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Report on the individual review of the annual submission of Kazakhstan submitted in 2021*

Note by the expert review team

Summary

Each Party included in Annex I to the Convention must submit an annual inventory of emissions and removals of greenhouse gases for all years from the base year (or period) to two years before the inventory due date (decision 24/CP.19). Parties included in Annex I to the Convention that are Parties to the Kyoto Protocol are also required to report supplementary information under Article 7, paragraph 1, of the Kyoto Protocol with the inventory submission due under the Convention. This report presents the results of the individual review of the 2021 annual submission of Kazakhstan, conducted by an expert review team in accordance with the "Guidelines for review under Article 8 of the Kyoto Protocol". The review took place from 18 to 23 October 2021 remotely.

* In the symbol for this document, 2021 refers to the year in which the inventory was submitted, not to the year of publication.

Contents

Abbreviations and acronyms

2006 IPCC Guidelines	*2006 IPCC Guidelines for National Greenhouse Gas Inventories*
AAU	assigned amount unit
AD	activity data
BKB	brown coal briquette
Bureau of National Statistics	Bureau of National Statistics of the Agency for Strategic Planning and Reforms of the Republic of Kazakhstan
Annex A source	source category included in Annex A to the Kyoto Protocol
AR	afforestation and reforestation
Article 8 review guidelines	"Guidelines for review under Article 8 of the Kyoto Protocol"
B_o	maximum methane-producing capacity
C	carbon
CaO	calcium oxide
CER	certified emission reduction
CH_4	methane
CKD	cement kiln dust
CM	cropland management
CO_2	carbon dioxide
CO_2 eq	carbon dioxide equivalent
Convention reporting adherence	adherence to the "Guidelines for the preparation of national communications by Parties included in Annex I to the Convention, Part I: UNFCCC reporting guidelines on annual greenhouse gas inventories"
CP	commitment period
CPR	commitment period reserve
CRF	common reporting format
CSC	carbon stock change
DOC	degradable organic carbon
DOC_f	fraction of degradable organic carbon that decomposes
EEA	European Environment Agency
EF	emission factor
EMEP	Cooperative Programme for Monitoring and Evaluation of the Long-range Transmission of Air Pollutants in Europe
EMEP/EEA guidebook	EMEP/EEA air pollutant emission inventory guidebook
ERT	expert review team
ERU	emission reduction unit
FAO	Food and Agriculture Organization of the United Nations
FAOSTAT	statistical database of the Food and Agriculture Organization of the United Nations
FM	forest management
FMRL	forest management reference level
FOD	first-order decay
$Frac_{LEACH-(H)}$	fraction of nitrogen input to managed soils that is lost through leaching and run-off
GHG	greenhouse gas
GM	grazing land management
HFC	hydrofluorocarbon
IE	included elsewhere
IEA	International Energy Agency
IEF	implied emission factor

IPCC	Intergovernmental Panel on Climate Change
IPCC good practice guidance for LULUCF	*Good Practice Guidance for Land Use, Land-Use Change and Forestry*
IPPU	industrial processes and product use
JSC	joint stock company
KP reporting adherence	adherence to the reporting guidelines under Article 7, paragraph 1, of the Kyoto Protocol
KP-LULUCF	activities under Article 3, paragraphs 3–4, of the Kyoto Protocol
Kyoto Protocol Supplement	*2013 Revised Supplementary Methods and Good Practice Guidance Arising from the Kyoto Protocol*
LULUCF	land use, land-use change and forestry
MCF	methane conversion factor
MMS	manure management system(s)
MSW	municipal solid waste
N	nitrogen
N_2O	nitrous oxide
NA	not applicable
NCV	net calorific value
NE	not estimated
NEU	non-energy use
NF_3	nitrogen trifluoride
NGL	natural gas liquid
NIR	national inventory report
NO	not occurring
PFC	perfluorocarbon
QA/QC	quality assurance/quality control
RMU	removal unit
RV	revegetation
SEF	standard electronic format
SF_6	sulfur hexafluoride
SIAR	standard independent assessment report
SOC	soil organic carbon
SWDS	solid waste disposal site(s)
UNDP	United Nations Development Programme
UNFCCC Annex I inventory reporting guidelines	“Guidelines for the preparation of national communications by Parties included in Annex I to the Convention, Part I: UNFCCC reporting guidelines on annual greenhouse gas inventories”
UNFCCC review guidelines	“Guidelines for the technical review of information reported under the Convention related to greenhouse gas inventories, biennial reports and national communications by Parties included in Annex I to the Convention”
VS	volatile solid(s)
WDR	wetland drainage and rewetting
Wetlands Supplement	*2013 Supplement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories: Wetlands*

I. Introduction[1]

1. This report covers the review of the 2021 annual submission of Kazakhstan, organized by the secretariat in accordance with the Article 8 review guidelines (adopted by decision 22/CMP.1 and revised by decision 4/CMP.11). In accordance with the Article 8 review guidelines, this review process also encompasses the review under the Convention as described in the UNFCCC review guidelines, particularly in part III thereof, namely the "UNFCCC guidelines for the technical review of greenhouse gas inventories from Parties included in Annex I to the Convention" (annex to decision 13/CP.20). The review took place from 18 to 23 October 2021 remotely[2] and was coordinated by Sevdalina Todorova and Javier Hanna (secretariat). Table 1 provides information on the composition of the ERT that conducted the review for Kazakhstan.

Table 1
Composition of the expert review team that conducted the review for Kazakhstan

Area of expertise	*Name*	*Party*
Generalist	Mikhail Gitarskiy	Russian Federation
	Olia Glade	New Zealand
Energy	Elena Gavrilova	North Macedonia
	Rana Humbatova	Azerbaijan
	Haakon Marold	Australia
IPPU	Wolfram Jörß	European Union
	Kakhaberi Mdivani	Georgia
	Samir Tantawi	Egypt
Agriculture	Marci Baranski	United States
	Kent Buchanan	South Africa
	Christopher John Dore	United Kingdom
LULUCF and KP-LULUCF	Mattias Lundblad	Sweden
	Walter Oyhantcabal	Uruguay
	Marina Shvangiradze	Georgia
Waste	Maryna Bereznytska	Ukraine
	Medeia Inashvili	Georgia
	Sergii Shmarin	Ukraine
Lead reviewers	Mikhail Gitarskiy	
	Kakhaberi Mdivani	

2. The basis of the findings in this report is the assessment by the ERT of the Party's 2021 annual submission in accordance with the UNFCCC review guidelines and the Article 8 review guidelines.

3. The ERT has made recommendations that Kazakhstan resolve identified findings, including issues[3] designated as problems.[4] Other findings, and, if applicable, the encouragements of the ERT to Kazakhstan to resolve related issues, are also included in this report.

[1] The Doha Amendment entered into force on 31 December 2020. At the time of publication of this report, Kazakhstan had not accepted the Amendment.
[2] Owing to the circumstances related to the coronavirus disease 2019, the review had to be conducted remotely.
[3] Issues are defined in decision 13/CP.20, annex, para. 81.
[4] Problems are defined in decision 22/CMP.1, annex, paras. 68–69, as revised by decision 4/CMP.11.

4. 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.

5. Annex I presents the annual GHG emissions of Kazakhstan, including totals excluding and including LULUCF, indirect CO_2 emissions, and emissions by gas and by sector, and contains background data on emissions and removals from KP-LULUCF, if elected by the Party, by gas, sector and activity.

6. Information to be included in the compilation and accounting database can be found in annex II.

II. Summary and general assessment of the Party's 2021 annual submission

7. Table 2 provides the assessment by the ERT of the Party's 2021 annual submission with respect to the tasks undertaken during the review. Further information on the issues identified, as well as additional findings, may be found in tables 3 and 5.

Table 2
Summary of review results and general assessment of the 2021 annual submission of Kazakhstan

Assessment			*Issue/problem ID#(s) in table 3 or 5*[a]
Dates of submission	Original submission: NIR, 28 May 2021; CRF tables (version 1), 16 April 2021; SEF tables, 28 May 2021 (SEF-CP1-2020, SEF-CP2-2020, SEF-CP1-2019 and SEF-CP2-2019)		
Review format	Centralized review conducted remotely		
Application of the requirements of the UNFCCC Annex I inventory reporting guidelines and the Wetlands Supplement (if applicable)	Have any issues been identified in the following areas:		
	(a) Identification of key categories?	Yes	KL.3
	(b) Selection and use of methodologies and assumptions?	Yes	E.10, E.32, E.63, I.19, I.29, I.42, I.44, I.45, A.16, A.17, L.10, L.16, L.21, L.25, W.11, W.24, W.29, W.34
	(c) Development and selection of EFs?	Yes	E.20, E.36, E.60, E.69, E.76, E.78, A.14, W.9, W.10, W.21, W.31
	(d) Collection and selection of AD?	Yes	E.5, E.8, E.12, E.30, E.41, E.44, E.46, E.59, E.65, E.66, E.75, I.25, I.43, I.51, A.2, L.7, L.8, W.37
	(e) Reporting of recalculations?	Yes	G.19, E.3, I.6, I.41, W.12
	(f) Reporting of a consistent time series?	Yes	E.5, E.25, E.54, E.55, E.57, E.69, E.70
	(g) Reporting of uncertainties, including methodologies?	Yes	G.21
	(h) QA/QC?	QA/QC procedures were assessed in the context of the national system (see supplementary information under the Kyoto Protocol below)	
	(i) Missing categories, or completeness?[b]	Yes	E.71, I.38, I.39, I.50, A.12, A.19, L.1, L.2, L.3, L.20, L.23, W.1, W.5, W.15, W.19, KL.1, KL.7, KL.11
	(j) Application of corrections to the inventory?	No	
Significance threshold	For categories reported as insignificant, has the Party provided sufficient information showing that the likely	No	I.37, I.48

Assessment			*Issue/problem ID#(s) in table 3 or 5[a]*
	level of emissions meets the criteria in paragraph 37(b) of the UNFCCC Annex I inventory reporting guidelines?		
Description of trends	Did the ERT conclude that the description in the NIR of the trends for the different gases and sectors is reasonable?	No	E.38, E.39, E.58, I.49
Supplementary information under the Kyoto Protocol	Have any issues been identified related to the following aspects of the national system:		
	(a) Overall organization of the national system, including the effectiveness and reliability of the institutional, procedural and legal arrangements?	Yes	G.3, G.4
	(b) Performance of the national system functions?	Yes	G.12, G.19, G.20, KL.4
	Have any issues been identified related to the national registry:		
	(a) Overall functioning of the national registry?	Yes	G.1
	(b) Performance of the functions of the national registry and the adherence to technical standards for data exchange?	Yes	G.1
	Have any issues been identified related to the reporting of information on AAUs, CERs, ERUs and RMUs and on discrepancies in accordance with decision 15/CMP.1, annex, chapter I.E, in conjunction with decision 3/CMP.11, taking into consideration any findings or recommendations contained in the SIAR?	No	
	Have any issues been identified in matters related to Article 3, paragraph 14, of the Kyoto Protocol, specifically problems related to the transparency, completeness or timeliness of the reporting on the Party's activities related to the priority actions listed in decision 15/CMP.1, annex, paragraph 24, in conjunction with decision 3/CMP.11, including any changes since the previous annual submission?	Yes	G.13
	Have any issues been identified related to the following reporting requirements for KP-LULUCF:		
	(a) Reporting requirements of decision 2/CMP.8, annex II, paragraphs 1–5?	Yes	G.6, G.8, KL.1, KL.2, KL.5
	(b) Demonstration of methodological consistency between the reference level and reporting on FM in accordance with decision 2/CMP.7, annex, paragraph 14?	No	
	(c) Reporting requirements of decision 6/CMP.9?	Yes	KL.8
	(d) Country-specific information to support provisions for natural disturbances in accordance with decision 2/CMP.7, annex, paragraphs 33–34?	Yes	KL.6, KL.9
CPR	Was the CPR reported in accordance with decision 18/CP.7, annex; decision 11/CMP.1, annex; and decision 1/CMP.8, paragraph 18?	No	G.14
Adjustments	Has the ERT applied any adjustments under Article 5, paragraph 2, of the Kyoto Protocol?	No	
	Has the Party submitted a revised estimate to replace a previously applied adjustment?	Yes	Kazakhstan has previously applied adjustments; revised estimates were submitted for some but not all adjustment cases

Assessment			*Issue/problem ID#(s) in table 3 or 5*[a]
Response from the Party during the review	Has the Party provided the ERT with responses to the questions raised, including the data and information necessary for assessing conformity with the UNFCCC Annex I inventory reporting guidelines and any further guidance adopted by the Conference of the Parties?	Yes	
Recommendation for an exceptional in-country review	On the basis of the issues identified, does the ERT recommend that the next review be conducted as an in-country review?	Yes	See annex III for a list of the questions and issues to be considered during the review
Questions of implementation	Did the ERT list any questions of implementation?	No	

[a] Further information on the issues identified, as well as additional findings, may be found in tables 3 and 5.
[b] Missing categories for which methods are provided in the 2006 IPCC Guidelines may affect completeness and are listed in annex III.

III. Status of implementation of recommendations included in the previous review report

8. Table 3 compiles the recommendations from previous review reports that were included in the most recent previous review report, published on 2 September 2020,[5] and had not been resolved by the time of publication of the report on the review of the Party's 2019 annual submission. The ERT has specified whether it believes the Party had resolved, was addressing or had not resolved each issue or problem by the time of publication of this review report and has provided the rationale for its determination, which takes into consideration the publication date of the most recent previous review report and national circumstances.

Table 3
Status of implementation of recommendations included in the previous review report for Kazakhstan

ID#	*Issue/problem classification*[a, b]	*Recommendation made in previous review report*	*ERT assessment and rationale*
General			
G.1	National registry (G.1, 2019) (G.13, 2017) KP reporting adherence	Establish and maintain the national registry and report information on how the national registry performs the functions defined in the mandatory requirements for the registry's functionality for the second commitment period of the Kyoto Protocol, in accordance with the requirements set out in decision 13/CMP.1, annex, chapter II, in conjunction with decision 3/CMP.11, and the annex to decision 5/CMP.1, and thereafter report information on any change in the national registry in subsequent annual submissions.	Addressing. The NIR does not contain any information on progress towards the establishment of a national registry. The ERT noted that the national registry had not been fully established for the current annual submission and not yet been connected to the international transaction log. During the review, the Party explained that it is working on the implementation and maintenance of a national emissions trading system. In 2020, an analysis was carried out of the legal and technical aspects of a State carbon unit register in accordance with the requirements of the Kyoto Protocol and the changes needed to adapt to the requirements of the Paris Agreement under the World Bank's Partnership for Market Readiness project to prepare Kazakhstan's fourth national quarter allocation plan by the end of 2020. Recommendations were developed to improve the State carbon unit register and currently the technical specifications of the design and requirements related to the purchase of the information technology system for the register are under development. Improvements to the State carbon unit register were due to be completed on the basis of the technical specification recommendations by the end of 2021.
G.2	Kyoto Protocol units (G.2, 2019) (G.14, 2017) KP reporting adherence	Provide the reporting on the Kyoto Protocol units using the SEF tables as required in decision 3/CMP.11, paragraph 13.	Resolved. The Party reported in its SEF tables (SEF-CP1-2019, SEF-CP2-2019, SEF-CP1-2020 and SEF-CP2-2020) on the Kyoto Protocol units, as required under decision 3/CMP.11, paragraph 13. The notation key "NO" was used in the SEF tables.
G.3	National system (G.3, 2019) (G.15, 2017) KP reporting adherence	Provide an action plan and information on its implementation to address the issues identified, in particular on the steps, including those already achieved, and expected time frames for:	(a) Resolved. The Party reported in its NIR (section 1.2.1, p.18) that a new draft regulatory document was being developed for the nationally determined contribution preparation and submission process, which was expected to be adopted and come into force on 1 July 2021, following the entry into force of the new Environmental Code.

[5] FCCC/ARR/2019/KAZ. The ERT notes that the report on the individual inventory review of Kazakhstan's 2020 annual submission has not been published yet owing to insufficient funding for the review process. As a result, the latest previously published annual review report reflects the findings of the review of the Party's 2019 annual submission.

ID#	*Issue/problem classification*[a, b]	*Recommendation made in previous review report*	*ERT assessment and rationale*
		(a) Putting in place additional agreements and mechanisms to improve inter-agency cooperation and support that clearly define mandates for each inventory contributor and participant regarding inventory roles and responsibilities, inventory funding and inventory resourcing; (b) Identifying roles and responsibilities for QA/QC and data verification for each inventory sector to ensure data quality and reliability; (c) Implementing arrangements for review, approval and sign-off processes to ensure timely annual submission of the NIR by the agreed submission due date.	Further, in the NIR (p.20) Kazakhstan provided a two-year workplan to address five issues associated with lack of compliance with the Kyoto Protocol that were identified in the 2019 annual review report (FCCC/ARR/2019/KAZ). During the review, the Party confirmed that the new Environmental Code entered into force on 1 July 2021, under which the national GHG inventory system is regulated in accordance with Article 302. Under paragraph 5 of Article 302, an audit of the completeness, transparency and reliability of the national inventory of GHG emissions and removals is carried out annually in accordance with the regulations of the authorized environmental protection body. A draft order on the national GHG inventory (see https://legalacts.egov.kz/npa/view?id=7190640 (in Russian)) was recently prepared, and was due to enter into force by the end of September 2021 but had not yet done so at the time of the review. It includes actions to improve the GHG inventory and compilation process, removes the inventory programme from the competitive annual contracts for the inventory preparation and determines timelines for the introduction of additional agreements and mechanisms to improve intersectoral cooperation and support; (b) Addressing. The NIR (section 1.2.3.2, p.24 and section 1.2.3.4, p.29) provides a plan and list of responsibilities for each action for the inventory QC process. However, the list does not include information on any planned QA activities, ownership of the various QA processes, or specific arrangements regarding data collection and the governance of this process; (c) Addressing. The NIR was submitted on 28 May 2021, which was prompter than previous submissions but still exceeded the mandatory submission date (15 April). However, the ERT noted that the draft order on the national GHG inventory (see (a) above) includes measures to introduce mechanisms for reviewing, approving and signing off the inventory to ensure timely annual submission of the NIR by the established deadline of 15 April.
G.4	National system (G.4, 2019) (G.16, 2017) KP reporting adherence	In the NIR, provide information on planned capacity-building steps and report on progress regarding the capacity-building activities in the inventory improvement plan. Specifically, it should include the planned actions, roles and responsibilities for those actions and the time frame for implementation of each action regarding (a) building technical capacity of the personnel participating in the inventory preparation and management and (b) making specific arrangements for data-sharing and data communication to ensure uninterrupted and	(a) Addressing. The Party reported in its NIR (section 1.2.4, pp.33–34) an overview of completed and planned capacity-building activities and potential external participants in the capacity-building. However, the NIR does not provide specific details regarding roles and responsibilities for the capacity-building activities, proposed time frames (including completion dates, where appropriate), the ways in which the themes of training are linked or prioritized according to inventory needs, or the target audience of the training (e.g. existing inventory personnel, trainees, government officials or academic researchers). During the review, Kazakhstan explained that a number of training seminars and sessions led by international consultants and aimed at increasing the capacity of national experts to improve national reporting in problematic sectors, primarily LULUCF and energy (transport and fugitive emissions), took place or were planned to take place in 2021. Within the framework of UNDP project #00117909 to assist Kazakhstan to update its nationally determined contributions, international experts provide support to improve the quality of the national GHG inventory and

ID#	Issue/problem classification[a, b]	Recommendation made in previous review report	ERT assessment and rationale
		timely access to AD by the designated inventory agency from other organizations.	conduct training sessions on the energy, IPPU and waste sectors. The UNDP office in Kazakhstan and other organizations, including the United Nations Economic and Social Commission for Asia and the Pacific and the Yu. A. Israel Institute of Global Climate and Ecology, organized and conducted training in the country in 2021 to improve the preparation of national GHG inventories; (b) Addressing. While the NIR (section 1.3, p.35) includes a description of the data-collection approach, it does not clarify the arrangements made to govern the relationship with data vendors for gathering the AD for the current annual submission to ensure uninterrupted and timely access to AD for the inventory team. During the review, the Party explained its plans to organize working meetings of State bodies and international organizations to improve the quality of input data. The main focus groups of these meetings will be government agencies, departments and organizations that provide initial data for calculating GHG emissions. The meetings will cover communication issues and the conclusion of memorandums of cooperation with the main State bodies and departments that provide initial data for the national GHG inventory. This will strengthen the national system and allow Kazakhstan to ensure regular and timely submission of its annual GHG inventories to the secretariat.
G.5	National system (G.5, 2019) (G.17, 2017) Transparency	In the NIR, include details of the national system structure and operation regarding the different stages of inventory data collection and processing. Specifically, it should include detailed information on (a) which organizations participate in data collection for each sector and whether those data providers are the same every year, (b) who is responsible for the preliminary (raw data) processing and (c) how the quality and reliability of plant-specific and country-specific EFs are ensured and who is responsible for this.	(a–b) Addressing. The Party included in its NIR (section 1.2.2, p.21) an overview of the organization of the inventory system and identified Zhasyl Damu JSC as the single national entity. Kazakhstan also improved the transparency of the NIR by including an overall description of the inventory development steps and a chart of the national inventory system (figure 1.2, p.22). However, the information in the NIR does not include specific details on participating organizations, such as the ministries, committees or industrial enterprises involved in providing data for each sector and its categories (where applicable), or whether those ministries, committees and industrial enterprises were involved in the preliminary data processing; (c) Addressing. Regarding the verification of plant- and country-specific data and EFs, the NIR (section 1.2.3.3, p.26) includes, among general QC procedures, a check for the correct recording and archiving process for EFs and other parameters of estimated emissions. However, the QA/QC plan in the NIR does not include specific information on how the quality and reliability of plant- and country-specific EFs are ensured or the ownership of this process. During the review, the Party clarified that the organizations which collect data for each sector are defined in line with the annexes to the draft order on the national GHG inventory (see ID# G.3 above), which itself will detail the roles and responsibilities for QA/QC and verification of data for each sector of the inventory to ensure the quality and reliability of data.
G.6	National system (G.6, 2019) (G.19, 2017) Transparency	Through the national system, which ensures that areas of land subject to KP-LULUCF are identifiable, include in the NIR a detailed and	Not resolved. The Party included in its NIR (chap. 8, pp.398–414) additional information on KP-LULUCF, including how land areas are represented. However, the information does not include detailed and transparent descriptions of the established process for ensuring that areas of land subject to KP-LULUCF are identifiable through

ID#	Issue/problem classification[a, b]	Recommendation made in previous review report	ERT assessment and rationale
		transparent description of the process established for this purpose.	the national system in accordance with decision 2/CMP.7, annex, paragraph 25 (see ID# KL.4 below).
G.7	National system (G.19, 2019) KP reporting adherence	Include detailed information on changes to the national system in the NIR of the next annual submission in accordance with decision 15/CMP.1, annex, paragraphs 21, 30 and 31, in conjunction with decision 3/CMP.11.	Resolved. The Party reported in its NIR (section 1.2.4, pp.31–34) information on changes in the national system since the previous annual submission in accordance with decision 15/CMP.1, annex, paragraphs 21, 30 and 31, in conjunction with decision 3/CMP.11.
G.8	KP-LULUCF supplementary information (G.7, 2019) (G.19, 2017) Transparency	In the NIR, include transparent information on geographical identification of lands where deforestation, AR, FM and GM activities occurred on the territory, in line with the methodological recommendations of the 2006 IPCC Guidelines (vol. 4) and the Kyoto Protocol Supplement.	Not resolved. The Party reported in its NIR (chap. 8, pp.398–414) additional information on KP-LULUCF and included a map of the distribution of forest in the country (figure 8.1, p.405). Although the overall forest distribution is shown, Kazakhstan has not included information on geographical identification of lands where deforestation, AR, FM and GM activities occurred on the territory, in line with the methodological recommendations of the 2006 IPCC Guidelines (vol. 4, chap. 3, p.3.18) and the Kyoto Protocol Supplement. During the review, the Party clarified that its national inventory system allows for the identification of land areas, including areas of forest land, using the broad area identification method (see ID# KL.4 below) with a geographical coverage of areas within the administrative regions of the national territory. Within each area, numerous activities are carried out, including those selected in accordance with Article 3, paragraphs 3–4, of the Kyoto Protocol.
G.9	Inventory management (G.8, 2019) (G.18, 2017) KP reporting adherence	Enhance the inventory archiving system and ensure that all inventory documentation is readily available to both inventory compilers and the ERTs.	Resolved. The Party reported in its NIR (section 1.3, p.37) a description of the inventory archiving system, including the steps in the archiving process and the inventory data archiving responsibilities of each agency. The ERT noted that it received a timely response to all requests for clarification of inventory information.
G.10	Inventory management (G.9, 2019) (G.4, 2017) (G.12, 2016) (G.12, 2015) (15, 2013) (24, 2012) Transparency	Provide, in the NIR, more information on: the archiving system, including the responsibilities of different institutions for the flow of data and archiving; whether the archiving system includes information generated through external and internal reviews, documentation on annual key category analysis, key category identification and planned inventory improvements; and how this system is maintained by the Kazakh Scientific Research Institute of Ecology and Climate.	Addressing. The Party reported in its NIR (section 1.3, p.37) new information describing the inventory archiving system, including how this system is maintained by Zhasyl Damu JSC (formerly the Kazakh Scientific Research Institute of Ecology and Climate). However, Kazakhstan has not included in the NIR additional information on whether or not the archiving system stores the information generated through external and internal reviews, documentation on annual key category analysis, key category identification and planned inventory improvements. During the review, the Party clarified that the draft order on the national GHG inventory provides a chapter on managing the NIR, which includes information on the inventory archiving system, such as the types of information stored, access arrangements, how it is used to respond to external queries (e.g. during individual reviews of annual submissions), and the implementation of recommendations based on the review results.
G.11	Inventory management (G.22, 2019) Transparency	Make fully functional the inventory management function described in decision 19/CMP.1, annex, paragraph 16(c), in	Addressing. The Party reported in its NIR (section 1.2.4, pp.33–34) that, although there were no structural changes to the national inventory system, there were substantial changes in legal governance of the inventory process that will significantly improve the functioning of the national system. In 2020, amendments and additions

