping	Only limited data are available. A small number of projects investigating emissions at a national scale are under way.
	5. Land Use, Land-Use Change and Forestry	5.E Settlements - Biomass Burning (i.e. Wildfires)	No data are available. Wildfires in urban areas occur in Australia.

Sources and sinks reported elsewhere (IE)[3]				
GHG	Source/sink category	Allocation as per IPCC Guidelines	Allocation used by the Party	Explanation
CO_2	5.A.2.1 Cropland converted to Forest Land		5.A.2.2 Grassland converted to Forest Land	Removals from Cropland converted to Forest Land are inlcuded within removals from Grassland converted to Forest Land. This is Afforestation and Reforestation since 1990.
	5.B.2.1 Forest Land converted to Cropland		5.C.2.1 Forest Land converted to Grassland	Most cropping in Australia is undertaken on a rotation basis with grazing activity.
CH_4	5.B.2.1 Forest Land converted to Cropland		5.C.2.1 Forest Land converted to Grassland - Controlled Burning	Most cropping in Australia is undertaken on a rotation basis with grazing activity.
	5.C.1 Grassland remaining Grassland	4.E Prescribed Burning of Savannas	4.E Prescribed Burning of Savannas	Covered in Agriculture sector.
	5.E Other Land		4.E Prescribed Burning of Savannas	Covered in Agriculture sector. Wildfires occur in the arid interior of Australia.
N_2O	5.B.2.1 Forest Land converted to Cropland		5.C.2.1 Forest Land converted to Grassland - Controlled Burning	Most cropping in Australia is undertaken on a rotation basis with grazing activity.
	5.C.1 Grassland remaining Grassland	4.E Prescribed Burning of Savannas	4.E Prescribed Burning of Savannas	Covered in Agriculture sector.
	5.E Other Land		4.E Prescribed Burning of Savannas	Covered in Agriculture sector. Wildfires occur in the arid interior of Australia.

(1) Clearly indicate sources and sinks which are considered in the IPCC Guidelines but are not considered in the submitted inventory. Explain the reason for excluding these sources and sinks, in order to avoid arbitrary interpretations. An entry should be made for each source/sink category for which the notation key NE (not estimated) is entered in the sectoral tables.
(2) Indicate omitted source/sink following the IPCC source/sink category structure (e.g. sector: Waste, source category: Waste-Water Handling).
(3) Clearly indicate sources and sinks in the submitted inventory that are allocated to a sector other than that indicated by the IPCC Guidelines. Show the sector indicated in the IPCC Guidelines and the sector to which the source or sink is allocated in the submitted inventory. Explain the reason for reporting these sources and sinks in a different sector. An entry should be made for each source/sink for which the notation key IE (included elsewhere) is used in the sectoral tables.

TABLE 10 EMISSIONS TRENDS (CO_2)
(Sheet 1 of 1)

Australia
2003
2005

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Base year[1]	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	Change from 1990[1] to latest reported year
	(Gg)															(%)
CO_2 [2]	101,141.87	101,141.87	76,299.63	59,242.08	46,588.54	46,763.93	43,979.84	40,197.40	35,659.21	48,273.66	39,868.25	42,065.20	36,914.41	40,628.55	30,581.52	-69.76
A. Forest Land	-21,083.58	-21,083.58	-21,503.85	-22,346.12	-21,920.19	-18,594.96	-18,212.18	-19,115.50	-19,856.09	-20,808.86	-15,745.54	-15,214.05	-14,223.89	-17,781.78	-17,093.55	-18.92
B. Cropland	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	
C. Grassland	122,225.44	122,225.44	97,803.48	81,588.21	68,508.74	65,358.90	62,192.02	59,312.90	55,515.30	69,082.52	55,613.79	57,279.25	51,138.31	58,410.33	47,675.07	-60.99
D. Wetlands	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	
E. Settlements	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	
F. Other Land	NE	NE	NE	NE	NE	NE	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	
CH_4	4,322.26	4,322.26	4,008.75	3,472.75	3,204.08	3,178.48	2,935.28	2,880.28	2,925.27	2,943.79	2,865.81	2,752.78	2,798.12	3,535.96	3,351.40	-22.46
A. Forest Land	1,219.88	1,219.88	1,258.29	1,187.04	1,166.05	1,109.81	1,174.39	1,133.58	1,195.34	1,185.99	1,124.89	965.37	1,050.39	1,846.83	1,826.47	49.73
B. Cropland	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	
C. Grassland	3,102.38	3,102.38	2,750.46	2,285.71	2,038.03	2,068.67	1,760.89	1,746.69	1,729.93	1,757.80	1,740.92	1,787.41	1,747.73	1,689.13	1,524.93	-50.85
D. Wetlands	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	
E. Settlements	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	
F. Other Land	NE	NE	NE	NE	NE	NE	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	
N_2O	1,180.21	1,180.21	1,094.48	948.05	874.63	867.69	801.15	786.16	798.40	803.47	782.21	751.47	763.78	964.69	914.26	-22.53
A. Forest Land	332.25	332.25	342.71	323.30	317.59	302.27	319.86	308.74	325.56	323.02	306.38	262.93	286.08	503.00	497.46	49.73
B. Cropland	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	
C. Grassland	847.96	847.96	751.77	624.74	557.05	565.42	481.30	477.42	472.83	480.45	475.84	488.55	477.70	461.68	416.80	-50.85
D. Wetlands	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	
E. Settlements	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	
F. Other Land	NE	NE	NE	NE	NE	NE	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	
Land Use, Land-Use Change and Forestry[2] (Gg CO_2 equivalent)	**106,644.34**	**106,644.34**	**81,402.86**	**63,662.88**	**50,667.25**	**50,810.10**	**47,716.28**	**43,863.84**	**39,382.88**	**52,020.91**	**43,516.28**	**45,569.45**	**40,476.32**	**45,129.19**	**34,847.19**	**-67.32**

(1) The column "Base year" should be filled in only by those Parties with economies in transition that use a base year different from 1990 in accordance with the relevant decisions of the COP. For these Parties, this different base year is used to calculate the percentage change in the final column of this table.

(2) Fill in net emissions/removals as reported in table Summary 1.A. For the purposes of reporting, the signs for removals are always negative (-) and for emissions positive (+).

Documentation box:

• Parties should provide detailed explanations on emissions trends in Chapter 2: Trends in Greenhouse Gas Emissions and, as appropriate, in the corresponding Chapters 3 - 9 of the NIR. Use this documentation box to provide references to relevant sections of the NIR if any additional information and further details are needed to understand the content of this table.

See chapter 7 and Annex 3 of the NIR for explanation.

LAND USE, LAND USE CHANGE AND FORESTRY

APPENDIX TABLE 1
ENERGY (INCLUDING TRANSPORT)

APPENDIX TABLE 1 - 2003

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_2O (Gg)	NO_x (Gg)	CO (Gg)	NMVOC (Gg)	SO_2 (Gg)
1A1 Energy Industries	**2,507.97**	**208,302.60**	**10.45**	**2.11**	**698.39**	**71.74**	**8.86**	**668.64**
Coal	1,936.57	177,078.71	1.51	1.98	489.25	28.46	2.88	641.15
Petroleum	136.81	9,360.53	0.26	0.08	94.21	18.31	3.04	25.73
Gas	425.09	21,863.36	5.14	0.05	95.06	19.94	1.75	1.72
Wood, wood waste	0.87	NA	0.00	0.00	0.23	0.01	0.00	0.00
Biogas	14.88	NA	3.54	0.00	19.64	5.02	1.18	0.03
1A1a Electricity and Heat Production	**2,181.20**	**189,518.35**	**8.95**	**2.01**	**579.73**	**49.83**	**6.28**	**640.68**
Black coal	1,239.41	112,191.92	1.04	1.01	390.19	13.41	1.97	480.68
Brown coal incl. briquettes	676.46	63,686.54	0.45	0.95	93.12	13.02	0.89	153.03
Petroleum	23.91	1,658.96	0.08	0.01	27.21	7.05	0.91	5.66
Gas	231.91	11,980.93	3.84	0.03	49.35	11.33	1.33	1.28
Wood, wood waste	0.87	NA	0.00	0.00	0.23	0.01	0.00	0.00
Biogas	14.88	NA	3.54	0.00	19.64	5.02	1.18	0.03
Electricity generation	**2,181.20**	**189,518.35**	**8.95**	**2.01**	**579.73**	**49.83**	**6.28**	**640.68**
Black coal	1,239.41	112,191.92	1.04	1.01	390.19	13.41	1.97	480.68
Brown coal incl. briquettes	676.46	63,686.54	0.45	0.95	93.12	13.02	0.89	153.03
Petroleum	23.91	1,658.96	0.08	0.01	27.21	7.05	0.91	5.66
Gas	231.91	11,980.93	3.84	0.03	49.35	11.33	1.33	1.28
Wood, wood waste	0.87	NA	0.00	0.00	0.23	0.01	0.00	0.00
Biogas	14.88	NA	3.54	0.00	19.64	5.02	1.18	0.03

Note: CO_2 emissions from biomass burning are reported in APPENDIX TABLE 1-Fuel combustion activities 1-Memo Items: Biomass burned for energy. These emissions are not included in totals in the COMMON REPORTING FORMAT TABLES.

APPENDIX TABLE 1 - 2003

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

SOURCE CATEGORIES	ACTIVITY DATA	EMISSION ESTIMATES						
Fossil fuels	Energy use (PJ)	CO_2 (Gg)	CH_4 (Gg)	N_2O (Gg)	NO_x (Gg)	CO (Gg)	NMVOC (Gg)	SO_2 (Gg)
1A1b Petroleum refining	**102.69**	**6626.14**	**0.09**	**0.05**	**46.45**	**5.60**	**0.09**	17.05
Petroleum	81.92	5563.40	0.07	0.05	31.44	4.42	0.07	17.00
Gas	20.78	1062.74	0.02	0.00	15.02	1.18	0.02	0.05
1A1c Manufacture of Solid Fuels and Other Energy Industries	**224.08**	**12158.11**	**1.40**	**0.05**	**72.20**	**16.31**	**2.49**	**10.91**
Coal	20.70	1200.26	0.02	0.02	5.94	2.03	0.02	7.44
Petroleum	30.98	2138.16	0.11	0.02	35.57	6.84	2.07	3.08
Gas	172.41	8819.68	1.27	0.02	30.69	7.44	0.40	0.40
Coke Ovens	**20.77**	**1191.85**	**0.02**	**0.02**	**6.19**	**2.00**	**0.02**	**8.66**
Coal	19.70	1113.73	0.02	0.02	5.65	1.92	0.02	7.29
Petroleum	1.07	78.12	0.00	0.00	0.54	0.08	0.00	1.37
Briquetting	**1.00**	**86.53**	**0.00**	**0.00**	**0.29**	**0.11**	**0.00**	**0.15**
Coal	1.00	86.53	0.00	0.00	0.29	0.11	0.00	0.15
Coal mining	**28.18**	**1944.69**	**0.10**	**0.02**	**32.86**	**6.24**	**1.97**	**1.61**
Petroleum	28.18	1944.69	0.10	0.02	32.86	6.24	1.97	1.61

APPENDIX TABLE 1 - 2003

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

SOURCE CATEGORIES		ACTIVITY DATA	EMISSION ESTIMATES						
Fossil fuels		Energy use (PJ)	CO_2 (Gg)	CH_4 (Gg)	N_2O (Gg)	NO_x (Gg)	CO (Gg)	NMVOC (Gg)	SO_2 (Gg)
1A1c	**Manufacture of Solid Fuels and Other Energy Industries (cont.)**								
	Oil and gas production and field processing	**150.69**	**7735.98**	**1.09**	**0.02**	**28.44**	**6.88**	**0.44**	**0.44**
	Petroleum	1.72	115.35	0.01	0.00	2.17	0.52	0.10	0.10
	Gas	148.97	7620.62	1.09	0.01	26.27	6.36	0.34	0.34
	Natural gas transmission	**14.82**	**757.92**	**0.12**	**0.00**	**2.78**	**0.68**	**0.04**	**0.03**
	Gas	14.82	757.92	0.12	0.00	2.78	0.68	0.04	0.03
	Gas production and distribution	**8.62**	**441.14**	**0.07**	**0.00**	**1.64**	**0.40**	**0.02**	**0.02**
	Gas	8.62	441.14	0.07	0.00	1.64	0.40	0.02	0.02

APPENDIX TABLE 1 - 2003

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_2O (Gg)	NO_x (Gg)	CO (Gg)	NMVOC (Gg)	SO_2 (Gg)
1A2 Manufacturing Industries and Construction	**732.23**	**39117.20**	**1.99**	**0.65**	**344.68**	**234.70**	**11.33**	**100.61**
Coal	136.35	11549.44	0.16	0.10	47.75	12.22	0.14	49.90
Petroleum	147.62	10348.90	0.60	0.09	122.31	59.92	9.32	49.94
Gas	336.25	17218.86	0.36	0.03	165.98	13.92	0.39	0.77
Biomass	105.35	NA	0.86	0.43	8.63	148.64	1.49	0.00
a. Iron and Steel	**45.68**	**2356.81**	**0.05**	**0.01**	**30.71**	**4.54**	**0.22**	**6.73**
Coal	17.54	890.87	0.02	0.00	5.62	0.85	0.02	6.49
Petroleum	1.63	109.45	0.01	0.00	0.84	1.88	0.18	0.17
Gas	26.52	1356.49	0.02	0.00	24.25	1.81	0.03	0.06
Wood, Wood Waste	NA	NA	NA	NA	NA	NA	NA	NA
b. Non-Ferrous Metals	**203.66**	**13441.79**	**0.28**	**0.09**	**85.70**	**14.50**	**0.44**	**61.52**
Coal	59.07	5392.78	0.07	0.05	18.72	6.12	0.06	21.86
Petroleum	37.64	2696.61	0.08	0.02	12.48	2.25	0.25	39.43
Gas	104.63	5352.40	0.12	0.01	54.32	4.56	0.12	0.24
Wood, Wood Waste	2.31	NA	0.01	0.01	0.17	1.57	0.02	0.00
c. Chemicals	**102.61**	**5816.34**	**0.20**	**0.03**	**53.47**	**24.92**	**1.57**	**4.47**
Coal	11.18	1011.46	0.01	0.01	3.73	1.10	0.01	3.80
Petroleum	26.12	1445.90	0.12	0.01	19.02	21.18	1.49	0.52
Gas	65.31	3358.98	0.07	0.01	30.72	2.63	0.07	0.15
d. Pulp, Paper and Print	**45.63**	**1852.44**	**0.11**	**0.08**	**5.56**	**12.46**	**0.21**	**4.28**
Coal	8.40	740.88	0.01	0.01	2.41	0.88	0.01	3.11
Petroleum	1.94	133.84	0.00	0.00	0.82	0.32	0.07	1.13
Gas	19.11	977.72	0.02	0.00	1.12	0.26	0.02	0.04
Wood, Wood Waste	16.17	NA	0.07	0.07	1.21	10.99	0.11	0.00

Note: CO_2 emissions from biomass burning are reported in APPENDIX TABLE 1-Fuel combustion activities 1-Memo Items: Biomass burned for energy. These emissions are not included in totals in the COMMON REPORTING FORMAT TABLES.

