Agriculture Peer Review of the UK Greenhouse Gas Inventory

Covering the 2004 and 2005 UK National Inventory Reports

Main authors Ulrich Dämmgen and Ulrike Döring

With contributions from Lorna Brown, John Watterson, Chris Dore, Susannah Grice and Sarah Baggott

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Approved by	John Watterson	John Watterson	03.11.06

Executive Summary

The UK greenhouse gas inventory is compiled by Netcen, under contract to Defra, using estimates of emissions from agriculture provided by the Institute of Grassland and Environmental Research, who are also under contract to Defra.

This report is the expert peer review of the agricultural sectors of the 2004 and 2005 greenhouse gas inventory submission of the United Kingdom. The review took place in the UK at Harwell, March 17th to 18th, 2005 and was completed by a Peer Review Team (PRT) consisting of:

- **A German expert team** — Ulrich Dämmgen (Federal Agricultural Research Centre, Institute of Agroecology), and, Ulrike Döring (Federal Environmental Agency),

in conjunction with

- **UK agricultural sector expert** — Lorna Brown (Institute of Grassland and Environmental Research)
- **UK GHG inventory manager** — John Watterson (National Environmental Technology Centre)
- **UK NAEI[1] manager** — Chris Dore (National Environmental Technology Centre)

This review examines the methods used to estimate emissions of

- methane from enteric fermentation and manure management (CRF[2] categories 4A and 4B), and,
- nitrous oxide from manure management and agricultural soils (CRF categories 4B and 4D).

It also examines the conformity of the methods used to estimate emissions with international recommendations for the accuracy, transparency and comparability of reporting, and the consistency between emissions presented in the CRF tables and presented in the UK National Inventory Report (NIR).

The German expert review team found the agricultural sector of the UK greenhouse gas inventory is constructed and prepared according to guidelines developed by the Intergovernmental Panel on Climate Change (IPCC) and extended in the IPCC Good Practice Guidance.

In general, the UK agricultural GHG inventory is *complete*. The NIR provides a general explanation of the agricultural inventory and reflects the national development of emissions methodology over recent years. However, German expert review team identified a number of issues still to be addressed regarding the *consistency and the transparency* of the submission, in particular relating to the reporting of recalculations and methods used, and explanations regarding the use of notation keys. The German expert review team recommended the NIR includes more user guidance and an improvements to the readability of the NIR.

[1] National Atmospheric Emissions Inventory. The NAEI is the air emissions inventory for the UK.
[2] CRF – Common Reporting Format. Electronic spreadsheet files, submitted to the Framework Convention on Climate Change, of anthropogenic emissions by sources and removals by sinks of all greenhouse gases not controlled by the Montreal Protocol.

The UK has reported a key source Tier 1 uncertainty analysis with both a level and trend assessment, as part of its 2004 submission. However, the degree of detail differs from that of the CRF tables. This should be improved, in order to decide on the choice of methodology or Tier applied for a single source.

Quantitative *uncertainty* information is provided in the NIR and is reported according to the IPCC Tier 1 and Tier 2 methods. There are still some issues to be addressed regarding the documentation of the referencing for uncertainties and the assumptions relating to uncertainties of activity data.

A full list of recommendations is given in Chapter 5.

Contents

Document revision history

Issue	Version	Revision history
Draft	**v1.4**	• Submitted to UK Defra, the Devolved Administrations, Ulrich Dämmgen, Ulrike Döring and Lorna Brown for review • Comments incorporated
1.0	**1.0**	• First issue

Abbreviations, acronyms and definitions

Greenhouse gases

CH_4	Methane
CO_2	Carbon dioxide
N_2O	Nitrous oxide

Other pollutants

N	Nitrogen
NMVOC	Non-Methane Volatile Organic Compounds
VOC	Volatile Organic Compound

