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Report of the individual review of the annual submission of Kazakhstan submitted in 2010*

* In the symbol for this document, 2010 refers to the year in which the inventory was submitted, and not to the year of publication.

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I. Introduction and summary

1. This report covers the in-country review of the 2010 annual inventory submission of Kazakhstan, coordinated by the UNFCCC secretariat, in accordance with decision 19/CP.8. The review took place from 16 to 21 August 2010 in Almaty, Kazakhstan, and was conducted by the following team of nominated experts from the UNFCCC roster of experts: generalist – Mr. Dennis Rudov (Belarus); energy – Mr. Christo Christov (Bulgaria); industrial processes – Ms. Natalya Parasyuk (Ukraine); agriculture – Ms. Batima Punsalmaa (Mongolia); land use, land-use change and forestry (LULUCF) – Mr. Daniel Martino (Uruguay); and waste – Ms. Medea Inashvili (Georgia). Ms. Natalya Parasyuk and Ms. Batima Punsalmaa were the lead reviewers. The review was coordinated by Mr. Javier Hanna (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” (hereinafter referred to as the UNFCCC review guidelines), a draft version of this report was communicated to the Government of Kazakhstan, which provided comments that were considered and incorporated, as appropriate, into this final version of the report.

3. In 2008, the main greenhouse gas (GHG) in Kazakhstan was carbon dioxide (CO₂), accounting for 81.5 per cent of total GHG emissions¹ expressed in CO₂ eq, followed by methane (CH₄) (16.9 per cent) and nitrous oxide (N₂O) (1.2 per cent). Hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulphur hexafluoride (SF₆) collectively accounted for 0.4 per cent of the overall GHG emissions in the country. The energy sector accounted for 87.2 per cent of total GHG emissions, followed by industrial processes (5.9 per cent), agriculture (4.9 per cent) and waste (2.0 per cent). The solvent and other product use sector is reported as not applicable (“NA”) and not estimated (“NE”). Total GHG emissions amounted to 245,855.05 Gg CO₂ eq and decreased by 27.3 per cent between 1990 and 2008.

4. Tables 1 and 2 show GHG emissions under the Convention, by gas and by sector, respectively. In table 1 CO₂, CH₄ and N₂O emissions do not include emissions and removals from the LULUCF sector.

¹ In this report, the term “total GHG emissions” refers to the aggregated national GHG emissions expressed in terms of CO₂ eq excluding LULUCF, unless otherwise specified.

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Table 1
Greenhouse gas emissions by gas, 1990 to 2008

Greenhouse gas	Gg CO ₂ eq							Change 1990–2008 (%)
	1990	1995	2000	2005	2006	2007	2008	
CO ₂	264 806.80	172 223.29	131 932.90	175 170.68	187 125.65	195 675.24	200 437.45	–24.3
CH ₄	68 480.86	41 484.47	32 608.08	37 069.78	39 605.34	40 286.85	41 456.00	–39.5
N ₂ O	4 957.31	2 864.88	1 866.19	2 445.74	2 652.92	2 860.78	2 880.07	–41.9
HFCs	NA, NO	0.21	112.16	167.96	272.51	291.06	293.19	NA
PFCs	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	87.17	788.23	NA
SF ₆	NA, NO	NA, NO	NA, NO	0.15	0.03	0.02	0.11	NA

Abbreviations: NA = not applicable, NO = not occurring.

Table 2
Greenhouse gas emissions by sector and activity, 1990 to 2008

Sector	Gg CO ₂ eq							Change 1990–2008 (%)
	1990	1995	2000	2005	2006	2007	2008	
Energy	295 979.18	191 156.49	143 861.68	185 901.02	200 352.10	208 806.23	214 446.16	–27.5
Industrial processes	17 916.83	8 144.59	10 092.67	13 456.18	13 062.52	13 862.19	14 445.09	–19.4
Solvent and other product use	NA, NE	NA, NE	NA, NE	NA, NE	NA, NE	NA, NE	NA, NE	NA
Agriculture	20 282.47	13 614.76	8 222.98	10 784.91	11 378.82	11 880.90	12 101.47	–40.3
LULUCF	–8 759.20	–3 144.35	–7 242.01	–2 119.70	–2 403.83	–1 790.47	–633.72	–92.8
Waste	4 066.50	3 657.00	4 342.00	4 712.20	4 863.00	4 651.80	4 862.33	19.6
Other	NA	NA	NA	NA	NA	NA	NA	NA
Total (with LULUCF)	329 485.78	213 428.49	159 277.32	212 734.62	227 252.62	237 410.65	245 221.34	–25.6
Total (without LULUCF)	338 245.98	216 572.84	166 519.32	214 854.31	229 656.45	239 201.12	245 855.05	–27.3

Abbreviations: NA = not applicable, NE = not estimated.

5. The GHG inventory does not fully follow the *Revised 1996 Intergovernmental Panel on Climate Change (IPCC) Guidelines for National Greenhouse Gas Inventories* (hereinafter referred to as the Revised 1996 IPCC Guidelines), the *IPCC Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories* (hereinafter referred to as the IPCC good practice guidance), the *IPCC Good Practice Guidance for Land Use, Land-Use Change and Forestry* (hereinafter referred to as the IPCC good practice guidance for LULUCF) and the “Guidelines for the preparation of national communications by Parties included in Annex I to the Convention, Part I: UNFCCC reporting guidelines on annual inventories” (hereinafter referred to as the UNFCCC reporting guidelines). The most important cross-cutting problems identified during the review by the expert review team (ERT) are with respect to issues of transparency, completeness and the accuracy of the reported information, as indicated in more detail in paragraph 6 below.

6. The 2010 inventory submission covers most sectors and categories, but the ERT identified a need for improvement in the following areas:

(a) The structure of the national inventory report (NIR) is not fully in accordance with the recommended outline provided in the UNFCCC reporting guidelines;

(b) A quality assurance/quality control (QA/QC) plan has not been elaborated in accordance with the IPCC good practice guidance;

(c) Details of recalculations and their rationale are not provided in the appropriate chapter of the NIR;

(d) There is a lack of consistency between the information provided in the NIR and the common reporting format (CRF) tables, in particular for the agriculture and waste sectors;

(e) The inventory does not provide clear and concise information on methods, emission factors (EFs) and activity data (AD) in the NIR, nor does it provide additional background information;

(f) The completeness of the inventory is an issue, as emissions from the solvent and other product use sector, as well as from some categories throughout all sectors, are reported as “NE”;

(g) The uncertainty analysis performed by Kazakhstan is not in line with the IPCC good practice guidance. The annex to the NIR with detailed information on this analysis, such as the quantitative estimates of uncertainty for the inventory as a whole and for the sectors separately, and the expert judgement used to determine uncertainty values, is missing;

(h) The key category analysis reported by Kazakhstan does not include the LULUCF sector, which is not in accordance with the IPCC good practice guidance for LULUCF; in addition, no detailed information containing the key category analysis results and methodology used is presented in an annex to the NIR;

(i) Notation keys are missing or improperly used throughout the sectors.

7. In the course of the review, the ERT formulated a number of recommendations relating to the elements listed above, which are elaborated in the relevant sector chapters and in the conclusions and recommendations chapter.

II. Technical assessment of the annual submission

A. Overview

1. Annual submission and other sources of information

8. Kazakhstan submitted a complete set of CRF tables for the period 1990–2008 on 9 April 2010 and an NIR on 25 May 2010. Kazakhstan resubmitted its CRF tables on 24 April 2010 and 21 May 2010. The inventory submission was submitted in accordance with the UNFCCC reporting guidelines; however, the ERT recommends that Kazakhstan made its complete inventory submission on the established due date (15 April).

9. During the in-country review, Kazakhstan provided the ERT with additional information. The documents concerned are not part of the inventory submission. The full list of materials used during the review is provided in annex I.

Completeness of inventory

10. The inventory of Kazakhstan is mostly complete in terms of geographical coverage, with the exception of the LULUCF estimates, which were made for land area covering less than 20 per cent of the national territory. Estimates for some source and sink categories are not reported in the CRF tables or the NIR; for example, land converted to forest land, land converted to wetlands and indirect N₂O emissions from agricultural soils are reported as “NO”. Emissions from the solvent and other product use sector were not estimated. Kazakhstan reported as “NE” potential emissions for HFCs, PFCs and SF₆ for all time series. Actual emissions of HFCs are reported starting from 1995 onwards, SF₆ are reported from 2004 and numerical values for actual emissions of PFCs are not reported for the whole time series (notation keys “NA” and “NO” are used). The CRF tables are generally complete and are provided for the whole time series; however, in many cases notation keys are missing or are used improperly and the explanatory information or information in documentation boxes in tables 7, 8(a), 8(b), 9(a) and 9(b) is missing for the whole time series.

11. The ERT recommends that Kazakhstan make the following improvements:

- (a) Include the missing categories (especially the emissions of HFCs, PFCs and SF₆ and emissions from the solvent and other product use sector) in future inventory submissions;
- (b) Achieve full coverage of territory for the LULUCF sector;
- (c) Appropriately use the notation keys;
- (d) Fill in the documentation boxes in the CRF tables with background information;
- (e) Prepare and report estimates for all missing categories for which the Revised 1996 IPCC Guidelines, the IPCC good practice guidance and the IPCC good practice guidance for LULUCF provide estimation methodologies and provide information in the NIR on other potential sources or sinks not addressed in the current inventory submission.

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

Overview

12. The ERT concluded that the institutional arrangements do not fully perform their required functions. The ERT noted that institutional arrangements regarding strengthening cooperation and information exchange between all institutions involved in inventory preparation should be improved. For example, cooperation can be improved between the inventory team of the Kazakh Scientific Research Institute of Ecology and Climate (KazNIEK), the Kazakhstan Hydrometeorological Service (KazHYDROMET) and some other institutions, such as the Commission on Management of Forestry and Hunting Sectors, regarding AD of the forest inventory.

Inventory planning

13. During the in-country review, Kazakhstan explained the institutional arrangements for the preparation of the inventory. The Ministry of Environmental Protection (MoEP) has overall responsibility for the national inventory, including the official submission to the UNFCCC secretariat. KazNIEK, under the supervision of MoEP, is responsible for the planning, preparation and management of the national inventory. A legal framework for the inventory preparation process has been put in place in Kazakhstan through two orders of MoEP: No. 258 of 4 December 2009 “On executive body for supporting activity of authorized body on coordination of realization of Kyoto Protocol to the UNFCCC” and No. 193 of 23 July 2010 “On approval of the National Green House Gas Inventory System”.

14. The Agency of Statistics of the Republic of Kazakhstan and many other institutions (the Ministry of Economic Development and Trade, the Ministry of Transport and Communications, the Ministry of Industry and New Technologies, the Ministry of Agriculture, etc.) collaborate with KazNIEK in the inventory preparation process, mainly by providing AD. KazNIEK is responsible for the calculation of emissions from the industrial processes, agriculture and waste sectors, while experts from KazHYDROMET calculate emissions from the energy and LULUCF sectors and submit their calculations using CRF files to the national inventory compiler at KazNIEK.

