UNITED
NATIONS

UNFCCC Framework Convention on Climate Change

Distr.
GENERAL

FCCC/ARR/2009/SWE
9 April 2010

ENGLISH ONLY

Report of the individual review of the annual submission of Sweden submitted in 2009*

* In the symbol for this document, 2009 refers to the year in which the inventory was submitted, and not to the year of publication.

CONTENTS

I. Overview

A. Introduction

1. This report covers the centralized review of the 2009 annual submission of Sweden, coordinated by the UNFCCC secretariat, in accordance with decision 22/CMP.1. The review took place from 21 to 26 September 2009 in Bonn, Germany, and was conducted by the following team of nominated experts from the UNFCCC roster of experts: generalists – Ms. Inga Konstantinviciute (Lithuania) and Ms. Batima Punsalmaa (Mongolia); energy – Mr. Takeshi Enoki (Japan) and Mr. Pavel Fott (Czech Republic); industrial processes – Ms. Pia Forsell (Finland) and Mr. Kiyoto Tanabe (Japan); agriculture – Ms. Yauheniya Bertosh (Belarus) and Mr. Tom Wirth (United States of America); land use, land-use change and forestry (LULUCF) – Ms. Ana Morales (Canada) and Mr. Richard Volz (Switzerland); and waste – Mr. Philip Acquah (Ghana) and Mr. Qingxian Gao (China). Mr. Acquah and Mr. Tanabe were the lead reviewers. The review was coordinated by Mr. Tomoyuki Aizawa (UNFCCC secretariat).

2. In accordance with the "Guidelines for review under Article 8 of the Kyoto Protocol" (decision 22/CMP.1), a draft version of this report was communicated to the Government of Sweden, which provided comments that were considered and incorporated, as appropriate, into this final version of the report.

B. Emission profiles and trends

3. In 2007, the main greenhouse gas (GHG) in Sweden was carbon dioxide (CO_2), accounting for 78.9 per cent of total GHG emissions[1] expressed in CO_2 eq, followed by nitrous oxide (N_2O) (11.0 per cent), and methane (CH_4) (8.2 per cent). Hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulphur hexafluoride (SF_6) collectively accounted for 1.9 per cent of the overall GHG emissions in the country. The energy sector accounted for 73.7 per cent of the total GHG emissions, followed by agriculture (12.9 per cent), industrial processes (10.0 per cent), waste (2.9 per cent), and solvents and other products (0.4 per cent). Total GHG emissions amounted to 65,412.11 Gg CO_2 eq and decreased by 9.1 per cent between the base year[2] and 2007.

4. Tables 1 and 2 show total GHG emissions by gas and by sector, respectively. Table 1 shows emissions from the source categories listed in Annex A to the Kyoto Protocol and excludes emissions and removals from the LULUCF sector.

---

[1] In this report, the term "total GHG emissions" refers to the aggregated national GHG emissions expressed in terms of CO_2 eq excluding LULUCF, unless otherwise specified.

[2] "Base year" refers to the base year under the Kyoto Protocol, which is 1990 for CO_2, CH_4 and N_2O, and 1995 for HFCs, PFCs and SF_6. The base year emissions include emissions from the source categories listed in Annex A to the Kyoto Protocol.

Table 1. Total greenhouse gas emissions by gas, 1990–2007[a]

Greenhouse gas	Gg CO_2 eq							Change base year–2007 (%)
	Base year[b]	1990	1995	2000	2005	2006	2007	
CO_2	56 257.02	56 257.02	57 993.19	53 369.97	52 949.62	52 726.89	51 621.01	–8.2
CH_4	6 708.97	6 708.97	6 665.53	6 071.82	5 623.86	5 530.45	5 357.18	–20.1
N_2O	8 480.18	8 480.18	8 333.95	7 818.09	7 430.01	7 430.87	7 180.55	–15.3
HFCs	127.13	3.85	127.13	564.63	796.94	825.63	855.34	572.8
PFCs	343.43	376.82	343.43	240.52	257.15	245.32	247.60	–27.9
SF_6	126.68	107.49	126.68	93.59	142.48	111.31	150.43	18.7

[a] "Total greenhouse gas emissions" comprises emissions from the sectors/source categories listed in Annex A to the Kyoto Protocol (and excludes emissions/removals from the land use, land-use change and forestry sector).

[b] "Base year" refers to the base year under the Kyoto Protocol, which is 1990 for CO_2, CH_4 and N_2O, and for HFCs, PFCs and SF_6. The base year emissions include emissions from the source categories listed in Annex A to the Kyoto Protocol.

Table 2. Greenhouse gas emissions by sector, 1990–2007

Sector	Gg CO_2 eq							Change base year–2007 (%)
	Base year[a]	1990	1995	2000	2005	2006	2007	
Energy	53 312.96	53 312.96	55 149.10	50 682.44	49 578.49	49 345.65	48 237.14	–9.5
Industrial processes	5 901.56	5 792.48	5 906.61	5 846.46	6 613.91	6 671.80	6 532.61	10.7
Solvent and other product use	332.49	332.49	308.55	277.54	301.50	294.18	294.18	–11.5
Agriculture	9 382.92	9 382.92	9 300.06	8 747.18	8 552.84	8 502.42	8 430.70	–10.1
LULUCF	NA	-32 053.37	-25 457.89	-35 603.32	-29 139.28	-25 587.16	-20 459.70	NA
Waste	3 113.48	3 113.48	2 925.59	2 605.01	2 153.34	2 056.42	1 917.48	–38.4
Other	NO	NO	NO	NO	NO	NO	NO	NA
Total (with LULUCF)	NA	39 880.94	48 132.02	32 555.30	38 060.80	41 283.31	44 952.41	NA
Total (without LULUCF)	72 043.40	71 934.32	73 589.91	68 158.62	67 200.07	66 870.47	65 412.11	–9.2

Abbreviations: LULUCF = land use, land-use change and forestry, NA = not applicable, NO = not occurring.

[a] Base year refers to the base year under the Kyoto Protocol, which is 1990 for CO_2, CH_4 and N_2O, and for HFCs, PFCs and SF_6. The base year emissions include emissions from the source categories listed in Annex A to the Kyoto Protocol.

C. Annual submission and other sources of information

5. The 2009 annual inventory submission was submitted on 7 April 2009; it contains common reporting format (CRF) tables for 2007 for the period 1990–2007 and a national inventory report (NIR). On 30 November 2009, Sweden officially submitted a full set of revised CRF tables. Sweden also submitted information required under Article 7, paragraph 1, of the Kyoto Protocol, including accounting of Kyoto Protocol units and information on changes in the national system and in the national registry. Sweden did not provide information on activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol or information on adverse impacts under Article 3, paragraph 14, of the Kyoto Protocol. The standard electronic format (SEF) tables were submitted on 14 April 2009. The annual submission was submitted in accordance with decision 15/CMP.1. The Party indicated that the 2009 submission is also its voluntary submission under the Kyoto Protocol.

6. In addition, the ERT used the standard independent assessment report (SIAR) to review information on the accounting of Kyoto Protocol units (including the SEF tables and their comparison report) and on the national registry.[3]

7. During the review, Sweden provided the ERT with additional information. The documents concerned are not part of the annual submission. The full list of materials used during the review is provided in annex I to this report.

Completeness of the inventory

8. The inventory is generally complete in terms of gases and categories, and is complete in terms of geographical coverage and years. Sweden has provided all CRF tables except table 7 for all years. The NIR (annex 5) and CRF table 9(a) give information and explanations on categories reported as not estimated ("NE"). A number of minor categories in energy (CO_2 and CH_4 from oil transport and venting of oil and gas), industrial processes (CH_4 from carbon black), and waste (N_2O from waste incineration) and some categories in LULUCF (carbon stock changes in dead organic matter and in mineral and organic soils in land converted to forest land and forest land converted to other land-use categories; carbon stock changes in all carbon pools in forest land converted to wetlands; and CO_2, CH_4 and N_2O emissions due to controlled burning in forest land converted to wetlands) have been reported as "NE". In response to questions raised by the ERT, Sweden expressed its intention to either include emission estimates or change the notation key to not occurring ("NO") for most of these categories in the 2010 submission. Sweden has provided both potential and actual emission estimates for fluorinated gases from the industrial processes sector except PFCs from the consumption of halocarbons and SF_6 for 1990. The ERT recommends that Sweden provide information in CRF table 7 as presented in annex 1 to the NIR for the purpose of completeness.

D. Main findings

9. The 2009 inventory submission is generally in line with the *Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories* (hereinafter referred to as the Revised 1996 IPCC Guidelines) and the Intergovernmental Panel on Climate Change (IPCC) *Good Practice Guidance and Uncertainty*

[3] The SIAR, Parts I and II, is prepared by an independent assessor in line with decision 16/CP.10 (paragraphs. 5(a), 6(c) and 6(k)), under the auspices of the international transaction log (ITL) administrator using procedures agreed in the Registry System Administrators Forum. Part I is a completeness check of the submitted information relating to the accounting of Kyoto Protocol units (including the SEF tables and their comparison report) and to national registries. Part II contains a substantive assessment of the submitted information and identifies any potential problem regarding information on the accounting of Kyoto Protocol units and the national registry. The SIAR is not publicly available.