General

AEAT	AEA Technology plc (netcen is part of AEAT)
Annex 1	Annex I to the Climate Convention (UNFCCC) Annex 1 lists all the countries in the Organization of Economic Cooperation and Development (OECD) in 1990, plus countries with economies in transition, Central and Eastern Europe (excluding the former Yugoslavia and Albania). By default the other countries are referred to as Non-Annex I countries. Under Article 4.2 (a & b) of the Convention, Annex I countries commit themselves specifically to the aim of returning individually or jointly to their 1990 levels of GHG emissions by the year 2000.
CEH	Centre for Ecology and Hydrology
COP	Conference of the Parties The supreme body of the UNFCCC, comprised of countries that have ratified or acceded to the Framework Convention on Climate Change. The first session of the COP (COP-1) was held in Berlin in 1995.
CRF	Common Reporting Format tables of GHG emissions (for EUMM and UNFCCC
DA	Devolved Administration
EU	European Union
GHG	Greenhouse gas
GHGI	Greenhouse gas inventory. The UK GHG inventory is part of the NAEI.
GPG	IPCC Good Practice Guidance documents
IPCC	Intergovernmental Panel on Climate Change
KSA	Key Source Analysis
MOP	Meeting of the Parties The Conference of Parties of the FCCC will serve as the MOP (Meeting Of Parties, the supreme body of the Kyoto Protocol) but only Parties to the Kyoto Protocol may participate in deliberations and make decisions. Until the Protocol enters into force, the MOP cannot meet.
NAEI	National Atmospheric Emissions Inventory
netcen	National Environmental Technology Centre (part of AEA Technology plc
NIR	National Inventory Report (greenhouse gas inventory report)
QA/QC	Quality Assurance / Quality Control
UK	United Kingdom
UNFCCC	United Nations Framework Convention on Climate Change

VS	Volatile solids

1 Introduction

As a signatory and an Annex I Party to the Framework Convention on Climate Change (FCCC), the UK has an obligation to prepare and report annually its estimates of GHG emissions from sources and sinks for each year since 1990.

The purpose of an annual technical review by experts is:

- to ensure that the Conference of the Parties (COP) has the adequate and reliable information on annual inventories and emission trends,
- to provide the COP with an objective, consistent, transparent, thorough and comprehensive technical assessment of the annual quantitative and qualitative inventory information submitted by Annex I Parties,
- to examine the reported inventory information for consistency with the Guidelines for the preparation of national communications by Parties included Annex I to the Convention, Part I: UNFCCC on Climate Change (IPCC) Guidelines for National Greenhouse Gas Inventories as elaborated by the IPCC report entitled Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories, and,
- to assist Annex I Parties in finding inconsistencies and in improving the quality of their greenhouse gas inventories.

The UK greenhouse gas inventory is subject to a number of regular reviews by the FCCC, and to Peer Reviews of selected sources in defined reporting sectors.

The frequency and scope of the Peer Reviews is determined by the importance of emissions in selected sectors (in relation to the national total emissions), and the level of uncertainty associated with those emissions.

This Chapter outlines the general process of Peer Review and the guidance used to compile the UK greenhouse gas inventory.

1.1 THE PROCESS OF PEER REVIEW

The IPCC Good Practice Guidance (GPG) and Uncertainty Management in National Greenhouse Gas Inventories[3] defines detailed quality assurance and quality control procedures that should be applied in national greenhouse gas preparation. The Good Practice Guidance (Section 8.8) requires that national inventories should be subjected to periodic expert external peer review. It defines expert peer review as follows -

> *'Expert peer review consists of a review of calculations or assumptions by experts in relevant technical fields. This procedure is generally accomplished by reviewing the documentation associated with the methods and results, but usually does not include rigorous certification of data or references such as might be undertaken in an audit. The objective of the expert peer review is to ensure that the inventory's results, assumptions, and methods are reasonable as judged by those knowledgeable in the specific field.'*

[3] Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories available at www.ipcc-nggip.iges.or.jp/public/public.htm

Peer Reviews should be performed by experts who are not involved in the inventory preparation process. The peer review process should focus on key sources in the inventory identified by the IPCC key source category analysis.

During 2002, the UK implemented a programme of peer reviews by experts outside of the organisation responsible for the estimates. The first peer review on CO_2 emissions from fossil fuel has been completed (Simmons, 2002). This Peer Review is the second external peer review as defined and concentrated on emissions from selected sources in the agricultural sector of the UK GHG inventory.

The 2002 inventory (presented in the 2004 National Inventory Report) was recently subjected to a Centralised Review by the UNFCCC (FCCC, 2005).