15. The ERT noted that the institutional framework for planning the inventory still needs to be enhanced in Kazakhstan in order to make inventory preparation sustainable. In order to achieve improvements in the institutional framework, Kazakhstan may consider:

(a) Increasing and expanding cooperation between the inventory team and governmental, scientific, private and non-governmental organizations and experts from other institutions and using the full spectrum of information available on AD, EFs and methodologies in such organizations;

(b) Ensuring the continuity of staff involved in inventory preparation and the transfer of knowledge and current approaches for inventory work to new staff;

(c) Developing and implementing a national QA/QC plan that involves all institutions participating in the preparation of the inventory.

Inventory preparation

Key categories

16. Kazakhstan reports a key category tier 1 analysis, both level and trend assessment, as part of its 2010 inventory submission. However, the key category results presented in

table 1.2 of the NIR contain only a qualitative assessment. Some discrepancies in the key categories description were found in the information provided in the NIR; for example, cement production is mentioned as key in the text but not in table 1.2 and solid waste disposal on land is mentioned as key in table 1.2 but not in the text. No annex containing the quantitative key category assessment is included in the NIR. However, during the visit to KazNIEK, tables with quantitative key category assessment were presented to the ERT. The ERT recommends that Kazakhstan ensure the consistency of reporting on key categories in the text of the NIR and that it include all relevant information in the NIR, particularly the annex containing the quantitative key category analysis results, in its next inventory submission.

17. The key category analysis performed by Kazakhstan and the analysis performed by the secretariat² produced different results, owing to the significant aggregation of categories and the use of 1992 as a base year in the analysis performed by Kazakhstan. Kazakhstan has not included the LULUCF sector in its key category analysis, which is not in accordance with the IPCC good practice guidance for LULUCF.

18. The ERT recommends that Kazakhstan perform its key category analysis at a more disaggregated level, in accordance with the IPCC good practice guidance, for example by distinguishing between fuel types for stationary combustion categories in the energy sector; it also recommends that Kazakhstan include the LULUCF sector in its key category analysis and that it provide a more detailed discussion of its analysis in its next inventory submission. In addition, the ERT recommends that Kazakhstan use its key category analysis as a driving factor for the preparation of the inventory, using the analysis to prioritize the development and improvement of the inventory and, if possible, identify additional key categories using a qualitative approach.

Uncertainties

19. The NIR states that an IPCC tier 1 uncertainty analysis was performed; however, the results of this analysis are not reported in the NIR and no annex containing the uncertainty analysis is given. Some information on uncertainties is reported in the sectoral chapters, but this information is insufficient to assess the rationale behind the assumptions used in the expert judgement and the choice of uncertainty values. The LULUCF sector is not included in the uncertainty analysis.

20. The uncertainty analysis is currently based to a great extent on the IPCC default values and, to a lesser extent, on institutional/expert judgement. The uncertainties calculated by some industries (e.g. cement producers) are commonly gathered during oral consultations and do not have supporting documentation.

21. The ERT recommends that Kazakhstan perform a quantitative uncertainty analysis, including the LULUCF sector, in accordance with the IPCC good practice guidance and present it in an annex to the NIR in its next inventory submission. The ERT also encourages Kazakhstan to improve the uncertainty analysis by using values more appropriate to its national circumstances and/or country-specific uncertainty values. The ERT also

² The secretariat identified, for each Party, the categories that are key categories in terms of their absolute level of emissions, applying the tier 1 level assessment as described in the Intergovernmental Panel on Climate Change *Good Practice Guidance for Land Use, Land-Use Change and Forestry*. Key categories according to the tier 1 trend assessment were also identified for Parties that provided a full set of CRF tables for the base year or period. Where the Party performed a key category analysis, the key categories presented in this report follow the Party's analysis. However, they are presented at the level of aggregation corresponding to a tier 1 key category assessment conducted by the secretariat.

recommends that Kazakhstan use the uncertainty analysis as a driving factor for the improvement of its inventory.

Recalculations and time-series consistency

22. Table 8(a) of the CRF reports recalculations for the whole time series for the following categories and gases: all categories and gases in the energy sector; CO₂ emissions from the chemical industry; N₂O emissions from agricultural soils; CO₂ emissions from cropland; and CO₂ emissions from grassland. Table 8(b) does not contain information on the rationale for the recalculations made.

23. The major changes, and their magnitude, include an increase in the estimated total GHG emissions in 1990 (12.7 per cent) and a decrease in the estimated total GHG emissions in 2007 (14.9 per cent). During the review, Kazakhstan provided general information on the reasons for these recalculations, which indicated that they were caused in the main by the update of statistical information by the Agency of Statistics, which revealed some inconsistencies in AD that were corrected by the recalculations performed.

24. The ERT noted, however, that the rationale and impact of the recalculations are not properly addressed in the chapter on recalculations and improvements, nor in the sectoral chapters of the NIR. The ERT recommends that Kazakhstan report in the appropriate chapters of the NIR and in relevant CRF tables detailed information on the rationale and impact of the recalculations performed and that it provide full explanatory information in its next inventory submission.

Verification and quality assurance/quality control approaches

25. A QA/QC plan in accordance with the IPCC good practice guidance has not been elaborated yet. An outline of basic QA/QC procedures contained in MoEP order No. 258 of 4 December 2009 “On executive body for supporting activity of authorized body on coordination of realization of Kyoto Protocol to the UNFCCC” was presented to the ERT during the in-country review.

26. The NIR reports that some of the tier 1 QC procedures were conducted during the preparation of the NIR; however, simple mistakes were found in calculations, in the NIR and in the CRF tables and the ERT identified discrepancies between the NIR and the CRF tables in AD and EFs and in the description of methodologies used. The NIR also reports that some QA activities are performed after the preparation of the NIR that has to be approved during scientific councils of KazNIIK and MoEP. As a result of these procedures a number of recommendations are made; after their implementation the NIR is approved and submitted to the secretariat. However, the ERT noted that the questions asked or the recommendations made during the scientific councils and their implementation are not documented. The ERT therefore recommends that Kazakhstan strengthen these procedures and that it improve the documentation on the recommendations received from the scientific councils and on the actions performed by the inventory team in response.

27. The ERT recommends that Kazakhstan develop and implement a national QA/QC plan in accordance with the IPCC good practice guidance and that it include descriptions of the QA/QC and verification activities and sector-specific procedures in the sector chapters in its next inventory submission, following the recommended outline of the NIR in the UNFCCC reporting guidelines. QA procedures should be improved, for example by annual independent peer review of all sectors of the inventory by experts or organizations not involved in the inventory preparation. The ERT notes that Kazakhstan has the capacity to build a fully functioning QA/QC system that ensures the quality of the GHG inventory.

Transparency

28. The CRF tables and the NIR do not provide sufficient transparency to enable the assessment of the AD used and of the EFs and methods applied. Justifications are not provided for the use of IPCC default values of EFs or the use of expert judgement on the percentage of HFC leaks from the total volume contained in refrigeration and mobile air-conditioning equipment. Notation keys are missing or improperly used throughout the sectors. Most categories are reported at the level of detail required in the CRF; however, the exception is the LULUCF sector, where the forest land remaining forest land category is reported without a division by types of forest, which is not in accordance with the recommendation of the IPCC good practice guidance for LULUCF.

29. The ERT recommends that Kazakhstan improve the transparency of its inventory by including clear and concise information on methods, EFs and AD in the NIR of its next inventory submission and that it include any other additional information in the annexes to the NIR following the recommendations of the UNFCCC reporting guidelines.

Inventory management

30. Kazakhstan has an archive under development at KazNIEK. At the end of each reporting cycle documentation used for its inventory is archived, although not for all sectors. During the in-country review, the ERT had some difficulties with obtaining the archived information for the agriculture and industrial processes sectors. The IPCC worksheets used for emission calculations and other calculations are stored in folders sorted by year on the computer of a staff member; however, this information is located in the folder of the CRF Reporter software, and in backup databases, which is not in line with good practice and international standards for records management. The ERT noted that in general the information used for inventory estimates and the calculations made are stored by individual experts in order that they may use them for their work and under their responsibility and that there is a lack of a centralized archive and backing up of the information in a systematic way. Paper-trail information is filed, but is sometimes hard to locate.

31. The ERT recommends that Kazakhstan enhance its archiving system, including for disaggregated EFs and AD and their references, information on how these EFs and AD have been generated and aggregated for the preparation of the inventory, methodologies used and references, internal documentation on QA/QC procedures, external and internal reviews, and documentation for each year for annual key categories, key categories and uncertainty analyses and planned inventory improvements. The archiving system should be managed by the institution responsible for the planning, preparation and management of the national inventory (KazNIEK). The ERT also recommends putting all electronic information regarding inventory submissions onto a separate drive, and that it is sorted by year, sector or other common attributes. This information should be backed up annually on CDs, DVDs and external server or by some other means. Organization of the paper archive should be improved, completed and enhanced and should follow good practice and international standards for records management.

3. Areas for further improvementIdentified by the Party

32. The 2010 NIR identifies several areas for improvement. In its NIR and also in response to the issues raised during the review, Kazakhstan indicated the following areas for improvement:

- (a) The quality of basic information received from ministries and organizations and enhance the collection and processing of data throughout the sectors should be improved;
- (b) Higher tiers (2 or 3) for emissions calculation in the energy and waste sectors should be used;
- (c) The use of country-specific EFs and national data in the energy, industrial processes, agriculture and waste sectors should be increased.

Identified by the expert review team

33. The ERT identified the following cross-cutting issues for improvement:

- (a) There should be an improvement in the NIR structure in order that it fully reflects the requirements of the UNFCCC reporting guidelines;
- (b) A quantitative uncertainty analysis, including for the LULUCF categories, should be conducted in accordance with the IPCC good practice guidance; and the sources and the references for the AD and EF uncertainty values selected for the emission estimates should be transparently documented;
- (c) A key category analysis in accordance with the IPCC good practice guidance for LULUCF should be performed using 1990 as a base year for the analysis and detailed results should be reported in an annex to the NIR;
- (d) Information on the methods, assumptions, AD and EFs used should be transparently documented in the NIR;
- (e) A QA/QC plan, in particular QC and QA procedures in accordance with the IPCC good practice guidance, should be fully developed and implemented;
- (f) The completeness and accuracy of the NIR and CRF tables should be improved by eliminating inconsistencies, reporting estimates for missing categories and revising the use of notation keys, as appropriate;
- (g) Detailed information on recalculations performed should be provided, including explanatory information and the rationale and justification for recalculations made;
- (h) The documentation and archiving procedures for AD, EFs, the methods used and the estimates of emissions should be improved in accordance with best practice and international standards for records management, if possible.

