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**Report of the individual review of the greenhouse gas inventory of Croatia  
submitted in 2005\***

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\* In the symbol for this document, 2005 refers to the year in which the inventory was submitted, and not to the year of publication.

## CONTENTS

	<i>Paragraphs</i>	<i>Page</i>
I. OVERVIEW .....	1–21	3
A. Introduction.....	1–2	3
B. Inventory submission and other sources of information.....	3	3
C. Emission profiles and trends.....	4	3
D. Key categories.....	5	4
E. Main findings.....	6–7	4
F. Cross-cutting topics.....	8–18	4
G. Areas for further improvement .....	19–21	6
II. ENERGY.....	22–35	6
A. Sector overview.....	22–25	6
B. Reference and sectoral approaches .....	26–31	7
C. Key categories.....	32–34	8
D. Non-key categories.....	35	8
III. INDUSTRIAL PROCESSES AND SOLVENT AND OTHER PRODUCT USE.....	36–45	8
A. Sector overview.....	36–39	8
B. Key categories.....	40–42	9
C. Non-key categories.....	43–45	9
IV. AGRICULTURE.....	46–56	10
A. Sector overview.....	46–51	10
B. Key categories.....	52–55	10
C. Non-key categories.....	56	11
V. LAND USE, LAND-USE CHANGE AND FORESTRY.....	57–63	11
A. Sector overview.....	57–61	11
B. Sink and source categories.....	62–63	12
VI. WASTE.....	64–68	12
A. Sector overview.....	64–66	12
B. Key categories.....	67	13
C. Non-key categories.....	68	13
	<u>Annex</u>	
Documents and information used during the review .....		14

## I. Overview

### A. Introduction

1. This report covers the centralized review of the 2005 greenhouse gas (GHG) inventory submission of Croatia, coordinated by the United Nations Framework Convention on Climate Change (UNFCCC) secretariat, in accordance with decision 19/CP.8. The review took place from 10 to 15 October 2005 in Bonn, Germany, and was conducted by the following team of nominated experts from the roster of experts: Generalists – Mr. Audun Rosland (Norway) and Mr. Ignacio Sánchez García (Spain); Energy – Mr. Scott McKibbin (Canada), Mr. Hongwei Yang (China) and Mr. Hristo Vassilev (Bulgaria); Industrial Processes – Mr. Manfred Ritter (Austria) and Mr. Menouer Boughedaoui (Algeria); Agriculture – Mr. Sergio González (Chile) and Ms. Lilian Portillo (Paraguay); Land Use, Land-use Change and Forestry (LULUCF) – Ms. Maria José Sanz Sánchez (Spain) and Mr. Charalampos Petsikos (Greece); Waste – Ms. Tatiana Tugui (Republic of Moldova) and Mr. Seungdo Kim (Republic of Korea). Mr. Audun Rosland and Mr. Sergio González were the lead reviewers. The review was coordinated by Mr. Sergey Kononov and Ms. Astrid Olsson (UNFCCC secretariat).

2. In accordance with the “Guidelines for the technical review of greenhouse gas inventories from Parties included in Annex I to the Convention”, a draft version of this report was communicated to the Government of Croatia for comment prior to its publication.

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

3. In its 2005 submission, Croatia submitted a complete set of common reporting format (CRF) tables for the years 1990–2003 and a national inventory report (NIR). Croatia has not provided the tables of the CRF for LULUCF as required by decision 13/CP.9. Where needed, the expert review team (ERT) also used previous years’ submissions, additional information provided during the review and other information (see the annex to this report).

### C. Emission profiles and trends

4. In 2003, the most important GHG in Croatia was carbon dioxide (CO<sub>2</sub>), contributing 77.0 per cent to total<sup>1</sup> national GHG emissions expressed in CO<sub>2</sub> equivalent, followed by methane (CH<sub>4</sub>), 12.1 per cent, and nitrous oxide (N<sub>2</sub>O), 10.8 per cent. Hydrofluorocarbons (HFCs) contributed 0.1 per cent<sup>2</sup> of the overall GHG emissions in the country. The Energy sector accounted for 75.8 per cent of total national GHG emissions, followed by Agriculture (10.8 per cent), Industrial Processes (9.0 per cent) and Waste (4.3 per cent). Total GHG emissions amounted to 29,867 Gg CO<sub>2</sub> equivalent in 2003. From 1990 to 1992, emissions declined by 28.1 per cent, mainly as a consequence of the war in Croatia. After 1992, emissions increased steadily, and in 2003 they were 6.0 per cent lower than in 1990. The trends for the different gases and sectors appear to be reasonable and well explained in the NIR.