Management in National Greenhouse Gas Inventories (hereinafter referred to as the IPCC good practice guidance) and the IPCC *Good Practice Guidance for Land Use, Land-Use Change and Forestry* (hereinafter referred to as the IPCC good practice guidance for LULUCF). The inventory has been compiled in accordance with the UNFCCC "Guidelines for the preparation of national communications by Parties included in Annex I to the Convention, Part I: UNFCCC reporting guidelines on annual inventories" (hereinafter referred to as the UNFCCC reporting guidelines). However, the ERT noted that the Party has not made many improvements to its inventory preparation since the previous submission and Sweden has recognized this in its NIR. Furthermore, The ERT found that the completeness of the annual submission could be improved with respect to the Party's reporting of NE for a number of non-LULUCF categories, especially those categories that are included in either the Revised 1996 IPCC Guidelines or the IPCC good practice guidance, and for which methods are prescribed therein.

10. Sweden acknowledged that calculation mistakes had been made in the key category analysis. In response to a request from the ERT, Sweden corrected this during the review.

11. Sweden has submitted on a voluntary basis part of the supplementary information required under Article 7, paragraph 1, of the Kyoto Protocol in accordance with section I of the annex to decision 15/CMP.1. The Party did not submit on a voluntary basis information on activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol or information on the minimization of adverse impacts in accordance with Article 3, paragraph 14, of the Kyoto Protocol.

12. The Party has reported information on its accounting of Kyoto Protocol units in accordance with section I.E of the annex to decision 15/CMP.1, and used the SEF tables as required by decision 14/CMP.1.

13. The national system continues to perform its required functions as set out in the annex to decision 19/CMP.1. Sweden reported on a change in the national system since the previous annual submission relating to a system for handling emission data, named Technical Production System (TPS) which was developed in 2006 and was used for the first time in the 2007 submission.

14. The national registry continues to perform the functions set out in the annex to decision 13/CMP.1 and the annex to decision 5/CMP.1, and is in conformity with practically all the technical standards for data exchange between registry systems, in accordance with relevant decisions of the Conference of the Parties serving as the meeting of the Parties to the Kyoto Protocol (CMP).

15. The ERT encourages Sweden to explore the possibility of structuring its reporting, in its next annual submission, following the annotated outline of the NIR, and the guidance contained therein, that can be found on the UNFCCC website.[4]

16. In the course of the review, the ERT formulated a number of recommendations relating to the completeness of the annual submission (see paras. 8 and 93), transparency (see paras. 24, 37, 49, 50, 59, 72, 74, 76 and 81), key category analysis (see para. 20), etc.

E. A description of the institutional arrangements for inventory preparation, including the legal and procedural arrangements for inventory planning, preparation and management

1. Overview

17. The ERT concluded that the national system continues to perform its required functions.

[4] <http://unfccc.int/files/national_reports/annex_i_ghg_inventories/reporting_requirements/application/pdf/annotated_nir_outline.pdf>.

18. The NIR and additional information submitted by Sweden describe the institutional arrangements of the national system for the preparation of the inventory. The Swedish Ministry of Environment has overall responsibility for the national inventory. The Swedish Environmental Protection Agency (Swedish EPA) coordinates the activities for developing the inventory and is also responsible for the final quality assurance and quality control (QA/QC) of the data before they are submitted. A consortium called Swedish Environmental Emissions Data (SMED), which is composed of Statistics Sweden, the Swedish Meteorological and Hydrological Institute (SMHI), the Swedish Environmental Research Institute AB (IVL) and the Swedish University of Agricultural Sciences (SLU) is also involved in the preparation of the inventory.

2. Inventory planning

19. The NIR provides a description of the institutional, legal and procedural arrangements of the national system in annex 6.1 to the NIR, including general information on which organization is responsible for documentation and peer review for each sector. According to the NIR, regarding the assignment of responsibility for the inventory preparation, a document (Ordinance (2005:626)) defines the data providers and the information they must provide for inventory compilation. Sweden has also provided descriptive information on the quality management system as part of the national system in annex 6.2 to the NIR. However, the ERT noted that there is no detailed explanation in the NIR about the allocation of specific responsibilities in the inventory development process, including those related information on choice of methods; data collection, particularly activity data (AD) and emission factors (EFs). The ERT recommends that Sweden extend the information on its national system to include the specific responsibilities of the organizations participating in SMED and consultants who assist the Swedish EPA in the inventory preparation.

3. Inventory preparation

Key categories

20. Sweden has reported a tier 1 key category analysis, both level and trend assessment including the LULUCF sector, as part of its 2009 submission. The key category analysis performed by the Party and that performed by the secretariat[5] produced different results owing to different disaggregation. Sweden used highly aggregated categories except for the energy sector. During the review the ERT found that Sweden had made some mistakes in the calculation of the trend assessment, including the LULUCF sector. The ERT also found that the total emission estimates used for the key category analysis were not the same as those reported in the NIR, CRF tables and the background tables (appendix 20B to the NIR). During the review Sweden corrected these errors and revised the key category analysis in a manner consistent with the IPCC good practice guidance for LULUCF. The ERT recommends that Sweden perform the key category analysis correctly and report it in the next annual submission.

Uncertainties

21. Sweden presents the results of its tier 1 uncertainty analysis at the same level of aggregation as that used for the key category analysis. However, the uncertainty analysis does not cover the LULUCF sector. The ERT recommends that Sweden extend its overall uncertainty analysis to include the LULUCF sector. Annex 7 to the NIR provides a detailed description of uncertainties and indicates that all assigned

[5] The secretariat identified, for each Party, the categories that are key categories in terms of their absolute level of emissions, applying the tier 1 level assessment as described in the IPCC good practice guidance for LULUCF. Key categories according to the tier 1 trend assessment were also identified for Parties that provided a full set of CRF tables for the base year or period. Where the Party performed a key category analysis, the key categories presented in this report follow the Party's analysis. However, they are presented at the level of aggregation corresponding to a tier 1 key category assessment conducted by the secretariat.

input uncertainties for the analysis are documented in Swedish in the electronic form called "Expert Protocols", together with the information on how uncertainties are estimated (which CRF codes are concerned, which years, what type of AD, EFs, etc.), the value or range of the estimated uncertainty, explanations of the reasons behind the given values, and the name and qualification of the expert involved, etc. The ERT noted that Sweden does not take correlations between gases into account. The ERT encourages Sweden to perform uncertainty analysis taking correlations between gases or categories into account in the next annual submission. Overall uncertainties in the 2009 submission were 8.0 per cent for 1990 and 7.7 per cent for 2007. Uncertainties are higher in this submission than in the previous submission. The main reason for this is the revised estimate of emissions from off-road vehicles and working machinery.

Recalculations and time-series consistency

22. Recalculations have been performed and reported in accordance with the IPCC good practice guidance. The ERT noted that recalculations reported by Sweden of the entire time series from 1990 to 2006 have been undertaken to take into account improvements in AD in the energy, industrial processes, agriculture, LULUCF and waste sectors; and a new method to estimate emissions from off-road vehicles and working machinery. The major changes include a decrease in total GHG emissions in the base year (0.2 per cent), a decrease in estimated emissions for 1990 (0.15 per cent) and an increase for 2006 (1.71 per cent), excluding the LULUCF sector. The rationale for these recalculations is provided in the NIR and in CRF table 8(b).

Verification and quality assurance/quality control approaches

23. The implementation of effective QA/QC procedures for the GHG inventory is ongoing in Sweden under the direction of the Swedish EPA. The QA/QC system is well documented in annex 6:2 to the NIR. It incorporates a coordinated quality management system with specified quality objectives and routines for QA/QC operated by the Swedish EPA, linked to internal QC systems for all agencies contributing to the GHG inventory. For its 2007 submission, Sweden started to use the recently developed technical production system (TPS) archiving system. The TPS also provides greater access to all important components of the inventory and facilitates approval, review and analysis of the inventory, and the export of results to CRF Reporter. However, the ERT found that there is still a room for improvement in the implementation of QA/QC with regard to the consistency of the NIR and the CRF and background tables contained in annexes to the NIR. Sweden makes use of European Union emissions trading scheme (EU ETS) data for the inventory but did not provide information on whether QA is applied to EU ETS data in order to ensure that these data are in line with the Revised 1996 IPCC Guidelines and the IPCC good practice guidance. The ERT recommends that Sweden provide information on QA applied to data from EU ETS.

Transparency

24. The ERT noted regarding some categories explanations are not sufficiently transparent about parameters used for estimation such as the data from EU ETS, and country-specific EFs or relevant parameters, which are different from the default values of the Revised 1996 IPCC Guidelines and the IPCC good practice guidance. The ERT recommends that Sweden improve transparency by providing more precise and detailed explanations of methodologies, AD and EFs used as well as relevant category-specific QA/QC activities in cases Sweden uses AD from different sources for a single category, country-specific EFs, or methods that are not explicitly explained in the Revised 1996 IPCC Guidelines or the IPCC good practice guidance.