ENERGY

APPENDIX TABLE 1 - 2003

Fuel combustion activities 1A-2 (sheet 2): 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_2O (Gg)	NO_x (Gg)	CO (Gg)	NMVOC (Gg)	SO (Gg
e. Food Processing, Beverages, and Tobacco	**123.47**	**2219.79**	**0.82**	**0.36**	**11.06**	**136.84**	**1.50**	**3.5**
Coal	6.97	619.22	0.01	0.01	1.44	0.74	0.01	2.4
Petroleum	2.53	168.81	0.01	0.00	1.06	0.33	0.09	1.0
Gas	27.99	1431.77	0.03	0.00	1.39	0.31	0.05	0.0
Wood, Wood Waste	4.50	NA	0.02	0.02	0.34	3.06	0.03	0.0
Bagasse	81.48	NA	0.76	0.33	6.84	132.41	1.33	0.0
f. Other	**211.18**	**13430.02**	**0.52**	**0.09**	**158.17**	**41.43**	**7.38**	**20.0**
Coal	33.18	2894.24	0.04	0.03	15.84	2.53	0.03	12.1
Petroleum	84.42	5794.28	0.39	0.05	88.08	33.96	7.24	7.6
Gas	92.69	4741.51	0.10	0.01	54.19	4.35	0.10	0.2
Wood, Wood Waste	0.89	NA	0.00	0.00	0.07	0.61	0.01	0.0
Mining (non-energy)	**83.58**	**5451.86**	**0.22**	**0.04**	**65.32**	**12.21**	**3.56**	**7.9**
Coal	7.95	659.67	0.01	0.01	3.56	0.57	0.01	2.9
Petroleum	51.61	3563.71	0.19	0.03	59.68	11.31	3.53	4.9
Gas	24.02	1228.49	0.03	0.00	2.07	0.34	0.03	0.0
Non-metallic mineral products	**82.90**	**5169.74**	**0.12**	**0.03**	**63.72**	**14.97**	**0.84**	**9.7**
Coal	24.15	2132.41	0.02	0.02	11.96	1.84	0.02	8.9
Petroleum	5.61	364.70	0.04	0.00	3.07	8.88	0.76	0.7
Gas	52.25	2672.63	0.05	0.01	48.63	3.64	0.06	0.1
Wood, Wood Waste	0.89	NA	0.00	0.00	0.07	0.61	0.01	0.0
All other manufacturing	**16.40**	**900.38**	**0.03**	**0.00**	**4.17**	**4.67**	**0.34**	**0.4**
Coal	1.07	102.16	0.00	0.00	0.31	0.11	0.00	0.2
Petroleum	1.32	81.57	0.02	0.00	0.51	4.21	0.32	0.1
Gas	14.01	716.66	0.02	0.00	3.35	0.35	0.02	0.0
Construction	**28.30**	**1908.05**	**0.14**	**0.02**	**24.96**	**9.58**	**2.64**	**1.8**
Petroleum	25.88	1784.31	0.14	0.02	24.82	9.55	2.64	1.8
Gas	2.42	123.74	0.00	0.00	0.14	0.02	0.00	0.0

Note: CO_2 emissions from biomass burning are reported in APPENDIX TABLE 1-Fuel combustion activities 1-Memo Items: Biomass burned for energy. These emis
are not included in totals in the COMMON REPORTING FORMAT TABLES.

APPENDIX TABLE 1 - 2003

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

SOURCE CATEGORIES	ACTIVITY DATA	EMISSION ESTIMATES						
Fossil fuels	Energy use (PJ)	CO_2 (Gg)	CH_4 (Gg)	N_2O (Gg)	NO_x (Gg)	CO (Gg)	NMVOC (Gg)	SO_2 (Gg)
Manufacturing	**514.99**	**31757.30**	**0.76**	**0.17**	**245.76**	**64.26**	**3.63**	**90.82**
Coal	128.39	10889.78	0.15	0.09	44.18	11.64	0.13	46.95
Petroleum	76.78	5000.88	0.28	0.04	37.81	39.06	3.15	43.15
Gas	309.82	15866.64	0.33	0.03	163.77	13.56	0.36	0.71

a: Includes all sub-categories other than *Mining (non-energy)* and *Construction* from the **1A-2 Manufacturing and Construction f. Other** category.

APPENDIX TABLE 1 - 2003

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

SOURCE CATEGORIES	ACTIVITY DATA	EMISSION ESTIMATES						
Fossil fuels	Energy use (PJ)	CO_2 (Gg)	CH_4 (Gg)	N_2O (Gg)	NO_X (Gg)	CO (Gg)	NMVOC (Gg)	SO_2 (Gg)
1A4a Commercial/Institutional	**73.55**	**4308.14**	**0.07**	**0.02**	**5.11**	**1.77**	**0.19**	**2.06**
Coal	2.87	289.50	0.00	0.00	0.8237	0.30	0.00	0.52
Petroleum	25.48	1725.01	0.02	0.02	2.2682	0.58	0.09	1.44
Gas	44.79	2293.63	0.05	0.01	1.9890	0.69	0.09	0.10
Wood, wood waste	0.42	NA	0.00	0.00	0.0295	0.19	0.00	0.00

Note: CO_2 emissions from biomass burning are reported in APPENDIX TABLE 1-Fuel combustion activities 1-Memo Items: Biomass burned for ene are not included in totals in the COMMON REPORTING FORMAT TABLES.

APPENDIX TABLE 1 - 2003

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

SOURCE CATEGORIES	ACTIVITY DATA	EMISSION ESTIMATES						
Fossil fuels	Energy use (PJ)	CO_2 (Gg)	CH_4 (Gg)	N_2O (Gg)	NO_X (Gg)	CO (Gg)	NMVOC (Gg)	SO_2 (Gg)
1A4b Residential[a]	**212.19**	**7773.86**	**44.19**	**0.14**	**7.64**	**617.25**	**71.31**	**0.67**
Coal	0.16	16.13	0.02	0.00	0.03	0.94	0.03	0.04
Petroleum	20.41	1277.53	2.02	0.01	1.18	66.97	17.75	0.35
Gas	126.56	6480.20	0.20	0.01	4.94	2.02	0.39	0.29
Wood, wood waste	65.05	NA	41.95	0.12	1.49	547.30	53.14	0.00

Note: CO_2 emissions from biomass burning are reported in APPENDIX TABLE 1-Fuel combustion activities 1-Memo Items: Biomass burned for ene are not included in totals in the COMMON REPORTING FORMAT TABLES.

APPENDIX TABLE 1 - 2003

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_2O (Gg)	NO_X (Gg)	CO (Gg)	NMVOC (Gg)	SO_2 (Gg)
1A4b Residential								
Lawnmowers	**5.14**	**335.62**	**1.95**	**0.00**	**0.45**	**66.78**	**17.72**	**0.08**
Petroleum	5.14	335.62	1.95	0.00	0.45	66.78	17.72	0.08

APPENDIX TABLE 1 - 2003

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

SOURCE CATEGORIES	ACTIVITY DATA	EMISSION ESTIMATES						
Fossil fuels	75.50 (PJ)	CO_2 (Gg)	CH_4 (Gg)	N_2O (Gg)	NO_X (Gg)	CO (Gg)	NMVOC (Gg)	SO_2 (Gg)
1A4c Agriculture/Forestry/Fishing	**75.50**	**5198.42**	**0.64**	**0.05**	**97.39**	**35.46**	**12.14**	**4.25**
Petroleum	75.41	5194.28	0.64	0.05	97.39	35.46	12.14	4.25
Gas	0.08	4.14	0.00	0.00	0.00	0.00	0.00	0.00

APPENDIX TABLE 1—2003
Fuel combustion activities 1A-3 (sheet 1): Emissions from transport

SOURCE CATEGORY	ACTIVITY DATA	EMISSION ESTIMATES						
	Energy Use (PJ)	CO_2 (Gg)	CH_4 (Gg)	N_2O (Gg)	NO_x (Gg)	CO (Gg)	NMVOC (Gg)	SO_2 (Gg)
1A3 Transport								
1A3 a Civil Aviation	**171.26**	**11,812.34**	**0.24**	**0.36**	**52.59**	**94.15**	**8.25**	**1.40**
i International Aviation (International Bunkers)	**95.87**	**6,615.32**	**0.03**	**0.20**	**35.43**	**10.96**	**5.42**	**0.79**
Jet Kerosene	95.87	6,615.32	0.03	0.20	35.43	10.96	5.42	0.79
ii Domestic	**75.39**	**5,197.02**	**0.21**	**0.16**	**17.16**	**83.18**	**2.84**	**0.62**
Aviation Gasoline	3.11	209.18	0.18	0.00	0.24	70.85	1.59	0.03
Jet Kerosene	72.28	4,987.84	0.03	0.16	16.93	12.34	1.24	0.59
1A3 b Road Transportation	**1,018.92**	**66,307.43**	**27.73**	**16.22**	**385.36**	**2,830.60**	**430.89**	**27.06**
i Cars	**558.87**	**39,585.24**	**21.07**	**15.27**	**228.28**	**2,251.32**	**146.06**	**9.80**
Automotive Gasoline	527.97	34,497.41	20.04	15.11	199.64	2,006.23	123.72	7.92
Passenger Cars with Catalysts [a]	222.89	14,563.41	3.94	7.42	45.82	334.86	20.67	3.34
Passenger Cars with Catalysts [b]	265.01	17,315.85	14.33	7.66	132.13	1,304.94	75.24	3.98
Passenger Cars without Catalysts [c]	35.06	2,290.87	1.48	0.03	21.68	310.32	23.19	0.53
Passenger Cars without Catalysts [d]	5.01	327.28	0.29	0.00	2.84	56.10	4.62	0.08
ADO	30.90	2,132.08	0.07	0.07	7.32	7.68	3.77	1.76
LPG	50.26	2,955.48	0.96	0.09	21.32	237.42	18.58	0.12
Natural Gas	0.01	0.28	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

APPENDIX TABLE 1—2003
Fuel combustion activities 1A-3 (sheet 2): Emissions from transport

SOURCE CATEGORY	ACTIVITY DATA	EMISSION ESTIMATES						
	Energy Use (PJ)	CO_2 (Gg)	CH_4 (Gg)	N_2O (Gg)	NO_x (Gg)	CO (Gg)	NMVOC (Gg)	SO_2 (Gg)
1A3 b Road Transportation (cont.)								
ii Light Trucks	**161.68**	**10,638.94**	**3.64**	**0.48**	**57.97**	**415.47**	**31.99**	**4.32**
Automotive Gasoline	94.91	6,201.18	3.19	0.27	36.52	319.10	19.68	1.42
ADO	50.10	3,457.27	0.11	0.15	12.69	11.57	5.68	2.86
LPG	16.67	980.44	0.35	0.05	8.76	84.80	6.64	0.04
Natural Gas	0.00	0.04	0.00	0.00	0.00	0.00	0.00	0.00
iii Heavy Duty Trucks and Buses[a]	**230.43**	**15,867.78**	**2.76**	**0.47**	**98.76**	**131.06**	**24.00**	**12.90**
Medium Duty Trucks	**85.72**	**5,900.51**	**1.39**	**0.22**	**46.57**	**62.31**	**10.78**	**4.76**
Automotive Gasoline	2.31	150.70	0.01	0.00	1.03	4.42	0.42	0.03
ADO	82.81	5,713.89	1.36	0.22	45.13	55.88	10.00	4.72
LPG	0.61	35.82	0.02	0.00	0.41	2.01	0.35	0.00
Natural Gas	0.00	0.10	0.00	0.00	0.00	0.00	0.00	0.00
Heavy Duty Trucks	**123.10**	**8,491.94**	**1.26**	**0.20**	**41.55**	**51.98**	**9.30**	**7.01**
Automotive Gasoline	NA	NA	NA	NA	NA	NA	NA	NA
ADO	122.85	8,477.32	1.25	0.20	41.40	51.26	9.17	7.00
LPG	0.25	14.62	0.01	0.00	0.15	0.72	0.13	0.01
Natural Gas	NA	NA	NA	NA	NA	NA	NA	NA
Buses	**21.60**	**1,475.33**	**0.11**	**0.05**	**10.64**	**16.77**	**3.92**	**1.14**
Automotive Gasoline	0.75	49.05	0.02	0.00	0.63	7.81	0.56	0.01
ADO	19.69	1,358.55	0.06	0.05	9.52	5.60	3.03	1.12
LPG	1.07	63.02	0.02	0.00	0.38	3.35	0.34	0.00
Natural Gas	0.09	4.72	0.01	0.00	0.11	0.02	0.00	0.00
iv Motorcycles	**3.30**	**215.46**	**0.25**	**0.00**	**0.36**	**32.75**	**7.78**	**0.05**
Automotive Gasoline	3.30	215.46	0.25	0.00	0.36	32.75	7.78	0.05

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

ENERGY

APPENDIX TABLE 1—2003
Fuel combustion activities 1A-3 (sheet 3): Emissions from transport

