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25 June 2003

**REPORT OF THE INDIVIDUAL REVIEW OF THE GREENHOUSE GAS INVENTORY  
OF BULGARIA SUBMITTED IN THE YEAR 2001<sup>1</sup>**

**Desk review**

**I. OVERVIEW**

**A. Introduction**

1. The Conference of the Parties (COP), at its fifth session, by its decision 6/CP.5, adopted guidelines for the technical review of greenhouse gas (GHG) inventories from Parties included in Annex I to the Convention, hereinafter referred to as the review guidelines,<sup>2</sup> for a trial period covering the GHG inventory submissions for the years 2000 and 2001. The COP requested the secretariat to conduct individual reviews of GHG inventories for a limited number of Annex I Parties on a voluntary basis. In so doing, the secretariat was requested to use different approaches to individual reviews by coordinating desk reviews, centralized reviews and in-country reviews.

2. In response to the mandate by the COP, the secretariat coordinated a desk review of five national GHG inventories (Bulgaria, France, Iceland, Latvia and Switzerland) submitted in 2001, which took place from 19 November to 14 December 2001. The review was carried out by a team of nominated experts from the roster of experts. The members of the team were: Mr. Jose Ramon Villarin (Philippines), Mr. Arthur Rypinski (United States of America), Professor Anthony Adegbulugbe (Nigeria), Mr. Domenico Gaudio (Italy), Ms. Nadzeya Zaleuskaya (Belarus), Dr. Lorna Brown (United Kingdom), Ms. Punsalma Batima (Mongolia), Mr. Rizaldi Boer (Indonesia), Mr. Josef Mindas (Slovakia), and Mr. Charles Jubb (Australia). The review was coordinated by Ms. Astrid Olsson (UNFCCC secretariat). Professor Anthony Adegbulugbe and Mr. Charles Jubb were lead authors of this report.

3. The principle objective of the review of the GHG inventories is to ensure that the Conference of the Parties has adequate information on the inventories. The review should also further assess the progress of the Parties towards fulfilling the requirement outlined in the UNFCCC reporting guidelines<sup>3</sup> on annual inventories (FCCC/CP/1999/7). In this context, the review team checked the responses of the Parties to questions raised in the previous stages of the review process and the consistency of the inventory submissions with the UNFCCC reporting

<sup>1</sup> In the symbol for this document, 2001 refers to the year in which the inventory was submitted, and not the year of publication. The number (1) indicates that this is a desk review report.

<sup>2</sup> Document FCCC/CP/1999/7; in particular the UNFCCC review guidelines (pages 109 to 114), and decision 6/CP.5 (pages 121 to 122).

<sup>3</sup> 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 (FCCC/CP/1999/7), are referred to in this report as the UNFCCC reporting guidelines.

guidelines and the Revised 1996 IPCC Guidelines (hereinafter referred to as the IPCC Guidelines), and identified possible areas of improvement in the inventories of the five Annex I Parties. Each inventory expert reviewed the information submitted for specific IPCC sectors and each sector was reviewed by two experts, with the exception of the general material and waste sectors which have been reviewed by one expert only.

4. The ERT also considered and commented upon the extent to which the reporting fulfilled the requirements included in the IPCC Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories (hereinafter referred to as the IPCC good practice guidance).<sup>4</sup>

5. In accordance with the UNFCCC review guidelines, a draft version of this report was communicated to the Government of Bulgaria, which provided comments that were considered and incorporated, as appropriate, in this final version of the report.

### **B. Inventory submission and other sources of information**

6. Bulgaria submitted its national inventory report (NIR) and the common reporting format (CRF) tables for 1999 on 19 April 2001. Both are available in hard copy and electronic format. Detailed CRF tables were provided only for 1999.

7. The materials used for the review were the NIR, Bulgaria's CRF submission for 1999, the status report 2001, the preliminary key source analysis<sup>5</sup> and the draft synthesis and assessment (S&A) 2001 report prepared by the secretariat.

8. Other sources of information used during the review include the preliminary guidance for experts participating in the individual review of GHG inventories, the UNFCCC reporting guidelines and the review guidelines.

### **C. Emission profiles, trends and key sources**

9. The assessment of trends was only possible in CRF table 10 and chapter 2 of the NIR. Bulgaria did not submit CRF tables for the years 1988 and 1990 to 1998. In respect of GHGs, some inconsistencies were observed between tables 2.1 and 2.4 in the NIR. Table 2.4 is consistent with CRF table 10. Bulgaria, in its response to the draft review report informed that table 2.1 includes data prior to the recalculations made in the 1998 inventory.

10. The trend tables show that Bulgaria's total carbon dioxide (CO<sub>2</sub>) equivalent emissions in 1999 decreased by 50.5% relative to the base year 1988. In terms of gases, decreases in CO<sub>2</sub> are largely responsible for this downward trend, while in terms of sectors, the energy sector mostly accounts for this falling trend.

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<sup>4</sup> According to the conclusions of Subsidiary Body for Scientific and Technological Advice (SBSTA) at its twelfth session, the IPCC good practice guidance should be applied by Annex I Parties as far as possible for inventories due in 2001 and 2002, and should be used for inventories due from 2003. Annex I Parties with economies in transition may phase in the IPCC good practice guidance two years later than other Annex I Parties.

<sup>5</sup> The UNFCCC had identified, for each individual Party, those source categories which are *key sources* in terms of their absolute level of emissions, applying the tier 1 level assessment as described in the IPCC good practice guidance. Key sources according to the tier 1 trend assessment were also identified for those Parties providing a full CRF for the year 1990. The key sources presented in this report are based on the secretariat's preliminary key sources assessment. They might differ from the key sources identified by the Party itself.

11. Bulgaria's main emissions are CO<sub>2</sub>, contributing 62.3% of total emissions (without CO<sub>2</sub> from land-use change and forestry (LUCF)) in 1999, a decrease from 66.1% in 1988. Nitrous oxide (N<sub>2</sub>O) emissions increased as a proportion of total emissions: from 16.1% in 1988 to 24.4% 1999. Emissions of methane (CH<sub>4</sub>) decreased from 17.8% to 13.1% over the same period. Hydrofluorocarbon (HFC) and perfluorocarbon (PFC) emissions contribute around 0.2% of emissions in 1999. Emissions for the years 1988 and 1990 to 1997 are shown as zero. Sulphur hexafluoride (SF<sub>6</sub>) emissions are reported as zero for the whole period. Bulgaria's emission trends are summarized by GHG and by sector in tables 1 and 2 below.

**Table 1. GHG emissions by gas, 1990–1999 (Gg CO<sub>2</sub> equivalent)**

GHG	Base year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
		<b>CO<sub>2</sub> equivalent (Gg)</b>									
CO <sub>2</sub> emissions (without LUCF) <sup>(a)</sup>	103,856	84,136	66,043	59,183	61,859	59,178	62,332	66,825	58,742	52,277	48,440
CH <sub>4</sub>	28,009	29,602	28,420	26,188	23,550	17,178	18,641	17,383	14,775	13,739	10,149
N <sub>2</sub> O	25,225	23,964	21,217	18,339	16,675	16,230	17,110	17,686	16,295	14,698	18,961
HFCs	0	0	0	0	0	0	0	0	0	577	103
PFCs	0	0	0	0	0	0	0	0	0	69	44
SF <sub>6</sub>	0	0	0	0	0	0	0	0	0	0	0
Total (with net CO <sub>2</sub> emissions/removals)	152,433	131,901	107,800	96,074	95,063	85,612	90,562	94,704	83,959	75,127	71,089
Total (without CO <sub>2</sub> from LUCF) <sup>(a)</sup>	157,090	137,701	115,679	103,710	102,084	92,586	98,083	101,894	89,811	81,360	77,697

