**COMPLIANCE COMMITTEE** **CC/ERT/ARR/2013/34**
**22 August 2013**

# Report of the individual review of the annual submission of Switzerland submitted in 2012

## Note by the secretariat

The report of the individual review of the annual submission of Switzerland submitted in 2012 was published on 31 May 2013. For purposes of rule 10, paragraph 2, of the rules of procedure of the Compliance Committee (annex to decision 4/CMP.2, as amended by decision 4/CMP.4), the report is considered received by the secretariat on the same date. This report, FCCC/ARR/2012/CHE, contained in the annex to this note, is being forwarded to the Compliance Committee in accordance with section VI, paragraph 3, of the annex to decision 27/CMP.1.

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# Report of the individual review of the annual submission of Switzerland submitted in 2012*

* In the symbol for this document, 2012 refers to the year in which the inventory was submitted, and not to the year of publication.

# Contents

# I. Introduction and summary

1. This report covers the centralized review of the 2012 annual submission of Switzerland, coordinated by the UNFCCC secretariat, in accordance with decision 22/CMP.1. The review took place from 17 to 22 September 2012 in Bonn, Germany, and was conducted by the following team of nominated experts from the UNFCCC roster of experts: generalists – Mr. Mikhail Gytarsky (Russian Federation) and Ms. Batimaa Punsalmaa (Mongolia); energy – Ms. Veronika Ginzburg (Russian Federation) and Mr. Glen Whitehead (Australia); industrial processes – Mr. Vladimir Danielik (Slovakia) and Ms. Detelina Petrova (Bulgaria); agriculture – Ms. Yauheniya Bertosh (Belarus) and Ms. Sumaya Zakieldeen (Sudan); land use, land-use change and forestry (LULUCF) – Mr. Vladimir Korotkov (Russian Federation) and Mr. Yusuf Serengil (Turkey); and waste – Mr. Gábor Kis-Kovács (Hungary) and Mr. Davor Vešligaj (Croatia). Mr. Gytarsky and Ms. Batimaa were the lead reviewers. The review was coordinated by Ms. Inkar Kadyrzhanova (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 Switzerland, which provided comments that were considered and incorporated, as appropriate, into this final version of the report.

3. In 2010, the main greenhouse gas (GHG) in Switzerland was carbon dioxide ($CO_2$), accounting for 84.7 per cent of total GHG emissions[1] expressed in carbon dioxide equivalent ($CO_2$ eq), followed by methane ($CH_4$) (7.0 per cent) and nitrous oxide ($N_2O$) (5.9 per cent). Hydrofluorocarbons (HFCs), perfluorocarbons and sulphur hexafluoride ($SF_6$) collectively accounted for 2.3 per cent of the overall GHG emissions in Switzerland. The energy sector accounted for 81.2 per cent of total GHG emissions, followed by the agriculture sector (10.5 per cent), the industrial processes sector (6.8 per cent), the waste sector (1.1 per cent) and the solvent and other product use sector (0.4 per cent). Total GHG emissions amounted to 54,222.72 Gg $CO_2$ eq and increased by 2.3 per cent between the base year[2] and 2010. The annual emission trends are largely driven by emissions from the energy sector, which are influenced by the low winter temperatures. The expert review team (ERT) noted that the emissions from the solvent and other product use, agriculture and waste sectors showed decreasing trends (see paras. 55, 70 and 96 below).

4. Tables 1 and 2 show GHG emissions from Annex A sources, emissions and removals from the LULUCF sector under the Convention and emissions and removals from activities under Article 3, paragraph 3, and, if any, Article 3, paragraph 4, of the Kyoto Protocol (KP-LULUCF), by gas and by sector and activity, respectively. In table 1, $CO_2$, $CH_4$ and $N_2O$ emissions included in the rows under Annex A sources do not include emissions and removals from the LULUCF sector.

5. Tables 3–5 provide information on the most important emissions and removals and accounting parameters that will be included in the compilation and accounting database.

[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 all gases. The base year emissions include emissions from Annex A sources only.

Table 1

**Greenhouse gas emissions from Annex A sources and emissions/removals from activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol, by gas, base year[a] to 2010**

| | | | *Gg $CO_2$ eq* | | | | | | | | *Change (%)* |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | *Greenhouse gas* | *Base year[a]* | *1990* | *1995* | *2000* | *2005* | *2008* | *2009* | *2010* | *Base year–2010* |
| Annex A sources | | $CO_2$ | 44 619.83 | 44 619.83 | 43 345.49 | 44 018.95 | 46 340.68 | 45 446.82 | 44 243.69 | 45 949.72 | 3.0 |
| | | $CH_4$ | 4 697.95 | 4 697.95 | 4 297.22 | 3 933.67 | 3 789.25 | 3 875.45 | 3 815.57 | 3 815.01 | –18.8 |
| | | $N_2O$ | 3 467.91 | 3 467.91 | 3 308.25 | 3 181.99 | 3 123.76 | 3 178.78 | 3 133.67 | 3 193.39 | –7.9 |
| | | HFCs | 0.02 | 0.02 | 179.71 | 496.67 | 873.86 | 990.15 | 1 022.68 | 1 072.97 | 4 762 636.5 |
| | | PFCs | 100.21 | 100.21 | 14.69 | 69.09 | 32.88 | 39.01 | 35.04 | 36.51 | –63.6 |
| | | $SF_6$ | 143.62 | 143.62 | 97.73 | 157.79 | 212.56 | 243.98 | 187.10 | 155.12 | 8.0 |
| KP-LULUCF | Article 3.3[b] | $CO_2$ | | | | | | 166.32 | 220.60 | 215.41 | |
| | | $CH_4$ | | | | | | NO | NO | NO | |
| | | $N_2O$ | | | | | | 0.01 | 0.01 | 0.01 | |
| | Article 3.4[c] | $CO_2$ | NA | | | | | –671.77 | –1 123.17 | –850.69 | NA |
| | | $CH_4$ | NA | | | | | 0.27 | 0.31 | 0.19 | NA |
| | | $N_2O$ | NA | | | | | 0.17 | 0.20 | 0.12 | NA |

*Abbreviations*: KP-LULUCF = land use, land-use change and forestry emissions and removals from activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol, NA = not applicable, NO = not occurring.

[a] "Base year" for Annex A sources refers to the base year under the Kyoto Protocol, which is 1990 for all gases. The "base year" for activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol is 1990.

[b] Activities under Article 3, paragraph 3, of the Kyoto Protocol, namely afforestation and reforestation, and deforestation. Only the inventory years of the commitment period must be reported.

[c] Elected activities under Article 3, paragraph 4, of the Kyoto Protocol, including forest management, cropland management, grazing land management and revegetation. For cropland management, grazing land management and revegetation, the base year and the inventory years of the commitment period must be reported.

Table 2
**Greenhouse gas emissions by sector and activity, base year[a] to 2010**

| | | | *Gg $CO_2$ eq* | | | | | | | *Change (%)* |
|---|---|---|---|---|---|---|---|---|---|---|
| | | *Sector* | *Base year[a]* | *1990* | *1995* | *2000* | *2005* | *2008* | *2009* | *2010* | *Base year–2010* |
| Annex A | | Energy | 42 043.95 | 42 043.95 | 41 486.62 | 42 348.14 | 44 477.58 | 43 602.91 | 42 492.91 | 44 019.59 | 4.7 |
| | | Industrial processes | 3 380.66 | 3 380.66 | 2 653.33 | 2 935.14 | 3 509.27 | 3 629.59 | 3 481.86 | 3 688.70 | 9.1 |
| | | Solvent and other product use | 472.05 | 472.05 | 368.41 | 272.92 | 219.31 | 217.55 | 218.09 | 214.56 | –54.5 |
| | | Agriculture | 6 138.30 | 6 138.30 | 5 899.87 | 5 571.12 | 5 521.20 | 5 699.69 | 5 637.21 | 5 688.32 | –7.3 |
| | | Waste | 994.58 | 994.58 | 834.85 | 730.83 | 645.63 | 624.45 | 607.67 | 611.55 | –38.5 |
| | | LULUCF | NA | –3 847.37 | –4 632.17 | 253.42 | –1 859.62 | –767.05 | –1 098.81 | –880.40 | NA |
| | | **Total (with LULUCF)** | **NA** | **49 182.16** | **46 610.91** | **52 111.59** | **52 513.36** | **53 007.15** | **51 338.94** | **53 342.32** | **NA** |
| | | **Total (without LULUCF)** | **53 029.53** | **53 029.53** | **51 243.08** | **51 858.16** | **54 372.98** | **53 774.19** | **52 437.75** | **54 222.72** | **2.3** |
| | | Other[b] | NA | 28.23 | 27.28 | 26.45 | 26.43 | 26.09 | 25.45 | 27.22 | NA |
| KP-LULUCF | Article 3.3[c] | Afforestation and reforestation | | | | | | –15.88 | –17.74 | –23.08 | |
| | | Deforestation | | | | | | 182.20 | 238.35 | 238.50 | |
| | | **Total (3.3)** | | | | | | **166.33** | **220.61** | **215.41** | |
| | Article 3.4[d] | Forest management | | | | | | –671.33 | –1 122.66 | –850.38 | |
| | | Cropland management | NA | | | | | NA | NA | NA | NA |
| | | Grazing land management | NA | | | | | NA | NA | NA | NA |
| | | Revegetation | NA | | | | | NA | NA | NA | NA |
| | | **Total (3.4)** | **NA** | | | | | **–671.33** | **–1 122.66** | **–850.38** | **NA** |

*Abbreviations*: KP-LULUCF = land use, land-use change and forestry emissions and removals from activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol, LULUCF = land use, land-use change and forestry, NA = not applicable.

[a] "Base year" for Annex A sources refers to the base year under the Kyoto Protocol, which is 1990 for all gases. The "base year" for activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol is 1990.

[b] Emissions/removals reported in the sector other (sector 7) are not included in Annex A to the Kyoto Protocol and are therefore not included in the national totals.

[c] Activities under Article 3, paragraph 3, of the Kyoto Protocol, namely afforestation and reforestation, and deforestation. Only the inventory years of the commitment period must be reported.

[d] Elected activities under Article 3, paragraph 4, of the Kyoto Protocol, including forest management, cropland management, grazing land management and revegetation. For cropland management, grazing land management and revegetation, the base year and the inventory years of the commitment period must be reported.

Table 3
**Information to be included in the compilation and accounting database in t $CO_2$ eq for the year 2010, including the commitment period reserve**

| | *As reported* | *Revised estimates* | *Adjustment*[a] | *Final*[b] |
|---|---|---|---|---|
| **Commitment period reserve** | **218 554 562** | | | **218 554 562** |
| **Annex A emissions for current inventory year** | | | | |
| $CO_2$ | 45 949 724 | | | 45 949 724 |
| $CH_4$ | 3 815 012 | | | 3 815 012 |
| $N_2O$ | 3 190 750 | 3 193 391 | | 3 193 391 |
| HFCs | 1 072 966 | | | 1 072 966 |
| PFCs | 36 505 | | | 36 505 |
| $SF_6$ | 155 123 | | | 155 123 |
| **Total Annex A sources** | **54 220 081** | **54 222 722** | | **54 222 722** |
| **Activities under Article 3, paragraph 3, for current inventory year** | | | | |
| 3.3 Afforestation and reforestation on non-harvested land for current year of commitment period as reported | –16 353 | | | –16 353 |
| 3.3 Afforestation and reforestation on harvested land for current year of commitment period as reported | –6 728 | | | –6 728 |
| 3.3 Deforestation for current year of commitment period as reported | 238 496 | | | 238 496 |
| **Activities under Article 3, paragraph 4, for current inventory year**[c] | | | | |
| 3.4 Forest management for current year of commitment period | –850 384 | | | –850 384 |
| 3.4 Cropland management for current year of commitment period | | | | |
| 3.4 Cropland management for base year | | | | |
| 3.4 Grazing land management for current year of commitment period | | | | |
| 3.4 Grazing land management for base year | | | | |
| 3.4 Revegetation for current year of commitment period | | | | |
| 3.4 Revegetation in base year | | | | |

[a] "Adjustment" is relevant only for Parties for which the expert review team has calculated one or more adjustment(s).
[b] "Final" includes revised estimates, if any, and/or adjustments, if any.
[c] Activities under Article 3, paragraph 4, are relevant only for Parties that elected one or more such activities.

Table 4
**Information to be included in the compilation and accounting database in t $CO_2$ eq for the year 2009**

| | *As reported* | *Revised estimates* | *Adjustment*[a] | *Final*[b] |
|---|---|---|---|---|
| **Annex A emissions for 2009** | | | | |
| $CO_2$ | 44 243 686 | | | 44 243 686 |
| $CH_4$ | 3 815 566 | | | 3 815 566 |
| $N_2O$ | 3 131 279 | 3 133 673 | | 3 133 673 |
| HFCs | 1 022 681 | | | 1 022 681 |
| PFCs | 35 038 | | | 35 038 |
| $SF_6$ | 187 102 | | | 187 102 |
| **Total Annex A sources** | **52 435 351** | **52 437 745** | | **52 437 745** |
| **Activities under Article 3, paragraph 3, for 2009** | | | | |
| 3.3 Afforestation and reforestation on non-harvested land for 2009 as reported | –17 743 | | | –17 743 |
| 3.3 Afforestation and reforestation on harvested land for 2009 as reported | IE, NO | | | IE, NO |
| 3.3 Deforestation for 2009 as reported | 238 349 | | | 238 349 |
| **Activities under Article 3, paragraph 4, for 2009**[c] | | | | |
| 3.4 Forest management for 2009 | –1 122 656 | | | –1 122 656 |
| 3.4 Cropland management for 2009 | | | | |
| 3.4 Cropland management for base year | | | | |
| 3.4 Grazing land management for 2009 | | | | |
| 3.4 Grazing land management for base year | | | | |
| 3.4 Revegetation for 2009 | | | | |
| 3.4 Revegetation in base year | | | | |

*Abbreviations*: IE = included elsewhere, NO = not occurring.
[a] "Adjustment" is relevant only for Parties for which the expert review team has calculated one or more adjustment(s).
[b] "Final" includes revised estimates, if any, and/or adjustments, if any.
[c] Activities under Article 3, paragraph 4, are relevant only for Parties that elected one or more such activities.

Table 5
**Information to be included in the compilation and accounting database in t $CO_2$ eq for the year 2008**

| | *As reported* | *Revised estimates* | *Adjustment*[a] | *Final*[b] |
|---|---|---|---|---|
| **Annex A emissions for 2008** | | | | |
| $CO_2$ | 45 446 824 | | | 45 446 824 |
| $CH_4$ | 3 875 448 | | | 3 875 448 |
| $N_2O$ | 3 176 673 | 3 178 780 | | 3 178 780 |
| HFCs | 990 151 | | | 990 151 |
| PFCs | 39 012 | | | 39 012 |
| $SF_6$ | 243 979 | | | 243 979 |
| **Total Annex A sources** | **53 772 087** | **53 774 194** | | **53 774 194** |
| **Activities under Article 3, paragraph 3, for 2008** | | | | |
| 3.3 Afforestation and reforestation on non-harvested land for 2008 as reported | –15 875 | | | –15 875 |
| 3.3 Afforestation and reforestation on harvested land for 2008 as reported | IE, NO | | | IE, NO |
| 3.3 Deforestation for 2008 as reported | 182 201 | | | 182 201 |
| **Activities under Article 3, paragraph 4, for 2008**[c] | | | | |
| 3.4 Forest management for 2008 | –671 326 | | | –671 326 |
| 3.4 Cropland management for 2008 | | | | |
| 3.4 Cropland management for base year | | | | |
| 3.4 Grazing land management for 2008 | | | | |
| 3.4 Grazing land management for base year | | | | |
| 3.4 Revegetation for 2008 | | | | |
| 3.4 Revegetation in base year | | | | |

*Abbreviations*: IE = included elsewhere, NO = not occurring.
[a] "Adjustment" is relevant only for Parties for which the expert review team has calculated one or more adjustment(s).
[b] "Final" includes revised estimates, if any, and/or adjustments, if any.
[c] Activities under Article 3, paragraph 4, are relevant only for Parties that elected one or more such activities.