SOURCE CATEGORY	ACTIVITY DATA	EMISSION ESTIMATES						
	Energy Use (PJ)	CO_2 (Gg)	CH_4 (Gg)	N_2O (Gg)	NO_x (Gg)	CO (Gg)	NMVOC (Gg)	SO_2 (Gg)
1A3 b Road Transportation (cont.)								
v Evaporative Emissions from Vehicles	e	NA	NA	NA	NA	NA	221.06	NA
Automotive Gasoline	e	NA	NA	NA	NA	NA	221.06	NA
Passenger Cars with Catalysts [a]	e	NA	NA	NA	NA	NA	77.81	NA
Passenger Cars with Catalysts [b]	e	NA	NA	NA	NA	NA	91.44	NA
Passenger Cars without Catalysts [c]	e	NA	NA	NA	NA	NA	17.00	NA
Passenger Cars without Catalysts [d]	e	NA	NA	NA	NA	NA	3.46	NA
Light Trucks	e	NA	NA	NA	NA	NA	29.94	NA
Medium Duty Trucks	e	NA	NA	NA	NA	NA	1.02	NA
Heavy Duty Trucks	e	NA	NA	NA	NA	NA	0.04	NA
Buses	e	NA	NA	NA	NA	NA	0.39	NA
Motorcycles	e	NA	NA	NA	NA	NA	1.39	NA
1A3 c Railways	**21.49**	**1,482.87**	**0.06**	**0.04**	**32.88**	**4.34**	**1.53**	**1.23**
ADO	21.49	1,482.87	0.06	0.04	32.88	4.34	1.53	1.23
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—2003
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_2O (Gg)	NO_x (Gg)	CO (Gg)	NMVOC (Gg)	SO_2 (Gg)
1A3 d Navigation	**38.69**	**3,225.95**	**2.56**	**0.08**	**68.28**	**133.42**	**23.83**	**38.42**
i International Marine (Bunkers)	**30.75**	**2,221.80**	**0.11**	**0.06**	**59.46**	**1.93**	**1.85**	**33.47**
ADO	4.86	335.35	0.03	0.01	7.68	0.79	0.22	0.28
IDF	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Fuel Oil	25.89	1,886.45	0.08	0.05	51.78	1.14	1.63	33.19
ii Navigation (Domestic)	**7.94**	**1,004.14**	**2.45**	**0.02**	**8.82**	**131.48**	**21.97**	**4.95**
Automotive Gasoline (small craft)	6.42	419.53	2.31	0.01	1.63	130.34	20.80	0.10
ADO	0.96	66.24	0.00	0.00	1.06	0.24	0.07	0.05
IDF	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Fuel Oil	2.72	198.09	0.01	0.01	5.44	0.12	0.17	3.49
Natural Gas	0.06	3.08	0.01	0.00	0.01	0.01	0.00	0.00
Coal	3.56	317.20	0.11	0.00	0.68	0.78	0.93	1.32
1A3 e Other Transportation	**0.64**	**41.95**	**0.02**	**0.00**	**0.24**	**4.49**	**0.69**	**0.01**
i Off-road Vehicles	**0.64**	**41.95**	**0.02**	**0.00**	**0.24**	**4.49**	**0.69**	**0.01**
Automotive Gasoline	0.64	41.95	0.02	0.00	0.24	4.49	0.69	0.01

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

SOURCE CATEGORIES	ACTIVITY DATA	Emissions Estimates						
	Energy Use (PJ)	CO_2 (Gg)	CH_4 (Gg)	N_2O (Gg)	NO_x (Gg)	CO (Gg)	NMVOC (Gg)	SO_2 (Gg)
1A5 Other								
1A5 b Mobile	**9.22**	**633.75**	**0.05**	**0.02**	**4.09**	**7.41**	**0.82**	**0.19**
Military Transport-Land	**2.18**	**148.18**	**0.03**	**0.00**	**1.59**	**3.65**	**0.62**	**0.10**
Automotive Gasoline	0.64	41.95	0.02	0.00	0.27	2.72	0.43	0.01
ADO	1.54	106.23	0.02	0.00	1.32	0.92	0.19	0.09
Military Transport-Water	**0.64**	**44.26**	**0.00**	**0.00**	**1.01**	**0.10**	**0.03**	**0.04**
ADO	0.64	44.16	0.00	0.00	1.01	0.10	0.03	0.04
Fuel Oil	0.00	0.10	0.00	0.00	0.00	0.00	0.00	0.00
Military Transport-Aviation	**6.40**	**441.31**	**0.01**	**0.01**	**1.48**	**3.66**	**0.17**	**0.05**
Aviation Gasoline	0.11	7.59	0.01	0.00	0.01	2.57	0.06	0.00
Jet Kerosene	6.29	433.73	0.00	0.01	1.47	1.09	0.11	0.05

APPENDIX TABLE 1 - 2003

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

SOURCE CATEGORIES	ACTIVITY DATA	Emissions Estimates						
Fossil fuels	Energy use (PJ)	CO_2 (Gg)	CH_4 (Gg)	N_2O (Gg)	NO_x (Gg)	CO (Gg)	NMVOC (Gg)	SO_2 (Gg)
1A5a Other	**8.64**	**636.96**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**
Lubricants and greases (not allocated to sector)								
Petroleum	8.64	636.96	NE	NE	NE	NE	NE	NE

APPENDIX TABLE 1 - 2003

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	**186.58**	**15948.03**
Wood, wood waste	90.21	7444.40
Bagasse	81.48	7729.71
Biogas	14.88	773.92
1A1a Electricity and Heat Production	**15.76**	**855.88**
Wood, wood waste	0.87	81.97
Biogas	14.88	773.92
1A2 Manufacturing Industries and Construction	**105.35**	**9928.78**
Wood, wood waste	23.87	2199.08
Bagasse	81.48	7729.71
a. Iron and Steel	**NA**	**NA**
Wood, wood waste	NA	NA
b. Non-Ferrous Metals	**2.31**	**212.86**
Wood, wood waste	2.31	212.86
d. Wood and Paper Product Manufacturin	**16.17**	**1489.49**
Wood, wood waste	16.17	1489.49
e. Food Processing, Beverages, and Tobacc	**85.98**	**8144.36**
Wood, wood waste	4.50	414.66
Bagasse	81.48	7729.71
f. Other - Non-metallic Mineral Products	**0.89**	**82.08**
Wood, wood waste	0.89	82.08
1A4a Commercial/Institutional	**0.42**	**38.28**
Wood, wood waste	0.42	38.28
1A4b Residential	**65.05**	**5125.08**
Wood, wood waste	65.05	5125.08

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

APPENDIX TABLE 1 - 2003

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

SOURCE AND SINK CATEGORIES	ACTIVITY DATA	EMISSIONS ESTIMATES	
	Production (Mt)	CO_2 (Gg)	CH_4 (Gg)
1B1 Solid fuels			
1B1a Coal mining[a]	**338.8**	**NE**	**787.3**
1B1ai Underground mines	**82.2**	**NE**	**449.0**
Underground activities	82.2	NE	424.5
Post mining activities	31.7	NE	24.4
1B1aii Surface mining	**256.5**	**NE**	**338.4**
Surface activities	256.5	NE	338.4
Post mining activities	256.5	NE	NE
1B1b Solid fuel transformation[b]	**IE**	**NA**	**IE**
1B1c Other	**NA**	**NA**	**NA**

a. 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.

b. Emissions from solid fuel transformation processes in Australia are reported under Industrial Process emissions, Iron and Steel.

APPENDIX TABLE 1 - 2002

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

SOURCE AND SINK CATEGORIES		ACTIVITY DATA	EMISSIONS ESTIMATES					
		Fuel quantity (PJ)	CO_2 (Gg)	CH_4 (Gg)	N_2O (Gg)	NO_x (Gg)	CO (Gg)	NMVOC (Gg)
1B2a	**Oil**	**NA**	**309.09**	**4.64**	**0.01**	**0.25**	**1.11**	**109.44**
	i Exploration (for both oil and gas)	NA	78.3	1.3	0.0045	0.1	0.4	0.2
	ii Crude oil production	1232.9	NA	1.1	NA	NA	NA	13.4
	iii Crude oil transport: domestic	202.5	NA	0.2	NA	NA	NA	0.9
	iv Crude oil refining and storage	1652.5	230.8	2.0	0.01	0.1	0.7	34.1
	v Petroleum product distribution	1184.5	NA	NA	NA	NA	NA	60.9
	vi Other	NA	NA	NA	NA	NA	NA	NA
1B2b	**Natural Gas**	**NA**	**4.918**	**88.930**	**NA**	**NA**	**NA**	**14.5**
	i Production and processing	1423.8	NE	1.597	NA	NA	NA	0.4
	iia Transmission	756.0	0.491	8.563	NA	NA	NA	1.6
	iib Distribution	443.1	4.427	78.771	NA	NA	NA	12.5
	iii Other	NE	NE	NE	NE	NE	NE	NE
1B2c	**Venting and Flaring**	**2656.7**	**5452.2**	**100.9**	**0.1**	**1.1**	**6.5**	**54.0**
	Venting at gas processing plant	1423.8	3349.38	74.83	NA	NA	NA	42.9
	Flaring	2656.7	2102.78	26.06	0.06	1.1	6.5	11.2
	Not included in totals	NA	NA	1.4	NA	NA	NA	7.8
	Crude oil transport: exports	774.7	NA	0.6	NA	NA	NA	3.3
	Crude oil transport: imports	1083.3	NA	0.8	NA	NA	NA	4.5

APPENDIX TABLE 1 - 2002

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

SOURCE AND SINK CATEGORIES	ACTIVITY DATA	EMISSIONS ESTIMATES
Petroleum product	Consumption (PJ)	NMVOC (Gg)
Petrol	645.4	59.2597
Diesel	536.1	1.3749
Avgas	3.0	0.2426

APPENDIX TABLE 2
Industrial Processes

APPENDIX TABLE 2 – 2003

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				
	A	B	C	D
Alcoholic Beverage Type	Quantity of Alcoholic Beverage (hl)	Emission Factor (kg NMVOC/hl beverage produced)	NMVOC Emitted (kg)	NMVOC Emitted (Gg)
			C = (A x B)	D = C/10^6
Beer	17240000	0.035	603400	0.603
Red wine	4516900	0.08	361352	0.361
White wine	3940500	0.035	137918	0.138
			Total (Gg):	1.103

Module	**Industrial Processes**			
Submodule	**Food and Drink**			
Worksheet	**2-13**			
Sheet	**2 of 2 Bread and Other Food Production – NMVOC Emissions**			
STEP 2				
	A	B	C	D
Food Production Type	Quantity of Food Produced (kt)	Emission Factor (kg NMVOC/t food produced)	NMVOC Emitted (t)	NMVOC Emitted (Gg)
			C = (A x B)	D = C/10^3
Bread	1082	1.66	1796.12	1.80
Sugar	5461	10	54610	54.61
Meat and Poultry	3779	0.3	1133.7	1.13
			Total (Gg):	57.54

APPENDIX TABLE 3
AGRICULTURE

APPENDIX TABLE 3 – 2003

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		106,836	40,439	720,498	662,125	2,151,830	642,205	1,103,292
Tas		9,427	3,688	69,273	49,062	169,580	60,053	120,823
WA	South West	21,640	9,030	171,077	125,387	434,589	132,891	200,028
	Pilbara	9,187	2,142	45,645	62,003	167,590	38,895	63,211
	Kimberley	6,966	1,549	40,278	44,332	146,689	39,196	52,880
SA		23,395	7,179	192,178	144,522	445,044	174,740	222,281
Vic		39,502	13,364	356,180	296,534	943,417	318,811	523,642
Qld		186,344	46,268	1,000,013	1,613,624	3,766,081	949,387	2,945,840
NT		33,799	9,298	173,857	294,548	728,390	166,487	276,219
Australia		**437,096**	**132,957**	**2,769,000**	**3,292,137**	**8,953,210**	**2,522,665**	**5,508,216**

Source: Australian Bureau of Statistics

APPENDIX TABLE 3 – 2003

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	250,465	83,570	58,627	0	3,949	1,334
Tas	142,443	27,726	27,024	0	1,667	772
WA	76,586	29,117	23,003	0	953	299
SA	117,303	40,963	30,472	0	2,061	591
Vic	1,303,276	292,520	274,610	0	19,158	6,553
Qld	158,532	41,458	29,868	0	2,073	618
NT	1,375	41	8	0	2	2
Australia	**2,049,979**	**515,394**	**443,612**	**0**	**29,863**	**10,168**

Source: Australian Bureau of Statistics

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

State	Milking Cows (kg/head/year)
NSW/ACT	4,996
Tas	4,304
WA	5,348
SA	6,556
Vic	4,885
Qld	4,230
NT	4,230

Source: Dairy Australia

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APPENDIX TABLE 3 – 2003

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	290,107	59,611	
	export/140 days	47,524	18,228	
	japan ox/ 250 days	326,295	223,490	301,329
Tas	domestic/75 days	0	0	
	export/140 days	0	0	
	japan ox/ 250 days	0	0	0
WA	domestic/75 days	22,755	4,676	
	export/140 days	3,728	1,430	
	japan ox/ 250 days	25,593	17,530	23,635
SA	domestic/75 days	22,165	4,554	
	export/140 days	3,631	1,393	
	japan ox/ 250 days	24,930	17,075	23,022
Vic	domestic/75 days	64,774	13,310	
	export/140 days	10,611	4,070	
	japan ox/ 250 days	72,854	49,900	67,280
Qld	domestic/75 days	516,968	106,226	
	export/140 days	84,687	32,483	
	japan ox/ 250 days	581,454	398,256	536,965
NT	domestic/75 days	0	0	
	export/140 days	0	0	
	japan ox/ 250 days	0	0	0
Australia	**domestic/75 days**	**916,769**	**188,377**	
	export/140 days	**150,181**	**57,604**	
	japan ox/ 250 days	**1,031,126**	**706,251**	**952,232**

Source: Australian Lotfeeders Association

APPENDIX TABLE 3 – 2003

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	253,513	6,743,525	3,256,272	14,576,314	806,041	8,167,764
Tas	29,970	884,464	281,073	1,193,271	147,276	762,917
WA	140,052	3,529,027	2,274,498	10,337,934	639,489	6,966,252
SA	88,463	1,871,534	1,105,743	5,751,913	197,706	4,044,111
Vic	143,169	4,457,123	1,686,574	8,263,222	442,784	5,395,462
Qld	50,104	1,632,129	498,617	1,979,380	133,187	521,463
NT	0	0	0	0	0	0
Australia	**705,272**	**19,117,803**	**9,102,776**	**42,102,035**	**2,366,482**	**25,857,969**