<sup>(a)</sup> LUCF: land-use change and forestry

**Table 2. GHG emissions by sector, 1990–1999 (Gg CO<sub>2</sub> equivalent)**

GHG SOURCE AND SINK CATEGORIES	Base year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
		<b>CO<sub>2</sub> equivalent (Gg)</b>									
1. Energy	105,832	85,911	68,987	62,492	64,918	61,291	64,349	69,978	60,499	54,843	49,754
2. Industrial processes	10,841	9,656	6,548	5,489	5,369	6,348	7,722	7,645	6,874	5,436	4,859
3. Solvent and other product use	0	0	0	0	0	0	0	0	0	0	0
4. Agriculture	23,514	23,186	21,083	17,744	15,427	14,375	14,463	13,869	13,711	13,285	18,032
5. Land-use change and forestry <sup>(a)</sup>	-4,657	-5,801	-7,880	-7,636	-7,022	-6,974	-7,520	-7,190	-5,852	-6,233	-6,608
6. Waste	16,903	18,948	19,062	17,984	16,370	10,572	11,549	10,402	8,727	7,798	5,052
7. Other	0	0	0	0	0	0	0	0	0	0	0

<sup>(a)</sup> LUCF: land-use change and forestry

12. The preliminary key source analysis prepared by the UNFCCC secretariat shows CO<sub>2</sub> stationary combustion – coal (35.2%), direct N<sub>2</sub>O emissions from agricultural soils (16.9%) and CO<sub>2</sub> stationary combustion – oil (7.3%) as the most significant key sources (see table 3 below).

**Table 3. Key sources Bulgaria 1999: Level assessment (UNFCCC secretariat)<sup>(a)</sup>**

<b>Key source</b>	<b>Gas</b>	<b>Level assessment</b>	<b>Cumulative total</b>
Stationary combustion: coal	CO <sub>2</sub>	35.2%	35%
Direct N <sub>2</sub> O emissions from agricultural soils	N <sub>2</sub> O	16.9%	52%
Stationary combustion: oil	CO <sub>2</sub>	7.3%	59%
Stationary combustion: gas	CO <sub>2</sub>	6.9%	66%
Mobile combustion: road vehicles	CO <sub>2</sub>	6.9%	73%
Solid waste disposal sites	CH <sub>4</sub>	5.3%	78%
Non-CO <sub>2</sub> stationary combustion: coal	N <sub>2</sub> O	2.8%	81%
Enteric fermentation in domestic livestock	CH <sub>4</sub>	2.2%	83%
Iron and steel industry	CO <sub>2</sub>	2.1%	86%
Fugitive emissions: oil and gas operations	CH <sub>4</sub>	2.0%	88%
Indirect N <sub>2</sub> O emissions from nitrogen used in agriculture	N <sub>2</sub> O	1.6%	89%
Fugitive emissions: coal mining and handling	CH <sub>4</sub>	1.5%	91%
Cement production	CO <sub>2</sub>	1.3%	92%
Waste-water handling	CH <sub>4</sub>	1.0%	93%
Animal production	N <sub>2</sub> O	1.0%	94%
Nitric acid production	N <sub>2</sub> O	0.9%	95%

<sup>(a)</sup> See footnote (5) to this report.

13. A key sources assessment performed by Bulgaria following tier 1 of the IPCC good practice guidance, for both level and trend assessment, is reproduced in table 4 below. The Party's key source analysis differs from that produced by the UNFCCC secretariat: for example, in the ranking given to CO<sub>2</sub> from mobile combustion and CH<sub>4</sub> from solid waste disposal sites. In its analysis Bulgaria does not include as key sources CH<sub>4</sub> from waste-water handling, N<sub>2</sub>O from animal production and N<sub>2</sub>O from nitric acid production. The reason for the differences is the country's use of a different aggregation of sources.

**Table 4. Bulgaria's key source analysis for 1999 (from the NIR)**

IPCC source categories	Direct GHG	Current year estimate (Gg)	Level assessment	Commutative total
Stationary combustion: coal	CO <sub>2</sub>	27,302	0.35	0.35
Direct N <sub>2</sub> O emissions from agricultural soils	N <sub>2</sub> O	13,897	0.18	0.53
Mobile combustion	CO <sub>2</sub>	6,212	0.08	0.61
Emissions from stationary combustion: oil	CO <sub>2</sub>	5,670	0.07	0.68
Emissions from stationary combustion: gas	CO <sub>2</sub>	5,329	0.07	0.75
Emissions from solid waste disposal sites	CH <sub>4</sub>	4,110	0.05	0.81
Non-CO <sub>2</sub> emissions from stationary combustion	N <sub>2</sub> O	2,412	0.03	0.84
Emissions from other industrial processes	CO <sub>2</sub>	2,348	0.03	0.87
Emissions from enteric fermentation in domestic livestock	CH <sub>4</sub>	1,742	0.02	0.89
Fugitive emissions from oil and gas operations	CH <sub>4</sub>	1,529	0.02	0.91
Indirect N <sub>2</sub> O emissions from agricultural soils	N <sub>2</sub> O	1,237	0.02	0.92
Fugitive emissions from coal mining and handling	CH <sub>4</sub>	1,176	0.02	0.94
Emissions from cement production	CO <sub>2</sub>	1,018	0.01	0.95

#### **D. General assessment of the inventory**

##### **1. Completeness of reporting and conformity with the UNFCCC reporting guidelines**

###### Completeness of CRF

14. Except for CRF tables 2(II).F and 5.B, 5.C and 5.D, Bulgaria's CRF submission is largely complete for the year 1999. As already stated above, CRF tables for the base year 1988 and the years 1990 to 1998 are missing.

###### Completeness and transparency of NIR

15. The NIR does give some information on the methodology applied in compiling Bulgaria's GHG inventory. The energy sector is more extensively addressed compared to the other sectors.

###### Conformity with the IPCC Guidelines and the IPCC good practice guidance

16. It is clear from the NIR that Bulgaria applies the IPCC Guidelines for its inventory calculations. The preliminary uncertainty calculations and key source assessment also take into account the IPCC good practice guidance.

##### **2. Cross-cutting issues**

###### Institutional arrangements

17. Even if institutional issues are more appropriately addressed during in-country visits, it is noted in the introductory section to the NIR that Bulgaria's initial inventories (at least for the years 1988 to 1994) were compiled through a country study project. Subsequent inventories were then made possible through the submission of its national communications and as part of its National Climate Change Action Plan.

### Verification and quality assurance/quality control (QA/QC) approaches

18. QA/QC issues are discussed briefly in chapter 3 of the NIR, in which it is stated that data were double checked for consistency using parallel estimates from different streams of information. Attempts were also made to apply CORINAIR and IPCC good practice guidance methods to ensure QA/QC of the inventory information. While differences between the two are cited, it is not clear if one or the other method is preferred or is more appropriate for Bulgaria's purposes. In its response to the draft review report the Party explained that the IPCC good practice guidance is preferred.

### Recalculations and changes in relation to previous years

19. Recalculations were done for 1998 mainly as a result of removing the double-counting of CO<sub>2</sub>, CH<sub>4</sub>, and N<sub>2</sub>O emissions from autogeneration. These changes resulted in a decrease in 1998 total emissions (without LUCF) of about 3.5%. It is not clear whether the removal of double-counting from autogeneration is true only of 1998 emissions or if it applies also for 1999. The expert review team (ERT) recommends that Bulgaria take this into account and recalculate emissions for the years 1988 and 1990 to 1997. Bulgaria explained in its response to the draft of this report that double-counting was eliminated for both the years 1998 and 1999.

### Uncertainties

20. Bulgaria did some initial quantification of uncertainty using the IPCC good practice guidance tier 1 methodology for two fuel categories, namely brown coal and lignite. The NIR mentions that uncertainty estimates for all source categories will be calculated in subsequent inventories. In CRF table 7 Bulgaria provides qualitative uncertainty estimates for the various source categories.