1.2 COMPILATION OF THE UK GREENHOUSE GAS INVENTORY

A key commitment of the Parties to the UN Framework Convention on Climate Change (UNFCCC) is to develop and report inventories of all greenhouse gas emissions by sources and removals by sinks. The UK submits a national inventory report annually based on the Intergovernmental Panel on Climate Change (IPCC) 1996 Guidelines and the IPCC's Good Practice Guidance, published in 2000. The UK aims to use the best scientific information to provide the most accurate national emission estimates compatible with the Guidelines. The UK Greenhouse Gas Inventory is compiled and maintained by the National Environmental Technology Centre (Netcen) of AEA Technology plc under contract to the Department for Environment, Food and Rural Affairs (Defra). This expert peer review forms part of this overall contract. The inventory is updated annually with revisions applied to previous years, so that a consistent time series from 1990 to the current year is obtained.

The UNFCCC reporting guidelines on annual inventories (FCCC/CP/2002/8) cover the international requirements for estimating and reporting of GHG emissions and removals of both annual inventories and inventories included in national communications. These guidelines were produced by the Conference of Parties at its eighth session (COP8), which took place in New Delhi from 23 October to 1 November 2002. Following these detailed requirements, and any good practices as agreed upon by the Conference of Parties (COP), the UK is required to submit a national inventory report annually to the COP through the UNFCCC Secretariat consistent with the inventory methodology contained in the Intergovernmental Panel on Climate Change (IPCC) 1996 Guidelines[4] and using the common reporting format (CRF) contained in FCCC/CP/2002/8[5].

The greenhouse gas inventory (GHGI) is based on the same data sets used by the National Atmospheric Emissions Inventory (NAEI) for reporting atmospheric emissions under other international agreements. The GHGI is therefore consistent with that of the NAEI where they overlap.

[4] Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories available at www.ipcc-nggip.iges.or.jp/public/public.htm

[5] www.unfccc.int/resource/docs/cop8/08.pdf

1.3 STRUCTURE OF THE REPORT

The report is structured as follows:

- **Chapter 1** (this chapter) presents purpose of the report and the structure of the report
- **Chapter 2** provides the background to the study and scope of work
- **Chapter 3** provides the detailed analysis of the UK 2005 greenhouse gas inventory and recommendations of the agricultural expert review team
- **Chapter 4** list the acknowledgements
- **Chapter 5** lists the references

2 Scope and Approach to the Agriculture Peer Review

This chapter sets out the general scope of the agriculture peer review, the team who completed the review, and the general approach to the review.

2.1 GENERAL SCOPE

An expert peer review consists of a review of calculations or assumptions by experts in the specific technical fields (according to IPCC Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories, Section 8.8). In this Peer Review, this procedure was accomplished by reviewing the documentation associated with the methods and results, and did not include rigorous certification of data or references.

The review was carried out using the UK National Inventory Report[6] as its basis. This reports the UK inventory in the UNFCCC Common Reporting Format together with a detailed description of the methods used to produce the estimates.

Only the calculations and assumptions of the estimates were reviewed and not the procedures identifying the key sources. Selected statistical uncertainties attached to the estimates were also reviewed. Compliance with IPCC Good Practice Guidance was examined only in so far as it affected emission estimates through the choice of data and estimation methodology. The GPG recommendations relating to data organisation, document keeping and reporting were not examined.

Factors considered in the review included:

- Completeness - were all sources included
- Appropriate use of emission factors
- Correct classification of sources according to IPCC Guidelines
- Consistency of time series
- Compliance with IPCC Good Practice Guidance

2.2 TEAM SELECTED FOR THE AGRICULTURE PEER REVIEW

The Peer Review Team (PRT) consisted of:

- **A German expert team** — Ulrich Dämmgen (Federal Agricultural Research Centre, Institute of Agroecology), and, Ulrike Döring (Federal Environmental Agency),

in conjunction with

- **UK agricultural sector expert** — Lorna Brown (Institute of Grassland and Environmental Research)
- **UK GHG inventory manager** — John Watterson (National Environmental Technology Centre).

[6] UK Greenhouse Gas Inventory 1990 to 2002. Annual report for submission under the Framework Convention on Climate Change, Baggott, SL, *et al,* AEAT/R/ENV/1702, NETCEN, Culham available at www.aeat.co.uk/netcen/airqual/reports/ghg/ghg2.html

The review took place in the UK at Harwell, March 17th to 18th, 2005. The German expert team have no involvement with the compilation of the UK inventory.

2.3 SOURCES COVERED

Institute of Grassland and Environmental Research provide the GHG emission estimates together with details of methodologies used and emission factors for:

- **Livestock** methane from enteric fermentation
  methane from animal wastes
  nitrous oxide from animal wastes
- **Agricultural soils** nitrous oxide from fertiliser use
  nitrous oxide from biological nitrogen fixation
- **Field burning** emissions from field burning in the UK of all pollutants.