ID#	Issue/problem classification[a, b]	Recommendation made in previous review report	ERT assessment and rationale
		conjunction with decisions 3/CMP.11 and 4/CMP.11.	were introduced to order 214 on the rules for monitoring the completeness, transparency and reliability of the State inventory of GHG emissions and removals (18 March 2015), which will be adopted in 2021. The new Environmental Code (see ID# G.3 above) contains provisions under which the preparation of the NIR is removed from the competitive environment of annual contracts and assigned instead to a specialized organization on a permanent basis. In addition, the NIR (section 1.2.4, p.32) specifically states that Kazakhstan is planning to make changes to implement inventory regulatory mechanisms governing the NIR review and approval process. During the review, the Party clarified that the new Environmental Code entered into force on 1 July 2021, under which the national GHG inventory system is regulated in accordance with Article 302 (see ID# G.3 above). The ERT considers that the recommendation has not been fully addressed because, although the relevant legislation has been drafted, Kazakhstan has not reported in the NIR the action plan for ensuring that the inventory system is fully functional, including the specific steps, roles and responsibilities, and time frame for aligning the national system structure and its governance and approval under the new legislation.
G.12	Inventory management (G.22, 2019) KP reporting adherence	Provide information and a detailed description of a communication plan (or a reference thereto), including specific actions and steps (time frames, deliverables and responsibilities), which ensures that: (a) Requests made by the ERT for clarifying inventory information are actioned and communicated in a timely manner; (b) An approval mechanism for the responses (where required) is clearly described, including the associated roles and responsibilities; (c) The timeline for responses is agreed between the approving agencies and organizations involved. Provide an update on progress with regard to the implementation of the communication plan in the NIR of the next annual submission.	Addressing. (a) The Party reported in its NIR (section 1.2.3.5, p.31) that the collection and repository procedure for inventory data and information, including all initial calculation information and results, is integrated into the national archive held at Zhasyl Damu JSC, the nationally designated agency; (b) In the NIR (section 1.2.4, p.32), the Party reported that the relevant approval mechanism is due to be implemented, although no further details were provided; (c) The Party has not included specific details (such as responsibilities or time frames) on the implementation of the governance mechanisms facilitating inter-agency communications that would support a fully functional inventory system. During the review, Kazakhstan clarified that, in order to improve the quality of the NIR, it plans to carry out capacity-building activities for specialists responsible for its compilation, including training and seminars provided with the support of a UNDP project in Kazakhstan and other international and national organizations. Kazakhstan further clarified that the draft order on the national GHG inventory includes legislation to improve the GHG inventory and compile the NIR, and determines the deadlines for the introduction of additional agreements and mechanisms to improve intersectoral cooperation and support, and details the measures to introduce mechanisms for reviewing, approving and signing off the GHG inventory.
G.13	Article 3, paragraph 14, of the Kyoto Protocol (G.10, 2019) (G.20,	Report in subsequent annual submissions any change to the information under Article 3, paragraph 14, in accordance with decision	Addressing. The Party reported in its NIR (section 1.5, pp.38–40) information under Article 3, paragraph 14, in accordance with decision 15/CMP.1, in conjunction with decision 3/CMP.11. The ERT noted, however, that the information reflects Kazakhstan's assistance for sustainable development without a specific focus on the minimization of adverse impacts required under Article 3, paragraph 14, of the Kyoto

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	2017) KP reporting adherence	15/CMP.1, in conjunction with decision 3/CMP.11.	Protocol, in accordance with decision 15/CMP.1, annex, paragraphs 23 and 24, in conjunction with decision 3/CMP.11. During the review, the Party clarified that it will provide updated information on the minimization of adverse impacts in accordance with Article 3, paragraph 14, in its next annual submission.
G.14	CPR (G.21, 2019) KP reporting adherence	Report the calculation of CPR based on 90 per cent of the Party's assigned amount or 100 per cent of eight times the most recently reviewed inventory, whichever is lowest, in accordance with decisions 18/CP.7 and 11/CMP.1 and paragraph 18 of decision 1/CMP.8 in the next annual submission.	Not resolved. The Party did not report the CPR calculation in the NIR. During the review, Kazakhstan clarified that it has not ratified the Doha Amendment and for that reason the CPR calculation is not presented in NIR. The Party does not plan to undertake a CPR calculation or provide the relevant information in its next annual submission. On the basis of the information contained in the submission, and when comparing 90 per cent of the Party's assigned amount and 100 per cent of eight times the most recently reviewed inventory, the ERT calculated the applicable CPR to be 2,633,575,513.32 t CO_2 eq.
G.15	NIR (G.11, 2019) (G.5, 2017) (G.16, 2016) (G.15, 2015) Transparency	Provide detailed information on the assessment of completeness (e.g. in an annex) in the NIR.	Not resolved. The Party did not report the required information in its NIR and there is no separate section or annex on completeness. Although some explanations for the categories reported using the notation key "NE" are included in CRF table 9, the relevant information is not summarized in the NIR by category or at an overall level in accordance with the UNFCCC Annex I inventory reporting guidelines, paragraphs 37 (demonstrating that the total national aggregate of estimated emissions for all gases and categories considered insignificant remains below 0.1 per cent of the national total GHG emissions without LULUCF) and 50(f) (providing an assessment of completeness, including information and explanations in relation to categories not estimated). During the review, the Party clarified that a table containing this information will be included in its next annual submission.
G.16	CRF tables (G.12, 2019) (G.6, 2017) (G.17, 2016) (G.16, 2015) Comparability	Complete all cells and do not leave blank cells in the CRF tables and ensure the correct use of the notation keys (including "NA") in the CRF tables in line with decision 24/CP.19, annex I, paragraph 37.	Addressing. The ERT noted that all cells in the CRF tables have been filled for all sectors using notation keys, where appropriate, in line with decision 24/CP.19, annex I, paragraph 37, with the exception of some cells under KP-LULUCF (tables 4(KP-I)A.1, 4(KP-I)A.1.1, 4(KP-I)A.2, 4(KP-I)B.1, 4(KP-I)B.1.1, 4(KP-I)B.1.3, 4(KP-II)4 and the accounting table). Some mistakes in notation key use are noted below in the sectoral sections of this report (see ID# G.18 below). During the review, the Party clarified that it will continue to improve reporting in line with the UNFCCC Annex I inventory reporting guidelines.
G.17	Notation keys (G.13, 2019) (G.7, 2017) (G.17, 2016) (G.16, 2015) Transparency	Provide justification on the use of notation keys, particularly the notation keys "NE" and "IE", in the NIR and in CRF table 9.	Resolved. The Party reported in CRF table 9 the appropriate explanations for the notation keys "NE" and "IE", as used in the GHG inventory. Omitted justifications are discussed in the sectoral sections of this report (see ID#s E.1, E.46, I.1, I.48, W.18, KL.6, KL.7 and KL.9 below).
G.18	Notation keys (G.14, 2019) (G.1, 2017) (G.2, 2016) (G.2, 2015)	Use the notation key "NO" if the activity is not occurring and "IE" if emissions are included elsewhere.	Addressing. The Party corrected the notation keys in the CRF tables (e.g. in CRF tables 1.A(a), 1.A(b), 1.A(d) and 5.C), reported corrected notation keys and provided the relevant explanations in the NIR (sections 3.37 (p.72), 3.4.1.6 (p.82), 3.4.3.6

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	(table 3, 2013) Convention reporting adherence		(p.111), 3.4.5.6 (p.131), 3.4.8.5 (p.139), 3.5.4.6 (p.158), 3.5.4.11 (pp.161–162), 4.1 (p.165), 4.4 (p.195) and 7.2.3 (p.370)). However, the ERT noted that some cells do not contain any data, in particular for the KP-LULUCF sector (see ID#s G.16, E.2, E.13, E.16 and L.13 below and ID# W.36 in table 5).
G.19	Recalculations (G.15, 2019) (G.11, 2017) Transparency	In the NIR of the future annual submissions, include detailed information explaining the reasons for recalculations, the specifics of methods and assumptions, and the impact of recalculations on the emissions for the particular category, on the entire sector and the total emissions (including and excluding LULUCF).	Addressing. The Party reported in CRF tables 8s1–8s4 recalculated emission estimates and impacts of the changes in total emissions including and excluding LULUCF. Some sectoral sections of the NIR (e.g. sections 3.3.6 (pp.70–71), 3.4.2.5 (pp.96–97), 3.4.3.5 (p.110), 4.2.2.5 (pp.174–175), 4.4.1.5 (p.206), 5.5.5 (pp.298–300) and 6.2.1 (pp.322–328)) contain detailed explanations for the recalculations. In some cases, however, the sections do not provide sufficient information on the reasons for recalculations, specific changes in the AD, methods and assumptions, or the impact of recalculations on the emissions of a particular category (e.g. sections 7.3.5 (p.382) and 7.3.11 (p.387) in the waste sector, and section 4.9.3.11 (p.252) in the IPPU sector). There is no recalculation section for forest land under the LULUCF sector. During the review, the Party agreed with the observations of the ERT and indicated that the issue will be solved by strengthening the QA/QC procedures.
G.20	QA/QC and verification (G.16, 2019) (G.12, 2017) Convention reporting adherence	In the NIR, include a specific procedure in the QA/QC process to ensure that the number of inconsistencies between the NIR and the CRF tables across all inventory sectors is minimized and report the updated QA/QC plan, and include information on this procedure.	Not resolved. The Party reported in its NIR (section 1.2.3.4, pp.29–30) a description of QC procedures for the inventory. However, the standard QC process does not include a procedure to ensure consistency between values used in the CRF tables and in the NIR. The ERT also noted that there are still multiple inconsistencies between the CRF tables and the NIR (e.g. see ID#s E.57, E.59, L.10, L.18 and W.2 below). During the review, the Party clarified that the procedures to ensure consistency between the NIR and CRF tables are included in the item "Checking the completeness of the inventory" in the NIR table in section 1.2.3.4 (p.30). The Party plans to list in the NIR the verification of consistency between values in the NIR and the CRF tables as a separate item in future annual submissions.
G.21	Uncertainty analysis (G.17, 2019) (G.9, 2017) (G.19, 2016) (G.18, 2015) Convention reporting adherence	Improve on the reporting of uncertainty by including information on the quantitative estimates of the uncertainty of data used for all source and sink categories using the 2006 IPCC Guidelines, and report uncertainties for the base year and the latest inventory year, as well as the methods and underlying assumptions used, and how the analysis helps in prioritizing efforts to improve the accuracy of national inventories in the future, in line with decision 24/CP.19, annex I, paragraph 42.	Addressing. The Party reported in its NIR (annex 4, pp.434–473) uncertainty tables using the 2006 IPCC Guidelines (vol. 1, chap. 3), reporting uncertainties for the base year and the most recent inventory year. For each source or sink category there is information on uncertainty estimates for EFs and AD. Kazakhstan included a general description of uncertainties and a list of the highest contributing categories in the NIR (section 1.7, p.42) for 1990 and 2019, including and excluding LULUCF. The Party provided information on how uncertainty estimates help in prioritizing efforts to improve the accuracy of the national inventory (section 1.7, p.42). However, the ERT noted that Kazakhstan did not provide details on the methods and underlying assumptions used, as required by decision 24/CP.19, annex I, paragraph 42 (e.g. the method of aggregation of uncertainties by category included in annex 4 (e.g. categories 3.A–3.C); the calculation methods for overall uncertainties in complex categories where complex EFs were used, each with a specific uncertainty (across all sectors); and identification of whether default or country-specific uncertainty values

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			were used (e.g. NIR section 4.3.3, p.215) and the relevant references (e.g. referencing expert judgment according to good practice in the 2006 IPCC Guidelines (vol. 1, annex 2A.1)). During the review, the Party clarified that, to estimate the uncertainty, it used methods and assumptions from the 2006 IPCC Guidelines. Kazakhstan plans to improve the assessment of uncertainties for all sectors in the NIR and will include a corresponding description of the uncertainty trend with and without LULUCF in its next annual submission.
Energy			
E.1	1. General (energy sector) – other fossil fuels – CO_2, CH_4 and N_2O (E.1, 2019) (E.1, 2017) (E.2, 2016) (E.2, 2015) (22, 2013) Transparency	Use the notation key "IE" instead of "NO" or "NA" in cases in which emissions are included elsewhere, and include appropriate explanations in CRF table 9 and the NIR.	Addressing. The ERT noted improvements in the use of the notation keys "NO" and "NA" in the sector and in the consistency of reporting "IE" estimates in CRF table 9. For example, the Party explained its use of "IE" for the reference approach and for subcategory 1.A.5.b other mobile – biomass. However, CRF table 9 does not contain information regarding the use of the notation key "IE" in CRF table 1.B.2. Further, although most instances of the use of the notation key "NA" were removed in the current annual submission, the Party still used "NA" to report AD and GHG emissions from other fossil fuel consumption for various periods of the time series (e.g. for AD for subcategory 1.A.1.a public electricity and heat production for 1992–1998, 2004–2005 and 2009–2019). The notation key "NA" was also used for subcategory 1.A.3.b.i cars for gaseous fuels and biomass instead of "NO" or "IE". During the review, the Party clarified that internal training has been provided for the inventory staff on the correct use of notation keys and the reporting of "NE" and "IE" in CRF table 9.
E.2	1. General (energy sector) – all fuels – CO_2, CH_4 and N_2O (E.57, 2019) Comparability	Use the notation keys in the next annual submissions in strict accordance with the definitions provided in paragraph 37 of the UNFCCC Annex I inventory reporting guidelines.	Addressing. The Party has improved the use of notation keys, but there remain categories where the use of the notation keys needs further improvement. For example, "NA" was used for the AD and CO_2 and CH_4 emissions from venting under subcategory 1.B.2.c venting and flaring instead of "NE", although in previous reviews it was reported that no reliable data were provided for this category. The notation key "NA" instead of "NO" was also used to report AD and emissions for category 1.C.2 injection and storage that do not occur in the country. During the review, the Party clarified that online training has been conducted by an international expert in the fugitive emissions sector where the issue of using the correct notation keys was raised.
E.3	1. General (energy sector) – all fuels – CO_2, CH_4 and N_2O (E.2, 2019) (E.2, 2017) (E.3, 2016) (E.3, 2015) (23, 2013) (32, 2012) Transparency	Report in the NIR all information regarding the reasons for recalculations and the methodologies used for the recalculated categories.	Addressing. The Party reported in its NIR (e.g. sections 3.4.1.5 (p.82), 3.4.2.5 (pp.96–97), 3.4.5.6 (p.131), 3.4.6.5 (p.134), 3.4.7.5 (p.136), 3.4.8.5 (pp.139–140), 3.4.9.5 (p.142), 3.4.10.5 (p.146), 3.5.2.5 (pp.151–152), 3.5.4.6 (pp.158–159) and 3.5.4.11 (pp.161–162)) brief information on the reasons for recalculations. However, Kazakhstan has not transparently and systematically documented all the reasons and methodological changes for the recalculated estimates. For example, section 3.5.2.5 (pp.151–152) on category 1.B.1 solid fuels only states that the recalculations were based on a question raised during a previous review. Further, there was a recalculation for subcategory 1.B.1.a.ii surface mines – mining activities where the CO_2 EF decreased significantly across the time series (by about 99.9 per cent, from 1.98 kg/t to

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			0.002 kg/t) and the CH_4 EFs decreased by about 88.0 per cent across the entire time series but the reasons and the methodological approach behind the recalculations were not documented in the NIR. During the review, the Party provided some explanation on the missing information on significant recalculations.
E.4	1. General (energy sector) – all fuels – CO_2, CH_4 and N_2O (E.3, 2019) (E.3, 2017) (E.4, 2016) (E.4, 2015) (28, 2013) (42, 2012) (49, 2011) Transparency	Explain the underlying assumptions and the degree of expert judgment used in the applied interpolation methodology to fill in the time series for AD of national statistics and report it in the NIR.	Addressing. In its NIR (section 3.2.2, p.57), the Party reported the issues regarding energy statistics across the time series and particularly for the 1990s when there was no official energy balance for Kazakhstan and data were provided across various handbooks and bulletins. Since 1999, the major data source (NIR section 3.3.3, p.68) in the sector is the national fuel and energy balance, which is compiled by the Bureau of National Statistics (available at https://stat.gov.kz/official/industry/30/publication (in Russian)). However, the NIR contains no overall explanation as to how time-series consistency between the data for 1991–1998 (for which no energy balance exists) and the AD for the rest of the time series was ensured. During the review, the Party clarified that the methodology used to complete the time series of AD for the energy sector, as in other sectors, was applied in strict accordance with the 2006 IPCC Guidelines (vol. 1, chap. 2, section 2.2.3, pp.2.10–2.11) and is described in the NIR in those categories where it was applied. The ERT noted that in the sections of the NIR on time-series consistency (e.g. sections 3.4.5.4 (pp.130–131) and 3.5.2.3 (p.151)), there is rarely any information as to how time-series consistency was ensured (one exception being section 3.5.4.5 (p.158)).
E.5	1. General (energy sector) – all fuels – CO_2, CH_4 and N_2O (E.4, 2019) (E.4, 2017) (E.5, 2016) (E.5, 2015) (28, 2013) (42, 2012) Consistency	Ensure the consistency of the entire time series and provide comparisons of AD obtained from different sources.	Addressing. The Party has reconciled the AD for 1990–1998 (the period before the Bureau of National Statistics started to develop the national fuel and energy balance) and 1999–2019 (see ID# E.4 above), but has not provided comparisons between the AD obtained from different national and international energy data sources used across the time series in the NIR. During the review, the Party clarified that most of the data used for the inventory are provided by the Bureau of National Statistics and it will consider including a comparison of data from different sources in its next annual submission.

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E.6	1. General (energy sector) – all fuels – CO_2 (E.6, 2019) (E.46, 2017) Transparency	Improve the transparency and consistency of the reporting: (a) By including CO_2 emissions from all specific types of fuels classified in the energy balance as "other fossil fuels"; (b) Use relevant country-specific NCVs and carbon content for each fuel; (c) Ensure consistency of the time series of the revised CO_2 emission estimates reported in CRF table 1.A(b) for 1990–2015; (d) In the NIR, provide information on the source, method of calculation or justifications on country-specific NCVs and CO_2 EFs for specific types of fuels, accompanied by relevant explanations.	(a) Resolved. The Party did not report CO_2 emission estimates for other fossil fuels and the notation keys "NO" and "NA" were used for the entire time series in CRF table 1.A(b) for apparent consumption and CO_2 emissions, but it did specify other fuels such as tar, oil tar under other liquid fossil fuels, and energy coal, high ash coal, other coal and coal concentrate under other solid fossil fuels in the table. Energy consumption and CO_2 emission estimates for other fossil fuels were reported under the sectoral approach for 1990–2008 and using the notation keys "NO" and "NA" for 2009–2019. In the NIR (section 3.2.2, p.59) and during the review, the Party clarified that, since 2009, national statistics have not reported other fossil fuels separately. However, according to the specialists responsible for the energy balance, other types of fuel are taken into account in the consumption of the corresponding types of fuel (liquid, solid, gaseous) and CO_2 emissions are included in the inventory across the entire time series; (b) Resolved. Kazakhstan used default NCVs from the 2006 IPCC Guidelines (vol. 2, chap. 1, pp.1.18–1.19) to report the energy consumption of all fuels, except for household stove fuel, for which it used a country-specific EF (NIR sections 3.3.3, table 3.8 (p.69) and 3.4.2.2 (pp.94–95)); (c) Resolved. The carbon content coefficients of fuels have been used consistently for the entire time series to report the CO_2 emissions in CRF table 1.A(b) and the time series has been recalculated in the 2020 submission; (d) Resolved. An explanation has been provided in the NIR (section 3.4.2.2, pp.94–95) as to how the plant-specific EF was obtained.
E.7	1. General (energy sector) – all fuels – CO_2, CH_4 and N_2O (E.58, 2019) Convention reporting adherence	Include in the NIR and CRF tables (e.g. CRF tables 1.A(b), 1.B.1 and 1.B.2) correct and consistent values of AD and associated units, including the description of the AD, in particular for crude oil production, natural gas production and coal production, and ensure that the necessary QC activities are implemented for this purpose.	Not resolved. The ERT noted that in many instances the Party reported AD and the associated units in the NIR and CRF tables inconsistently. Kazakhstan reported in CRF table 1.A(b) crude oil production of 78,634.20 kt in 2019, while in CRF table 1.B.2 it reported 78,634.20 t. The reported quantity of oil produced in CRF table 1.B.2 is 78,643.20 m^3 under category 1.B.2.a.1 exploration, 106,800.00 t under category 1.B.2.a.3 transport and 16,514.24 t under category 1.B.2.a.4 refining/storage. The same type of discrepancy has also been identified for 2010 and 2013–2016. The discrepancy in the unit of measurement occurs throughout CRF table 1.B.2 for 2019, with, for example, oil produced reported as both 78,634.20 t and 78,634.20 "10^m^3" in the same table. The ERT also noted significant differences between the volume and corresponding units of natural gas production reported in CRF tables 1.B.2 and 1.A(b). During the review, the Party clarified that the inconsistencies are caused by technical errors in the data sets. The issue has been documented and will be addressed in the next annual submission.
E.8	Fuel combustion – reference approach – solid fuels – CO_2 (E.8, 2019) (E.8, 2017)	Carry out the planned improvement to separate coking coal consumption from the total other bituminous coal consumption.	Addressing. The ERT noted that the Party reported coking coal consumption separately from other types of coal (sub-bituminous and lignite) for 2014 onward but reported coking coal consumption in an aggregate manner under lignite and sub-

ID#	Issue/problem classification[a, b]	Recommendation made in previous review report	ERT assessment and rationale
	(E.9, 2016) (E.9, 2015) (34, 2013) Comparability		bituminous coal for 1990–2013. During the review, the Party provided no further clarification on the issue.
E.9	Fuel combustion – reference approach – all fuels – CO_2, CH_4 and N_2O (E.7, 2019) (E.7, 2017) (E.8, 2016) (E.8, 2015) (33, 2013) (46, 2012) (44, 2011) Transparency	Cross-check the AD and provide explanations for the differences in inter-annual changes between the reference and sectoral approaches.	Addressing. The differences in estimated CO_2 emissions between the reference and sectoral approaches for 1990–2013 range between 0.6 and 25.8 per cent, with higher emissions estimated from the reference approach. For 2014–2017, the differences range between –6.4 and –11.3 per cent, with higher emissions estimated from the sectoral approach. The difference in 2019 is 1.3 per cent. Kazakhstan indicated in the NIR (section 3.2.2, pp.57–59) that the differences are caused by difficulties in collecting AD for the production, export or import of liquid fuels (crude oil) and solid fuels (coking coal and different types of coal), which also explains the inter-annual changes in the values of the differences between the reference and sectoral approaches. The explanation is, however, not sufficient to clarify the magnitude and the observed trend in the differences between the approaches. During the review, the Party clarified that further explanation of the differences observed in the emissions estimated from the sectoral and reference approaches will be provided in the next annual submission.
E.10	Fuel combustion – reference approach – all fuels – CO_2 (E.9, 2019) (E.18, 2017) (E.27, 2016) (E.27, 2015) Accuracy	Reconsider the accuracy of the data concerning the combusted fuels and the fuels used as feedstocks in order to further reduce the level of difference between the sectoral and reference approaches across the time series and include additional information in the NIR explaining the observed differences in the CO_2 emissions estimated from the two approaches.	Not resolved. The Party continues to report significant differences between the sectoral and reference approaches across the time series at the fuel level, including up to 80.3 per cent difference for gaseous fuels (2005), up to 66.6 per cent for liquid fuels (1999) and 24.7 per cent for solid fuels (1993). The ERT noted decreasing differences between the approaches in the later years of the time series. Kazakhstan indicated in the NIR (section 3.2.2, pp.57–59) that the difficulties in collecting AD for production, export or import of liquid fuels (crude oil) and solid fuels (coking coal and different types of coal) had caused the differences in both energy consumption and CO_2 emissions, although it did not provide in the NIR an assessment of the accuracy of the data for the combustion of fuels by type or the fuels used as feedstock, or explanations for the significant differences in CO_2 emission estimates for the two approaches at the fuel type level. For possible reasons for the differences, see ID#s E.9 above and E.11, E.12, E.13, E.14, E.15 and E.16 below. During the review, the Party clarified that it plans to cross-check the data and explain the differences in its next annual submission.
E.11	Fuel combustion – reference approach – all fuels – CO_2 (E.10, 2019) (E.19, 2017) (E.28, 2016) (E.28, 2015) Accuracy	Improve the accuracy and consistency of the reporting of energy consumption in the reference approach, particularly paying attention to the correct completion of cells for "Apparent consumption (excluding NEU, reductants and feedstocks)" and ensure that the differences between the approaches are reasonable.	Resolved. The Party corrected the reporting of apparent consumption excluding NEU of fuels in CRF table 1.A(d) by completing the cells for apparent consumption (excluding NEU, reductants and feedstocks), resulting in reasonable differences between the approaches in the most recent years (e.g. 3.4 per cent for solid fuels and 0.7 per cent for liquid fuels for 2019). For the outstanding issues linked to differences between the approaches, particularly those affecting the beginning of the time series, see ID# E.10 above.