# II. Technical assessment of the annual submission

## A. Overview

### 1. Annual submission and other sources of information

6. The 2012 annual inventory submission was submitted on 12 April 2012; it contains a complete set of common reporting format (CRF) tables for the period 1990–2010 and a national inventory report (NIR). Switzerland also submitted information required under Article 7, paragraph 1, of the Kyoto Protocol, including information on: activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol, accounting of Kyoto Protocol units, changes in the national system and in the national registry, and the minimization of adverse impacts in accordance with Article 3, paragraph 14, of the Kyoto Protocol. The standard electronic format (SEF) tables were submitted on 12 April 2012. The annual submission was submitted in accordance with decision 15/CMP.1.

7. Switzerland officially submitted revised emission estimates on 1 November 2012 in response to the list of potential problems and further questions raised by the ERT during the review week (see paras. 49–53 below). The figures contained in this report are based on those submitted by the Party on 1 November 2012.

8. The ERT also used the previous years' submissions during the review. In addition, the ERT used the standard independent assessment report (SIAR), parts I and II, to review information on the accounting of Kyoto Protocol units (including the SEF tables and their comparison report) and on the national registry.[3]

9. During the review, Switzerland provided the ERT with additional information. The documents concerned are not part of the annual submission but are in many cases referenced in the NIR. The full list of materials used during the review is provided in annex I to this report.

Completeness of inventory

10. The inventory covers all mandatory[4] source and sink categories for the period 1990–2010 and is complete in terms of geographical coverage, years, gases, categories and sectors. Based on questions raised by the ERT during the review, the ERT noted that $N_2O$ emissions from natural gas combustion in road transportation and $N_2O$ emissions from flaring associated with oil production were reported in the CRF tables as not occurring ("NO"), even though such emissions do occur in Switzerland. In response to the list of potential problems and further questions raised by the ERT during the review week,

[3] The SIAR, parts I and II, is prepared by an independent assessor in line with decision 16/CP.10 (paras. 5(a), and 6(c) and (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.

[4] Mandatory source and sink categories under the Kyoto Protocol are all source and sink categories for which the Intergovernmental Panel on Climate Change (IPCC) *Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories*, the IPCC *Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories* 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) provide methodologies and/or emission factors to estimate GHG emissions.

Switzerland provided the missing $N_2O$ emission estimates, which the ERT agreed with. As a result, total estimated GHG emissions increased by 0.62 Gg $CO_2$ eq for 1990 and increased by 2.64 Gg $CO_2$ eq for 2010, which amounts to significantly less than 0.1 per cent of total GHG emissions without LULUCF for 1990 and for 2010 (see paras. 50 and 53 below). The ERT recommends that Switzerland continue to include emission estimates for these categories in its next annual submission (see paras. 49–53 below). The ERT also noted that the Party reported fugitive $CO_2$ and $CH_4$ emissions from oil transport as "NO" in the CRF tables and reported in the NIR that these emissions do not occur in the country. The ERT recommends that Switzerland either provide verifiable information to support the assertion that there are no $CO_2$ or $CH_4$ emissions from oil transport in the country or report emission estimates for this category in its next annual submission (see para. 51 below). The Party reported $N_2O$ and $CH_4$ emissions from drainage of soils under forest land and of wetlands as not estimated ("NE") due to the lack of available data. Although the ERT notes that these categories are not mandatory, the ERT nevertheless encourages Switzerland to report these emissions in its next annual submission.

11. Switzerland has provided all of the required CRF tables and the notation keys are used throughout them.

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

Overview

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

13. Switzerland described in its NIR the changes to the national system since the previous annual submission and these changes are discussed in chapter II.H.3 of this report, including: a change to the name and contact information of the national inventory compiler; some changes in the formal cooperation arrangements within the national inventory system; and a new agreement with the Swiss Federal Statistical Office (SFSO) for land area surveys for the LULUCF sector (see para. 132 below).

Inventory planning

14. The NIR and additional information submitted by Switzerland in response to questions raised by the ERT during the review, such as a description of the quality management system, described the national system for the preparation of the inventory. The Federal Office for the Environment (FOEN) has overall responsibility for the national inventory. Within FOEN, the National Inventory System Supervisory Board (NISSB) oversees the inventory preparation process. NISSB meets biannually: once in autumn to coordinate the preparation of the upcoming national inventory and once in spring to consider and approve the latest inventory before its submission. A GHG inventory working group, consisting of technical personnel involved in the inventory preparation process or representing institutions that supply data (e.g. the Swiss Federal Office of Energy (SFOE) (which supplies data on energy and wood energy), the Federal Office of Civil Aviation (including data on military aviation), the Swiss Farmers' Union, the Agroscope Reckenholz-Tänikon Research Station and various industry associations), meets at least once a year to take stock of the state of the inventory, discuss priorities for the development of the inventory and address issues arising from domestic or international reviews.

15. The GHG inventory core group, which is part of the GHG inventory working group, comprises the inventory experts employed at FOEN, who are entrusted with specific responsibilities for inventory planning, preparation and/or management. Switzerland also

has a quality assurance/quality control (QA/QC) officer, who is responsible for the enforcement of the quality standards defined in the quality manual. FOEN and the Swiss Federal Institute for Forest, Snow and Landscape Research participate in the preparation of the inventory for the LULUCF sector and the KP-LULUCF activities. The land area data are provided by the Swiss Federal Statistical Office.

16. The results of the expert peer reviews and of the UNFCCC reviews are the main drivers for the improvement of the Swiss inventory. The process of prioritizing the areas for improvement is undertaken by the GHG inventory core group, which takes the necessary steps to implement the required recalculations. Switzerland stated in the NIR that, since the draft annual review report of its 2011 annual submission was not made available by 12 March 2012, the recommendations made in the previous review report could only be partially implemented in its 2012 annual submission.

Inventory preparation

*Key categories*

17. Switzerland has reported tier 1 and tier 2 key category analyses, both level and trend assessment, as part of its 2012 annual submission. The tier 1 key category analysis performed by the Party and that performed by the secretariat[5] produced different results, owing to the different levels of disaggregation used: Switzerland used a more detailed level of disaggregation for the energy sector. The Party has included the LULUCF sector in its key category analysis, which was performed in accordance with the Intergovernmental Panel on Climate Change (IPCC) *Good Practice Guidance and Uncertainty 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).

18. $CH_4$ emissions from car shredding, waste composting and digesting of organic waste reported under the category other (waste) and $CO_2$ emissions from the sector other from fire-damaged estates and fire-damaged motor vehicles were identified as key categories in Switzerland's 2011 annual submission, but have not been identified as key in its 2012 annual submission. On the other hand, $CO_2$ emissions from solvent and other product use and $N_2O$ emissions from wastewater handling have become key categories in the 2012 annual submission. As explained by Switzerland in the NIR, this is due to the allocation of indirect $CO_2$ emissions from the sector other to the solvent and other product use sector. However, the Party did not provide any explanations in the NIR of the reasons for the changes to the key categories.

19. Switzerland also conducted a key category analysis for activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol, following the guidance on establishing the relationship between the activities under the Kyoto Protocol and the associated key categories provided in chapter 5.4.4 of the IPCC good practice guidance for LULUCF. Three of the KP-LULUCF activities – afforestation and reforestation, deforestation and forest management – were identified as key categories for 2010. The description of the key category analysis and its results are documented in the NIR (chapter 11, table 11–3, and annex 1) and in the KP-LULUCF CRF tables.

[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.

20. In response to questions raised by the ERT during the review, Switzerland explained that it uses the results of the key category analysis to prioritize the development and improvement of the inventory. For example, for the 2012 annual submission, FOEN commissioned studies, the results of which were used for the estimation of emissions, to specifically target the key categories with large uncertainties (e.g. studies on the fraction of organic matter in municipal solid waste used for incineration with a view to updating the country-specific $CO_2$ emission factor (EF) for other fuels used in public electricity and heat production, as well as studies on the calculation of the $CH_4$ EF for enteric fermentation). The ERT acknowledged this improvement.

*Uncertainties*

21. Switzerland has conducted a tier 1 uncertainty analysis for its 2012 annual submission. In addition, a tier 2 analysis (Monte Carlo simulation) is carried out by Switzerland every two years and was performed for its 2012 annual submission. The ERT considered the uncertainty analyses to be consistent with the recommendations contained in the IPCC good practice guidance. The main results of the quantitative tier 1 and tier 2 uncertainty assessments have been transparently presented in the NIR (chapter 1.7 and annex 7). In terms of level, the tier 1 uncertainty of the total GHG emissions for 2010 is 3.8 per cent without LULUCF and 4.1 per cent with LULUCF. The trend uncertainty for 2010 is 2.0 per cent without LULUCF and 3.4 per cent with LULUCF. The tier 2 level uncertainty for 2010 is 4.0 per cent of total GHG emissions excluding LULUCF and 4.2 per cent including LULUCF. The trend uncertainty is 3.2 per cent excluding LULUCF and 4.4 per cent including LULUCF for 2010. The ERT noted that Switzerland has not reported precise quantitative uncertainty estimates for some of the non-key categories, but has derived a quantitative estimate based on a qualitative uncertainty assessment using the terms "high", "medium" and "low" quality and applying default quantitative values for these qualitative terms. The ERT further noted that Switzerland continues to use this qualitative assessment as the basis for the quantitative assessment for some of the non-key categories in the 2012 annual submission, despite the encouragement in the previous review report that the Party perform a quantitative assessment for all categories. Thus, the ERT reiterates the encouragement of the previous review report that Switzerland undertake a qualitative uncertainty analysis for all categories in its next annual submission.

22. In response to the encouragement in the previous review report, Switzerland has corrected the trend uncertainty analysis including LULUCF for 2010, which was calculated incorrectly for the Party's 2011 annual submission, as the uncertainty introduced by each category in the LULUCF sector was compared with the total emissions from the LULUCF sector instead of with the overall total GHG emissions.

*Recalculations and time-series consistency*

23. Recalculations have been performed and reported in accordance with the IPCC good practice guidance. The ERT noted that the recalculations reported by Switzerland for the years 1990–2009 have been undertaken to take into account improvements in activity data (AD) in the energy sector (updates in energy statistics), in the industrial processes sector (the use of the official production data instead of the previously interpolated values), in the agriculture sector (updates of and improvements to the time-series consistency of the animal populations following the provision of data from the Swiss Farmers' Union), in the LULUCF sector (an update of the AREA database) and in the waste sector (a revision of the fraction of fossil and organic matter in municipal solid waste, and changes in sewage gas treatment); the updates of EFs in the energy sector ($CO_2$ EFs for bituminous coal, brown coal and petroleum coke), in the industrial processes sector (new EFs for $SF_6$) and in the waste sector ($CO_2$, $CH_4$ and $N_2O$ EFs for waste incineration); and the modification of the equation used to calculate the carbon stock changes in living biomass in the LULUCF

sector that led to the recalculations of $CO_2$ emissions from land converted to forest land. More details on these recalculations are provided in the sectoral chapters of this report (see paras. 36, 56, 71, 88, 97 and 112 below).

24. The major changes, and the magnitude of the impact, include the following: a decrease in total GHG emissions of 0.1 per cent for 1990 and an increase of 1.0 per cent for 2009. The ERT noted that as the result of the recalculations, the time-series consistency of the inventory has improved. The rationale for these recalculations has been provided in the NIR and in CRF table 8(b), with the exception of an explanation for the recalculation of fugitive $CO_2$ and $CH_4$ emissions from oil and gas. The ERT recommends that Switzerland fully explain all recalculations in its next annual submission.

*Verification and quality assurance/quality control approaches*

25. Switzerland has a detailed QA/QC plan in place, in accordance with decision 19/CMP.1 and the IPCC good practice guidance. The plan is described in a supplementary report entitled *Description of the Quality Management System*, which was submitted together with the NIR. The Party has implemented tier 1 and tier 2 QA/QC activities. The data suppliers are responsible for the quality of the sectoral data they provide, in addition to being responsible for checking the appropriateness of the choice of methods and EFs as part of the QA procedures, in line with the *Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories* (hereinafter referred to as the Revised 1996 IPCC Guidelines), the IPCC good practice guidance and the IPCC good practice guidance for LULUCF. The ERT noted that five types of checklists are used for the QA/QC checks (the checklist for suppliers of AD; the checklist for suppliers of AD, EFs and emission estimates; the checklist for the national inventory compiler; the checklist for the lead authors of the NIR; and the checklist for the project management). The GHG inventory core group reviews the NIR and checks the transparency, accuracy, completeness, consistency, comparability and quality of the documentation.

26. As recommended by the ERT in the previous review report, the Party has compared the time series in the current annual submission with the previous annual submissions, and all AD, implied emission factors (IEFs) and emission estimates undergo the following three checks: the estimates reported for 2009 and 2010 in the 2012 annual submission are compared; the CRF tables for 2009 reported in the 2011 annual submission are compared with the CRF tables for 2009 reported in the 2012 annual submission; and the CRF tables for 1990 reported in the 2011 annual submission are compared with the CRF tables for 1990 reported in the 2012 annual submission). The findings are discussed among the members of the GHG inventory core group and the modelling specialists (part of the GHG inventory working group). All differences are investigated and the reasons for the differences are sought. This procedure has already led to the identification of several errors, which were subsequently corrected prior to the submission of the inventory to the UNFCCC secretariat. Switzerland's 2012 annual submission was reviewed by the responsible persons at FOEN (members of the GHG inventory core group as well as consultants involved in the compilation of the inventory), who are not directly involved in the preparation of a particular section of the inventory, and revised accordingly. Expert peer reviews are commissioned periodically to provide in-depth analysis of specific sectors. In 2006, peer reviews were conducted for the energy and industrial processes sectors, as well as for $CH_4$ emissions from agriculture. In 2009, the waste sector was subject to a domestic expert review. At the end of 2010, a thorough review of the LULUCF sector took place. The review of the industrial processes sector was scheduled to start in May 2012.

27. The ERT welcomed these improvements in Switzerland's QA/QC procedures, but noted that there were still missing emission estimates (see para. 10 above), small

discrepancies occurring within the CRF tables (see para. 43 below) and a lack of explanations for the recalculations (see paras. 37 and 71 below).

*Transparency*

28. The NIR submitted by Switzerland is generally transparent. However, there is a lack of clarity in the descriptions of some of the methods, data sources, assumptions and EFs used for the energy (e.g. fugitive emissions from oil and gas), industrial processes (e.g. $CO_2$ emissions from limestone and dolomite use), LULUCF (e.g. land areas used for the reporting under the Convention and under the Kyoto Protocol) and waste (e.g. wastewater handling) sectors (see paras. 51, 64, 103 and 113 below). The ERT recommends that Switzerland improve the transparency of the explanations of the methodologies, data sources, assumptions and EFs used in the NIR of its next annual submission.