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	4.32	1.78	67.20
Tas	3.99	1.22	71.10
WA	4.20	1.55	61.90
SA	4.70	1.70	63.00
Vic	4.24	1.44	67.70
Qld	4.25	1.98	65.30
NT	0.00	0.00	0.00

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

APPENDIX TABLE 3 – 2003

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	3,776	85,992	15,444	623,990
Tas	146	2,216	232	16,374
WA	1,785	35,901	5,244	266,367
SA	2,167	44,741	7,263	326,543
Vic	3,074	63,951	15,522	472,024
Qld	3,078	68,357	7,304	584,118
NT	32	310	64	2,292
Australia	**14,058**	**301,468**	**51,072**	**2,291,708**

Source: Australian Bureau of Statistics

APPENDIX TABLE 3 – 2003

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	119,053	74,174	34,302	0	0	52,903	1,305	0	32,782,456
Tas	1,885	2,726	7,343	0	0	1,466	135	0	432,922
WA	34,306	21,813	24,516	0	0	25,453	0	419	8,817,194
SA	12,820	11,692	27,734	0	0	7,265	1,603	0	5,285,617
Vic	14,169	47,331	54,627	0	0	36,533	0	8	23,826,912
Qld	89,206	177,351	29,358	0	157	21,502	0	0	14,187,469
NT	0	11,592	0	8,598	6	0	0	2,331	156,909
Australia	**271,440**	**346,677**	**177,881**	**8,598**	**162**	**145,122**	**3,043**	**2,758**	**85,489,479**

APPENDIX TABLE 3 - 2003

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}	2002	147268	0	147268
Y_m	2003	38356	0	38356
Y_{m+1}	2004	64735	0	64735
ave Y_m	**2003**	**83453**	**0**	**83453**

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}	2002	1,564.00	0.00	1,564.00
Y_m	2003	879.20	0.00	879.20
Y_{m+1}	2004	NE	0.00	0.00
ave Y_m	**2003**	**1,221.60**	**0.00**	**1,221.60**

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}	2002	0.00	0.00	0.00
Y_m	2003	0.00	0.00	0.00
Y_{m+1}	2004	NE	0.00	0.00
ave Y_m	**2003**	**0.00**	**0.00**	**0.00**

Sources:
1 Ricegrowers Association of Australia
2 Australian Bureau of Statistics

APPENDIX TABLE 3 - 2003

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

Nominated Year Y_m	Year	Crops A_{jkl} (ha)	Improved Pasture A_{jkl} (ha)
Y_{m-1}	2002	24,059,745	25,004,691
Y_m	2003	23,574,780	NE
Y_{m+1}	2004	NE	NE
ave Y_m	**2003**	**23,817,263**	**25,004,691**

Agricultural soils 4D-1 (sheet 2): N_2O 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_2O Emissions $Total_{ijkl}$ (Gg N_2O/year)
Crop	23,817,263	0.29	1.57	10.85
Pasture	25,004,691	0.29	1.57	11.39
Total	**48,821,954**			**22.24**

Agricultural soils 4D-1 (sheet 3): N_2O emissions due to fertilizer use

Nominated Year Y_m	Year	Total N Fertilizer Applied M_{jkl} (Gg N)	Emission Factor E_{ijk} (%)	Conversion Factor C_i	N_2O Emissions $Total_{ijkl}$ (Gg N_2O/year)
Y_{m-1}	2002	971.00	1.25	1.57	19.07
Y_m	2003	932.91	1.25	1.57	18.32
Y_{m+1}	2004	NE	1.25	1.57	NE
ave Y_m	**2003**	**951.96**			**18.70**

Sources:

[1] Australian Bureau of Statistics

[2] Fertilizer Industry Federation of Australia

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APPENDIX TABLE 3 - 2003

Agricultural soils 4D-2 (sheet 1): N_2O emissions due to animal urine

Animals k	Waste Deposited M_{jkl} (Gg N)	Emission Factor E_{ijk} (%)	Conversion Factor C_i	N_2O Emission $Total_{ijkl}$ (Gg N_2O)
Cattle				
beef	625.50	0.40	1.57	3.93
dairy	333.95	0.40	1.57	2.10
feedlot	0.00	0.40	1.57	0.00
Sheep	541.32	0.40	1.57	3.40
Pigs	0.00	0.40	1.57	0.00
Poultry	0.00	0.40	1.57	0.00
Other	11.79	0.40	1.57	0.07
Total	**1,512.55**			**9.51**

Agricultural soils 4D-2 (sheet 2): N_2O emissions due to animal faeces

Animals k	Waste Deposited M_{jkl} (Gg N)	Emission Factor E_{ijk} (%)	Conversion Factor C_i	N_2O Emission $Total_{ijkl}$ (Gg N_2O)
Cattle				
beef	297.38	0.50	1.57	2.34
dairy	71.59	0.50	1.57	0.56
feedlot	0.00	0.50	1.57	0.00
Sheep	180.65	0.50	1.57	1.42
Pigs	0.00	0.50	1.57	0.00
Poultry	1.77	0.50	1.57	0.01
Other	4.81	0.50	1.57	0.04
Total	**556.20**			**4.37**

Source: Australian Methodology for the Estimation of Greenhouse Gas Emissions and Sinks 2003: Agriculture

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APPENDIX TABLE 3 - 2003

Agricultural soils 4D-2 (sheet 3): N_2O emissions due to manure application

Animals k	**Waste deposited** M_{jkl} (Gg N)	**Emission factor** E_{ijk} (%)	**Conversion factor** C_i	**N_2O emission** $Total_{ijkl}$ (Gg N_2O)
Cattle				
beef	0.00	1.80	1.57	0.00
dairy	29.22	1.80	1.57	0.83
feedlot	74.99	1.80	1.57	2.12
Sheep	0.00	1.80	1.57	0.00
Pigs	33.92	1.80	1.57	0.96
Poultry	56.05	1.80	1.57	1.59
Other	0.00	1.80	1.57	0.00
Total	**194.18**			**5.49**

Source: Australian Methodology for the Estimation of Greenhouse Gas Emissions and Sinks 2003: Agriculture

Agricultural soils 4D-2 (sheet 4): Annual N_2O emissions from agricultural (cultivated) soils

Process	**Emission** (Gg N_2O)
Soil disturbance	22.24
Fertilizer application	18.70
Animal waste	19.37
Total	**60.31**

APPENDIX TABLE 3 - 2003

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	Australia
		A_{jkl} (ha)								
Y_{m-8}	1995	89,112	28,134	17,536,700	88,338	17,502	6,300,000	23,710,940	0	47,770,726
Y_{m-7}	1996	90,480	18,662	15,417,600	3,707	7,564	7,500,000	14,420,518	0	37,458,532
Y_{m-6}	1997	131,068	7,308	13,424,700	191,670	15,131	3,802,000	11,474,000	0	29,045,877
Y_{m-5}	1998	NE	5,017	22,089,100	26,000	7,965	4,619,892	18,374,400	0	45,122,374
Y_{m-4}	1999	16,380	1,428	10,518,100	24,600	18,979	4,386,800	15,494,800	0	30,461,087
Y_{m-3}	2000	5,528	14,177	21,403,300	441,168	11,901	8,665,300	20,962,100	0	51,503,474
Y_{m-2}	2001	NE	9,198	41,957,100	18,680	35,425	7,269,400	35,087,000	0	84,376,803
Y_{m-1}	2002	NE	7,623	17,064,000	13,036	15,872	13,896,500	38,107,700	0	69,104,731
Y_m	2003	NE	7,597	14,452,800	48,671	101,765	6,910,300	26,556,700	0	48,077,833
Y_{m+1}	2004	81,900	25,828	6,416,500	14,700	17,849	7,623,000	11,350,400	0	25,530,177
ave Y_m	**2003**	**69,078**	**12,497**	**18,027,990**	**87,057**	**24,995**	**7,097,319**	**21,553,856**	**0**	**46,872,793**

Sources

[1] Satellite Remote Sensing Services, Department of Land Administration, WA
[2] Country Fire Authorithy, Victoria
[3] Forests Tasmania
[4] Parks Tasmania
[5] National Parks Service of NSW
[6] State Forests of NSW

APPENDIX TABLE 3 - 2003

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

State l	Area Burnt A_{jkl} (ha)	Fuel Load Fl_{jkl} (Mg/ha)	Burning efficiency Z_{jk}	Mass of Fuel Burnt M_{jkl} (Gg)
NSW	69,078	6.90	0.72	343.18
Tas	12,497	9.00	0.72	80.98
WA	18,027,990	(a)	(a)	69,558.01
SA	87,057	3.00	0.72	188.04
Vic	24,995	11.70	0.72	210.56
Qld	7,097,319	3.00	0.72	15,330.21
NT	21,553,856	(a)	(a)	96,314.98
ACT	0	11.10	0.72	0.00
Total	**46,872,793**			**182,025.96**

a. For WA and NT fuel loads are 3.0 and 12.7 for savanna grassland and savanna woodland respectively. Burning eifficiencies are 0.76 and 0.40 for savanna grassland and savanna woodland respectively. These parameters are weighted by the area burnt in each savanna category. See the Australian Methodology for the Estimation of Greenhouse Gas Emissions and Sinks 2003: Agriculture for more detail.

APPENDIX TABLE 3 - 2003

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

Gas i	**CH_4**	**N_2O**	**NO_x**	**CO**	**NMVOC**
Mass of fuel burnt (M_jGg)	182,025.96	182,025.96	182,025.96	182,025.96	182,025.96
Carbon mass fraction (CC_j)	0.46	0.46	0.46	0.46	0.46
Elemental N:C ratio (NC_j)		0.01	0.01		
Emission factor (E_{ij})	0.00	0.01	0.21	0.08	0.01
Elemental to molecular mass conversion factor (C_i)	1.34	1.57	3.28	2.33	1.17
Emission Total$_{ij}$ (Gg)	**391.44**	**11.50**	**664.17**	**15,230.77**	**888.55**

APPENDIX TABLE 3 - 2003

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

Nominated Year Y_m	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-1}	2002	24,299	1.50	0.50	0.90	0.96	0.23	3,621.57
Y_m	2003	10,132	1.50	0.50	0.90	0.96	0.23	1,510.06
Y_{m+1}	2004	NE	1.50	0.50	0.90	0.96	0.23	NA
ave Y_m	**2003**	**17,216**						**2,565.82**

Source: Australian Bureau of Statistics

AGRICULTURE

APPENDIX TABLE 3 - 2003

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

Gas i	**CH_4**	**N_2O**	**NO_x**	**CO**	**NMVOC**
Mass of fuel burnt (M_jGg)	2,565.82	2,565.82	2,565.82	2,565.82	2,565.82
Carbon mass fraction (CC_j)	0.40	0.40	0.40	0.40	0.40
Elemental N:C ratio (NC_j)		0.01	0.01		
Emission factor (E_{ij})	0.00	0.01	0.21	0.08	0.01
Elemental to molecular mass conversion factor (C_i)	1.34	1.57	3.28	2.33	1.17
Emission Total$_{ij}$ (Gg)	**4.80**	**0.10**	**5.66**	**186.69**	**10.89**

AGRICULTURE

APPENDIX TABLE 3 - 2003

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

Nominated Year	Year	Production	Residue to Crop Ratio	Fraction of Residue Remaining at Time of Burning	Dry Matter Content	Burning Efficiency	Fraction Burnt	Mass of Residue
Y_m		P_{jkl} (Gg/yr)	R_{jk}	S_{jk}	DM_{jk}	Z_{jk}	F_{jk}	M_{jkl} (Gg)
Y_{m-1}	2002	14,240	1.50	0.50	0.80	0.96	0.23	1,886.51
Y_m	2003	7,362	1.50	0.50	0.80	0.96	0.23	975.26
Y_{m+1}	2004	NE	1.50	0.50	0.80	0.96	0.23	NA
ave Y_m	**2003**	**10,801**						**1,430.89**

Source: Australian Bureau of Statistics

AGRICULTURE

AGRICULTURE

APPENDIX TABLE 3 - 2003

Field burning of agricultural residues 4F-1 (sheet 4)
Emissions from on-site agricultural waste burning from coarse grains

Gas i	**CH_4**	**N_2O**	**NO_x**	**CO**	**NMVOC**
Mass of fuel burnt (M_jGg)	1430.89	1430.89	1430.89	1430.89	1430.89
Carbon mass fraction (CC_j)	0.40	0.40	0.40	0.40	0.40
Elemental N:C ratio (NC_j)		0.01	0.01		
Emission factor (E_{ij})	0.00	0.01	0.21	0.08	0.01
Elemental to molecular mass conversion factor (C_i)	1.34	1.57	3.28	2.33	1.17
Emission Total$_{ij}$ (Gg)	**2.68**	**0.05**	**3.16**	**104.11**	**6.07**

APPENDIX TABLE 3 - 2003

Field burning of agricultural residues 4F-1 (sheet 5): Crop production of cereals

Crop	Year	Y_m			Production	Residue to Crop Ratio	Fraction of Residue Remaining at Time of Burning	Dry Matter Content	Burning Efficiency	Fraction Burnt	Mass of Residue
		2002	2003	2004	P_{jkl} (Gg/yr)	R_{jk}	S_{jk}	DM_{jk}	Z_{jk}	F_{jk}	M_{jkl} (Gg)
Wheat	2003	24,299.33	10,131.92	NE	17,215.63	1.50	0.50	0.90	0.96	0.23	2,565.82
Barley	2003	8,279.77	3,864.83	NE	6,072.30	1.50	0.50	0.80	0.96	0.23	804.46
Maize	2003	453.85	310.05	NE	381.95	1.50	1.00	0.80	0.96	0.30	132.00
Oats	2003	1,433.65	957.10	NE	1,195.38	1.50	0.50	0.80	0.96	0.23	158.36
Rye	2003	NE	0.00	NE	0.00	1.50	0.50	0.80	0.96	0.23	0.00
Rice	2003	1,192.20	438.11	NE	815.16	1.31	1.00	0.80	0.96	0.82	668.15
Millet	2003	25.31	34.21	NE	29.76	1.50	0.50	0.80	0.96	0.23	3.94
Sorghum	2003	2,020.84	1,464.51	NE	1,742.68	1.50	0.50	0.80	0.96	0.23	230.87
Triticale	2003	859.65	326.96	NE	593.30	1.50	0.50	0.80	0.96	0.23	78.60
Total											**4,642.20**