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E.12	Fuel combustion – reference approach – liquid, solid, gaseous and other fossil fuels – CO_2 (E.11, 2019) (E.47, 2017) Accuracy	In order to improve the alignment between the reference and the sectoral approaches and to increase the transparency of reporting in the energy sector: (a) Strengthen the QC procedures for the AD used for the emission estimates across fuel combustion activities; (b) Disaggregate the AD included in category 1.A.5 other and reallocate emissions to appropriate categories; (c) Estimate carbon excluded from NEU and feedstocks of NGLs and associated petroleum gas separately from natural gas; (d) Implement the recommendations provided in ID#s E.51 and E.53 (FCCC/ARR/2017/KAZ); (e) Provide clear and detailed explanations in the NIR for the differences between the CO_2 emissions reported in the reference and sectoral approaches for each fuel type.	(a) Not resolved. The ERT noted persistent inconsistencies between the approaches, suggesting the need for further improvement to the QC procedures (see ID# E.10 above); (b) Addressing. The Party continues to report the consumption and corresponding emissions for category 1.A.5 at an aggregated level under subcategory 1.A.5.a stationary in CRF table 1.A(a)s4. A value equivalent to the difference in consumption of coking coal between the reference and sectoral approaches was also included under the category. During the review, the Party clarified that AD for category 1.A.5 other cannot be disaggregated owing to the methodology for data collection and aggregation for the fuel and energy balance used by the Bureau of National Statistics. Improved data accuracy and consistency for this subcategory can only be achieved by implementing a new methodology which is in line with IEA standards, and this is planned for 2022; (c) Addressing. The Party has not consistently reported the carbon excluded for NEU and feedstocks of NGLs and associated petroleum gas from the natural gas across the time series. Carbon excluded from NEU and feedstocks of NGLs is reported for 2000–2014 and the notation key "NA" is used for thereafter; (d) Addressing. The ERT notes that the issues are covered by ID#s E.29 and E.37 below where relevant assessments are included; (e) Not resolved. The ERT notes that the issue is covered by ID# E.10 above.
E.13	Fuel combustion – reference approach – liquid fuels – CO_2, CH_4 and N_2O (E.59, 2019) Convention reporting adherence	Report in CRF table 1.A(b) correct AD for international bunkers that are consistent with the data reported for the international aviation and international navigation categories in CRF table 1.D.	Not resolved. The ERT noted that the Party reported AD for jet kerosene under aviation bunkers and AD for gas/diesel oil under marine bunkers in CRF table 1.D. Nevertheless, Kazakhstan continues to use the notation key "NO" for reporting these AD in CRF table 1.A(b) for both international bunkers of these two fuels. The ERT noted that this inconsistency and incorrect data could contribute to the differences reported by Kazakhstan between the reference and sectoral approaches for liquid fuels. During the review, the Party explained that the recommendation will be taken into consideration in the next annual submission.
E.14	Fuel combustion – reference approach – liquid fuels – CO_2 (E.60, 2019) Comparability	Use authoritative available data, either national or international (e.g. the IEA energy balance for Kazakhstan), report production of NGLs and other AD separately from crude oil in CRF table 1.A(b) for the years when data are available, extrapolate production of NGLs and other AD for the rest of the time series and report corresponding CO_2 emissions from the use of NGLs and the corresponding NEU of this fuel.	Resolved. The Party separated the reporting of NGLs from crude oil for the entire inventory period and reported in CRF table 1.A(b) a revised time series of consumption for NGLs and crude oil in its 2020 submission. The segregation of the fuels and the explanation was also documented in the NIR (section 3.3.6, pp.70–71). Corresponding CO_2 emissions from the use of NGLs are reported in CRF table 1.A(b) across the time series and the NEU of the fuels are reported as values for 2000–2014 and using the notation keys "NO", "NE" and "NA" for the remaining years (see ID# E.12 above for the pending issue on consistent reporting of NEU across the time series).

ID#	*Issue/problem classification*[a, b]	*Recommendation made in previous review report*	*ERT assessment and rationale*
E.15	Feedstocks, reductants and other NEU of fuels – all fuels – CO_2 (E.12, 2019) (E.21, 2017) (E.30, 2016) Convention reporting adherence	Improve the QA/QC procedures relevant to the estimation of the use of the feedstocks, reductants and NEU of fuels and ensure consistent reporting across CRF table 1.A(b) and table 1.A(d).	Addressing. The Party consistently reported the use of feedstocks, reductants and NEU of fuels across CRF tables 1.A(b) and 1.A(d) for NGL, suggesting improved QA/QC procedures. However, the ERT noted that, for crude oil, the Party continues to report using the notation key "NE" for the carbon excluded in CRF table 1.A(b), while in CRF table 1.A(d), it reported using the notation key "NO". During the review, the Party noted that in the next annual submission it will aim to improve the QA/QC procedures relating to the use of feedstocks, reductants and NEU of fuels.
E.16	International aviation – liquid fuels – CO_2, CH_4 and N_2O (E.13, 2019) (E.45, 2017) (E.59, 2016) Convention reporting adherence	Ensure consistency between CRF table 1.D (fuel consumption of the international aviation/ international bunkers) and CRF table 1.A(b) (reference approach – fuel consumption of the international bunkers).	Not resolved. The Party continued to use the notation key "NO" to report international bunkers of jet kerosene and other kerosene in CRF table 1.A(b), while the AD (8,435.42 TJ) and emissions from jet kerosene used as bunker fuel in aviation were reported in CRF table 1.D (see ID# E.13 above). During the review, the Party noted that the difference is probably due to different input data being used and explained that the issue will be discussed among the experts involved.
E.17	International aviation – liquid fuels – CO_2, CH_4 and N_2O (E.14, 2019) (E.59, 2017) Accuracy	Correct the CO_2, CH_4 and N_2O EFs used for the emission estimates for international aviation and provide in the NIR detailed explanations on any recalculations made in accordance with the 2006 IPCC Guidelines, including a description of methods and EFs used and considering the availability of updated data.	Resolved. The ERT noted that the Party consistently reported the CO_2, CH_4 and N_2O emissions from international aviation using a tier 1 approach from the 2006 IPCC Guidelines (vol. 2, chap. 3, p.3.58) and included information on the methods and EFs in the NIR (section 3.4.8.2, pp.138–139). The Party reported in its NIR (section 3.4.8.5, p.139) that, following previous recommendations, it had performed a complete recalculation of the entire time series for the subcategory domestic and international aviation (see ID# E.29 below).
E.18	International navigation – liquid fuels – CO_2, CH_4 and N_2O (E.15, 2019) (E.9, 2017) (E.11, 2016) (E.11, 2015) (37, 2013) (50, 2012) (46, 2011) Accuracy	Obtain relevant navigation statistics and use the appropriate EFs for reporting emissions.	Resolved. The ERT noted that the Party estimated gas/diesel oil consumption for international navigation and reported emissions for the entire time series under the international navigation category in CRF table 1.D. As explained in the NIR (section 3.4.10.2, p.145) and during the review, the segregation by fuel type is based on data from the Bureau of National Statistics, data on transportation activities, type and number of vessels/ships and types of fuel used. In the NIR (section 3.4.10.2, p.145), it states that a tier 1 method was used. The EFs used are the default CO_2, CH_4 and N_2O EFs provided in the 2006 IPCC Guidelines for gas/diesel oil used in navigation (vol. 2, chap. 3, tables 3.5.2–3.5.3, p.3.50).
E.19	International navigation – liquid fuels – CO_2, CH_4 and N_2O (E.61, 2019) Transparency	Provide GHG emission estimates for the use of residual fuel oil under international navigation, or include in the NIR an appropriate explanation for changing the previous reporting of residual fuel oil consumption under international navigation to "NO".	Not resolved. The ERT noted that the Party reported residual fuel oil consumption and emission estimates for the entire time series both under the international navigation category in CRF table 1.D and under category 1.A.3.d domestic navigation in CRF table 1.A(a) using the notation key "NO". Kazakhstan has not provided an explanation for not reporting residual fuel oil. The ERT noted that the residual fuel bunker is not reported to IEA. During the review, the Party informed the ERT of the ongoing work to recalculate the input data on international cargo transportation taking into account the consumption of residual fuel oil.

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E.20	1.A Fuel combustion – sectoral approach – solid fuels – CO_2 (E.16, 2019) (E.10, 2017) (E.14, 2016) (E.17, 2015) (39, 2013) (53, 2012) Accuracy	Investigate the possibility of calculating country-specific CO_2 EFs for lignite and sub-bituminous coal as weighted average values based on information on specific coal production and CO_2 EFs for each mining field, as the majority of coal used in Kazakhstan is from domestic production.	Not resolved. The NIR did not contain any information on the Party's efforts to investigate the possibility of calculating country-specific CO_2 EFs for lignite and sub-bituminous coal. To estimate CO_2 emissions from consumption of these fuels, Kazakhstan used default CO_2 EFs (NIR table 3.8, p.69). During the review, the Party reported that it is currently working on applying higher tier methodologies and the data obtained from the enterprises will help with the development of country-specific CO_2 EFs for domestic lignite and sub-bituminous coal.
E.21	1.A Fuel combustion – sectoral approach – all fuels – CO_2, CH_4 and N_2O (E.17, 2019) (E.11, 2017) (E.16, 2016) (E.15, 2015) (26, 2013) Transparency	Include detailed data on energy consumption by fuel for all subcategories in the energy sector.	Addressing. In its NIR (e.g. tables 3.9 (p.73), 3.14 (p.84) and 3.19 (p.99)), the Party included detailed information on energy consumption data by fuel type for most of the subcategories in the sector. However, the NIR did not cover subcategory 1.A.3 transport. During the review, the Party clarified that data on fuel consumption, divided by type of fuel consumed, will be included in its next annual submission.
E.22	1.A Fuel combustion – sectoral approach – all fuels – CO_2 (E.18, 2019) (E.12, 2017) (E.18, 2016) (E.18, 2015) (40, 2013) (54, 2012) (47, 2011) Comparability	Investigate the allocation of AD and emissions from the energy sector to the industrial processes sector and correct any misallocations.	Addressing. The Party provided in the NIR (table 3.7, p.66) information on the NEU of fuels which is consistent with the AD reported in CRF table 1.A(d). However, the ERT noted that some inconsistencies in the data reported in CRF table 1.A(d) and the IPPU sector still exist, as described during the previous review. In the NIR (section 4.4.1.2.1, p.198), Kazakhstan explained that coking coal is used as a raw material to produce coke for the iron and steel industry by the major producer in the sector ArcelorMittal Temirtau JSC. However, in CRF table 1.A(d) the NEU of coking coal is only reported for the ferroalloys industry (3,260.47 TJ). For 2019, the NEU of lubricants was reported as 138.59 TJ in CRF table 1.A(d) but in CRF table 2(I).A-H the consumption of lubricants was reported as 32.00 kt, which is equivalent to 1,286.40 TJ. During the review, the Party clarified that, for the next annual submission, it will aim to review the consistency of the NEU of fuels in the energy and IPPU sectors.
E.23	1.A Fuel combustion – sectoral approach – solid fuels – CO_2, CH_4 and N_2O (E.19, 2019) (E.48, 2017) Transparency	In the NIR: (a) Provide verifiable information on consumption of coking coal in the country by category; (b) Provide a carbon balance for coking coal used in the calculations; (c) Report correctly emission estimates in the respective CRF tables; (d) Provide information on the source, method of calculation and justifications for the NCV	(a–b) Resolved. The ERT noted that the Party provided information on consumption of coking coal by category in table P.2.2 (NIR annex 2, p.419) and a carbon balance and information on consumption of coking coal by category in table P.2.1 (NIR annex 2, p.418); (c) Resolved. Kazakhstan reported the GHG emission estimates for coking coal using the tier 1 methodology provided in the 2006 IPCC Guidelines (vol. 2, chap. 2, p.2.11) in CRF table 1.A for relevant categories and provided an explanation in the NIR (section 3.4.2.6, p.98 and annex 2); (d) Resolved. Kazakhstan reported in table 3.8 (p.69) of the NIR the default values used for the NCV (28.2 TJ/kt) and carbon content (25.8 kg/GJ) of coking coal, as

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		and country-specific CO_2 EF for coking coal used for the emission estimates.	provided in the 2006 IPCC Guidelines (vol. 2, chap. 1, tables 1.2–1.3, pp.1.18 and 1.21, respectively).
E.24	1.A Fuel combustion – sectoral approach – solid fuels – CO_2, CH_4 and N_2O (E.62, 2019) Accuracy	(a) In accordance with ID# E.19 of the 2019 annual review report, provide verifiable and documented information in the NIR on consumption of coking coal in the country by category and subcategory; (b) Provide an accurate and comprehensive carbon balance of coking coal, including by-products, used in the calculations (available resources versus energy use and NEU of the fuel) developed with close collaboration between energy and IPPU experts. If possible, compare the carbon balance with the IEA data on consumption of coking coal and by-products for different uses, and report on the results in the NIR.	(a) Resolved. See ID# E.23 above; (b) Resolved. Annex 2 (pp.418–420) to the NIR provides the carbon balance (see ID# E.23 above) of coking coal, as well as information on the NEU of the fuel and produced coke oven gas. A comparison between the carbon balance and the IEA data on consumption of coking coal and by-products for different uses has not been reported in the NIR. During the review, the Party clarified that it is improving the quality of aggregated information for compiling the data in order to fulfil IEA requirements and in the next annual submission it will provide a comparison between the carbon balance and the IEA data and an overview of the by-products for different uses.
E.25	1.A Fuel combustion – sectoral approach – solid fuels – CO_2, CH_4 and N_2O (E.62, 2019) Accuracy	While avoiding double counting, revise and report in the respective CRF tables for the energy and IPPU sectors the CO_2, CH_4 and N_2O emission estimates calculated strictly in accordance with the 2006 IPCC Guidelines, at a minimum for 2013–2017 and subsequent years as a first and immediate step, but with the aim of covering the complete time series, in addition to providing information on the source and method of calculation used for the emission estimates, including the NCVs and EFs for coking coal and other fuels used.	Addressing. The ERT noted that recalculations for the 2014–2017 time series were completed for the 2019 resubmission of CRF tables to account for the coking coal not included under combustion activities under the sectoral approach emission estimates or reported as NEU in the IPPU sector. The difference between the reference and sectoral approaches has been added to category 1.A.5.a other in CRF table 1.A(a) and background information has been provided in annex 2 (pp.418–420) to the NIR in the current annual submission. However, the complete time series has not been recalculated. Estimates have been calculated in accordance with the 2006 IPCC Guidelines (vol. 3, chap. 4, pp.4.13 and 4.17) using default NCVs and EFs for the tier 1 method. During the review, the Party explained that a plant-specific methodology is being developed to allow the reporting of country-specific NCV and CO_2 coefficients for future annual submissions. The Party further clarified that it would aim to review the consistency of the NEU of fuels in the energy and IPPU sectors in its next annual submission.
E.26	1.A.2.a Iron and steel – solid fuels – CO_2, CH_4 and N_2O (E.21, 2019) (E.50, 2017) Transparency	In the NIR, provide information on AD for coking coal combusted for own needs by ArcelorMittal Temirtau JSC for all relevant years of the time series and ensure the consistency of the time series by performing relevant recalculations for 1990–2013, as necessary.	Not resolved. The Party did not provide in the NIR information on AD for coking coal combusted or used for own needs by ArcelorMittal Temirtau JSC for the relevant years of the time series. During the review, Kazakhstan clarified that it has not yet requested information from ArcelorMittal Temirtau JSC on the consumption of coking coal for the company's own needs but that this information would be requested during the next annual submission preparation cycle. Further, the Party explained that coking coal consumption for 1990–2013 will be recalculated for the next annual submission.
E.27	1.A Fuel combustion – sectoral approach –	In the NIR, include detailed information on the allocation of other fossil fuels to ensure	Not resolved. Energy consumption and CO_2, CH_4 and N_2O emission estimates for other fossil fuels were reported under the sectoral approach for 1990–2008 and using

ID#	Issue/problem classification[a, b]	Recommendation made in previous review report	ERT assessment and rationale
	other fossil fuels – CO_2, CH_4 and N_2O (E.20, 2019) (E.49, 2017) Comparability	transparency of reporting emissions from these fuels and use appropriate notation keys, where necessary.	the notation keys "NO" and "NA" for 2009–2019. There is no information in CRF table 1.A(a) as to which fuels are included in other fossil fuels, nor a reference to the NIR section where further information is provided. In the NIR (section 3.2.2, p.59) and during the review, the Party clarified that, since 2009, the national statistics do not separate consumption of other fossil fuels from liquid, solid or gaseous fuels owing to the lack of a separate code for industrial products, but fuels and emissions are included in the consumption of the corresponding type of fuel (liquid, solid or gaseous) (see ID# E.6 above). Noting the fuel definitions for reporting GHG inventories for other fossil fuels (municipal waste (non-biomass fraction), industrial waste and waste oils) in table 1.1 of the 2006 IPCC Guidelines (vol. 2, chap. 1, pp.1.12–1.16) and the definitions of notation keys provided in paragraph 37 of the UNFCCC Annex I inventory reporting guidelines, the Party might reconsider the appropriate use of notation keys in CRF table 1.A(a).
E.28	1.A.2.d Pulp, paper and print – all fuels – CH_4 and N_2O (E.22, 2019) (E.23, 2017) (E.32, 2016) (E.31, 2015) Comparability	Include emissions of CH_4 and N_2O for the subcategory 1.A.2.d pulp, paper and print or provide justification to support that these emissions are insignificant and use a notation key in accordance with decision 24/CP.19, annex I, paragraph 37.	Addressing. The Party included CH_4 and N_2O emissions for liquid and solid fuels and, for part of the time series, for biomass and gaseous fuels, despite their insignificance. The ERT noted, however, that Kazakhstan still used the notation key "NA" to report gaseous fuel consumption and emissions of CO_2, CH_4 and N_2O for 1990–1998 instead of the notation key "NO". The ERT also noted that CH_4 and N_2O emissions from biomass were reported for 1992–2008 and 2017, while the notation key "NA" was used incorrectly for other years, as the notation key "NO" should have been reported instead because biomass was not used for those years.
E.29	1.A.3.a Domestic aviation – liquid fuels – CO_2 (E.25, 2019) (E.51, 2017) Transparency	In the NIR, report correct CO_2 EFs and provide a detailed explanation on the methodological approaches used for the emission estimates for the category, as well as on selection of the AD.	Addressing. Kazakhstan reported CO_2, CH_4 and N_2O emissions from jet kerosene consumption in domestic aviation for the entire time series using the tier 1 method and default constant EFs (as confirmed during the review) in line with the 2006 IPCC Guidelines (vol. 2, chap. 3, p.3.58) and reported in the NIR (section 3.4.8.2, pp.138–139) an explanation of the AD and methodology used to estimate national and international fuel consumption in the aviation sector. However, the ERT noted that the NIR does not provide the value of the EFs used and it is stated in CRF table summary 3 that the method used for the sector is tier 2 with "D" (default) and "CS" (country-specific) EFs. Similarly, in section 3.4.8.6 of the NIR (p.140) it states that a tier 2 methodology was used and information on the AD refers to only some of the AD needed for that methodology.
E.30	1.A.3.b Road transportation – liquid fuels – CO_2, CH_4 and N_2O (E.26, 2019) (E.13, 2017) (E.21, 2016) (E.21, 2015) (42, 2013) Comparability	Reallocate AD and emissions from transportation in agriculture/forestry/fisheries to the subcategory agriculture/forestry/fishing and emissions from industrial and construction off-road transport to the category manufacturing industries and construction.	Addressing. AD and emissions from transportation in agriculture/forestry/fisheries are reported under subcategory 1.A.4.c.ii off-road vehicles and other machinery in CRF table 1.A(a)s4. However, as stated in the NIR (section 3.4.6.1, p.132), subcategory 1.A.3.e.ii includes vehicles used in agriculture, industry (including construction and maintenance), the residential sector, as well as ground support facilities at airports, agricultural machinery (tractors, combines, loaders, etc.) and construction. In addition, the Party reported in the NIR (section 3.4.2.2, p.94) that GHG emissions from off-road transport in industry and construction (gasoline, kerosene and diesel fuel, without

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			specifying the type of fuel used) were included under subcategory 1.A.3.e.ii other in order to eliminate double counting in the subcategories under category 1.A.2 manufacturing industries and construction. In accordance with the 2006 IPCC Guidelines (vol. 2, chap. 2, table 2.1, pp.2.7–2.9), the consumption and corresponding emissions for off-road activities should be included in the industry where these activities occur. During the review, Kazakhstan explained that it has difficulties separating the fuels reported under subcategory 1.A.3.e.ii other transportation, subcategory 1.A.4.c.ii agriculture/forestry/fishing – off-road vehicles and other machinery, and off-road transportation in category 1.A.2 manufacturing industries and construction, but the reallocation is among the planned improvements for the sector.
E.31	1.A.3.b Road transportation – liquid fuels – CO_2 (E.28, 2019) (E.25, 2017) (E.35, 2016) Accuracy	Verify the road transportation related AD for diesel oil consumption with a view to being able to report the emissions for the entire time series, investigate the technology used and the background information on road transportation activities within the country, and justify the EF used or use the default EF suggested by the 2006 IPCC Guidelines.	Resolved. Kazakhstan consistently reported diesel oil consumption for subcategories 1.A.3.b.i cars, 1.A.3.b.ii light-duty trucks and 1.A.3.b.iii heavy-duty trucks and buses using the default CO_2 EFs (74.1 t/TJ) for the entire time series (from the 2006 IPCC Guidelines, vol. 2, chap. 3, table 3.2.1, p.3.16). The NIR (section 3.4.5.1, pp.116–121) provides information on the verification of AD, the technology used for road transportation and background information on road transportation activities.
E.32	1.A.3.b Road transportation – liquid fuels – N_2O (E.27, 2019) (E.14, 2017) (E.22, 2016) (E.22, 2015) (43, 2013) (60, 2012) Accuracy	Improve the accuracy of the N_2O emission estimates for gasoline consumption, taking into account the pollution control technologies introduced over time in the vehicle fleet.	Not resolved. In the NIR (section 3.4.5.3, p.122), the Party indicated that it was not possible to assess the number of vehicles that have oxidation catalysts in the country and that a tier 1 method and default EFs have been used for estimating the N_2O emissions for this category. Kazakhstan used default EFs (3.2 kg/TJ; vol. 2, chap. 3, table 3.2.2, p.3.21, of the 2006 IPCC Guidelines) for uncontrolled technologies, given that the number of vehicles with oxidation catalysts is relatively small and did not have a significant influence on N_2O emissions. Noting the composition of the vehicle fleet as described in the NIR (section 3.4.5, pp.116–131), the ERT considers that the approach of using default N_2O EFs for uncontrolled combustion gasoline engines is not justified, since catalytic converters for gasoline engines were introduced in the 1980s on the United States market and since 1993 in Europe (with the introduction of the EURO I standard). Taking the above into consideration, it can be concluded that even the vehicles which are 25 years old have three-way catalytic converters. The ERT noted that, in order to estimate N_2O emissions accurately from fuels consumed by vehicles with oxidation catalysts, it is good practice to ensure that default N_2O EFs, if used, best represent local fuel quality and combustion or emission control technologies, in accordance with the 2006 IPCC Guidelines (vol. 2, chap. 3, tables 3.2.2–3.2.5, pp.3.21–3.24). The use of default EFs could result in underestimations of emissions in the category. During the review, the Party explained that significant preparatory work to improve data collection and data quality is required for any change of estimates in the category. The Party also explained that more information will be available for future annual submissions when the Bureau of National Statistics improves its questionnaire for data collection.