## **3. Issues related to previous reviews**

21. Not applicable.

## **4. Areas for further improvement**

### Issues identified by the Party

22. The Party identified problems encountered by the inventory team. These include lack of financial resources, inadequate capacity, low-level participation in international meetings and data availability. There are, however, no indications about areas for further improvement.

23. The Party stated in its NIR that it would need the support of international organizations and Annex II Parties insofar as methodological and financial assistance and capacity building. As stated in the conclusion of the NIR, Bulgaria did incorporate some of the more recent methodologies in its 1999 inventory. Data quality has improved because of the Party's adoption of Eurostat standards and the use of country-specific methodologies.

### Issues identified by the ERT

24. The ERT suggests that completion of CRF tables for the years 1988 and 1990 to 1998 be undertaken in order to improve the assessment of trends and thus address the large year-to-year variations in emission levels. It likewise recommends that Bulgaria continue what it has begun in applying the sound methodologies of the IPCC good practice guidance.

## II. ENERGY

### A. Sector overview

25. In the base year 1988, Bulgaria's total GHG emissions from the energy sector were estimated to be 105,832 Gg of CO<sub>2</sub> equivalent, representing about 67.5% of total GHG emissions in that year. By 1999, GHG emissions from that sector had decreased by about 53%, to 49,754 Gg CO<sub>2</sub> equivalent, corresponding to about 64% of total emissions. CO<sub>2</sub> emissions constitute by far the largest share of GHG emissions in this sector; in 1999 CO<sub>2</sub> accounted for 89.5% of emissions, CH<sub>4</sub> for 5.6%, and N<sub>2</sub>O for 4.9%.

26. There are differences between the key sources identified in the NIR and those identified by the secretariat, mainly because the Bulgarian analysis used a more aggregated definition of sources. Seven of the sixteen key sources identified in the NIR are in the energy sector, and account for about 63% of total emissions in 1999.

#### 1. Completeness

27. The CRF summary table 3 identifies sources that are not estimated, namely those associated with CO<sub>2</sub> from burning coal and waste piles, and fugitive N<sub>2</sub>O and CO<sub>2</sub> associated with oil and gas production. Given that there is no agreed methodology for estimating these excluded sources, and that they are likely to be very small (i.e. < 0.05%), it could be said that the coverage of the inventory is functionally complete.

#### 2. Transparency

28. Sources of some of the data and assumptions used are documented in the NIR; however, the information provided does not sufficiently and satisfactorily back up the data in the CRF and the methodologies employed.

29. The NIR could benefit from a more detailed discussion of data availability, sources and processing procedures.

#### 3. Methodologies, emission factors and activity data

30. Methodologies used are consistent with the IPCC Guidelines. Predominantly, the emission factors employed are the IPCC default values. In the specific case of the coal subsector, the NIR states that the emission factors used are based on tests and measurements of coal used in the country.

31. Activity data source is mainly the National Statistical Institute (NSI). Other sources include the Road Control Department (KAT) and the Ministry of Internal Affairs.

#### 4. Recalculations

32. Recalculated estimates are given in CRF table 8(a) for 1998. The overall effect of the recalculation is a reduction of about 3.8% in total CO<sub>2</sub> equivalent emissions. The changes are due mainly to the previous double-counting of autogeneration in the manufacturing industries and construction categories in the energy sector. The effects of this on manufacturing industries and construction are reductions of 21% in CO<sub>2</sub>, 37% in CH<sub>4</sub>, and 33% in N<sub>2</sub>O emissions.

## **5. Uncertainty estimates**

33. The NIR provides quantitative estimates for only two fuel types, brown coal and lignite, using tier 1 methodology of the IPCC good practice guidance. However, qualitative uncertainty estimates are included in CRF table 7.

34. The estimates of uncertainty reported for coal and lignite are 0.43% and 0.09%, respectively. The figure for brown coal compares favourably with the example given in the IPCC good practice guidance (appendix 6A.2) for coal from the United Kingdom.

## **6. Verification and QA/QC approaches**

35. The NIR reported that data are double-checked by using parallel estimates to indicate possible inconsistencies in activity data input. There are no descriptions of how data were obtained to generate the split in fuel consumption in the end-use subsectors (i.e. whether surveys are employed or the frequency of such surveys). It is therefore uncertain which QC procedures were established for the surveys that produced the energy statistics. Similarly, no mention is made of emission monitoring to verify the different emission estimates. The ERT recommends that Bulgaria provide more information on data collection in future submissions. Bulgaria provided a description of the data collection and the split of fuels to end-users, in its response to the draft of this report. The ERT recommends that Bulgaria provide this information in future inventory submissions.

### **B. Conformity with the UNFCCC reporting guidelines and the IPCC Guidelines**

36. In general, the methodology used for the estimates of GHG is consistent with the IPCC Guidelines. The submission is not yet in accordance with the UNFCCC guidelines since CRF tables were included only for the year 1999. An NIR is provided.

### **C. Reference and sectoral approaches**

#### **1. Comparison between the reference and the sectoral approach**

37. The CO<sub>2</sub> emissions from fuel combustion in the energy sector were estimated using the IPCC reference and the sectoral approach.

38. CRF table 1.A(c), which compares the reference approach with the national approach for CO<sub>2</sub> emissions from fuel combustion, shows a huge difference of 31.59% in energy consumption between the two methods, yet emissions from the two approaches agree to within 0.14%. The Party needs to explain this and if necessary recalculate the figures. Investigations by the ERT show that this problem is probably due to the inherent double-counting in activity data as a result of the input of incorrect activity data for the petroleum refinery and manufacture of solid fuels in source categories 1.A.1.b and 1.A.1.c, respectively. For instance, the activity data input for petroleum refining includes input for total crude oil into the refinery rather than fuel consumed by the refining process itself. The effect of this is that the activity data are overstated while the implied emission factor (IEF) is underestimated. This same problem has been identified in the S&A 2000 report and the draft S&A 2001 report. Bulgaria, in its response to the draft of this report confirmed that data are for the whole amount of crude oil processed, but that the low emission factor reflects the actual amount of crude oil burnt during the processing. Emissions are correctly calculated. However, this approach was not used in the 2000 inventory and all previous years are recalculated.



39. The reference approach estimates and estimates based on International Energy Agency (IEA) data on energy-related CO<sub>2</sub> were found to agree within 1%. The difference in the two estimates was due mainly to minor discrepancies in coal production figures.

## **2. Treatment of feedstocks and non-energy use of fuels**

40. CRF table 1.A(d) provides estimates for carbon storage for fuels used for feedstock and non-energy use of fuel. The methodology used for this estimation is the IPCC tier 1 method of assessment of emission from fuels used for storage of carbon from fuels used as feedstock. Fraction of carbon stored for different products are given and agree more or less with the IPCC suggested coefficients, except for natural gas used as feedstock. The IPCC storage coefficient for natural gas is 33%, while 100% is assumed in the CRF. The calculated CO<sub>2</sub> stored in products is appropriately subtracted from the total emissions calculated by the reference approach. The ERT encourages Bulgaria to explain the storage coefficient for natural gas. Bulgaria explained, in its response to the draft review report that the fraction of carbon stored of 100% is adopted as the Party assumes that there are no CO<sub>2</sub> emissions from non-energy use of natural gas in the inventory year.

## **3. International bunker fuels**

41. An allocation of 76% and 90% of the total fuel consumed in the marine and aviation subsectors were assumed for international marine and aviation bunker fuels, respectively. The ERT recommends that Bulgaria explain how these percentages are derived. The reported percentage of fuel used for international marine and aviation bunk fuels are based on expert assessment of fuel consumption in domestic aviation and water transportation in 1999, as Bulgaria explained in its response to the draft of this review.