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<sup>1</sup> In this report, the term total emissions refers to the aggregated national GHG emissions expressed in terms of CO<sub>2</sub> equivalent excluding LULUCF, unless otherwise specified. Croatia has not provided the tables of the common reporting format for LULUCF as required by decision 13/CP.9 using the land use categories of the Intergovernmental Panel on Climate Change *Good Practice Guidance for Land Use, Land-use Change and Forestry*. Instead it has used the CRF tables for Land-use Change and Forestry as contained in the CRF adopted by decision 18/CP.8, which are based on the categories of the Intergovernmental Panel on Climate Change *Revised 1996 Guidelines for National Greenhouse Gas Inventories*.

<sup>2</sup> Croatia has reported the emissions of perfluorocarbons and sulphur hexafluoride as either “not occurring” or “not estimated”. For hydrofluorocarbons, only potential emissions have been reported. The given value of 0.1 per cent in national total is calculated using potential HFC emissions.

#### D. Key categories

5. Croatia has reported a key category tier 1 analysis, both level and trend assessment, as part of its 2005 submission. The key category analyses performed by the Party and the secretariat<sup>3</sup> produced similar results, except that Croatia identified three more categories in the trend analysis. The ERT encourages Croatia to implement a tier 2 analysis and to use it to prioritize the development of the inventory. During the review, Croatia informed the ERT that it plans to implement a tier 2 method for determining key categories in the preparation of its next inventory.

#### E. Main findings

6. Croatia has developed a sound and well-documented GHG inventory in only a few years. The CRF and the NIR include information that makes the review of the methodologies and assumptions possible. However, the structure of the NIR is not fully consistent with the structure outlined in 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 revised UNFCCC reporting guidelines). Furthermore, some categories are not included in the NIR or the CRF, see paragraphs 8 and 9 below. Data for the LULUCF sector, required by decision 13/CP.9, have not been estimated and reported.

7. The Croatian inventory is mainly based on tier 1 methodologies. The ERT encourages Croatia to consider a more extensive use of higher-tier methods for key categories. During the review Croatia informed the ERT that it is preparing a National GHG Inventory Improvement Strategy of which the priority goal will be a shift from tier 1 methods to tier 2/3 methods for key categories as far as possible, depending on the availability of detailed activity data (AD). The ERT also welcomes Croatia's plans to establish a formal quality assurance and quality control (QA/QC) plan, and a tier 2 key category analysis.

#### F. Cross-cutting topics

##### 1. Completeness

8. Croatia's inventory is complete for all years with regard to geographical coverage as defined by the national borders and is generally complete in terms of coverage of sources and gases. However, Croatia has not submitted the LULUCF reporting tables according to the *Intergovernmental Panel on Climate Change (IPCC) Good Practice Guidance for Land Use, Land-use Change and Forestry* (hereinafter referred to as the IPCC good practice guidance for LULUCF) following decision 13/CP.9, but has used the old reporting format for Land-use Change and Forestry (LUCF), as contained in decision 3/CP.5.

9. Some other sources are not included in the inventory, the most important ones being HFCs from several sub-sectors of consumption of halocarbons, sulphur hexafluoride (SF<sub>6</sub>) from electrical equipment, CO<sub>2</sub> and N<sub>2</sub>O from Solvent and Other Product Use, Field Burning of Agricultural Residues, Forest and Grassland Conversion, Abandonment of Managed Lands, CO<sub>2</sub> Emissions and Removals from Soil, CH<sub>4</sub> from Wastewater Handling and CO<sub>2</sub>, CH<sub>4</sub> and N<sub>2</sub>O from Waste Incineration. Croatia has indicated that it plans to include the missing sources in future submissions, depending on the availability of resources and

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<sup>3</sup> The secretariat identified, for each Party, those source categories that are key categories in terms of their absolute level of emissions, applying the tier 1 level assessment as described in the *Intergovernmental Panel on Climate Change Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories*. Key categories according to the tier 1 trend assessment were also identified for those Parties that provided a full set of CRF tables for the year 1990. 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.

data. A working group for LULUCF was established recently and the required new LULUCF reporting tables will be compiled for next year's submission.