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E.33	1.A.3.b Road transportation – liquid fuels – N_2O (E.29, 2019) (E.26, 2017) (E.36, 2016) Transparency	Provide in the NIR explanatory information on the trend of the N_2O IEF for diesel oil between 1990 and 2014.	Resolved. Kazakhstan used a constant default N_2O EF (5.7 kg/TJ) for the entire time series (see ID# E.76 in table 5).
E.34	1.A.3.b Road transportation – liquid fuels – N_2O (E.63, 2019) Transparency	Provide in the NIR information on the composition of the vehicle fleet, including the number of cars with pollution control technologies, and justify the share of 5–6 per cent of these vehicle types in the fleet, as indicated by the Party, and the evolution of the share over the years, taking into account the fact that these data are very important for the accurate estimation of N_2O (and CH_4) emissions for this subcategory.	Addressing. The NIR (sections 3.4.5, pp.116–131 and 4.9, pp.234–253) provides information on the composition of the vehicle fleet, age, fuel types used and changes across the time series. However, the ERT noted that Kazakhstan did not report in the NIR specific information on the consumption of fuels by vehicle category, and provided limited information on the number of vehicles with oxidation catalysts (figure 3.23, p.125) in the country and the evolution of the share over the time series. In addition, the Party noted in its NIR (section 3.4.5.3, pp.122–129) and during the review the insignificant share of CO_2 emissions from the use of urea additives (see ID#s I.39 below and I.50 in table 5). For the estimates of the N_2O emissions from gasoline vehicles, the Party used default EFs for gasoline (3.2 kg/TJ) and diesel oil (5.7 kg/TJ) (see ID# E.76 in table 5) from the 2006 IPCC Guidelines (vol. 2, chap. 3, table 3.2.2, p.3.21) for uncontrolled technologies in its estimates, given that the number of vehicles with oxidation catalysts is relatively small and did not have a significant influence on total CH_4 or N_2O emissions. The ERT concluded that the information in NIR section 3.4.5 is not sufficient to justify the choice of the N_2O EF for gasoline (see ID# E.32 above) and its constant use across the time series.
E.35	1.A.3.b.i Cars – liquid fuels – CH_4 (E.30, 2019) (E.27, 2017) (E.37, 2016) (E.34, 2015) Accuracy	Verify the road transportation related AD for gasoline consumption, the technology used and the background information about road transportation and justify the relatively high, and increasing, CH_4 IEF.	Resolved. The Party used AD based on the national fuel and energy balance and the default CH_4 EF (33.00 kg/TJ) for uncontrolled motor gasoline vehicles from the 2006 IPCC Guidelines (vol. 2, chap. 3, table 3.2.2, p.3.21) to estimate the emissions for the entire time series. For pending issues on the justification and applicability of the CH_4 EF used across the time series, see ID# E.36 below.
E.36	1.A.3.b.i Cars – liquid fuels – CH_4 (E.31, 2019) (E.52, 2017) Accuracy	Finalize the investigation of the technologies used in the country, provide more detailed background information about road transportation and, with this information, justify the relatively high CH_4 EF used for gasoline, in particular for the latest years of the time series, or revise the estimates using corresponding more appropriate IPCC default values.	Addressing. The Party continued to report a CH_4 IEF value (33.00 kg/TJ) for gasoline cars, which is the IPCC default value for uncontrolled gasoline cars (2006 IPCC Guidelines, vol. 2, chap. 3, table 3.2.2, p.3.21). As previously noted, the value may be applicable to earlier years of the time series but, considering the introduction of catalyst controls and other technologies for cars in the most recent years of the time series, lower values would be more appropriate. In the NIR (section 3.4.5, pp.116–131), the Party provided an overview of the age of the vehicle fleet, underlining that the vehicle fleet is relatively old and that fuel standards were introduced more recently than in the member States of the European Union. Noting the information provided, the ERT considers that, despite the slow modernization of the vehicle fleet in Kazakhstan, the three-way catalytic converters for gasoline engines were first introduced in Europe in 1993, which means that the use of EFs for uncontrolled

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			combustion is not justified across the entire time series and may lead to an overestimation of the CH_4 emissions from gasoline vehicles.
E.37	1.A.3.d Domestic navigation – liquid fuels – CO_2, CH_4 and N_2O (E.32, 2019) (E.53, 2017) Transparency	Estimate emissions for subcategory 1.A.3.d domestic navigation in accordance with the 2006 IPCC Guidelines by: (a) Collecting relevant data on fuel consumption by type of fuel, separately for domestic and international navigation, or use appropriate interpolation/extrapolation techniques based on existing indicators or expert judgment to allow this disaggregation, and documenting comprehensively these data in the NIR; (b) Using appropriate EFs for CO_2, CH_4 and N_2O (e.g. default EFs from the 2006 IPCC Guidelines) to calculate emissions from fuels used for domestic navigation for the complete time series.	(a) Addressing. The Party reported separately consumption of fuel by type and the corresponding emissions for domestic and international navigation for the complete time series. In the NIR (section 3.4.10.1, p.143) the Party explained that the AD cannot be collected separately for the two types of navigation and the relevant total fuel consumption was disaggregated between domestic and international navigation by considering the classification of types of vessel. However, the methodology and any appropriate interpolation or extrapolation techniques based on existing indicators or expert judgment are not documented in the NIR. Kazakhstan also reported that military activities on water cannot be reported separately from domestic navigation and are reported under this category (section 3.4.10.2, p.145). During the review, the Party clarified that the methodology for the separation of fuels used for domestic and for international navigation is based on the type of vessel and its technical characteristics, the length of domestic routes and the amount of goods transported domestically and internationally; (b) Resolved. The entire time series of CO_2, CH_4 and N_2O emissions from domestic navigation were estimated using a tier 1 approach (NIR section 3.4.10.2, p.145) from the 2006 IPCC Guidelines (vol. 2, chap. 3, p.3.47).
E.38	1.A.3.d Domestic navigation – liquid fuels – CO_2, CH_4 and N_2O (E.64, 2019) Transparency	Include in the NIR a well-documented justification for the decrease in the gas/diesel oil consumption in subcategory 1.A.3.d domestic navigation since the 2017 submission and ensure the consistency of the emission estimates for the complete time series.	Addressing. There have been no recalculations for gas/diesel oil consumption in subcategory 1.A.3.d domestic navigation since the 2018 submission and therefore no explanation on previously applied recalculations. However, the NIR (section 3.4.10.5, p.146) indicates that the AD were revised to ensure time-series consistency. Owing to lack of clarity in the way the AD are collected, the ERT was not able to conclude whether there is an underestimation of emissions in the category. The ERT noted that the IEA energy balance reported gas/diesel oil consumption in domestic navigation as 256 TJ for Kazakhstan for 2017, which is 135.7 per cent higher than the value of 108.61 TJ reported in CRF table 1.A(a)s3. However, no values are reported for 2018 or 2019 in the IEA data set, while CRF table 1.A(a)s3 contains data on gas/diesel oil consumption for 2018 and 2019. During the review, the Party clarified that the methodology for separation of the fuels used for domestic and international navigation is based on the type of vessel and its technical characteristics, the length of domestic routes and the amount of goods transported domestically and internationally. Emission estimates were reported for the entire time series. In addition, the Party reported that it will expand this section of the NIR in order to increase transparency regarding the methodology used to segregate the fuel consumption for this category.
E.39	1.A.3.d Domestic navigation – liquid fuels – CO_2, CH_4 and N_2O	Include in the NIR a well-documented justification for the decrease in gasoline consumption in subcategory 1.A.3.d domestic	Not resolved. There have been no recalculations for gasoline consumption in subcategory 1.A.3.d domestic navigation since the 2018 submission. The decrease in gasoline consumption in subcategory 1.A.3.d domestic navigation continued in 2001–2019 without any justification provided in the NIR. During the review, the Party

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	(E.65, 2019) Transparency	navigation and ensure the consistency of the emission estimates for the complete time series.	explained that the AD on domestic navigation are complete but not presented clearly or transparently in the NIR. The Party will improve the presentation of information on the types of fuel consumed, inland waterway transport and possible reasons for the variations in fuel consumption across the time series in the next annual submission.
E.40	1.A.4.c Agriculture/forestry/ fishing – liquid fuels – CO_2, CH_4 and N_2O (E.33, 2019) (E.54, 2017) Comparability	Disaggregate CO_2, CH_4 and N_2O emissions for subcategory 1.A.4.c by type of fuel under the correct subcategories (i.e. 1.A.4.c.ii off-road vehicles and other machinery and 1.A.4.c.iii fishing) for the entire time series and, in the NIR, provide detailed explanations on the methods used to allow such reallocation.	Addressing. The Party reported correctly disaggregated CO_2, CH_4 and N_2O emissions for the three subcategories under category 1.A.4.c by type of fuel (1.A.4.c.i stationary, 1.A.4.c.ii off-road vehicles and other machinery and 1.A.4.c.iii fishing) for 2019. However, there is no explanation in the NIR on the method used to allocate the fuels to the relevant subcategory. During the review, Kazakhstan explained that it has difficulties in separating the fuels reported under subcategory 1.A.c.i stationary and reallocating them under the relevant subcategory because the information for 1990–2000 is insufficient, and many changes in infrastructure and administration have taken place during the reporting period, including in transport infrastructure, the number and size of national parks and land-use changes.
E.41	1.A.5 Other (fuel combustion activities) – all fuels – CO_2, CH_4 and N_2O (E.34, 2019) (E.55, 2017) Comparability	Revise the AD and emission allocations to ensure that they are included in the appropriate categories in the CRF tables according to the UNFCCC Annex I inventory reporting guidelines and, in the NIR of the next annual submission, include information on the revised allocations, provide detailed explanations on all reallocations and provide revised emission estimates.	Not resolved. The ERT noted minor recalculations of AD for the category, but no reallocations since the 2019 submission. In the NIR (section 3.4.3.1, p.98), the Party reported that this category included the emissions of public administration, defence and social security, and, under any other fuel consumption, emissions not accounted for elsewhere. The ERT noted that, according to the 2006 IPCC Guidelines (vol. 2, chap. 2, table 2.1, p.2.10), mobile defence activities should be included in subcategory 1.A.5.b mobile. During the review, the Party stated that it will revise the distribution of the AD and estimate the emissions in accordance with the UNFCCC Annex I inventory reporting guidelines in the next annual submission.
E.42	1.A.5.a Stationary – all fuels – CO_2, CH_4 and N_2O (E.66, 2019) Comparability	Report in CRF table 1.A(a) (sheet 4) the fuel consumption and corresponding GHG emissions for subcategory 1.A.5.a stationary by type of fuel.	Addressing. The ERT noted that the Party reported in the NIR data on consumption of fuels and CO_2 emissions by fuel type for category 1.A.5 other (section 3.4.5, table 3.20, p.100, and table 3.22, p.102). However, in CRF table 1.A(a)s4, the AD and GHG emissions for category 1.A.5 other were reported aggregated under subcategory 1.A.5.a stationary, without specifying the type of fuel (e.g. liquid, solid, gaseous and other fossil fuels). During the review, the Party stated that it will report the consumption for category 1.A.5.a stationary by fuel type in the next annual submission.
E.43	1.B Fugitive emissions from fuels – solid fuels – CO_2, CH_4 and N_2O (E.62, 2019) Comparability	If estimating other emissions such as those from coke oven gas flaring or venting, report those emissions under subcategory 1.B.1.b solid fuel transformation and include in the NIR clear and detailed information on the method, AD and EFs used.	Resolved. The Party reported the AD for coke gas production (NIR annex 2, table P.2.3, p.420) and emissions from coke oven gas flaring under subcategory 1.B.1.c flaring of coke oven gas and included in the NIR clear and detailed information on the method, AD and EFs used (section 3.5.3, pp.152–153).
E.44	1.B.1.a Coal mining and handling – solid fuels –	Provide in the next annual submission consistent and accurate information on the	Not resolved. The Party reported production of coal for 2019 as 109.07 Mt in table P1.3 of the NIR (annex 1, p.417) but as 104.78 Mt in CRF table 1.B.1. There are

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	CO_2 and CH_4 (E.67, 2019) Accuracy	quantity of coal produced in the country in CRF table 1.B.1 and the NIR, estimate CO_2 and CH_4 fugitive emissions from this activity accordingly and report the corresponding AD used for the emission estimates for the entire time series consistently across the sectoral and reference approaches.	inconsistencies of this type across the entire time series. Coal production according to CRF table 1.A(b) is 10,478.50 kt coking coal and 5,928.90 kt lignite. As well as the errors in the units of measurement, the ERT noted that the production of lignite reported in CRF table 1.A(b) is not accounted for under coal production in CRF table 1.B.1 and no justification is provided for this. This may result in an underestimation of the emissions for the category. During the review, the Party clarified that it will aim to eliminate the inconsistencies in the next annual submission.
E.45	1.B.1.a Coal mining and handling – solid fuels – CH_4 (E.35, 2019) (E.15, 2017) (E.23, 2016) (E.23, 2015) (44, 2013) (56, 2012) Transparency	Include the background information about the measurements made and time series of the CH_4 concentration in the NIR (underground mines).	Not resolved. The NIR does not provide any information on measurements made, apart from mentioning (section 3.5.2.4, p.151) that the EFs are verified by measurements linked to servicing and maintenance at plant level. In the NIR (section 3.5.2.2, p.150), the Party states that the higher value of the range of default CH_4 EFs for mining activities (25 m^3/t) is used for estimating CH_4 emissions but, in the CRF tables, the CH_4 EF for underground mines – mining activities is 16.03 kg/t for 2019 and 16 kg/t for the other years, instead of 16.75 kg/t (which is equivalent to the default value of 25 m^3/t when a conversion factor of 0.67 kg/m^3 is used, as recommended by the 2006 IPCC Guidelines (vol. 2, chap. 4, section 4.1.3.2, p.4.12)). During the review, Kazakhstan explained that it is establishing a CH_4 measurement system and developing country-specific EFs for coal mines, and plans to revise the estimates when country-specific data are available. The Party further noted that the text of the NIR will be expanded to cover all important aspects relating to the coal industry, in particular underground coal mines.
E.46	1.B.1.a Coal mining and handling – solid fuels – CH_4 (E.37, 2019) (E.28, 2017) (E.38, 2016) (E.35, 2015) Accuracy	Report the recovery/flaring of CH_4 from underground mines in CRF table 1.B.1 or use the relevant notation key in accordance with decision 24/CP.19, annex I, paragraph 37.	Addressing. The Party corrected the notation key to "NE" for CH_4 recovery/flaring for underground mines – mining activities and "NO" for the other subcategories in CRF table 1.B.1 for the entire time series but no further explanation or justification was included in the NIR or CRF table 9. During the review, the Party explained that data on the volume of CH_4 recovered and flared in underground mines are considered as one of the most important aspects for improvement of the GHG inventory and it will continue efforts to obtain data and improve the transparency and accuracy of this category.
E.47	1.B.1.a Coal mining and handling – solid fuels – CH_4 (E.38, 2019) (E.29, 2017) (E.39, 2016) (E.36, 2015) Transparency	Investigate and transparently document the use of the country-specific CH_4 EF for the post-mining activities of the underground mines.	Resolved. The Party reported in CRF table 1.B.1 the highest end value of the default CH_4 EF range for post-mining activities of underground mines (2.68 kg/t) from the 2006 IPCC Guidelines (vol. 2, chap. 4, section 4.1.3.2, p.4.12), and documented its choice in the NIR (section 3.5.2.2, p.150).
E.48	1.B.1.a Coal mining and handling – solid fuels – CH_4 (E.36, 2019) (E.16, 2017) (E.24, 2016) (E.24, 2015)	Include all relevant information about the calculation of the country-specific CH_4 EF for coal mining and handling (surface mines) in the NIR and ensure the consistency of the time series.	Resolved. In its NIR (section 3.5.2.2, p.150), the Party states that the default CH_4 EFs for mining activities are used. In CRF table 1.B.1, the EF of 0.80 kg/t is reported across the time series, which is the average default EF for surface mines in the 2006 IPCC Guidelines (vol. 2, chap. 4, section 4.1.4.2, p.4.18) (see also ID# E.78 in table 5).

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	(45, 2013) (56, 2012) Transparency		
E.49	1.B.1.a Coal mining and handling – solid fuels – CH_4 (E.39, 2019) (E.30, 2017) (E.40, 2016) (E.37, 2015) Transparency	Assess and verify the data provided by the coal mining companies and verify if the conversion between the volume and mass units is properly done, and justify the country-specific CH_4 EF of the surface mining activities in the NIR and the changes in the IEF for 1990–2014.	Resolved. The ERT noted that the inconsistency in the time series of the CH_4 IEF for surface mining activities has been resolved, and an EF of 0.80 kg/t (the average default EF for surface mines in the 2006 IPCC Guidelines (vol. 2, chap. 4, section 4.1.4.2, p.4.18)) was applied across the time series, which is a middle range default CH_4 EF calculated using the default conversion factor between the volume and mass units.
E.50	1.B.1.a Coal mining and handling – solid fuels – CO_2 (E.40, 2019) (E.31, 2017) (E.41, 2016) (E.38, 2015) Transparency	Transparently document in each NIR the methodology and the background information used for the estimation of the CO_2 EF for surface mining activities.	Not resolved. The Party reported in its NIR (section 3.5.2.2, p.150) that default approaches and EFs recommended by IPCC methodology have been used to estimate CO_2 emissions from surface mining activities but no further background information used in the estimates was provided in the NIR or during the review. According to the previous review report, the method was based on the CO_2 content of the in-situ gas.
E.51	1.B.1.a Coal mining and handling – solid fuels – CO_2 and CH_4 (E.42, 2019) (E.56, 2017) Completeness	Provide CO_2 and CH_4 emission estimates for abandoned underground coal mines using the methodological approach provided in the 2006 IPCC Guidelines (vol. 2, chap. 4, p.4.24) and strengthen the inventory arrangements procedure to ensure completeness of reporting.	Resolved. The Party calculated the CH_4 emissions of abandoned underground mines for 1997–2019 for the first time in the current annual submission. In the NIR (section 3.5.2.2, p.150), the Party reported that it used a tier 1 methodology to estimate CH_4 emissions for the category, and in section 3.5.2.5 (p.152) the Party reported that nine mines owned by ArcelorMittal Temirtau JSC were closed as unprofitable in 1997 and included in this calculation. CO_2 emissions from abandoned underground coal mines are reported as "NA". The ERT notes that there is no default methodology suggested by the 2006 IPCC Guidelines for the calculation of CO_2 emissions from abandoned underground coal mines.
E.52	1.B.1.b Solid fuel transformation – solid fuels – CH_4 (E.43, 2019) (E.17, 2017) (E.26, 2016) (E.26, 2015) (46, 2013) Convention reporting adherence	Ensure the correct use of notation keys and report the information in the documentation boxes in the CRF tables.	Resolved. The Party calculated the emission estimates for the category for the first time and reported CO_2 and CH_4 emissions for the entire time series in CRF table 1.B.1.
E.53	1.B.2 Oil, natural gas and other emissions from energy production – liquid and gaseous fuels – CO_2, CH_4 and N_2O	Ensure that the description and units regarding the AD for the calculation of fugitive CO_2 and CH_4 emissions are provided in a consistent and complete manner in CRF table 1.B.2.	Not resolved. See ID# E.7 above.

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	(E.44, 2019) (E.33, 2017) (E.44, 2016) (E.41, 2015) Transparency		
E.54	1.B.2 Oil, natural gas and other emissions from energy production – liquid and gaseous fuels – CO_2, CH_4 and N_2O (E.68, 2019) Transparency	Include in the NIR detailed information on the regulatory acts certifying the introduction of new technologies and the modernization of oil and natural gas operations and infrastructure, including clear information on the timeline for the introduction of these new technologies and intended changes, and on the target year for finalizing the modernization of oil and natural gas operations, together with documented information on the status of progress towards the modernization of the oil and natural gas industry in the country and an analysis of the similarity of such operations with those in developed countries.	Not resolved. In the NIR (e.g. sections 3.5.4.2 (p.155), 3.5.4.6 (pp.158–159) and 3.5.4.11 (pp.161–162)), the Party explained that changes from the use of default CO_2, CH_4 and N_2O EFs for developing countries to those for developed countries from the 2006 IPCC Guidelines (vol. 2, chap. 4, tables 4.2.4–4.2.5, pp.4.48–4.63) within the time series are linked to the national legislation for implementation of the best technologies and building materials in the sector. However, neither the legislative basis nor the justification for the step approach and the varying years for the different EFs used across subcategories were provided in the NIR. For example, the Party used default EFs for developing countries for 1990–2007 and for developed countries for 2007–2019 for category 1.B.b.2 natural gas production but the default EFs for developing countries for 1990–2000 and for developed countries for 2001–2019 for category 1.B.2.b.4 transmission and storage. The ERT further notes that the 2006 IPCC Guidelines provide ranges for the EFs for the category but the choice of default values used within the range is not explained in the NIR. During the review, the Party clarified that it will expand the fugitive emission section of the NIR in the next annual submission in order to improve the transparency of the use of different EFs for oil and natural gas production.
E.55	1.B.2 Oil, natural gas and other emissions from energy production – liquid and gaseous fuels – CO_2, CH_4 and N_2O (E.68, 2019) Accuracy	Taking into account the information collected on the status of progress towards the modernization of the oil and natural gas industry in the country, and if it is not possible to use a tier 2 method for the estimates, provide revised CO_2, CH_4 and N_2O emission estimates using a gradual linear introduction across the time series, starting in 2001 or later, of the default CO_2, CH_4 and N_2O EFs for developing countries provided in table 4.2.5 of the 2006 IPCC Guidelines (vol. 2, chap. 4, p.4.55).	Addressing. The ERT noted that the Party applied some gradual changes to the IEFs (e.g. for oil production between 1997 and 2009) but the approach used is not documented in the NIR. In addition, Kazakhstan continues to report an inconsistent time series of IEFs for a number of categories and subcategories of fugitive emissions from oil and natural gas operations, because Kazakhstan has not consistently changed its reporting from using default CO_2, CH_4 and N_2O EFs for developing countries to those for developed countries from the 2006 IPCC Guidelines (vol. 2, chap. 4, tables 4.2.4–4.2.5, pp.4.48–4.63) within the time series (see ID# E.54 above). During the review, the Party explained that it is taking steps to introduce the tier 2 method more quickly. In particular, several national methodologies have been developed for enterprises in the sector which are currently at the approval stage. There are plans to introduce a new system-wide data form in the next two to three years as part of the information-gathering process that will collect large volumes of data and information on coefficients that companies use in their production processes, and allow for a transition to a tier 2 method for the category.
E.56	1.B.2.a Oil – liquid fuels – CO_2, CH_4 and N_2O (E.45, 2019) (E.34, 2017) (E.45, 2016)	Estimate and include emissions from oil exploration or, if data for the estimation of the emissions for this subcategory are not available, use the notation key “NE” with the	Resolved. The Party consistently reported AD and CO_2, CH_4 and N_2O emissions for category 1.B.2.a.1 oil exploration in CRF table 1.B.2 for the entire time series. Information on the methodology and the EFs used for the estimation of emissions for this category are provided in the NIR (section 3.5.4.2, p.155). The ERT noted that the

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	(E.42, 2015) Accuracy	relevant explanation in the CRF tables and in the NIR.	category was subject to adjustment in accordance with the guidance for adjustments under Article 5, paragraph 2, of the Kyoto Protocol (annex to decision 20/CMP.1, in conjunction with decision 4/CMP.11) in the 2019 review report (FCCC/ARR/2019/KAZ, chap. VI and tables 1–2 of annex IV). The ERT further noted that the emissions for the category have been recalculated since the 2019 resubmission and all IEFs have been significantly increased (e.g. from 0.19 to 2.05 kg/unit for 1990 and from 0.19 to 0.23 kg/unit for 2017).
E.57	1.B.2.a Oil – liquid fuels – CH_4 (E.47, 2019) (E.36, 2017) (E.47, 2016) Consistency	Improve the QA/QC procedures to verify the CH_4 EF for oil production and ensure the time-series consistency for the IEF for the whole time series.	Not resolved. Kazakhstan inconsistently reported the CH_4 EFs for subcategory 1.B.2.a.2 oil production across the entire time series, ranging from 36,145 kg/unit for 1990 to 14,458,215 kg/unit for 2006 and 2,137 kg/unit for 2019. The NIR contains information on general QA/QC activities for fugitive emissions from oil activities, but not on QC procedures to verify the CH_4 EFs for oil production. The ERT noted that in the NIR (section 3.5.4.3, pp.155–156) it states that, for 1990–1998, EFs for developing countries were used, for 1999–2008, transition EFs were used and, since 2009, EFs for developed countries have been used. The default EFs are presented in NIR table 3.29 (section 3.5.4.3, p.156), but they do not correspond to the IEFs provided in CRF table 1.B.2. During the review, the Party stated that it is constantly working to improve the QC procedures for all categories.
E.58	1.B.2.a Oil – liquid fuels – CO_2 and CH_4 (E.69, 2019) Accuracy	Report and use well-documented and revised AD for crude oil production that are consistent with the values reported in CRF table 1.A(b) and the NIR to calculate emissions of CO_2 and CH_4 for subcategory 1.B.2.a.2 oil – production for 2013–2017 and subsequent years, using the appropriate default CO_2 and CH_4 EFs provided in tables 4.2.4–4.2.5 of the 2006 IPCC Guidelines (vol. 2, chap. 4, pp.4.48 and 4.55, respectively).	Addressing. The NIR (section 3.5.4.3, p.156 and table 3.29) states that the Party is using the default CO_2 and CH_4 EFs provided in tables 4.2.4–4.2.5 (vol. 2, chap. 4, pp.4.48–4.63) of the 2006 IPCC Guidelines. During the review, the Party confirmed that AD from the National Bureau of Statistics were used together with the default EFs to calculate the emission estimates for the category. The ERT noted that the Party continues to report inconsistently the AD for crude oil production in the NIR and CRF table 1.A(b); for example, for 2019 it reports 78,642.20 kt in CRF table 1.A(b) and table 3.30 (section 3.5.4.3, p.157) of the NIR compared with 78,642.20 t reported in CRF table 1.B.2 (see ID# E.7 above).
E.59	1.B.2.a Oil – liquid fuels – CO_2 and CH_4 (E.69, 2019) Accuracy	Following the principle of consistency, check the correctness, accuracy and consistency of the crude oil production value reported in CRF table 1.B.2 for the entire time series and report revised CO_2 and CH_4 emission estimates for subcategory 1.B.2.a.2 oil – production accordingly, using the corresponding default EFs from tables 4.2.4–4.2.5 of the 2006 IPCC Guidelines (vol. 2, chap. 4, pp.4.48 and 4.55, respectively).	Not resolved. The ERT noted that the category was subject to adjustment in accordance with the guidance for adjustments under Article 5, paragraph 2, of the Kyoto Protocol (annex to decision 20/CMP.1, in conjunction with decision 4/CMP.11) in the 2019 review report (FCCC/ARR/2019/KAZ, chap. VI and tables 3–4 of annex IV). The ERT noted that there are no changes in the AD reported for the subcategory since the 2019 submission, apart from the correction of input errors for 2012 and 2013 and minor changes to AD values for 2016 and 2017. The Party reported in its NIR (section 3.5.4.3, table 3.30, p.157) that oil production for 2019 was 78.64 Mt, whereas in CRF table 1.B.2 oil production is reported as 78,643.20 t and in CRF table 1.A(b) as 78,643.20 kt. The differences for some of the years in the time series are not only in the units of measurement used, but also in the values reported (e.g. 25,820.00 t for 1990 in CRF table 1.B.2 but 21.68 Mt in table 3.30, p.157 of the NIR).