4. Inventory management

25. Sweden has an effective centralized archiving system, which includes the archiving of disaggregated EFs and AD, and documentation on how these factors and data have been generated and aggregated for the preparation of the inventory. The archived information also includes internal documentation on QA/QC procedures, external and internal reviews, and documentation on annual key categories and planned inventory improvements. The Swedish EPA manages and maintains the national GHG inventory database and the documentation of the inventory information.

F. Follow-up to previous reviews

26. Chapter 10 of the NIR outlines the recalculations and improvements undertaken by Sweden. According to the NIR, no general improvements were made in response to the review process. However, the ERT recognizes some improvements based on the recommendations from the previous review such as providing information on time series for industrial organic waste in order to provide a more complete picture of municipal solid waste AD for the waste sector in the NIR, and providing more information on N_2O emissions from wastewater handling.

G. Areas for further improvement

1. Identified by the Party

27. It is stated in the 2009 NIR that the inventory and reporting are to be steadily developed and improved. All sector descriptions in the NIR include the item “coming improvements” where explanations are provided about planned improvements such as revisions of emission estimates from several industries, revisions of several EFs for the energy sector, a detailed review to improve estimates in industrial processes and verification of data for agricultural land. Extensive further improvements are outlined in the LULUCF sector but these are the same as those identified in the previous submission.

2. Identified by the expert review team

28. The ERT identifies the following cross-cutting issues for improvement:

(a) It is important that Sweden implement in its next inventory the recommendations identified during the previous review, in particular those for key categories. If those recommendations cannot be implemented, the Party should clearly explain the reasons;

(b) Key category analyses should be performed correctly in accordance with the IPCC good practice guidance for LULUCF;

(c) More precise and detailed explanations of methodologies, AD and EFs as well as relevant category-specific QA/QC activities should be provided in cases where Sweden uses AD from different sources for a single category, country-specific EFs, or methods that are not explicitly explained in the Revised 1996 IPCC Guidelines or the IPCC good practice guidance;

(d) The implementation of QA/QC procedures needs to be improved to avoid calculation errors and inconsistency between the CRF tables and the NIR;

(e) Explanation of the national system in the NIR needs to be improved by providing more descriptive information on specific responsibilities of organizations participating in the SMED and consultants who assist the Swedish EPA in the inventory preparation.

29. Recommended improvements relating to specific categories are presented in the relevant sector chapters of this report.

II. Energy

A. Sector overview

30. The energy sector is the main sector in the GHG inventory of Sweden. In 2007, emissions from the energy sector amounted to 48,237.14 CO_2 eq, or 73.7 per cent of total GHG emissions. Since 1990 emissions have decreased by 9.5 per cent. The key driver for the fall in emissions is the decrease of fuel consumption in the category residential and manufacturing industries and construction. Within the sector, 43.2 per cent of the emissions were from transport, followed by 22.3 per cent from energy industries, 22.1 per cent from manufacturing industries and construction and 9.2 per cent from other sectors. CO_2 accounted for 96.2 per cent and N_2O accounted for 2.8 per cent. The remaining 1.0 per cent was from CH_4.

31. Sweden has provided recalculations of the period 1990–2006 for the energy sector in its 2009 submission. Recalculations of the 2006 estimates implied an overall increase in estimated emissions of 1.2 per cent (from 48,736.85 Gg CO_2 eq to 49,345.65 Gg CO_2 eq). The largest increase of emissions, 363.6 per cent (from 173.64 Gg CO_2 eq to 804.94 Gg CO_2 eq), is in fugitive emissions of oil and natural gas owing to an allocation change of petroleum coke in refineries from the category manufacturing industries and construction to the category fugitive emissions. Other recalculations include an increase in estimated emissions in transport of 2.8 per cent (from 20,190.59 Gg CO_2 eq to 20,752.47 Gg CO_2 eq), a decrease in energy industries of 2.0 per cent (from 11,374.49 Gg CO_2 eq to 11,150.78 Gg CO_2 eq) and a decrease in manufacturing industries and construction of 1.5 per cent (from 11,349.88 Gg CO_2 eq to 11,177.74 Gg CO_2 eq). The ERT commends Sweden for its efforts to improve the accuracy of the inventory. However, the ERT noted that Sweden has not implemented some of the recommendations made by previous reviews that would have made the inventory more accurate. For example, Sweden was recommended to take steps to reconcile its reporting to the international energy agency (IEA) with its reporting to the UNFCCC, and to improve the transparency on the low carbon content values of diesel oil used for road transportation, but has not implemented these recommendations. The ERT reiterates these recommendations. In particular, the ERT recommends that Sweden investigate the cause of the difference between the data reported to the IEA and that reported to the UNFCCC with a view to correcting any identified errors or to providing an explanation of the difference in the next annual submission.

32. Sweden submitted a complete inventory of GHGs including CRF tables. Emissions from some categories were reported as "NE", such as the CH_4 and N_2O emissions from mobile military use of biomass for the years 1999 to 2001, CO_2 and CH_4 from oil transport for all years, and CO_2, CH_4 and N_2O from venting of oil and gas and flaring of gas for all years. During the review, Sweden informed the ERT that emission estimates of CO_2 and CH_4 from oil transport and CO_2 and CH_4 from venting of oil and gas will be included in the next annual submission. Sweden also informed the ERT that CO_2 and CH_4 from flaring of gas will be reported as "NO" in the next annual submission. The ERT recommends that Sweden implement these improvements in the next annual submission.

33. Sweden mostly uses higher-tier methods and country-specific EFs for estimating emissions in the energy sector. Confirming and reviewing EFs in the energy sector is a collective effort made by Swedish EPA, the Swedish Energy Agency and SMED, and comparisons are also made with a number of research and environmental reports. As a result, Sweden has revised EFs and calorific values for some fuels and has indicated that it will continue these activities in the future. The ERT welcomes the efforts made by Sweden to improve the accuracy of the inventory and recommends that Sweden provide the reasons behind the revisions and a brief explanation of the verification results in the NIR.

34. Sweden uses several sources for AD in the energy sector. For example, for energy industries, Sweden uses a combination of yearly statistics and quarterly fuel statistics (for in-house fuels used in the

energy industries) for the years 1990 to 1996, quarterly statistics for 1997 to 1999, yearly statistics for 2000 to 2002 and quarterly statistics for 2003 onward. Descriptions of sources of AD and general reasons for using different sources are provided in the NIR, for example energy consumption data provided by the manufacturing industry statistics for 1997–1999 have not been used in the inventory because these data were considered to be not sufficiently accurate. The ERT recommends that Sweden include in the NIR in its next submission a brief discussion on how AD sources are deemed accurate or inaccurate and how Sweden ensures the time-series consistency of the data used. The discussion should include efforts made by Sweden to ensure the accuracy of the inventory without compromising the time-series consistency of the data used for estimations.

B. Reference and sectoral approaches

1. Comparison of the reference approach with the sectoral approach and international statistics

35. For 2007, there is a difference of 14.8 per cent in the CO_2 emission estimates between the reference approach and the sectoral approach. Explanations have been provided in the documentation box of CRF table 1.A(c) and the NIR provides explanations of the fluctuations in the differences between the two approaches over the years. The discrepancies are mainly due to statistical differences in the energy balance between energy supply and energy consumption, and to the difference between the EFs for crude oil used in the reference approach and those used in the sectoral approach. During the review, Sweden informed the ERT that there are plans to address this issue during 2010. The ERT reiterates the recommendation made by the previous review that Sweden reconcile the data in its next annual submission.

36. In general, the apparent consumption of fuels estimated using the reference approach reported to the UNFCCC corresponds to that reported to the IEA, within about 5 per cent difference for most years. As indicated by previous review reports, discrepancies still exist in peat production, imports and exports of lubricants, natural gas imports and stock changes, coking coal imports, liquid fuels stock changes, and brown coal briquettes (BKB) and patent fuel imports. The ERT reiterates the previous review recommendation that Sweden take steps to reconcile its reporting to the IEA with its reporting to the UNFCCC. Moreover, the ERT recommends that Sweden investigate the cause of the difference between the data reported to the IEA and that reported to the UNFCCC with a view to correcting any identified errors or to providing an explanation of the difference in the next annual submission.

2. International bunker fuels

37. Estimates of fuel consumption and emissions from domestic and international aviation for the years 1995 to 2007 are taken from studies conducted by the Swedish Civil Aviation Authority (SCAA). For the years 1990 to 1994, the methodology is different owing to some gaps in fuel combustion and emission data. The ERT recommends that Sweden provide more information in the NIR on the methods and assumptions used in estimating emissions from 1990 to 1994 in order to ensure time-series consistency. The ERT also recommends that Sweden provide more information on the methodology of the SCAA study in order to improve the transparency of the methodology used to calculate the split of fuel combustion between domestic and international use.