The present peer review covered the calculations and assumptions of estimates for emissions of CH_4 for enteric fermentation and manure management (CRF categories 4A and 4B) and for emissions of N_2O for manure management and agricultural soils (CRF categories 4B and 4D).

The following two charts and tables present the time series of emissions from these sources in relation to the national emissions. These data have been taken from the 2005 UK NIR (emissions from 1990 to 2003 inclusive).

Figure 2.1 Emissions of methane from categories IPCC categories 4A and 4B (enteric fermentation and manure management). The remainder of the emissions is the sum of all the remaining methane emissions reported in the UK GHG inventory.

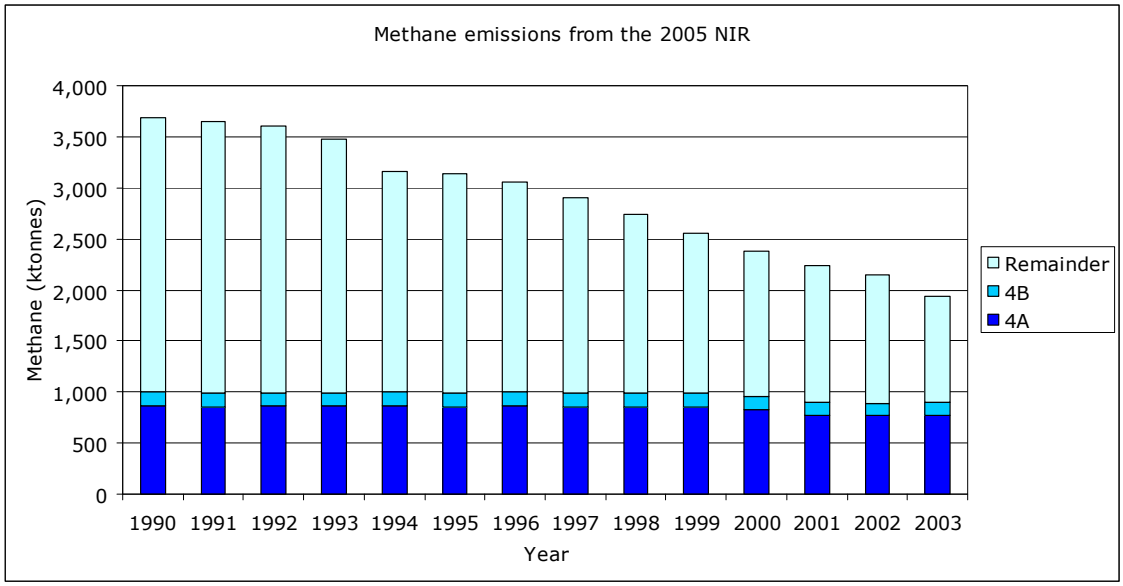

Table 2.1 Emissions of methane from categories IPCC categories 4A and 4B (enteric fermentation and manure management). The remainder of the emissions is the sum of all the remaining methane emissions reported in the UK GHG inventory.

	IPCC category		
Year	4A	4B	Remainder
1990	865.37	139.20	2684.95
1991	853.30	137.64	2663.21
1992	857.89	137.20	2606.63
1993	857.83	138.12	2479.53
1994	864.06	139.57	2152.96
1995	855.29	136.98	2148.50
1996	863.37	137.91	2052.16
1997	851.86	137.57	1917.35
1998	851.47	138.20	1754.03
1999	852.30	136.48	1570.55
2000	823.68	131.33	1421.61
2001	772.75	126.23	1337.11
2002	764.85	124.82	1252.05
2003	770.00	124.27	1038.26

Figure 2.2 Emissions of nitrous oxide from categories IPCC categories 4B and 4D (manure management and agricultural soils). The remainder of the emissions is the sum of all the remaining nitrous oxide emissions reported in the UK GHG inventory.