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			Although the Party refers to the default EFs in the NIR (section 3.5.4.3, p.156), the IEF time series shows significant inter-annual changes (e.g. 2005/2006 (79,900.12 per cent) and 2006/2007 (–99.93 per cent)). The inconsistency of the units reported in CRF table 1.B.2 makes it difficult to compare the IEF values with the default IPCC values (2006 IPCC Guidelines, tables 4.2.4–4.2.5, vol. 2, chap. 4, pp.4.48–4.63) and the values indicated as used by the Party in table 3.29 (NIR section 3.5.4.3, p.156). During the review, the Party clarified that all necessary procedures for data validation had been carried out and that default EFs were used from the 2006 IPCC Guidelines (vol. 2, chap. 4) with a smooth transition from the use of coefficients for developing countries to those for developed countries. The Party also indicated that there were technical mistakes in CRF table 1.B.2.
E.60	1.B.2.a Oil – liquid fuels – CH_4 (E.49, 2019) (E.38, 2017) (E.49, 2016) Accuracy	Ensure consistency in the estimation of the CH_4 emissions from transport (1.B.2.a.3), fill the gaps for 1990–1996, verify the CH_4 IEF for 2014, and ensure consistency in the IEF for the entire time series.	Addressing. The Party reported the AD and estimates for CH_4 (and CO_2) emissions for the entire time series, including 1990–1996, and, as reported in the NIR (section 3.5.4.3, p.156), it used two different sets of default CH_4 (and CO_2) EFs, namely those for developing or developed countries provided in the 2006 IPCC Guidelines (vol. 2, chap. 4, tables 4.2.4–4.2.5, pp.4.48–4.63), as presented in table 3.29 of the NIR (section 3.5.4.3, p.156) for pipeline and road transport. However, those EFs do not correspond to the values in CRF table 1.B.2, where the CH_4 IEFs for this category vary between 20.52 kg/unit for 1990 and 6.60 kg/unit for 2019 and follow a continuous downward trend, with an outlier for 2003 (129.19 kg/t oil). The overall decreasing trend can be explained by the increased share of pipeline transportation having lower EFs (NIR section 3.5.4.3, table 3.30 (p.157) and p.156, noting the modernization of the equipment). The only recalculations for the subcategory are for 2016 and 2017. As the EF trend is not justified in the NIR, the ERT could not confirm that there is no underestimation of emissions for this subcategory. During the review, the Party stated that the refinement of the EFs is justified because the technological solutions in the oil sector have advanced since 1990.
E.61	1.B.2.a Oil – liquid fuels – CH_4 (E.50, 2019) (E.57, 2017) Transparency	Validate the AD for the subcategory and strengthen QC procedures to ensure that AD for 1990–1996 for the subcategory oil transport are correct; include the AD description and units in the CRF tables; and use an appropriate and consistent CH_4 EF to estimate emissions for the subcategory for 1990–1996.	Addressing. The ERT noted that a consistent time series for 1990–1996 was provided in the 2019 submission and the CH_4 emissions from oil transport were reported for the entire time series. However, the Party reported in CRF table 1.B.2 the AD as oil produced in t (176,800.00 t). In the NIR (section 3.5.4.3, table 3.30, p.157), the Party provided the quantities of oil transported by type of transportation in Mt (via pipelines (176.8 Mt) and via rail and auto transport (17.5 Mt)). In the NIR (section 3.5.4.5, p.158), Kazakhstan provided information on general QA/QC activities for fugitive emissions from oil activities, but the ERT found no evidence that the Party had strengthened QC procedures for the AD and IEFs for this subcategory, including their validation (see the outlier noted in ID# E.60 above). During the review, the Party indicated that it will take this comment into consideration.
E.62	1.B.2.a Oil – liquid fuels – CO_2, CH_4 and N_2O	Report in the NIR and CRF table 1.B.2 accurate, consistent and documented AD from	Not resolved. The Party has not reported in its NIR or CRF table 1.B.2 documented AD for subcategory 1.B.2.a.4 oil – refining/storage (see ID# E.7 above). A value of

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	(E.70, 2019) Transparency	the national energy balance or from recognized international sources, including units and a description of the AD for subcategory 1.B.2.a.4 oil – refining/storage for the entire time series, particularly for 2013–2017 and subsequent years of the second commitment period of the Kyoto Protocol.	16,514.24 t is reported in CRF table 1.B.2 for 2019 as AD for this subcategory indicated as oil produced, when other values for oil produced in CRF table 1.B.2 are reported as 176,800 t for subcategory 1.B.2.a.3 oil – transport and 78,643.20 t for subcategory 1.B.2.a.2 oil – production. There is no information on refined and stored oil in the NIR. The Party reported in its NIR (section 3.5.4.6, p.159) that changes have been made to the units of measurement for the categories of oil and gas production for subcategories 1.B.2.a.4 oil – refining/storage, 1.B.2.a.5 oil – distribution of oil products and 1.B.2.a.6 oil – other, but did not provide further explanation regarding the AD used. The relevant emissions are presented for 2010–2019 and the notation key "NA" has been incorrectly reported for 1990–2009. During the review, the Party confirmed that there were technical mistakes in the information reported in CRF table 1.B.2. The Party clarified that data, reports and bulletins from the Bureau of National Statistics were used and, in some cases, information requested from enterprises in the sector.
E.63	1.B.2.a Oil – liquid fuels – CO_2, CH_4 and N_2O (E.70, 2019) Accuracy	Revise, as necessary, the estimates of CO_2, CH_4 and N_2O emissions for subcategory 1.B.2.a.4 oil – refining/storage using the identified accurate AD and appropriate default EFs from tables 4.2.4–4.2.5 of the 2006 IPCC Guidelines (vol. 2, chap. 4, pp.4.48 and 4.55, respectively) or recognized international methodological sources for the entire time series, particularly for 2013–2017 and subsequent years of the second commitment period of the Kyoto Protocol, and document the EFs and method used in the NIR.	Not resolved. The emissions for this category have only been calculated for 2010–2019 and have not been recalculated since the 2019 resubmission. The ERT notes that the AD for subcategory 1.B.2.a.4 oil – refining/storage in CRF table 1.B.2 are provided in t and not consistent with the other information provided in the table or justified in the NIR (see ID# E.62 above). The NIR (section 3.5.4.3, pp.155–156) explains that IPCC methodology in combination with AD from the energy balance of the Bureau of National Statistics and the default EFs, namely the average values for developing countries for 1999–2008 and for developed countries for 2009 onward in tables 4.2.4–4.2.5 of the 2006 IPCC Guidelines (vol. 2, chap. 4, pp.4.48–4.63), were used for the estimates. However, there is no section in the NIR that covers this subcategory and no EFs are provided in the NIR. During the review, the Party confirmed that this subcategory is calculated using the methodological approaches of the 2006 IPCC Guidelines (vol. 4, chap. 4). The ERT noted that the 2006 IPCC Guidelines only provide default values for CH_4 IEFs and the mistakes in the units used in CRF table 1.B.2 make it difficult to assess the EFs used against the default values.
E.64	1.B.2.b Natural gas – gaseous fuels – CO_2 and CH_4 (E.71, 2019) Transparency	Report CO_2 and CH_4 emission estimates for subcategory 1.B.2.b.1 natural gas – exploration using, if available, a well-documented method and country-specific EFs, together with accurate, complete and documented AD obtained from national companies, and document in detail in the NIR the AD, method and parameters used in the estimates and explain how the double counting of emissions was avoided for subcategory 1.B.2.a.1 oil – exploration. If this is not possible, and if emissions are estimated for subcategory	Not resolved. Kazakhstan included emission estimates for subcategory 1.B.2.b.1 natural gas – exploration for the entire time series (CRF table 1.B.2 and NIR section 3.5.4.2, p.155). However, the information in the NIR is not sufficiently transparent, as, for example, section 3.5.4.8 (p.159) indicates that estimates were not provided owing to lack of data. Although the NIR contains a specific section on methodologies used for estimating emissions for oil and gas exploration (section 3.5.4.2, p.155), the AD, method and parameters used in the estimates and explanation of the avoidance of double counting of emissions for subcategory 1.B.2.a.1 oil – exploration are not provided. During the review, the Party explained that, in preparing the calculations of emissions for the exploration category, the experts relied on data for fuel production, as required by the 2006 IPCC Guidelines for well drilling, testing and maintenance (vol. 2, chap. 4, tables 4.2.4–4.2.5, pp.4.48–4.63). As there were certain difficulties

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		1.B.2.a.1 oil – exploration using the default EFs provided in tables 4.2.4–4.2.5 of the 2006 IPCC Guidelines for well drilling, testing and servicing (vol. 2, chap. 4, pp.4.48 and 4.55, respectively) and the corresponding AD required, report emissions for subcategory 1.B.2.b.1 natural gas – exploration using the notation key "IE" and include relevant explanations in the NIR and CRF tables.	with obtaining comprehensive data on natural gas exploration, the inventory team relied on expert assessments and data from specific enterprises.
E.65	1.B.2.b Natural gas – gaseous fuels – CO_2 and CH_4 (E.72, 2019) Accuracy	Report and use well-documented and revised AD for the volume of natural gas production that are consistent with the reported values in CRF table 1.A(b) and the NIR to calculate emissions of CH_4 and CO_2 from subcategory 1.B.2.b.2 natural gas – production for 2013–2017 and subsequent years, using the appropriate default CH_4 and CO_2 EFs provided in tables 4.2.4–4.2.5 of the 2006 IPCC Guidelines (vol. 2, chap. 4, pp.4.48 and 4.55, respectively).	Not resolved. The Party reported in CRF table 1.B.2 for 2019 and in NIR table 3.34 (p.160) 12,067 10^6 m^3 natural gas produced but 32,673.40 10^6 m^3 in CRF table 1.A(b). In addition, in CRF table 1.B.2 there are other AD defined as gas produced: for subcategories 1.B.2.b.1 exploration – 12,067.00 10^6 m^3, 1.B.2.b.3 processing – 33,673.40 10^6 m^3, 1.B.2.b.4 transmission and storage – 44,470.59 billion m^3, 1.B.2.b.5 distribution – 12,067.00 billion m^3 and 1.B.2.b.6 other – 792.00 kt. The inconsistency in the figures and units of measurement reported in the NIR and CRF tables occurs over the entire time series. During the review, the Party clarified that the inconsistencies in the AD were caused by a technical error in the data sets and explained that the issue will be addressed in the next annual submission. The Party reported that default CH_4 and CO_2 EFs provided in tables 4.2.4–4.2.5 of the 2006 IPCC Guidelines (vol. 2, chap. 4, pp.4.48–4.63) were applied for the category (NIR section 3.5.4.8, table 3.33, p.160).
E.66	1.B.2.b Natural gas – gaseous fuels – CO_2 and CH_4 (E.72, 2019) Accuracy	Following the principle of consistency, check the correctness, accuracy and consistency of the natural gas production volume reported in CRF table 1.B.2 for 1990–2012, and report revised CH_4 and CO_2 emission estimates for subcategory 1.B.2.b.2 natural gas – production, accordingly, using the corresponding default EFs from tables 4.2.4–4.2.5 of the 2006 IPCC Guidelines (vol. 2, chap. 4, pp.4.48 and 4.55, respectively).	Not resolved. The ERT noted that subcategory 1.B.2.b.2 natural gas – production was subject to adjustment in accordance with the guidance for adjustments under Article 5, paragraph 2, of the Kyoto Protocol (annex to decision 20/CMP.1, in conjunction with decision 4/CMP.11) in the 2019 review report (FCCC/ARR/2019/KAZ, chap. VI and tables 5–6 of annex IV). The emissions for the subcategory have been recalculated since the 2019 resubmission, not to update the AD but to introduce the EF for developed countries in 2008 instead of 2001 and to decrease the CH_4 EF by a factor of 100 compared with the previously reported values for 1990–2007 and by a factor of 10 for 2008–2019 (e.g. from 1,340 to 134 kg/unit). The ERT noted that the value for natural gas production reported in NIR table 3.34 (section 3.5.4.8, p.160) and CRF table 1.B.2 (12,067.00 10^6 m^3) is not the same as the value reported for production of natural gas in CRF table 1.A(b) (32,673.40 10^6 m^3) (see ID# E.65 above), which suggests a possible underestimation of the emissions for the subcategory. In the NIR (section 3.5.4.2, p.155), the Party stated that tier 1 methodology is used to estimate the emissions for category 1.B.2 oil and natural gas but did not document the methodology behind the EFs or the choice of tier 1 default EFs from the range provided in the 2006 IPCC Guidelines (vol. 2, chap. 4, tables 4.2.4–4.2.5, pp.4.48–4.63). The CO_2 EF was reported as 97.0 kg/unit for 1990–2000 and 48.0 kg/unit for 2001–2019, while the 2006 IPCC Guidelines (vol. 2, chap. 4, table 4.2.4, pp.4.48–4.54) provide a range of

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			tier 1 EFs from 14 to 82 kg/10^6 m^3. The CH_4 EF was reported as 121.9 kg/10^6 m^3 for 1990–2007 and 134.0 kg/10^6 m^3 for 2008–2019, while the 2006 IPCC Guidelines (vol. 2, chap. 4, table 4.2.4, pp.4.48–4.54) provide a range of tier 1 EFs from 380 to 2,300 kg/10^6 m^3. The ERT noted that the CH_4 IEFs have been reduced by factors of 10 and 100 compared with the previous submission, meaning that the IEFs for 2008–2019 are higher than those for the beginning of the time series. During the review, the Party clarified that natural gas production in Kazakhstan is increasing annually and the volumes produced depend on economic and political factors. The AD are taken from the Bureau of National Statistics while the EFs are taken from the 2006 IPCC Guidelines (vol. 2, chap. 4). The Party confirmed the technical errors detected in CRF table 1.B.2.
E.67	1.B.2.b Natural gas – gaseous fuels – CO_2 and CH_4 (E.51, 2019) (E.39, 2017) (E.52, 2016) (E.46, 2015) Transparency	(a) Verify the CO_2 and CH_4 IEF for the production of natural gas for 2013 and 2014; (b) Ensure time-series consistency of the EFs; (c) Describe the emission trends in the NIR.	(a) Resolved. The ERT noted that the erroneous IEFs for 2013 and 2014 were corrected in the 2019 submission; (b) Not resolved. The CH_4 EFs for this category reported in CRF table 1.B.2 are 121.9 kg/10^6 m^3 kg/unit for 1990–2007 and 134.0 kt/10^6 m^3 for 2008–2019. The CO_2 EFs are 97.0 kg/10^6 m^3 for 1990–2000 and 48.0 kg/10^6 m^3 for 2001–2019. The values are not consistent with the values in NIR table 3.33 (section 3.5.4.8, p.160); (c) Addressing. The NIR (section 3.5.4.8, p.161) explains the increased natural gas production and the implementation of new technologies in the sector, and the input AD and overall GHG emissions are provided in NIR table 3.34 (section 3.5.4.8, p.160).
E.68	1.B.2.b Natural gas – gaseous fuels – CO_2 and CH_4 (E.52, 2019) (E.40, 2017) (E.53, 2016) (E.47, 2015) Accuracy	Provide a complete estimate of the fugitive CH_4 and CO_2 emissions from the processing of natural gas in the country.	Resolved. The Party provided a complete time series of fugitive CH_4 and CO_2 emissions from the processing of natural gas in its 2019 submission and the emissions were not further recalculated. The values used for gas processing in CRF table 1.B.2 correspond to those in CRF table 1.A(b) in the 2021 submission. The ERT noted that subcategory 1.B.2.b.3 natural gas – processing was subject to adjustment in accordance with the guidance for adjustments under Article 5, paragraph 2, of the Kyoto Protocol (annex to decision 20/CMP.1, in conjunction with decision 4/CMP.11) in the 2019 review report (FCCC/ARR/2019/KAZ, chap. VI and tables 7–8 of annex IV) (see ID# E.79 in table 5).
E.69	1.B.2.b Natural gas – gaseous fuels – CO_2 and CH_4 (E.53, 2019) (E.41, 2017) (E.54, 2016) Accuracy	Verify the CH_4 emission estimates for 2014 for the transmission and storage of natural gas, provide a consistent time series for 1990–2014, estimate the CO_2 emissions for the same subcategory for 1990–2013 and provide a consistent time series for the CO_2 emissions.	Addressing. The error in data entry for 2014 was corrected and revised estimates for the category provided in the 2018 submission. The Party provided CH_4 and CO_2 emission estimates for the complete time series, using the corresponding default EFs from the 2006 IPCC Guidelines (vol. 2, chap. 4, tables 4.2.4–4.2.5, pp.4.48–4.63), namely the EFs for developing countries for 1990–2000 and for developed countries for 2001–2017, without justification for the change in 2001. The EFs are provided in NIR table 3.33 (section 3.5.4.8, p.160) and the relevant AD are provided in NIR table 3.34 (section 3.5.4.8, p.160). The time series of AD has not been revised since the 2019 resubmission. In addition, the ERT noted that Kazakhstan inconsistently reported

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			AD and units in NIR table 3.34 (section 3.5.4.8, p.160) on transmission and storage (34.2 Mt for 2019) and CRF table 1.B.2 (44,470.59 billion m^3).
E.70	1.B.2.b Natural gas – gaseous fuels – CO_2 and CH_4 (E.54, 2019) (E.42, 2017) (E.55, 2016) Consistency	Verify the CH_4 emission estimate for 2014 for the distribution of natural gas, ensure time-series consistency for 1990–2014, estimate the CO_2 emissions for the same subcategory for 1990–2013 and provide a consistent time series for the CO_2 emissions.	Addressing. The error in data entry for 2014 was corrected and revised estimates for the category provided in the 2018 submission. The Party reported in its CRF table 1.B.2 CO_2 and CH_4 emission estimates for subcategory 1.B.2.b.5 natural gas – distribution for the entire time series. According to the NIR (section 3.5.4.8, pp.159–161 and table 3.33, p.160) default EFs from the 2006 IPCC Guidelines (vol. 2, chap. 4, tables 4.2.4–4.2.5, pp.4.48–4.63) for developed and developing countries were used across the time series, with a step approach applied between 2000 and 2011. However, the ERT noted that, although the CO_2 IEF remains unchanged, the CH_4 IEF and emissions have been reduced by a factor of 100 since the 2019 resubmission, and no further information on those trends was provided in the NIR or during the review.
E.71	1.B.2.c Venting and flaring – liquid and gaseous fuels – CO_2 and CH_4 (E.55, 2019) (E.43, 2017) (E.56, 2016) Completeness	Review and estimate the CO_2 and CH_4 emissions from the relevant venting and flaring of the liquid and gaseous fuels for 2013 and 2014, and provide a complete and consistent estimate of the emissions for this subcategory.	Addressing. The ERT noted that the subcategory venting was subject to adjustment in accordance with the guidance for adjustments under Article 5, paragraph 2, of the Kyoto Protocol (annex to decision 20/CMP.1, in conjunction with decision 4/CMP.11) in the 2019 review report (FCCC/ARR/2019/KAZ, chap. VI and tables 9–10 of annex IV). The emissions for the subcategory have not been recalculated since the 2019 resubmission and the Party continues to use the notation key "NA" for venting across the time series without any explanation in the NIR, suggesting a possible underestimation of emissions. The Party estimated the CO_2 and CH_4 emissions from flaring for the entire time series but reported inconsistent quantities and measurement units regarding the combined flaring AD (e.g. the amount of flared oil and natural gas for 2019 is 792 t in CRF table 1.B.2 but 0.79 10^6 m^3 in NIR table 3.34 (section 3.5.4.8, p.160)). There is also an unexplained rapid downward trend in the reported AD from 2013 onward. During the review, the Party confirmed that the AD time series for flaring is consistent with the source data.
E.72	1.B.2.c Venting and flaring – oil and natural gas – CO_2 and CH_4 (E.73, 2019) Transparency	Include in the NIR a transparent and detailed explanation of the methodology used to determine the AD and EFs for the estimates and provide the conversion factors used to estimate emissions of CO_2, CH_4 and N_2O from flaring of oil and natural gas for subcategory 1.B.2.c.2.iii flaring – combined.	Not resolved. The ERT noted that the Party reported AD and CO_2, CH_4 and N_2O emissions from flaring of oil and natural gas for subcategory 1.B.2.c.2.iii flaring – combined. However, the ERT was not able to identify in the NIR or in CRF table 1.B.2 the description of the AD and EFs, including the conversion factors (e.g. calorific values and density of the oil and natural gas) used by the Party to estimate emissions for this subcategory, apart from AD for flaring during natural gas production (e.g. 0.79 10^6 m^3 reported in NIR table 3.34 (section 3.5.4.8, p.160) for 2019). The ERT noted that similar values using different units of measurement are reported under subcategory 1.B.2.b other for natural gas and under subcategory 1.B.2.c.iii combined for flaring, namely 792.00 kt and 792 t, respectively. During the review, the Party stated that it will include a new section in its NIR to cover the disaggregation of fuels and the methodology used to determine the AD and EFs for combined flaring.

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E.73	1.C CO_2 transport and storage – CO_2 (E.56, 2019) (E.44, 2017) (E.57, 2016) Convention reporting adherence	Estimate CO_2 emissions for this category or ensure the correct use of notation keys in CRF table 1.C, and include a category-specific discussion in the NIR for this activity, in accordance with paragraph 50 of the UNFCCC Annex I inventory reporting guidelines.	Not resolved. The Party continued to use the notation key "NA" to report CO_2 emissions for category 1.C.2 injection and storage and for all associated relevant information, such as the AD and IEFs. The NIR did not contain any information on category 1.C CO_2 transport and storage or a category-specific discussion. During the review, the Party explained that the issue will be addressed as part of the improvement plans for the inventory as a whole once sufficient information is available.
IPPU			
I.1	2. General (IPPU) – CO_2 (I.1, 2019) (I.1, 2017) (I.1, 2016) (I.1, 2015) (49, 2013) (69, 2012) Transparency	Strengthen the QA/QC processes to ensure correct use of notation keys and consistency of the information provided in the inventory submission. Explain in CRF table 9(a) in which category the emissions reported as "IE" are included.	Addressing. The ERT noted that the QA/QC processes have been strengthened to improve the correct use of notation keys and consistency of the information provided in the annual submission. The Party has further enhanced the reporting in CRF table 9 by listing the categories where the notation key "NE" has been used (2.C.1.b pig iron and 2.G.3.a medical applications) and adding explanations for the use of the notation key "IE" for CO_2 emissions from coke production under subcategory 2.C.1.f other that are allocated under the energy sector in line with previous ERT recommendations. Meanwhile, the ERT noted that incorrect use of notation keys is still occurring, in particular for category 2.F product uses as substitutes for ozone-depleting substances. For example, in CRF table 2(II).B-Hs2, the notation key "NO" was used for the AD (filled into new manufactured products, in operating systems (even if relevant emissions were reported) and remaining in products at decommissioning) and for the IEFs (product manufacturing factor, product life factor and disposal loss factor) when emissions were reported. During the review, the Party drew attention to its efforts to ensure completeness in the reporting in CRF table 9.
I.2	2. General (IPPU) – CO_2 and HFCs (I.2, 2019) (I.2, 2017) (I.10, 2016) (I.10, 2015) Convention reporting adherence	Strengthen the QA/QC procedures and update all comments in the CRF tables, and make the reporting consistent between the NIR and the CRF tables of the same submission.	Addressing. The ERT noted that QA/QC procedures for the IPPU sector have been strengthened, and comments in the CRF tables have been updated and are mostly consistent with the NIR. The ERT noticed, however, some discrepancies, such as the AD for subcategory 2.C.1.b pig iron being reported as 3,165.14 kt in CRF table 2(I).A-Hs2 but as 3,208.7 kt in the NIR (table 4.15, p.197) for 2019. During the review, the Party clarified that an error was made when completing NIR table 4.15 (section 4.4.1.1, p.197). Pig iron production in Kazakhstan amounted to 3,165.14 kt in 2019 and the calculation of CO_2 emissions from pig iron production for 2019 was based on this value. The discrepancy will be corrected in the next annual submission.
I.3	2. General (IPPU) – CO_2, CH_4 and N_2O (I.3, 2019) (I.3, 2017) (I.11, 2016) (I.11, 2015) Transparency	Include the relevant AD descriptions in CRF table 2(I).A-H in order to improve the comparability and transparency of reported data.	Not resolved. The Party has not reported the AD descriptions in CRF table 2(I).A-H. During the review, the Party clarified that it will aim to make the necessary changes when compiling the next annual submission.
I.4	2. General (IPPU) (I.4, 2019) (I.4, 2017)	Apply the structure and names of the inventory categories in the NIR following the UNFCCC	Addressing. The ERT noted that the structure and inventory category names in the NIR are mostly consistent with the 2006 IPCC Guidelines and follow the UNFCCC

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	(I.12, 2016) (I.12, 2015) Convention reporting adherence	Annex I inventory reporting guidelines, as per decision 24/CP.19.	Annex I inventory reporting guidelines. There are no instances of wrong category names as there were previously, for example "solvents and other product use". However, there were some minor inconsistencies detected in the NIR structure, for example for the metal industry. The Party did not include a specific section in the NIR dealing with category 2.E electronics industry and the description of category 2.G.3 N_2O from product uses is still included in the NIR under category 2.D non-energy products from fuels and solvent use (section 4.8.1, p.224). Similarly, Kazakhstan reported information on categories 2.C.4 magnesium production (NIR section 4.5, pp.216–217), 2.C.5 lead production (NIR section 4.6, pp.217–220) and 2.C.6 zinc production (NIR section 4.7, pp.220–224) as separate categories in the NIR structure and not as subcategories under category 2.C metal industry (NIR section 4.4, pp.195–216). During the review, the Party stated that it had attempted to follow the structure and titles of the inventory categories in the NIR in accordance with the UNFCCC Annex I inventory reporting guidelines and noted that it would consider this feedback when compiling its next annual submission.
I.5	2. General (IPPU) (I.5, 2019) (I.25, 2017) Convention reporting adherence	Report in the NIR, for the key categories identified by the trend or level, an explanation if the recommended methods from the appropriate decision trees in the 2006 IPCC Guidelines are not used, as required by the UNFCCC Annex I inventory reporting guidelines, paragraph 50(c).	Addressing. The Party reported in its NIR (section 4.2.4.3.1, p.183) an explanation as to why the recommended methodology (tier 2) from the appropriate decision tree in the 2006 IPCC Guidelines (vol. 3, chap. 2, figure 2.4, p.2.35) was not used for the key category 2.A.4 other process uses of carbonates. However, the Party has not included a similar explanation for category 2.F.1 refrigeration and air conditioning. During the review, the Party clarified that the recommended methods from the corresponding decision trees in the 2006 IPCC Guidelines were applied for key categories. Kazakhstan would further consider including an explanation where the recommended methods from the appropriate decision trees in the 2006 IPCC Guidelines are not used.
I.6	2. General (IPPU) (I.6, 2019) (I.26, 2017) Transparency	Provide the description of the recalculations of emissions in the IPPU sector in accordance with the UNFCCC Annex I inventory reporting guidelines, paragraphs 43–45, and report in the NIR the reasons for recalculations, the assessment of the impact of recalculations on GHG emission trends, and changes of calculation methods, AD and EFs.	Addressing. The Party has reported in the NIR the recalculations made under the relevant section for each subcategory (sections 4.2.1.5 (p.172), 4.2.2.5 (pp.174–175), 4.2.3.5 (p.177), 4.2.4.1.5 (p.180), 4.2.4.2.5 (p.182), 4.2.4.3.5 (pp.187–188), 4.3.1.5 (p.191), 4.3.2.5 (p.193), 4.3.3.5 (pp.194–195), 4.4.1.5 (pp.206–207), 4.4.2.5 (p.210), 4.4.3.5 (p.216), 4.6.5 (p.220), 4.7.5 (p.224), 4.8.2.5 (p.226), 4.8.3.5 (p.228), 4.8.5.5 (p.232), 4.8.6.4 (p.233), 4.8.7.4 (p.234), 4.9.3.11 (p.252) and 4.11.4 (p.259)). However, Kazakhstan has not provided sufficiently detailed information in all categories for the recalculations applied. For example, NIR section 4.9.3.11 (p.252) refers to recalculations made throughout category 2.F.1 without providing details such as the years covered, the assessment of the impact of recalculations on emission trends, or changes of calculation methods, AD and EFs. The section does not mention, for example, the recalculation of fluorinated gas emissions from domestic refrigeration for 2017–2018 detected in CRF table 2(II).B-Hs2.
I.7	2.A.1 Cement production – CO_2	Provide the same detailed information about lime content in clinker and the CKD correction	Resolved. The Party reported in its NIR (section 4.2.1.1, table 4.2, p.170) information on the constant value of CaO content in clinker and on the CKD correction factor values used for the entire time series. Although the information is not provided at the