38. Sweden indicates in the NIR that verification has not yet been carried out as to how well the distribution of marine distillate fuels and residual fuel oils between domestic and international navigation data corresponds to the definition of international and domestic marine transport as set out in the IPCC good practice guidance. The ERT recommends that Sweden investigate this issue and include a discussion in the NIR in its next annual submission.

39. The consumption of fuels in international aviation and international marine bunkers, as reported in CRF table 1.C is not always comparable to the data reported to the IEA. For example, the figures for

jet kerosene and residual fuel oil consumption reported to the UNFCCC are higher than those reported to the IEA. During the review, Sweden informed the ERT that data in the CRF tables are of better quality than the IEA data for these categories and that differences with IEA data have not yet been analysed in the Swedish inventory because of other priorities. The ERT reiterates the recommendation made by the previous review that Sweden investigate the reasons for the discrepancies and reconcile the data in the next annual submission.

C. Key categories

1. Stationary combustion: solid fuels – CO_2

40. During the review, Sweden informed the ERT that a study was performed during 2008 comparing reported GHG emission data for several industry plants with data from environmental reports. The results showed that the reporting of GHG data could be further improved and brought more into line with the data reported in the facilities legal environmental report which is submitted to the government. During 2009 it was decided by the Swedish EPA that data from environmental reports for the two major primary iron and steel plants in Sweden will be used in the 2010 submission instead of a combination of data from energy statistics and data from environmental reports. Both facilities use a carbon balance when calculating the CO_2 emissions. The ERT recommends that Sweden include in the NIR in its next annual submission a brief discussion on the results of the carbon balance checks for the entire time series and an explanation of how Sweden ensures time-series consistency.

41. The NIR shows that emissions from iron and steel are allocated to six subcategories: public electricity and heat production, manufacture of solid fuels and other energy industries, iron and steel, other stationary, other fugitive emissions from solid fuels in the energy sector, and iron and steel production in the industrial processes sector. Emissions from autoproduction of electricity by iron and steel plants have been included in the public electricity and heat production category. However, the Revised 1996 IPCC Guidelines state that emissions from autoproduction are to be attributed to the industrial or commercial branches in which the generation activity occurs. The ERT recommends that Sweden allocate emissions from autoproduction to the industries where the fuel is being combusted, in accordance with the Revised 1996 IPCC Guidelines.

2. Stationary combustion: other fuels – all gases[6]

42. The IEFs in the public electricity and heat production and chemicals categories for all gases have fluctuating trends throughout the time series. During the review, Sweden informed the ERT that this is a result of the changing distribution of the different types of fuel. The ERT recommends that Sweden provide a brief explanation of the other types of fuel and the fluctuating IEFs in the NIR in its next annual submission.

3. Road transportation: liquid fuels – CO_2

43. The CO_2 implied emission factor (IEF) for diesel oil for the period 1997–2005 (ranging from 72.02 t/TJ to 72.24 t/TJ) is among the lowest of reporting Parties (ranging from 72.02 t/TJ to 76.14 t/TJ). The IEF has a decreasing trend from 1990 (74.26 t/TJ) to 2007 (72.01 t/TJ). During the review, Sweden informed the ERT that the diesel oil used in Sweden is of a lower carbon content than that used in other countries. The ERT reiterates the recommendation made by the previous review that Sweden include information on specific carbon content values of Swedish diesel oil and provide a brief discussion on the trend of the decreasing carbon content.

[6] CO_2 is identified as a key category, while CH_4 and N_2O are not identified as key categories.

44. Emissions from road transportation were recalculated for the entire time series as a result of the use of a new model for estimating emissions from off-road vehicles and machinery, which reallocated emissions among road transportation, domestic navigation and fisheries, in addition to minor revisions made to the ARTEMIS (Assessment and Reliability of Transport Emission Models and Inventory Systems) road model[7] regarding fuel consumption for new passenger cars, vehicle fleet and traffic load. The ERT recommends that Sweden clearly describe recalculations made with the logic for making the revisions in the NIR in its next annual submission.

D. Non-key categories

Stationary combustion: biomass – CH_4

45. As identified by the previous review, CH_4 IEFs for the years 2000 and 2002 to 2007 (ranging from 242.07 kg/TJ to 274.89 kg/TJ) in the residential subcategory have been recognized as being among the lowest of the reporting Parties (ranging from 30.00 kg/TJ to 1,158.00 kg/TJ). The ERT reiterates the recommendation made by the previous review that Sweden provide some information in the NIR on how technology improvements influence the CH_4 IEFs from biomass burning in its next annual submission.

III. Industrial processes and solvent and other product use

A. Sector overview

46. In 2007, emissions from the industrial processes sector amounted to 6,532.61 Gg CO_2 eq, or 10.0 per cent of total GHG emissions and emissions from the solvent and other product use sector amounted to 294.18 Gg CO_2 eq, or 0.4 per cent of total GHG emissions. Since the base year, emissions have increased by 10.7 per cent in the industrial processes sector. Since 1990, emissions have decreased by 11.5 per cent in the solvent and other product use sector. The ERT noted that the emissions from the industrial processes sector in 2007 are reported to be 5,753 Gg CO_2 eq in chapter 2 of the NIR, although these are reported to be 6.5 million tonnes of CO_2 eq in the Executive Summary and chapter 2 of the NIR, and 6,532.61 Gg CO_2 eq in the CRF tables. The ERT recommends that Sweden correct this discrepancy in its next annual submission. The key driver for the increase in emissions in the industrial processes sector is HFC emissions from consumption of halocarbons and SF_6, CO_2 emissions from iron and steel production and CO_2 emissions from lime production. Within the industrial processes sector, 33.4 per cent of the emissions were from iron and steel production, followed by 20.9 per cent from cement production, 13.7 per cent from consumption of halocarbons and SF_6 and 9.6 per cent from lime production. Aluminium production accounted for 5.9 per cent and nitric acid production accounted for 3.7 per cent. The remaining 12.8 per cent were from the other categories. The key driver for the decrease in emissions in the solvent and other product use sector is CO_2 from paint application, which decreased by 54.5 per cent from 1990 to 2007 because of a reduction in paint sales. In 2007, within the solvent and other product use sector, 44.6 per cent of the emissions were from the subcategory other use of N_2O, followed by 40.2 per cent from the subcategory other (e.g. solvents used in the printing industry), 14.5 per cent from paint application, 0.6 per cent from chemical products, manufacture and processing, and 0.1 per cent from degreasing and dry cleaning.

47. Sweden's inventory of emissions from these sectors is almost complete, although "NE" is reported for CH_4 emissions from carbon black production. During the review, the Party stated that CH_4 emissions from carbon black production will be included in the 2010 submission. The ERT welcomes this plan, and recommends that Sweden implement it. According to the NIR, QA/QC was implemented in line with the Swedish QA/QC plan (Manual for SMED Quality System in the Air Emission

[7] Keller M, Kljun N and Zbinden I. 2005. ARTEMIS Road Emission Model 0.2R Model description (draft). INFRAS, Berne, Switzerland.

Inventories) during the work on this inventory submission. Despite a recommendation from the previous ERT and efforts made by Sweden, the current ERT found that the NIR does not yet provide a transparent explanation of the methodology used for some categories, including some key categories such as CO_2 from iron and steel production. However, the ERT noted that Sweden is making further efforts to improve its methods and the explanation of these for some key categories in the inventory submission in 2010. Details of these plans for improvement are explained below in the appropriate paragraphs on key categories.

B. Key categories

1. Cement production – CO_2

48. The tier 2 method in line with IPCC good practice guidance was applied for this category throughout the entire time series (1990–2007). In Sweden, there are three cement producing facilities and all of them are owned by a single company. The data on clinker production were obtained from the cement producing company for 1990–2004 and from EU ETS for 2005–2007. The data obtained from the cement producing company until 2004 included information on emissions from cement kiln dust (CKD), but the EU ETS data since 2005 lack that information. Sweden therefore assumed that CO_2 emissions from CKD for 2005–2007 are the same as for 2004. However, according to the NIR, discussions with the cement producing company indicate that CO_2 emissions from CKD are no longer existent at Swedish cement production sites, although detailed explanation of why this came about is not provided. This implies that CO_2 emissions for 2005–2007 may be overestimated, which is also supported by the fact that higher IEFs are observed for 2005–2007 (0.546–0.552 t-CO_2/t-clinker) than for 1990–2004 (0.538–0.543 t-CO_2/t-clinker). The ERT recommends that Sweden continue its discussion with the cement producing company and improve the estimates as appropriate in the next inventory submission.

2. Lime production – CO_2

49. Sweden reported CO_2 emissions from lime production by lime producers, a sugar producing company and the pulp and paper industry. However, the method applied for the pulp and paper industry is not transparently explained in the NIR. In response to questions from the ERT, Sweden indicated that it was planning to improve its estimates in the 2010 annual submission, for example by revising the method for the pulp and paper industry and by removing the double counting identified between conventional producers and the pulp and paper industry. The ERT recommends that Sweden complete the planned revision of methods and explain the new methods in a transparent manner in the next annual submission.