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

B. Energy

1. Sector overview

35. The energy sector is the main sector in the GHG inventory of Kazakhstan. In 2008, emissions from the energy sector, as reported by the country, amounted to 214,446.16 Gg CO₂ eq, or 87.2 per cent of total GHG emissions. Since 1990, emissions have decreased by 27.5 per cent. The key driver for the fall in emissions was the reduction of fossil fuel consumption due to the process of the establishment of a new independent State, and the associated deep economic crisis, as well as social and economic reforms in the period 1992–1999. Economic activities and fossil fuel consumption decreased until 1999, showing a 60 per cent decrease in the energy sector emissions compared with 1990. Following the

recovery from the economic crisis, a stable growth of the energy sector emissions was observed in the period 2000–2008. Within the sector, 48.0 per cent of emissions were from energy industries, followed by 14.1 per cent from manufacturing industries and construction and 11.3 per cent from transport. The other sectors category accounted for 9.8 per cent, solid fuels accounted for 9.6 per cent and oil and natural gas accounted for 4.2 per cent. The remaining 3 per cent were from the other category.

36. Owing to the high energy intensity of the national economy and the significant extraction, consumption and export of fossil fuels, the contribution of the energy sector to the total GHG emissions is extremely high compared with other Annex I Parties, including Parties with economies in transition.

37. The sources of information used for the inventory for the energy sector include: energy balances from Agency of Statistics reports; official statistical information sheets filled in and submitted to the Agency of Statistics by power plants and industrial enterprises (the sheets provide production data and data for fuel delivery, consumption and stocks by fuel type); reports from external scientific, research and design organizations, such as subcontractors to the inventory team concerning the calculation of EFs, AD and emission estimates; and letters to governmental organizations and enterprises with requests for information and the corresponding answers.

Sector-specific issues relating to completeness

38. The geographical coverage of the sector is complete, while some categories, such as coal mining and handling (CO₂), CO₂ from exploration (oil and natural gas), distribution of oil products (oil), production/processing (natural gas), CH₄ from other leakage at industrial plants and power stations (natural gas) and CH₄ from venting, are not estimated. Neither data nor notation keys are reported for some categories, such as other transportation and solid fuel transformation. The ERT recommends that Kazakhstan develop emission estimates for these categories and that it use proper notation keys.

39. In the energy balance of the country a specific category “losses” is reported. The Party explained that this category includes physical losses of fuel during transport and storage, including losses of the energy content of fuel during storage and transport, as well as the theft of fuel and the accuracy of fuel measurement. These quantities of fuel are oxidized or combusted, but emissions from these processes are not estimated either in the combustion or in the fugitive emissions categories. Owing to the significant amounts of these losses the ERT strongly recommends that Kazakhstan include emission estimates related to “losses” for all categories in its next inventory submission.

Sector-specific issues relating to transparency

40. The reporting of the energy sector is not sufficiently transparent. The description of the methods for energy industries and for transportation is not detailed enough and data about the carbon content, oxidation factors and calorific values are not reported for all fuels. Further improvement of the description of methods for these categories is recommended, as well as reporting the AD, EFs and other parameters by categories following the level of disaggregation of data collected and used for calculations. There is an inappropriate use of notation keys or missing notation keys in the CRF tables. For example, the apparent consumption (excluding non-energy use and feedstocks) is reported as “NA” for all fuels in table 1.A(c), there are no notation keys or data in table 1.B.2 for venting and flaring (oil, natural gas and combined), other leakage from industrial plants and power stations (natural gas), refining/storage (oil) and distribution of oil products subcategories, etc. The ERT encourages Kazakhstan to improve the use of notation keys and to report in the CRF tables information about the allocation of emissions for the categories reported as included elsewhere (“IE”). Generally, the data in the NIR are reported in terms of GJ and

PJ, but some data are reported in tonnes of coal equivalent, which hinders the assessment of the emission estimates and requires additional effort from the ERT. Therefore the ERT encourages Kazakhstan to report all figures for energy consumption and EFs in terms of GJ (PJ) in the NIR.

Sector-specific issues relating to recalculations and time-series consistency

41. The ERT noted that the applied calculation methods are consistent through the time series for all categories in the energy sector. However, the time-series estimates for some categories in the sector are not consistent because different sets of data have been used. For example, the other (manufacturing industries and construction) category covers fuel combustion for other industries and construction. However, for 1990 and 1992 emissions from activities related to construction materials and glass and porcelain production are also reported under this category. For 1993–1997 the Agency of Statistics reported fuel consumption data not separated by industrial subsectors and extrapolation was used to separate the data based on shares of the fuels used by the industry in the previous year. As in 2008, data from national statistics for the ferrous and non-ferrous metals industries are reported together in one category, “metals industry”; the same approach was used to separate the fuel consumption between them. Fuels used for feedstock in the chemical and petrochemical industries were not estimated for the period 1991–1997 owing to the lack of statistical data. Data for the export and import of some fuels for the same period are also not available. During the in-country review the ERT was informed that most of the absent data had been recovered, as the statistical reports had been found in the national statistical data archive. The ERT recommends that Kazakhstan ensure consistency of time-series estimates for all categories by using the recently found archived statistical data and, for the cases for which data cannot be found, by applying interpolation in accordance with the IPCC good practice guidance.

42. The NIR does not report any recalculations for the energy sector, while in CRF table 8(a) recalculations are reported for all categories and for the whole period 1990–2007. No explanations are given in table 8(b) for the recalculations. The ERT strongly recommends reporting in the NIR and CRF table 8(b) all the information required on recalculations, in accordance with the IPCC good practice guidance.

43. The recalculations of the energy sector made a significant impact on the emission estimates for 1990. The recalculations resulted in an increase of the sector CO₂ emissions by 12.4 per cent and of the national CO₂ totals by 8.0 per cent. The most significant increase in the sector (71.6 per cent) is observed in the oil and natural gas category and the second biggest increase (52.0 per cent) is observed in the manufacturing industries and construction category.

44. In contrast to the 1990 recalculations, the recalculations for 2007 resulted in a decrease by 22.5 per cent of CO₂ emissions in the sector and a decrease of the national CO₂ total by 22.1 per cent. The most significant decrease in the sector (47.5 per cent) is observed in the other sectors category, followed by a decrease of 25.7 per cent in manufacturing industries and construction and a decrease of 23.6 per cent in energy industries.

45. The second national communication of Kazakhstan,³ submitted in June 2009, reports 259 Tg CO₂ eq for 1990 estimates for the energy sector and 197 Tg CO₂ eq for 2005. In the 2010 submission these values are reported as 296 Tg CO₂ eq and 186 Tg CO₂ eq, respectively. The ERT considers the difference in the estimates reported in the 2010 inventory submission and in the second national communication as an issue that is not

³ <http://unfccc.int/essential_background/library/items/3599.php?such=j&symbol=KAZ/COM/2%20E#beg>.

adequately covered in the NIR. The ERT recommends that Kazakhstan report a detailed analysis of the rationale behind these recalculations in its next inventory submission.

Sector-specific issues relating to uncertainties

46. Uncertainty estimates are not reported in the NIR and only a general discussion on the uncertainty for the sector is given. The discussion is not based on expert assessments and calculations of uncertainties of the EFs and AD used in the estimates. The ERT recommends that Kazakhstan develop, for its next inventory submission, estimates for the uncertainty of AD and EFs based on real conditions in the energy sector of the country and that it calculate and report in the NIR the uncertainty of the energy sector emission estimates.

Sector-specific issues relating to verification and quality assurance/quality control approaches

47. There are no records on QA/QC activities available for the energy sector. A number of typing mistakes and inconsistencies were found between the data from the sources of information, the calculation sheets, the CRF tables and the NIR that considerably affect the emission estimates. The ERT strongly recommends that Kazakhstan perform intensive checks for correctness of the methods, data input and calculations, implement all QC procedures recommended in the IPCC good practice guidance and that it carry out a peer review of, and verify the information and studies delivered from external organizations and institutions for, the preparation of the inventory in its next inventory submission.

2. Reference and sectoral approaches

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

48. CO₂ emissions from fuel combustion were calculated using the reference approach and the sectoral approach. For 2008, there is a difference of 4.37 per cent in the CO₂ emission estimates between the reference approach and the sectoral approach. Explanations for this difference are not provided in the documentation box of table 1.A(c) of the CRF. This difference varies between -5.70 per cent (1990) and 42.92 per cent (1997) and is above 2 per cent for most of the years. The explanations provided in the NIR for the fluctuations in the differences between the two approaches over the years are not fully credible. The origin of these significant differences between estimates should be clarified and estimates recalculated in the next inventory submission.

49. Kazakhstan reported fuel consumption excluding non-energy use and feedstocks in the reference approach as "NA", which makes the comparison of fuel consumption in both approaches in table 1.A(c) not possible. A comparison made by the ERT of fuel consumption by fuel categories for the two approaches (not excluding non-energy use and feedstocks in the reference approach) for 2008 shows that the total fuel consumption difference is very high (21.2 per cent) and is higher by fuel type: for gaseous fuels it is 104.2 per cent; for liquid fuels it is -34.9 per cent; and for solid fuels it is 26.3 per cent. These differences show that the emission estimates for 2008 may be significantly underestimated and that there may be either an incorrect allocation of fuels between types or incorrect (lower) data were reported for fuel consumption in the sectoral approach.

50. A comparison made by the ERT of fuel consumption by fuel categories for the two approaches (not excluding non-energy use and feedstocks in the reference approach) for 1990 shows that there is no difference in total fuel consumption but the difference by fuel type is high: for gaseous fuels it is -10.2 per cent; for liquid fuels it is 17.5 per cent; and for solid fuels it is -4.5 per cent. These differences show that the emission estimates for 1990 may be significantly overestimated and that there may be either an incorrect allocation of

fuels between types or incorrect (higher) data were reported for fuel consumption for the sectoral approach.

51. The differences identified by the ERT probably originate from mistakes in transferring data from data sources to calculation sheets and to CRF Reporter. Some of the most significant mistakes were identified during the in-country review. The available information shows that the GHG emission estimates for the energy sector are not accurate and not representative. The ERT recommends conducting more accurate checks of the calculations and the correctness of the information, of the transfer between data sources, calculation sheets and CRF Reporter, and of emission estimates, in order to improve accuracy and correctness.

52. The ERT noted that the apparent consumption of fuels in Kazakhstan's reference approach for 2008 does not correspond to the data of the International Energy Agency (IEA). For 2008, there is a difference of 8.0 per cent in the apparent consumption between the reference approach and the IEA data, mainly due to discrepancies in production and export for all fuels. In addition, the apparent consumption reported by Kazakhstan differs from that reported to the IEA for all years of the time series (differences within 13 per cent, except for 2005 (17 per cent)). Crude oil production reported in the CRF is 5 per cent lower than that reported to the IEA for all the years and natural gas production differences vary from -32 per cent in 1996 to 48 per cent in 1999. Significant differences exist for coal. During the in-country review a representative of the Agency of Statistics explained these differences as occurring from an incorrect allocation of fuels and annual data (data for one year were allocated to the other year) and also by differences between the classification of coal by IEA and by Kazakhstan. The ERT was informed that the Party is improving the reporting of statistical data for the period 1990–2000 and is planning to better clarify and remove the discrepancies in its next inventory submission.