## 2. Transparency

10. The NIR is comprehensive and includes information on emissions, key categories, methods, data sources, completeness, uncertainty estimates, and general QA/QC and verification procedures. In general, the NIR follows the structure set out in the revised UNFCCC reporting guidelines. However, no section on improvements implemented and planned is included. Moreover, there is no specific section on follow-up to previous reviews. The ERT recommends that Croatia make full use of the structure set out in the revised UNFCCC reporting guidelines in future.

11. The CRF uses the notation keys extensively. However, they are not always used consistently, particularly "not estimated" ("NE") and "not occurring" ("NO"). For example, in table 2(I) "NE" is reported for potential emissions of HFCs, while the actual emissions are reported as "NO". The ERT encourages Croatia to use the notation keys consistently in the CRF.

## 3. Recalculations and time-series consistency

12. The ERT noted that recalculations for the years 1990–2002 have been undertaken to take into account changes in methodology, emission factors (EFs) and AD for energy industries; the implementation of the COPERT III model for road transportation; updated AD for lime production and limestone and dolomite use; revised numbers of animals for enteric fermentation; changes in methodology for agricultural soils; and revised AD for waste-water handling. The major changes have been made in Energy Industries, Agricultural Soils and Road Transportation. CO<sub>2</sub> emissions from changes in forest and other woody biomass stocks have been recalculated due to updated biomass density factors, which has resulted in a much greater sink – the estimates of CO<sub>2</sub> removals have increased by 95.0 per cent in the base year (1990) and by 70.8 per cent in 2002.

13. The rationale for these recalculations is provided in the NIR, and the information in the NIR and the CRF is in general consistent. In the ERT's judgement, the recalculations are sufficiently justified and have resulted in real improvements of the inventory. However, there are some minor inconsistencies in the presentation of the recalculations, such as the use of the term "implied emission factor" (IEF) instead of "default EF".

14. The effect of the recalculations is an increase in the estimates of total GHG emissions without LULUCF in 1990 and 2002, by 0.5 per cent and 1.5 per cent, respectively. The trend from 1990 to 2002 has been adjusted upwards by 0.9 per cent, from –11.5 per cent in the 2004 submission to –10.6 per cent in this year's submission.

## 4. Uncertainties

15. Croatia has provided quantitative uncertainty estimates using the tier 1 level and trend methods as set out in the IPCC *Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories* (hereinafter referred to as the IPCC good practice guidance). The uncertainty estimates are mostly based on IPCC default values, and in some cases on expert judgement. The ERT recommends Croatia to document better the sources for the different values used in the uncertainty assessment.

16. The NIR does not give a clear description of how the uncertainty analysis has been and will be used in prioritizing future improvements of the Croatian inventory. During the review Croatia informed the ERT that evaluation of inventory uncertainty is a key QC component of the inventory preparation and improvement. For instance, the planned improvement of the emissions calculation for Waste Disposal was chosen because of the high uncertainty in the emissions from that category.

#### 5. Verification and quality assurance/quality control approaches

17. The NIR gives an informative general description of the verification and QA/QC procedures in the introduction chapter. These procedures are not fully described in the sectoral chapters. Croatia has not yet implemented a formal QA/QC plan. However, it seems that Croatia has a good basis for developing such a plan, including institutional arrangements and clear assignment of institutional responsibilities. There are also several QA/QC procedures that are currently carried out, such as the development of a sectoral methodological guideline in order to support the inventory preparation, and an inventory data record sheets with details on responsibilities, data sources, suggestions for improvements etc. The ERT was informed that the Croatian inventory team is working on the preparation of a QA/QC plan and is planning to finish it by April 2006.

#### 6. Follow-up to previous reviews

18. The NIR and CRF have improved compared to the 2004 submission. The NIR structure is now more in line with the revised UNFCCC reporting guidelines, although further improvement is still needed. The inventory now includes higher-tier methodologies for some new source categories.

### **G. Areas for further improvement**

#### 1. Issues identified by the Party

19. The NIR identifies some areas for improvement. The most important is the development of a QA/QC system for the national inventory, including the specification of institutional responsibilities, a QA/QC plan, and reporting, documentation and archiving procedures. Croatia plans to implement the IPCC good practice guidance for LULUCF and to submit the LULUCF reporting tables in accordance with decision 13/CP.9.