### **D. Key sources**

#### **1. Stationary combustion: coal, oil and gas – CO<sub>2</sub>**

##### Trend

42. Total CO<sub>2</sub> emissions from stationary fuel combustion decreased by 54% between 1988 and 1999. This decrease is typical for Annex I Parties going through a transition to a market economy. However, the NIR does not provide any explanations for the decrease. From CRF table 10 it can be seen that the most drastic reduction occurs in the emissions from manufacturing industries and construction, which fell by 73% between 1988 and 1999. This is followed closely by the commercial sector, which suffered a drop of 67% during the same period. On the other hand, the decrease in the energy industry was only 30% for the same period. Because disaggregated data for individual fuel types are not provided for all years, it was not possible to undertake a trend analysis for different fuels. The ERT encourages Bulgaria to include information that explains the decrease of emissions, as well as disaggregated data for the whole time series.

##### Completeness

43. The coverage is functionally complete. There are some inconsistencies between time series estimates in the NIR and CRF but it is not possible to attribute these to this key source category since CRF tables are provided only for 1999.

Methodologies

44. IPCC tier 2 methods are mostly used for this key source category, with the exception of energy industries where tier 3 was used.

Activity data

45. The NIR indicated that most activity data are from the NSI. Beyond this statement, individual activity data were not properly referenced (i.e., document numbers, publication dates etc.). There are no discussions of the integrity of the data, or of how the data were generated (i.e., whether through surveys, sampling or measurements etc.). None of the activity data are reported to be confidential. Bulgaria explained in its response to the draft review report that NSI collects the data through surveys.

Emission factors

46. Country-specific and IPCC default emission factors are used for the estimation of emissions from this key source category. The IPCC default factors are used for liquid and gaseous fuels, while country-specific values are used for coal. The source of the country-specific emission factor for coal is given as Energoproekt. It was observed that there were no significant differences between IPCC default emission factors and country-specific emission factors for anthracite, coking coal and sub bituminous coal. However, as shown below, there is a significant difference in regard to lignite.

**Table 5. Comparison of IPCC default and Bulgaria country-specific emission factors for coal**

	<b>IPCC default factor</b>	<b>Country-specific EF (t C/TJ)</b>	<b>% Deviation from IPCC default factor</b>
Anthracite	26.8	26.8	0
Coking coal	25.8	25.8	0
Other bit coal	25.8	26.2	+1.5
Sub bit coal	26.2	26.2	0
Lignite	27.6	30.7	+11.2

## 2. Fugitive emissions from oil and gas – CH<sub>4</sub>

Trend

47. Total fugitive CH<sub>4</sub> emissions from oil and gas decreased by 56.3% between 1988 and 1999 (i.e., from 3,501.3 Gg CO<sub>2</sub> equivalent in 1988 to 1,528.8 Gg CO<sub>2</sub> equivalent in 1999). The NIR does not provide any explanations for the steep drop. However, it does explain that crude oil and natural gas production in Bulgaria is very small, hence the fugitive emissions relate only to the transportation, processing and distribution of these fuels. Since overall energy consumption has decreased over the period, one would expect fugitive emissions to have decreased correspondingly.

Completeness

48. The coverage is functionally complete. Although activity data for the distribution of oil products is not included, this is generally assumed to be negligible. According to the IPCC

Guidelines, CH<sub>4</sub> emissions are not estimated for the transportation and distribution of refined products. Similarly, activity data for flaring and venting are not reported. This should not have a great impact on total emissions, given the low production of oil and gas in Bulgaria.

#### Methodologies

49. The IPCC tier 1 method production-based average emission factor approach is used.

#### Activity data

50. The NIR indicated that most activity data were obtained from the NSI. Beyond this statement, individual activity data were not properly referenced (i.e., document numbers, publication dates etc.).

#### Emission factors

51. Average values of the range of IPCC default regional emission factors for the former Union of the Soviet Socialist Republics (USSR) and Central and Eastern Europe are used for the estimation of emissions from this key source.

### **3. Fugitive emissions from solid fuels – CH<sub>4</sub>**

#### Trend

52. Total fugitive CH<sub>4</sub> emissions from solid fuels decreased by 39.1% between 1988 and 1999 (i.e., from 1,929.1 Gg CO<sub>2</sub> equivalent in 1988 to 1,176.2 Gg CO<sub>2</sub> equivalent in 1999). Overall, there is a downward trend in emissions from this source in most Annex I Parties.

53. The NIR does not provide any explanations for the steep drop. However, given that overall energy consumption has decreased over the period, one would expect fugitive emissions to have decreased correspondingly.

#### Completeness

54. The coverage is functionally complete.

#### Methodologies

55. The IPCC tier 1 global average method was used.

#### Activity data

56. The NIR indicated that most activity data were obtained from the NSI. Beyond this statement, individual activity data were not properly referenced (i.e., document numbers, publication dates etc.). Even then, the activity data reported for coal is much lower than that published by the IEA. The ERT recommends that Bulgaria check the data reported to the UNFCCC secretariat and the IEA, and explain the differences. Bulgaria in its response to the draft review report explained the discrepancy between the CRF data and IEA data as being due to a mistake in data conversion to the CRF. Correct data are included in table 1.A(b), the reference approach.

#### Emission factors

57. Average values of the range of IPCC default regional emission factors for the former USSR, Central and Eastern Europe are used for the estimation of emissions from this key source.

#### **4. Mobile combustion: road transport – CO<sub>2</sub>**

##### Trend

58. Neither the NIR nor the CRF provide any information on the trend of CO<sub>2</sub> emissions from road transport, since CRF tables only are provided for the year 1999. For 1999, CO<sub>2</sub> from road transport constitutes about 85% of total CO<sub>2</sub> emissions from mobile sources. Taking mobile sources as a proxy, CO<sub>2</sub> emissions from mobile sources decreased by 50.8% between 1988 and 1999.

##### Completeness

59. The coverage is functionally complete.

##### Methodologies

60. The IPCC tier 2 method is used for this key source. In this case, emissions relate to the volume of energy consumed by different models of vehicle and an emission factor specific to vehicle type.

##### Activity data

61. Estimates for fuel consumption were obtained from NSI, while details of each vehicle type, ownership and mileage were obtained from the statistical unit of the Road Control Department, KAT. Beyond this statement, individual activity data were not properly referenced (i.e., document numbers, publication dates etc.). There are no discussions of the integrity of the data, or how the data were generated (i.e., whether through surveys, sampling or measurements, etc).

62. A closer look at the CRF table reveals several data entry problems that need to be address and resolved. For example:

- (a) No activity data are recorded for gasoline, yet CO<sub>2</sub> emissions are given;
- (b) A large volume of fuels are reported as “Other fuels” under road transport, yet no corresponding emissions are reported;
- (c) Other fuels are not specified or discussed in either the CRF or NIR. The ERT suspects that the activity attributed to “Other fuels” could as well have been that for gasoline. The Party needs to review and amend this accordingly. Bulgaria, in its response to the draft of this report, explained that there was a mistake in the transfer of data to the CRF and provided the corrected data. The ERT encourages Bulgaria to provide these data in its next submission.

##### Emission factors

63. Emission factors employed are IPCC default values, modified by experts to take into account Bulgarian conditions. The basis or the rationale for these expert judgements or opinions is, however, not stated. Because of the data entry problem highlighted above, the IEF in table 1.A(a) for gasoline is unrealistically high (5,548.71 t/TJ). The emission factors for mobile sources reported in the NIR (table 1.1) show that gasoline and diesel vehicles emission factors are about the same. However, in CRF table 1.A(a), the IEFs vary widely (5,548.71 and reported 74.81 t CO<sub>2</sub>/TJ for gasoline and diesel vehicles, respectively). The ERT recommends that Bulgaria provide information on how the IPCC default values have been modified and the

rationale for the modification. In its response to the draft review report Bulgaria explained that the emission factors used are based on scientific studies and analytical assessments of different vehicle types. CO<sub>2</sub> emission factors do not depend on the vehicle type but are based on the carbon content of the fuel and the amount of fuels sold. Non-CO<sub>2</sub> emission factors differ between the vehicle types.