Inventory management

29. The NIR reports that Switzerland has a centralized archiving system located at FOEN, 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 key category identification and planned inventory improvements. The archiving system is described in the *Description of the Quality Management System* (see para. 25 above). The actual inventory is compiled in a database called the Emissions Information System, which is also located in FOEN, from which the relevant parameters are exported into the CRF tables.

## 3. Follow-up to previous reviews

30. Switzerland has included a table in the NIR (chapter 1.6.1.5) showing the implemented improvements made in its 2012 annual submission, as recommended in the previous review reports. According to the table, the Party has addressed the recommendations related to the use of the results of the key category analysis, corrected the differences in the results of the uncertainty analyses between annual submissions and improved the uncertainty assessment. The recommendation made in the previous review report that Switzerland enhance its QA/QC activities has also been addressed; for example: national peer reviews of specific sectors are carried out periodically, checking, among other tasks, methodological aspects and looking at higher-tier estimation methods, in particular a workshop was organized on the Yasso model used to assess soil carbon in forest soils; the procedures for checking the CRF tables have been adapted to allow for a two-stage control of the tables; a comparison across reporting Parties of IEFs has been performed and is documented in the relevant chapters of the NIR under the title "Source-specific QA/QC and verification"; and the information on the KP-LULUCF activities has undergone the same QA/QC procedures as all sectors of the inventory (e.g. it was subject to a peer review in 2010). In addition, transparency has been improved, especially in relation to the industrial processes sector; owing to data confidentiality, some information cannot be made publicly available, but such data were disclosed to the ERT during the review. Furthermore, Switzerland has provided detailed information on recalculations in chapter 10 of the NIR, with the exception of an explanation for the recalculation of fugitive $CO_2$ and $CH_4$ emissions from oil and gas (see para. 37 below). Lastly, information on updates of the national system and the national registry and on the minimization of adverse impacts has been provided.

31. In addition, following the recommendations in the previous review report, Switzerland has: completed the sampling and analysis to update the EFs for bituminous

coal, lignite and petroleum coke; completed the study and applied its results with regard to the share of fossil and organic matter in waste incinerated for energy purposes in the energy sector; estimated emissions from $CH_4$ recovery from solid waste disposal sites (SWDS); and improved the completeness of the estimates of emissions from organic soils in forest land under the LULUCF sector (see paras. 47, 48, 92 and 102 below). The ERT noted that Switzerland reported in the NIR that it was not able to consider all of the recommendations made in the previous review report owing to the late availability of the draft 2011 annual review report. The following recommendations made in the 2011 review report have not yet been addressed by Switzerland:

(a) The disaggregated reporting of fuels included under the category "other" (for feedstocks and non-energy use of fuels) in CRF table 1.A(d) (see para. 46 below);

(b) The improvement of the method used to estimate $CO_2$ emissions from brick and tile production in the industrial processes sector, and the explanation thereof (see para. 64 below);

(c) The separate reporting of $CH_4$ emissions for each subcategory under the category "other" (waste) in the NIR (see para. 104 below).

### 4. Areas for further improvement identified by the expert review team

32. During the review, the ERT identified a number of areas for improvement. These are listed in table 7 below.

33. Recommended improvements relating to specific categories are presented in the relevant chapters of this report and in table 7 below.

## B. Energy

### 1. Sector overview

34. The energy sector is the main sector in the GHG inventory of Switzerland. In 2010, emissions from the energy sector amounted to 44,019.59 Gg $CO_2$ eq, or 81.2 per cent of total GHG emissions. Since 1990, emissions have increased by 4.7 per cent, while between 2009 and 2010, emissions increased by 3.6 per cent, due to the increased fuel combustion in the residential sector, reflecting the colder weather conditions in the winter of 2010. This increase in 2010 followed a decrease of 2.5 per cent between 2008 and 2009, due to the decreases in emissions from manufacturing industries and construction and other sectors. The key drivers for the rise in emissions since 1990 are the increased emissions from road transportation, in particular from diesel road vehicles, and the increased emissions from energy industries, which is mainly due to the increased combustion of waste for electricity generation. These increases in emissions were partially offset by the decreases in emissions from the residential, commercial/institutional and manufacturing industries and construction categories/subcategories.

35. Within the sector, 38.7 per cent of emissions were from other sectors, followed by 37.3 per cent from transport, 13.6 per cent from manufacturing industries and construction and 9.5 per cent from energy industries. Fugitive emissions from fuels accounted for 0.6 per cent and other (energy) accounted for 0.3 per cent. The emission trends have been discussed transparently in the NIR.

36. Switzerland has made recalculations for the energy sector between its 2011 and 2012 annual submissions following recalculations of AD and EFs. The impact of these recalculations on the energy sector is a decrease in emissions of 0.2 per cent for 1990 and an increase in emissions of 0.6 per cent for 2009. The main recalculations took place in the following categories:

(a) $CO_2$ emissions from public electricity and heat production, due to revised data on the mix of fossil and non-fossil matter in municipal solid waste combusted for electricity generation and as a result of recalculations of the AD published in the Swiss energy statistics (an increase in emissions of 388.09 Gg $CO_2$ eq, or 11.2 per cent);

(b) $CO_2$ emissions from manufacturing industries and construction, due to a revision of the country-specific $CO_2$ EFs for bituminous coal, brown coal and petroleum coke and as a result of recalculations of the AD published in the Swiss energy statistics (a decrease in emissions of 129.20 Gg $CO_2$ eq, or 2.2 per cent);

(c) $CO_2$ emissions from other sectors, based on recalculations of the AD published in the Swiss energy statistics (a decrease in emissions of 52.54 Gg $CO_2$ eq, or 0.3 per cent).

37. The ERT considered these recalculations to be consistent with the Revised 1996 IPCC Guidelines and the IPCC good practice guidance. The recalculations for the energy sector have generally been documented in the NIR, with the exception of the recalculation of the estimated fugitive $CO_2$ and $CH_4$ emissions from the following subcategories: oil refining/storage; and distribution of oil products. In response to a question raised by the ERT during the review, Switzerland explained that the recalculation was a result of an updated EF based on new data available for 2007 and 2010. The ERT made a recommendation in relation to this issue (see para. 24 above).

38. Switzerland's reporting of the emissions from the energy sector is complete in terms of gases, years, geographical coverage and categories. The ERT noted that Switzerland reported $N_2O$ emissions from natural gas combusted in road transportation and $N_2O$ emissions from flaring associated with oil refining as "NO", but reported the relevant AD for these subcategories in the CRF tables, thereby indicating that such emissions do occur. The emission estimates for these subcategories were provided by Switzerland in response to the list of potential problems and further questions identified by the ERT during the review week. The impact of these emission estimates was an increase in emissions of 2.64 Gg $CO_2$ eq for 2010, which amounts to significantly less than 0.1 per cent of total emissions from the energy sector. The missing emission estimates were prepared and reported in line with the Revised 1996 IPCC Guidelines and the IPCC good practice guidance (see paras. 49–53 below).

39. Overall, the NIR provides transparent information on the methods and EFs applied in relation to the energy sector. Tier 2 and tier 3 methods and country-specific EFs were used to estimate emissions for the key categories, and tier 1, tier 2 and tier 3 methods and country-specific and default EFs were used for the non-key categories. In the NIR, Switzerland has provided information on the general and category-specific tier 1 and tier 2 QA/QC procedures and practices applied in the energy sector. These procedures are in line with the recommendations contained in the IPCC good practice guidance.

40. The country-specific EFs for fuel combustion have been listed in the NIR. In some cases, the EFs for road transportation deviate significantly from the IPCC default EFs. For example, Switzerland's $CO_2$ EF (73.90 t $CO_2$/TJ) for gasoline is a constant value for the entire time series and is the highest of such EFs among all reporting Parties for the entire time series (ranging from 64.00 t $CO_2$/TJ to 73.90 t $CO_2$/TJ ) and is higher than the IPCC default EF (73.00 t $CO_2$/TJ). In response to questions raised by the ERT during the review, Switzerland provided an explanation and a report containing the analyses of gasoline samples taken from Swiss gas stations that supported this country-specific EF. The ERT considered the justification provided by Switzerland to be acceptable and reiterates the recommendation made in previous review reports that, in order to further improve the transparency of the NIR of its next annual submission, where the country-specific EFs

deviate significantly from the IPCC default values for the key categories, Switzerland include more background information thereon and justification for their use.

41. Switzerland has provided details on and the results of the uncertainty assessment for subcategories in the energy sector in its NIR. The ERT noted that the Party is planning an evaluation of the uncertainty estimates of the energy statistics for its next annual submission. The ERT supports such an evaluation and encourages Switzerland to incorporate the results in its next annual submission.

## 2. Reference and sectoral approaches

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

42. Estimated $CO_2$ emissions from fuel combustion in Switzerland were calculated using both the reference approach and the sectoral approach in accordance with the IPCC good practice guidance. For 2010, there is a 0.9 per cent difference in relation to $CO_2$ emissions and a 0.8 per cent difference in energy consumption between the estimates calculated using the two approaches. Switzerland has explained the differences in the CRF tables and in the NIR, in line with the "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.

43. The ERT noted small discrepancies between CRF table 1.C and CRF table 1.A(b), for example in the reporting of jet kerosene for 2006 and 2007. In response to questions raised by the ERT during the review, Switzerland confirmed that corrections will be made for its next annual submission. The ERT recommends that the Party reconcile the differences and report the correct figures in its next annual submission. For 2010, there is a difference of 7 per cent in the apparent consumption between the reference approach and the International Energy Agency (IEA) data. In the previous annual submission, Switzerland undertook a thorough investigation of the differences. The key drivers of the differences included the use of different energy contents and the inclusion of energy consumption from Liechtenstein in the IEA data.

*International bunker fuels*

44. Switzerland estimated fuel consumption for and emissions from international aviation bunkers using a country-specific model with traffic data and engine information for domestic and international flights consistent with a tier 3a method from the *2006 IPCC Guidelines for National Greenhouse Gas Inventories* (hereinafter referred to as the 2006 IPCC Guidelines). The modelled total fuel consumption for aviation is compared with the total fuel sales data, which do not differentiate between domestic and international aviation. In order to avoid an underestimation of the emissions from civil aviation, the estimated international fuel consumption is adjusted accordingly to match the total fuel sales data. The factor between the calculated and corrected estimated international fuel consumption is used to scale the emissions from bunkers linearly. In its 2012 annual submission, Switzerland has provided a table that outlines the differences between the modelled fuel consumption data and actual fuel sales. The ERT commends Switzerland for this improvement in the transparency of its reporting.

45. Emissions from marine bunkers were calculated using a tier 1 method. For marine bunkers, AD were collected from the customs administration, as bunker fuels are subject to specific taxation arrangements. Emissions from marine bunkers for Switzerland's two international lakes (Lake Geneva and Lake Constance) were reported for the first time in the Party's 2012 annual submission. The AD were either collected from company data or derived from passenger information.

*Feedstocks and non-energy use of fuels*

46. Switzerland has reported data on lubricants, bitumen and other fuels (gasoline, diesel, paraffin and waxes, petroleum coke and white spirit) used as feedstocks and for non-energy purposes in CRF table 1.A(d). The ERT noted the improvements implemented by Switzerland to improve the consistency of the reporting on feedstocks between the reference approach and the sectoral approach, including the addition of a flow chart in the NIR that explains the flows of fuels through the sectoral and reference approaches, including non-energy use of fuels and feedstocks. In the CRF tables, the ERT noted that the category "other" in CRF table 1.A(d) is not disaggregated by fuel. The ERT reiterates the recommendation made in the previous review report that Switzerland disaggregate the fuels included under "other" in CRF table 1.A(d) in its next annual submission, to the extent possible.

## 3. Key categories

Stationary combustion: solid and other fuels – $CO_2$

47. For its 2012 annual submission, Switzerland has revised the $CO_2$ EFs for bituminous coal (from 94.00 t $CO_2$/TJ to 92.70 t $CO_2$/TJ), brown coal (from 104.00 t $CO_2$/TJ to 96.10 t $CO_2$/TJ) and petroleum coke (from 94.00 t $CO_2$/TJ to 91.40 t $CO_2$/TJ). The EFs are constant for the entire time series. Only a limited explanation for these updated factors was provided in the NIR. In response to a question raised by the ERT during the review, the Party confirmed that the updated EFs are based on samples that were taken from Switzerland's cement plants and analysed by an independent laboratory. The results of the analysis of the samples from the individual plants were weighted according to each plant's proportion of fuel consumed, in order to estimate a country-specific EF. The cement industry is the primary consumer of these fuels in Switzerland. The ERT considered these updated EFs to be an improvement compared to the previously used EFs, which were based on expert judgement. In order to improve transparency, the ERT recommends that Switzerland provide detailed justifications for updates to EFs in the NIR of its next annual submission.

48. A study was undertaken in 2011 to evaluate the organic fraction in municipal solid waste used for incineration. The results of the study led to the update of the shares of fossil (47.8 per cent) and organic (52.2 per cent) matter in municipal solid waste used as fuel (other fuels). The previous share of fossil matter was based on data from 2002, which was kept constant at 40.0 per cent. The organic fraction of the waste between 2002 and 2011 was linearly interpolated between the two data points in order to maintain time-series consistency. The results were applied in calculating the emission estimates for 2003 to 2009. The ERT commends Switzerland for this improvement in the accuracy of its emission estimates for this category.

## 4. Non-key categories

Road transportation: gaseous fuels – $N_2O$

49. Switzerland reported $N_2O$ emissions from natural gas combustion in road transportation as "NO", with no justification for the use of that notation key provided in the NIR. On the other hand, Switzerland reported AD for $CO_2$ and $CH_4$ emissions from this category. The ERT noted that a default EF for $N_2O$ emissions from natural gas combustion in road transportation is provided in the Revised 1996 IPCC Guidelines (table 1.8 on page 1.36 of volume 3). The ERT considered that $N_2O$ emissions from this category occur in the country and that not reporting these emissions would result in an underestimation of emissions. The ERT included this category in the list of potential problems and further questions raised by the ERT during the review week.

50. The ERT reviewed the information, including the revised CRF tables, provided by Switzerland in response to the list of potential problems and further questions raised by the ERT during the review week. As a result, $N_2O$ emissions from this category increased by 0.01 Gg $CO_2$ eq for 1990 and by 1.7 Gg $CO_2$ eq for 2010, which is significantly less than 0.1 per cent of the total sectoral emissions. The ERT concluded that Switzerland's estimates of $N_2O$ emissions from natural gas combustion in road transportation had been prepared in accordance with the method recommended by the ERT. The ERT suggested that the Party apply the EF (0.1 kg/TJ) from the Revised 1996 IPCC Guidelines; however, Switzerland applied the EFs (0.027 g/km and 0.101 g/km for light-duty vehicles and buses, respectively, and 7.95 g/GJ for tank tourism) from the 2006 IPCC Guidelines. The ERT was satisfied with the justification provided by the Party for the use of such EFs, namely that they are more appropriate to the modern natural-gas vehicle fleet used in Switzerland, as natural-gas vehicles were first introduced in the country in 2003 and the EFs provided in the Revised 1996 IPCC Guidelines are very low compared with more recent data. The ERT considered the potential problem to have been resolved. The ERT recommends that Switzerland continue to include estimates of $N_2O$ emissions from natural gas combustion in road transportation in its next annual submission.