Crop	Year	Emissions (Gg)						
		C emitted	N emitted	CH4	N2O	NOx	CO	NMVOC
Wheat	2003	1,026.33	8.21	4.80	0.10	5.66	186.69	10.89
Barley	2003	321.78	2.57	1.50	0.03	1.78	58.53	3.41
Maize	2003	55.44	0.99	0.26	0.01	0.68	10.08	0.59
Oats	2003	63.35	0.51	0.30	0.01	0.35	11.52	0.67
Rye	2003	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Rice	2003	280.62	4.34	1.31	0.05	3.00	51.05	2.98
Millet	2003	1.58	0.01	0.01	0.00	0.01	0.29	0.02
Sorghum	2003	92.35	0.74	0.43	0.01	0.51	16.80	0.98
Triticale	2003	31.44	0.25	0.15	0.00	0.17	5.72	0.33
Total				**8.76**	**0.21**	**12.16**	**340.68**	**19.87**

Source: Australian Bureau of Statistics

APPENDIX TABLE 3 - 2003

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

Nominated Year Y_m	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-1}	2002	32,229	0.25	1.00	0.20	0.96	0.40	615.99
Y_m	2003	37,803	0.25	1.00	0.20	0.96	0.37	675.45
Y_{m+1}	2004	36,020	0.25	1.00	0.20	0.96	0.37	636.84
ave Y_m	**2003**	**35,351**	0.25	1.00	0.20	0.96	0.38	**642.76**

Source:

[1] Australian Bureau of Statistics

[2] Canegrowers Association of Australia

[3] NSW Canegrowers Association

APPENDIX TABLE 3 - 2003

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

Gas i	**CH_4**	**N_2O**	**NO_x**	**CO**	**NMVOC**
Mass of fuel burnt (M_jGg)	642.76	642.76	642.76	642.76	642.76
Carbon mass fraction (CC_j)	0.40	0.40	0.40	0.40	0.40
Elemental N:C ratio (NC_j)		0.03	0.03		
Emission factor (E_{ij})	0.00	0.01	0.21	0.08	0.01
Elemental to molecular mass conversion factor (C_i)	1.34	1.57	3.28	2.33	1.17
Emission Total$_{ij}$ (Gg)	**1.20**	**0.08**	**4.43**	**46.77**	**2.73**

APPENDIX TABLE 4
LAND USE CHANGE AND FORESTRY

APPENDIX TABLE 4—2003

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 Area of Forest/ Biomass	B Annual Growth Rate (t dm/ha)	C Annual Biomass Increment	D Carbon Fraction of Dry Matter	E Total Carbon Uptake Increment
tate Forests and Other Tenur				C=(AxB)		E=(CxD)
Forest Ty	Rainforests	1,333	1.15	1,536	0.50	768
	Tall Dense Eucalyp	3,235	4.81	15,546	0.50	7,773
	Medium Dense	6,705	1.90	12,716	0.50	6,358
	Medium Sparse	2,029	0.35	716	0.50	358
	Callitris	295	0.51	150	0.50	75
	Plantations[a]	1,664	NA	9,913	0.50	4,956
	Other Forests	1,289	0.47	606	0.50	303
Total		16,550		41,183		**20,591**
					CO2-e	**75,501**

a. The Australian methodology uses an NCAS carbon accounting model to estimate emissions from regional data for short rotation hardwood, long rotation hardwood and softwood plantations so that a single growth rate cannot be reported.

APPENDIX TABLE 4—2003

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 Commercial Harvest (if applicable) (1000 m^3 roundwood)	G Biomass Conversion/ Expansion Ratio (if applicable) (t dm/m^3)	H Total Biomass Removed in Commercial Harvest in Inventory Year[a] (kt dm)	I Total Traditional Fuelwood Consumed (kt dm)	J Total Other Wood Use (kt dm)	K Total Biomass Consumpt. (kt dm)	L Wood Removed from Forest Clearing (kt dm)	M Total Biomass Consumpt. from Stocks (kt dm)
			H=(FxG)			K=(H+I+J)		M=K-L
Hardwood	11,789	1.18	13,961		NE			
Softwood	16,764	0.74	12,330		NE			
Total	**28,553**		**26,290**	**5,670**		**31,960**	**101**	**31,859**

a. The Australian methodology applies different decay times to different wood products.

APPENDIX TABLE 4—2003

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 Carbon Fraction	O Annual Carbon Release (kt C)	P Net Annual Carbon Uptake (+) or Release (-) (kt C)	Q Convert to CO_2 Annual Emission (-) or Removal (+) (Gg CO_2)
	O=(MxN)	P=(E-O)	Q=(Px[44/12])
0.50	15,929	4,662	17,094
CO2-e	**58,408**		

APPENDIX TABLE 4—2003

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	468,384	180,473	68,118	54,718	973	526	318,831	93,396	13,044	6,642	13,262	3,770	8,820	6,747	45,337	14,672
1991	334,737	175,173	57,874	58,854	1,410	905	226,789	92,557	7,680	5,056	9,212	2,784	8,298	6,341	23,473	8,673
1992	294,788	159,940	38,807	41,004	1,182	922	213,014	95,113	6,951	5,057	8,166	2,760	8,788	7,475	17,880	7,606
1993	278,748	178,557	35,285	41,909	666	646	203,281	111,064	5,563	4,258	8,443	2,731	6,664	9,239	18,844	8,712
1994	266,647	166,838	34,011	40,613	676	630	192,698	101,172	5,651	4,224	8,449	2,768	6,528	9,015	18,632	8,416
1995	221,601	162,906	29,274	50,408	1,133	953	157,315	87,104	4,032	3,701	8,514	2,651	5,249	8,498	16,083	9,589
1996	222,056	167,336	28,956	52,612	1,405	1,208	158,094	89,173	3,859	3,700	8,535	2,635	5,224	8,367	15,981	9,637
1997	218,717	166,285	28,899	52,579	1,221	1,067	155,128	88,408	3,832	3,663	8,504	2,602	5,205	8,355	15,923	9,608
1998	228,312	202,383	30,578	72,020	596	719	171,087	105,831	3,664	4,510	7,566	2,963	4,588	10,228	10,232	6,111
1999	230,280	204,592	30,426	72,130	569	711	174,457	107,765	3,689	4,575	6,735	3,234	4,522	10,320	9,879	5,857
2000	232,097	193,931	27,491	59,871	465	870	181,244	110,192	3,365	4,468	5,086	2,443	3,613	7,465	10,832	8,623
2001	232,948	193,677	27,538	59,767	471	869	181,321	109,819	3,631	4,522	5,106	2,427	3,525	7,127	11,355	9,146
2002[a]	154,132	158,576	25,024	48,463	748	1,137	102,951	77,374	2,934	5,424	7,055	3,560	6,594	13,062	8,822	9,556
2003[a]	128,011	154,846	25,428	49,619	1,057	1,448	74,847	69,825	2,748	5,501	8,222	4,387	7,154	14,379	8,555	9,684

a. These are preliminary estimates and will be revised when areas of forest and grassland conversion are confirmed following the next update of estimates using the National Carbon Accounting System.

APPENDIX TABLE 4 -2003

Other 5E (sheet 1): Area of forest burnt due to prescribed (fuel reduction) burns

Nominated Y_m	**Year**	**State**								
		NSW	Tas	WA	SA	Vic	Qld	NT	ACT	Australia
		A_{jkl} (ha)								
Y_{m-8}	1995	131,629	6,700	260,846	142	141,000	101,039	0	20	641,376
Y_{m-7}	1996	169,377	9,058	363,209	297	131,000	61,067	0	200	734,208
Y_{m-6}	1997	159,999	8,647	449,201	173	131,000	103,650	0	200	852,871
Y_{m-5}	1998	173,585	20,687	205,497	0	30,268	95,314	0	100	525,451
Y_{m-4}	1999	119,940	18,565	192,911	0	104,586	67,131	0	100	503,233
Y_{m-3}	2000	37,965	30,655	194,969	0	105,693	80,974	0	300	450,556
Y_{m-2}	2001	110,954	14,550	138,355	0	65,802	136,664	0	0	466,325
Y_{m-1}	2002	166,468	11,593	96,880	0	81,141	138,119	0	0	494,201
Y_m	2003	244,845	12,973	255,519	0	30,491	126,128	0	0	669,956
Y_{m+1}	2004	69,646	8,233	231,905	0	7,156	94,372	0	0	411,311
ave Y_m	**2003**	**138,441**	**14,166**	**238,929**	**61**	**82,814**	**100,446**	**0**	**92**	**574,949**

APPENDIX TABLE 4 - 2003

Other 5E (sheet 2): Total forest fuel burnt as a result of prescribed burning

State l	Area burnt A_{jkl} (ha)	Fuel load Fl_{jkl} (Mg/ha)	Burning efficiency Z_{jk}	Mass of fuel burnt M_{jkl} (Gg)
NSW	138,441	18.20	0.42	1,058.24
Tas	14,166	20.00	0.42	119.00
WA	238,929	12.00	0.42	1,204.20
SA	61	9.60	0.42	0.25
Vic	82,814	17.90	0.42	622.59
Qld	100,446	9.70	0.42	409.22
NT	0	4.10	0.42	0.00
ACT	92	17.60	0.42	0.68
Australia	**574,949**			**3,414.18**

APPENDIX TABLE 4 - 2003

Other 5E (sheet 3): Emissions from prescribed burning

Gas i	CH_4	N_2O	NO_x	CO	NMVOC
Mass of fuel burnt (M_jGg)	3,414.18	3,414.18	3,414.18	3,414.18	3,414.18
Carbon mass fraction (CC_j)	0.46	0.46	0.46	0.46	0.46
Elemental N:C ratio (NC_j)		0.01	0.01		
Emission factor (E_{ij})	0.01	0.01	0.15	0.09	0.02
Elemental to molecular mass conversion factor (C_i)	1.34	1.57	3.28	2.33	1.17
Emission Total$_{ij}$ (Gg)	**11.33**	**0.21**	**8.51**	**333.29**	**40.29**

APPENDIX TABLE 4 - 2003

Other 5E (sheet 4): Area of forest burnt due to wildfires

Nominated Y_m	Year	State								
		NSW	Tas	WA	SA	Vic	Qld	NT	ACT	Australia
		A_{jkl} (ha)								
Y_{m-8}	1995	23,716	52,572	101,692	7	19,000	90,256	0	180	287,423
Y_{m-7}	1996	32,764	51,607	400,899	7	14,169	20,844	0	500	520,789
Y_{m-6}	1997	30,242	47,623	168,192	145	25,612	47,761	0	200	319,775
Y_{m-5}	1998	341,861	31,085	268,762	40	57,475	37,679	0	100	737,002
Y_{m-4}	1999	18,796	5,407	45,029	70	60,680	1,511	0	300	131,793
Y_{m-3}	2000	7,293	17,765	74,334	40	18,023	24,746	0	100	142,302
Y_{m-2}	2001	217,980	43,203	392,886	62	32,589	25,458	0	0	712,178
Y_{m-1}	2002	934,565	4,846	218,492	0	56,402	47,189	0	2,000	1,263,494
Y_m	2003	1,575,007	29,292	1,513,894	335	1,346,678	46,934	0	170,000	4,682,140
Y_{m+1}	2004	89,012	79,568	51,201	NE	24,207	120,402	0	NE	364,390
ave Y_m	**2003**	**327,124**	**36,297**	**323,538**	**78**	**165,483**	**46,278**	**0**	**19,264**	**918,063**

LAND USE, LAND USE CHANGE AND FORESTRY

APPENDIX TABLE 4 - 2003

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

State l	Area burnt A_{jkl} (ha)	Fuel load Fl_{jkl} (Mg/ha)	Burning efficiency Z_{jk}	Mass of fuel burnt M_{jkl} (Gg)
NSW	327,124	36.40	0.72	8,573.26
Tas	36,297	40.00	0.72	1,045.35
WA	323,538	33.40	0.72	7,780.45
SA	78	19.20	0.72	1.08
Vic	165,483	35.80	0.72	4,265.50
Qld	46,278	19.40	0.72	646.41
NT	0	7.20	0.72	0.00
ACT	19,264	35.20	0.72	488.24
Total	**918,063**			**22,800.29**

APPENDIX TABLE 4 - 2003

Other 5E (sheet 6): Emissions from wildfires

Gas i	**CH_4**	**N_2O**	**NO_x**	**CO**	**NMVOC**
Mass of fuel burnt (M_jGg)	22,800.29	22,800.29	22,800.29	22,800.29	22,800.29
Carbon mass fraction (CC_j)	0.46	0.46	0.46	0.46	0.46
Elemental N:C ratio (NC_j)		0.01	0.01		
Emission factor (E_{ij})	0.01	0.01	0.15	0.09	0.02
Elemental to molecular mass conversion factor (C_i)	1.34	1.57	3.28	2.33	1.17
Emission Total$_{ij}$ (Gg)	**75.65**	**1.40**	**56.84**	**2,225.75**	**269.07**

PART C
Kyoto Accounting Trends Tables

KYOTO ACCOUNTING TRENDS TABLES

TABLE 1 EMISSIONS TRENDS (CO_2)—KYOTO ACCOUNTING
(Sheet 1 of 6)