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	(I.7, 2019) (I.5, 2017) (I.2, 2016) (I.2, 2015) (50, 2013) Transparency	factor for all the years in the time series as has been provided in the NIR for 2011.	same level of detail as in the 2011 submission, namely at the plant level, during the review, Kazakhstan clarified that, owing to a lack of historical data at cement plants, it is not possible to obtain detailed information on the lime content in clinker and the CKD correction factor for all years of the time series for individual cement plants. The ERT accepted this explanation.
I.8	2.A.1 Cement production – CO_2 (I.8, 2019) (I.6, 2017) (I.13, 2016) (I.13, 2015) Accuracy	Strengthen the QA/QC procedures and correct the value for CKD used to estimate the 2011 emissions, and provide in the NIR the same detailed information as for 2014 for all the years in the time series, in order to explain the large variations in the IEFs across the time series.	Resolved. The ERT noted that the value for CKD used to estimate the emissions for 2011 has been corrected and a constant value (1.02) in combination with a country-specific CaO content of clinker (65.72 per cent) was applied across the time series (section 4.2.1.2, p.171). Consequently, the CO_2 IEF for this category has been reported with a constant value for the entire time series (0.526 t/t) (see ID#s I.7 above and I.13 below).
I.9	2.A.1 Cement production – CO_2 (I.9, 2019) (I.27, 2017) Transparency	Provide in the NIR clear and consistent information on the AD, CKD correction factor and methods used for CO_2 emission estimates for category 2.A.1 cement production, and include clarifications on changes to the methods and AD sources for 2000 onward.	Addressing. The Party reported in its NIR (section 4.2.1, pp.169–172) information on the AD, CKD correction factor and methods used for CO_2 emissions for category 2.A.1 cement production. The time series was recalculated for the 2020 submission and relevant explanations were included in section 4.2.1.5 (p.157) of the 2020 NIR. The ERT noted that the recalculations under this category resulted in an increase in emissions of 7.65 per cent for 2017 (by 271.28 kt, which is equivalent to 0.07 per cent of the total emissions). The entire time series was recalculated to use a single data source, namely the Bureau of National Statistics data, and a tier 2 methodology applied across the 1990–2019 time series. However, there is no information on the methodology used to define the country-specific value of the CaO content in clinker (65.72 per cent). During the review, the Party clarified that the country-specific value was obtained as an average value of the CaO content in clinker for all years of the time series according to data from clinker plants in Kazakhstan. The Party further noted that the comments of the ERT will be taken into account to provide more information in the NIR sections on category description and methodological approaches in its next annual submission.
I.10	2.A.1 Cement production – CO_2 (I.11, 2019) (I.29, 2017) Accuracy	Determine the average fraction of clinker in cement for 2000–2015 and use this value for revising the clinker production for 1990–1999 if the technologies for cement production and types of cement produced in Kazakhstan were similar to the current state. Otherwise, the use of the default value of clinker share in cement (0.75) is appropriate to estimate emissions for 1990–1999.	Resolved. According to the 2020 NIR (section 4.2.1.1, pp.153–155) the default value of clinker share in cement (0.75) was used to estimate emissions for 1990–1999, but in the 2020 submission the value of cement was replaced by a clinker production value across the time series. The Party reported in its current NIR (section 4.2.1.2, p.171) that emissions from cement production were estimated using a tier 2 method from the 2006 IPCC Guidelines (vol. 3, chap. 2, pp.2.9–2.10). The AD on the volume of clinker production obtained from the Bureau of National Statistics were used across the entire time series.
I.11	2.A.1 Cement production – CO_2	Clarify whether export and import of clinker occurred in 1990–1999 and take this information into consideration for the	Resolved. The ERT noted that the Party has changed its approach to estimating the CO_2 emissions for the category (see ID# I.10 above) and clinker production data from

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	(I.12, 2019) (I.29, 2017) Accuracy	calculation of clinker production in Kazakhstan for the estimates for category 2.A.1 cement production.	the Bureau of National Statistics are used as AD across the entire time series, making corrections for export and import of clinker for 1990–1999 unnecessary.
I.12	2.A.1 Cement production – CO_2 (I.50, 2019) Transparency	Correct the discrepancy in the CaO content in clinker values in the NIR.	Resolved. According to the NIR (table 4.2, p.170), the same CaO content in clinker value (65.72 per cent) was used across the time series.
I.13	2.A.1 Cement production – CO_2 (I.50, 2019) Transparency	Include in the NIR an explanation for the large variations in the CO_2 IEFs across the time series.	Resolved. There were no large variations in the CO_2 IEF (0.526 t/t) after the recalculation of the emissions in the 2020 submission following a tier 2 approach, apart from a technical mistake for 2003 (0.520 t/t instead of 0.526 t/t).
I.14	2.A.2 Lime production – CO_2 (I.14, 2019) (I.31, 2017) Transparency	Improve the transparency of the information on the category 2.A.2 lime production in the NIR by providing the list of industries where the lime is produced and which are included in the aggregated data on lime production in Kazakhstan (e.g. pig iron and steel plants, copper plants, construction industry, sugar plants, etc.) and clarify, based on the procedures used for the compilation of national statistics, whether non-marketed lime production is included in the total national lime production used for the CO_2 emission calculation for the category.	Addressing. The Party clarified in the NIR (category 4.2.2.1, pp.172–173) and during the review that, according to the procedures used for the compilation of national statistics, the data from the Bureau of National Statistics, which were used for the estimates, include all aggregated national data (including non-marketed lime). However, the Party did not report in the NIR detailed information on industries where lime is produced and which are included in the aggregated data on lime production.
I.15	2.A.2 Lime production – CO_2 (I.15, 2019) (I.32, 2017) Transparency	Include in the NIR clear information on the fact that statistical data on lime production used for the calculations for the submission by 15 April each year could be revised by the Bureau of National Statistics after the inventory submission and, if that is the case, recalculated subsequently.	Resolved. The Party referred in the NIR (section 4.2.2.5, p.174) to the legal basis for possible statistical revisions of lime production data after the official submission of the annual GHG inventory. Article 18.1 of the amendment of 5 November 2018 to the State Statistics Act of 19 March 2010 (see https://online.zakon.kz/Document/?doc_id=30605510 (in Russian)) calls for a revision of published official statistical information where the methodology has changed, on the basis of updated, documented information in a manner to be determined by the appropriate authorized body.
I.16	2.A.4 Other process uses of carbonates – CO_2 (I.19, 2019) (I.35, 2017) Accuracy	Estimate CO_2 emissions for category 2.A.4.a ceramics by using available data on production of ceramic bricks, refractory products, home ceramics products and ceramic tiles and total carbonate content in these products and	Resolved. The Party reported in its NIR (section 4.2.4.1.1, pp.177–178) that the estimates for the category include the assessment of CO_2 emissions from the production of ceramic bricks, facade ceramic tiles and ceramic household products. Since this is not a key category, the emissions were estimated using a tier 1 methodology, equation 2.14 and default CO_2 EFs from the 2006 IPCC Guidelines (vol.

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		equation 2.14 in volume 3 of the 2006 IPCC Guidelines.	3, chap. 2, p.2.34). The ERT noticed in the NIR (section 4.2.4.1.2, p.178) that the Party updated the carbonate content in clay from 1 per cent (as in its 2019 submission) to 10 per cent in line with the 2006 IPCC Guidelines (vol. 3, chap. 2, p.2.34). The updated values resulted in an increase in estimated CO_2 emissions for this subcategory by 900 per cent (or 50.87 kt CO_2 for 2017).
I.17	2.A.4 Other process uses of carbonates – CO_2 (I.20, 2019) (I.35, 2017) Accuracy	Calculate the mass of ceramic bricks production (e.g. using the densities provided in the "Interstate Standard GOST 530-2012. Ceramic bricks and stones. General technical conditions") and the clay consumption for ceramics product production using the default loss factor provided in the 2006 IPCC Guidelines (vol. 3, chap. 2, section 2.5.1.3) and the default content of carbonates provided in the 2006 IPCC Guidelines (vol. 3, chap. 2, section 2.5.1.1), if country-specific values are not available.	Resolved. The Party recalculated its CO_2 emissions for this category using a tier 1 method (see ID# I.16 above), applying the default loss factor and the default content of carbonates provided in the 2006 IPCC Guidelines (vol. 3, chap. 2, section 2.5.1.3, p.2.36 and section 2.5.1.1, pp.2.34–2.35, respectively).
I.18	2.A.4 Other process uses of carbonates – CO_2 (I.51, 2019) Accuracy	Revise the estimates of CO_2 emissions for subcategory 2.A.4.a ceramics using the default value for carbonate content in clay (10 per cent) provided in the 2006 IPCC Guidelines (vol. 3, chap. 2, p.2.34).	Resolved. The Party recalculated its CO_2 emissions for this category using a tier 1 approach (see ID# I.16 above) and the default value for carbonate content in clay (10 per cent) provided in the 2006 IPCC Guidelines (vol. 3, chap. 2, p.2.34).
I.19	2.B.1 Ammonia production – CO_2 (I.22, 2019) (I.9, 2017) (I.16, 2016) (I.16, 2015) Accuracy	Move to a tier 2 method to calculate CO_2 emissions from ammonia production, based on the amount of natural gas used and ensure consistent reporting of the category across the time series.	Addressing. The Party continues to report the CO_2 emissions from ammonia production using a tier 1 method and explained in its NIR (section 4.3.1, p.188) that the only operating ammonia plant in the county, KazAzot JSC, cannot provide the data required for the tier 2 method on the volume of consumption of natural gas for the entire time series, since the plant was established in 2005. During the review, the Party clarified that there are only small volumes of ammonia production in the country and GHG emissions do not exceed 500 kt CO_2 eq, so, as this is not a key category, it decided to calculate emissions using a tier 1 method. The Party further clarified it has contacted KazAzot JSC regarding the issue and explained that the data on ammonia production are confidential. The ERT noted that there are several splicing techniques available in the 2006 IPCC Guidelines (vol. 1, chap. 5, section 5.3, pp.5.8–5.14) that can be used for estimating missing AD where it is not possible to use the same method or data source for all years of the time series.
I.20	2.B.1 Ammonia production – CO_2 (I.23, 2019) (I.37, 2017) Transparency	Include in the NIR clear information on the fact that statistical data on ammonia production used for the calculations for the submission by 15 April each year could be revised by the Bureau of National Statistics after the inventory	Resolved. See ID# I.15 above.

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		submission and, if that is the case, recalculated subsequently.	
I.21	2.B.2 Nitric acid production – N_2O (I.52, 2019) Consistency	Clarify with the nitric acid production company the actual data on nitric acid production for 2015 and, if necessary, recalculate N_2O emissions for category 2.B.2 nitric acid production using correct AD for the next annual submission.	Resolved. The Party corrected the AD for nitric acid production for 2015 reported in CRF table 2(II).B-Hs1 from 621.68 kt to 261.68 kt in line with the data provided on the website of KazAzot JSC, the only nitric acid production company in Kazakhstan. The revision led to a reduction by 57.9 per cent of N_2O emissions for 2015.
I.22	2.B.5 Carbide production – CO_2 (I.25, 2019) (I.10, 2017) (I.4, 2016) (I.4, 2015) (52, 2013) Transparency	Explore the use and potential imports or exports of calcium carbide and revise the EF, if necessary.	Resolved. There were no revisions to the CO_2 EF applied to the category and the IEF (0.79 t/t for 2019) continues to be the lowest of all reporting Parties. However, more information was included in the NIR (section 4.3.3.1, p.193), indicating that the only producer of calcium carbide in the country is Temirtau Electrometallurgical Plant JSC. The majority of the calcium carbide produced is exported to Georgia, Romania, the Russian Federation, Ukraine and countries in Central Asia. In Kazakhstan, calcium carbide is mainly used for desulfurization of cast iron, which is not an emissive process.
I.23	2.B.5 Carbide production – CO_2 (I.26, 2019) (I.39, 2017) Transparency	Transparently report in the NIR the EFs and AD used for the CO_2 emission estimates for category 2.B.5 carbide production and continue estimating CO_2 emissions for this category using the actual data on coke consumption for carbide production available from the production plant and the corresponding EF from the 2006 IPCC Guidelines (vol. 3, table 3.8).	Resolved. The Party reported in its NIR (section 4.3.3.2, pp.193–194) that the calculation of CO_2 emissions from the production of calcium carbide was carried out by applying a tier 2 method with the volume of the reducing agent used and the default CO_2 EF of 1.70 t CO_2/t raw material used for the reducing agent (coke) in line with the 2006 IPCC Guidelines (vol. 3, chap. 3, table 3.8).
I.24	2.C.1 Iron and steel production – CO_2 (I.27, 2019) (I.11, 2017) (I.17, 2016) (I.17, 2015) Transparency	Include in the NIR a justification for the decreasing trend of the CO_2 IEF since 2012.	Resolved. The ERT noted that the Party has updated the CO_2 IEF for pig iron to a constant value across the time series (1.64 t/t).
I.25	2.C.1 Iron and steel production – CO_2 and CH_4 (I.28, 2019) (I.13, 2017) (I.19, 2016) (I.19, 2015) Accuracy	Investigate the ratio of sinter + pellets to steel + pig iron and describe the reasons for the observed ratio in the NIR, including the possibility of exports of sinter and/or pellets, which could explain the ratio; and review the AD for the whole time series, if found necessary.	Addressing. The NIR (section 4.4.1.2.4, pp.203–204) indicates that, for ore producers, supplies to the domestic market do not normally exceed 5–10 per cent of the total volume of commodity shipments of concentrate, sinter ore and pellets, while the rest is sent to metallurgical companies in China and the Russian Federation. However, the ratios and a description of the reasons for the observed ratios were not provided in the NIR. During the review, the Party provided a table that includes information on the ratio of sinter + pellets to steel + pig iron and provided information on the comparative analysis. The Party confirmed that it will include detailed information, including the aforementioned table, in its next annual submission.

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I.26	2.C.1 Iron and steel production – CO_2 (I.29, 2019) (I.41, 2017) Transparency	Include in the NIR clear descriptions of the method, AD and EFs used in the emission estimates for subcategory 2.C.1.a steel in accordance with paragraph 50(a–b) of the UNFCCC Annex I inventory reporting guidelines.	Addressing. According to the NIR (section 4.4.1.5, pp.206–207), the methodology for the category has been changed from tier 1 to tier 2. The Party makes reference in its NIR (section 4.4.1.2, p.198) to the method and AD used in the emission estimates for subcategory 2.C.1.a steel without any details as to how the tier 2 approach was applied or the AD used. The NIR does not specify how the AD from the largest steel production company, ArcelorMittal Temirtau JSC, and from the national statistics are used in the estimates, nor does it provide the EF used. During the review, the Party stated that all ERT comments will be taken into account to produce more detailed reporting for this category in its next annual submission.
I.27	2.C.1 Iron and steel production – CO_2 (I.30, 2019) (I.42, 2017) Transparency	Provide in the NIR clear and complete information on the method, AD and EFs used for the estimates of pig iron and ensure consistency of this information with the information reported in the CRF tables.	Addressing. The Party reported recalculated emissions for the category (see ID# I.26 above) and provided in its NIR (section 4.4.1.2.1, pp.198–199) overall information on the method and AD used to estimate CO_2 emissions from pig iron production. Kazakhstan has moved to using a tier 3 method from the 2006 IPCC Guidelines (vol. 3, chap. 4, section 4.2.2, p.4.18) and the recalculations are explained, with data provided in NIR table 4.16 (section 4.4.1.2.1, p.199). The CO_2 emission values in NIR table 4.16 are consistent with those in the CRF tables, but the EF for the category is specified as default in CRF Reporter and there is no description of the AD used in CRF table 2(I).A-Hs2. During the review, the Party stated that the comments of the ERT will be taken into account to produce more detailed reporting for this category and ensure consistency with the CRF tables in its next annual submission.
I.28	2.C.1 Iron and steel production – CO_2 (I.32, 2019) (I.44, 2017) Transparency	Revise the description of category 2.C.1 in the NIR to improve the transparency of the inventory by providing a clear statement that direct reduced iron production is not occurring in the country, including relevant references to the existing iron and steel plants.	Addressing. The Party continues to report the notation key “NO” in CRF table 2(I).A-Hs2 without providing justification in the NIR (section 4.4, pp.195–216) that there is no production of direct reduced iron in the country. During the review, the Party confirmed that no direct reduced iron production takes place in the country and that it will provide more detailed information for this category in its next annual submission.
I.29	2.C.1 Iron and steel production – CO_2 (I.33, 2019) (I.45, 2017) Accuracy	Collect AD for fuels, reducing agents (coke breeze) and limestone used for sinter production, revise the CO_2 emission estimates for category 2.C.1.d sinter for the complete time series using tier 2 or 3 methods from the 2006 IPCC Guidelines and demonstrate that emissions from fuels used for sinter production are excluded from the energy sector.	Addressing. The Party reported in its NIR (section 4.4.1.2.3, pp.201–203) and confirmed during the review that CO_2 emissions for subcategory 2.C.1.d sinter were estimated using a tier 2 method from the 2006 IPCC Guidelines (vol. 3, chap. 4, section 4.2.2.2, pp.4.22–4.23) on the basis of data provided by ArcelorMittal Temirtau JSC. During the review, Kazakhstan further clarified that the volumes of consumption of limestone and dolomite for the production of sinter were submitted by the only integrated enterprise for the production of sinter in the country, ArcelorMittal Temirtau JSC. The CO_2 emissions from sinter production consisted of emissions from coke breeze used in sinter production and emissions from natural gas consumed for sinter production. However, the ERT noted that the Party did not demonstrate in the NIR that emissions from fuels used for sinter production were excluded from reporting in the energy sector and therefore concluded that the recommendation has not yet been fully addressed.

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I.30	2.C.1 Iron and steel production – CO_2 (I.34, 2019) (I.46, 2017) Transparency	Collect AD for fuels (natural gas), reducing agents and limestone used for pellet production, revise the CO_2 emission estimates for category 2.C.1.e pellet for the complete time series using tier 2 or 3 methods from the 2006 IPCC Guidelines and demonstrate that emissions from fuels used for pellet production are excluded from the energy sector.	Addressing. The ERT noted that CO_2 emissions for subcategory 2.C.1.e pellet are estimated using a tier 2 method from the 2006 IPCC Guidelines (vol. 3, chap. 4, section 4.2.2.2, pp.4.22–4.23) and the emissions for the entire time series have been recalculated (NIR section 4.4.1.5, pp.206–207). The ERT noted that the recalculations resulted in increased emissions for 2017 by 255.18 per cent (or 267.06 kt). However, the Party has not included information explaining that emissions from fuels used for pellet production are excluded from the energy sector and the NIR provides no information on the quantity of AD for fuels (natural gas), reducing agents or limestone used for pellet production, but does state in section 4.4.1.2.4 (p.203) that the main pellet producer in the country, the Sokolov-Sarybai Mining Production Association JSC, provided data on the volume of pellet production (section 4.4.1.2.3, table 4.20), taking into account the volume of natural gas used for the production of pellets for the entire time series. This was confirmed during the review and the Party further clarified that it will take the comments of the ERT into account and provide more detailed information for this category in its next annual submission.
I.31	2.C.1 Iron and steel production – CO_2 and CH_4 (I.35, 2019) (I.47, 2017) Transparency	Provide in the NIR clear and documented information justifying that CO_2 and CH_4 emissions from coke production are not double counted under categories 2.C.1 iron and steel production, 1.A.1.b pig iron and 1.A.2.a iron and steel.	Addressing. The ERT noted that CO_2 and CH_4 emissions from coke production were reported under subcategory 2.C.1.f other using the notation key "IE" and were included in the energy sector under category 1.A.2.a iron and steel. This explanation is included for CO_2 in CRF table 9 and in the NIR (section 4.4.1.2.1, p.198). However, the NIR contains no clear statement or explanation as to how double counting is prevented for emissions from coke production under categories 2.C.1 iron and steel production in the IPPU sector and 1.A.2.a iron and steel in the energy sector. The ERT noted that the statement in the NIR (section 4.4.1.2.1, p.198) does not refer to CH_4 emissions. During the review, the Party clarified that, in its next annual submission, it will state that CO_2 and CH_4 emissions from coke production are not included in category 2.C.1 iron and steel production, but are included in the energy sector.
I.32	2.C.2 Ferroalloys production – CO_2 (I.36, 2019) (I.14, 2017) (I.5, 2016) (I.5, 2015) (53, 2013) Transparency	Further improve transparency by providing the AD disaggregated by type of ferroalloy for the entire time series.	Resolved. The Party reported in its NIR (table 4.24, pp.210–2011) production volumes by type of ferroalloy for the entire time series.
I.33	2.C.2 Ferroalloys production – CO_2 (I.37, 2019) (I.48, 2017) Transparency	Include in the NIR clear descriptions of the method, AD and EFs used for the emission estimates for category 2.C.2 ferroalloys production in accordance with paragraph 50(a–b) of the UNFCCC Annex I inventory reporting guidelines.	Addressing. The Party reported in its NIR (section 4.4.2, pp.207–211) a description of category 2.C.2 ferroalloys production, including the method (tier 2), AD (table 4.23, pp.208–209) and EFs used. The ERT noted that the Party reported that a reducing agent emission coefficient equal to 3.3 t CO_2/t reducing agent was used to calculate CO_2 emissions for the data of TNC Kazchrome JSC. The difference in production volumes between the data of the enterprise and the Statistics Committee of the Ministry of National Economy of Kazakhstan was calculated by applying the default CO_2 EF of 1.6 t CO_2/t for ferroalloys from table 4.5 of the 2006 IPCC Guidelines (vol.

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			3, chap. 4, p.4.37). However, the Party did not explain in the NIR on what basis the EFs used were chosen.
I.34	2.C.3 Aluminium production – CO_2 (I.38, 2019) (I.16, 2017) (I.21, 2016) (I.21, 2015) Convention reporting adherence	Improve the reporting of information on aluminium technology and parameters provided in the NIR and strengthen the QA/QC procedures in preparing the report with a view to eliminating internal inconsistencies in the NIR.	Addressing. The Party reported in its NIR (section 4.4.3, pp.211–216) information on category 2.C.3 aluminium production, including the technology and parameters of aluminium production in the country. However, the ERT noted that there is an incorrect reference in the NIR (section 4.4.3.2, p.214) to equation 4.17 of the 2006 IPCC Guidelines (vol. 3, chap. 4, p.4.34) which relates to CO_2 emissions for ferroalloys production using a tier 3 method, whereas the correct reference should be to equation 4.21 of the 2006 IPCC Guidelines (vol. 3, chap. 4, p.4.45), which relates to CO_2 emissions from prebaked anode consumption (tier 2 and 3 methods).
I.35	2.C.3 Aluminium production – CO_2 (I.39, 2019) (I.50, 2017) Completeness	Estimate CO_2 emissions associated with anode baking furnaces using the tier 2 or 3 methods from the 2006 IPCC Guidelines and report these emissions in the CRF tables with relevant and detailed explanations in the NIR.	Resolved. The ERT noted that CO_2 emissions associated with anode baking furnaces were estimated by the Party in its 2020 submission, following the tier 2 method from the 2006 IPCC Guidelines (vol. 3, chap. 4, section 4.4. equations 4.21–4.23, pp.4.45–4.46) and using plant-specific data (NIR section 4.4.3.1, pp.211–214). The Party calculated two additional sources of CO_2 emissions associated with anode baking furnaces, including the combustion of volatile substances released during firing and the combustion of furnace loading material (coke). The recalculations under this category resulted in an increase in emissions by 170.06 per cent for 2017 (818.46 kt CO_2, equivalent to 0.22 per cent of the total national emissions) compared with the 2019 submission.
I.36	2.C.6 Zinc production – CO_2 (I.41, 2019) (I.17, 2017) (I.22, 2016) (I.22, 2015) Transparency	Demonstrate in the NIR that complete AD for zinc production are reported in the CRF tables, providing an explanation for any differences between the data in the CRF tables and the data on the website of the only zinc-producing company in the country using CO_2-emitting technology. If an error is identified in the AD reported in the CRF tables, recalculate the AD and update the whole time series for this category, as appropriate.	Resolved. It is explained in the NIR (section 4.7.1, pp.220–221) that the primary zinc production in Kazakhstan is carried out by hydrometallurgy, which does not produce non-energy CO_2 emissions. Secondary zinc production from Waelz keys in Waelz kilns takes place in the country at Kazzinc, which emits CO_2 and is included in the inventory. Kazzinc's share of national production is about 87 per cent (NIR section 4.7.2, p.222). The AD for CO_2 emission estimates for zinc production provided by Kazzinc based on production from Waelz-processing of zinc cakes in Waelz kilns are considered and reported in CRF table 2(I).A-Hs2 and NIR table 4.27 (pp.222–223). This explains the difference between the values used in the inventory for zinc production and the values shown on the company's website (https://www.kazzinc.com/eng/o-proizvodstve). A recalculation was performed to reflect updated data for 2018 provided by the company (NIR section 4.7.5, p.224).
I.37	2.D Non-energy products from fuels and solvent use – CO_2 and N_2O (I.42, 2019) (I.18, 2017) (I.23, 2016) (I.23, 2015) Completeness	Provide estimates for the emissions for the category or evidence to show the insignificance of this category, in accordance with decision 24/CP.19, annex I, paragraph 37(b); and include clear information of the category included under other in CRF table 2(I).A-H.	Addressing. The Party reported CO_2 emissions for category 2.D.1 lubricant use in CRF table 2(I).A-Hs2, and the NIR provides information on lubricant production (table 4.29, p.225) and the corresponding CO_2 emissions (table 2.30, p.226). The ERT noted that in CRF table 2(I).A-Hs2 the CO_2 emissions for category 2.D.2 paraffin wax use were reported using the notation key "NA" (see ID# I.38 below); CO_2 emissions for category 2.D.3 other were reported using the notation key "NO", but the notation keys are not explained in the NIR. The Party has not provided evidence for the insignificance of these categories, in accordance with decision 24/CP.19, annex I,