International bunker fuels

53. No AD are reported for aviation and marine bunkers in table 1.C of the CRF and in the NIR ("NA" is reported for "other" under marine bunkers). For marine bunkers, CO₂, CH₄ and N₂O emissions are reported as "NA". During the in-country review, the ERT was informed that no data are available for marine bunker fuels because there was no international sea transport to or from the country and hence no marine bunker fuels in Kazakhstan until 2010. Only starting in 2010 is taking place some development of international sea navigation on short distances in the Caspian Sea. The ERT recommends that the absence or existence of navigation in the Caspian Sea between Kazakhstan and other former republics of the Union of Soviet Socialist Republics (USSR) from 1990 onwards be documented and that, if there was such transport, the allocation of bunker fuels in the statistical reports should be clarified.

54. For aviation bunkers, CO₂, CH₄ and N₂O emissions are reported as "NE" (no notation key is reported for N₂O emission from jet kerosene). It is not clear from the NIR if fuels under the aviation bunker category are included under the civil aviation category, are reported as fuel export or are not reported at all. The ERT recommends that Kazakhstan clarify the allocation of aviation bunker fuels consumption, separate this fuel consumption from that for domestic flights and report it under the international bunkers emissions category. The rest of the fuel should be reported under the civil aviation category. If data about international flights are missing, the ERT recommends using expert estimates for the share of the fuel used for international and domestic flights, or to use drivers (e.g. the number of international flights and distances) to estimate aviation bunker fuels. The ERT suggests approaching Aeroflot for data on estimates of the fuel used for domestic flights (on the Kazakhstan territory) and for fuel used for international flights (from Kazakhstan to

the territory of the other republics of the former USSR and out of the territory of the former USSR) for the early 1990s, when all flights were operated by this airline.

3. Key categories

Stationary combustion: liquid, solid and gaseous fuels – CO₂

55. For estimates of CO₂ emissions from the public electricity and heat production category a bottom-up approach was used. Emission calculations are based on AD collected from plants and plant-specific EFs. This method is not consistent with the IPCC good practice guidance because the plant AD (fuel consumption in energy units) is determined as the sum of the quantities of the main fuel, the ignition fuel, the stabilization fuel and the backup fuel. The EF for the main fuel is used to calculate emissions, which results in an overestimation of emissions if the main fuel is coal and the other fuels are residual oil or natural gas, and an underestimation of emissions if the main fuel is natural gas and the other fuel is residual oil. The ERT recommends that Kazakhstan modify the calculation method to account separately for the main fuel emissions and the other fuel emissions.

56. The difference between the fuel reported for the public electricity and heat production category in the national energy balance and the sum of the fuel reported by the plants is not taken into account in the AD used for estimating emissions. The ERT recommends that, if AD from the plants are to be used for the estimates, in order to avoid an underestimation, Kazakhstan should in its next inventory submission calculate this difference and report the resulting emissions.

57. In the annex A of the NIR, Kazakhstan reported high country-specific oxidation factors (0.985–0.99 for coal and 0.995 for residual oil). The ERT concluded that there is a misunderstanding about the methodology used for calculating the oxidation factor. The NIR states that the oxidation factor is the ratio between CO₂ and CO in the flue gases, while according to the Revised 1996 IPCC Guidelines the oxidation factor is determined by the ratio of the carbon content of the fuel and the non-oxidized carbon in the fly and bottom ash. The ERT recommends that Kazakhstan modify the methodology used for calculating country-specific oxidation factors in its next inventory submission, in accordance with the definition of the Revised 1996 IPCC Guidelines.

58. The NIR states that the plant-specific CO₂ EFs used are calculated based on the energy efficiency of the plant and the carbon content of the fuels, while during the in-country review the inventory team informed the ERT that the EFs result from plant tests, conducted once every five years. Since the CO₂ EF does not depend on the efficiency of the plant, but does depend on the carbon content of the fuels used and on the oxidation factor, the ERT recommends that Kazakhstan revise the methodology for the definition of plant-specific EFs and that it report on it in its next inventory submission.

59. The associated gas combusted at power plants is reported together with the natural gas combusted. The quantities and characteristics (calorific value and CO₂ EFs) of the associated gas should be reported in the NIR.

60. For CO₂ emission estimates from manufacturing industries and construction, information from iron and steel producers and information on the energy balance for the other industries is used. The difference between the fuel reported for the category in the national energy balance and the sum of the fuel reported by the industries is not taken into account in the AD used for estimating emissions in the categories where data from industries are used. The ERT recommends that, if AD from the plants are to be used for the estimates, in order to avoid an underestimation Kazakhstan should in its next inventory submission calculate this difference and report the resulting emissions.

Coal mining and handling: solid fuels – CH₄

61. Fugitive emissions from coal mining and handling are estimated based on the volume of coal mined and on country-specific EFs for underground and open cast mining. The CH₄ implied emission factor (IEF) values reported for 1990–2008 for surface mines are constant (8.3 kg/t). They are above the IPCC default range (0.2–1.34 kg/t) and are the highest of reporting Parties (0.01–8.30 kg/t). Kazakhstan explained to the ERT that EFs in national studies are higher than the IPCC default EFs by a factor of two to three. The ERT recommends that Kazakhstan conduct a peer review of the methodology used to derive these country-specific EFs and that it report in detail on the methodology and EFs used in the calculations in its next inventory submission.

Oil and natural gas: gaseous fuels – CH₄

62. Fugitive CH₄ emissions (and also CO₂) from exploration (oil), exploration (natural gas), production/processing (natural gas) and other leakage at industrial plants and power stations (natural gas), venting (oil, gas and combined) and flaring (oil and gas) are not estimated. In addition, CO₂ emissions from a number of categories for oil and natural gas are reported as “NE”. The ERT strongly recommends that Kazakhstan improve completeness of the inventory and estimate emissions from these significant categories in its next inventory submission and that it include associated gas from oil production under the production/processing category (natural gas).

63. Fugitive emissions from natural gas transmission and distribution networks are estimated based on the losses reported by the operators of networks, calculated as the difference in the measured quantities at the inlets and outlets of the network. This method is not accurate, owing to the inaccuracy of measuring equipment and possible double counting of the natural gas used to power the transmission and distribution compressors, which may be significant. The ERT recommends that Kazakhstan estimate emissions based on EFs per unit length of the network, as leakage mostly depends on the length of the pipelines and on their age and the quality of materials than on the volume of transported gas. The experience of other countries with similar network conditions may be used for improving the methodologies used and for verification purposes.

4. Non-key categoriesRoad transportation: liquid fuels – N₂O, CH₄

64. The NIR reports a very brief description of the methodology and model used for N₂O and CH₄ emissions calculation for this category. Data on the vehicle fleet by type of vehicle and on the fuel consumption distribution by the type of vehicle used in the model are not reported. During the in-country review the inventory team informed the ERT that data on the age of the fleet are not available in the national statistics. The ERT recommends that Kazakhstan improve modelling of the emissions by collecting data about the fleet age from the Ministry of Interior Affairs for the next inventory submission. The ERT believes that the use of new and internationally recognized models (such as COPERT) may improve estimates of CH₄ and N₂O emissions from road transportation.

65. The N₂O EFs used in the calculations for gasoline cars (0.09–0.1 kg/TJ) are below the IPCC default range (1–20 kg/TJ) and are the lowest of reporting Parties (0.09–18.16 kg/TJ). The EFs used for diesel cars (0.6 kg/GJ) are below the IPCC default range (3–4 kg/TJ). These EFs may be appropriate to use for old cars without catalytic converters; however, the ERT noted that Kazakhstan’s vehicle fleet does include a significant number of new and used cars equipped with such technology (Euro 3 and Euro 4). These cars have significantly higher N₂O emissions and the EFs used in the inventory may not be representative of the actual condition of the vehicle fleet. The ERT recommends that

Kazakhstan estimate the amounts of fuel combusted by vehicle type and in particular consider the number of vehicles equipped with catalytic converters, and revise its N₂O emission estimates using appropriate N₂O EFs.

66. Off-road vehicle emissions and construction machinery emissions are accounted for together in the road transportation category. The ERT recommends that Kazakhstan estimate emissions from off-road vehicles and construction machinery in separate subcategories for off-road activities and report them under the other transportation category, or, if appropriate, under the other (manufacturing industries and construction), agriculture/forestry/fisheries and other (1.A.5) categories, as the EFs of these off-road machinery differ significantly from the EFs of road vehicles.

5. Areas for further improvement

Identified by the Party

67. The Party identifies several areas for improvement:

(a) There should be improvement of the information collection approach and the use of country-specific EFs in general for the energy sector and in particular for combustion in the iron and steel and cement industries;

(b) There should be a more precise allocation of emissions by categories, through clarification of the data for the years (periods) for which the Agency of Statistics has not developed a disaggregated energy balance;

(c) A better emission calculation methodology, estimation of the uncertainty of the results and identification of possible ways for the delivery of additional alternative information for the energy industries should be selected;

(d) Country-specific EFs developed by Kazakhstan's Research and Design Institute "Energiprom" and AD developed by Kazakhstan's Research and Design Institute "Energy" for the public electricity and heat production category should be used;

(e) There should be an improvement in the quality of data used for the subcategories under manufacturing industries and construction by enhancing the working cooperation of the inventory team with the Ministry of Energy, the Ministry of Industry and the Agency of Statistics and the introduction of additional QC activities;

(f) There should be an improvement in the methodology for the estimation of emissions from the road transportation category through continuing research on the refinement of the N₂O EFs for all types of fuel and vehicles and accounting of the control techniques;

(g) There should be an examination and update of the oil and oil products balances for the 1991–1998 period and natural gas balance for the 1991–1998 period and 2006 together with statistics on energy consumption, the oil industry and foreign trade.

Identified by the expert review team

68. The quality and accuracy of the inventory should be increased by implementing intensive QC activities at all stages of the preparation of the inventory in order to avoid the significant number of mistakes identified during the review in transferring data from data sources to calculation sheets and to CRF Reporter.

69. Transparency of the inventory should be increased by improved reporting of methodologies, including more detailed information on EFs for the energy industries, transportation and fugitive emissions.

70. Estimates on the uncertainty of AD and EFs based on country-specific conditions in the energy sector should be developed for the next inventory submission and the uncertainty of the energy sector emission estimates should be calculated and reported in the NIR.

71. Emission estimates related to the “losses” reported in the energy balance for all categories should be developed for and incorporated in the next inventory submission.

72. The calculation method for the public electricity and heat production category should be modified in order to account separately for the main fuel emissions and the other (ignition, supporting and backup) fuels emissions.

73. The allocation of consumption of aviation bunker fuels should be clarified and separated from the fuel consumption of domestic flights and the figure should be reported under international bunkers emissions.

74. The amounts of fuel combusted should be estimated by vehicle type, in particular taking into consideration the number of vehicles equipped with catalytic converters, and the N₂O emission estimates should be revised using appropriate N₂O EFs. Consideration should be given to the implementation of an internationally accepted transportation model, such as COPERT.

75. Emissions from off-road vehicles and construction machinery should be estimated in separate subcategories for off-road activities and should be reported under the other transportation category, or, if appropriate, under the other (manufacturing industries and construction), agriculture/forestry/fisheries or other (1.A.5) categories, as the EFs of these off-road machinery differ significantly from the EFs of road vehicles.