Australia
2003
Submission 2005

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Base year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
1. Energy	**258,514.98**	**258,514.98**	**260,571.13**	**265,312.30**	**268,734.92**	**272,645.90**	**282,511.43**	**292,261.49**	**299,109.36**	**315,606.46**	**324,728.21**
A. Fuel Combustion (Sectoral Approach)	252,552.25	252,552.25	254,826.01	259,471.35	262,887.57	267,073.34	276,797.06	287,011.70	294,061.74	310,318.95	318,995.66
1. Energy Industries	141,805.68	141,805.68	145,296.14	148,512.17	149,790.74	150,825.59	156,805.91	163,386.78	169,466.13	184,861.38	189,208.33
2. Manufacturing Industries and Construction	37,355.76	37,355.76	36,722.04	36,680.49	37,115.64	38,553.82	39,134.40	40,323.12	39,407.24	40,223.79	43,597.54
3. Transport	59,724.27	59,724.27	59,097.02	60,188.94	61,381.12	62,912.11	65,490.09	67,739.23	69,063.96	69,129.34	70,015.95
4. Other Sectors	12,485.07	12,485.07	12,557.97	12,894.10	13,375.24	13,491.27	13,961.21	14,044.97	14,585.65	14,785.34	14,941.39
5. Other	1,181.47	1,181.47	1,152.85	1,195.65	1,224.84	1,290.55	1,405.45	1,517.59	1,538.76	1,319.10	1,232.46
B. Fugitive Emissions from Fuels	5,962.73	5,962.73	5,745.12	5,840.95	5,847.35	5,572.57	5,714.37	5,249.79	5,047.62	5,287.51	5,732.55
1. Solid Fuel	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
2. Oil and Natural Gas	5,962.73	5,962.73	5,745.12	5,840.95	5,847.35	5,572.57	5,714.37	5,249.79	5,047.62	5,287.51	5,732.55
2. Industrial Processes	**19,995.20**	**22,359.30**	**21,818.53**	**19,893.48**	**20,929.54**	**22,906.82**	**23,077.74**	**23,513.21**	**23,366.19**	**24,092.05**	**24,209.15**
A. Mineral Products	4,825.64	4,825.64	4,508.72	4,329.46	4,538.74	5,237.80	5,047.73	5,091.60	5,023.59	5,438.55	5,353.54
B. Chemical Industry	503.70	503.70	477.77	633.84	663.91	672.51	798.51	837.18	877.27	1,082.03	777.81
C. Metal Production	14,665.86	14,665.86	14,598.62	12,537.79	12,383.54	13,494.29	13,774.00	13,953.45	13,863.72	13,770.70	14,396.98
D. Other Production	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 [1]	2,364.10	2,364.10	2,233.42	2,392.39	3,343.34	3,502.23	3,457.50	3,630.99	3,601.60	3,800.76	3,680.81
3. Solvent and Other Product Use	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**
4. Agriculture	**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
B. Manure Management	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
D. Agricultural Soils	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
F. Field Burning of Agricultural Residues	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
G. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
5. Land Use, Land-Use Change and Forestry	**122,225.44**	**122,225.44**	**97,350.33**	**80,659.56**	**67,106.47**	**63,606.58**	**59,895.25**	**56,364.32**	**51,324.96**	**63,493.51**	**48,503.47**
A. Afforestation and reforestatio [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
B. Land use change (deforestation)	122,225.44	122,225.44	97,803.48	81,588.21	68,508.74	65,358.90	62,192.02	59,312.90	55,515.30	69,082.52	55,613.79
6. Waste	**11.58**	**11.58**	**11.58**	**11.58**	**11.58**	**11.58**	**16.83**	**13.53**	**16.94**	**17.13**	**17.49**
A. Solid Waste Disposal on Land	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
C. Waste Incineration	11.58	11.58	11.58	11.58	11.58	11.58	16.83	13.53	16.94	17.13	17.49
D. Other	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
Total Emissions/Removals with LUCF	**400,747.21**	**403,111.31**	**379,751.57**	**365,876.93**	**356,782.52**	**359,170.88**	**365,501.25**	**372,152.54**	**373,817.44**	**403,209.14**	**397,458.31**
Total Emissions without LUCF	**278,521.77**	**280,885.87**	**282,401.24**	**285,217.36**	**289,676.04**	**295,564.31**	**305,606.00**	**315,788.22**	**322,492.48**	**339,715.63**	**348,954.84**
Memo Items:											
International Bunkers	**6,400.97**	**6,400.97**	**6,378.80**	**6,584.40**	**6,987.84**	**7,361.83**	**8,532.60**	**9,030.65**	**9,059.30**	**9,449.69**	**9,718.28**
Aviation	4,345.12	4,345.12	4,520.39	4,795.71	5,199.38	5,349.80	5,857.66	6,311.70	6,540.10	7,232.89	7,268.09
Marine	2,055.85	2,055.85	1,858.42	1,788.69	1,788.46	2,012.03	2,674.93	2,718.95	2,519.20	2,216.80	2,450.19
Multilateral Operations	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**
CO_2 Emissions from Biomass	**16,862.98**	**16,862.98**	**16,761.21**	**15,509.28**	**17,178.08**	**18,046.52**	**18,832.03**	**18,822.79**	**20,665.13**	**20,878.84**	**21,034.57**

1. Speciated emissions from Ammonia Production, Nitric Acid Production, Magnesia Production and Soda Ash Production and Use areConfidential. These emissions are reported as CO_2-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 (CO_2)—KYOTO ACCOUNTING
(Sheet 1 of 6)

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Base year	2000	2001	2002	2003
1. Energy	**258,514.98**	**329,368.25**	**336,310.48**	**339,668.02**	**345,770.51**
A. Fuel Combustion (Sectoral Approach)	252,552.25	322,882.35	329,389.08	333,208.63	340,004.36
1. Energy Industries	141,805.68	192,527.49	198,354.42	202,001.04	208,302.60
2. Manufacturing Industries and Construction	37,355.76	41,590.84	42,035.99	39,364.06	39,117.20
3. Transport	59,724.27	72,095.22	72,052.04	73,520.69	74,033.42
4. Other Sectors	12,485.07	15,392.97	15,593.57	16,983.78	17,280.43
5. Other	1,181.47	1,275.82	1,353.07	1,339.07	1,270.71
B. Fugitive Emissions from Fuels	5,962.73	6,485.90	6,921.39	6,459.38	5,766.16
1. Solid Fuel	NE	NE	NE	NE	NE
2. Oil and Natural Gas	5,962.73	6,485.90	6,921.39	6,459.38	5,766.16
2. Industrial Processes	**19,995.20**	**23,698.80**	**24,305.76**	**24,125.76**	**25,913.70**
A. Mineral Products	4,825.64	5,155.38	5,146.66	5,215.57	5,384.17
B. Chemical Industry	503.70	888.02	1,017.98	935.85	952.11
C. Metal Production	14,665.86	13,761.22	13,331.54	12,737.94	13,866.07
D. Other Production	NE	NE	NE	NE	NE
E. Production of Halocarbons and SF_6					
F. Consumption of Halocarbons and SF_6					
G. Other [1]	2,364.10	3,894.19	4,809.58	5,236.40	5,711.34
3. Solvent and Other Product Use	**NA**	**NA**	**NA**	**NA**	**NA**
4. Agriculture	**NA**	**NA**	**NA**	**NA**	**NA**
A. Enteric Fermentation	NA	NA	NA	NA	NA
B. Manure Management	NA	NA	NA	NA	NA
C. Rice Cultivation	NA	NA	NA	NA	NA
D. Agricultural Soils	NA	NA	NA	NA	NA
E. Prescribed Burning of Savannas	NA	NA	NA	NA	NA
F. Field Burning of Agricultural Residues	NA	NA	NA	NA	NA
G. Other	NA	NA	NA	NA	NA
5. Land Use, Land-Use Change and Forestry	**122,225.44**	**47,102.19**	**40,010.16**	**45,431.48**	**32,876.97**
A. Afforestation and reforestatio [2]	0.00	-10,177.06	-11,128.14	-12,978.84	-14,798.10
B. Land use change (deforestation)	122,225.44	57,279.25	51,138.31	58,410.33	47,675.07
6. Waste	**11.58**	**16.30**	**16.30**	**16.30**	**16.30**
A. Solid Waste Disposal on Land	NE	NE	NE	NE	NE
B. Waste-water Handling	NA	NA	NA	NA	NA
C. Waste Incineration	11.58	16.30	16.30	16.30	16.30
D. Other	NA	NA	NA	NA	NA
7. Other *(please specify)*	**NA**	**NA**	**NA**	**NA**	**NA**
NA	NA	NA	NA	NA	NA
Total Emissions/Removals with LUCF	**400,747.21**	**400,185.55**	**400,642.71**	**409,241.56**	**404,577.49**
Total Emissions without LUCF	**278,521.77**	**353,083.36**	**360,632.54**	**363,810.08**	**371,700.52**
Memo Items:					
International Bunkers	**6,400.97**	**10,099.67**	**10,625.28**	**8,603.39**	**8,837.12**
Aviation	4,345.12	7,330.88	8,151.32	6,392.44	6,615.32
Marine	2,055.85	2,768.79	2,473.96	2,210.95	2,221.80
Multilateral Operations	**NE**	**NE**	**NE**	**NE**	**NE**
CO_2 Emissions from Biomass	**16,862.98**	**20,620.04**	**19,518.87**	**16,478.80**	**16,937.68**

1. Speciated emissions from Ammonia Production, Nitric Acid Production, Magnesia Production and Soda Ash Production and Use areConfidential. These emissions are reported as CO_2-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 (CH_4)—KYOTO ACCOUNTING
(Sheet 2 of 6)

Australia
2003
Submission 2005

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Base Year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Total Emissions	**5,400.62**	**5,400.62**	**5,380.70**	**5,348.85**	**5,239.94**	**5,209.62**	**5,254.73**	**5,198.52**	**5,285.12**	**5,361.81**	**5,327.40**
1. Energy	**1,198.42**	**1,198.42**	**1,173.71**	**1,224.82**	**1,186.00**	**1,225.16**	**1,283.17**	**1,267.30**	**1,299.86**	**1,375.35**	**1,266.41**
A. Fuel Combustion (Sectoral Approach)	113.93	113.93	115.06	117.56	118.83	117.35	115.75	113.94	115.48	111.23	106.23
1. Energy Industries	1.89	1.89	1.91	2.00	2.05	2.08	2.25	2.30	4.69	5.05	5.13
2. Manufacturing Industries and Construction	1.49	1.49	1.44	1.41	1.52	1.60	1.71	1.72	2.35	2.42	2.41
3. Transport	26.47	26.47	25.56	25.78	26.37	27.16	28.38	29.40	30.31	31.37	31.70
4. Other Sectors	84.03	84.03	86.11	88.32	88.84	86.46	83.36	80.47	78.06	72.33	66.93
5. Other	0.05	0.05	0.04	0.04	0.04	0.05	0.05	0.06	0.06	0.06	0.05
B. Fugitive Emissions from Fuels	1,084.49	1,084.49	1,058.65	1,107.26	1,067.17	1,107.82	1,167.41	1,153.35	1,184.38	1,264.13	1,160.18
1. Solid Fuel	753.16	753.16	760.91	790.69	791.02	828.21	832.39	846.98	865.54	954.70	903.33
2. Oil and Natural Gas	331.33	331.33	297.75	316.57	276.15	279.61	335.02	306.38	318.84	309.42	256.86
2. Industrial Processes	**3.29**	**3.29**	**3.26**	**3.30**	**3.33**	**3.72**	**3.80**	**3.88**	**3.80**	**3.96**	**3.70**
A. Mineral Products	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
B. Chemical Industry	0.44	0.44	0.40	0.41	0.32	0.40	0.38	0.45	0.43	0.35	0.34
C. Metal Production	2.85	2.85	2.85	2.89	3.01	3.32	3.42	3.43	3.37	3.60	3.36
D. Other Production	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
3. Solvent and Other Product Use	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**
4. Agriculture	**3,587.41**	**3,587.41**	**3,593.11**	**3,525.90**	**3,455.06**	**3,390.58**	**3,373.87**	**3,370.09**	**3,416.58**	**3,426.34**	**3,481.68**
A. Enteric Fermentation	3,214.89	3,214.89	3,225.53	3,165.04	3,096.48	3,023.30	2,999.76	2,987.93	3,012.34	3,011.19	3,048.77
B. Manure Management	73.32	73.32	73.39	74.88	77.86	80.50	82.14	82.95	86.55	90.18	92.65
C. Rice Cultivation	23.36	23.36	24.94	25.72	28.69	28.87	30.89	33.56	34.44	34.50	31.94
D. Agricultural Soils	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
E. Prescribed Burning of Savannas	267.06	267.06	260.74	251.58	242.71	248.72	251.51	255.30	271.51	278.18	296.14
F. Field Burning of Agricultural Residues	8.79	8.79	8.52	8.68	9.32	9.19	9.56	10.35	11.74	12.29	12.18
G. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
5. Land Use, Land-Use Change and Forestry	**147.73**	**147.73**	**130.97**	**108.84**	**97.05**	**98.51**	**83.85**	**83.18**	**82.38**	**83.70**	**82.90**
A. Afforestation and reforestation	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
B. Land use change (deforestation)	147.73	147.73	130.97	108.84	97.05	98.51	83.85	83.18	82.38	83.70	82.90
6. Waste	**463.78**	**463.78**	**479.65**	**485.99**	**498.50**	**491.65**	**510.04**	**474.08**	**482.51**	**472.46**	**492.71**
A. Solid Waste Disposal on Land	355.82	355.82	370.21	375.17	386.43	378.44	395.62	358.10	365.10	353.84	372.79
B. Waste-water Handling	107.95	107.95	109.44	110.82	112.06	113.20	114.42	115.98	117.41	118.61	119.92
C. Waste Incineration	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
D. Other	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
Memo Items:											
International Bunkers	**0.13**	**0.13**	**0.11**	**0.11**	**0.11**	**0.12**	**0.16**	**0.15**	**0.15**	**0.13**	**0.15**
Aviation	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.03
Marine	0.11	0.11	0.09	0.09	0.09	0.10	0.14	0.14	0.13	0.11	0.12
Multilateral Operations	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
CO_2 Emissions from Biomass											

TABLE 1 EMISSIONS TRENDS (CH_4)—KYOTO ACCOUNTING
(Sheet 2 of 6)