#### 2. Issues identified by the ERT

20. The ERT identifies the following major areas for improvement related to cross-cutting issues in the Croatian inventory:

- (a) Use of tier 2 methods for the determination of key categories;
- (b) More extensive use of higher-tier methods for key categories, depending on available resources and AD;
- (c) Full use of the NIR structure set out in the revised UNFCCC reporting guidelines;
- (d) Consistent use of the notation keys in the CRF;
- (e) Timely submission of the NIR, together with the CRF tables, by 15 April.

21. Recommended improvements relating to specific source/sink categories are presented in the relevant sector sections of this report.

## **II. Energy**

### **A. Sector overview**

22. In 2003, the Energy sector was the main source of anthropogenic GHG emissions in Croatia, accounting for 75.8 per cent of total national emissions. CO<sub>2</sub> represented 92.7 per cent of total Energy sector emissions, while CH<sub>4</sub> and N<sub>2</sub>O accounted for 6.3 and 0.9 per cent, respectively. Annual emissions from the sector declined by 31 per cent between 1990 and 1994, but after 1994 a slow and steady

increase can be observed, resulting in an overall increase of 0.7 per cent between 1990 and 2003; this is in contrast to the 6.0 per cent decrease in total national emissions over the same period.

23. The uncertainties section of the NIR reports that the uncertainties in the national energy balance values are estimated to be below 5 per cent, while those associated with the net calorific values (NCVs) of fuels are shown as “high”. The uncertainty associated with CH<sub>4</sub> emissions is estimated to be 40 per cent, while the estimates of N<sub>2</sub>O emissions are given an uncertainty factor of 2, meaning that the actual value could be “twice larger or smaller than the estimated one”.

24. In the latest NIR and CRF, Croatia has included activity data for Energy Industries and Manufacturing Industries and Construction, which made it easier to understand the fluctuations observed for the emissions from these categories.

25. The NIR does not explicitly address improvements for the Energy sector but the questions forwarded to the Party during the review were answered promptly, including by the provision of a draft report discussing improvements for road transportation and a suggestion that data from the International Energy Agency (IEA) would be used in the future to facilitate the disaggregation of fuel between international and domestic uses. The ERT welcomes these efforts.

## **B. Reference and sectoral approaches**

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

26. The reference approach estimates for the complete time series were not available in time to enable a comparison with the IEA data. The Party is encouraged to provide a complete time series by the submission date in order to facilitate this comparison.

27. The total differences between the reference and sectoral approaches for the period 1990–2003 vary, being 7–13 per cent for fuel consumption and 3–9 per cent for CO<sub>2</sub> emissions (the reference approach giving higher values), with the lower values appearing in the years after 1999. The Party states that the differences are due to natural gas losses from pipelines, and the large amount of natural gas used in non-energy applications in the petrochemical industry and natural gas liquefaction plants. When only solid and liquid fuels are compared, these differences are much smaller. The ERT recommends the Party to consider providing a category-specific reconciliation between the reference and sectoral approaches.

### **2. International bunker fuels**

28. Emissions from international bunker fuels are reported separately from those associated with domestic operations. Expert judgement is often employed, along with information from the national energy balance, to provide the fuel split between international and domestic uses, although references for these estimates are not provided in the latest NIR. Transparency would be greatly enhanced if Croatia could include a clear description of the rationale for the expert judgement used.

29. In 2003, GHG emissions from international aviation and marine bunkers were 63.1 per cent and 36.7 per cent, respectively, lower than in 1990. Croatia is encouraged to explain the reasons for these changes.

### **3. Feedstocks and non-energy use of fuels**

30. Previous reviews have stated that an elaboration of data collection methods and an analysis of the underlying trends relevant to this category would greatly enhance the comparability of the reference and sectoral approaches. The ERT supports this finding.

#### 4. Country-specific issues

31. Croatia reports CO<sub>2</sub> scrubbing to reduce the excessive CO<sub>2</sub> content (more than 15 per cent) found in the domestic raw natural gas. The NIR indicates that the estimates of CO<sub>2</sub> generated are based on the mass balance of the scrubbing plants as there is no recommended IPCC method for dealing with this.