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			paragraph 37(b), and there is no specific section in the NIR chapter on IPPU for any possible emissions for these subcategories. During the review, the Party reiterated its constant efforts to improve the consistency and completeness of the inventory.
I.38	2.D.2 Paraffin wax use – CO_2 (I.53, 2019) Completeness	Collect AD and estimate CO_2 emissions for category 2.D.2 paraffin wax use using the default methodology provided in the 2006 IPCC Guidelines (vol. 3, chap. 5, p.5.11) or clearly demonstrate in the NIR that emissions for this category are insignificant according to paragraph 37(b) of the UNFCCC Annex I inventory reporting guidelines.	Not resolved. As indicated in ID# I.37 above, the NIR did not contain any information on category 2.D.2 paraffin wax use, and the notation key "NA" is reported in CRF table 2(I).A-Hs2. During the review, the Party clarified that paraffin is not produced in the country and no data on paraffin were found in data sources (including the Bureau of National Statistics). The ERT noted that the Party's response is related to paraffin wax production, whereas the clarification requested by the ERT is related to paraffin wax use. Further, the NIR does not include any reference to conducting additional studies on the use of paraffin wax or justification that the emissions under this category are insignificant.
I.39	2.D.3 Other (non-energy products from fuels and solvent use) – CO_2 (I.54, 2019) Completeness	Collect AD and estimate CO_2 emissions from urea-based catalytic converters using the default methodology provided in the 2006 IPCC Guidelines (vol. 2, chap. 3, p.3.12) or clearly demonstrate in the NIR that emissions from this subcategory are insignificant according to paragraph 37(b) of the UNFCCC Annex I inventory reporting guidelines.	Addressing. The Party reported in its NIR (section 3.4.5.3, p.122) accounting of urea-based catalytic converters for road transport for the first time, including the methodological approaches used, the initial data set and the estimates obtained to demonstrate the emission magnitude. However, the emissions are still not included in the inventory and no cross reference to the information on the CO_2 emissions from urea-based catalytic converters in the energy chapter of the NIR is provided under the IPPU section (see ID# I.50 in table 5).
I.40	2.F.1 Refrigeration and air conditioning – HFCs (I.43, 2019) (I.20, 2017) (I.7, 2016) (I.7, 2015) (55, 2013) Transparency	Provide a transparent explanation in the NIR to justify the choice of the notation key "NO" for years prior to 2007, or collect AD and estimate emissions of HFC-32, HFC-125 and HFC-143a from refrigeration and air-conditioning equipment for the entire time series.	Addressing. The Party revised the HFC emission estimates for category 2.F.1 refrigeration and air conditioning and reported the emissions for 1993 onward, reporting the preceding years using the notation key "NO". However, apart from for subcategory 2.F.1.e mobile air conditioning (NIR section 4.9.3.8, pp.245–251), there is no justification in the NIR that HFC emissions did not occur before 1993.
I.41	2.F.1 Refrigeration and air conditioning – HFCs (I.44, 2019) (I.21, 2017) (I.25, 2016) (I.25, 2015) Transparency	(a) Provide transparent information on methods, AD and EFs for this category; (b) Provide information on how time-series consistency is ensured for the category; (c) Provide clear information on the recalculations made across the entire time series; (d) Correct the reporting of the emissions in the CRF tables by providing data per subcategory, and clearly distinguish emissions from manufacturing, from stocks and from disposal.	(a) Addressing. The ERT noted significant progress in the provision of information in the NIR (section 4.9.3, pp.236–253) relating to HFC emission estimates in category 2.F.1 refrigeration and air conditioning, as it distinguishes between subcategories 2.F.1.a commercial refrigeration, 2.F.1.b domestic refrigeration, 2.F.1.c industrial refrigeration, 2.F.1.d transport refrigeration, 2.F.1.e mobile air conditioning and 2.F.1.f stationary air conditioning. The ERT commends the Party on the progress in the estimation of HFC emissions and the presentation of this information in the NIR. Despite these improvements, the NIR (section 4.9.3, pp.236–253) still lacks transparent information on approaches taken to estimate emissions and on the EFs and AD used. Although AD were provided for subcategories 2.F.1.d transport refrigeration and 2.F.1.e mobile air conditioning (sections 4.9.3.7, pp.244–245 and 4.9.3.8, pp.245–251, respectively), there was no explanation in the NIR as to how those AD were used to calculate HFC emission estimates. During the review, the Party explained that the emission estimates for all 2.F.1 subcategories were based on data received from

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			service companies, using the assumption that the emissions are the same as the refilled amounts. The ERT noted that the NIR contains an estimate of HFC consumption at an aggregated level (section 4.9.3.2, figure 4.4, p.238) followed by emission estimates at the subcategory level (sections 4.9.3.3–4.9.3.9, pp.239–252). The ERT considers that providing formulae explaining the calculation approach could facilitate the transparency of the emission estimates; (b) Not resolved. Although the NIR provides significant amounts of background data, the Party has not explained in its NIR how the refrigerant data collected from servicing companies were used to derive the time series of emissions for the various HFCs reported, which additional assumptions or EFs were used or how time-series consistency was ensured; (c) Not resolved. The Party reported recalculations across the entire time series and for all subcategories. There is general information on the recalculations in the 2020 NIR (section 4.9.3.11, p.234) and the current NIR (section 4.9.3.11, p.252). However, no details were given on the changes made to the AD, methodology or assumptions used, and there is no specific information on the years affected or any information disaggregated by subcategory and/or gas; (d) Not resolved. The ERT further noted that only emissions from stocks were reported in the CRF tables (see ID# I.42 below) and that across the entire time series HFC emissions under 2.F.1 reported in CRF table 2(II).B-Hs2 have no accompanying AD or IEF data, as the AD and IEFs were reported using the notation key "NO". During the review, the Party explained that HFC emissions for all 2.F.1 subcategories were estimated from data on the supply of gases needed for servicing refrigeration and air-conditioning equipment, collected from service companies at the subcategory level, using the assumption that the emissions are the same as the refilled HFC amounts. During the review, the Party shared a scientific paper (Cherednichenko et al., 2021b) describing the research and results of the recalculation of HFC emissions in category 2.F.1. However, that paper was largely consistent with the information provided in the NIR and did not provide additional insight to the ERT on the approaches, AD and EFs used for the HFC emission estimates. The Party also provided during the review a detailed spreadsheet covering the time series of HFC emission estimates at the subcategory and compressor type level and at both the refrigerant/mixture (i.e. R-404A, R-410A, R-401 and R-134a) and HFC substance level (i.e. HFC-134a, HFC-32, HFC-125 and HFC-143a). However, the spreadsheet contained only the emission and consumption estimates and did not help the ERT to understand the calculation approach or how the data collected from service companies at the subcategory level were used to derive the further disaggregated emission estimates at the compressor type level given in the spreadsheet.

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			The ERT considers that, given the calculation approach explained by the Party during the review, it would be appropriate to report AD used, equalling emissions, in CRF table 2(II).B-Hs2.
I.42	2.F.1 Refrigeration and air conditioning – HFCs (I.45, 2019) (I.51, 2017) Accuracy	Collect relevant AD (manufacturing, stocks and recovery), in particular for equipment in operation and disposal, and estimate HFC emissions for category 2.F.1 refrigeration and air conditioning by applying the corresponding method from the 2006 IPCC Guidelines; however, if that is not possible, estimate HFC emissions for this category using the techniques on data gathering presented in the 2006 IPCC Guidelines (vol. 1, chap. 2) and apply the corresponding method from the 2006 IPCC Guidelines.	Addressing. The ERT noted that recalculations of HFC emissions in category 2.F.1 were performed but that in CRF table 2(II).B-Hs2 only emissions from stocks in operating systems were reported (see ID# I.41 above). The ERT noted that emissions from manufacturing and from the disposal of equipment were reported as "NO". During the review, the Party stated that, apart from the import of ready-made refrigeration equipment, there had been some limited production of refrigeration equipment from imported components that was filled in in Kazakhstan but that the assembly line is currently not operational. Regarding the emissions from disposal, during the review, Kazakhstan described its efforts to collect data relating to the end-of-life of refrigeration and air-conditioning equipment containing HFCs and related recovery, destruction and emissions of HFCs. The Party stated that results of the effectiveness of a previous programme to recover HFCs from old refrigeration equipment are not available but that new activities in this area are planned in cooperation with the Kazakh Refrigeration Industry Association and UNDP. The ERT also noted that category 2.F.1 refrigeration and air conditioning is a key category and so, according to the decision tree in the 2006 IPCC Guidelines (vol. 3, chap. 7, figure 7.6, p.7.46), higher tier methods should be used for this category (e.g. tier 2a or 2b), which is not currently the case. The Party did not provide information on the methods used in the NIR (see ID# I.41 above) or an explanation as to why the methods used differ from the recommended methods. The ERT further noted the need for the Party to reconsider the notation key used to report emissions from disposal.
I.43	2.F.1 Refrigeration and air conditioning – HFCs (I.55, 2019) Accuracy	Continue efforts to collect accurate AD and report HFC emissions for subcategory 2.F.1.c industrial refrigeration and include in the NIR clear descriptions of the method, AD and EFs used in the emission estimates for this subcategory, in accordance with paragraph 50(a–b) of the UNFCCC Annex I inventory reporting guidelines.	Addressing. The HFC emissions for subcategory 2.F.1.c industrial refrigeration were recalculated for the 2020 submission but there were no details on the changes implemented in section 4.9.3.11 (p.234) of the 2020 NIR. In the current NIR (section 4.9.3.5, pp.241–242), the Party provided a description for subcategory 2.F.1.c industrial refrigeration and an overview for the time series of estimated HFC emissions (section 4.9.3.5, figure 4.7, p.242). However, section 4.9.3.1 of the NIR (pp.236–238) on methodological approaches for category 2.F.1 refrigeration and air conditioning does not provide transparent information on the methods, AD, EFs or underlying assumptions used to estimate HFC emissions for subcategory 2.F.1.c industrial refrigeration (see ID# I.41 above). During the review, the Party stated that it is continuing its efforts to improve the system for collecting information in conjunction with the Kazakh Refrigeration Industry Association and that improvements for the emission estimates are expected in the near future.
I.44	2.F.1 Refrigeration and air conditioning – HFCs	Calculate HFC emission estimates for subcategory 2.F.1.e mobile air conditioning using the default methodology provided in the	Addressing. The HFC emissions for subcategory 2.F.1.e mobile air conditioning were recalculated for the 2020 submission but there were no details of the implemented changes in section 4.9.3.11 of the 2020 NIR. In the current NIR (section 4.9.3.8,

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	(I.56, 2019) Accuracy	2006 IPCC Guidelines, with the EF for operation emissions from mobile air conditioning taken from the default range (2006 IPCC Guidelines, vol. 3, chap. 7, table 7.9, p.7.52), and accurate AD, including HFC emissions from disposal (end-of-life) if relevant, and provide transparent and detailed information in the NIR on the method, AD and other parameters used in the calculations (e.g. assumptions on the percentage of vehicles sold with air conditioning among the total number of vehicle registrations and the average HFC charge of mobile air conditioners or other relevant documentation), in addition to reporting relevant AD and IEF values in CRF table 2(II).B-H.	pp.245–251), the Party provided information on AD (passenger cars equipped with an air conditioning system) and assumptions on specific refrigerant charges. However, other parameters, such as EFs and the method used to calculate HFC emissions, were not explained. No AD or IEFs for the category, nor any HFC emissions from disposal are reported in CRF table 2(II).B-Hs2. The ERT noted that emissions presented in the NIR (section 4.9.3.8, figure 4.11, p.251) and labelled as potential emissions are not consistent with the emission estimates given in CRF table 2(II).B-Hs2. For example, potential emissions given in the NIR for 2011–2019 are higher by a factor of approximately 20 than the emissions reported in the CRF tables. During the review, the Party provided additional information as described in ID# I.41 above. Nevertheless, the ERT was not able to assess whether or not methodologies provided in the 2006 IPCC Guidelines were used, or whether or not accurate AD were used and EFs for operation emissions from mobile air conditioning are within the default range (2006 IPCC Guidelines, vol. 3, chap. 7, table 7.9, p.7.52).
I.45	2.F.1 Refrigeration and air conditioning – HFCs (I.57, 2019) Accuracy	Calculate HFC emission estimates for category 2.F.1 refrigeration and air conditioning using the methodology provided in the 2006 IPCC Guidelines, in particular for subcategories 2.F.1.a commercial refrigeration and 2.F.1.f stationary air conditioning, ensuring the use of accurate AD, and include HFC emission estimates by gas for the refrigerant blends used in Kazakhstan, ensuring, in particular, that HFC-125 is included.	Addressing. The ERT noted that the category was subject to adjustment in accordance with the guidance for adjustments under Article 5, paragraph 2, of the Kyoto Protocol (annex to decision 20/CMP.1, in conjunction with decision 4/CMP.11) in the 2019 review report (FCCC/ARR/2019/KAZ, chap. VI and tables 11–12 of annex IV) owing to the underestimation of the HFC-125 emissions reported using the notation key "NO". The ERT noted the improvements made for the current annual submission. In its 2020 submission, the Party recalculated its emissions for 1993–2018 for category 2.F.1 refrigeration and air conditioning, in particular HFC emissions for subcategories 2.F.1.a commercial refrigeration (recalculated for 1995–2018 and now including emissions from HFC-125, previously reported as "NO") and 2.F.1.f stationary air conditioning (recalculated for 1997–2018 and now including emissions from HFC-125, previously reported as "NO"). The Party reported on the recalculation in its 2020 NIR (section 4.9.3.11, p.234) and current NIR (section 4.9.3.11, p.252). However, no details were provided on the changes made to the AD, methodology or assumptions used and there was no specific information on the subcategories and gases affected by the recalculations. Furthermore, in the NIR (section 4.9.3, pp.236–253) the Party did not explain transparently the calculation approach applied for all 2.F.1 subcategories (see ID# I.41 above). During the review, the Party provided additional information, as described in ID# I.41 above. Nevertheless, the ERT was not able to assess whether or not methodologies provided in the 2006 IPCC Guidelines were used and whether accurate AD were used.
I.46	2.F.1 Refrigeration and air conditioning – HFCs	Provide transparent and detailed information in the NIR on the method, AD and other parameters used for the emission estimates, including transparent information on the types	Addressing. The Party reported in the NIR (section 4.9.3.2, pp.238–239) a matrix covering the subcategories of category 2.F.1 refrigeration and air conditioning, types of compressors and refrigerants used. However, in the NIR (section 4.9.3, pp.236–253) Kazakhstan did not explain transparently the calculation approach applied for all 2.F.1

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	(I.57, 2019) Transparency	of refrigeration and/or air-conditioning applications (commercial refrigeration, domestic refrigeration, transport refrigeration or stationary air conditioning) in which the specific refrigerant blends are used.	subcategories (see ID# I.41 above). During the review, the Party provided additional information as described in ID# I.41 above but the ERT was not able to ascertain the method, AD or other parameters used for the emission estimates.
I.47	2.F.4 Aerosols – HFCs (I.58, 2019) Completeness	Collect AD and estimate CO_2 emissions for subcategory 2.F.4.a metered dose inhalers using the default methodology provided in the 2006 IPCC Guidelines (vol. 2, chap. 7, pp.7.28–7.29) or clearly demonstrate in the NIR that emissions for this subcategory are insignificant in accordance with paragraph 37(b) of the UNFCCC Annex I inventory reporting guidelines.	Resolved. In its 2020 submission, the Party provided an estimate of HFC emissions for subcategory 2.F.4.a metered dose inhalers in CRF table 2(II).B-Hs2 that covers the time series 2002–2019. The methodology and assumptions used are reported in the NIR (section 4.10, pp.253–256).
I.48	2.G.3 N_2O from product uses – N_2O (I.49, 2019) (I.52, 2017) Convention reporting adherence	Estimate N_2O emissions for subcategory 2.G.3.a medical applications and report these emissions in the next annual submission and include in the NIR information in accordance with paragraph 50(a–b) of the UNFCCC Annex I inventory reporting guidelines.	Not resolved. The Party reported AD and N_2O emissions for subcategory 2.G.3.a medical applications using the notation key "NE" in CRF table 2(I).A-Hs2. There is no section in the NIR on category 2.G.3 N_2O from product uses or any justification for the notation key used. According to CRF table 9, the Party provided preliminary estimates of N_2O emissions from the use of anaesthesia based on data from countries with similar conditions and the estimates are shown in section 4.5 (pp.216–217) of the NIR. The estimates showed that this category is not significant in accordance with decision 24/CP.19, annex I, paragraph 37(b). The ERT noted that there is no reporting of medical applications in section 4.5 (pp.216–217) of the NIR, which addresses magnesium production. During the review, the Party clarified that N_2O emissions from medical applications are not included in subcategory 2.G.3.a, but presented in category 5.C.1.2 non-biogenic waste incineration for technical reasons. The ERT suggests that the Party include a separate section in the NIR for category 2.G.3 N_2O from product uses, with a clear explanation of the magnitude of any possible emissions for the category and their allocation in the inventory, if applicable.
Agriculture			
A.1	3. General (agriculture) – CH_4 and N_2O (A.2, 2019) (A.11, 2017) Transparency	In the NIR, include information on the AD and method used to estimate CH_4 and N_2O emissions from MMS of rabbits. (For the livestock subcategories of marals, ostriches and fur animals, emissions of which are considered negligible, the provisions of paragraph 37(b) of the UNFCCC Annex I inventory reporting guidelines may be applied and relevant justifications, including preliminary estimates, should be included in the NIR.)	Resolved. The Party provided emissions of CH_4 and N_2O from MMS of rabbits in tables 5.17 (section 5.3.1.1, p.279) and 5.21 (section 5.3.2.2, p.284) of the NIR, applying tier 1 methods and default values (NIR section 5.3.1.2, pp.280–281 for CH_4 emissions, and section 5.3.2.2, p.285 for N_2O emissions from manure management). Further, Kazakhstan explained in the NIR (section 5.10, p.304) that emissions from marals, ostriches and fur animals are considered insignificant. The Party justified in the NIR (tables 5.35–5.37, pp.304–305) that these emissions are well below the significance threshold, with a total of approximately 5.04 kt CO_2 eq, and therefore not included in the annual submission.

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A.2	3.B Manure management – CH_4 and N_2O (A.13, 2019) Accuracy	Collect robust information on MMS used for all animal species for the whole time series, ensuring the representation, at a minimum, of the current and 1990 distribution of MMS, taking into account changes and progress in agriculture production systems, and use this information in the emission calculations of future annual submissions.	Not resolved. The Party reported in its NIR (table 5.25, p.286) the fraction of manure handled in each management system and this does not change over the time series. The same information is also provided in CRF table 3.B(a)s2. Kazakhstan stated in its NIR (section 5.2.2, p.271) that the distribution of animal housing systems does not vary significantly year to year but no explanation is provided for this statement. The Party also reported in the NIR (section 5.3.2.2, p.286) that information about distribution of manure by management system is based on an analysis of scientific literature, local meteorological conditions and distribution of livestock population by region and directly depends on the share of different maintenance methods. However, the ERT considers that, given the significant changes in livestock management in the 1990s, distribution of animal housing and MMS may also have changed since the 1990s. During the review, the Party explained that it has not yet conducted an expert survey on MMS for animal species that covers the entire time series but that such research will be carried out and reported in its next annual submission.
A.3	3.B.1 Cattle – N_2O (A.14, 2019) Transparency	Provide more disaggregated information regarding the contribution of different species according to age, type of production and sex (e.g. calves, bulls, heifers) in the NIR and include, if available, animal numbers for different animal species considered in the non-dairy subcategory.	Resolved. The Party has not provided more disaggregated information in its NIR (tables 5.3–5.7 (pp.266–271), 5.12 (p.274), 5.14–5.15 (pp.276–277), 5.17 (p.279), 5.19 (pp.280–281), 5.21 (p.284) and 5.23–5.25 (pp.285–286)) for different animal species under cattle in comparison with the 2019 submission and continues to report the category subdivided into dairy and non-dairy cattle. During the review, the Party clarified that it does not collect data on population size and typical animal mass of non-dairy cattle for subcategories (such as bulls or calves) and so they are not currently available for the entire time series. The ERT concluded that the Party's reporting is consistent with figure 10.1 of the 2006 IPCC Guidelines (vol. 4, chap. 10, p.10.9). The ERT considers that the Party could make further efforts to use enhanced livestock characterization, which requires at least the population size, typical animal mass and feeding situation in the different cattle subcategories over the reported time series. The Party may consider, for example, conducting an expert survey or developing estimates based on countries with similar economic and climatic conditions.
A.4	3.B.4 Other livestock – CH_4 (A.16, 2019) Accuracy	Report unrounded emission data for subcategory 3.B.4 other livestock – buffalo in the CRF tables of the next annual submission and ensure that no rounding errors are reflected in the CRF tables.	Resolved. The Party updated CRF table 3.B to include unrounded emission estimates for buffalo for the entire time series, resulting in a constant CH_4 IEF (5.00 kg CH_4/head/year) across the entire time series (with negligible deviations for 2016–2019). Kazakhstan reported in the NIR (table 5.20, p.281) for subcategory 3.B.4 other livestock – buffalo that it used the default tier 1 EF of 5 kg CH_4/head/year for cool Eastern Europe from the 2006 IPCC Guidelines (vol. 4, chap. 10, table 10.14, p.10.38).
A.5	3.D Direct and indirect N_2O emissions from agricultural soils – N_2O	Provide detailed information on the reasons for recalculations of emissions for category 3.D agricultural soils, including, when relevant, information at the subcategory level, in the	Addressing. The Party performed recalculations of N_2O emissions from agricultural soils compared with the 2020 annual submission, including increases of up to 45.9 per cent (for 2006) and decreases of as much as 6.1 per cent (for 2000). Kazakhstan provided a section on recalculations for N_2O emissions from agricultural soils in the

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	(A.17, 2019) Transparency	recalculation sections of the NIR, and tables showing the resulting differences among annual submissions.	NIR (section 5.5.5, pp.298–300). This explanation covers the correction of $Frac_{LEACH-(H)}$, cultivation of organic soils (3.D.a.6), disaggregated mineral fertilizers (3.D.a.1), animal manure applied to soils (3.D.a.2.a), sewage sludge applied to soils (3.D.a.2.b), other organic fertilizers applied to soils (3.D.a.2.c), and mineralization/immobilization associated with the loss/gain of soil organic matter (3.D.a.5). The ERT noted that the Party provided in its NIR information at the subcategory level for N_2O released from mineralization of organic soils, including a chart (section 5.5.5, figure 5.9, p.300) and a table (section 5.5.5, table 5.33, p.300) showing the difference between the estimates for the 2020 and current submissions. However, the N_2O emissions from crop residues increased by 11.23, 12.15 and 10.15 per cent, respectively, for 2016, 2017 and 2018 and the Party did not explain why the estimates of emissions from crop residues for 2016–2018 changed between the 2020 and current submissions. During the review, the Party clarified that the recalculation for crop residues for 2016–2018 was required because of a technical error in the Excel sheet of the 2020 submission and noted that the correction was considered minor and therefore not explained in the NIR. The ERT notes that, in line with paragraph 45, annex I, of the UNFCCC Annex I inventory reporting guidelines, Parties shall report changes in estimates of emissions and removals and indicate the reason for these changes, such as error corrections.
A.6	3.D.a.1 Inorganic N fertilizers – N_2O (A.18, 2019) Transparency	Include disaggregated AD on fertilizer application for arable land and rice fields in the NIR.	Resolved. The Party provided disaggregated AD on mineral fertilizer application for rice and other cropland from the Bureau of National Statistics in table 5.28 of the NIR (section 5.5.2, p.292).
A.7	3.D.a.2.b Sewage sludge applied to soils – N_2O (A.19, 2019) Completeness	Estimate N_2O emissions for subcategory 3.D.a.2.b sewage sludge applied to soils and report emission values or use the notation key "NE" and provide evidence that N_2O emissions for this subcategory are below the significance threshold provided in paragraph 37(b) of the UNFCCC Annex I inventory reporting guidelines.	Resolved. The Party calculated sewage sludge emissions using the default rate of 0.05 kg sewage sludge N applied to soils per capita and per year from the 2016 EMEP/EEA guidebook and a default N_2O EF (EF1 = 0.01) from the 2006 IPCC Guidelines (vol. 4, chap. 11, table 11.1, p.11.11). As indicated in the NIR (section 5.5.5, p.298), the resulting emission estimates proved to be insignificant, as 4.3 kt CO_2 eq is well below the significance threshold of 177.43 kt CO_2 eq for 2019. The Party reported using the notation key "NE" for subcategory 3.D.a.2.b sewage sludge applied to soils in CRF table 3.D in line with paragraph 37(b) of the UNFCCC Annex I inventory reporting guidelines and provided the relevant explanation in CRF table 9.
A.8	3.D.a.2.c Other organic fertilizers applied to soils – N_2O (A.20, 2019) Transparency	Include, in the agriculture chapter of the NIR, an explanation of the non-occurrence of the application of other organic fertilizers to soils based on analyses of scientific literature or any other documented source of information.	Resolved. The Party explained in the NIR (section 5.5.5, p.299) that, according to several national publications, there is no significant source of other organic waste that could be applied to soils and a lack of data on any use of composting, even in rural areas. References to the background national planning documents are included in the NIR (section 5.5.5, pp.298–300).
A.9	3.D.a.6 Cultivation of organic soils (i.e. histosols) – N_2O	In the NIR, provide detailed information on the absence of organic soils in the country.	Addressing. On page 297 of section 5.5.2 of the NIR (also referenced during the review), the Party explained that data on organic soils are not collected or reported because the soils in the country do not meet the criteria for organic soils (see the 2006