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Base Year	2000	2001	2002	2003
Total Emissions	**5,400.62**	**5,460.02**	**5,465.31**	**5,327.15**	**5,165.14**
1. Energy	**1,198.42**	**1,318.34**	**1,255.21**	**1,170.20**	**1,069.66**
A. Fuel Combustion (Sectoral Approach)	113.93	105.22	97.86	89.66	87.86
1. Energy Industries	1.89	9.19	9.11	10.38	10.45
2. Manufacturing Industries and Construction	1.49	2.45	2.30	1.99	1.99
3. Transport	26.47	31.69	29.46	31.13	30.47
4. Other Sectors	84.03	61.83	56.93	46.11	44.91
5. Other	0.05	0.05	0.05	0.05	0.05
B. Fugitive Emissions from Fuels	1,084.49	1,213.12	1,157.35	1,080.54	981.80
1. Solid Fuel	753.16	935.15	878.36	831.25	787.34
2. Oil and Natural Gas	331.33	277.97	278.99	249.28	194.46
2. Industrial Processes	**3.29**	**3.33**	**3.10**	**3.08**	**3.32**
A. Mineral Products	NA	NA	NA	NA	NA
B. Chemical Industry	0.44	0.44	0.35	0.36	0.44
C. Metal Production	2.85	2.90	2.76	2.71	2.88
D. Other Production	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
3. Solvent and Other Product Use	**NA**	**NA**	**NA**	**NA**	**NA**
4. Agriculture	**3,587.41**	**3,552.18**	**3,610.26**	**3,542.94**	**3,505.95**
A. Enteric Fermentation	3,214.89	3,064.57	3,086.27	3,014.23	2,988.00
B. Manure Management	73.32	94.14	96.57	97.40	97.50
C. Rice Cultivation	23.36	35.30	35.13	28.06	19.05
D. Agricultural Soils	NE	NE	NE	NE	NE
E. Prescribed Burning of Savannas	267.06	345.63	379.40	392.35	391.44
F. Field Burning of Agricultural Residues	8.79	12.54	12.88	10.90	9.96
G. Other	NA	NA	NA	NA	NA
5. Land Use, Land-Use Change and Forestry	**147.73**	**85.11**	**83.23**	**80.43**	**72.62**
A. Afforestation and reforestation	NA	NA	NA	NA	NA
B. Land use change (deforestation)	147.73	85.11	83.23	80.43	72.62
6. Waste	**463.78**	**501.06**	**513.51**	**530.49**	**513.61**
A. Solid Waste Disposal on Land	355.82	379.71	390.67	406.01	387.69
B. Waste-water Handling	107.95	121.35	122.84	124.48	125.92
C. Waste Incineration	NE	NE	NE	NE	NE
D. Other	NA	NA	NA	NA	NA
7. Other *(please specify)*	**NA**	**NA**	**NA**	**NA**	**NA**
NA	NA	NA	NA	NA	NA
Memo Items:					
International Bunkers	**0.13**	**0.16**	**0.15**	**0.14**	**0.14**
Aviation	0.02	0.03	0.03	0.03	0.03
Marine	0.11	0.13	0.12	0.11	0.11
Multilateral Operations	NE	NE	NE	NE	NE
CO_2 Emissions from Biomass					

TABLE 1 EMISSIONS TRENDS (N_2O)—KYOTO ACCOUNTING
(Sheet 3 of 6)

Australia
2003
Submission 2005

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Base year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Total Emissions	**70.75**	**70.84**	**72.02**	**72.08**	**73.78**	**75.61**	**76.12**	**76.44**	**81.36**	**85.72**	**90.87**
1. Energy	**7.70**	**7.70**	**8.75**	**9.56**	**10.46**	**11.40**	**12.33**	**13.17**	**13.99**	**15.04**	**15.92**
A. Fuel Combustion (Sectoral Approach)	7.58	7.58	8.65	9.45	10.36	11.31	12.23	13.07	13.92	14.93	15.85
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
2. Manufacturing Industries and Construction	0.66	0.66	0.63	0.57	0.64	0.68	0.72	0.72	0.79	0.80	0.81
3. Transport	5.26	5.26	6.29	7.12	7.96	8.85	9.69	10.47	11.14	11.95	12.83
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
5. Other	0.01	0.01	0.01	0.01	0.01	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	0.10	0.10	0.07	0.11	0.07
1. Solid Fuel	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	0.10	0.10	0.07	0.11	0.07
2. Industrial Processes	**C**	**0.09**	**0.09**	**0.07**	**0.07**	**0.08**	**0.08**	**0.08**	**0.08**	**0.08**	**0.08**
A. Mineral Products	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
B. Chemical Industry	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE
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
D. Other Production	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
3. Solvent and Other Product Use	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**
4. Agriculture	**58.77**	**58.77**	**59.19**	**58.85**	**59.84**	**60.68**	**60.53**	**59.98**	**64.09**	**67.36**	**71.62**
A. Enteric Fermentation	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
B. Manure Management	1.68	1.68	1.86	2.14	2.44	2.70	3.00	2.91	3.23	3.50	4.00
C. Rice Cultivation	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
D. Agricultural Soils	48.96	48.96	49.39	49.05	49.98	50.38	49.83	49.25	52.52	55.32	58.57
E. Prescribed Burning of Savannas	7.84	7.84	7.66	7.39	7.13	7.31	7.39	7.50	7.98	8.17	8.70
F. Field Burning of Agricultural Residues	0.28	0.28	0.27	0.27	0.29	0.30	0.31	0.33	0.35	0.36	0.35
G. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
5. Land Use, Land-Use Change and Forestry	**2.74**	**2.74**	**2.43**	**2.02**	**1.80**	**1.82**	**1.55**	**1.54**	**1.53**	**1.55**	**1.53**
A. Afforestation and reforestation	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
B. Land use change (deforestation)	2.74	2.74	2.43	2.02	1.80	1.82	1.55	1.54	1.53	1.55	1.53
6. Waste	**1.54**	**1.54**	**1.57**	**1.59**	**1.60**	**1.62**	**1.64**	**1.66**	**1.68**	**1.70**	**1.72**
A. Solid Waste Disposal on Land	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
B. Waste-water Handling	1.54	1.54	1.57	1.59	1.60	1.62	1.64	1.66	1.68	1.70	1.72
C. Waste Incineration	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
D. Other	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
Memo Items:											
International Bunkers	**0.19**	**0.19**	**0.19**	**0.19**	**0.21**	**0.22**	**0.25**	**0.27**	**0.27**	**0.28**	**0.29**
Aviation	0.13	0.13	0.13	0.14	0.16	0.16	0.18	0.19	0.20	0.22	0.22
Marine	0.06	0.06	0.05	0.05	0.05	0.06	0.07	0.08	0.07	0.06	0.07
Multilateral Operations	NE	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**
CO_2 Emissions from Biomass											

TABLE 1 EMISSIONS TRENDS (N_2O)—KYOTO ACCOUNTING
(Sheet 3 of 6)

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Base year	2000	2001	2002	2003
Total Emissions	**70.75**	**96.36**	**98.98**	**100.23**	**99.04**
1. Energy	**7.70**	**16.84**	**17.23**	**18.80**	**19.52**
A. Fuel Combustion (Sectoral Approach)	7.58	16.75	17.14	18.71	19.44
1. Energy Industries	1.41	1.97	2.03	2.04	2.11
2. Manufacturing Industries and Construction	0.66	0.78	0.73	0.65	0.65
3. Transport	5.26	13.74	14.13	15.79	16.45
4. Other Sectors	0.24	0.23	0.23	0.21	0.21
5. Other	0.01	0.02	0.02	0.02	0.02
B. Fugitive Emissions from Fuels	0.12	0.09	0.09	0.08	0.07
1. Solid Fuel	NE	NE	NE	NE	NE
2. Oil and Natural Gas	0.12	0.09	0.09	0.08	0.07
2. Industrial Processes	**C**	**0.07**	**0.07**	**0.06**	**0.07**
A. Mineral Products	NA	NA	NA	NA	NA
B. Chemical Industry	IE	IE	IE	IE	IE
C. Metal Production	0.09	0.07	0.07	0.06	0.07
D. Other Production	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
3. Solvent and Other Product Use	**NE**	**NE**	**NE**	**NE**	**NE**
4. Agriculture	**58.77**	**76.14**	**78.38**	**78.10**	**76.31**
A. Enteric Fermentation	NA	NA	NA	NA	NA
B. Manure Management	1.68	4.24	4.26	4.25	4.15
C. Rice Cultivation	NA	NA	NA	NA	NA
D. Agricultural Soils	48.96	61.39	62.62	62.01	60.38
E. Prescribed Burning of Savannas	7.84	10.15	11.14	11.52	11.50
F. Field Burning of Agricultural Residues	0.28	0.36	0.36	0.31	0.29
G. Other	NA	NA	NA	NA	NA
5. Land Use, Land-Use Change and Forestry	**2.74**	**1.58**	**1.54**	**1.49**	**1.34**
A. Afforestation and reforestation	NA	NA	NA	NA	NA
B. Land use change (deforestation)	2.74	1.58	1.54	1.49	1.34
6. Waste	**1.54**	**1.74**	**1.76**	**1.78**	**1.80**
A. Solid Waste Disposal on Land	NA	NA	NA	NA	NA
B. Waste-water Handling	1.54	1.74	1.76	1.78	1.80
C. Waste Incineration	NE	NE	NE	NE	NE
D. Other	NA	NA	NA	NA	NA
7. Other *(please specify)*	**NA**	**NA**	**NA**	**NA**	**NA**
NA	NA	NA	NA	NA	NA
Memo Items:					
International Bunkers	**0.19**	**0.30**	**0.31**	**0.25**	**0.26**
Aviation	0.13	0.22	0.25	0.19	0.20
Marine	0.06	0.08	0.07	0.06	0.06
Multilateral Operations	NE	**NE**	**NE**	**NE**	**NE**
CO_2 Emissions from Biomass					

TABLE 1 EMISSION TRENDS (HFCs, PFCs and SF_6)—KYOTO ACCOUNTING (Sheet 4 of 6)

Australia
2003
Submission 2005

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Base year [1]	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Emissions of HFCs[2] – CO_2 equivalent (Gg)	**1,126.27**	**1,126.27**	**1,126.27**	**1,053.94**	**1,446.59**	**819.19**	**923.87**	**546.17**	**1,026.48**	**1,622.81**	**2,185.74**	**2,716.33**	**3,257.79**	**3,762.47**	**4,309.02**
HFC-23	0.10	0.10	0.10	0.09	0.12	0.07	0.06	C	C	C	C	C	C	C	C
HFC-32	NE	NE	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	NE	NE
HFC-43-10mee	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
HFC-125	NO	NO	NO	NO	NO	0.00	0.00	0.01	0.01	0.02	0.03	0.05	0.06	0.08	0.11
HFC-134	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
HFC-134a	NO	NO	NO	NO	NO	0.01	0.14	0.38	0.70	1.10	1.47	1.80	2.13	2.43	2.70
HFC-152a	NE	NE	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	NE	NE
HFC-143a	NO	NO	NO	NO	NO	0.00	0.00	0.01	0.01	0.02	0.04	0.05	0.06	0.08	0.11
HFC-227ea	NE	NE	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	NE	NE
HFC-245ca	NE	NE	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**	**1,555.97**	**1,507.17**	**1,472.05**
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	0.20	0.19
C_2F_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	0.03	0.02
C_3F_8	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
C_4F_{10}	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
$c\text{-}C_4F_8$	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
C_5F_{12}	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
C_6F_{14}	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
Emissions of SF_6 – CO_2 equivalent (Gg)	**521.02**	**521.02**	**521.02**	**521.02**	**521.02**	**521.02**	**521.02**	**529.62**	**527.00**	**524.68**	**524.61**	**523.41**	**521.02**	**521.02**	**521.02**
SF_6	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02

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_2F_6	9200
C_3F_8	7000
C_4F_{10}	7000
$c\text{-}C_4F_8$	8700
C_5F_{12}	7500
C_6F_{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.
2 Includes the following confidential HFC emissions

Emissions of HFCs - CO_2 equivalent (Gg)	Base year[1]	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Confidential HFC emissions							4.54	13.62	22.70	31.77	40.99	52.15	64.00	76.55	89.79

TABLE 1 EMISSION TRENDS (SUMMARY)—KYOTO ACCOUNTING
(Sheet 5 of 6)

Australia
2003
Submission 2005

GREENHOUSE GAS EMISSIONS	Base year [1]	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
	CO_2 equivalent (Gg)										
Net CO_2 emissions/removals	403,111.31	403,111.31	379,751.57	365,876.93	356,782.52	359,170.88	365,501.25	372,152.54	373,817.44	403,209.14	397,458.31
CO_2 emissions (without LUCF)	280,885.87	280,885.87	282,401.24	285,217.36	289,676.04	295,564.31	305,606.00	315,788.22	322,492.48	339,715.63	348,954.84
CH_4	113,413.12	113,413.12	112,994.79	112,325.86	110,038.81	109,402.06	110,349.36	109,169.02	110,987.58	112,598.08	111,875.40
N_2O	21,959.26	21,959.26	22,325.90	22,345.97	22,870.84	23,438.01	23,598.64	23,695.13	25,221.00	26,572.53	28,169.88
HFCs	1,126.27	1,126.27	1,126.27	1,053.94	1,446.59	819.19	923.87	546.17	1,026.48	1,622.81	2,185.74
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
SF_6	NE	NE	NE	NE	NE	NE	NE	529.62	527.00	524.68	524.61
Total (with net CO_2 emissions/removals)	**543,548.24**	**543,548.24**	**520,140.01**	**505,537.78**	**493,971.82**	**494,677.71**	**501,682.19**	**507,297.89**	**512,630.17**	**545,924.23**	**541,195.92**
Total (without CO_2 from LUCF)	**421,322.80**	**421,322.80**	**422,789.68**	**424,878.22**	**426,865.35**	**431,071.13**	**441,786.94**	**450,933.57**	**461,305.21**	**482,430.72**	**492,692.45**

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Base year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
	CO_2 equivalent (Gg)										
1. Energy	286,067.71	286,067.71	287,933.10	293,997.96	296,884.21	301,909.52	313,279.77	322,958.21	330,742.66	349,150.70	356,257.53
2. Industrial Processes	28,040.78	28,040.78	27,502.32	25,495.02	25,822.01	26,196.85	25,936.24	25,900.56	26,074.64	27,743.21	28,004.00
3. Solvent and Other Product Use	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
4. Agriculture	93,555.11	93,555.11	93,803.34	92,286.74	91,107.88	90,013.32	89,614.41	89,366.89	91,614.61	92,833.60	95,317.76
5. Land Use, Land-Use Change and Forestry	126,175.78	126,175.78	100,852.57	83,570.01	69,701.55	66,240.66	62,137.44	58,588.43	53,527.72	65,731.76	50,720.22
6. Waste	10,229.88	10,229.88	10,569.70	10,709.08	10,977.19	10,838.37	11,235.35	10,483.80	10,670.54	10,464.95	10,896.40
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 from Ammonia Production (2B1) and Soda Ash Production and Use (2A4), Magnesia Production (2A7) and N_2O from Nitric Acid Production (2B2).