#### **C. Key categories**

##### 1. Stationary combustion: liquid, solid, gaseous fuels – CO<sub>2</sub>

32. The NIR states that detailed fuel characteristics and combustion performance data are available for the years 2001–2003, while the text suggests that IPCC default EFs are used incorporating general oxidation factors from the *Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories* (hereinafter referred to as the Revised 1996 IPCC Guidelines). As these are key categories, and detailed AD are available, the ERT encourages Croatia to employ site-specific AD to verify the EFs and the selection of oxidation coefficients.

##### 2. Mobile combustion – aircraft: liquid – fuel consumption

33. For the year 2002, the Party's 2004 submission reported a value for jet kerosene consumption which was found to be 36.7 per cent lower than that reported to the IEA (1,631 TJ vs. 2,229 TJ), and the same value for 2002 is reported in the 2005 submission. The ERT encourages Croatia to explain the reason for this difference.

##### 3. Mobile combustion – road vehicles: liquid – CO<sub>2</sub>

34. The method of calculating CO<sub>2</sub> emissions for this category for the years 1990–2000 is different from the method used for 2001–2003. As a result, a step-wise change in the CO<sub>2</sub> IEF occurred from 2000 to 2001; but the NCVs reported in the NIR remained constant. The ERT encourages Croatia to employ a consistent method for estimating these emissions and to explain the reasons for the step-wise change if it does occur.

#### **D. Non-key categories**

##### Mobile combustion – water-borne navigation: liquid, gas – CO<sub>2</sub>

35. The ERT noted high inter-annual fluctuations in these emissions and in the fuels used during the period 1990–2003. The ERT encourages Croatia to explain these fluctuations in its next NIR.

### **III. Industrial Processes and Solvent and Other Product Use**

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

36. In 2003, the Industrial Processes sector accounted for 9.0 per cent of the total GHG emissions of Croatia, slightly less than in the base year (1990) when the share was 12.4 per cent. The emissions in 2003 amounted to 2,702 Gg CO<sub>2</sub> equivalent, of which 99.0 per cent were from mineral products and the chemical industry.

37. CO<sub>2</sub> emissions from the Industrial Processes sector decreased by 1.9 per cent from 1990 to 2003. Increased emissions from mineral products (an increase by 26.2 per cent) were compensated by decreased emissions from the chemical industry (a decrease by 12.2 per cent) and the shutting down of the primary production of pig iron. N<sub>2</sub>O emissions declined by 29.1 per cent between 1990 and 2003, mainly because of a reduction in nitric acid production, the main source of N<sub>2</sub>O emissions in this sector. CH<sub>4</sub> emissions declined by 62.1 per cent over the same period, mainly because of a reduction in the production of black carbon, ethylene and other chemicals.



38. Croatia uses the notation key “NO” in the CRF tables for Asphalt Roofing, Road Paving with Asphalt, as well as for actual emissions of HFCs and perfluorocarbons (PFCs), and for potential emissions of PFCs and SF<sub>6</sub>; the ERT encourages Croatia to investigate further whether these emissions do indeed not occur. Potential emissions of HFCs are reported in CRF table 2(I).

39. Croatia provides general explanations on the methodology used but does not always describe the data collection process, for example, for voluntary surveys to collect data from manufacturers. The ERT encourages Croatia to provide more such information.

## **B. Key categories**

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

40. Croatia uses an IPCC tier 2 methodology based on clinker production and a default EF of 0.507 tonnes of CO<sub>2</sub> per tonne of clinker produced. A default correction factor was used to account for cement kiln dust (CKD). The ERT recommends Croatia to estimate CKD in plants and to report on these estimates in its next NIR. In response to a question from the ERT, Croatia mentioned that CKD is neither collected nor recycled in any of the cement plants which use the dry process, and that there is only one plant which imports clinker. The ERT recommends Croatia to provide more information about the quantities of clinker imported since 1990, and how the imported clinker has been considered in the inventory.

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

41. Croatia uses a country-specific methodology based on the consumption of natural gas used as feedstock and a country-specific EF based on the composition of natural gas. The CO<sub>2</sub> IEF decreased over the period 1990–2003 from 1.43 to 1.34 t/t, which is outside the IPCC range. Croatia explained that there is only one ammonia production plant in Croatia, and that the same gas source has been used since 1990; gas composition is analysed regularly and continuously at that plant. The ERT encourages Croatia to report this information on gas composition in the next NIR.