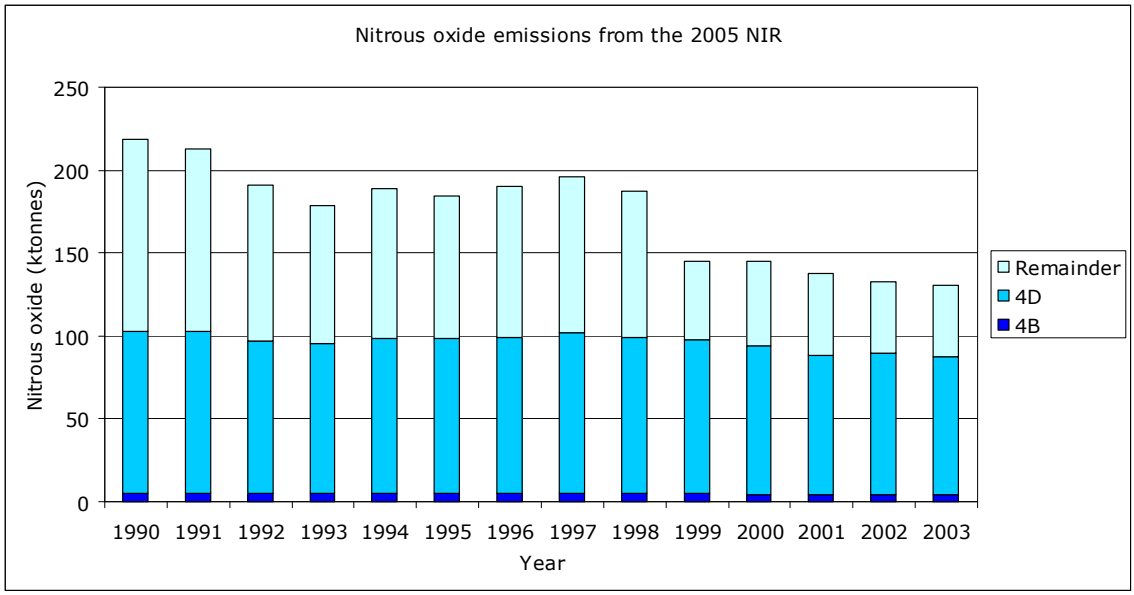

Table 2.2 Emissions of nitrous oxide from categories IPCC categories 4B and 4D (manure management and agricultural soils). The remainder of the emissions is the sum of all the remaining nitrous oxide emissions reported in the UK GHG inventory.

	IPCC category		
Year	4B	4D	Remainder
1990	4.88	98.10	116.03
1991	4.87	97.68	110.22
1992	4.79	92.46	93.45
1993	4.82	90.88	83.13
1994	4.89	93.24	90.92
1995	4.82	93.81	85.52
1996	4.88	94.34	91.29
1997	4.88	97.29	94.07
1998	4.93	94.42	88.08
1999	4.93	92.56	47.58
2000	4.64	89.12	50.96
2001	4.45	83.43	49.62
2002	4.31	85.22	42.87
2003	4.26	83.06	43.08

2.4 APPROACH ADOPTED IN THE PEER REVIEW

The review proceeded by:

- Considering the guidelines and checklists of the Handbook for Review of National GHGI (IPCC)
- Commenting on the conformity of the inventory preparation with the IPCC Guidelines and the IPCC Good Practice Guidebook.
- Considering the former review reports (from the centralized review (FCCC, 2005) and the Peer Review of CO_2 emissions from fuel combustions as a guide to the expected output.

2.5 DOCUMENTS USED IN THE PEER REVIEW

The following documents were used in the Peer Review:

- Chapter 6 (Agriculture), of the 2005 draft National Inventory Report, unpublished, which was supplied by Email, March 16 to the German Expert Team.
- The complete UK NIR 2004 (available on March 17). It contained the CRFs on compact disc.
- The results of the third centralised review of the UK greenhouse gas inventory (FCCC, 2005)
- The UK CRF for 2005 (available on March 17).
- The Peer Review of the UK greenhouse gas inventory, carbon dioxide from fuel combustion (Simmons, 2002)

The 2004 UK NIR and associated CRF were sent to the German experts before the review.

3 Analysis and Recommendations

This Chapter contains the findings of the German expert reviewers.

3.1 GENERAL COMMENTS

3.1.1 Key Source Analysis

The Key Source Analysis (KSA) provides the tool to decide which calculation Tier should be used to estimate emissions. The detail of the KSA should therefore reflect the resolution of categories and sub-categories used for reporting. In particular, it should differentiate between the various animal sub-categories which might receive different attention (dairy cows, other cattle, sheep, swine, horses, poultry). A comment on the choice of a Tier should be made in each chapter with reference to the KSA. Closer attention to the results of the key source analysis could assist with the allocation of resources for the future development of the inventory.