## **5. Non-CO<sub>2</sub> from stationary combustion – N<sub>2</sub>O**

### Trend

64. Neither the NIR nor the CRF provide any information on the trend of N<sub>2</sub>O emissions from solid fuel combustion, since CRF tables are provided only for year 1999.

### Completeness

65. The coverage is functionally complete.

### Methodologies

66. The IPCC tier 2 method is used for this key source.

### Activity data

67. Estimates for fuel consumption are obtained from NSI. Beyond this statement, individual activity data are not properly referenced (i.e., document numbers, publication dates etc.). There are no discussions of the integrity of the data, or of how the data were generated (i.e., whether through surveys, sampling or measurements etc).

### Emission factors

68. The NIR states that both country-specific and IPCC default emission factors are used for the estimation of emissions from this key source. The NIR further claims that Bulgaria uses country-specific emission factors for energy transformation industries while IPCC default values are used for other sectors. The country-specific emission factors are not well documented and the ERT encourages the Party to provide more information in this regard.

## **E. Non-key sources**

69. CH<sub>4</sub> emissions from stationary combustion and CH<sub>4</sub> and N<sub>2</sub>O emissions from mobile combustion are non-key sources. The draft S&A 2001 report indicates that the IEF calculated for N<sub>2</sub>O emissions from liquid fuel consumption by energy industries is one of the lowest (0.38 kg/TJ) among the reporting Parties, while on the other hand that for solid fuel in public electricity and heat production is the highest (34.0 kg/TJ). The Party has not yet addressed these matters. Bulgaria explained in its response to the draft of this report that the IEF for N<sub>2</sub>O from liquid fuel consumption in energy industries is low because crude oil is included in the combusted fuels volumes. The IEF for N<sub>2</sub>O emissions from solid fuel in public electricity and heat production is high due to the specific characteristics of local lignite coal.

## **F. Areas for further improvement**

### **1. Issues identified by the Party**

70. The Party has not provided any information on sector-specific improvements.

## **2. Issues identified by the ERT**

71. For the future submission of inventories, it is recommended that the Party note the following for further improvement:

- (a) More explanations should be given about data sources, verification and QA/QC procedures;
- (b) Although the Party has made an initial attempt to apply the principles of the IPCC good practice guidance, there is more to be done in this area, especially as regards quantification of uncertainties;
- (c) In order to improve transparency, more information should be provided in the NIR to support sufficiently the data used in the CRF tables;
- (d) More attention should be paid to values calculated for IEFs, since grossly underestimated or overestimated IEFs are possible indicators of incorrect activity data input. Source categories 1.A.1.b and 1.A.1.c are typical examples.

## **III. INDUSTRIAL PROCESSES**

### **A. Sector overview**

72. In the base year 1988, Bulgaria's total GHG emissions from the industrial processes sector were estimated to be 10,841 Gg of CO<sub>2</sub> equivalent, representing about 6.9% of total GHG emissions in that year. By 1999, GHG emissions from that sector had decreased by about 55%, to 4,859 Gg CO<sub>2</sub> equivalent, corresponding to about 6.3% of total emissions. CO<sub>2</sub> emissions constitute the largest share of GHG emissions in that sector; in 1999 CO<sub>2</sub> accounted for 80.8%, N<sub>2</sub>O for 15.1%, potential HFC emissions for 2.1%, CH<sub>4</sub> for 1.1% and actual PFC emissions for 0.9% of total emissions.

73. There are differences between the key sources identified in the NIR and those identified by the secretariat. Bulgaria's key source assessment identifies CO<sub>2</sub> emissions from other industrial processes as a key source. The secretariat's preliminary key source analysis does not identify this key source but identifies CO<sub>2</sub> emissions from the iron and steel industry and N<sub>2</sub>O emissions from nitric acid production as key sources.

### **1. Completeness**

74. The sectoral report for industrial processes is filled in with either data or notation keys. The sectoral background data tables for HFCs, PFCs and SF<sub>6</sub> are partially completed and notation keys are not used. Table 2(II).F was not filled in at all.

75. Emission trends for CO<sub>2</sub>, CH<sub>4</sub> and N<sub>2</sub>O are provided for the years 1988, and 1990 to 1999. HFC and PFC emission estimates are available only for 1998 and 1999.

### **2. Transparency**

76. The NIR states that, in general, the emission estimates from industrial processes followed the methodology given in the IPCC Guidelines. In the NIR, the Party clarifies that for all process emissions the quantities produced are obtained from NSI and its Statistical Yearbook of Bulgaria. There is no information on the activity data or emission factors used to estimate potential HFC emissions and actual PFC emissions.

77. Sources of some data and assumptions used are documented in the NIR. However, the information provided does not sufficiently and satisfactorily support the data in the CRF and the methodologies employed. The NIR could benefit from a more detailed discussion of data availability, sources and processing procedures.

### **3. Methodologies, emission factors and activity data**

78. IPCC tier 1 methodologies are used. Emission factors are IPCC default values. No information is provided on the methodology, activity data and emission factors used to estimate potential HFC emissions and actual PFC emissions. For the other source categories, activity data are from the NSI, Statistical Yearbook of Bulgaria.

### **4. Recalculations**

79. No recalculations for the industrial processes sector are reported in the CRF, in comparison to the previous submission.

### **5. Uncertainty estimates**

80. The NIR does not provide any quantitative estimate for uncertainty in the estimates. CRF table 7 contains qualitative uncertainty estimates.

### **6. Verification and QA/QC approaches**

81. The NIR reported that data are double-checked by using parallel estimates to indicate possible inconsistencies in activity data input. There are no descriptions of how data were obtained (i.e., whether surveys were employed, the frequency of such surveys, etc.). The ERT recommends that in future submissions Bulgaria provide more information in respect of data collection.

## **B. Conformity with the UNFCCC reporting guidelines and the IPCC Guidelines**

82. In general, the methodologies used for the estimates in this sector are consistent with the IPCC Guidelines. The submission is not yet in accordance with UNFCCC guidelines since CRF tables were included only for 1999. An NIR is provided.

## **C. Key sources**

### **1. Iron and steel production – CO<sub>2</sub>**

83. Emission estimates for this key source category account for 34.3% of the industrial processes emissions and 2.1% of total emissions (without LUCF) in 1999.

84. The CRF indicates that the methodology used is IPCC tier 1 and that the emission factors are IPCC default values. CO<sub>2</sub> emission estimates are reported only for steel production, although activity data are reported for pig iron, sinter and coke. The resulting IEF for steel (0.821 t/t) is about one half of the IPCC default value of 1.6 t/t for the iron and steel category. The ERT recommends that the Party consider the emission factor. In its response to the draft review report Bulgaria explained that the IEF for steel production is aggregated taking into account the different emissions from converter and electrical steel, respectively. Thus the emission factor is lower than the IPCC default value.

## **2. Cement production – CO<sub>2</sub>**

85. Emission estimates for this key source category account for 20.1% of the industrial processes emissions and 1.3% of total emissions (without LUCF) in 1999.

86. The CRF indicates that the methodology used is IPCC tier 1 and that the emission factors are IPCC default values. The CO<sub>2</sub> IEF (0.52) is a little higher than the IPCC default value (0.499) and is comparable to other countries.