Oil and natural gas: oil – $CO_2$, $CH_4$ and $N_2O$

51. Switzerland reported fugitive $CO_2$ and $CH_4$ emissions from oil transport as "NO". It is noted in the NIR that oil transport in Switzerland is realized through underground pipelines, but no direct justification for the use of the notation key "NO" is provided. Furthermore, Switzerland explained in the NIR that it is not clear whether leakages from oil transport are already included in the data provided by the Swiss refineries. In response to a question raised by the ERT during the review, Switzerland explained that the tightness of the pipelines is tested regularly and that no leakages have ever been detected. The Party further observed that oil pipelines in Switzerland are very short and are all underground and that, therefore, $CH_4$ emissions would be likely to be oxidized in the top soil covering the pipelines. It is stated in the NIR that Switzerland will analyse this category further and provide an update in its next annual submission. The ERT strongly recommends that Switzerland either provide verifiable information to support the assertion that there are no $CO_2$ or $CH_4$ emissions from oil transport in the country, or estimate the emissions from this category for its next annual submission.

52. Switzerland reported $N_2O$ emissions from flaring associated with oil refining as "NO", with no justification for the use of that notation key provided in the NIR. At the same time, the Party reported the AD for $CO_2$ and $CH_4$ emissions from this category. The ERT noted that default EFs for $N_2O$ emissions from flaring associated with oil production are included in the IPCC good practice guidance (table 2.16 on pages 2.86 and 2.87). In response to a question raised by the ERT during the review, Switzerland acknowledged the missing emissions estimate and indicated that it will apply the default EFs in its calculations for its next annual submission. The ERT considered that the omission of $N_2O$ emissions from flaring associated with oil production results in an underestimation of emissions. The ERT included this category in the list of potential problems and further questions raised by the ERT during the review week.

53. The ERT reviewed the information, including the revised CRF tables, provided by Switzerland in response to the list of potential problems and further questions raised by the ERT during the review week. As a result, $N_2O$ emissions increased by 0.6 Gg $CO_2$ eq for 1990 and by 0.9 Gg $CO_2$ eq for 2010, which is considerably less than 0.1 per cent of the total sectoral emissions. The ERT concluded that Switzerland's estimates of $N_2O$ emissions from flaring associated with oil production had been prepared in line with the method recommended by the ERT and using the appropriate EF ($6.4*10^{-7}$ $Gg/10^3$ $m^3$) from the IPCC good practice guidance. The ERT considered the potential problem to have been

resolved. The ERT recommends that Switzerland continue to include estimates of $N_2O$ emissions from flaring associated with oil production in its next annual submission.

Oil and natural gas: natural gas – $CO_2$ and $CH_4$

54. The ERT noted that a small amount of natural gas production in Switzerland was reported by IEA for the period 1990–1994. However, Switzerland reported fugitive $CO_2$ and $CH_4$ emissions from natural gas production as "NO" for the entire time series. In response to a question raised by the ERT during the review, the Party confirmed that such emissions were accounted for under fuel combustion; however, the corresponding fugitive emissions from natural gas production were reported as "NO". The ERT recommends that Switzerland calculate separately and report relevant emission estimates for this category for the period 1990–1994 in its next annual submission.

## C. Industrial processes and solvent and other product use

### 1. Sector overview

55. In 2010, emissions from the industrial processes sector amounted to 3,688.70 Gg $CO_2$ eq, or 6.8 per cent of total GHG emissions, and emissions from the solvent and other product use sector amounted to 214.56 Gg $CO_2$ eq, or 0.4 per cent of total GHG emissions. Since the base year, emissions have increased by 9.1 per cent in the industrial processes sector and decreased by 54.5 per cent in the solvent and other product use sector. The key driver for the rise in emissions in the industrial processes sector is the increase in consumption of halocarbons and $SF_6$ due to the replacement of HFCs for chlorofluorocarbons in many technical applications; this was partly offset by the decrease in emissions from metal production and mineral products. The decrease in emissions from the solvent and other product use sector is related to the decrease in indirect $CO_2$ emissions from the decomposition of non-methane volatile organic compounds (NMVOCs) in the atmosphere due to the introduction of NMVOC emission limit values and the associated taxation. Within the industrial processes sector, 55.9 per cent of the emissions were from mineral products, followed by 33.3 per cent from consumption of halocarbons and $SF_6$, 5.6 per cent from metal production, 5.2 per cent from chemical industry and 0.03 per cent from other (industrial processes).

56. Switzerland has made recalculations for the industrial processes sector between its 2011 and 2012 annual submissions due to the use of more precise AD and new EFs, and in order to rectify identified errors for the entire time series. The ERT considered the recalculations to be consistent with the Revised 1996 IPCC Guidelines and the IPCC good practice guidance. The impact of these recalculations on the industrial processes sector is a decrease in emissions of 0.1 per cent for 1990 and an increase in emissions of 8.1 per cent for 2009. The main recalculations took place in the following categories:

(a) $CO_2$ emissions from cement production, owing to the use of newly obtained AD for 2009 based on official production data rather than interpolated values (an increase in emissions of 85.90 Gg $CO_2$ eq, or 4.9 per cent);

(b) HFC emissions from consumption of halocarbons and $SF_6$, owing to the use of new EFs and new parameters in the calculation models for the different subcategories (an increase in emissions of 168.36 Gg $CO_2$ eq, or 19.7 per cent).

57. Switzerland has made recalculations for the solvent and other product use sector between its 2011 and 2012 annual submissions due to the use of revised AD and new EFs for NMVOC emissions, resulting in higher $CO_2$ emissions for the entire time series. The ERT considered the recalculations to be consistent with the Revised 1996 IPCC Guidelines.

The impact of these recalculations on the solvent and other product use sector is an increase in emissions of 0.9 per cent for 1990 and an increase of 0.5 per cent for 2009.

58. The GHG inventory for the industrial processes and solvent and other product use sectors is complete in terms of geographical coverage, gases, years and categories. Generally, the methods and data used to calculate the emission estimates have not been explained transparently in the NIR, as the AD and EFs for lime production, ammonia production, nitric acid production, carbide production and ethylene are reported as confidential. The explanations of the rationale and the methods used for the recalculations are also not sufficiently transparent in the NIR. In response to questions raised by the ERT prior to the review, Switzerland provided the ERT with some additional information on the AD and EFs, in order to increase the transparency of the confidential data. The ERT commends Switzerland for these efforts.

59. Switzerland has addressed most of the recommendations made in the previous review reports; for example, $CH_4$ emissions from carbide production have now been estimated and errors in the estimates of HFC emissions from mobile air-conditioning equipment have been corrected. However, Switzerland has not fully implemented some of the other recommendations, such as the improvement of the method used for estimating $CO_2$ emissions from brick and tile production and/or the improvement of the explanation of that method (see paras. 64 and 65 below).

60. An uncertainty analysis was performed using both tier 1 and tier 2 methods in accordance with the IPCC good practice guidance. QC procedures were carried out using both general (tier 1) and specific (tier 2) procedures for some categories (e.g. fluorinated gases (F-gases)).The ERT noted from the information provided in the NIR that an expert peer review, in which two independent consultancies perform an in-depth check of the inventory for the industrial processes sector, was scheduled to start in May 2012. The results of the review should be available at the beginning of 2013 and Switzerland indicated in the NIR that the recommendations from the review will be implemented for its next annual submission. The ERT commends the Party for these efforts and encourages Switzerland to provide the results of the review in the NIR of its next annual submission.

## 2. Key categories

Cement production – $CO_2$

61. $CO_2$ emissions from cement production were estimated using information provided by the industry on the amount of clinker produced. The country-specific EF, which accounts for the composition of the raw material, is a constant value of 0.525 t $CO_2$/t clinker for the period 1990–2004, but fluctuates between 0.528 t $CO_2$/t and 0.531 t $CO_2$/t clinker for the period 2005–2010. The EF used is higher than the IPCC default value (0.51 t $CO_2$/t clinker) for the entire time series. The NIR stated that the correction factor for cement kiln dust (CKD) used is 1.00 because no CKD is lost in cement plants in Switzerland. In response to a question raised by the ERT during the review regarding the provision of a justification for the country-specific CKD correction factor (the IPCC default value is 1.02), Switzerland explained that, in the national cement plants, all filter dust is collected in high-performance electrostatic precipitators or bag filters (having an efficiency of more than 99.9 per cent) and recycled to the kiln feed. The ERT agreed with the explanation provided by the Party and recommends that Switzerland include this information in the NIR of its next annual submission, to improve the transparency of its reporting.

62. In addition, Switzerland calculated $CO_2$ emissions from blasting operations during the digging of limestone using a country-specific method. These emissions are added to the estimated $CO_2$ emissions from clinker production. In response to a question raised by the

ERT during the review, Switzerland explained that the $CO_2$ EF for the use of blasting agents is taken from a national report[6] and amounts to 600 kg $CO_2$/kg blasting agent. For the average amount of blasting agent used per kg cement, the measured data for 2002 were used. The measurement data were available for four Swiss cement plants, covering more than 60 per cent of the national cement production. The average blasting agent input per kg cement amounts to 0.13 kg. The $CO_2$ EF/kg cement or lime therefore amounts to 96 g/t cement or lime produced. The ERT appreciated this explanation and agreed with it. The ERT encourages Switzerland to include this information in the NIR of its next annual submission, to enhance the transparency of its reporting.

### 3. Non-key categories

Lime production – $CO_2$

63. Switzerland calculated $CO_2$ emissions from lime production on the basis of the amount of lime produced and using a single country-specific EF for the entire time series which takes into account the purity of limestone and the grade of calcination. In response to questions raised by the ERT during the review, Switzerland provided additional confidential information on the method and EFs used. The ERT noted that according to the IPCC good practice guidance, certain large industries can produce lime for their own consumption, which may not be well accounted for or reported. Therefore, the exclusion of non-marketed lime (e.g. that used in the sugar or chemicals industries) can lead to an underestimation of emissions from lime production. The ERT also noted that the Party has not reported autoproduced lime. In response to a question raised by the ERT during the review, Switzerland explained that the sugar-producing plants confirmed that they do indeed produce lime from limestone in their own shaft kilns but that the emitted $CO_2$ is recaptured and used in the sugar-producing process. The ERT agreed with this explanation and recommends that Switzerland include this information in the NIR of its next annual submission.

Limestone and dolomite use – $CO_2$

64. Under this category, Switzerland included $CO_2$ emissions from brick and tile production on the basis of the amount produced (t bricks and tiles) multiplied by a constant EF (0.08 t $CO_2$/t bricks and tiles). This approach is based on information provided by the industry, which states that the quantity of $CO_2$ emissions released during the calcination process is approximately 4–12 per cent of the mass of the produced bricks and tiles. The ERT noted that the Party does not provide a transparent justification for this assumption in the NIR. In the previous review reports, the ERT recommended that Switzerland either provide a detailed justification for the assumption or estimate $CO_2$ emissions from brick and tile production using the method for the calculation of emissions from limestone and dolomite use in accordance with the Revised 1996 IPCC Guidelines. The ERT found that Switzerland has not yet implemented this recommendation, and the planned improvement in relation to this issue is only briefly mentioned in the NIR.

65. During the review, Switzerland informed the ERT that FOEN is in contact with the Swiss Association of Brick and Tile Manufacturers in order to obtain detailed data on the carbonate content of the raw material for the entire time series. The ERT strongly reiterates the recommendation made in the previous review report that Switzerland implement its plan to perform a recalculation for the entire time series based on the information from the Association for its next annual submission.

[6] BUWAL. 1995. *Emissionsfaktoren für Stationäre Quellen*.

Nitric acid production – $N_2O$

66. Switzerland estimated $N_2O$ emissions from nitric acid production using a tier 2 method and a plant-specific EF, which was provided to the ERT as part of the additional confidential information requested by the ERT during the review. However, the EF based on measurements made in 2009 from a single nitric acid plant was applied for the entire time series and has been reported as confidential, as there is only one plant in Switzerland. In response to a question raised by the ERT during the review, Switzerland did not provide specific information on the type of measurements which were carried out to justify the use of the plant-specific EF. The ERT encourages the Party to provide, in the NIR, detailed information on the verification procedures for this EF and on the validity of the application of this EF for the plant for all years of the time series, and to ensure time-series consistency. In addition, the ERT recommends that Switzerland report on the category-specific QC checks applied to the plant data in its next annual submission.

Carbide production – $CO_2$

67. Switzerland made a recalculation for this category for the entire time series, resulting in lower $CO_2$ emission estimates than those previously reported for the entire the time series (a decrease of 0.1 per cent in $CO_2$ emissions for 2009), except for the periods 2004–2005 and 2007–2008. The explanation for the recalculation is not sufficiently transparent in the NIR due to the confidentiality of the AD and EFs. In response to questions raised by the ERT during the review, the Party informed the ERT that it had decided to make the recalculation in order to ensure time-series consistency given the availability of new annual production data and a revised plant-specific EF. The ERT had access to the confidential data on the method, AD and EFs used and agreed with the explanation provided by the Party. The ERT encourages Switzerland to provide an explanation of the rationale and methods used for all recalculations in the NIR, in order to ensure transparency.

68. The ERT noted that the AD and EFs provided by the plant operator have been revised as a result of the availability of more precise production data for 1997–2009 and a corrected EF for 1990–2007. In response to a question raised by the ERT during the review regarding the category-specific QC checks performed to verify the plant-specific information, Switzerland explained that prior to using this information, plausibility checks and a comparison with the IPCC method and the EFs used by neighbouring countries are performed to verify the plant-specific information. The ERT agreed with the explanation provided by the Party and recommends that Switzerland continue to improve the quality of its data, in order to ensure time-series consistency.

Solvent and other product use – $N_2O$

69. Switzerland estimated $N_2O$ emissions from the use of $N_2O$ for anaesthesia and from aerosol cans for this sector. The ERT noted that the Party did not provide sufficient information in the NIR on the method, data and assumptions used to estimate such emissions. In response to a question raised by the ERT during the review, Switzerland explained that the constant country-specific EF (14 g $N_2O$/capita) for use of $N_2O$ for anaesthesia was derived from sales information from a private company for 1990 and for the period 2001–2004, and sales projections for up to 2020 based on information obtained from a distributor of anaesthesia. The EFs for the period 1991–2000 were estimated by interpolating the data for 1990 and 2001, and for the years after 2004 by interpolating the data for 2004 and 2020. The EF used for $N_2O$ emissions from aerosol cans is based on data from the food industry and is constant at 10 g $N_2O$/capita throughout the time series (1990–2010). The ERT reiterates the recommendation in the previous review report that Switzerland make efforts to collect data and information to verify the $N_2O$ emission

estimates for these categories for the recent years of the time series and make recalculations, if necessary, for its next annual submission. Furthermore, the ERT recommends that Switzerland provide such information in the NIR of its next annual submission, to enhance the transparency of the inventory.

## D. Agriculture

### 1. Sector overview

70. In 2010, emissions from the agriculture sector amounted to 5,688.32 Gg $CO_2$ eq, or 10.5 per cent of total GHG emissions. In 1990, the share of emissions from the agriculture sector was 11.6 per cent. Since 1990, emissions have decreased by 7.3 per cent. These emissions showed a decreasing trend between 1990 and 2004, when emissions decreased by 10.5 per cent due to the reduction in the number of cattle and the reduced input of mineral fertilizers, while the emissions trend was reversed between 2004 and 2008, when there was a 3.6 per cent increase due to the increase in livestock numbers. However, in 2009 and 2010 emissions showed no significant difference from those in 2008. Since 2007, total sectoral GHG emissions have remained relatively stable because most of the EFs have not changed significantly. In general, the key driver for the fall in emissions is the reduction in the number of cattle and the reduced input of mineral fertilizers due to the introduction of the "Required Standards of Ecological Performance". Within the sector, 44.6 per cent of the emissions were from enteric fermentation, followed by 38.1 per cent from agricultural soils and 17.0 per cent from manure management. The remaining 0.2 per cent were from field burning of agricultural residues.