### **3. Nitric acid production – N<sub>2</sub>O**

42. Croatia uses a methodology based on nitric acid production and the IPCC default EF for the only domestic manufacturer of nitric acid where no abatement technology is installed. Since nitric acid production is a key category in Croatia the ERT encourages Croatia to consider the use of industry-supplied emission estimates as recommended by IPCC good practice guidance.

## **C. Non-key categories**

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

43. Croatia has used the IPCC default EF for estimating CO<sub>2</sub> emissions from Lime Production, but the IEF increased over the period 1990–2003 from 0.79 to 0.85 t/t, this being the highest of all the Parties that reported in 2005. The NIR states that AD for quicklime and dolomitic lime production are aggregated. To enhance transparency, Croatia is encouraged to report more disaggregated data in order to explain the high IEF value. The NIR should also give more details about the methodology, taking into account the process used and the chemical characteristics of the raw material, considering that there are numerous different producers.

### **2. Consumption of HFCs, PCFs, and SF<sub>6</sub>**

44. Croatia only reported potential emissions of HFCs for refrigeration and air conditioning equipment. Potential emissions of HFCs from foam blowing, fire extinguishers, aerosols/metered dose

inhalers, solvents and semiconductor manufacture are reported as “NE”. The NIR states lack of data as the reason. The ERT considers not correct the report of actual emissions of HFCs as not occurring (“NO”) while the potential emissions are reported. The ERT recommends Croatia to use the notation key “NE” instead of “NO” for actual emissions of HFCs. Potential and actual emissions from PFCs are reported as “NO”. Potential emissions from SF<sub>6</sub> are reported as “NO”, while actual emissions are reported as “NE”. Following previous review findings, the ERT recommends Croatia to collect data related to these subcategories and to calculate these emissions.

45. There is no production of HFCs in Croatia and all HFCs are imported. The ERT recommends Croatia to clarify whether there is any export of HFCs in manufactured products.

## **IV. Agriculture**

### **A. Sector overview**

46. In 2003, emissions from the Agriculture sector amounted to 3,238 Gg CO<sub>2</sub> equivalent, representing 10.8 per cent of total national emissions; the sector is the main source of N<sub>2</sub>O emissions (with 70.2 per cent of total emissions of N<sub>2</sub>O), and the second-largest source of CH<sub>4</sub> emissions (with 26.9 per cent of total emissions of CH<sub>4</sub>). Emissions from the sector decreased by 32.2 per cent from 1990 to 1996, followed by a recovery of 8.2 per cent from 1996 to 2003.

47. The submission is almost complete in terms of gases, sources and years covered; emissions from field burning of crop residues are not estimated due to lack of AD. Croatia’s submission is consistent across the time series. Uncertainties have been estimated by expert judgement. Internal verification and checks are performed within the sector. No information on sectoral archiving or documentation procedures is reported in the NIR.

48. During the review, Croatia clarified that differences in animal populations between the AD used and the database of the Food and Agriculture Organization of the United Nations (FAO) are due to the use of different data sources. Croatia is aware of the need to improve the data collection system, to harmonize the data sources and to use higher-tier methods for key categories.

49. Croatia is also aware of the need to establish a sectoral QA/QC plan and to improve uncertainty estimates, depending on financial support. The ERT recognizes the improvements made in the submission and supports Croatia’s plans for future development, in particular with respect to the use of higher-tier methods for key categories and enhanced characterization of significant animal species.

50. Recalculations have been performed to take into account minor changes in the populations of goats, and mules and asses, from 1990 to 1992, leading to minor changes in the estimates of CH<sub>4</sub> emissions from enteric fermentation and manure management. Recalculations of N<sub>2</sub>O emissions from agricultural soils have also been performed due to more stringent application of the IPCC method and the use of improved AD for the cultivation of histosols.

51. Tier 1 methods were applied extensively even for key source categories, due to lack of AD. The ERT encourage Croatia to make its best effort to move to tier 2 or country-specific methods for the key categories.

### **B. Key categories**

#### **1. Enteric fermentation – CH<sub>4</sub>**

52. Although this is a key category, Croatia has applied a tier 1 approach and default EFs (for cool conditions in Eastern Europe) due to the lack of accurate AD, which is in line with the IPCC good practice guidance. The emission trends follow changes in animal populations exactly, with large overall

decreases from 1990 to 2003 and considerable inter-annual changes, due to changes in animal populations.