87. The NIR reported that Bulgaria's clinker import and export data are confidential.

## **3. Lime production – CO<sub>2</sub>**

88. Until 1998 activity data were based on hydrated lime production. This changed in 1999, when quicklime production data are used. The IPCC default emission factor is used. There is a more than 1,000% increase in CO<sub>2</sub> emissions in the period from 1998 to 1999. The ERT recommends that Bulgaria recalculate its emissions before 1999 in order to establish a consistent time series and include the recalculated estimates in future submissions. Bulgaria explained in its response to the draft of this report that recalculations will be undertaken so as to produce a consistent time series for future submissions.

## **4. Nitric acid production**

89. Bulgaria uses the IPCC tier 1b methodology to estimate the emissions and the chosen emission factor is 6 kg/t HNO<sub>3</sub>. This factor is within the IPCC default range, but the ERT encourages the Party to provide the rationale for choosing it.

### **D. Non-key sources**

#### **1. Ammonia production**

90. Bulgaria reports using the IPCC default methodology and emission factors. The IEF for CO<sub>2</sub> 0.88 t/t is about one half of the IPCC default range (1.5-1.6 t/t) and substantially lower in comparison to other countries. Activity data reported for ammonia production in the CRF are 378 kt, considerably lower than United Nations statistics of 527 kt. Bulgaria is encouraged to check the emission factor and the activity data. In its response to the draft review report Bulgaria explained that value in the United Nations' statistics is probably from the year 1998 and that the correct value should be 378 kt based on a study of ammonia production in Bulgaria.

#### **2. Aluminium production – PFCs**

91. IPCC default methodology and emission factors are reported as being used. Actual PFC emissions are provided only for 1998 and 1999. The emissions decreased by 57% between 1998 and 1999. Since activity data are available only for 1999, it is not possible to assess the reason for the decrease in emissions.

92. CF<sub>4</sub> IEF (1.40 kg/t) is higher than the IPCC default range (0.02-1.19 t/t) and is the highest among other reporting countries.

93. C<sub>2</sub>F<sub>6</sub> IEF (100.00 kg/t) is non-comparable to the IPCC default range (0.001-0.14 kg/t) and to other reporting countries. The ERT encourages Bulgaria to check the emission factors used and explain the difference from the IPCC default values. Bulgaria explained in its response to the draft review report that the IEF for C<sub>2</sub>F<sub>6</sub> is based on the CF<sub>4</sub> emissions and not on the quantities of aluminium produced, i.e. the activity data reported are the CF<sub>4</sub> emissions. The C<sub>2</sub>F<sub>6</sub>



emissions equal 10% of the CF<sub>4</sub> emissions and thus the calculated IEF is 100 kg/t. The reported IEF equals 0.14 kg/t aluminium produced. The ERT suggests that Bulgaria reconsider the reported IEF.

### **3. Consumption of halocarbons and SF<sub>6</sub> – HFCs**

94. No information on the methodology or emission factors used is provided. Potential HFC emissions only are reported in this source category and only for 1998 and 1999. Between 1998 and 1999 HFC emissions decreased by 460% with no explanation provided.

95. Tables 2(II) and 2(II).C, E are only partially completed and notation keys are not used. Table 2(II).F is not filled in at all.

96. The ERT is aware of the difficulties in collecting activity data and obtaining emission factors for this source category. Nevertheless, it encourages Bulgaria to put some effort into estimating at least potential emissions of HFCs and PFCs and, if possible, actual emissions as well. Bulgaria should also provide information on any decrease in the emissions.

### **4. Asphalt roofing**

97. The description of the activity data is reported as not estimated (NE) but a value is provided for the activity data. No GHG emissions are reported for this source. The ERT recommends that Bulgaria provide the description of the activity data and either provide emission estimates or use the notation key NE. In its response to the draft of this report Bulgaria explained that the notation key NE was incorrectly placed in the activity data column. Instead the notation key NA should have been included in the CO<sub>2</sub> emissions column.

### **5. Solvent and other product use**

98. Only non-methane volatile organic compounds (NMVOC) emissions are reported for solvent and other product use. Notation keys are not used in the tables relating to solvent and other product use. Information on activity data is provided only for some sources. Bulgaria provided revised emission factors for the solvent and other product use sector. The revision has led to significantly lower emissions of NMVOC. The ERT encourages Bulgaria to provide the data for the full time series in its future submissions. Inclusion of emissions of CO<sub>2</sub> and N<sub>2</sub>O is also encouraged.

## **E. Areas for further improvement**

### **1. Issues identified by the Party**

99. The Party has not provided any information on sector-specific improvements.

### **2. Issues identified by the ERT**

100. For future submissions the ERT recommends that Bulgaria:

(a) Provide more information regarding the methodological choices made, data sources used and planned QA/QC procedures;

(b) Improve transparency in the reporting of HFCs, PFCs and SF<sub>6</sub> by using notation keys appropriately;

(c) Continue implementing the principles of the IPCC good practice guidance.

## IV. AGRICULTURE

### A. Sector overview

101. In the base year 1988, Bulgaria's GHG emissions from the agricultural sector were estimated to be 23,514 Gg of CO<sub>2</sub> equivalent, representing about 15% of total GHG emissions in that year. By 1999, GHG emissions from that sector had decreased by about 23.3%, to 18,032 Gg CO<sub>2</sub> equivalent, but the relative share of emissions from agriculture has increased to 23% of total emissions. N<sub>2</sub>O emissions constitute 86.6% and CH<sub>4</sub> 13.4% of the emissions in the agricultural sector in 1999.

102. There are differences between the key sources identified in the NIR and those identified by the secretariat. The secretariat's preliminary key source analysis identifies N<sub>2</sub>O emissions from animal production as key sources which the Bulgarian key source analysis does not identify.

#### 1. Completeness

103. All tables are filled in with data or notation keys, except for table 4.C (Rice cultivation) where notation keys have not been used. All source categories are included.

#### 2. Transparency

104. The NIR states that in general the emission estimates from the agricultural sector follow the methodology given in the IPCC Guidelines. Sources of some data and assumptions used are documented in the NIR. However, the information provided does not sufficiently and satisfactorily support the data in the CRF and the methodologies employed. The NIR could benefit from a more detailed discussion of data availability, sources and processing procedures.

#### 3. Methodologies, emission factors and activity data

105. Bulgaria uses the IPCC default methodology, except for manure management for cattle and swine where the tier 2 methodology is used. For CH<sub>4</sub> emissions from manure management and field burning of agricultural residues and for N<sub>2</sub>O from field burning of agricultural residues, country-specific emission factors are used. These emission factors are not presented in the NIR. CRF table 3 reports methodology and emission factors to be NE for agricultural soils (source category 4.D). In tables 4 and 4.D, emissions of N<sub>2</sub>O are included for agricultural soils. Different population size data for non-dairy cattle are reported in tables 4.B(a) and 4.B(b) (250.3 and 260.1, respectively). Bulgaria explained in its response to the draft review report that both methodology and emission factors should be reported as default (D) instead of NE. The difference of the population size in tables 4.B(a) and 4.B(b) is due to the fact that in table 4.B(a) non-dairy cattle and bulls (reported as buffalo) are reported separately and in 4.B(b) both are reported as non-dairy cattle.

#### 4. Recalculations

106. No recalculations for the agricultural sector are reported in the CRF, in comparison to the previous submission.

#### 5. Uncertainty estimates

107. The NIR does not provide any quantitative estimate for uncertainty in the estimates. CRF table 7 contains qualitative uncertainty estimates.

## 6. Verification and QA/QC approaches

108. The NIR reports that data are double-checked by using parallel estimates to indicate possible inconsistencies in activity data input. There are no descriptions of how data were obtained (i.e., whether surveys are employed, or the frequency of such surveys etc.). The ERT recommends that, in future submissions, Bulgaria provide more information on data collection.

### **B. Conformity with the UNFCCC reporting guidelines and the IPCC Guidelines**

109. In general, the methodologies used for the estimates in the agricultural sector are consistent with the IPCC Guidelines. The submission is not yet in accordance with the UNFCCC guidelines, since only CRF tables are included only for the year 1999. An NIR is provided.