3. Limestone and dolomite use – CO_2

50. Despite recommendations from the previous reviews, the explanation provided in the NIR of the methods used for this category, particularly with regard to glass production, is not transparent enough. In response to questions from the current ERT, Sweden replied that it was planning to improve its reporting in such a way as to enhance the transparency. Sweden also expressed its intention to update the data on limestone and dolomite use in scrubbers within energy producing facilities and to include data on limestone and dolomite use in another three facilities that are not yet included in the calculation of emissions. Furthermore, Sweden stated that it would include in the next NIR a table with information concerning the allocation of emissions from the use of limestone and dolomite as well as the amount of emissions from limestone and dolomite use allocated to other categories. The ERT welcomes this plan, and recommends that Sweden implement it in the next annual submission.

4. Iron and steel production – CO_2

51. Sweden carried out a recalculation of this category in the 2009 inventory submission, which resulted in an increase of estimated CO_2 emissions for 2006 of 517.7 Gg, while there was no change in CO_2 emissions for 1990. This recalculation was applied mainly for the period 2005–2007 in order to include CO_2 emissions from coke oven gas, which were not included either in the energy sector or in the industrial processes sector in the previous estimates. The ERT noted with appreciation the efforts made by Sweden to improve the accuracy and completeness of its reporting.

52. Sweden performed a study during 2008 aiming at comparing emission data for several plants according to the GHG inventory with data according to the environmental reports. The ERT noted that the Party is planning to revise the estimation methods based on this study, if approved by the Swedish EPA, in order to improve emission estimates in the next inventory submission. In response to a question from the ERT, Sweden explained that this revision would include the reallocation of emissions from the energy sector to this category in order to be in line with the Revised 1996 IPCC Guidelines and the IPCC good practice guidance. The ERT welcomes this plan, and recommends that Sweden implement it and provide a transparent explanation of the revised estimation methods as well as the reallocation of emissions from the energy sector to this category in the next inventory submission. The ERT also recommends that Sweden include in the NIR in its next annual submission a brief discussion on the results of the carbon balance checks as mentioned in paragraph 40 in the energy sector chapter of this report.

53. Despite recommendations from previous reviews, Sweden still includes CO_2 emissions from limestone and dolomite use in iron and steel production in this category, which is not in line with the Revised 1996 IPCC Guidelines. The ERT reiterates the previous recommendation to the effect that Sweden should include these emissions in the category limestone and dolomite use. During the review, Sweden explained that it strongly believes that reporting of emissions from limestone use in blast furnaces separately from the other emissions from this category would result in greater uncertainty compared with the current way of reporting. The ERT recommends that Sweden clearly explain this in more detail in the NIR if it continues reporting CO_2 from limestone use in this category in its next annual submission.

5. Consumption of halocarbons and SF_6 – HFCs

54. This category was identified as a key category according to both level and trend assessment. Emissions increased considerably from the base year (127.13 Gg CO_2 eq) to 2007 (855.34 Gg CO_2 eq). In 2007, within this category, 90.0 per cent of the emissions of HFCs were from refrigeration and air conditioning equipment, followed by 6.4 per cent from foam blowing. Sweden stated in the NIR that the emission estimates for the most significant sources within the subcategory refrigeration and air conditioning equipment are considered, by expert judgment, to be of medium quality. The ERT encourages Sweden to make efforts to improve the quality of estimates for this subcategory. The Party also stated in the NIR that some emissions from foam blowing or products in use in Sweden were not estimated owing to difficulties in obtaining relevant and reliable background information. The ERT recommends that Sweden make efforts to estimate the emissions from foam blowing that are not estimated currently, and include them in the next annual submission.

C. Non-key categories

1. Carbide production – CO_2

55. CO_2 emissions from calcium carbide were calculated using an EF of 1.25 kt CO_2/kt carbide produced, which is based on the data presented in the carbide producing company's environmental report in 2002. Sweden stated in the NIR that the calculation includes emissions from the use of limestone, gas

and coke. In response to a question from the ERT, Sweden explained that emissions from the use of calcium carbide are not included in the reported estimates. Sweden stated to the ERT that CO_2 emissions from the use of calcium carbide will not be taken into consideration in the 2010 submission because this category is not a key category and cannot be prioritized for detailed studies. Nevertheless, the ERT recommends that Sweden calculate and include CO_2 emissions from the use of calcium carbide using the default EF presented in the Revised 1996 IPCC Guidelines unless there is evidence showing that the calcium carbide produced is not used in the country.

2. Other production – CH_4 and N_2O

56. Sweden reported emissions of CH_4 and N_2O from combustion of cooking liquor in this category. The cooking liquor is combusted in the pulp and paper industry to recover sodium and sulphur, but also to utilize its energy. The ERT recommends that Sweden report these emissions in the pulp, paper and print category under the energy sector, in accordance with the Revised 1996 IPCC Guidelines. Sweden stated that the reallocation of CH_4 and N_2O from pulp and paper under the industrial processes sector to pulp, paper and print under the energy sector cannot be considered in the 2010 submission but can be examined for the 2011 submission.

IV. Agriculture

A. Sector overview

57. In 2007, emissions from the agriculture sector amounted to 8,430.70 Gg CO_2 eq, or 12.9 per cent of total GHG emissions. Since 1990, emissions have decreased by 10.1 per cent. The key driver for the fall in emissions is the structural changes over the last 50 years in the agricultural sector. Since the 1950s over one fifth of the arable land has been taken out of cultivation and many small farms have closed with the remaining operations growing larger. Within the sector, 56.3 per cent of the emissions were N_2O from agricultural soils, 32.5 per cent were CH_4 from enteric fermentation, and 11.3 per cent were CH_4 and N_2O from manure management. All three categories of agricultural emissions have been identified as key categories for the Party. Recalculations of the figures in the 2008 submission were performed for the manure management and agricultural soils categories due to revised AD. For the agriculture sector this resulted in a decrease in estimated emissions of 0.1 per cent for 1990 and an increase of 0.1 per cent for 2006.

58. Reporting for the agriculture sector is complete in terms of the gases, categories and years covered. Field burning of agricultural residues, prescribed burning of savannah and rice cultivation do not occur in Sweden. All relevant tables in the CRF were completed, although minimal information was provided in the tier 2 additional information table for enteric fermentation. Some problems were identified during the previous review in the preparation of the CRF such as failure to correctly fill in CRF table 4.B(b), and previous ERTs have recommended that additional QA/QC measures be put into effect to minimize this problem. The ERT was unable to find documentation describing any additional QA/QC measures that may have been taken and some problems remain with the compilation of the CRF as described below (see para. 61). As mentioned by previous ERTs, sufficient explanation is not given about country-specific EFs for tier 2 methods such as those used for enteric fermentation, agricultural soils and manure management. Following the recommendations from previous reviews, the ERT recommends that Sweden improve transparency by providing additional information on how the EFs are calculated for tier 2 methods.

B. Key categories

1. Enteric fermentation – CH_4

59. Enteric fermentation accounts for 51.0 per cent of total national CH_4 emissions and 85.3 per cent of agricultural CH_4 emissions. The CH_4 IEF values for dairy cattle, ranging from 120 to 132 kg/CH_4/head are consistently higher across the time series than those of most reporting Parties, which range from 56 to 132 kg/CH_4/head. Previous ERTs have asked for additional information on how this is calculated. While recognizing that the relationship between milk production per head and increasing emissions as described in the NIR is reasonable, the ERT recommends that further details be provided in its next annual submission on how the EF for dairy cattle is developed.

2. Manure management – CH_4 and N_2O

60. There is an increasing trend in the use of liquid manure management systems. This has increased CH_4 emissions from this category over the period 1990–2007 by 33.1 per cent. Recalculations of the figures in the 2008 submission have been made because the AD were updated. The recalculations resulted in a decrease in estimated base year emissions of 1.5 per cent and an increase in 2006 emissions of 0.75 per cent. However, sufficient explanation is not provided in the NIR about the trend in emissions for this category. The ERT recommends that the Party provide further documentation to explain the trend in emissions for manure management and the changing IEF in the next annual submission.

61. Recalculations of the figures in the 2008 submission for N_2O emissions from manure management have been made because the AD were updated. The recalculations resulted in a decrease in estimated emissions for 1990 of 2.1 per cent and a decrease of 4.6 per cent for 2006. Over the period 1990–2007 the emissions from this category decreased by 34.3 per cent. This trend was largely driven by an increasing use of liquid manure management systems, which tend to have lower N_2O emissions than the dry systems they replaced. As previously noted by the ERT from 2008, CRF table 4.B(b) is not filled in correctly for all years because there was an error in calculating the amount of nitrogen excretion proportional to each animal waste management system (AWMS) for dairy cattle, beef cattle, swine and poultry. The values are off by a factor of 1,000. This has also resulted in incorrect IEFs for all AWMS types. The nitrogen excretion values for sheep and horses are correct. This error has affected only the reporting of nitrogen excretion to the AWMS, and not the emissions estimate. Sweden has indicated that it is aware of the problem and will correct it in the next submission. In addition, an error identified by the previous ERT regarding the reporting of nitrogen excretion rates for non-dairy cattle and swine (and poultry) has been corrected by the Party in the 2009 submission. This error did not affect the emission calculations.