## 2. Manure management – N<sub>2</sub>O

53. Croatia has applied a tier 1 method and default EFs, but no information is provided in CRF table Summary 3. This methodological approach is in line with the IPCC good practice guidance. The trends in N<sub>2</sub>O emissions follow changes in animal populations. Recalculations have been performed to correct a double counting in animal production, leading to annual changes of N<sub>2</sub>O emissions, ranging from no change in 1991–1995 to a decrease by 41.2 per cent in 2000.

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

54. Croatia has used a tier 1 method and default parameters and EFs to estimate direct emissions. In the NIR, the EF of the nitrogen input to soils is erroneously reported as “0.125” (instead of 0.0125). The ERT also noted other inconsistencies such as:  $Frac_{BURN}$  is reported as 0.45 for 1990, and 0.9 for 1992, while being 0.1 for the rest of the years; the values for  $Frac_{NCRBF}$  and  $Frac_{NCRO}$  are transposed in error; the values for  $Frac_R$  are reported as 0.25 for 1990 and 0.55 for 1991 and 1996, while the default value of 0.45 is used for the other years; the AD for leaching and run-off in 2002 are incorrect, being one tenth lower than for all other years; and the value of  $Frac_{GASM}$  is the lowest among the reporting Parties and lower than the IPCC default value which was reported by Croatia as the value used. The ERT recommends Croatia to correct these apparent typing mistakes for the next submission.

## 4. Indirect N<sub>2</sub>O emissions from agricultural soils – N<sub>2</sub>O

55. For indirect emissions, Croatia reports the use of a tier 1 method, and default parameters and EFs, which is in line with the IPCC good practice guidance. These emissions fluctuate with some large inter-annual changes, which are due to changes in the relevant AD.

### C. Non-key categories

#### Manure management – CH<sub>4</sub>

56. Croatia has applied a tier 1 method and default EFs. The ERT found the following inconsistencies: the IEF for Horses is 1.04 kg/head/year only for 1993, and 1.1 for all other years; CH<sub>4</sub> emissions from mules and asses are reported as “NO” only for 1992. The ERT encourages Croatia to correct these apparent typing mistakes for the next submission.

## V. Land Use, Land-use Change and Forestry

### A. Sector overview

57. Croatia has not provided the LULUCF reporting tables as required by decision 13/CP.9 and following the land-use categories of the IPCC good practice guidance for LULUCF. Instead, Croatia continued to report according to the tables for LUCF as contained in the CRF adopted by decision 18/CP.8, which are based on the categories of the Revised 1996 IPCC Guidelines. The CRF and the NIR provide estimates for the LUCF category Changes in Forest and Other Woody Biomass Stocks. Categories Forest and Grassland Conversion, Abandonment of Managed Lands and Emissions and Removals from Soil have not been estimated due to lack of data. Emissions of non-CO<sub>2</sub> gases have also not been estimated. The remainder of this section is based on Croatia’s reporting of the LUCF sector.

58. Over the period 1990–2003, the LUCF sector in Croatia was a net sink of increasing magnitude, amounting to between 40 and 58 per cent of total national GHG emissions. The annual net removals

from the sector are estimated as 12,688 Gg CO<sub>2</sub> for the period 1990–1996, 14,442 Gg CO<sub>2</sub> for the period 1997–2001 and 15,373 Gg CO<sub>2</sub> for 2002 and 2003.

59. Recalculations are mentioned in the NIR and new LUCF estimates are reported in the CRF tables 5; however, recalculations are not reported in table 8. Net removals from the sector reported in 2005 are 57–95 per cent higher than those reported in the previous (2004) submission. The ERT encourages Croatia to include explanations for the recalculations in CRF table 8(b) and the NIR to enhance the transparency of the inventory.

60. The ERT noted that the CRF tables are complete in Croatia's 2005 submission, with the appropriate notation keys being used where estimates are not provided. For all years, except for 1990 and 2003, an inconsistency was identified between the estimates of total emissions and removals reported in sectoral background data table 5.A and those reported in sectoral report table 5. Uncertainties are reported to be reduced since the 2004 inventory but these estimates are not supported by relevant documentation.