TABLE 1 EMISSION TRENDS (SUMMARY)—KYOTO ACCOUNTING
(Sheet 5 of 6)

GREENHOUSE GAS EMISSIONS	Base year [1]	2000	2001	2002	2003
Net CO_2 emissions/removals	403,111.31	400,185.55	400,642.71	409,241.56	404,577.49
CO_2 emissions (without LUCF)	280,885.87	353,083.36	360,632.54	363,810.08	371,700.52
CH_4	113,413.12	114,660.49	114,771.51	111,870.06	108,468.02
N_2O	21,959.26	29,872.97	30,682.96	31,070.10	30,701.19
HFCs	1,126.27	2,716.33	3,257.79	3,762.47	4,309.02
PFCs	3,938.28	1,103.21	1,555.97	1,507.17	1,472.05
SF_6	NE	523.41	521.02	521.02	521.02
Total (with net CO_2 emissions/removals)	**543,548.24**	**549,061.96**	**551,431.96**	**557,972.39**	**550,048.80**
Total (without CO_2 from LUCF)	**421,322.80**	**501,959.77**	**511,421.80**	**512,540.91**	**517,171.83**

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Base year	2000	2001	2002	2003
1. Energy	286,067.71	362,273.53	368,010.77	370,069.48	374,283.09
2. Industrial Processes	28,040.78	28,134.64	29,726.18	29,999.83	32,305.69
3. Solvent and Other Product Use	NA	NA	NA	NA	NA
4. Agriculture	93,555.11	98,198.79	100,114.32	98,611.86	97,280.64
5. Land Use, Land-Use Change and Forestry	126,175.78	49,378.15	42,235.59	47,582.30	34,818.71
6. Waste	10,229.88	11,076.85	11,345.10	11,708.93	11,360.68
7. Other	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 from Ammonia Production (2B1) and Soda Ash Production and Use (2A4), Magnesia Production (2A7) and N_2O from Nitric Acid Production (2B2).

TABLE 1 EMISSIONS TRENDS (CO_2-e)—KYOTO ACCOUNTING
(Sheet 6 of 6)

Australia
2003
Submission 2005

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Base year [1]	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
1. Energy	**286,067.71**	**286,067.71**	**287,933.10**	**293,997.96**	**296,884.21**	**301,909.52**	**313,279.77**	**322,958.21**	**330,742.66**	**349,150.70**	**356,257.53**
A. Fuel Combustion (Sectoral Approach)	**257,294.72**	**257,294.72**	**259,922.70**	**264,871.19**	**268,594.00**	**273,044.17**	**283,020.14**	**293,457.09**	**300,801.47**	**317,283.17**	**326,138.43**
1. Energy Industries	142,282.25	142,282.25	145,790.84	149,018.63	150,295.05	151,336.13	157,334.23	163,933.98	170,096.62	185,562.12	189,920.93
2. Manufacturing Industries and Construction	37,590.47	37,590.47	36,948.68	36,887.76	37,345.62	38,799.48	39,392.64	40,582.33	39,699.95	40,522.21	43,898.56
3. Transport	61,911.31	61,911.31	61,582.90	62,936.89	64,402.68	66,226.14	69,090.68	71,602.80	73,154.84	73,492.19	74,658.71
4. Other Sectors	14,324.53	14,324.53	14,442.60	14,826.98	15,320.49	15,385.98	15,790.01	15,812.39	16,303.10	16,380.05	16,420.99
5. Other	1,186.16	1,186.16	1,157.68	1,200.93	1,230.16	1,296.44	1,412.58	1,525.59	1,546.95	1,326.60	1,239.23
B. Fugitive Emissions from Fuels	28,773.00	28,773.00	28,010.40	29,126.77	28,290.21	28,865.35	30,259.64	29,501.11	29,941.19	31,867.54	30,119.10
1. Solid Fuel	15,816.36	15,816.36	15,979.04	16,604.39	16,611.41	17,392.34	17,480.17	17,786.50	18,176.44	20,048.78	18,969.85
2. Oil and Natural Gas	12,956.64	12,956.64	12,031.36	12,522.38	11,678.80	11,473.01	12,779.46	11,714.61	11,764.75	11,818.76	11,149.24
2. Industrial Processes	**28,040.78**	**28,040.78**	**27,502.32**	**25,495.02**	**25,822.01**	**26,196.85**	**25,936.24**	**25,900.56**	**26,074.64**	**27,743.21**	**28,004.00**
A. Mineral Products	4,825.64	4,825.64	4,508.72	4,329.46	4,538.74	5,237.80	5,047.73	5,091.60	5,023.59	5,438.55	5,353.54
B. Chemical Industry	512.89	512.89	486.24	642.40	670.65	680.87	806.50	846.73	886.30	1,089.40	785.00
C. Metal Production	18,690.86	18,690.86	18,626.64	16,555.81	15,301.67	15,435.75	15,179.62	15,255.45	15,009.67	15,267.02	15,474.30
D. Other Production	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
F. Consumption of Halocarbons and SF_6	521.02	521.02	521.02	521.02	521.02	528.51	726.04	1,075.80	1,553.48	2,147.48	2,710.34
G. Other	2,364.10	2,364.10	2,233.42	2,392.39	3,343.34	3,502.23	3,457.50	3,630.99	3,601.60	3,800.76	3,680.81
3. Solvent and Other Product Use	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**
4. Agriculture	**93,555.11**	**93,555.11**	**93,803.34**	**92,286.74**	**91,107.88**	**90,013.32**	**89,614.41**	**89,366.89**	**91,614.61**	**92,833.60**	**95,317.76**
A. Enteric Fermentation	67,512.63	67,512.63	67,736.04	66,465.79	65,026.00	63,489.39	62,995.06	62,746.53	63,259.13	63,234.89	64,024.23
B. Manure Management	2,061.13	2,061.13	2,119.21	2,235.01	2,390.42	2,527.21	2,655.17	2,643.10	2,819.19	2,978.71	3,185.92
C. Rice Cultivation	490.50	490.50	523.78	540.22	602.42	606.24	648.74	704.74	723.17	724.59	670.74
D. Agricultural Soils	15,178.92	15,178.92	15,311.99	15,204.68	15,495.16	15,616.59	15,446.58	15,267.65	16,282.47	17,150.11	18,155.68
E. Prescribed Burning of Savannas	8,040.04	8,040.04	7,849.82	7,573.97	7,307.12	7,487.91	7,571.96	7,686.10	8,174.04	8,374.74	8,915.48
F. Field Burning of Agricultural Residues	271.90	271.90	262.49	267.08	286.76	285.98	296.90	318.76	356.62	370.56	365.72
G. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
5. Land Use, Land-Use Change and Forestry	**126,175.78**	**126,175.78**	**100,852.57**	**83,570.01**	**69,701.55**	**66,240.66**	**62,137.44**	**58,588.43**	**53,527.72**	**65,731.76**	**50,720.22**
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
B. Land use change (deforestation)	126,175.78	126,175.78	101,305.72	84,498.66	71,103.81	67,992.98	64,434.21	61,537.01	57,718.06	71,320.77	57,830.55
6. Waste	**10,229.88**	**10,229.88**	**10,569.70**	**10,709.08**	**10,977.19**	**10,838.37**	**11,235.35**	**10,483.80**	**10,670.54**	**10,464.95**	**10,896.40**
A. Solid Waste Disposal on Land	7,472.31	7,472.31	7,774.35	7,878.50	8,115.11	7,947.33	8,308.01	7,520.11	7,667.07	7,430.69	7,828.52
B. Waste-water Handling	2,745.99	2,745.99	2,783.77	2,818.99	2,850.49	2,879.46	2,910.51	2,950.16	2,986.52	3,017.13	3,050.40
C. Waste Incineration	11.58	11.58	11.58	11.58	11.58	11.58	16.83	13.53	16.94	17.13	17.49
D. Other	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
Total Emissions/Removals with LUCF	**544,069.26**	**544,069.26**	**520,661.03**	**506,058.80**	**494,492.84**	**495,198.73**	**502,203.21**	**507,297.89**	**512,630.17**	**545,924.23**	**541,195.92**
Total Emissions without LUCF	**417,893.48**	**417,893.48**	**419,808.46**	**422,488.79**	**424,791.29**	**428,958.07**	**440,065.77**	**448,709.45**	**459,102.45**	**480,192.47**	**490,475.70**
Memo Items:											
International Bunkers	**6,461.31**	**6,461.31**	**6,438.80**	**6,646.42**	**7,053.77**	**7,431.37**	**8,613.45**	**9,116.20**	**9,145.29**	**9,539.42**	**9,809.68**
Aviation	4,385.53	4,385.53	4,562.42	4,840.41	5,247.98	5,399.87	5,912.66	6,371.10	6,601.70	7,301.19	7,336.02
Marine	2,075.78	2,075.78	1,876.37	1,806.01	1,805.79	2,031.51	2,700.79	2,745.10	2,543.59	2,238.24	2,473.67
Multilateral Operations	**NE**	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
CO_2 Emissions from Biomass	**16,862.98**	16,862.98	16,761.21	15,509.28	17,178.08	18,046.52	18,832.03	18,822.79	20,665.13	20,878.84	21,034.57

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.

TABLE 1 EMISSIONS TRENDS (CO_2-e)—KYOTO ACCOUNTING (Sheet 6 of 6)

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Base year [1]	2000	2001	2002	2003
1. Energy	**286,067.71**	**362,273.53**	**368,010.77**	**370,069.48**	**374,283.09**
A. Fuel Combustion (Sectoral Approach)	**257,294.72**	**330,285.59**	**336,756.10**	**340,892.86**	**347,876.89**
1. Energy Industries	142,282.25	193,332.46	199,174.45	202,851.56	209,176.90
2. Manufacturing Industries and Construction	37,590.47	41,885.05	42,310.01	39,607.42	39,361.38
3. Transport	61,911.31	77,021.09	77,051.12	79,069.58	79,772.15
4. Other Sectors	14,324.53	16,764.25	16,860.15	18,018.02	18,289.32
5. Other	1,186.16	1,282.74	1,360.37	1,346.28	1,277.14
B. Fugitive Emissions from Fuels	28,773.00	31,987.95	31,254.67	29,176.62	26,406.19
1. Solid Fuel	15,816.36	19,638.07	18,445.52	17,456.28	16,534.08
2. Oil and Natural Gas	12,956.64	12,349.87	12,809.16	11,720.34	9,872.12
2. Industrial Processes	**28,040.78**	**28,134.64**	**29,726.18**	**29,999.83**	**32,305.69**
A. Mineral Products	4,825.64	5,155.38	5,146.66	5,215.57	5,384.17
B. Chemical Industry	512.89	897.24	1,025.27	943.50	961.28
C. Metal Production	18,690.86	14,948.10	14,965.85	14,320.86	15,418.86
D. Other Production	NE	NE	NE	NE	NE
E. Production of Halocarbons and SF_6	1,126.27	NO	NO	NO	NO
F. Consumption of Halocarbons and SF_6	521.02	3,239.74	3,778.81	4,283.49	4,830.04
G. Other	2,364.10	3,894.19	4,809.58	5,236.40	5,711.34
3. Solvent and Other Product Use	**NA**	**NA**	**NA**	**NA**	**NA**
4. Agriculture	**93,555.11**	**98,198.79**	**100,114.32**	**98,611.86**	**97,280.64**
A. Enteric Fermentation	67,512.63	64,356.06	64,811.65	63,298.87	62,748.00
B. Manure Management	2,061.13	3,291.28	3,347.22	3,361.86	3,333.64
C. Rice Cultivation	490.50	741.36	737.83	589.29	400.09
D. Agricultural Soils	15,178.92	19,030.14	19,412.31	19,223.66	18,716.27
E. Prescribed Burning of Savannas	8,040.04	10,405.50	11,422.18	11,812.02	11,784.48
F. Field Burning of Agricultural Residues	271.90	374.44	383.13	326.17	298.17
G. Other	NA	NA	NA	NA	NA
5. Land Use, Land-Use Change and Forestry	**126,175.78**	**49,378.15**	**42,235.59**	**47,582.30**	**34,818.71**
A. Afforestation and reforestation [2]	0.00	-10,177.06	-11,128.14	-12,978.84	-14,798.10
B. Land use change (deforestation)	126,175.78	59,555.21	53,363.73	60,561.14	49,616.80
6. Waste	**10,229.88**	**11,076.85**	**11,345.10**	**11,708.93**	**11,360.68**
A. Solid Waste Disposal on Land	7,472.31	7,973.82	8,204.09	8,526.30	8,141.48
B. Waste-water Handling	2,745.99	3,086.72	3,124.71	3,166.32	3,202.89
C. Waste Incineration	11.58	16.30	16.30	16.30	16.30
D. Other	NA	NA	NA	NA	NA
7. Other *(please specify)*	**NA**	**NA**	**NA**	**NA**	**NA**
NA	NA	NA	NA	NA	NA
Total Emissions/Removals with LUCF	**544,069.26**	**549,061.96**	**551,431.96**	**557,972.39**	**550,048.80**
Total Emissions without LUCF	**417,893.48**	**499,683.81**	**509,196.37**	**510,390.09**	**515,230.10**
Memo Items:					
International Bunkers	**6,461.31**	**10,194.60**	**10,725.56**	**8,684.21**	**8,920.19**
Aviation	4,385.53	7,399.30	8,227.86	6,451.95	6,676.98
Marine	2,075.78	2,795.30	2,497.71	2,232.26	2,243.21
Multilateral Operations	**NE**	NE	NE	NE	NE
CO_2 Emissions from Biomass	**16,862.98**	20,620.04	19,518.87	16,478.80	16,937.68

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.