C. Industrial processes and solvent and other product use

1. Sector overview

76. In 2008, emissions from the industrial processes sector amounted to 14,445.09 Gg CO₂ eq, or 5.9 per cent of total GHG emissions. Emissions from the solvent and other product use sector were reported as “NE” and “NA”. Since 1990, emissions have decreased by 19.4 per cent in the industrial processes sector. The key driver for the fall in emissions is a decline in metallurgy and in the production of mineral products, owing to the transition from a planned economy to a market economy. Within the industrial processes sector, 42.9 per cent of the emissions were from iron and steel production, followed by 15.2 per cent from ferroalloys production, 13.7 per cent from limestone and dolomite use and 12.1 per cent from cement production. Aluminium production accounted for 6.7 per cent, lime production accounted for 4.7 per cent and ammonia production accounted for 1.3 per cent. The remaining 3.4 per cent was from soda ash production and use, carbide production, other (coke production under chemical industry) and refrigeration and air-conditioning equipment.

Sector-specific issues relating to completeness

77. The CRF includes estimates of most gases and categories of emissions from the industrial processes sector, as recommended by the Revised 1996 IPCC Guidelines. Categories and gases reported as “NE” by Kazakhstan include CO₂ from coke under iron and steel production, asphalt roofing and road paving with asphalt. Potential emissions of fluorinated gases are reported as “NO”, while actual emissions for most of the subcategories and gases in the consumption of halocarbons and SF₆ category are not reported. CO₂ emissions from glass production are reported as “IE”, while in the CRF tables it is indicated that these emissions are reported under limestone and dolomite use.

Emissions from the solvent and other product use are reported as “NE” for the entire time series.

78. During the in-country review, the ERT was informed that data collection, in cooperation with MoEP, has already started for almost all the missing categories. Kazakhstan is planning to report emission estimates for these categories in its next inventory submission. Emissions from N₂O use and indirect CO₂ emissions from non-methane volatile organic compounds in the solvent and other product use category need further investigation; however, Kazakhstan also plans to report on these categories in its next inventory submission. The ERT recommends that Kazakhstan estimate emissions from all missing categories for which the Revised 1996 IPCC Guidelines and the IPCC good practice guidance provide methodologies for their estimation and report the results in its next inventory submission.

Sector-specific issues relating to transparency

79. The structure and content of the NIR are not in accordance with the outline provided in the UNFCCC reporting guidelines. Descriptions of AD, EFs and methods are not provided for all categories of the sector, including key categories. The ERT recommends that Kazakhstan elaborate the description of the methods, EFs and AD used and report them in its next inventory submission. The ERT also recommends that Kazakhstan improve the structure of the NIR in accordance with the outline provided in the UNFCCC reporting guidelines.

80. The ERT recommends that Kazakhstan increase the transparency of the NIR by including complete descriptions of the methods undertaken to quantify emissions, especially where plant-specific data are reported, and of trends. The ERT also recommends that Kazakhstan undertake category-specific QA/QC procedures for the sector in its next inventory submission. This should first be done for all key categories in accordance with the IPCC good practice guidance.

2. Key categories

Cement production – CO₂

81. There are five cement production plants in the country. Clinker and cement kiln dust AD and EFs are received directly from the plants. The ERT was informed during the in-country review that Kazakhstan wants to continue using plant-specific data. The ERT welcomes efforts by Kazakhstan to continue using AD and EFs from the plants and to report corresponding emissions in its next inventory submission. The ERT recommends that Kazakhstan provide a detailed description of the technological process of cement production in the country, data and EFs used and correction factors in its next inventory submission in order to improve the transparency of the inventory.

Lime production – CO₂

82. The inter-annual changes of CO₂ IEFs reported in the CRF tables during the period 1990–1998, ranged from –1.1 per cent to 0.5 per cent, and then the value of the CO₂ IEF was practically kept constant for the 1998–2008 period (0.766 t/t). The 2008 value is 0.6 per cent lower than the 1990 value. No explanations on the changes, nor on the methods and AD used for the estimates, are provided in the NIR or were given to the ERT during the in-country review. The ERT recommends that Kazakhstan check the estimates using methods in accordance with the IPCC good practice guidance and that it provide detailed descriptions of the method, AD and EFs used for the estimates in its next inventory submission in order to improve the transparency of the inventory.

Limestone and dolomite use – CO₂

83. The NIR noted that a balance of limestone and dolomite use in the country was prepared for accurate estimation of CO₂ emissions and the correct allocation of limestone and dolomite among the different categories of the sector. However, such a balance and the applied calculation methods, EFs and AD are not presented in the NIR and were not provided to the ERT during the in-country review. The ERT recommends that Kazakhstan provide a detailed description of the AD, EFs and methods used in its next inventory submission in order to improve the transparency of the inventory. The ERT also recommends that Kazakhstan use methods in accordance with the Revised 1996 IPCC Guidelines and the IPCC good practice guidance.

Carbide production – CO₂

84. The CO₂ IEF values reported in the CRF tables (2.95 t/t) for the whole time series are above the IPCC default range (0.76–1.1 t/t). The EFs, AD and applied calculation methods are not presented in the NIR and were not provided to the ERT during the in-country review. The ERT recommends that Kazakhstan provide a detailed description of the AD, EFs and methods used in its next inventory submission in order to improve the transparency of the inventory. The ERT also recommends that Kazakhstan use methods in accordance with the IPCC good practice guidance.

Iron and steel production – CO₂

85. The CO₂ IEF values reported in the CRF tables for steel (ranging from 0.12–0.14 t/t) are below the IPCC default range (1.5–1.6 t/t) and for pig iron (ranging from 1.14–1.83 t/t) are below the IPCC default range (2.5–3.6 t/t). During the in-country review the ERT was informed that incorrect AD are probably reported in the CRF tables, which resulted in the error. Calculation sheets presented to the ERT show that the right methodology, in accordance with the IPCC good practice guidance, was used for the whole time series, complemented with AD from plants and default IPCC EFs. This information is not provided in the NIR. The ERT recommends that Kazakhstan develop a carbon balance for iron and steel production in order to avoid CO₂ emissions being double counted in the energy and industrial processes sectors. The ERT also recommends that Kazakhstan continue using plant-specific data and that it provide a more detailed description of the AD, EFs and methods used in its next inventory submission in order to improve the transparency of the inventory.

Ferroalloys production – CO₂

86. Kazakhstan reports CO₂ emissions in the CRF tables, but no description of the methods, EFs and AD used is included in the NIR. The ERT recommends that Kazakhstan check and provide a detailed description of the AD, EFs and methods used in its next inventory submission in order to improve the transparency of the inventory.

Aluminium production – PFCs

87. Kazakhstan reports CO₂, CF₄ and C₂F₆ emissions in the CRF tables, but no description of the methods, EFs and AD used is included in the NIR. AD and emissions are reported for 2007 and 2008 only. The NIR explains that aluminium production started in Kazakhstan in 2007 and hence for all other years “NO” is used in the CRF tables. The ERT recommends that Kazakhstan provide a detailed description of the AD, EFs and methods used in its next inventory submission in order to improve the transparency of the inventory.

3. Non-key categories

Consumption of halocarbons and SF₆ – HFCs, PFCs and SF₆

88. Actual emissions of HFCs are reported only for HFC-134, under the refrigeration and air-conditioning equipment subcategory, and actual emissions of SF₆ are reported only under the electrical equipment subcategory. None of the assumptions made in estimating actual emissions are well-documented in the NIR. The ERT recommends that Kazakhstan provide precise documentation and validation of such assumptions, especially for refrigeration equipment and mobile air-conditioning equipment. No actual emissions or notation keys for other gases and species or subcategories are reported under this category. Potential emissions of all gases are reported as “NO”. The ERT was informed during the in-country review that Kazakhstan is planning to estimate the missing emissions and will provide information in its future inventory submissions. The ERT welcomes these plans and recommends that Kazakhstan provide a detailed description in the NIR of the methods, AD and EFs used in estimating emissions under this category in its next inventory submission.

4. Areas for further improvement

Identified by the Party

89. The NIR does not identify areas for improvement.

Identified by the expert review team

90. The ERT recommends that the Party:

(a) Increase the transparency of the NIR by including complete descriptions of the methods undertaken to quantify emissions, especially where plant-specific data are reported;

(b) Undertake category-specific QA/QC procedures in its next inventory submission. This should first be done for all key categories in accordance with the IPCC good practice guidance.

D. Agriculture

1. Sector overview

91. In 2008, emissions from the agriculture sector amounted to 12,101.47 Gg CO₂ eq, or 4.9 per cent of total GHG emissions. Since 1990, emissions have decreased by 40.3 per cent. The key driver for the fall in emissions is the decrease in the livestock population, cultivated land areas and the use of fertilizers. Within the sector, 71.6 per cent of the emissions were from enteric fermentation, followed by 14.1 per cent from agricultural soils, 11.7 per cent from manure management and 2.6 per cent from rice cultivation. The Agency of Statistics and the Ministry of Agriculture are the main sources of AD. The ERT noted, however, that the archiving of AD in the country appears not to be of a high quality. The ETR was not able to see related AD for the entire time series, for example electronic files contained data only for 1990–2004 and the paper archive contained only data for the last year. The ERT therefore recommends improving the archiving of the AD.

Sector-specific issues relating to completeness

92. Information for the sector submitted by Kazakhstan was not reported fully in accordance with the IPCC good practice guidance and the UNFCCC reporting guidelines,

as it was not fully complete and transparent. The inventory does not include CH₄ and N₂O emissions from mules and asses and poultry (reported as “NE”), N₂O emissions from pasture, range and paddock manure (reported as “IE” but probably not included elsewhere) or indirect N₂O emissions from agricultural soils (reported as “NO”). Prescribed burning of savannas does not occur in Kazakhstan and is reported as “NO”. Burning of agricultural residues has not been practised since the end of the 1980s and is reported also as “NO”.

Sector-specific issues relating to transparency

93. The descriptions of the AD, the selection of the EFs and the methods are short (just one page for each category) in the NIR. The NIR does not provide information on recalculations, QA/QC and verification procedures. Kazakhstan provides data in the CRF tables for all years, but not all the cells have been completed with values or notation keys and very often inappropriate notation keys are used. With regard to the explanations on trends, Kazakhstan compares the emissions of 2008 with 1991 or 1992, but not with 1990, which is the base year for the inventory. The ERT recommends that Kazakhstan follow more closely the IPCC good practice guidance and the UNFCCC reporting guidelines, in order to achieve better transparency in its next inventory submission.

Sector-specific issues relating to uncertainties

94. Kazakhstan has provided in the NIR uncertainties for emissions, AD and EFs, but not a total for the sector. It also reported country-specific uncertainty estimates for some national values, such as allocation of manure to different systems (± 20 per cent) and the fraction of residue dry biomass that is nitrogen (N) and the fraction of the total above-ground biomass of N-fixing crop that is N (± 25 per cent). However, the ERT was not able to check the calculation of these uncertainties because no supporting documentation was available. The ERT recommends that Kazakhstan in its next inventory submission document its uncertainty analysis and better represent the uncertainty estimates for categories where country-specific values and parameters are used.