### **C. Key sources**

#### **1. Direct emissions from agricultural soils – N<sub>2</sub>O**

110. Direct soil emissions account for 84.1% of the total N<sub>2</sub>O emissions from the agricultural sector in 1999. They also account for 16.9% of the total GHG emissions in that year. The N<sub>2</sub>O emissions from agricultural soils reported in the CRF are not split into direct and indirect emissions for the historical years; hence it is not possible to be accurate with regard to the trend of N<sub>2</sub>O direct emissions. However, overall N<sub>2</sub>O emissions from agricultural soils decreased by 9.4% between 1988 and 1999.

111. The NIR states that the IPCC default methodology has been used. All subsources are included.

112. The NIR does not provide any information regarding the sources of data. There is a discrepancy between the fertilizer use specified in the CRF (105,641 tonnes) and that in the Food and Agriculture Organization (FAO) statistics (110,594 tonnes). In its response to the draft review report Bulgaria explained that the data source of amount of synthetic fertilizer used is from the Statistical Yearbook of the NSI.

113. The IEF for emissions for synthetic fertilizer and animal wastes applied to soils are lower than the IPCC default values. The IEF for N-fixing crop is one of the highest among reporting Parties. The values for fractions (Frac<sub>R</sub>, Frac<sub>BURN</sub>) are lower than the IPCC default values. Emissions from histosols contribute 89% of the direct soils emissions. Bulgaria explained in its response to the draft of this review report that the findings of the ERT are due to data displacement of the N<sub>2</sub>O emissions when transferring them to the CRF table. Bulgaria provided the correct allocation of emissions in its response. The ERT encourages the Party to include this information in future submissions. Regarding the values for different fractions Bulgaria also explained that it is only Frac<sub>R</sub> that differs from the IPCC default. The value is adopted based on expert assessment of the amounts of agricultural residues collected from fields.

#### **2. Enteric fermentation in domestic livestock – CH<sub>4</sub>**

114. CH<sub>4</sub> emissions from enteric fermentation account for 71.9% of national CH<sub>4</sub> emissions, and have decreased by 56.9% in the period 1988 and 1990 to 1999, in line with the overall trend in CH<sub>4</sub> emissions from agriculture.

115. Bulgaria uses tier 1 methodology for estimating the CH<sub>4</sub> emissions from enteric fermentation for all livestock categories, together with default emission factors.

116. Disaggregated livestock population data are given. The source of the activity data is given as the National Statistical Institute. A discrepancy exists in animal numbers for swine between the CRF and FAO data. FAO data are 6.4% higher than those in the CRF.

#### **D. Non-key sources**

##### **1. Manure management**

117. Different population sizes are reported in tables 4.B(a) and 4.B(b) for non-dairy cattle (250.3 and 260.1 (thousands of head), respectively).

##### **2. Rice cultivation – CH<sub>4</sub>**

118. Large variations in emissions among the years are reported, with no explanations provided in either the NIR or the CRF tables. Bulgaria reports emission estimates under only one water regime (Irrigated-continuously flooded). No data are provided and notation keys are not used for the other types of water regimes. The IEF is the highest among the reporting Parties. Bulgaria reports using the IPCC default methodology and emission factors. The ERT encourages Bulgaria to provide more information on the choice of emission factor.

#### **E. Areas for further improvement**

##### **1. Issues identified by the Party**

119. The Party has not provided any information on sector-specific improvements.

##### **2. Issues identified by the ERT**

120. The ERT encourages Bulgaria to:

- (a) Provide more information on the source of activity data in the NIR;
- (b) Provide more information on the choice of emission factors, especially in those cases in which the use of default factors is reported but the emission factors differ from default factors;
- (c) Check the activity data for swine as there is a difference between FAO data and those reported in the CRF, as well as a difference in the data for non-dairy cattle reported in tables 4.B(a) and 4.B(b).

### **V. LAND USE CHANGE AND FORESTRY**

#### **A. Sector overview**

121. In table 5, Bulgaria reports emissions and removals only from category 5.A (Changes in forest and other woody biomass stocks). The net CO<sub>2</sub> emissions / removals for 1999 are –6,608 Gg and represent about 8.5% of the overall emissions of Bulgaria. Some discussion of LUCF activities is provided in the NIR.

## **1. Completeness**

122. Estimates of GHG emissions and removals are provided in the trend table for the period 1988 and 1990 to 1999. CRF sectoral table 5 provides overall data on the LUCF sector, including changes in forest and other woody biomass stocks (source category 5.A). Individual sectoral tables (5.B to 5.E) do not report any data and notation keys are not used. In CRF table 7 source categories 5.B to 5.E are reported as NE.

## **2. Transparency**

123. The reporting of this sector is transparent, but transparency could be enhanced by including more detailed information in the NIR. The NIR provides basic information about the methodology used and the activity data. The data in tables 5 and 5.A correspond.

## **3. Recalculations**

124. No recalculations are undertaken in the LUCF sector.

## **4. Uncertainty estimates**

125. The NIR does not provide any quantitative estimate for uncertainty in the estimates. CRF table 7 contains qualitative uncertainty estimates.

## **5. Verification and QA/QC approach**

126. The NIR reports that data are double-checked by using parallel estimates to indicate possible inconsistencies in activity data input. There are no descriptions of how data were obtained (i.e., whether surveys are employed, or the frequency of such surveys etc.). The ERT recommends that, in future submissions, Bulgaria provide more information on data collection.

### **B. Conformity with the UNFCCC reporting guidelines and the IPCC Guidelines**

127. In general, the methodologies used for the estimates in the LUCF sector are consistent with the IPCC Guidelines. The submission is not yet fully in accordance with the UNFCCC guidelines since only CRF tables were included only for 1999. An NIR is provided.

### **C. Sources and sinks categories**

#### **1. Methodology**

128. The NIR states that the calculation of the emissions and/or removals from the LUCF sector is carried out according to the IPCC methodology.

#### **2. Emission factors**

129. It is likely that national-specific factors are used in source category 5.A (Changes in forests and other woody biomass stocks) but in table 5.A, data on average annual growth rate are reported as “different”. This information should be clarified. No specific information related to this topic is provided in the NIR. In its response to the draft review report Bulgaria explained that the word “different” is referring to the different biomass growth for different tree types, as well as within different regions of the country.

#### **3. Activity data**

130. There is no specific information about the activity data in the NIR or the CRF.

#### **4. Changes in forests and other woody biomass stock**

131. Gross emissions and removals as well as net removals are reported for the whole period from 1988 and 1990 to 1999. CO<sub>2</sub> removals are reported for temperate forests in the removal column and the value of -6,608 Gg CO<sub>2</sub> (1999) as net annual removals; for previous years, the values are in the range of -4,657 to -7,880 Gg. CO<sub>2</sub> emissions are reported in category 5.A, "Other", but CO<sub>2</sub> removals are reported in the category "Temperate forests". The Party should consider reporting under "Temperate forests" instead of "Other".

#### **5. Forest and grassland conversion**

132. Emission data for this category are not reported. The NIR states that land-use change activities in forests and grassland conversion are negligible in Bulgaria.

#### **6. Abandonment of managed lands**

133. The data for this category are not reported. The NIR states that this land-use change activity is negligible in Bulgaria.

#### **7. Emissions and removals from soil – CO<sub>2</sub>**

134. The data for this category are not reported. The NIR states that this land-use change activity is negligible in Bulgaria.

### **D. Areas for further improvement**

#### **1. Issues identified by the Party**

135. Only general information about planning of improvements of future inventory submissions is provided in the NIR, with no specification of key issues.