3.1.2 References

1. Referencing to the IPCC Guidelines could be more detailed (by referencing to the relevant section in IPCC Reference Manual, Workbook, …).
2. References should relate to publicly accessible information - whether peer reviewed, Defra research (e.g. CSG15) etc.
3. Whenever references to personal communications cannot be avoided, they should be extended, indicating whether they are based on expert judgement, on modelled output, on surveys, etc.

3.1.3 Notation keys

The consistent use of notation keys should be checked again.

3.1.4 Consistency

1. Consistency of text and CRF tables: Comments made in the tables (documentation box) should be reflected in the text, and *vice versa* (completely).
2. Consistency of references between Annex and main body of report should be checked.

3.1.5 Transparency and readability

The inclusion of additional tables in the main text, in particular of time series of recalculations, total emissions of sub-categories should be checked. Sentences repeated in the Annex should be avoided.

3.1.6 Completeness

1. All animal categories contributing significantly to GHG emissions are mentioned. However, the order of magnitude of the numbers of those animals which are kept in the UK with negligible contributions to emission totals (in particular those mentioned in the CRF tables: donkeys, mules, fur animals) should be presented with the comment that they are negligible and therefore not estimated (NE).
2. The treatment of sewage sludge application to farmed land with respect to its N_2O emissions should be checked and reported in the documentation accordingly.
3. Some mineral fertilizers contain lime. It should be checked whether the data provided for liming (to be reported in CRF 5D (old)) contains the amount of lime applied with calcium ammonium nitrate.

3.2 EMISSIONS FROM ENTERIC FERMENTATION

3.2.1 All animals

The consistency of the information provided in the GHG inventory with other inventories (air pollutants) should be checked.

3.2.2 Dairy cattle

Table A3.6.3 in the 2005 NIR contains information explaining the derivation of emission factors. The time series of weights used needs to be explained or referenced adequately. Grazing times are unlikely to be constant over the whole period. If they are not constant, the digestibility of the feed is not constant with time. Higher milk yields will result in higher shares of concentrates in the feed, which again will have an effect on the digestibility of the feed and hence on the output of volatile solids needed to derived methane emissions from manure management. Typical feed compositions might be provided to enhance transparency.

3.2.3 Other cattle

With the increase of individual milk yields, the herd composition (remonting) will have changed. Table A3.6.4 in the 2005 NIR suggests a constant composition of the "other cattle" herd over time. Farm management practices are likely to have changed over the past 15 years; so, grazing time and digestibility of feed may not have been constant with time. This should be explained or considered in the report.

3.2.4 Sheep

With sheep being a key source, a differentiation between upland and lowland sheep might be adequate due to different feeding regimes and animal performances. The treatment of emissions from lambs appears to be adequate. However, an explanation might be provided how the percentage was derived. N excretions might be helpful do explain both VS excretions and CH_4 emissions from enteric fermentation.

3.3 EMISSIONS FROM MANURE MANAGEMENT

3.3.1 All animals

1. For all animal categories not treated as key sources, N excretion is considered to be constant with time. This is felt to be adequate.
2. The distribution of Animal Waste Management Systems is treated to be constant with time. This is unlikely. Time varied farm size distributions might provide a tool to a time series for the dominant animal categories.
3. The methane conversion factor for slurry used at present is the one listed in the Good Practice Guidance (39%). There has been concern in the Scandinavian countries that this factor is not well documented, and that the value of 10% given in the Guidelines (1997) is more appropriate. National data should be checked whether they allow for a decision between the two default values or even allow for the use of a national value.
4. According to specific IPCC definition of anaerobic lagoons, the assumption that UK reports "NO" is accepted.
5. Treatment of N losses in the N flow during housing and storage (before being returned to soil) is accepted by the reviewers.

3.3.2 Dairy cattle

1. The EFs provided in Table A3.6.7of the 2005 NIR are adequate. A source should be cited.
2. Information regarding hard standings should be added to clarify that they are not considered in GHG calculations.

3.3.3 Sheep

Production of lambs' meat and consumers' habits with regard to meat consumption have changed during the past decade. It is likely that the raising and fattening of lambs reflects this. This should influence N excretion in particular. Including some information about the time series of N excretions would be helpful.