71. Switzerland has made recalculations for the agriculture sector between its 2011 and 2012 annual submissions in response to recommendations in the previous review report and following updates of animal population numbers in order to improve the time-series consistency of the AD for livestock numbers; the most important update concerns the categories mature non-dairy cattle, pre-weaned calves, horses, and mules and asses for the period 1990–1998. The impact of these recalculations on the agriculture sector is an increase in total estimated emissions of 7.06 Gg $CO_2$ eq, or 0.1 per cent, for 2009. The main recalculations took place in the following categories:

(a) $CH_4$ emissions from enteric fermentation, owing to changes in AD in order to correct inconsistencies for the categories mature non-dairy cattle, pre-weaned calves, horses, and mules and asses for the period 1990–1998 and due to the inclusion of previously unreported emissions from horses, and mules and asses used for non-agricultural purposes for the entire time series (an increase in emissions of 0.60 Gg $CO_2$ eq, or 0.02 per cent);

(b) $CH_4$ and $N_2O$ emissions from manure management, owing to the same reason as under point (a) above (an increase in emissions of 4.69 Gg $CO_2$ eq, or 0.5 per cent) (see para. 78 below);

(c) $N_2O$ emissions from agricultural soils, owing to the same reason as under point (a) above, and due to several data updates from the Swiss Farmers' Union (an increase in emissions of 3.98 Gg $CO_2$ eq, or 0.2 per cent);

(d) $CH_4$ and $N_2O$ emissions from field burning of agricultural residues, due to the use of constant AD for this category (70,000 t) for the entire time series (a decrease in emissions of 1.02 Gg $CO_2$ eq, or 6.8 per cent).

72. The inventory for the agriculture sector is complete in terms of gases, years, geographical coverage and categories. Switzerland has reported $CH_4$ emissions from rice cultivation as "NO" and not applicable ("NA"), and $CH_4$ and $N_2O$ emissions from

prescribed burning of savannas as "NA" for the entire time series. For field burning of agricultural residues, Switzerland has reported the default subcategories as "NO" and "NA" and has included a country-specific subcategory, branches in agriculture and forestry, under other (field burning of agricultural residues). The ERT concluded that the use of the notation key "NA" to report these categories (rice cultivation and field burning of agricultural residues) is correct.

73. The methodologies and EFs used for the inventory for the agriculture sector are, in general, transparently described in the NIR. However, the ERT noted that, as mentioned in the previous review report, the livestock categorization is not clearly described in the NIR and that Switzerland has not updated its categorization in the 2012 annual submission. It is not clear how the split between mature dairy, mature non-dairy and young cattle is carried out (e.g. Switzerland includes breeding cattle over one year old in the class of young cattle). In order to enhance transparency, the ERT encourages Switzerland to describe its livestock categorization in more detail in the NIR of its next annual submission.

74. All QA/QC activities performed for the agriculture sector have been described in a separate document provided with the NIR. The Party used both the expert peer reviews and the internal peer reviews procedures, as well as both tier 1 and tier 2 QA/QC activities. General information on agricultural structures and policies has been provided and the differences between national and IPCC default values have been analysed and discussed. Furthermore, comparisons with data from other reporting Parties have been conducted, where possible, and discussed. The provision of documentation on the data sets and calculation methods ensures the transparency and traceability of said calculation methods.

75. For the uncertainty analysis for the agriculture sector, the input data from the Agroscope Reckenholz-Tänikon Research Station were used. The arithmetic mean of the lower and upper bound of uncertainty was used for the AD and EFs, resulting in a combined uncertainty for the different categories of emissions. Tier 1 and tier 2 analyses were both used, with the combined uncertainty of emissions from the agriculture sector determined using a tier 1 error propagation method. For the tier 2 uncertainty analysis, correlations between the EFs or AD were considered. For a given category, the uncertainty for all years of the time series is constant (e.g. the uncertainty value (tier 2) is 54.5 per cent for $CH_4$ emissions from manure management and 71.8 per cent for $N_2O$ emissions from manure management.

76. The improvements planned for the different categories in the agriculture sector are: a revision of the estimates of energy intake for non-cattle animals, particularly mules and asses, for enteric fermentation; and the use of new data from the updated projections from the Swiss ammonium emission model AGRAMMON for manure management and agricultural soils. The ERT noted that there are no pending recommendations from previous review reports that have not yet been addressed by the Party.

## 2. Key categories

Enteric fermentation – $CH_4$

77. Switzerland used a tier 2 methodology to calculate the $CH_4$ emission estimates for all animal categories, with a country-specific EF developed in line with the IPCC good practice guidance and calculated using country-specific data on nutrient requirements, feed intake and $CH_4$ conversion rates for specific feed types. The ERT noted that in the official statistics, the categories mature non-dairy cattle and pre-weaned calves are included under mature dairy cattle and fattening calves for the period 1990–1999. Owing to the increase in production (natural beef production), the respective categories were split in 1999 and have been reported separately since then, which led to inconsistencies in the time series. The

inconsistencies have now been corrected in the 2012 annual submission by means of an independent estimate of the number of mature non-dairy cattle and pre-weaned calves for the period 1990–1998 (0.02 per cent and 0.03 per cent, respectively). Additionally, horses, and mules and asses used for non-agricultural purposes have been reported for the first time for the entire time series, leading to an increase in estimated emissions from enteric fermentation. The ERT commends the Party for the improvements made to the completeness of the emission estimates.

Manure management – $CH_4$ and $N_2O$

78. Switzerland used a tier 2 methodology for estimating $CH_4$ emissions from manure management for all animal species, in line with the IPCC good practice guidance. For the methane conversion factor (MCF) for deep litter, the IPCC good practice guidance suggests a value of 39 per cent. However, it was stated in the NIR that the use of such a value would lead to a large overestimation of $CH_4$ emissions from deep litter manure management systems in Switzerland. Instead, the MCF from the Revised 1996 IPCC Guidelines (10 per cent) was used and it was explained in the NIR that the choice of that MCF for deep litter is supported by a number of studies and is representative of country-specific manure management conditions. In response to questions raised by the ERT during the review regarding the studies that support the chosen MCF, Switzerland provided the studies, which document estimates of $CH_4$ emissions from different manure management systems. In addition, Switzerland stated that this change led to recalculations of $CH_4$ emissions from manure management using the MCF of 10 per cent for livestock in deep litter manure management systems and the tier 2 method from the Revised 1996 IPCC Guidelines since the 2008 annual submission made in submitted in October 2010. The ERT noted that the use of an MCF that is lower than the one suggested by the IPCC good practice guidance had been agreed upon by the previous ERT in the previous review reports. The ERT recommends that Switzerland include the detailed references provided to the ERT during the review for the choice of the MCF of 10 per cent in the NIR of its next annual submission.

79. For the calculation of $N_2O$ emissions from manure management, Switzerland used a country-specific method which is consistent with the IPCC good practice guidance, with IPCC default EFs, but AD adjusted to the particular situation of the country. The ERT noted from the NIR that ammonium losses to the atmosphere were calculated using the Swiss ammonium emission model AGRAMMON. The input data for the AGRAMMON model for the period 1990–1995 are based mainly on expert judgement and literature studies, whereas the data for the period 2002–2007 are based on the results of extensive farm surveys. The values for the period 1996–2001 have been interpolated linearly (which is conservative), while the values for 2008 onwards have been kept constant until the results of the latest farm survey become available. As stated by the Party, the results from the newly conducted survey will be included in the next annual submission.

80. In response to questions raised by the ERT during the review on whether any survey is planned to improve the data used for estimating $N_2O$ emissions from manure management or to reduce the uncertainty, Switzerland informed the ERT that the estimates for the period 1990–1995 are based on the best available data and on the questionnaires used for the farm surveys carried out in 2002 and 2007. A general uncertainty analysis has been conducted and is included in chapter 1.7 on the general uncertainty evaluation of the NIR. Switzerland indicated that a sensitivity analysis is currently being conducted and is expected to facilitate the drawing of further conclusions on uncertainties. In 2010, another farm survey was conducted on a representative number of approximately 3,000 farms. Although information from this latest survey has not been used, the Party stated that it will be validated by an additional survey conducted by SFSO of the most important parameters on 17,000 farms. Switzerland also explained that information on the aforementioned survey will be included in its next annual submission. In addition, the Party stated that regular

surveys are planned for the future, which will be conducted approximately every five years. The ERT commends Switzerland for the efforts made to improve and update the relevant data and recommends that the Party report the estimates using the results of the new surveys in the NIR of its next annual submission.

Agricultural soil emissions – $N_2O$

81. For the calculation of $N_2O$ emissions from agricultural soils, Switzerland used a country-specific method (the IULIA model), which is a method derived from the default IPCC tier 1b method and uses the IPCC default EFs. The ERT considers Switzerland's approach to be consistent with the IPCC good practice guidance.

82. The ERT noted that the country-specific method (using the IULIA model), which was updated using new parameters derived from the Swiss ammonium model AGRAMMON resulted in considerable differences of emissions (lower) compared to the emissions calculated using the IPCC method. In response to a question raised by the ERT during the review for the reasons behind these differences, Switzerland elaborated on the differences, which are also stated in the NIR, and informed the ERT that a comparison was made between the IPCC and the national IULIA methods in 2000, and provided the ERT with the respective excerpt from the study published in 2000.[7] In addition, Switzerland explained to the ERT that, since then, the model has been further developed, but a comprehensive comparison such as that conducted in 2000 has not been made since. Accordingly, Switzerland mentioned in its response to the ERT that it will improve the transparency of the NIR with regard to the explanation of the differences. The ERT considered the explanation provided by the Party to be satisfactory and encourages Switzerland to improve the transparency of the explanation of the differences and improve the summary of the above-cited reference in the NIR of its next annual submission, given that it contains useful and informative figures.

### 3. Non-key categories

Field burning of agricultural residues – $CH_4$ and $N_2O$

83. Emissions from field burning of agricultural residues occur as a result of the open burning of branches on agricultural land and in forests. Switzerland used the IPCC default method to calculate the emission estimates for this category (i.e. by multiplying the annual estimate of branches burned by the EFs).

84. The ERT noted that the Party used a constant AD value (70,000 t wood) for the entire time series in the 2012 annual submission. In response to questions raised by the ERT during the review, Switzerland informed the ERT that agricultural and forestry practices are often carried out by farmers who own or maintain the forests near their fields. Branches from both fruit plantations and the edges of the forests are collected and burned in piles. The burning of crop residues does not occur in Switzerland. In response to a further question raised by the ERT during the review, Switzerland explained that there are no recorded data or other statistical data available on the burning of agricultural residues in the country; therefore, the reported data are based entirely on expert judgement. Over the last decade, the local authorities have tended to prohibit open burning, while, on the other hand, there are indications of an increase in the burning of whole plantations in the case of tree diseases. As a result of these two opposing tendencies, the AD have been kept constant up to now.

[7] Schmid M, Neftel A and Fuhrer J. 2000. *Lachgasemissionen aus der Schweizer Landwirtschaft. Schriftenreihe der FAL 33. Zürich-Reckenholz*.

85. Switzerland also explained that, since the resulting $CO_2$ emissions are biogenic and the precursor emissions are considered to be negligible, the improvement of these AD has had a rather low priority in the past. Furthermore, Switzerland is following the on-going burning and survey study being conducted in Germany. As soon as the results of this study become available, Switzerland will try to derive a country-specific survey model. In its response to a question raised by the ERT during the review, Switzerland stated that only the burning of agricultural plant residues on fields should be reported under field burning of agricultural residues, whereas the burning of collected agricultural and forestry residues outside fields should be reported under the waste sector. The ERT recommends that Switzerland allocate and report in this category emissions from on-site burning of plant residues, whereas the emissions from residues that are removed and burned off-site should be reported elsewhere (e.g. under the energy or waste sectors), as appropriate. The ERT also recommends that Switzerland report emissions from burning of whole trees under the category field burning of agricultural residues. However, if Switzerland decides to reallocate these emissions, it should document and report them elsewhere in the CRF tables, in order to avoid a potential underestimation of emissions. Furthermore, the ERT encourages Switzerland to collect relevant data that could increase the accuracy of the emission estimates for this category.

## E. Land use, land-use change and forestry

### 1. Sector overview

86. In 2010, net removals from the LULUCF sector amounted to 880.40 Gg $CO_2$ eq. Since 1990, net removals have decreased by 77.1 per cent. The key driver for the fall in removals is the reduction in the sink capacity of forest land remaining forest land due to increased harvests since the mid-1990s. The emissions and removals are quite variable throughout the time series. Net emissions were reported for the period 2000–2002, following which the sector became a sink, with a sharp increase in removals in 2003. The removals fluctuate during the period 2004–2010. Forest land has the largest share of land area in the LULUCF sector and is responsible for significant fluctuations in emissions and removals over the time series, even though the forest area has remained stable throughout the period 1990–2010.

87. Within the sector, 2,149.85 Gg $CO_2$ eq net removals were from forest land, followed by 456.76 Gg $CO_2$ eq net emissions from cropland, 336.03 Gg $CO_2$ eq net emissions from grassland and 327.51 Gg $CO_2$ eq net emissions from settlements. Other land accounted for 121.89 Gg $CO_2$ eq net emissions and wetlands accounted for 27.26 Gg $CO_2$ eq net emissions. Forest land is the largest and only sink category. Net emissions and removals from other (harvested wood products) are reported as "NE".

88. Switzerland has made recalculations for the LULUCF sector between its 2011 and 2012 annual submissions for the entire time series due to changes in the AD (the AD change every year as the coverage of the AREA land-use database expands) and modifications of equation 7.1, following a recommendation made in the previous review report. The modification of equation 7.1 of the NIR used to calculate the carbon stock changes in living biomass led to the recalculation of $CO_2$ emissions from land converted to forest land. The recalculations affected all categories in the LULUCF sector, resulting in an increase in net emissions from 88.56 Gg $CO_2$ eq for 2009, as reported in the 2011 annual submission, to net removals of 1,098.81 Gg $CO_2$ eq for 2009, as reported in the 2012 annual submission (a change of 1,140.8 per cent), and an increase in net removals for 1990 from 2,725.00 Gg $CO_2$ eq to 3,847.37 Gg $CO_2$ eq (41.2 per cent). The major recalculations were made in the following categories:

(a) The carbon stock changes in living biomass for forest land owing to changes in AD and the modification of equation 7.1 (see para. 93 below);

(b) The net carbon stock changes in organic soils for forest land and for both organic and mineral soils for land converted to forest land following the recommendation made in the previous review reports.

89. The inventory for the LULUCF sector is transparent and complete in terms of years, gases and categories. Switzerland uses the AREA land-use statistical database and the National Forestry Inventory of 1985, 1995, and 2006 to report the AD, EFs and carbon stocks. The Party uses two systems for the area data: AREA and ASCH. The AREA database is a new and more precise system but does not yet cover the whole country; at the time of the preparation of the previous annual submission, its coverage was 59 per cent, while at the time of the compilation of the 2012 annual submission, its coverage was 72 per cent. The Party reports emissions and removals for the complete territory but it uses the AREA database for 72 per cent of the territory and extrapolates for the rest of the territory using the ASCH database. This approach is in line with the IPCC good practice guidance for LULUCF. The coverage of land area in the AREA database is expanding every year, with an anticipated deadline for full coverage of the Swiss territory in 2013. Therefore, the area data used by Switzerland need to be changed every year until the Party's entire land area is covered, which leads to corresponding recalculations every year. The ERT recommends that the Party finalize the studies on the full coverage of the territory as planned, and report the carbon stock changes calculated using the AREA database for the entire territory of Switzerland in its 2014 annual submission.