62. Based on table 6.6 in the NIR it appears that the Party has not applied the average annual population to the nitrogen excretion rate for piglets to account for the number of production cycles. The ERT recommends that the Party account for the annual average populations for all growing animals in the next annual submission.

3. Agricultural soils – N_2O

63. Emissions from agricultural soils account for 65.0 per cent of total national N_2O emissions and 90.8 per cent of agricultural N_2O emissions. Recalculations of the figures in the 2008 submission for agricultural soils have been made because the AD were updated. The recalculations resulted in a decrease in estimated emissions for 1990 of less than 0.1 per cent and an increase of 0.3 per cent for 2006. Sweden uses country-specific EFs of 0.8 and 2.5 per cent kg N_2O-N/kgN for nitrogen from synthetic fertilizer and nitrogen from manure applied to soils, respectively. The country-specific EF for nitrogen from synthetic fertilizer additions is lower than the IPCC default of 1.25 per cent kg N_2O-N/kg N, while the country-specific EF for manure additions is higher than that. The Party has justified the use

of these factors based on research carried out by the Swedish EPA. The $Frac_{GASM}$ values for the whole time series (ranging from 0.32 to 0.37) have also been identified as unusual – some of the highest values of any reporting Party (0.17 – 0.37). The NIR provides minimal documentation for the use of these factors, which includes reference papers. The ERT recommends that Sweden provide further information in the NIR in its next annual submission on the appropriateness of these factors for Swedish conditions.

64. The EF used for emissions from pasture, range and paddock manure is 0.016 kg N_2O-N/kg N, which is 20 per cent lower than the IPCC default of 0.02 kg N_2O–N/kg N. The EF is based on a value of 0.01 kg N_2O–N/kg N for permanent pastures and another value for unfertilized pastures/grasslands which is not provided in the NIR. The value for unfertilized pastures/grasslands is based on a value in the range of 0.002–0.01 kg N_2O–N/kg N that is referred to as estimates for unfertilized grasslands in New Zealand in the Revised 1996 IPCC Guidelines; however, no justification has been provided regarding why this value would be more appropriate for the grasslands in Sweden than the IPCC default. The IPCC good practice guidance makes no distinction between fertilized and unfertilized pastures/grasslands in recommending the default EF. The ERT recommends that further explanation be provided in the NIR in the next annual submission of the appropriateness of the use of this country-specific EF for this source category.

V. Land use, land-use change and forestry

A. Sector overview

65. In 2007, net removals from the LULUCF sector amounted to 20,459.70 Gg CO_2 eq. Since 1990, net removals have decreased by 36.2 per cent. The key driver for the fall in net removals is an increase in felling and, in the last few years, a severe storm at the beginning of 2005 that brought down a large quantity of forest. Within the sector, forest land is the dominant category, accounting for a sink of 22,799.14 Gg CO_2 eq, whereas cropland offsets part of these removals with net emissions amounting to 2,802.16 Gg CO_2 eq; grassland and settlements are reported as small sinks of 524.51 Gg CO_2 eq altogether and a source of 61.78 Gg CO_2 eq for the wetlands category. Most of the emissions/removals in the sector were CO_2 (–20,577.65 Gg CO_2 eq); the rest were CH_4 (2.39 Gg CO_2 eq) and N_2O (115.56 Gg CO_2 eq).

66. The following categories were reported as "NE": carbon stock changes in dead organic matter and in mineral and organic soils in land converted to forest land and forest land converted to other land-use categories; carbon stock changes in all carbon pools in forest land converted to wetlands; and CO_2, CH_4 and N_2O emissions due to controlled burning in forest land converted to wetlands. In response to questions raised by the ERT during the review, Sweden explained that dead organic matter and mineral soil and organic soil pools in land converted to forest land and in forest land converted to cropland, grassland and settlements will be included in the next submission; that the categories wetlands and other lands are considered unmanaged and not reported, and that therefore the notation key will be changed to "NO"; and that controlled burning in forest land converted to wetlands does not occur in Sweden and will also be reported as "NO".

67. In response to recommendations from previous reviews, Sweden explained in the 2009 NIR that carbon stock changes for some categories, especially those reported currently as "NE", are being revised. The ERT welcomes these initiatives and encourages the Party to continue making efforts to improve the completeness of its reporting by providing in its next annual submission estimates and relevant information for the categories that are currently reported as "NE".

68. In response to recommendations from and issues raised during previous reviews and in preparation for the reporting of activities under Article 3, paragraph 3, and its elected forest management

activity under Article 3, paragraph 4, of the Kyoto Protocol, Sweden mentions in the revised NIR of 2008 and in the NIR of 2009 plans to make improvements in plot sampling for the reporting of living biomass and dead organic matter pools, and also for the reporting of information on land use and land-use change areas, in order to improve the accuracy of the estimated emissions/removals. The ERT welcomes these plans and encourages Sweden to continue making efforts to improve the accuracy of the determination of land use and land-use changes and in the estimates to be used in its GHG reporting under the Convention and under the Kyoto Protocol.

69. The ERT found some inconsistencies in the CRF tables for this sector. For example, for 2007, CO_2 emissions or removals from forest land converted to other land-use categories are reported as "NA" in table 5, while net CO_2 emissions or removals from forest land converted to cropland are reported as –18.15 Gg CO_2 in table 5.B. A similar inconsistency was observed with regard to grassland converted to other land-use categories. In response to a question raised by the ERT, Sweden expressed its intention to correct the errors in CRF table 5 for its next annual submission. The ERT recommends that Sweden improve consistency in the CRF tables by correcting the errors in its next annual submission.

70. Table 7.1 in Sweden's NIR shows the land-use change matrix between 1990 and 2003, not in an annual basis as was recommended in previous review. In response to a question from the ERT, the Party indicated that land-use changes in Sweden are rare and that this is not expected to change drastically; extrapolation of land-use changes are, from its point of view, speculative and very difficult to implement in a sample-based system. The ERT would like to remind Sweden that chapter 2 of the IPCC good practice guidance for LULUCF recommends the use of the techniques outlined in chapter 5 for interpolation and extrapolation of sampled areas to estimate fluxes for missing years. The ERT recommends that Sweden clarify in the NIR in its next annual submission whether annual land-use change data are used to produce the estimates and report a consistent time series of these annual land-use change data in accordance with the IPCC good practice guidance for LULUCF.

71. Owing to an error influencing the estimates of living biomass pool, which was identified and corrected in the revised inventory submission of 2008, the recalculations for the LULUCF sector in the 2009 submission resulted in large changes of estimates: –45.5 per cent for 1990 and –32.6 per cent for 2006. This is explained by the Party in the NIR and in the CRF tables of its current inventory submission.

B. Key categories

1. Forest land remaining forest land – CO_2, CH_4, N_2O

72. In response to the ERT's request for clarification of the contribution of different drivers to carbon stock changes in managed forests, Sweden stated that according to the IPCC good practice guidance for LULUCF it is not required to report separately the effects of management practices for different land-use categories. The ERT is concerned about the fact that management practices and possible changes between those practices can significantly affect all carbon pools. The ERT encourages Sweden to consider providing more information on these drivers in future submissions, in order to improve transparency and facilitate the review of the inventory.

2. Cropland remaining cropland – CO_2

73. There is a small discrepancy in the area of organic soils reported for cropland remaining cropland in the LULUCF sector and the area of cultivated organic soils reported in the agriculture sector (CRF table 4.Ds1). The area reported for 2007 in CRF table 5.B is 249.80 kha, whereas the area reported in the agriculture sector is 252.57 kha. In response to a question raised by the ERT, Sweden explained that this inconsistency is due to the use of different sources for the area estimates and indicated its plan to make the reporting consistent by recalculating the emissions in the agriculture sector using the area

estimates provided in the LULUCF sector. The ERT welcomes this plan and encourages Sweden to continue making efforts to improve consistency across all sectors.

3. Land converted to cropland – CO_2

74. Sweden is the only Party reporting overall net removals in 2007 for the category forest land converted to cropland. Sweden has explained that the carbon stock changes in this category depend largely on the history of land-use conversions and that there may be trees left on the deforested area that continue to grow and to some extent will compensate for the emissions with a small removal every year after the conversion. The ERT is concerned about the fact that the estimates may be biased since carbon stock changes in the dead organic matter and the soils are currently not estimated in this category. The ERT encourages Sweden to improve completeness and transparency in its reporting of land conversions by providing further documentation regarding land-use change areas, relevant factors and associated emissions or removals in both the NIR and the CRF tables. This should include information on the criteria applied to report a land-use change and whether Sweden uses the same definitions as those used for reporting under the Kyoto Protocol.