2. Key categories

Enteric fermentation – CH₄

95. The tier 1 method with IPCC default EFs for Asia was used for the estimates of all categories of animals. As the Party used IPCC default EFs for Asia, the IEFs for dairy (56 kg/head/year) and non-dairy (44 kg/head/year) cattle and sheep (5 kg/head/year) are the lowest among reporting Annex I Parties. Therefore, the ERT encourages Kazakhstan to consider re-examining the EFs used for this category in order to make them more in accordance with the productivity of the animals and that it use a higher tier in accordance with the IPCC good practice guidance, as this is a key category. Emissions from poultry were not estimated (reported as “NE”), as there is neither an IPCC default EF nor a country-specific EF available. Emissions from goats are reported together with sheep, as data in national statistics are reported together. Buffalo are reported as “NO”, as the Party states that this subcategory does not occur in the country, while mules and asses are reported as “NE” because there are no statistics on the animals and their number in the country is small. The ERT recommends that Kazakhstan check the availability of data on mules and asses in related national institutions and international data sources, such as the Food and Agriculture Organization of the United Nations, and that it estimate emissions from these missing species. The ERT also encourages Kazakhstan to estimate emissions from sheep and goats separately, in order to be in accordance with IPCC good practice guidance.

Direct soil emissions – N₂O

96. Kazakhstan reports in its NIR that it used tier 1, but does not indicate whether it used 1a or 1b, and that IPCC default EFs and a combination of IPCC default and country-specific values of N fractions were used to estimate direct emissions from this category. Kazakhstan reports all the fractions used to estimate N₂O emissions from agricultural soils as “0.00” in the CRF tables, but table 5.6 in the NIR provides IPCC default and country-specific fractions. According to table 5.6, Kazakhstan used a country-specific fraction of residue dry biomass that is N (0.04995) and fraction of total above-ground biomass of N-fixing crop that is N (0.02240). However, the ERT was not able to confirm the use of these fractions because of the unavailability of the working sheets. Also, the ERT was not able to review the methodology for calculating these fractions as no supporting documentation was provided. The ERT recommends that Kazakhstan improve consistency between the NIR and CRF tables in order to ensure correct estimates of emissions and that it improve the record-keeping of the national methodologies used to estimate country-specific values.

97. Emissions from the pasture, range and paddock manure category are reported as “IE”. During the in-country review the ERT was informed that this is a typing mistake. However, the ERT was not able to confirm that the emissions from pasture, range and paddock manure were estimated because the working sheet provided by the inventory team was not complete and other supporting documentation was not provided. The ERT recommends that Kazakhstan complete its inventory by providing estimates for the missing categories in its next inventory submission.

3. Non-key categoriesManure management – CH₄ and N₂O

98. Kazakhstan used the tier 1 method with IPCC default EFs for Asia to estimate emissions from this category, which is in line with the IPCC good practice guidance and the Revised 1996 IPCC Guidelines. As reported in the NIR, the national allocation of manure to waste management systems is: manure from swine, 100 per cent in anaerobic lagoons; cattle, 100 per cent in liquid systems; and others, 100 per cent in pasture, range and paddock. However, these allocations are not reported in the CRF tables. Emissions from poultry were not estimated, although there is an IPCC default EF. The ERT recommends that Kazakhstan complete the inventory by providing estimates for the missing categories and that it provide additional information in the CRF tables.

Rice cultivation – CH₄

99. Kazakhstan used the tier 1 method with an IPCC default EF to estimate emissions from rice cultivation in continuously flooded areas. The methodology used is in line with the IPCC good practice guidance and the Revised 1996 IPCC Guidelines. Emissions from this sector declined by 39.2 per cent in 2008 compared with 1990. Kazakhstan plans to verify AD for the rice cultivation areas. The ERT welcomes this planned improvement and encourages the Party to do so in its next inventory submission.

4. Areas for further improvementIdentified by the Party

100. The 2010 NIR identifies several areas for improvement:

- (a) There should be an improvement of AD verification for rice cultivation and agricultural soil categories;
- (b) There should be verification of the EF used for rice cultivation;

- (c) There should be an extension of country-specific EFs used for agricultural soils.

Identified by the expert review team

101. The ERT identifies the following issues for improvement:

- (a) The UNFCCC reporting guidelines should be taken more closely into consideration in order to achieve transparency in its next inventory submission;
- (b) The EFs used for animals should be re-examined in accordance with their productivity;
- (c) A higher tier for key categories, in accordance with the IPCC good practice guidance and taking into account national circumstances, should be used;
- (d) Record-keeping for the AD and the working sheets used for emission estimates should be improved.

E. Land use, land-use change and forestry

1. Sector overview

102. In 2008, net removals from the LULUCF sector amounted to 633.72 Gg CO₂ eq, which offset 0.3 per cent of total emissions. Since 1990, net removals have decreased by 92.8 per cent. Net CO₂ removals in the forest land remaining forest land category decreased by 86.4 per cent (4,805.36 Gg) between 1990 and 2008. During the same period, net CO₂ removals in the cropland remaining cropland category decreased by 26.6 per cent (876.24 Gg) and CO₂ emissions from land converted to grassland increased by 959.9 per cent (2,654.65 Gg). While there are some clearly identified drivers for the decrease in net removals, such as the decline in the average carbon stock in forests with time and a progressive degradation of soils under grassland, the main reason for the reported changes is the inconsistency in the time series regarding estimates of carbon stock changes in forests and the representation of land use. In 2008, within the sector, 3,164.70 Gg CO₂ emissions were from forest land converted to grassland, followed by a removal of 2,418.21 Gg CO₂ from the cropland remaining cropland category. The forest land remaining forest land category accounted for a removal of 793.80 Gg CO₂, complemented by 36.41 Gg CO₂ emissions from biomass burning due to forest fires. Other categories, such as land converted to cropland, grassland remaining grassland, cropland converted to grassland and settlements remaining settlements, contributed minor removals for the sector.

103. The ERT noted that Kazakhstan implemented the reporting of the LULUCF sector in accordance with decision 14/CP.11 and applied the IPCC good practice guidance for LULUCF, including the use of higher-tier methods for estimating carbon stock changes in forest land, one of the key categories. However, the ERT detected several deficiencies regarding accuracy, completeness, transparency, consistency and QA/QC procedures in Kazakhstan's inventory submission, which are described below. The Party is encouraged to implement all necessary measures for solving these problems in its next inventory submission.

Sector-specific issues relating to completeness

104. The report for the LULUCF sector is incomplete. Several mandatory categories (e.g. land converted to forest land, land converted to wetlands, land converted to settlements, land converted to other land, direct N₂O emissions from N fertilization and N₂O emissions from disturbance associated with land-use conversion to cropland) are reported as "NE" or as "NO" without providing proper justification in the NIR. For some of these mandatory

categories the Party explained to the ERT during the in-country review that the activities do not occur in Kazakhstan (e.g. nitrogen fertilization of forests). For other categories, an absence of data was the reason for not producing estimates. The ERT recommends that Kazakhstan improve the completeness of the inventory by collecting suitable data and/or providing suitable notation keys in its future inventory submissions.

105. The inventory also lacks completeness regarding geographical coverage. Estimates are made for all forest land areas, but for only a reduced fraction of the cropland and grassland area. The ERT assessed that more than 80 per cent of the land area of Kazakhstan was not considered in the inventory estimates. The ERT recommends that Kazakhstan implement in its next inventory submission a complete representation of the use of land in the country, consistently with the IPCC good practice guidance, covering the full time series.

Sector-specific issues relating to transparency

106. The NIR is not sufficiently transparent as Kazakhstan failed to provide some relevant descriptions, references and sources of information for the specific methods, assumptions, EFs and AD, as well as the rationale for their selection. In addition, documentation boxes in CRF tables were not used. Most of this information was provided by the Party to the ERT during the in-country review. The ERT recommends that Kazakhstan fully follow the recommendations of the UNFCCC reporting guidelines, in order to achieve transparency in its next inventory submission.

Sector-specific issues relating to uncertainties

107. No estimates of uncertainties are provided for different categories or for the LULUCF sector as a whole. While the NIR includes a section on uncertainties, it is limited to providing basic information on the errors associated with different parameters in the national forest inventory and to reproducing the default values given in the IPCC good practice guidance for LULUCF. The ERT recommends that Kazakhstan provide estimates of uncertainties for carbon stock changes and GHG emissions, if possible using country-specific values, in its next inventory submission.

Sector-specific issues relating to verification and quality assurance/quality control approaches

108. A QA/QC plan was not prepared or implemented for the sector. The ERT noted that there are inconsistencies, for example in the reported land areas subjected to land-use changes, between the NIR and the CRF tables. Also, some calculation errors were identified during the review (e.g. in the estimation of emissions from forest fires). These and other problems identified (e.g. completeness, transparency) could be avoided by applying the necessary QA/QC procedures. Besides recommending the implementation of a QA/QC plan in accordance with the IPCC good practice guidance, the ERT suggests that Kazakhstan consider the adoption of available software (e.g. the Agriculture and Land Use (ALU) software tool for GHG inventories in the agriculture, forestry and other land-use sector, developed by Colorado State University), or develop a new one, for performing inventory calculations and QA/QC procedures for the LULUCF sector. The use of software would ensure consistency in the representation of land use and would minimize the risks of errors in data processing and reporting.

2. Key categories

Forest land remaining forest land – CO₂

109. Kazakhstan reports a net removal of 793.80 Gg CO₂ by forest land remaining forest land in 2008. This estimate includes land converted to forest land, because the Party could not provide a separate estimate for this category. The carbon stock changes in forest land were, for most of the area, estimated by a tier 2 method using data provided by the national forest inventory. Biomass stocks were estimated by the stock change method and the dead organic matter pool was estimated by a country-specific method not described in the NIR and not provided to the ERT during the in-country review. The ERT recommends that Kazakhstan provide in its future inventory submissions a full description of the methods used for estimating the changes in carbon stocks in forest land, including the relevant procedures followed by the national forest inventory, and that it provide separate estimates for forest land remaining forest land and lands converted to forest land.

110. The national forest inventory covers nearly 12 million ha of forests included in the State Forest Fund. There is an additional area of approximately 2 million ha of forests for which no data on carbon stocks are available. The tier 1 estimates made for carbon stock changes in this area may not be appropriate for Kazakhstan's conditions, and the Party is encouraged to collect data on these areas in order to improve the accuracy of the estimates in its next inventory submission.

111. The annual changes in carbon stocks show large inter-annual variability, with fluctuations corresponding to five-year cycles associated with national forest inventory measurements. These measurements are performed in random plots and since the annual changes in stocks are of a lower magnitude than the uncertainty of the stock estimates, the observed fluctuations can be expected to occur. The ERT recommends that Kazakhstan implement suitable statistical procedures to improve the consistency of the time series in its next inventory submission. This may include, inter alia, using 10-year moving averages of annual stock changes.