90. The Party has reported the carbon stock changes in mineral soils in forest land remaining forest land as "NO", assuming that carbon stock changes do not occur in mineral soils in this category. Switzerland has addressed all of the recommendations made in previous review reports in relation to the LULUCF sector. The QA/QC procedures applied to the AD are performed by SFSO and related agencies. The LULUCF sector was reviewed by the Johann Heinrich von Thünen-Institut in Germany in 2010.

### 2. Key categories

Forest land remaining forest land – $CO_2$

91. The AD and parameters used by Switzerland for this category are transparently documented in the NIR. The data have been derived from the National Forest Inventory, which is prepared every 10 years. The estimation methods used to calculate the carbon stock changes are in line with the IPCC good practice guidance for LULUCF and are mostly based on country-specific data and approaches based on scientific references (e.g. data on the stratification of forests). However, some of the assumptions used still require further justification; for example, by providing the references to published literature (e.g. the assumptions concerning the carbon stock changes in unproductive forests and the average growing stock of these forests can be supported by literature instead of being based on expert judgement). The ERT encourages Switzerland to provide references to support the assumptions used in the calculation of the carbon stock changes in its next annual submission and to incorporate additional information on the scientific justification for the basic assumptions used for this category.

92. In the previous review report, the ERT recommended that the Party estimate the emissions from organic soils in forest land, considering that there may be drained organic soils in the country (see para. 88 above). Even though the drainage of organic soils has been prohibited by law in Switzerland by regulation since 1991, the Party concluded that drainage might have occurred before the law came into effect and decided to report emissions from organic soils on forest land in its 2012 annual submission. Switzerland

assumed that all forest land with organic soils was subject to drainage and applied an IPCC default EF (0.66 Mg C/ha), as there were no available data on the drainage of forest land. The ERT commends Switzerland for this improvement.

Land converted to forest land – $CO_2$

93. The AD and parameters used by Switzerland for this category are transparently documented in the NIR. For this category, the Party has used a similar method for forest stratification as that it used for the category forest land remaining forest land. The data have been derived from the first two National Forest Inventories, as the third has not yet assessed land converted to forest land. The estimation methods used by Switzerland to calculate the carbon stock changes are in line with the IPCC good practice guidance for LULUCF. As indicated in paragraph 88 above, Switzerland modified the equation used to the calculate carbon stock changes in living biomass. This modification is consistent with a recommendation included in the previous review report reflecting the concern of the previous ERT that the Party was underestimating the removals in biomass. The modification of the equation has affected the removal rate for land converted to forest land in the LULUCF sector by substantially increasing the removals. Switzerland has also recalculated the AD for this category owing to an increase in the land area coverage of the AREA database. As the area covered by the database increases, the estimates become more reliable. The recalculations resulting from the above-mentioned explanations caused a 25-fold increase in the estimate of net removals for 2009 (from 46.58 Gg $CO_2$ eq to 1,172.40 Gg $CO_2$ eq) for this category. In addition, Switzerland has reported emissions and removals from mineral and organic soils in its 2012 annual submission for land converted to forest land, consistent with its reporting under the Kyoto Protocol. The ERT commends the Party for these improvements.

94. In this category, grassland converted to forest land was responsible for the largest share of removals. The ERT noted that for grassland converted to forest land, the implied carbon stock change factor per area reported for gains in living biomass in the 2012 annual submission is 4.36 Mg C/ha for 2009, while before the recalculation it was 1.26 Mg C/ha. The implied carbon stock change factor per area increased more than threefold for 2009 for land converted to forest land. Before the recalculation, the IEF for gains was 1.33 Mg C/ha in 2009, but after the recalculations it changed to 4.44 Mg C/ha and is much higher than the IEFs used by Switzerland's neighbouring countries. The IEFs for the gains in living biomass for grassland converted to forest land reported for 2010 by the Party's neighbouring countries that are located on the same latitude are as follows: Austria – 1.18 Mg C/ha; and France – 1.15 Mg C/ha. The ERT recommends that, in its next annual submission Switzerland undertake further work on the methodology used for this subcategory, paying particular attention to the equation used to calculate the carbon stock changes in living biomass (NIR section 7.1.3.2, equation 7.1).

### 3. Non-key categories

Land converted to cropland – $N_2O$

95. In CRF table 5(III), Switzerland has reported the AD (the land area converted) for all land-use conversions to cropland, but has reported estimates of $N_2O$ emissions for mineral soils for conversions from forest land and grassland to cropland only. Further, the Party has reported emissions and removals in the other land-use conversions to cropland as "NO". This issue was raised in the previous review report. The ERT reiterates the recommendation in the previous review report that Switzerland report the relevant emission estimates and document the relevant methods used in its next annual submission.

# F. Waste

## 1. Sector overview

96. In 2010, emissions from the waste sector amounted to 611.55 Gg $CO_2$ eq, or 1.1 per cent of total GHG emissions. Since 1990, emissions have decreased by 38.5 per cent. The key driver for the fall in emissions is the implementation of waste legislation which prohibits the landfilling of municipal solid waste and enforces recycling and/or thermal treatment with energy recovery as mandatory. The sectoral emission trends are transparently explained in the NIR. Within the sector, 41.7 per cent of the emissions were from wastewater handling, followed by 32.4 per cent from solid waste disposal on land, 19.5 per cent from other (waste) (i.e. composting and digesting) and 6.4 per cent from waste incineration.

97. Switzerland has made recalculations for the waste sector between its 2011 and 2012 annual submissions following changes and improvements in the AD and EFs for wastewater handling, waste incineration and the category other (waste) for the entire time series. The impact of these recalculations on the waste sector is an increase in emissions of 0.5 per cent for 1990 and a decrease in emissions of 1.1 per cent for 2009. The main recalculation took place in waste incineration: owing to the revision of the quantities of illegal waste incinerated and the EFs for $CO_2$, $CH_4$ and $N_2O$ emissions from waste incineration (a decrease in emissions of 18.07 Gg $CO_2$ eq, or 31.8 per cent).

98. The inventory for the waste sector is transparent and complete in terms of gases, categories, geographical coverage and years. The ERT noted that some of the recommendations in the previous review report have been implemented, specifically those related to the inclusion of estimates for the amount of $CH_4$ recovered in SWDS and the use of the country-specific protein consumption rate. However, some other recommendations in the previous review report that could improve the transparency of the inventory are still pending and are reiterated in the category-specific paragraphs below (see paras. 104 and 105 below).

99. Switzerland has reported information on the general tier 1 and category-specific tier 2 QC activities performed, which include the cross-checking and verification of the AD and parameters used in the first order decay (FOD) model, the verification of time-series consistency, and the comparison of the results of the current annual submission with those of the previous annual submission. An expert peer review (QA) of the waste sector was commissioned in 2009, according to the Party's QA/QC plan. Improvements are planned for waste incineration, where the shares of fossil and biogenic carbon in illegally incinerated waste will be revised, and for the category other (waste), for which the AD for backyard composting will be improved. The ERT noted that Switzerland has reported high uncertainty estimates for the AD used for solid waste disposal on land, and for the EF used for $N_2O$ emissions from wastewater handling, which are estimated to be 58.0 per cent and 50.0 per cent, respectively. The ERT encourages Switzerland to explore the possibility of reducing the uncertainty of the AD and EFs, and to provide additional information on the rationale and expert judgement used in estimating these uncertainty values in its next annual submission.

## 2. Key categories

Solid waste disposal on land – $CH_4$

100. Switzerland used the IPCC FOD method with a combination of default and country-specific parameters for estimating $CH_4$ emissions from SWDS. All waste disposal sites in the country are categorized as managed according to the IPCC classification and further

divided into three different categories according to the type of waste which is landfilled (i.e. municipal solid waste, construction waste and sewage sludge).

101. The information on the methods, EFs and AD used is presented in the NIR and in the CRF tables and is generally transparent and complete. The NIR provides useful information on waste management practices and waste streams, but without information on imports and exports of different types of waste. The ERT recommends that Switzerland, in its next annual submission, update the information provided on waste streams according to the types of waste treatment, include data on imports and exports of waste and provide information on the amount of waste reported under other sectors, such as the energy or agriculture sectors, if such allocations occur.

102. The ERT acknowledged that Switzerland provided information on $CH_4$ recovery and additional information on the parameters used in the FOD method in CRF table 6.A for the entire time series, as recommended in the previous review reports. The ERT commends Switzerland for this improvement in the completeness of the information provided in CRF table 6.A.

Wastewater handling – $N_2O$

103. For estimating $N_2O$ emissions from domestic and commercial wastewater handling, Switzerland used the IPCC default method, which is based on annual protein consumption per capita. The ERT acknowledged that, based on the recommendations from the previous review report, Switzerland recalculated the entire time series using country-specific AD on annual protein consumption provided by the Swiss Farmers' Union, instead of using constant values for the entire time series, which is in line with the Revised 1996 IPCC Guidelines. The ERT encourages Switzerland to provide, in the NIR of its next annual submission, information on the consistency of the country-specific AD on annual protein consumption with data from the statistical database of the Food and Agriculture Organization of the United Nations.

Other (waste) – $CH_4$

104. $CH_4$ emissions from car shredding, composting and digesting of organic waste is a key category according to the Party's trend assessment. The key driver for the 345.8 per cent increase in emissions from these activities during the period 1990–2010 is the change in waste management practices, whereby the organic component of waste has been prohibited to be disposed of on land. Switzerland applied a country-specific emission estimation method, with EFs for the different types of waste treatment, which remain constant throughout the entire time series. The ERT reiterates the recommendation in the previous review report that Switzerland report emission estimates for each subcategory separately under the category "other" (waste) in the NIR, in order to improve the transparency of the reporting.

### 3. Non-key categories

Wastewater handling – $CH_4$

105. A country-specific method was used to estimate $CH_4$ emissions from industrial and domestic/commercial wastewater handling, which is in line with the Revised 1996 IPCC Guidelines and the IPCC good practice guidance. The ERT reiterates the recommendation in the previous review report that Switzerland, in the NIR of its next annual submission, describe in further detail the method used to derive the country-specific EF values since they are not sufficiently documented in the NIR and in the CRF tables, and provide additional information on industrial wastewater streams, even though they are mixed and treated with domestic and commercial wastewaters, in CRF table 6.B.

106. The ERT noted that for the estimation of $CH_4$ emissions from wastewater handling, Switzerland has applied an incorrect EF for sewage gas upgrading that is part of the treatment process, which was 20 times higher than the correct EF (19,945 kg/TJ instead of 997 kg/TJ) and therefore led to the overestimation of the corresponding emissions. The ERT recommends that Switzerland apply the correct EF (997 kg/TJ) for the calculation of $CH_4$ emissions from sewage gas upgrading in its next annual submission, in order to improve the accuracy of the emission estimates.

Waste incineration – $CO_2$, $CH_4$ and $N_2O$

107. Emissions from waste incineration with energy recovery were reported under the energy sector in line with the Revised 1996 IPCC Guidelines and the IPCC good practice guidance. Emissions from the incineration of hospital waste, illegal waste and cable insulation materials and from cremation were reported in this category. The EFs used for the estimation of the emissions are country-specific, based on measurements, experts' estimates and the EFs from the EMEP/CORINAIR (European Monitoring and Evaluation Programme/core inventory of air emissions) *Emission Inventory Guidebook*.[8] Since 2002, the total amount of hospital waste has been incinerated in the municipal waste incineration plants with energy recovery, since all hospital incinerators have been closed.

## G. Other sectors

108. The ERT noted that Switzerland reported emissions of $CO_2$, $CH_4$ and $N_2O$, carbon monoxide, nitrogen oxides, NMVOCs and sulphur dioxide from fire-damaged estates and fire-damaged motor vehicles under the sector other (sector 7). The methodology used by the Party has been described in chapters 5 and 9 of the NIR. The ERT noted that $CH_4$ and $N_2O$ emissions have been estimated for those categories for the first time in the 2012 annual submission, following the encouragement in the previous review report. The ERT commends Switzerland for its continuous efforts to develop emission estimates for this sector for its annual submission.

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

### 1. Information on activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol

Overview

109. Switzerland has reported information on activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol in line with the requirements outlined in paragraphs 5–9 of the annex to decision 15/CMP.1. Switzerland has reported emissions and removals from afforestation and reforestation, and deforestation under Article 3, paragraph 3, of the Kyoto Protocol and from forest management as the only elected activity under Article 3, paragraph 4, of the Kyoto Protocol for 2008–2010. Switzerland chose annual accounting for activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol. The reporting is complete in terms of pools and categories. However, the ERT noted that, although not mandatory, $N_2O$ emissions from drainage of soils in forest management have been reported as "NE", together with an explanation that it should not be assumed that drainage of soils in forest management is a net source of emissions. The AREA land-use statistical database is used, as for the reporting of the LULUCF sector.

[8] European Environment Agency, 2007.

110. Emissions from wildfires are reported under forest management, but under afforestation and reforestation, and deforestation they are reported as "NO". The ERT noted that Switzerland has reported for the first time in its 2012 annual submission the carbon stock changes in litter for afforestation and reforestation activities for lands harvested since the beginning of the commitment period, but has reported this pool as "NO" under forest management and for lands not harvested since the beginning of the commitment period. This issue was also identified in the previous review report. The ERT commends Switzerland for the improvement made and strongly recommends that the Party provide estimates of the emissions and removals from litter under forest management in its next annual submission. The Party has reported emissions from liming and biomass burning for afforestation and reforestation activities and from liming for forest management activities as "NO", but has reported emissions from biomass burning for forest management activities.

111. The Party has provided information to demonstrate that all pools reported as "NO" are not net sources of emissions. However, the Party's explanations for using the notation key "NO" are not supported by scientific literature but mostly by expert judgement. The carbon stock changes in mineral soils are assumed to remain constant and are therefore reported as "NO". The carbon stock changes in the dead wood pool for afforestation and reforestation are also reported as "NO". The ERT encourages the Party to provide scientific justification for the categories and pools reported as "NO". The Party merges above- and below-ground biomass under above-ground biomass for afforestation and reforestation, deforestation and forest management activities. The ERT encourages Switzerland to report these two pools separately in its next annual submission.

112. Switzerland has made recalculations for the KP-LULUCF activities between its 2011 and 2012 annual submissions following changes in the land area data (as the area covered by the AREA database increased) and in response to the recommendations in the previous review reports. The impact of these recalculations on each KP-LULUCF activity for 2009 is as follows:

(a) The estimate of net $CO_2$ removals from afforestation and reforestation activities increased by 4.8 per cent due to changes in the land area data;

(b) The estimate of net $CO_2$ emissions from deforestation activities decreased by 7.7 per cent due to changes in the land area data;

(c) The estimate of net $CO_2$ removals from forest management decreased by 2.6 per cent due to changes in the land area data.