C. Non-key categories

1. N_2O emissions from disturbance associated with land-use conversion to cropland – N_2O

75. Sweden was unable to separate emissions from organic and mineral soils (CRF table 5 (III)), and, accordingly, all emissions have been reported as those from organic soils. The ERT reiterates the recommendation from the previous review that Sweden improve its methodology in order to be able to report the two soil categories separately in future submissions.

2. Land converted to settlements – CO_2

76. Sweden is the only Party reporting overall net removals for the category forest land converted to settlements in 2007. Sweden has explained that the carbon stock changes in this category depend largely on the history of land use conversions and that there may be trees left on the deforested area that continue to grow and to some extent will compensate for the emissions with a small removal every year after the conversion. The ERT is concerned about the fact that the estimates may be biased since carbon stock changes in the dead organic matter and soils are currently not estimated in this category. The ERT encourages Sweden to improve completeness and transparency in its reporting of land conversions by providing further documentation regarding land-use change areas, relevant factors and associated emissions or removals in both the NIR and the CRF tables. This should include information on the criteria applied to report a land-use change and whether Sweden uses the same definitions as those used for reporting under the Kyoto Protocol.

VI. Waste

A. Sector overview

77. In 2007, emissions from the waste sector amounted to 1,917.5 Gg CO_2 eq, or 2.9 per cent of total GHG emissions. Since 1990, GHG emissions in this category have decreased by 38.4 per cent. The key driver for the fall in emissions is the collection of landfill gas, implementation of waste treatment policies and the introduction of a landfill tax. Within the sector, 87.4 per cent of the emissions were from solid waste disposal on land, followed by 7.2 per cent from wastewater handling, and 5.4 per cent from waste incineration.

78. In general, the Swedish inventory is transparent with regard to this sector. However, there are some inconsistencies between the NIR and the CRF tables. The sectoral QA/QC plan was implemented

when the inventory was being prepared. Solid waste landfills are the second largest source of CH_4 emissions in Sweden. CH_4 emissions from solid waste disposal on land was identified as a key category both by level assessment and by trend assessment. The tier 1 methodology described in the IPCC good practice guidance was used for the uncertainty analysis, and CH_4 emissions from solid waste disposal on land was identified as one of the largest uncertainty contributions in the Swedish inventory for the base year and the latest year.

79. Recalculations were carried out for N_2O emissions from industrial wastewater and domestic and commercial wastewater. They are well documented in the NIR and the CRF tables. According to the NIR, no improvements are planned for the waste sector for the 2010 submission.

80. CH_4 emissions from solid waste disposal on land and N_2O emissions from wastewater handling are decreasing over the period 1990-2007 while CO_2 emissions from waste incineration are on an increasing trend.

B. Key categories

Solid waste disposal on land – CH_4

81. It was reported in the NIR that there is no unmanaged landfill site for municipal solid waste (MSW) in Sweden today. However, it is not clear to the ERT whether this explanation applies only to recent years or to whole the time series from 1990 to 2007. In fact, since 1990 the annual MSW at solid waste disposal sites for unmanaged solid waste disposal on land have been reported as "NO", but sufficiently transparent explanation is not provided either in the NIR or in the CRF tables about unmanaged landfill sites throughout the time series from 1990 to 2007. The ERT also noted that it was reported in the NIR that "Waste management in Sweden has developed over recent years." The situation in recent years is also unclear. The ERT recommends that Sweden clarify this issue and provide more information on managed and unmanaged landfill sites in Sweden in its next annual submission.

82. It was reported in the NIR that the methodology used for this category was tier 2, the IPCC first order decay (FOD) model. However, in summary 3 of the CRF tables, the method used for calculating CH_4 emissions from solid waste disposal on land was reported as T3 (tier 3), and in the NIR in the inventory submission of the European Community it was reported that the tier 3 method was used in the Swedish inventory. Tier 3 is a method provided only in the *2006 IPCC Guidelines for National Greenhouse Gas Inventories*, which are based on the use of good-quality country-specific AD and the use of either the FOD method with (1) nationally developed key parameters, or (2) measurement-derived country-specific parameters. The ERT recommends that Sweden confirm this point and if necessary correct this information in its next annual submission. During the review week, Sweden indicated that it has noted this and will correct it in its next annual submission.

83. The amount of landfill gas recovered was reported in Sweden from 1982 to 2007. This amount is constantly decreasing because of the dramatic reduction of organic waste disposed of at landfills. The landfill gas is mainly used for heating but also for the production of electricity. The ERT recommends that Sweden give more and updated information in its next annual submission on the amount of landfill gas recovered that was used for energy and was flared.

C. Non-key categories

1. Wastewater handling – CH_4 and N_2O

84. CH_4 emissions from wastewater handling were reported as "NE". CH_4 emissions from sludge treatment were reported as included elsewhere in CRF table 6B; these emissions are included in solid waste disposal on land (in CRF table 6A). N_2O emissions from wastewater handling were reported based

on country-specific AD on nitrogen in discharged wastewater from municipal wastewater treatment plants and industries. The IPCC default EF is used for discharges from wastewater treatment plants, industries and unconnected households. The ERT encourages Sweden to use country-specific EFs for these three sources in its future submissions.

2. Waste incineration – CO_2

85. With regard to the inter-annual changes of CO_2 emissions from waste incineration, the ERT noticed that CO_2 emissions decreased between 2005 and 2006 by 29 per cent and increased between 2006 and 2007 by 47 per cent. Emissions have increased in recent years in comparison with the level of emissions from 1990 to 2002. It was reported in the NIR that this increase of emissions is due to an increased quantity of waste being incinerated since 2003. The ERT recommends that Sweden provide some additional information in its next submission about the lower value in 2006.

VII. Supplementary information required under Article 7, paragraph 1, of the Kyoto Protocol

A. Information on Kyoto Protocol units

1. Standard electronic format and reports from the national registry

86. Sweden has reported information on its accounting of Kyoto Protocol units in the required SEF tables, as required by decisions 15/CMP.1 and 14/CMP.1. The ERT took note of the findings and recommendations included in the SIAR on the SEF and the SEF comparison report.[8] The SIAR was forwarded to the ERT prior to the review, pursuant to decision 16/CP.10. The ERT reiterated the main findings and recommendations contained in the SIAR.

87. Information on the accounting of Kyoto Protocol units has been prepared and reported in accordance with section I.E of the annex to decision 15/CMP.1, and reported in accordance with decision 14/CMP.1 using the SEF tables. This information is consistent with that contained in the national registry and with the records of the international transaction log (ITL) and the CDM registry and meets the requirements set out in paragraphs 88(a) to (j) of the annex to decision 22/CMP.1. The transactions of Kyoto Protocol units initiated by the national registry are in accordance with the requirements of the annex to decision 5/CMP.1 and the annex to decision 13/CMP.1. No non-replacement has occurred. The national registry has adequate procedures in place to minimize discrepancies.

2. National registry

88. The ERT took note of the SIAR and its finding that the reported information on the national registry is complete and has been submitted in accordance with the annex to decision 15/CMP.1. The ERT further noted from the SIAR and its finding that the national registry continues to perform the functions set out in the annex to decision 13/CMP.1 and the annex to decision 5/CMP.1, and is in conformity with practically all the technical standards for data exchange between registry systems in accordance with decisions 16/CP.10 and 12/CMP.1. The national registry also has adequate security, data safeguard and disaster recovery measures in place and its operational performance is adequate. The ERT noted from the SIAR that Sweden has not made the information referred to in paragraphs 45 to 47 of the annex to decision 13/CMP.1 publicly available, and that the Party did not report several transactions that were reported by the ITL because the transactions were recorded in Sweden's database as rejected, whereas they should have been recorded as terminated. The ERT reiterates the recommendation in the SIAR that Sweden enhance the availability of the required public information

[8] The SEF comparison report is prepared by the ITL administrator and provides information on the outcome of the comparison of data contained in the Party's SEF tables with corresponding records contained in the ITL.

mentioned above and ensure that rejected transactions are terminated, and should report, in its next annual submission, on these two identified issues.

3. Calculation of the commitment period reserve

89. Sweden has reported its commitment period reserve in its 2009 annual submission. The Party reported that its commitment period reserve has not changed since the initial report review (337,669,705 t CO_2 eq) as it is based on the assigned amount and not the most recently reviewed inventory. The ERT disagrees with this figure; its calculation of the commitment period reserve is 327,060,563 t CO_2 eq based on the national emissions in Sweden's most recently reviewed inventory (65,412.11 Gg CO_2 eq). During the review, Sweden agreed with the figure presented by the ERT. The ERT recommends that Sweden include correct information on its commitment period reserve in its next annual submission.

B. Changes to the national system

90. Sweden provided information on changes to the national system in annex 6:1 to the NIR. According to this, there have been no significant changes to the national system since the previous annual submission. However, in the same annex, Sweden highlighted TPS, a new system for handling emission data, developed in 2006 and used since the 2007 submission. It was not reported in the previous inventory submissions. Sweden explained that the introduction of TPS had enhanced and improved efficiency regarding QA/QC of inventory emission data. The ERT concluded that, taking into account the confirmed changes in the national system, Sweden's national system continues to be in accordance with the requirements of national systems set out in decision 19/CMP.1. The ERT recommends that the Party, in its next annual submission, report any changes in its national system in accordance with section I.F of the annex to decision 15/CMP.1.