112. Biomass gains and losses are not reported separately as the UNFCCC reporting guidelines recommends. Losses are indicated as "NO". The Party explained that it is not possible to report them separately given that the stock change method is used. Data on wood harvests, both legal and illegal, are available or can be estimated, as well as data on losses due to forest fires. Reporting gains and losses separately contributes to transparency of the inventory and the ERT recommends that Kazakhstan make the necessary efforts to do so. If losses are still not reported in future inventory submissions, the CRF table should indicate "IE" instead of "NO".

Cropland remaining cropland – CO₂

113. A removal of 2,418.21 Gg CO₂ is reported for the cropland remaining cropland category in 2008. This is mostly attributed to the implementation of agroforestry systems and to improvement of hay fields. The area reported in the CRF table for this category in 2008 is 676.80 kha, which corresponds to 2.0 per cent of the total cropland area reported in the NIR (page 203, annex B). The Party explained to the ERT during the in-country review that the area reported in the CRF table corresponds only to the areas where carbon stock changes were assumed to occur. However, according to a recent United States Department of Agriculture report⁴ on wheat production in Kazakhstan, important changes are occurring in the management of agricultural land (reduced tillage, increased use of fertilizers, conversion of lands to cropland) that should be affecting carbon stocks. The ERT recommends that Kazakhstan implement a full assessment of carbon stock changes in

⁴ <http://www.pecad.fas.usda.gov/highlights/2010/01/kaz_19jan2010/>.

cropland and that it comply with the UNFCCC reporting guidelines by including the total area of cropland remaining cropland in CRF table 5.B, consistent with the information provided in the NIR, in its next inventory submission.

114. The increases in biomass carbon stocks in this category were estimated using the IPCC tier 1 method. The default value for increments in living biomass given in the IPCC good practice guidance for LULUCF (table 3.3.2) for a temperate climate was used. However, this value seems to be too high for Kazakhstan's climatic conditions, thus leading to an overestimation of CO₂ removals. This default value is the only one provided in the IPCC good practice guidance for LULUCF and is generic for a "temperate climate", which includes a wide range of climates, from warm-wet to cold-dry, and hence has an uncertainty of 75 per cent. The ERT recommends that Kazakhstan develop country-specific growth rate values, or adopt a value within the range of uncertainty given to the default value by the IPCC good practice guidance for LULUCF.

115. A single IPCC default value of reference soil organic carbon (SOC_{REF}) was used for the whole country. During the in-country review, the ERT was informed that Kazakhstan has a very detailed soils map (1:250,000 scale for the whole country, with a higher resolution for some regions) that would enable the use of more accurate, country-specific values. The AD would, however, need to be matched with the geographic location of the different soil types. The ERT recommends that Kazakhstan make the necessary efforts to adapt the existing information to adopt country-specific values for reference soil organic carbon in its next inventory submission.

116. Kazakhstan classifies hay fields as cropland. However, the IPCC default stock-change factors for soil organic carbon under cropland are not completely suitable for the country's hay fields. The ERT recommends that Kazakhstan develop country-specific factors for hay fields or, alternatively, that it consider reclassifying hay fields as grassland in its next inventory submission.

117. Several problems were identified with the choice of stock-change factors for the determination of changes in soil organic carbon stocks using the IPCC tier 1 method. The selected factors were generally not adequate (e.g. the value chosen for f_{MG} (management factor) in generic cropland was 1.10, which corresponds to a no-tillage practice, when it is clear that not all areas of cropland in Kazakhstan are managed without tillage) and a single combination of the three carbon stock-change factors was adopted for the whole country for a given land management type (e.g. for hay fields, selected values for f_{LU} (land use factor), f_{MG} and f_I (input factor) were 0.82, 1.00 and 1.10, respectively, for the whole area of the country). The current estimates therefore have a high degree of uncertainty because of this assumption. The ERT recommends that Kazakhstan disaggregate the cropland area into a larger number of subcategories or management systems in order to reflect the wide variety of types of cropping systems and to achieve more accurate estimates of emissions and removals in its next inventory submission. Also, the choice of stock-change factors should follow more closely the recommendations of the IPCC good practice guidance.

118. Changes in soil organic carbon stocks from changes in management practices were estimated for the year in which those changes occurred. However, the soil organic carbon pool is affected several years after a change is made. The ERT recommends that Kazakhstan produce estimates of changes in soil organic carbon stocks for a number of years equal to the transition period (20 years by default) after the implementation of new management practices.

Land converted to grassland – CO₂

119. An emission of 2,931.20 Gg CO₂ is reported for the land converted to grassland category in 2008. This is mostly attributed to the conversion of forest land and cropland to

grassland. The time series for this category shows strong inter-annual variability in the areas over which the conversion of forest land to grassland occurred. The findings and recommendations by the ERT related to reference soil organic carbon (see para. 115 above), to the selection of a single combination of stock-change factor for a given management system (see para. 117 above) and the use of a transition period (see para. 118 above) also apply for this category.

3. Non-key categories

Grassland remaining grassland – CO₂

120. A removal of 172.24 Gg CO₂ is reported for this category in 2008. The area reported in the CRF table for this category in 2008 is 70.80 kha, which corresponds to 0.04 per cent of the total grassland area reported in the NIR (page 203, annex B). The Party explained to the ERT during the in-country review that the area reported in the CRF table corresponds only to the areas where carbon stock changes were assumed to occur. However, it is highly unlikely that no changes in management are occurring in the rest of the grassland area. Kazakhstan is encouraged to collect AD to characterize systems of grassland management in the country and to assess their changes over time in order to improve both the completeness and accuracy of the reporting in its next inventory submission.

Biomass burning – CO₂, CH₄, N₂O

121. Emissions reported for this category amounted to 39.82 Gg CO₂ eq in 2008, with CO₂ being 91.4 per cent of this amount. Only emissions from wildfires in forest land remaining forest land are reported. Kazakhstan used the stock-change method for accounting changes in the biomass stocks of forests, and therefore carbon losses due to forest fires are implicit in the carbon stock changes reported under forest land. These emissions do not need to be reported again under biomass burning. The ERT suggests that Kazakhstan revise the allocation of these estimates in order to avoid double counting in its next inventory submission.

122. The estimated value for carbon loss per hectare seems very low, resulting in emissions per hectare (5.1 t CO₂ per ha, with one outlier value in 1996 of 6.7 t CO₂ per ha) that are lower than would be expected. Using even the lowest default value from table 3A.1.13 of the IPCC good practice guidance for LULUCF, the resulting value of emissions is much higher than the estimate reported. It must be noted that, when using tier 1, the fraction burned is assumed to be 1 (i.e. the parameter $1-f_{LB}$ is equal to zero). The ERT encourages Kazakhstan to revise the estimates of emissions from biomass burning due to forest fires in its next inventory submission.

4. Areas for further improvement

Identified by the Party

123. The Party identified one area for future improvement, which is the reallocation of agricultural land areas reported in the national statistics under reserve land, which currently is included under the other land category.

Identified by the expert review team

124. The ERT recommends that Kazakhstan:

- (a) Improve the completeness and accuracy of the inventory by including cropland and grassland areas currently not included in the estimates, including the implementation of higher-tier methods for key categories under these land-use categories;

- (b) Make better use of the information on land use and management practices available in the country in order to characterize the main systems of land management under cropland and grassland;
- (c) Improve technical support to the inventory team;
- (d) Achieve full implementation of a QA/QC plan for the LULUCF sector in accordance with the IPCC good practice guidance for LULUCF;
- (e) Consider the use of geographic information systems technology to achieve a consistent representation of land use and, eventually, land management and the use of existing specialized software tools for producing the estimates and implementing QA/QC measures.

F. Waste

1. Sector overview

125. In 2008 emissions from the waste sector amounted to 4,862.33 Gg CO₂ eq, or 2.0 per cent of total GHG emissions. Since 1990, emissions have increased by 19.6 per cent, mainly because the rise in emissions is CH₄ emissions from solid waste disposal on land, which shows an increase since the middle of the 1990s after a gradual decrease in 1990–1995. The key driver of this rise is, according to the NIR, the growth of the population and economy since the middle of the 1990s. However, this cause cannot explain the opposite trend of the other main category, wastewater handling, which shows a decrease in total emissions since 1990. Three different sources for this category demonstrate different trends: CH₄ emissions from domestic and commercial wastewater have gradually decreased since 1990; CH₄ emissions from industrial wastewater show a gradual decrease from 1990 to 2000 and an increase since 2000; and N₂O from human sewage has a sinusoidal fluctuation, showing some increase in 1992–1994 and from 2000 onwards. In addition, a new category of CO₂ emissions, from waste incineration (medical waste), has been included since 2006.

126. Within the sector, 76.1 per cent of the emissions were from solid waste disposal on land, with 18.9 per cent from wastewater handling (of which 8.9 per cent was from N₂O from human sewage) and 5.0 per cent from waste incineration. The sector's contribution to total emissions increased from 1.2 per cent in 1990 to 2.0 per cent in 2008.

127. The estimates are complete in the sense of geographical coverage, categories and gases. Time series show fluctuations for all the categories and there is lack of transparency in the NIR with respect to their explanation. Recalculations were made for the past three years owing to a new source of emissions, waste incineration, being added, which resulted in additional emissions from the sector. Uncertainties for emissions are assessed mainly based on default figures for the parameters, using the tier 1 method. The QA/QC procedures carried out and described in the NIR do not provide a sufficient level of data verification.

2. Key categories

Solid waste disposal on land – CH₄

128. CH₄ emissions from this key category were calculated using the tier 1 method, mostly with default parameters; this is not in accordance with the IPCC good practice guidance, which requires emissions to be estimated using the first-order decay (FOD) method. The NIR does not provide comprehensive information on national AD or justification for the choice of default EFs. The emission time series shows fluctuations for

1994–2000 (an abrupt increase from 117.00 to 171.00 Gg) and 2004–2005 (an abrupt increase from 172.50 to 182.60 Gg), while the trend shows a gradual decrease of the CH₄ IEF from 1990–2008 (from 0.06 to 0.04 t/t for municipal solid waste). Managed and unmanaged solid waste disposal sites (SWDS) are estimated together under the managed waste disposal on land category, using a methane correction factor (MCF) of 0.6 for uncategorized SWDS. No notation keys are used for the unmanaged waste disposal sites category. The additional information table either does not report values for parameters or gives “0.00” for them. In CRF table 6.A, the degradable organic carbon (DOC) value is reported as “0.00” for all years of the time series, which introduces an obvious inconsistency with the default figure of 0.17 reported in the NIR. The ERT recommends that Kazakhstan ensure accuracy and completeness in its next inventory submission.

129. During the in-country review, the ERT noted that the Party has sufficient information for disaggregation of AD into managed and unmanaged SWDS, as well as for the identification of the country-specific fraction of municipal solid waste (MSW) disposed at SWDS (MSW_F) and even for the morphological composition of the MSW for the past three years. The ERT recommends that Kazakhstan use this information and differentiate SWDS between managed and unmanaged and report them separately, reconstruct the whole time series of emissions by means of calculating missing AD using appropriate methods of extrapolation as recommended in the IPCC good practice guidance and estimate the emissions using the tier 2 method (FOD) in its next inventory submission. Kazakhstan is also encouraged to improve the description of the category in the NIR in order to ensure transparency of the inventory, namely the solid waste disposal practices in the country, as well as AD, methods and EF used in the estimates.