#### **2. Issues identified by the ERT**

136. The ERT encourages Bulgaria to:

(a) Include detailed information about methodology and activity data related to category 5.A in the NIR;

(b) Provide any additional information on methods or techniques used to estimate or develop emission factors (e.g., expert judgement, field measurement, remote sensing etc.) in order to improve the quality and allow a better understanding of the estimates.

## **VI. WASTE**

### **A. General overview**

137. Emissions from the waste sector comprise 6.5% of total emissions (without CO<sub>2</sub> from LUCF) in 1999, compared with 10.8% in 1988. CH<sub>4</sub> emissions, the major greenhouse gas from this sector, declined by 70.6% between 1988 and 1999. Based on the preliminary key source analysis compiled by the UNFCCC secretariat, the waste sector has two key sources: CH<sub>4</sub> emissions from solid waste disposal on land, which represent 5.3% of total emissions, and CH<sub>4</sub> emissions from waste-water handling, which comprise 1.0% of total emissions.

## 1. Completeness

138. All CRF tables specific to the waste sector contain data and notations, and all subsources and gases are included, but only for 1999. Tables 6.A and 6.C include a notation of NR in the additional information box for CH<sub>4</sub> generation rate constant, and time lag considered. It is suggested that these should be noted as not applicable (NA), since NR is not an accepted notation key. Table 9 provides explanations for the sources and sinks that are not reported.

139. CH<sub>4</sub> recovery for both solid waste disposal sites (SWDS) and waste-water handling is shown as 0.00. It is not obvious whether this is intended to indicate that there is some recovery or whether it should be NE. Further clarification would be of assistance. Bulgaria explained in its response to the draft of this report that in 1999 there was no CH<sub>4</sub> recovery from landfills.

## 2. Transparency

140. Read in conjunction with the Party's NIR, the CRF tables provide an adequate level of transparency. Methodologies used for estimating emissions from the waste sector are summarized in a relatively accessible format, with comments provided on sources of data and emission factors. CRF summary table 3 specifies that the methodologies used are the IPCC defaults and that emission factors for CH<sub>4</sub> are a combination of IPCC default and country-specific factors. It would be of assistance if the NIR provided more information on the country-specific emission factors.

141. An issue affecting transparency is that the reasons for the very sharp fall in emissions from waste are not obvious from the NIR. More detailed discussion in the NIR would be of assistance.

## 3. Uncertainties

142. Qualitative assessment of the estimates is provided in CRF table 7. The NIR does not include any uncertainty analysis for the waste sector, but notes that in future inventories the limited uncertainty analysis described in the NIR will be extended to all sources.

## 4. Recalculations

143. The Party has provided information on recalculations in tables 8(a) and 8(b). The information in the tables indicates that there are no recalculations affecting the waste sector. This appears to be contradicted in the NIR, in which the Party notes that implementation of the IPCC good practice guidance includes the recommended revision to degradable organic carbon dissimilated (DOC<sub>F</sub>) from 0.77 to 0.50–0.60. The value of 0.60 has been used by the Party and estimates for all years from 1988 and 1990 to 1998 should be recalculated using this value. It is suggested that recalculations should be undertaken and reported in future inventories.

### **B. Conformity with the UNFCCC reporting guidelines and the IPCC Guidelines**

144. Under the IPCC Guidelines, Parties are permitted to develop and apply country-specific methodologies in order to estimate emissions, provided that the methodologies are transparent and documented. It is considered that the reporting of emissions in the CRF and in the NIR is largely consistent with the IPCC Guidelines and the UNFCCC reporting guidelines, while noting the issues referred to under completeness above.

### C. Key sources

#### 1. Solid waste disposal on land – CH<sub>4</sub>

##### Methodology

145. CRF summary table 3 shows the methodology used is IPCC default. Clarification of the treatment of CH<sub>4</sub> recovery (0.00) is needed. Solid waste disposal also includes a category of waste, “Other”, that is denoted as “Unspecified”. It would be helpful if more details on this waste category could be included in the NIR. Bulgaria in its response to the draft review report explained that the NSI methodology classifies landfills as controlled and uncontrolled. The uncontrolled landfills are included in the category “unspecified”.

##### Activity data

146. Activity data are described in the NIR with the source of data specified as the NSI. No information on the data collection regime is included. Further clarification of the activity data is required; specifically, whether data are collected annually by survey or whether they are based on reports from landfill managers, or whether some other approach to data collection is used. In its response to the draft of this report explained that data on amounts of solid waste and wastewater flows are collected by NSI through statistical surveys.

##### Emission factors

147. CRF summary table 3 notes the emission factors as default and country-specific. It is not obvious from the NIR which factors are considered to be default and which are country-specific. Further explanation of the emission factors is suggested. Bulgaria explained in its response to the draft review report that only the percentage of solid waste disposal in landfills and the ration between aerobic and anaerobic wastewater handling are country specific. All other parameters are default.

#### 2. Waste-water handling – CH<sub>4</sub>

##### Methodology

148. CRF summary table 3 shows the methodology used is IPCC default. Some consideration and discussion of CH<sub>4</sub> recovery is desirable.

##### Activity data

149. The NIR provides an explanation of the proportion of wastewater treated. However, it is not clear which proportion is used in the estimation. The NIR notes that the proportion treated is less than 60%, and that the proportion of biologically treated wastewater meeting the directive 91/271/EEC of the Council of the European Communities is 43%. It does not state which value is used to estimate emissions, or whether estimates are included of the quantity of wastewater that is not biologically treated. Further explanation of the activity data is necessary. In its response to the draft of this report explained that the share of biologically treated wastewater from the overall discharged wastewater is 61.6% for industrial wastewater and 73.8% for domestic wastewater. CH<sub>4</sub> emissions are estimated based on these percentages; emissions from wastewater not treated biologically are not accounted for.



Emission factors

150. Emission factors are shown in CRF summary table 3 as default and country-specific. The NIR does not assist in understanding which factors are default and which factors are country-specific. This requires more explanation.

**D. Results from previous reviews**

151. The S&A 2000 report and the draft S&A 2001 report commented on the sharp decrease in CH<sub>4</sub> emissions from solid waste disposal, the very large per capita estimate of CH<sub>4</sub> emissions from waste-water handling, the fluctuations in CH<sub>4</sub> estimates from waste-water handling and the unexplained differences in the CH<sub>4</sub> and N<sub>2</sub>O trends for waste-water handling.

**E. Non-key sources**

152. N<sub>2</sub>O emissions from waste-water handling are a non-key source.

153. The methodology used is IPCC default. No information is provided on the source of per capita protein consumption. Bulgaria in its response to the draft review report explained that protein consumption is estimated on the basis of annual consumption of basic foods (total of 18 products) per capita. Data are collected by the NSI and published in the annual statistical report. The relative protein content in food is based on measurements.

**F. Areas for further improvement****1. Issues identified by the Party**

154. No response by the Party to the issues raised in the S&A 2000 report and the draft S&A 2001 report were available for the review.

155. The Party noted in the NIR the need to improve historical data, and for research into degradable organic carbon (DOC) content, moisture content of waste, waste composition and emission factors.

156. It is important that the Party provide full recalculation tables when variables are changed as a result of improved data and revised equation constants.

**2. Issues identified by the ERT**

157. In future inventories it is recommended that the Party ensure that:

- (a) Information is provided on CH<sub>4</sub> recovery;
- (b) Information is provided on the category of waste denoted as "Unspecified";
- (c) Further information is provided on the source of solid waste;
- (d) The use of default and country-specific emission factors is explained (i.e., factors that are default and those that are country-specific should be identified in the NIR);
- (e) Information is provided on whether any estimates are included for wastewater that is not biologically treated;
- (f) The data source for protein consumption is specified;

(g) Full recalculation tables are provided where equation constants or data are revised (e.g., the change to  $DOC_F$  in accordance with the IPCC good practice guidance).

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