61. A Working Group on LULUCF was established in May 2005 by the Ministry of Agriculture, Forestry and Water Management to improve and complete the estimates for this sector. The ERT encourages Croatia to implement the IPCC good practice guidance for LULUCF in the preparation of the estimates, including carbon stock changes and emissions of non-CO<sub>2</sub> GHGs from all carbon pools and from all land uses and land-use changes, and to use the CRF tables, in accordance with decision 13/CP.9, for reporting them.

## **B. Sink and source categories**

### **1. Changes in forest and other woody biomass stocks**

62. The net emissions/removals from this category have been calculated, according to the IPCC methodology, as the difference between removals from growth increment and emissions from harvest. Activity data are derived from the Forest Management Area Plan, the public enterprise Hrvatske Šume Company (the Croatian Forests Co.) and the Ministry of Agriculture, Forestry and Water Management. Emission/removal factors are taken from the Revised 1996 IPCC Guidelines. However, it is difficult to replicate the emissions and removals estimates with the information provided in the NIR. Croatia is encouraged to provide more information on the AD, the methodologies used, and the results of the estimates.

### **2. Forest and grassland conversion**

63. The NIR states that forest conversion does not occur in Croatia because of legal restrictions, and thus no emissions resulting from land-use changes are reported. The ERT suggests that land-use changes should be monitored and emissions estimated because deforestation may occur even if it is banned by law. The effect of disturbances (e.g. forest fires) on carbon stocks and potential emissions of non-CO<sub>2</sub> GHGs should also be investigated and reported in the appropriate category – Forest Land Remaining Forest Land if land use has not changed, or Land Converted to Other Land if these disturbances are followed by land-use change.

## **VI. Waste**

### **A. Sector overview**

64. In 2003, total emissions from the Waste sector in Croatia amounted to 1,289 Gg CO<sub>2</sub> equivalent, or 4.3 per cent of total national GHG emissions. Of this amount, 92.7 per cent came from solid waste

disposal sites (SWDS) and 7.3 per cent from human sewage. From 1990 to 2003, emissions from the sector increased by 38.2 per cent.

65. Only CH<sub>4</sub> emissions from SWDS and N<sub>2</sub>O from human sewage are reported in 2005. The emissions from other sources have not been estimated, mainly because of lack of data.

66. Little improvement has been made since the previous submission. Croatia plans to improve its waste statistics and to improve the quality of its data. The ERT recommends that Croatia develop a sound data collection and analysis system, include in its inventory emissions from waste-water handling and waste incineration, and re-evaluate its protein intake value in a consistent manner for all years.

### **B. Key categories**

#### Solid waste disposal sites – CH<sub>4</sub>

67. The EF has been derived based on a tier 1 method and is regarded as a combination of a country-specific value and an IPCC default. The ERT encourages Croatia to adopt a tier 2 method, if possible, depending on availability of data and resources. To this end, Croatia needs to develop a well-managed data collection and analysis system for solid waste generation and treatment. Croatia is also encouraged to extrapolate back (from recent years to earlier years) the AD for SWDS, applying reasonable assumptions from waste experts.

### **C. Non-key categories**

#### Waste-water handling – N<sub>2</sub>O

68. Owing to different assumptions being made and different data sources being used for the amount of per capita protein intake, the estimates of N<sub>2</sub>O emissions before and after 1996 are quite different. This raises the question of whether these estimates are accurate and consistent. The ERT recommends Croatia to assess the data and methodology for calculation in order to improve consistency in the time series.

Annex

**Documents and information used during the review**

**A. Reference documents**

IPCC. Good practice guidance and uncertainty management in national greenhouse gas inventories, 2000. Available at: <<http://www.ipcc-nggip.iges.or.jp/public/gp/english/>>.

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UNFCCC secretariat. Status report for Croatia. 2005. Available at <[http://unfccc.int/files/national\\_reports/annex\\_i\\_ghg\\_inventories/inventory\\_review\\_reports/application/pdf/2005\\_status\\_report\\_croatia.pdf](http://unfccc.int/files/national_reports/annex_i_ghg_inventories/inventory_review_reports/application/pdf/2005_status_report_croatia.pdf)>.

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**B. Additional information provided by the Party**

Responses to questions during the review were received from Mr. Željko Jurić (National Inventory Team Leader, EKONERG, Atmospheric Protection Department).

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