3. Non-key categories

Wastewater handling – CH₄

130. CH₄ emissions from this category were calculated using a tier 1 method, which is in accordance with the IPCC good practice guidance. For both subcategories, industrial wastewater and domestic and commercial wastewater, CH₄ emissions were estimated. In both subcategories sludge emissions are included under wastewater. However, for industrial sludge “NO” notation keys were used and for domestic and commercial sludge the cells are left blank. For N₂O IEF and emissions from industrial wastewater different notation keys, “NA” and “NO”, were used, respectively. It is recommended that Kazakhstan use appropriate notation keys for CH₄ and N₂O emissions from industrial wastewater and domestic and commercial wastewater and that it fill in the blank cells. The description of the national conditions in the NIR for the category is not sufficient to provide transparency and to allow an assessment of the emission estimates for both subcategories. AD for wastewater under the domestic and commercial wastewater category are reported as “NA”. The IEF for CH₄ from industrial wastewater is too low (0.000025 kg CH₄/kg DC) compared with other reporting Parties (0.001425–0.25 kg CH₄/kg DC). In the additional information table for wastewater handling no value or information is reported. The ERT recommends that Kazakhstan improve transparency and completeness for the category by providing appropriate and detailed information in the CRF tables and the NIR of its next inventory submission.

Waste incineration – CO₂

131. The category covers CO₂ emissions from medical waste incineration. The practice of incineration began in Kazakhstan in 2006 and CO₂ emissions have increased from 8.0 Gg in 2006 to 241.3 Gg in 2008 (approximately 30 times). The biogenic part of the waste incinerated is not estimated and no notation keys are used in CRF table 6.C. The ERT encourages Kazakhstan to check the AD used and justify such a significant rise in

emissions and recommends that the Party estimate emissions from the biogenic part of the medical waste incinerated in its next inventory submission.

4. Areas for further improvement

Identified by the Party

132. The NIR of the 2010 submission identified the following improvements:

- (a) The morphological composition of MSW should be identified;
- (b) The tier 2 (FOD) method for the estimation of CH₄ emissions from solid waste disposal on land should be used;
- (c) The quality of country-specific AD for the waste sector should be improved;
- (d) Country-specific AD for wastewater handling should be collected, for example population connected to wastewater collectors.

Identified by the expert review team

133. The ERT identifies the following issues for improvement:

- (a) Transparency of the inventory should be increased by means of providing in the NIR comprehensive descriptions of and background information for the categories covered in the sector, including national circumstances, waste management practices, methods, AD, EFs and assumptions made;
- (b) Country-specific AD for all time series for the morphological composition of MSW produced and the share of landfilled MSW should be identified;
- (c) AD for managed and unmanaged solid waste disposal on land should be collected and assessed separately;
- (d) QA/QC procedures should be implemented for the sector.

III. Conclusions and recommendations

134. Kazakhstan submitted a complete set of CRF tables for the period 1990–2008 on 9 April 2010 and an NIR on 25 May 2010. Kazakhstan resubmitted its CRF tables on 24 April 2010 and 21 May 2010. The inventory submission was submitted in accordance with the UNFCCC reporting guidelines; however, the ERT recommends that Kazakhstan made its complete inventory submission on the established due date (15 April).

135. The GHG inventory submission does not fully follow the recommendations of the Revised 1996 IPCC Guidelines, the IPCC good practice guidance and the IPCC good practice guidance for LULUCF regarding uncertainty analysis, key categories assessment and implementation of QA/QC procedures and does not follow the recommended structure of the NIR provided in the UNFCCC reporting guidelines. The most important cross-cutting problems identified by the ERT are concerned with issues of transparency, completeness and the accuracy of the reported information.

136. The inventory of Kazakhstan covers most sectors and categories and is mostly complete in terms of geographical coverage, with the exception of the LULUCF estimates made for the land area, which were made for land area covering less than 20 per cent of the national territory. Estimates for some source and sink categories are not reported in the CRF tables or the NIR, for example land converted to forest land and land converted to wetlands. Emissions from the solvent and other product use sector are not estimated.

Kazakhstan has reported as “NE” potential emissions for HFCs, PFCs and SF₆ for all time series. Actual emissions of HFCs are reported starting from 1995 onwards, actual emissions of SF₆ from 2004 and actual emissions of PFCs are reported for the whole time series as “NA” and “NO”. The CRF tables are generally complete and provided for the whole time series; however, in many cases notation keys are missing or are used improperly and the explanatory information or information in documentation boxes in tables 7, 8(a), 8(b), 9(a) and 9(b) is missing for the whole time series. The ERT recommends that Kazakhstan improve the completeness of the inventory by: achieving full coverage of territory for the LULUCF sector; preparing and reporting estimates for all missing categories for which the Revised 1996 IPCC Guidelines, the IPCC good practice guidance and the IPCC good practice guidance for LULUCF provide estimation methodologies; providing in the NIR a description and discussion of these categories and information on other potential sources or sinks not addressed in the current inventory submission; and appropriately applying notation keys and using documentation boxes in the CRF tables.

137. The ERT concluded that the institutional arrangements implemented by Kazakhstan for the preparation of the inventory do not fully perform their required functions. The ERT noted that institutional and procedural arrangements should be improved with regard to the following issues:

- (a) Increasing and expanding cooperation between the inventory team and other institutions and experts not involved in the inventory preparation and using the full range of information available on AD, EFs and methods in the country;
- (b) Improving, completing and enhancing the procedures and organization of the archive and “paper-trail” information, including AD, EFs and methodologies for the inventory compilation, following good practices and international standards for record-keeping and management;
- (c) Ensuring the continuity of staff involved in inventory preparation and the transfer of knowledge and current approaches for inventory work to new staff;
- (d) Developing and fully implementing a national QA/QC plan that involves all institutions and experts participating in the preparation of the inventory, in accordance with the IPCC good practice guidance.

138. In the course of the review, the ERT formulated a number of recommendations relating to the completeness, transparency, consistency and accuracy of the information presented in Kazakhstan’s annual submission. The key recommendations are that Kazakhstan:

- (a) Improve the NIR structure to fully reflect the requirements of the UNFCCC reporting guidelines;
- (b) Enhance the consistency and accuracy of the information provided in the NIR and the CRF tables;
- (c) Improve the transparency of the inventory by including clear and concise information on methods, EFs and AD in the NIR, as well as additional background information;
- (d) Achieve the full coverage of territory for the LULUCF sector;
- (e) Perform a key category analysis in accordance with the IPCC good practice guidance for LULUCF using 1990 as a base year for the analysis and report detailed results in the annex to the NIR;
- (f) Use higher-tier methods for key categories, when appropriate;

(g) Report in the NIR and relevant CRF tables detailed information on the recalculations performed, with explanatory information that includes the rationale and justification for the recalculations made;

(h) Perform a quantitative uncertainty analysis, including for the LULUCF categories, in accordance with the IPCC good practice guidance and transparently document in the NIR the sources and the references for the AD and EF uncertainty values selected for the emission estimates, including the expert judgement;

(i) Include descriptions of the QA/QC and verification activities and procedures in specific sections of the sectoral chapters of the NIR;

(j) Improve QA procedures, if possible by an annual independent peer review of all sectors of the inventory by individual experts or organizations not involved in inventory preparation. The results of this review should be documented and may be used to improve the quality of the inventory;

(k) Use the key category analysis and uncertainty analysis to identify the areas for further improvement in the inventory.

Annex I

Documents and information used during the review

A. Reference documents

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

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

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

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

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

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

Status report for Kazakhstan 2010. Available at <<http://unfccc.int/resource/docs/2008/asr/kaz.pdf>>.

Synthesis and assessment report on the greenhouse gas inventories submitted in 2010. Available at <<http://unfccc.int/resource/webdocs/sai/2010.pdf>>.

B. Additional information provided by the Party

Responses to questions during the review were received from Ms. Irina Yesserkepova (Kazakh Scientific Research Institute of Ecology and Climate), including additional material on the methodology and assumptions used. The following documents¹ were also provided by Kazakhstan:

1. Order of the MoEP № 258 of 4 December 2009 “On executive body for supporting activity of authorized body on coordination of realization of Kyoto Protocol to the UNFCCC”
2. Order of the MoEP №193 of 23 July 2010 “On approval of the National Green House Gas Inventory System”.
3. Order of the MoEP №194 of 23 July 2010 “On approval of the national system for estimation of anthropogenic emissions by sources and removals by sinks of greenhouse gases”.

¹ Reproduced as received from the Party.

4. Order of the MoEP № 348 of 13 December 2007 “On establishing rules for the inventory of greenhouse gases and ozone-depleting substances”.
5. Order of the MoEP №350 of 13 December 2007 “On establishing rules for the development and adoption of maximum permissible emissions of greenhouse gases and ozone-depleting substances”.
6. Government regulation №124 of 8 February 2008 “On establishing rules for government accounting sources of greenhouse gas emissions and consumption of ozone-depleting substances”.
7. Government regulation №128 of 11 February 2008 “On establishing rules of limitation, suspension or reduction of emissions of greenhouse gases in the atmosphere”.
8. List of literature of KazNIIK Library on GHG inventory.
9. Record № 4 of Scientific Council in KazNIIK of 18 November 2008 “On hearing annual reports on the programme 003 of MoEP and report on scientific and technical programme of MES (Ministry of Education and Science) performed by KazNIIK during 2008”.
10. KazNIIK. 2009. Livestock population data for 2008.
11. KazNIIK. Working sheet of emission estimates in agricultural soils of the agricultural sector.

Annex II

Acronyms and abbreviations

AD	activity data
CH ₄	methane
CO ₂	carbon dioxide
CO ₂ eq	carbon dioxide equivalent
CRF	common reporting format
EF	emission factor
ERT	expert review team
GHG	greenhouse gas; unless indicated otherwise, GHG emissions are the sum of CO ₂ , CH ₄ , N ₂ O, HFCs, PFCs and SF ₆ without GHG emissions and removals from LULUCF
GJ	gigajoule (1 GJ = 10 ⁹ joule)
HFCs	hydrofluorocarbons
IEA	International Energy Agency
IPCC	Intergovernmental Panel on Climate Change
kg	kilogram (1 kg = 1,000 grams)
LULUCF	land use, land-use change and forestry
m ³	cubic metre
NA	not applicable
N ₂ O	nitrous oxide
NIR	national inventory report
PFCs	perfluorocarbons
PJ	petajoule (1 PJ = 10 ¹⁵ joule)
QA/QC	quality assurance/quality control
SF ₆	sulphur hexafluoride
SO ₂	sulphur dioxide
Tg	teragram (1 Tg = 1 million tonnes)
TJ	terajoule (1 TJ = 10 ¹² joule)
UNFCCC	United Nations Framework Convention on Climate Change