113. Switzerland has also started to report $CO_2$ emissions from organic soils in forest land for entire time series, following the recommendation made in the previous review report (previously, this pool was reported as zero ("0")). The land area subject to forest management and the area of forest land remaining forest land are different and this issue was raised in the previous review report. Although the reason for the difference has been explained in the NIR, the ERT is of the view that the explanation provided is not sufficiently transparent. The ERT recommends that Switzerland provide a table in the NIR showing the relationship between the areas of forest land reported under the Convention and those reported under Article 3, paragraphs 3 and 4, of the Kyoto Protocol.

114. The description of the uncertainty assessment for the KP-LULUCF activities is transparent and complete. An overall uncertainty of 36.0 per cent was calculated for afforestation, followed by 50.0 per cent for deforestation and 36.0 per cent for forest management activities. Country-specific values were used for the uncertainty estimates based on scientific references. The ERT noted that Switzerland did not include information in the NIR on how the uncertainty assessments have been affected by the exclusion of

naturally regenerating forest land from afforestation land, as was encouraged in the previous review report. The ERT reiterates the encouragement in the previous review report that Switzerland provide this information in its next annual submission.

Activities under Article 3, paragraph 3, of the Kyoto Protocol

*Afforestation and reforestation – $CO_2$*

115. The methodologies and AD used to report this activity are in line with the IPCC good practice guidance for LULUCF. The ERT noted that the estimate of removals from afforestation and reforestation activities reported under the Kyoto Protocol did not change in parallel with the modification of equation 7.1 of the NIR used to calculate the carbon stock changes in living biomass in the LULUCF sector (see para. 88 above). The ERT also noted that Switzerland explained, in section 11.3.1.1 of the NIR, the difference between the reporting under the Convention and under the Kyoto Protocol for forest land remaining forest land, land converted to forest land and forest management under Article 3, paragraph 4, of the Kyoto Protocol. The reason for using different equations for the calculation of the carbon stock changes in living biomass for forest land remaining forest land and land converted to forest land and for forest management is that under forest management, only land-use changes within the activity (between CC12-productive forest and CC13-unproductive forest) are reported using a stock change method, but for land converted to forest land all land uses converted to forest land are reported. The ERT recommends that Switzerland also explain the linkage between the reporting of land converted to forest land under the Convention and afforestation and reforestation activities under Article 3, paragraph 3, of the Kyoto Protocol, in terms of the AD and methodology used for the emission/removal calculations, in its next annual submission.

116. The methodology used to calculate biomass gains for afforestation and reforestation is different from the methodology used for the land converted to forest land category. The biomass gains are much larger in land converted to forest land. The ERT concludes that the methodologies used for these KP-LULUCF activities should be approximately the same as those used for the biomass growth calculations for the land converted to forest land category, otherwise the reporting under the Convention and the Kyoto Protocol will not be consistent (see para. 111 above). The ERT recommends that the Party improve the methodologies used in order to enhance the consistency of the reporting under the Convention and under the Kyoto Protocol in its next annual submission.

117. The ERT noted that country-specific data have been appropriately used in the application of the higher-tier estimation methods. However, the litter and dead wood pools have been reported as "NO". The Party has explained the reasons for reporting these pools as "NO" in the NIR (section 11.3.1.1). The assumption of zero emissions is based on the observation that afforestation sites should have more litter and dead wood compared to initial land uses. The ERT concludes that the explanation provided by the Party is acceptable.

118. The ERT also noted that the recommendation in the previous review report concerning the reporting of $CO_2$ emissions from drainage of forested wetlands has been addressed by Switzerland, which made a conservative assumption that all organic soils were drained because data on land drained prior to 1990 were not available.

*Deforestation – $CO_2$*

119. Switzerland has continued to use the AREA database to determine the land areas subject to deforestation (see para. 89 above).

120. In the previous review report, the ERT recommended that Switzerland provide further explanations of the definitions (i.e. non-permanent forest) and of the methods used to identify the areas under deforestation activities. In its 2012 annual submission, Switzerland has provided information on the distinction of areas between harvesting and deforestation, but has not provided any additional information on how it deals with permanent (i.e. roads) or temporary (i.e. pipelines) harvestings in terms of deforestation. The ERT encourages Switzerland to further explain, in the NIR of its next annual submission, its definition of deforestation activity, taking the above-mentioned points into account.

Activities under Article 3, paragraph 4, of the Kyoto Protocol

*Forest management – $CO_2$ and $N_2O$*

121. The ERT noted that for forest management Switzerland has reported the carbon stock changes in above- and below-ground biomass together under the carbon stock changes in above-ground biomass. Switzerland has also reported the carbon stock changes in dead wood and organic soils, while the carbon stock changes in litter and mineral soils have been reported as "NO". The reporting of the carbon stock changes in mineral soils as "NO" was raised by the ERT in the previous review report. The Party provided a section in the NIR of the 2012 annual submission (section 7.3.6) to support the assumption of zero emissions. The ERT notes that there exists a significant amount of literature on the effects of forest management activities on the rate of decomposition of the litter layer. The Party explained this issue in the section of the NIR (section 7.3.8) on planned improvements and confirmed that it will be able to start reporting this pool in its next annual submission. The ERT strongly recommends that Switzerland improve the method used for calculating the carbon stock changes for certain activities under forest management, such as harvesting, where the decomposition rate can accelerate $CO_2$ emissions.

122. In the previous review report, the ERT recommended that the Party change the notation key "NO" to "NE" for $N_2O$ emissions from drainage of soils under forest management. The reason for this recommendation was the possible occurrence of drainage in mineral and organic soils prior to the introduction of the Swiss Forest Act. The ERT noted that the notation key used to report $N_2O$ emissions from drainage of soils has been changed from "NO" to "NE", but no AD were collected to report this activity. The ERT encourages Switzerland to provide information justifying the use of the notation key "NE" or to report $N_2O$ emissions from drainage of soils under forest management in its next annual submission.

## 2. Information on Kyoto Protocol units

Standard electronic format and reports from the national registry

123. Switzerland 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 included in the SIAR on the SEF tables and the SEF comparison report.[9] The SIAR was forwarded to the ERT prior to the review, pursuant to decision 16/CP.10. The ERT reiterated the main findings contained in the SIAR.

124. Information on the accounting of Kyoto Protocol units has been prepared and reported in accordance with decision 15/CMP.1, annex, chapter I.E, and reported in accordance with decision 14/CMP.1 using the SEF tables. This information is consistent

[9] 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.

with that contained in the national registry and with the records of the international transaction log (ITL) and the clean development mechanism registry and meets the requirements referred to in decision 22/CMP.1, annex, paragraph 88(a–j). 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 discrepancy has been identified by the ITL and no non-replacement has occurred. The national registry has adequate procedures in place to minimize discrepancies.

Accounting of activities under Article 3, paragraph 3, of the Kyoto Protocol and any elected activities under Article 3, paragraph 4, of the Kyoto Protocol

125. Switzerland has reported information on its accounting of KP-LULUCF in the accounting table, as included in the annex to decision 6/CMP.3. Information on the accounting of KP-LULUCF has been prepared and reported in accordance with decisions 16/CMP.1 and 6/CMP.3.

126. Table 6 shows the accounting quantities for KP-LULUCF as reported by Switzerland and the final values after the review.

Table 6
**Accounting quantities for activities under Article 3, paragraph 3, and, if any, activities under Article 3, paragraph 4, of the Kyoto Protocol, in t $CO_2$ eq**

| | *2012 submission*[a] | | | *2010 and 2011 submissions*[b] | *"Net" accounting quantity*[c] |
|---|---|---|---|---|---|
| | *As reported* | *Revised estimates* | *Final* | *Final* | |
| Afforestation and reforestation | –56 699 | | –56 699 | –32 113 | –24 586 |
| Deforestation | 659 046 | | 659 046 | 514 888 | 144 158 |
| Forest management | –2 644 366 | | –2 644 366 | –1 833 870 | –810 496 |
| Article 3.3 offset[d] | 0 | | 0 | 0 | 0 |
| Forest management cap[e] | –9 166 667 | | –9 166 667 | –9 166 667 | 0 |
| Cropland management | NA | | NA | NA | NA |
| Grazing land management | NA | | NA | NA | NA |
| Revegetation | NA | | NA | NA | NA |

*Abbreviation*: NA = not applicable.

[a] The values included under the 2012 submission are the cumulative accounting values for 2008, 2009 and 2010 as reported in the accounting table of the KP-LULUCF CRF tables for the inventory year 2010.

[b] The values included under the 2010 and 2011 submissions are the final accounting values as a result of the 2010 and 2011 reviews and are included in table 4 of the 2011 annual review report (FCCC/ARR/2011/CHE, page 33) in the column "Final" under "2011 annual submission".

[c] The "net accounting quantity" is the quantity of Kyoto Protocol units that the Party shall issue or cancel under each activity under Article 3, paragraph 3, and paragraph 4, if relevant, based on the final accounting quantity in the 2011 submission and where the quantities issued or cancelled based on the 2010 review have been subtracted ("net accounting quantity" = final 2012 – final 2010 and 2011).

[d] "Article 3.3 offset": for the first commitment period, a Party included in Annex I to the Convention that incurs a net source of emissions under the provisions of Article 3, paragraph 3, of the Kyoto Protocol may account for anthropogenic greenhouse gas (GHG) emissions by sources and removals by sinks in areas under forest management under Article 3, paragraph 4, up to a level that is equal to the net source of emissions under the provisions of

Article 3, paragraph 3, but not greater than 9.0 Mt carbon times five, if the total anthropogenic GHG emissions by sources and removals by sinks in the managed forest since 1990 is equal to, or larger than, the net source of emissions incurred under Article 3, paragraph 3.

[e] In accordance with decision 16/CMP.1, annex, paragraph 11, for the first commitment period only, additions to and subtractions from the assigned amount of a Party resulting from forest management under Article 3, paragraph 4, of the Kyoto Protocol after the application of decision 16/CMP.1, annex, paragraph 10, and resulting from forest management project activities undertaken under Article 6, shall not exceed the value inscribed in the appendix of the annex to decision 16/CMP.1, times five.

127. Based on the information provided in table 6 for the activity afforestation/reforestation, Switzerland shall issue 24,586 removal units (RMUs) in its national registry.

128. Based on the information provided in table 6 for the activity deforestation, Switzerland shall cancel 144,158 assigned amount units, emission reduction units, certified emission reduction units and/or RMUs in its national registry.

129. Based on the information provided in table 6 for the activity forest management, Switzerland shall issue 810,496 RMUs in its national registry.

National registry

130. 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 continues to adhere to 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.

Calculation of the commitment period reserve

131. Switzerland has reported its commitment period reserve in its 2012 annual submission. Switzerland reported that its commitment period reserve has not changed since the initial report review (218,554,562 t $CO_2$ eq), as it is based on the assigned amount and not on the most recently reviewed inventory. The ERT agrees with this figure.

### 3. Changes to the national system

132. Switzerland reported that there have been changes to its national system since the previous annual submission. The Party described the changes in its NIR. The name and contact information of the national inventory compiler have changed and a new name and contact address has been provided in the NIR (chapter 13, page 385). There have been some changes in the formal cooperation arrangements within the national system, including new agreements with SFSO for land-use area surveys for the LULUCF sector, with SFOE for energy statistics, with the Federal Office of Civil Aviation for aviation emissions, with FOEN on air pollution control and with the non-ionizing radiation division of the EMIS inventory database and archive, including emissions from the energy, industrial processes (without F-gases), solvent and other product use and waste sectors and the key category analysis. The duration of these agreements is open-ended. The ERT concluded that Switzerland's national system continues to be in accordance with the requirements of national systems outlined in decision 19/CMP.1.

### 4. Changes to the national registry

133. Switzerland reported that there have been changes to its national registry since the previous annual submission. The Party described the changes in its NIR, including a change to the name and contact details of the registry administrator designated by Switzerland. The changes in the conformance to technical standards are related to the Seringas software upgrade from version 4.2 to 5.3, which significantly increased the operational and user security of the registry. As a result of this software upgrade, the general terms and conditions for registry users were amended. The changes to the security measures followed the recommendation contained in the 2011 SIAR (part II), and since 2011 Switzerland has implemented, on a voluntary basis, the two-person rule (additional authorized representative), which became mandatory for all accounts in the Swiss national registry on 1 April 2012. With the installation of a new release of the registry software, together with several other security improvements, the two-factor authentication by smsTAN was also implemented and became mandatory on 1 October 2012. The ERT concluded that, taking into account the confirmed changes to the national registry, Switzerland'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, and continues to adhere to 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).

### 5. Minimization of adverse impacts in accordance with Article 3, paragraph 14, of the Kyoto Protocol

134. Switzerland reported that there have been no changes in its reporting of the minimization of adverse impacts in accordance with Article 3, paragraph 14, of the Kyoto Protocol since the previous annual submission. In response to recommendations made in the previous review report, Switzerland expanded its reported information on the minimization of adverse impacts to include fiscal incentives, tax and duty exemptions and in order to describe its national circumstances in more detail. The ERT concluded that, taking into account the expanded information included in the NIR, the information provided is complete and transparent.

135. Switzerland reported that its policies and measures are both compatible and consistent with those of the European Union in order to avoid trade distortion and non-tariff barriers to trade and in order to set similar incentives. All major draft laws in Switzerland are accompanied by impact assessments, including, inter alia, an evaluation of trade-related issues. In accordance with international law, this approach aims to ensure that Switzerland is implementing the climate change response measures that are least trade-distortive and do not create unnecessary barriers to trade. Switzerland consistently notifies the World Trade Organization of all proposed non-tariff measures with a potential impact on trade, where specific concerns can be raised by other Parties. Moreover, Switzerland is one of the most important donors in the area of Aid for Trade. The technical assistance provided by the State Secretariat for Economic Affairs for trade promotion amounted to 42 million Swiss francs for 2010, which is a non-reimbursable grant contribution.

# III. Conclusions and recommendations

## A. Conclusions

136. Switzerland made its annual submission on 12 April 2012. The annual submission contains the GHG inventory (comprising the CRF tables and an NIR) and supplementary information under Article 7, paragraph 1, of the Kyoto Protocol (information on: activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol, Kyoto Protocol units, changes to the national system and the national registry, and the minimization of adverse impacts in

accordance with Article 3, paragraph 14, of the Kyoto Protocol). This is in line with decision 15/CMP.1.

137. The ERT concludes that the inventory submission of Switzerland has been prepared and reported in accordance with the UNFCCC reporting guidelines. The inventory submission is complete and Switzerland has submitted a complete set of CRF tables for the years 1990–2010 and an NIR; these are complete in terms of geographical coverage, years, gases, sectors and categories. $N_2O$ emissions from natural gas use for road transportation and $N_2O$ emissions from flaring associated with oil refining were reported as "NO", even though such emissions do occur in Switzerland. In response to the list of potential problems and further questions raised by the ERT during the review week, Switzerland provided the missing estimates of $N_2O$ emissions on 1 November 2012, which the ERT agreed with. The ERT also noted that the Party reported fugitive $CO_2$ and $CH_4$ emissions from oil transport as "NO". $N_2O$ and $CH_4$ emissions from drainage of soils under forest land and of wetlands were reported as "NE" with an explanation that there are no relevant data available.

138. The submission of information required under Article 7, paragraph 1, of the Kyoto Protocol has been prepared and reported in accordance with decision 15/CMP.1.