3.4 DIRECT EMISSIONS FROM AGRICULTURAL SOILS

1. The calculation of the quantities of fertilizers applied using areas and typical fertilizer amounts should be checked against the overall sales of fertilizers in the UK.
2. The areas of the crops grown in the UK should be listed in the NIR in the same way as the animal numbers.
3. The calculation of mineral fertilizers applied as well as of crop residues relies on the knowledge of plant yields. These are not constant with time. This could be reflected, if the respective information is available.
4. $Frac_{(GASF)}$ is treated according to the IPCC Guidelines, however, this methodology is at least "questionable".
5. The assessment of nitrogen returned to soil (from both mineral fertilizers and animal manures) is considered to be adequate.

3.5 INDIRECT EMISSIONS

The treatment of N losses before returning to soil is accepted.

3.6 IMPROVEMENT OF QUALITY REDUCTION OF UNCERTAINTIES

In agriculture, major uncertainties are attributed to emission factors, which often reflect the order of magnitude rather than being "sound" figures. The estimate of uncertainty of the EFs as provided by e.g. the Atmospheric Emission Inventory Guidebook and in the uncertainty analysis provided by AEAT (20 to 50%) seems adequate. Improvements are unlikely considering the present state of knowledge. The uncertainty of activity data is in the range of 5%. The assumptions made relating to the uncertainties of activity data should be updated and referenced.

3.7 ANALYSIS AND COMPARISON OF THE CRF TABLES SUBMITTED IN 2004 AND 2005

This analysis follows the order of the tables in the CRF:

3.7.1 Table 4s(1):

- Emissions from poultry are recorded as "0". This should be "NE". Submission 2004 is correct in this respect.
- Mules and asses etc. should be "NE".

3.7.2 Table 4s(2):

- Inconsistent notation keys: Rice cultivation should be "NO".
- Agricultural soils CH_4 emissions should be "NE".
- Prescribed savanna burning should be "NO".
- On field burning of agricultural residues should be "NO" for all gases after 1993.
- Others should be "NO".

3.7.3 Table 4A:
The contents of the documentation box should be discussed within the NIR text.

3.7.4 Table 4B(a)
- The contents of the documentation box should be discussed within the NIR text.
- Typical animal masses are missing in the 2005 submission, but given in the 2004 submission. For 2002, the contents of documentation box are to be discussed within the NIR text.
- VS excretion for dairy cattle as presented in submission 2005 (3.4 kg) differs from 2004 submission (5.4 kg) without an explanation.
- AWMS frequency distribution for dairy cattle (liquid systems) in 2005 differs from 2004 submission without an explanation.
- For all animals except cattle and swine, the climate region is wrong (transcription error).

3.7.5 Table4B(b)
The contents of the documentation box should be discussed within the NIR text.

3.7.6 Table4C
Aggregated emissions should be "NO".

3.7.7 Table 4D
The contents of the documentation box should be discussed within the NIR text.

3.7.8 Table 4F
Activity data should be "NO".

3.7.9 Tables Summary 1.As2, Summary 3.s2
Notation keys should be consistent with background information tables.

3.7.10 Table Summary 3.s2
Check notation keys.

3.7.11 Table 7.s2
CRF "CO_2 emissions" should be "IE".

3.7.12 Table 8(a)s1
The submission 2004 for 2002 was incomplete. 2005 was completed. However, the cell "recalculated year" is empty.

3.7.13 Table 8b
CH_4 emissions from manure management were recalculated according to CRF tables. This is not mentioned in the NIR under "recalculations". A comparison of the emission factors used should be provided in the NIR.

3.7.14 Table 9s(1)
Check notation keys.

3.7.15 Tables 10s1 ff
Tables have not been completed yet.

3.8 FUTURE INVENTORIES

The revision of the Guidelines anticipated for 2006 will result in more sophisticated inventories, clearly requiring more work in the collation of emission explaining data, the

establishment of more detailed calculation procedures and documentation which exceeds the present efforts. An increase in future resources necessary to accommodate the increased demands seems inevitable.

4 Acknowledgements

We are grateful for the support and encouragement of Jim Penman, Susan Donaldson, Joanne Halliday and Steve Cornelius (UK Defra).

Susannah Grice helped produced the charts and tables of emissions.

The German experts thanked their UK colleagues for the open discussion of all problems encountered, and the UK representatives extended their thanks to the German experts for their professional approach and open and friendly working style.

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