C. Changes to the national registry

91. Sweden reported changes in its national registry compared with the previous annual submission with regard to the implementation of the connection to the ITL, upgrading the registry software and the change of contact person designated by Sweden. The ERT concluded that, taking into account the reported changes in the national registry as well as the conclusion of the SIAR, Sweden's national registry continues to perform the functions set out in the annex to decision 13/CMP.1 and the annex to decision 5/CMP.1. The ERT recommends that the Party report in its next annual submission any changes in its national registry in accordance with section I.G of the annex to decision 15/CMP.1.

VIII. Conclusions and recommendations

92. Sweden made its annual submission on 7 April 2009. The Party indicated that the 2009 annual submission is its voluntary submission under the Kyoto Protocol. The annual submission contains the GHG inventory (comprising CRF tables and an NIR) and supplementary information under Article 7, paragraph 1, of the Kyoto Protocol (information on Kyoto Protocol units, information on changes to the national system and the national registry). The annual submission was submitted in accordance with decision 15/CMP.1.

93. The inventory submission is generally complete and the Party has submitted a complete set of CRF tables for the years 1990–2007 except for tables 7 for all years, and an NIR; these are complete in terms of geographical coverage and years, and generally complete in terms of categories and gases. Some of the categories for which methods exist in the Revised 1996 IPCC Guidelines and/or the IPCC good practice guidance have been reported as "NE", namely the following: CO_2 and CH_4 emissions from oil transport; CO_2 and CH_4 emissions from venting of oil and gas; CO_2 and CH_4 emissions from flaring of gas; CH_4 emissions from carbon black; CO_2 emissions or removals from dead organic matter, mineral

soils and organic soils under land converted to forest land, forest land converted to cropland, forest land converted to grassland and forest land converted to settlements; CO_2 emissions or removals from forest land converted to wetlands and forest land converted to other land; CO_2, CH_4 and N_2O emissions from controlled burning in forest land converted to wetlands under biomass burning; and N_2O emissions from waste incineration.

94. The submission on a voluntary basis of information required under Article 7, paragraph 1, of the Kyoto Protocol has been prepared and reported in accordance with decision 15/CMP.1. The Party did not report on a voluntary basis information on activities under Article 3, paragraphs 3 and 4, and information on the minimization of adverse impacts in accordance with Article 3, paragraph 14, of the Kyoto Protocol.

95. Sweden has reported information on its accounting of Kyoto Protocol units in accordance with section I.E of the annex to decision 15/CMP.1, and used the required reporting format tables as required by decision 14/CMP.1.

96. The national system continues to perform its required functions as set out in the annex to decision 19/CMP.1.

97. The national registry continues to perform the functions set out in the annex to decision 13/CMP.1 and the annex to decision 5/CMP.1, and is in conformity with practically all the technical standards for data exchange between registry systems in accordance with relevant CMP decisions.

98. In the course of the review, the ERT formulated a number of recommendations[9] relating to the completeness of the annual submission, transparency, the reporting of categories as ”NE” in the energy, industrial processes, LULUCF and waste sectors, and other issues relating to QA/QC and recalculations of Sweden’s information presented in its annual submission. The key recommendations are that Sweden:

(a) Ensure, to the extent possible, the inclusion in its next annual submission, emissions for categories currently reported as “NE” and for which methods exist in the Revised 1996 IPCC Guidelines and/or the IPCC good practice guidance, and if emissions for a given category cannot be estimated then the Party is to provide sufficient explanation in the NIR as to why it cannot be estimated;

(b) Improve transparency by providing more precise and detailed explanations of methodologies, AD and EFs as well as relevant category-specific QA/QC activities, in cases where Sweden uses AD from different sources for a single category, country-specific EFs, or methods that are not explicitly explained in the Revised 1996 IPCC Guidelines or the IPCC good practice guidance;

(c) Perform the key category analysis correctly in accordance with the IPCC good practice guidance for LULUCF;

(d) Extend the overall uncertainty analysis to include the LULUCF sector;

(e) Describe clearly any recalculations made and explain the logic for making the revisions in its NIR;

(f) Further improve the QA/QC procedures to avoid calculation errors and inconsistency between the CRF tables and the NIR;

[9] For a complete list of recommendations, the relevant chapters of this report should be consulted.

(g) Improve the explanation of the national system in the NIR by providing more descriptive information on specific responsibilities of organizations participating in the SMED and consultants who assist the Swedish EPA in the inventory preparation;

(h) Report any changes in its national system and national registry;

(i) Include correct information on its commitment period reserve in the NIR;

(j) Enhance the availability of public information referred to in paragraphs 45 to 47 of the annex to decision 13/CMP.1;

(k) Ensure the rejected transactions are recorded as terminated in its national registry;

(l) Implement the recommendations identified during the previous review, in particular those for key categories, and clearly explain the reasons if the Party cannot implement those recommendations.

IX. Questions of implementation

99. No questions of implementation were identified by the ERT during the review.

Annex I

Documents and information used during the review

A. Reference documents

Intergovernmental Panel on Climate Change. *Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories*. Available at <http://www.ipcc-nggip.iges.or.jp/public/gl/invs1.htm>.

Intergovernmental Panel on Climate Change. *Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories*. Available at <http://www.ipcc-nggip.iges.or.jp/public/gp/english/>.

Intergovernmental Panel on Climate Change. *Good Practice Guidance for Land Use, Land-Use Change and Forestry*. Available at <http://www.ipcc-nggip.iges.or.jp/public/gpglulucf/gpglulucf.htm>.

"Guidelines for the preparation of national communications by Parties included in Annex I to the Convention, Part I: UNFCCC reporting guidelines on annual inventories". FCCC/SBSTA/2006/9. Available at <http://unfccc.int/resource/docs/2006/sbsta/eng/09.pdf>.

"Guidelines for the technical review of greenhouse gas inventories from Parties included in Annex I to the Convention". FCCC/CP/2002/8. Available at <http://unfccc.int/resource/docs/cop8/08.pdf>.

"Guidelines for national systems under Article 5, paragraph 1, of the Kyoto Protocol". Decision 19/CMP.1. Available at <http://unfccc.int/resource/docs/2005/cmp1/eng/08a03.pdf#page=14>.

"Guidelines for the preparation of the information required under Article 7 of the Kyoto Protocol". Decision 15/CMP.1. Available at <http://unfccc.int/resource/docs/2005/cmp1/eng/08a02.pdf#page=54>.

"Guidelines for review under Article 8 of the Kyoto Protocol". Decision 22/CMP.1. Available at <http://unfccc.int/resource/docs/2005/cmp1/eng/08a03.pdf#page=51>.

Status report for Sweden 2009. Available at <http://unfccc.int/resource/docs/2009/asr/swe.pdf>.

Synthesis and assessment report on the greenhouse gas inventories submitted in 2009. Available at <http://unfccc.int/resource/webdocs/sai/2009.pdf>.

FCCC/ARR/2008/SWE. Report of the individual review of the greenhouse gas inventories of Sweden submitted in 2007 and 2008. Available at <http://unfccc.int/resource/docs/2009/arr/swe.pdf>.

UNFCCC. Standard independent assessment report, Parts I and II. Unpublished document.

B. Additional information provided by the Party

Responses to questions during the review were received from Mr. Hakam Al-Hanbali (Swedish Environmental Protection Agency), including additional material on the methodology and assumptions used.

Annex II

Acronyms and abbreviations

AD	activity data
AWMS	animal waste management system
CH_4	methane
CMP	Conference of the Parties serving as the meeting of the Parties to the Kyoto Protocol
CO_2	carbon dioxide
CO_2 eq	carbon dioxide equivalent
CRF	common reporting format
EF	emission factor
ERT	expert review team
EU ETS	European Union emissions trading scheme
FOD	first order decay
GHG	greenhouse gas; unless indicated otherwise, GHG emissions are the sum of CO_2, CH_4, N_2O, HFCs, PFCs and SF_6 without GHG emissions and removals from LULUCF
HFCs	hydrofluorocarbons
IEA	International Energy Agency
IEF	implied emissions factor
IPCC	Intergovernmental Panel on Climate Change
kg	kilogram (1 kg = 1 thousand grams)
kt	kilotonne (1 kt = 1 thousand tonnes)
LULUCF	land use, land-use change and forestry
MSW	municipal solid waste
NA	not applicable
NE	not estimated
N_2O	nitrous oxide
NIR	national inventory report
PFCs	perfluorocarbons
QA/QC	quality assurance/quality control
SEF	standard electronic format
SF_6	sulphur hexafluoride
SIAR	standard independent assessment report
TJ	terajoule (1 TJ = 10^{12} joule)
UNFCCC	United Nations Framework Convention on Climate Change

- - - - -