139. Switzerland's inventory is generally in line with the Revised 1996 IPCC Guidelines, the IPCC good practice guidance and the IPCC good practice guidance for LULUCF. The ERT noted that there remains some room for further improvement to make the inventory more transparent and in line with the Revised 1996 IPCC Guidelines, the IPCC good practice guidance and the IPCC good practice guidance for LULUCF. The following recommendations in the preview review report have not yet been addressed by the Party: reporting the fuels included under the category "other" (feedstocks and non-energy use of fuels) in a disaggregated way in CRF table 1.A(d); reviewing and, if necessary, revising the method used for estimating $CO_2$ emissions from brick and tile production in the industrial processes sector and the explanation thereof; and reporting separately $CH_4$ emissions for each subcategory under the category "other" (waste) in the NIR.

140. Switzerland has made recalculations for the inventory between its 2011 and 2012 annual submissions in response to the recommendations in the previous review report and following improvements in the AD, EFs and methodologies used. The recalculations were performed for the entire time series. The impact of these recalculations on the national totals is a decrease in emissions of 0.1 per cent for 1990 and an increase in emissions of 1.0 per cent for 2009. The main recalculations took place across all sectors in the following categories:

(a) $CO_2$ emissions from public electricity and heat production, due to revised data on the mix of fossil and non-fossil matter in municipal solid waste combusted for electricity generation;

(b) $CO_2$ emissions from manufacturing industries and construction, due to a revision of the country-specific $CO_2$ EFs for bituminous coal, brown coal and petroleum coke;

(c) $CO_2$ emissions from cement production, owing to the use of new AD for 2009 based on official production data instead of previously interpolated values;

(d) $N_2O$ emissions from agricultural soils, owing to updates of the time series of animal populations using data from the Swiss Farmers' Union;

(e) $CO_2$ emissions from land converted to forest land, due to the modification of the equation used to calculate the carbon stock changes in living biomass;

(f) $CO_2$, $CH_4$ and $N_2O$ emissions from waste incineration, due to a revision of the quantities of illegal waste incinerated and the corresponding EFs.

141. Switzerland has reported information on the KP-LULUCF activities in accordance with the requirements outlined in paragraphs 5–9 of the annex to decision 15/CMP.1. The reporting is complete in terms of pools and activities. Emissions from drainage of forest land have been reported as "NE" with an explanation that it should not be assumed that drainage of forest land is a net source. Switzerland has reported emissions and removals from afforestation and reforestation, and deforestation under Article 3, paragraph 3, of the Kyoto Protocol and emissions and removals from forest management as the only elected activity under Article 3, paragraph 4, of the Kyoto Protocol for 2008–2010. Switzerland chose annual accounting for activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol.

142. Switzerland has made recalculations for the KP-LULUCF activities between its 2011 and 2012 annual submissions in response to the recommendations in the previous review report and due to the updates of the AREA database. The impact of these recalculations on each KP-LULUCF activity for 2009 is as follows:

(a) The estimate of net $CO_2$ removals from afforestation and reforestation activities increased by 4.8 per cent due to changes in the land area data;

(b) The estimate of net $CO_2$ emissions from deforestation activities decreased by 7.7 per cent due to changes in the land area data;

(c) The estimate of net $CO_2$ removals from forest management decreased by 2.6 per cent due to changes in the land area data.

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

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

145. 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 continues to adhere to the technical standards for data exchange between registry systems in accordance with relevant decisions of the CMP.

146. Switzerland has reported information under decision 15/CMP.1, annex, chapter I.H, "Minimization of adverse impacts in accordance with Article 3, paragraph 14", as part of its 2012 annual submission. The Party reported that there have been no changes in its reporting of the minimization of adverse impacts since the previous annual submission. Switzerland reported that it has expanded its reported information on the minimization of adverse impacts to include fiscal incentives, tax and duty exemptions and in order to describe its national circumstances in more detail. The ERT concluded that, taking into account the expanded information included in the NIR, the information provided is complete and transparent.

## B. Recommendations

147. The ERT identifies issues for improvement as listed in table 7 below. All recommendations are to be implemented for the next annual submission to the extent possible, unless otherwise specified.

Table 7
**Recommendations identified by the expert review team**

| *Sector* | *Category* | *Recommendation* | *Paragraph reference* |
|---|---|---|---|
| General | Completeness | Continue to include estimates of $N_2O$ emissions from natural gas combustion in road transportation and $N_2O$ emissions from flaring associated with oil production | 10 |
| | | Provide verifiable information to support the assertion that there are no $CO_2$ or $CH_4$ emissions from oil transport in the country or estimate the emissions from this category | 10 |
| | Recalculations and time-series consistency | Explain fully any recalculations made for all categories | 24 |
| | Transparency | Improve the transparency of the reporting in the NIR on the methodologies, data sources, assumptions and emission factors | 28 |
| Energy | General | Include more background information on and justification for the use of country-specific EFs when these factors deviate significantly from the IPCC default values for the key categories | 40 |
| | Reference and sectoral approaches | Reconcile the differences between the approaches and report correct figures | 43 |
| | Feedstocks and non-energy use of fuels | Report fuels included in the category "other" in a disaggregated way in CRF table 1.A(d) | 46 |
| | Stationary combustion: solid fuels – $CO_2$ | Provide detailed justifications for updates to EFs in the NIR | 47 |
| | Road transportation: gaseous fuels – $N_2O$ | Continue to include estimates of $N_2O$ emissions from natural gas combustion in road transportation | 50 |
| | Oil and natural gas: oil – $CO_2$, $CH_4$ and $N_2O$ | Provide verifiable information to support the assertion that there are no $CO_2$ or $CH_4$ emissions from oil transport, or estimate the emissions from this category | 51 |
| | | Continue to include estimates of $N_2O$ emissions from flaring associated with oil production | 53 |
| | Oil and natural gas: natural gas – $CO_2$ and $CH_4$ | Calculate separately and report relevant emission estimates under this category for the period 1990–1994 | 54 |
| Industrial processes and solvent and other product use | Cement production – $CO_2$ | Include information on the EFs used to estimate $CO_2$ emissions from cement production in the NIR | 61 |
| | Lime production – $CO_2$ | Include more transparent information on lime production in the NIR | 63 |
| | Limestone and dolomite use – $CO_2$ | Implement the plan to perform a recalculation for the entire time series for the next annual submission based on the information from the Swiss Association of Brick and Tile Manufacturers | 65 |

| *Sector* | *Category* | *Recommendation* | *Paragraph reference* |
|---|---|---|---|
| | Nitric acid production – $N_2O$ | Implement category-specific QC checks for the plant data | 66 |
| | Carbide production – $CO_2$ | Continue to improve the quality of the data in order to ensure time-series consistency | 68 |
| | Solvent and other product use – $N_2O$ | Make efforts to collect data/information to verify the emission estimates for the recent years of the time series and make recalculations, if necessary; and provide sufficient information on the methods, data and assumptions used in the NIR | 69 |
| Agriculture | Manure management – $CH_4$ and $N_2O$ | Include a documented justification and the references provided to the ERT for the choice of the methane conversion factor of 10 per cent in the NIR | 78 |
| | | Report the estimates using the results of the new surveys in the NIR | 80 |
| | Agricultural soil emissions – $N_2O$ | Improve the transparency of the explanation of the differences in the emissions calculated using the new model and the IPCC method and include, in the NIR, a summary of the study by Schmid et al. | 82 |
| | Field burning of agricultural residues – $CH_4$ and $N_2O$ | Appropriately allocate and report in this category emissions from on-site burning of plant residues, and report the emissions from residues that are removed and burned off-site elsewhere (e.g. under the energy or waste sectors), as appropriate; And report emissions from burning of whole plantations under the category field burning of agricultural residues | 85 |
| Land use, land-use change and forestry | General | Finalize the studies on the full coverage of the territory as planned and report the carbon stock changes calculated using the AREA database for the entire territory of Switzerland in the 2014 annual submission | 89 |
| | Land converted to forest land – $CO_2$ | Undertake further work on the methodology used for this category, paying particular attention to the equation used to calculate the carbon stock changes in living biomass (NIR section 7.1.3.2, equation 7.1) | 94 |
| | Land converted to cropland – $N_2O$ | Report emission estimates and document the relevant estimation methods used in the next annual submission | 95 |
| Waste | Solid waste disposal on land – $CH_4$ | Update the information on waste streams according to the types of waste treatment, include data on imports and exports of waste and provide information on the amount of waste reported under other sectors | 101 |
| | Other (waste) – $CH_4$ | Report emission estimates for each subcategory under the category “other” (waste) separately in the NIR | 104 |
| | Wastewater handling – $CH_4$ | Describe in the NIR in further detail the method used to derive the country-specific EF and provide additional information in CRF table 6.B on industrial wastewater streams | 105 |
| | | Apply the correct EF (997 kg/TJ) for the calculation | 106 |

| *Sector* | *Category* | *Recommendation* | *Paragraph reference* |
|---|---|---|---|
| | | of $CH_4$ emissions from sewage gas upgrading | |
| Supplementary information required under Article 7, paragraph 1 of the Kyoto Protocol | Overview | Provide estimates of emissions and removals from litter for forest management activity | 110 |
| | | Provide a table in the NIR showing the relationship between the areas of forest land reported under the Convention and those reported under Article 3, paragraphs 3 and 4, of the Kyoto Protocol | 113 |
| | Afforestation and reforestation – $CO_2$ | Explain the linkage between the reporting of land converted to forest land under the Convention and afforestation and reforestation activities under Article 3, paragraph 3, of the Kyoto Protocol, in terms of the AD and methodology used for the emission/removal calculations | 115 |
| | | Improve the methodologies in order to ensure the consistency of the reporting under the Convention and under the Kyoto Protocol | 116 |
| | Forest management – $CO_2$ and $N_2O$ | Improve the method used for calculating the carbon stock changes for certain activities under forest management, such as harvesting, where the decomposition rate can accelerate $CO_2$ emissions | 121 |

*Abbreviations*: AD = activity data, CRF = common reporting format, EF = emission factor, IPCC = Intergovernmental Panel on Climate Change, NIR = national inventory report, QC = quality control.

# IV. Questions of implementation

148. 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. *2006 IPCC Guidelines for National Greenhouse Gas Inventories*. Available at <http://www.ipcc-nggip.iges.or.jp/public/2006gl/index.html>.

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 Switzerland 2012.
Available at <http://unfccc.int/resource/docs/2012/asr/che.pdf>.

Synthesis and assessment report on the greenhouse gas inventories submitted in 2012. Available at <http://unfccc.int/resource/webdocs/sai/2012.pdf>.

FCCC/ARR/2011/CHE. Report of the individual review of the annual submission of Switzerland submitted in 2011. Available at <http://unfccc.int/resource/docs/2012/arr/che.pdf>.

UNFCCC. *Standard independent assessment report*, parts I and II. Available at <http://unfccc.int/kyoto_protocol/registry_systems/independent_assessment_reports/items/4061.php>.

## B. Additional information provided by the Party

Responses to questions during the review were received from Ms. Regine Röthlisberger (Federal Office for the Environment), including additional material on the methodologies and assumptions used. The following documents[1] were also provided by Switzerland:

B. Amon, Th. Amon, J. Boxberger and Ch. Alt, 2001. *Emissions of $NH_3$, $N_2O$ and $CH_4$ from dairy cows housed in a farmyard manure tying stall (housing, manure storage, manure spreading)*. Institute of Agricultural, Environmental and Energy Engineering, University of Agricultural Sciences, Nussdorfer, Austria. Available at <http://www.prairieswine.com/pdf/2966.pdf>.

D.R. Kulling, Fridda Dohme, H. Menzi, F. Sutter, P. Lischer and M. Kreuzer, 2002. *Methane emissions of differently fed dairy cows and corresponding method and nitrogen emissions from their mature during storage.* Environmental Monitoring and Assessment.

H.B. Moeller, S.G. Sommer and B.K. Ahring, 2004. *Biological degradation and greenhouse gas emissions during pre-storage of liquid animal manure.* J Environ Qual. Available at <http://www.ncbi.nlm.nih.gov/pubmed/14964355>.

D.R. Kulling, H. Menzi, F. Sutter, P. Lischer and M. Kreuzer, 2003. *Ammonia, nitrous oxide and methane emissions from differently stored dairy manure derived from grass- and hay-based rations.* Nutrient Cycling in Agroecosystems. Available at <http://link.springer.com/article/10.1023%2FA%3A1021857122265?LI=true>.

K. Hindrichsen, H.-R. Wettstein, A. Machmuller, M. Kreuzer, 2005. *Methane emission, nutrient degradation and nitrogen turnover in dairy cows and their slurry at different milk production scenarios with and without concentrate supplementation*. Swiss Federal Institute of Technology Zurich, Institute of Animal Science, Animal Nutrition, Zurich, Switzerland. Available at <http://www.sciencedirect.com/science/article/pii/S016788090500441X>.

Kyu-Hyun Park, A.G. Thompson, M. Marinier, K. Clark, C. Wagner-Riddle, 2006. *Greenhouse gas emissions from stored liquid swine manure in a cold climate*. Atmospheric environment. Available at <http://www.prairieswine.com/pdf/3145.pdf>.

M. Schmid, A. Neftel, J. Fuhrer, 2000. *Lachgasemissionen aus der Schweizer Landwirtschaft. Schriftenreihe der FAL 33. Zürich-Reckenholz*. Available at <http://www.environment-switzerland.ch/climatereporting/00545/01913/index.html?lang=en>.

S.G. Sommer, S.O. Petersen, P. Soerensen, H.D. Poulsen, H.B. Moeller, 2007. *Methane and carbon dioxide emissions and nitrogen turnover during liquid manure storage*. Nutrient Cycling in Agroecosystems. Available at <http://link.springer.com/article/10.1007%2Fs10705-006-9072-4?LI=true>.

FOEN, Climate division, 2011. $CO_2$-Emissionsfaktoren des Schweizerischen Treinhausgasinventars.

BAFU, 2011. *Bestimmung des Anteils biogener und fossiler $CO_2$ emissionen aus Schweizer KVAs.*

FOEN, Climate division, 2012. Description of the Quality Management System. Supplement to Switzerland's Greenhouse Gas Inventory 1990–2010.

[1] Reproduced as received from the Party.

FOEN, Climate division, 2012. Comparison of energy data from the IEA energy statistics and the UNFCCC reference approach.

# Annex II

## Acronyms and abbreviations

| | |
|---|---|
| AD | activity data |
| $CH_4$ | methane |
| CKD | cement kiln dust |
| 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 |
| F-gases | fluorinated gases |
| 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 |
| GJ | gigajoule (1 GJ = 109 joules) |
| HFCs | hydrofluorocarbons |
| IEF | implied emission factor |
| IPCC | Intergovernmental Panel on Climate Change |
| ITL | international transaction log |
| kg | kilogram (1 kg = 1,000 grams) |
| KP-LULUCF | land use, land-use change and forestry emissions and removals from activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol |
| LULUCF | land use, land-use change and forestry |
| MCF | methane conversion factor |
| Mg | megagram (1 Mg = 1 tonne) |
| Mt | million tonnes |
| $N_2O$ | nitrous oxide |
| NA | not applicable |
| NE | not estimated |
| NIR | national inventory report |
| NMVOC | non-methane volatile organic compound |
| NO | not occurring |
| PFCs | perfluorocarbons |
| QA/QC | quality assurance/quality control |
| RMU | removal unit |
| SEF | standard electronic format |
| $SF_6$ | sulphur hexafluoride |
| SIAR | standard independent assessment report |
| SWDS | solid waste disposal site |
| TJ | terajoule (1 TJ = $10^{12}$ joule) |
| UNFCCC | United Nations Framework Convention on Climate Change |