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	(A.10, 2019) (A.19, 2017) Transparency		IPCC Guidelines, vol. 4, chap. 11, p.11.6, footnote 4) in line with the *World Reference Base for Soil Resources* (FAO, 1998) in terms of humus content. The Party provided information on the humus content of black soils in the country (6–8 per cent), which is below the definition for organic soils (>12 per cent) and so concluded that there are no organic soils in the country. However, no justification or detailed information to underpin this statement, such as references showing the lack of these soils in Kazakhstan, were provided in the NIR (see ID# A.10 below).
A.10	3.D.a.6 Cultivation of organic soils (i.e. histosols) – N_2O (A.21, 2019) Transparency	Provide references to scientific works regarding the characteristics of agricultural soils in Kazakhstan, such as Borovsky and Uspanov (1971) and Faizov, Urazaliev and Iorgansky (2001), including accompanying explanations in the NIR (section 5.5.2).	Not resolved. The ERT noted that references to the studies on Kazakhstan's agricultural soils by Borovsky and Uspanov (1971) and Faizov, Urazaliev and Iorgansky (2001) were not included in the agriculture chapter of the NIR. During the review, the Party provided technical reasons for the missing references to the relevant scientific literature and noted that it will correct this issue in its next annual submission. The ERT noted the availability of more recent publications on soils in Kazakhstan, namely Pachikin, Erokhina and Funakawa (2014) and Yapiyev et al. (2018), that could be referenced and used in the next annual submission.
A.11	3.D.b.2 N leaching and run-off (A.22, 2019) Convention reporting adherence	(a) Correct the identified inconsistency between the $Frac_{LEACH-(H)}$ values reported in the NIR and CRF table 3.D; (b) Improve the QC procedures for ensuring complete consistency of the reporting of the agriculture sector in the NIR and CRF tables; (c) Describe the specific QA/QC activities performed for the agriculture sector in the NIR.	(a) Resolved. The Party reported a $Frac_{LEACH-(H)}$ value of 0.1 consistently in both the NIR (section 5.5.2, table 5.31, p.297) and CRF table 3.D; (b) Addressing. The ERT noted that the value reported by the Party in CRF table 3.D for 3.D.b.1 atmospheric deposition for N that is lost through leaching and run-off was 10 times higher than the value calculated by the ERT using equation 11.10 from the 2006 IPCC Guidelines (vol. 4, chap. 11, p.11.21). During the review, the Party clarified that the value includes the total N used in the calculations, not just that lost through leaching and run-off. This did not affect the results of the emission calculations and will be corrected in the next annual submission. The ERT noted that this resulted in low IEFs for indirect N_2O emissions from leaching and run-off in CRF table 3.D and suggests the need for improved QC procedures in the sector; (c) Not resolved. The Party provided a basic explanation of QA/QC procedures for each category in the NIR, similar to that in the previous review. The ERT noted that the explanation in the NIR (section 5.5.4, p.298) has not been updated and the Party only indicated that QA/QC procedures were carried out by specialists from Zhasyl Damu JSC and experts from other agencies in Kazakhstan, without providing further information on the specific activities performed (e.g. comparing AD and emission estimates with FAOSTAT estimates for the Party, comparing EFs and IEFs with those of countries with similar conditions, or referring to international literature and methodologies).
A.12	3.G Liming – CO_2 (A.12, 2019) (A.21, 2017) Completeness	Provide, in the NIR, detailed justification for reporting CO_2 emissions from liming as "NO".	Addressing. The Party reported the notation key "NO" for liming in CRF table 3.G and information in the NIR (section 5.8, pp.301–302) explaining why liming of soils is not practised in the country, with references to national experts. However, the website referenced (https://agroinfo.kz/est-li-perspektivy-u-dolomitovoj-muki/ (in Russian)) does find that dolomite can be used in some cases in Kazakhstan (Bakumenko, 2014)

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			and the ERT concluded that emissions may still occur under the category. The Party does not refer to any national statistics such as the import or sale of lime for agricultural use.
A.13	3.H Urea application – CO_2 (A.23, 2019) Completeness	Provide a complete time series of CO_2 emission estimates for urea application in the next annual submission, using the recommendations provided in the 2006 IPCC Guidelines on data gathering (vol. 1, chap. 2) or splicing techniques (vol. 1, chap. 5.3, pp.5.8–5.14) if data are not available for the early years of the time series.	Resolved. The Party reconstructed a time series of CO_2 emission estimates for urea application in agriculture using extrapolation for 1990–1995, as recommended by the 2006 IPCC Guidelines (vol. 1, chap. 2), and presented the results in the NIR (section 5.9.1, pp.302–303).
LULUCF			
L.1	4. General (LULUCF) – CO_2, CH_4 and N_2O (L.1, 2019) (L.1, 2017) (L.1, 2016) (L.1, 2015) (table 3, 2013) (114, 2012) (95, 2011) Completeness	Improve completeness by including estimates for all mandatory categories, together with the relevant documentation supporting the estimates: (a) Net CO_2 emissions from forest land remaining forest land – mineral soils; (b) Net CO_2 emissions from grassland converted to forest land – mineral soils; (c) Net CO_2 emissions from wetlands converted to forest land – organic soils; (f) Net CO_2 emissions from forest land converted to grassland – dead organic matter and mineral soils; (g) Net CO_2 emissions from other land converted to wetlands; (h) N_2O emissions from disturbance associated with land-use conversion to cropland, grassland converted to cropland – mineral soils.	(a) Resolved. CSC in mineral soils is now reported for forest land remaining forest land and documentation is provided in the NIR (section 6.2.2, pp.329–331); (b) and (g) Not resolved. The categories are reported using the notation key "NO" in CRF tables 4.A and 4.D; (c), (f) and (h) Not resolved. The Party continues to report using the notation key "NO" for the conversions in points (c), (f) and (h) without providing transparent information in the NIR to justify that the conversions did not occur. During the review, Kazakhstan stated that there are no net CO_2 emissions from wetlands converted to forest land – mineral and organic soils or from forest land converted to cropland and other land converted to wetlands – dead organic matter and mineral soils in the country, as there are no such land transformations. The ERT noted that a change in area over time occurred in most LULUCF categories (NIR section 6.1, table 6.1.3, p.312) which indicates that land-use changes occur and should be presented in CRF tables 4.1 and 4.A–F with explanatory information in the NIR. However, not all these changes are consistently reflected in NIR table 6.1.8 (section 6.1, p.321) or CRF tables 4.1 and 4.A–F, such as land-use change to and from forest land. The ERT notes that the land-use changes reported under the LULUCF sector should be annual in CRF table 4.1 and accumulated over a period of years (the default being 20 years) in CRF tables 4.A–F, and that a change in area should also be reflected in the remaining categories. Further, the ERT noted the efforts made to develop a preliminary land-use change matrix (NIR section 6.1, table 6.1.8, p.321) which will support future reporting of land use and land-use changes. The improvements in the matrix are expected to support the Party in reporting all mandatory land-use categories and changes, as well as associated CSCs (where methods are provided in the 2006 IPCC Guidelines) or using the appropriate notation key for categories that do not occur in the country (see ID# L.3 below).

ID#	*Issue/problem classification*[a, b]	*Recommendation made in previous review report*	*ERT assessment and rationale*
L.2	4. General (LULUCF) – CO_2, CH_4 and N_2O (L.4, 2019) (L.5, 2017) (L.15, 2016) (L.15, 2015) Completeness	Improve the completeness of the reporting for the sector by providing estimates for all mandatory categories and pools (as listed in ID# L.1 (FCCC/ARR/2017/KAZ) and for the relevant land conversions, currently reported as "NO").	Addressing. The Party reported estimates for some mandatory categories and pools (see ID# L.1 above) but there remain many mandatory categories reported using the notation key "NO" but without any information provided to support the use of this notation key. A list of the categories not estimated is provided in annex II to this report. During the review, the Party clarified that the results of CSC calculations for all identified subcategories of land use and CO_2 are presented in the inventory and the calculation methodologies will be described in more detail in the next annual submission. Additional checks will be carried out on the use of the notation keys "NO" and "NE".
L.3	4. General (LULUCF) – CO_2 (L.2, 2019) (L.2, 2017) (L.4, 2016) (L.4, 2015) (76, 2013) Completeness	Report areas of conversion from forest land to other land-use categories in land-use change matrices and provide estimations of GHG net emissions from deforestation in appropriate subcategories.	Not resolved. The Party did not report areas converted from forest land to other land-use categories in the land-use change matrix (CRF table 4.1) or in table 6.1.8 of the NIR (section 6.1, p.321). No estimates of emissions from forest land converted to other land-use categories were provided in CRF tables 4.B–4.F or in the NIR. However, the ERT noted that Kazakhstan reported in CRF table NIR-2 and 4(KP-I) A.2 an area of deforestation under KP-LULUCF for 2013–2019. During the review, the Party clarified that the total area of forest land and the total stock of wood have steadily increased over the past two decades (NIR section 6.2.1, tables 6.2.1–6.2.2, pp.324–325) owing to an increase in the volume of natural renewal and overgrowth of forest land, an increase in the area of artificially created forests and their strengthening, protection against and prevention of the spread of forest fires, and regulation of commercial forest felling. The conversion of forest land to other categories of land has therefore not taken place in practice. The insignificant volumes of net emissions reported from deforestation were explained by an increase in the area of forest roads, small clearings and fire breaks on forest land.
L.4	4. General (LULUCF) – CO_2, CH_4 and N_2O (L.5, 2019) (L.6, 2017) (L.17, 2016) (L.17, 2015) Transparency	Improve the methodological information for the estimated categories by including: (c) A description of the methodology applied, which includes: assumptions (and for each assumption, its logical basis and evidence of its reliability with regard to the condition to which it is applied) and the equations applied (noting that when an IPCC method is used, information on assumptions is not needed and equations may simply be quoted); (d) A description of the AD and their quality, including information on data collection (methodology and timing), data compilation (methodology) and uncertainties.	(c) Addressing. The ERT noted that the Party improved the description of the methods applied for its estimates in the NIR, such as including a description of the methodology for reporting CSCs for all pools in forest land (section 6.2.2, pp.329–331) that provided references to the equation and assumptions used in the estimates. However, the assumptions used for the calculations for some categories are not presented transparently. For instance, for the biomass carbon stock calculation for perennial crops on cropland, Kazakhstan assumed that living biomass (standing volume) is similar to the biomass of other trees in the national forest fund (NIR section 6.3.2, p.342), without justifying this assumption. During the review, the Party clarified that it plans to extend improvements in the inventory to cover all categories, including pastures, settlements and other land use; (d) Addressing. The ERT noted an improvement in the description of the AD, namely that data previously missing for certain years from tables in the NIR had been completed. The ERT further noted that the AD used in the calculations are described and presented in the relevant section for each land category in the NIR (tables 6.2.7 (p.328), 6.3.5 (p.339), 6.4.2 (p.352), 6.5.1 (p. 357) and 6.6.1 (p.359)). The main

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			sources for AD are also reported in the NIR (section 6.1, pp.318–319). However, limited information was provided on methods for data collection, the temporal resolution of data and compilation methods. A description of the quality of the AD was not provided in the relevant section for the uncertainty in the NIR chapter on LULUCF (chap. 6, pp.306–360).
L.5	4. General (LULUCF) – CO_2 (L.3, 2019) (L.4, 2017) (L.6, 2016) (L.6, 2015) (78, 2013) (120, 2012) (100, 2011) Convention reporting adherence	Implement the QA/QC plan for the sector.	Resolved. The Party included a category-specific section in the LULUCF chapter of the NIR that states that the QA/QC procedures for the LULUCF categories were implemented in line with the general QA/QC plan for the inventory (sections 6.2.4 (p.332), 6.3.4 (p.349), 6.4.4 (p.355), 6.5.4 (p.358) and 6.6.4 (p.360)) (see ID# L.6 below).
L.6	4. General (LULUCF) – CO_2, CH_4 and N_2O (L.6, 2019) (L.7, 2017) (L.18, 2016) (L.18, 2015) Transparency	Include in the NIR a description of any QA/QC checks undertaken, and the results of such checks.	Addressing. The Party included specific sections on QA/QC procedures and verification for each land-use category in the NIR (sections 6.2.4 (p.332), 6.3.4 (p.349), 6.4.4 (p.355), 6.5.4 (p.358) and 6.6.4 (p.360)) (see ID# L.5 above). However, the ERT noted that the information reported on specific LULUCF QA/QC procedures in the NIR is still very limited. During the review, Kazakhstan explained that QA/QC procedures were applied for the preparation of the NIR, as mentioned in various places in the NIR, namely by using additional information available in the country from independent sources for cultivated land (section 6.3, pp.332–350), by duplicating calculations based on disaggregated information for cropland (section 6.2, pp.322–332) and using expert assessments with auxiliary information for the assessed areas for grassland (section 6.4, pp.350–356). The Party also explained that a cross-check of the sector was carried out by an expert on agriculture. However, information on the QA/QC checks undertaken and the external verification procedures and their results is not provided transparently in the NIR.
L.7	4. General (LULUCF) – CO_2, CH_4 and N_2O (L.7, 2019) (L.22, 2017) Accuracy	Fully resolve the inconsistencies identified in the reporting of land-use areas and report an accurate and consistent land representation used for the estimates in accordance with the 2006 IPCC Guidelines.	Addressing. The Party partially eliminated some inconsistencies identified in the reporting on land-use areas in table 6.1.6 of the NIR (section 6.1, p.317), which are consistent with the areas reported in CRF tables 4.A–4.F, such as land remaining in a category and land converted to another land-use category. However, the ERT noted that inconsistencies in land representation still persist for forest land remaining forest land, grassland converted to settlements and flooded land remaining flooded land (see also ID#s L.8, L.9 and L.14 below). During the review, the Party stated that it intends to improve the representation of land use further in its next annual submission in accordance with the 2006 IPCC Guidelines (vol. 4, chap. 3, section 3.3).

ID#	*Issue/problem classification*[a, b]	*Recommendation made in previous review report*	*ERT assessment and rationale*
L.8	Land representation – CO_2 (L.8, 2019) (L.8, 2017) (L.3, 2016) (L.3, 2015) (75, 2013) (116, 2012) Accuracy	Make efforts to convert existing statistics into the IPCC land-use categories, taking into consideration, among other issues, that: (a) Even if land use results in no emissions, it is good practice to report its area and use appropriate notation keys for net emissions and IEFs; (c) The definitions of land-use categories in the IPCC good practice guidance for LULUCF are rather flexible, and this should facilitate the use of available statistics, with the help of proxy data, expert judgment and justified assumptions, which should be documented in the NIR; (d) Lands that do not change land use should be reported separately from lands with land-use conversion; the Party may report aggregated estimates for all land conversions to a particular land use, when data are not available to report them separately. This should be clearly stated in the documentation boxes and documented in the NIR; (e) The category other land remaining other land is intended to allow the total reported land area to match the total area of the country.	Addressing. The ERT noted improvements in the conversion of national statistics into the IPCC land-use categories: (a) Addressing. The Party reported the CSCs for all pools of the land-use categories/subcategories for which AD were reported in CRF tables 4.A–4.F. In addition, AD are reported in CRF table 4.D for flooded land remaining flooded land and other wetlands remaining other wetlands, although no CSCs are reported. However, according to the AD reported in the NIR (section 6.1, tables 6.1.3 (p.312), 6.1.6 (p.317) and 6.1.8 (p.321)), for instance for land converted to forest land, land converted to grassland and land converted to other land, several land conversion categories exist and associated CSCs should also be reported in the CRF tables, whereas the notation key "NO" is currently used (see ID# L.1 above); (c) Not resolved. Kazakhstan reported in the NIR (section 6.1, pp.318–319) a general description of the AD sources used for land representation. However, information on how national land-use categories were transformed into the IPCC land-use categories was not provided in the NIR (e.g. for the data presented in section 6.1, table 6.1.6, p.317), nor was information included on the methodology, assumptions or expert judgment used in the process. During the review, Kazakhstan explained that table 6.1.6 was mainly based on data from tables 6.1.3 and 6.1.5; (d) Addressing. In the 2020 submission, Kazakhstan reported some land-use conversions separately from the remaining land-use categories, but in the current submission only grassland converted to settlements is reported. The previously reported category of grassland converted to forest land, for example, has not been reported in CRF table 4.A in the 2021 submission. The ERT also noted that land converted to grassland has only been reported for certain years, although the reported area should accumulate in the category for 20 years (see item (a) above). The CRF tables continue to include information on land categories that do not change and lands under conversion categories aggregated under the remaining land category. For example, cropland remaining cropland includes cropland converted to grassland in CRF table 4.B, as the ERT noted that the calculation of net CO_2 emissions from cropland converted to grassland was reported in the NIR (table 6.3.5, p.339). No information on the approach applied was provided in the documentation box of CRF table 4.B or in the NIR; (e) Addressing. Kazakhstan reported areas of other land remaining other land in CRF table 4.F and in the NIR (section 6.1, table 6.1.6, p.317). In the NIR (section 6.7, p.360) the Party explained that these areas are considered unmanaged and included to balance the total national area. However, the total reported area of the country is not constant over time (see ID# L.10 below). Also, despite the large area reported for other land remaining other land (23,106.8 kha for 2017), transparent and detailed information on which national land-use categories were considered under other land was not reported in the NIR and so the Party did not demonstrate that those areas

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			could not be considered as managed or do not correspond to other land-use categories. Kazakhstan did not consider land conversion to and from other land to reflect how the balancing of the total area was carried out. However, the ERT noted that, according to CRF table 4.F and the NIR (section 6.1, table 6.1.6, p.317) the area varies over time. During the review, the Party stated its assumption that all lands in the country, except for natural reservoirs and swamps, as well as other lands, belong to managed lands, since production, ecological or social functions are carried out on them to some degree.
L.9	Land representation – CO_2 (L.9, 2019) (L.9, 2017) (L.16, 2016) (L.16, 2015) Transparency	Include information on: (a) Ancillary data used for land classification, comprising timing and methodology of data collection and any further elaboration before their use for land classification; (b) The methodology applied for classifying land under land categories; (c) Explanations on how consistency is maintained when different sources of data and/or different methodologies are used for preparing the land representation.	Not resolved. The ERT notes that the Party added information relating to land use in the NIR (section 6.1, pp.306–322), including regarding efforts to construct a land-use transformation matrix (section 6.1, table 6.1.6, p.317). However, information relating to the way national land-use classes are aggregated into the six IPCC land-use categories has not been included: (a) The ERT noted that Kazakhstan reported in the NIR (section 6.1 (pp.318–319)) only general information on the AD providers involved in the preparation of the land representation, namely the Committee of Land Administration of the Ministry of Agriculture, the forest management enterprise of the Ministry of Ecology, Geology and Natural Resources, and the National Joint Stock Company State Corporation Government for Citizens of the Ministry of Digital Development, Innovations and Aerospace Industry. No information on the ancillary data or further details on the data used for the preparation of land representation was reported in the NIR or during the review (see ID# L.8 above); (b) The methodology applied for classifying national land-use categories (reported in tables 6.1.2 (p.310), 6.1.3 (p.312) and 6.1.5 (p.317)) according to the definitions in the 2006 IPCC Guidelines was not reported in the NIR (see ID# L.8 above); (c) The ERT noted that no information was reported in the NIR as to how consistency was maintained when different sources of data or different methodologies were used for preparing the land-use representation. During the review, the Party explained that the inconsistency in land areas in the country is the reason for the construction of an incomplete transformation matrix for land use (section 6.1, table 6.1.6, p.317). To construct the matrix, Kazakhstan used information on the distribution of land by purpose and by type of land (section 6.1, tables 6.1.3 (p.312) and 6.1.5 (p.317)) and on the types of economic activity on the land. For additional control of land-use transformations, the main categories were subdivided, in a similar way to the guidance in tables 3.2 and 3.3 of the 2006 IPCC Guidelines (vol. 4, chap. 3, pp.3.11–3.12).
L.10	Land representation – CO_2 (L.10, 2019) (L.10, 2017) (L.19, 2016)	Revise the methodology according to good practice provided in the 2006 IPCC Guidelines (vol. 4, chap. 3) in order to build a consistent land representation, and develop and implement	Addressing. The Party reported the area of land-use categories and a national total area for the entire time series in NIR table 6.1.3 (section 6.1, p.312) and CRF table 4.1 and explained how it had improved its methodology in the NIR (section 6.1, p.320). The ERT noted that the reported national total area is not constant over time, with

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	(L.19, 2015) Accuracy	QA/QC procedures in order to check the consistency of conversions between land uses, to ensure that the total land area is constant over time and to ensure that the GHG inventory estimates are not affected by technical mistakes.	specifically high deviations of between 2,000 and 6,000 ha in 2009, 2012, 2013 and 2019 compared with the average. The Party did not report in the NIR which methodology (approach 1, 2 or 3) according to the 2006 IPCC Guidelines (vol. 4, chap. 3, section 3.3.1, p.3.10–3.13) was applied in order to build a consistent land representation or provide information on the revision of the previous methodology used, although various alternatives are discussed in the NIR (section 6.1, pp.319–320). During the review, Kazakhstan confirmed the need for further development of a complete set of information for the sector. The Party agreed with the ERT proposal to develop and implement a QA/QC procedure to check the consistency of information and control transformations between land categories, and stated that it has been gradually introducing such QA/QC procedures.
L.11	Land representation – CO_2 (L.20, 2019) Convention reporting adherence	Revise the application of notation keys in CRF table 4.1 in accordance with paragraph 37 of the UNFCCC Annex I inventory reporting guidelines and footnote 1 to the above-mentioned table, taking into consideration that some land-use changes have occurred and/or may occur within the country.	Resolved. The Party reported using the notation key "NO", having reported "NA" in previous submissions, in CRF table 4.1 for land-use changes that do not occur, in line with paragraph 37 of the UNFCCC Annex I inventory reporting guidelines. Although the correct notation keys are being used, the ERT noted that a number of land-use changes may occur and should be reported in CRF table 4.1 (see ID# L.9 above).
L.12	4.A Forest land – CO_2 (L.11, 2019) (L.11, 2017) (L.20, 2016) (L.20, 2015) Transparency	Verify reported values of deadwood and biomass carbon stock of the forest subcategories hardwood and other trees and revise them, as needed, as well as include the relevant explanations on the national circumstances in the NIR.	Not resolved. The Party reported CSCs separately for living biomass and dead organic matter in CRF table 4.A and the NIR (section 6.2.1, pp.322–329) with values of forest productivity, taking into account groups of species and age groups. However, there was no information in the NIR relating to the verification of values for deadwood or biomass carbon stock for the forest subcategories hardwood and other trees, nor any relevant explanation regarding national circumstances. During the review, Kazakhstan stated that it is continually working to improve AD for forests and will provide in its next annual submission the results of additional CSC calculations for living biomass and deadwood by forest type (coniferous, soft-leaved, hard-leaved and saxaul), taking into account national growing conditions.
L.13	4.A.1 Forest land remaining forest land – CO_2 (L.12, 2019) (L.12, 2017) (L.7, 2016) (L.7, 2015) (80, 2013) (124, 2012) (101 and 105, 2011) Comparability	Report CSC separately for all the pools; report both biomass gains and biomass losses separately.	Addressing. The Party reported CSC changes in living biomass, dead organic matter and soils separately. However, the notation key "NO" was used for CSC in living biomass losses instead of "IE" to report biomass losses in CRF table 4.A, as required when using the stock change method.
L.14	4.B.1 Cropland remaining cropland – CO_2	Exclude abandoned lands from cropland and report this category under cropland converted	Resolved. The ERT noted that the Party reported arable land converted from crop rotation to fallow land (pastures) under cropland remaining cropland in CRF table 4.B and the NIR (table 6.3.5, p.339), stating that the land is not considered abandoned.

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	(L.13, 2019) (L.14, 2017) (L.8, 2016) (L.8, 2015) (82, 2013) (129, 2012) Comparability	to grassland or cropland converted to other land.	During the review, Kazakhstan further justified its reporting by explaining that in the national land code there is no definition for abandoned land, and cropland includes arable land that has been in crop rotation for at least 20 years, remaining a reserve for the restored area of arable land, and classified as the most valuable land; these areas and the estimates for them are allocated to one category – arable land. Although a change in management may imply a change in land use, taking into account the national circumstances relating to definitions and status of land, the ERT agreed with the approach of the Party to report arable land converted from crop rotation to fallow land (pastures) under cropland remaining cropland in CRF table 4.B.
L.15	4.B.1 Cropland remaining cropland – CO_2 (L.14, 2019) (L.15, 2017) (L.9, 2016) (L.9, 2015) (83, 2013) (128, 2012) Convention reporting adherence	Apply the necessary procedures for the verification of emissions from soils, including any procedures in accordance with the QA/QC plan, and include these emissions in the CRF tables.	Addressing. The Party reported in CRF table 4.B the CSCs in mineral soils in cropland remaining cropland and explained the methodology used in the NIR (section 6.3.2, pp.338–348). Kazakhstan reported in the NIR (section 6.3.5, pp.349–350) that additional analyses of humus content in soils were performed, although the NIR did not contain information on how they were used to verify data on carbon content and the respective emissions from soils. During the review, the Party explained that the calculation methodology and verification process will be described in more detail in its next annual submission.
L.16	4.B.1 Cropland remaining cropland – CO_2 (L.15, 2019) (L.17, 2017) (L.23, 2016) (L.23, 2015) Accuracy	Estimate carbon stock losses from biomass in cropland and report all information on the method and background data used for calculating the rates used for estimating the CSC.	Addressing. The ERT noted that carbon stock losses from biomass were reported as "NO" in CRF table 4.B. Information on the non-occurrence of biomass losses was not provided in the NIR. As the CSC method was applied for the calculation of CSCs in living biomass, using the value of biomass carbon stock samples for naturally regrown vegetation, the notation key "IE" could be used for losses. The Party included in its NIR (section 6.3.2, p.342) a biomass carbon stock value for restored steppe ecosystems of 5.485 t/ha (dead and living biomass) and a reference to the source of this value. No justification is provided in the NIR for using the biomass of trees in forests in the national forest fund for the value of carbon stock in living biomass of perennial crops. During the review, the Party further clarified that the assessment of CSCs is carried out on the basis of the initial carbon stock of the category with the allocation of its individual subcategories and reservoirs of accumulated carbon. Kazakhstan also explained that the assessment of the dynamics of carbon and carbon absorption for arable land was carried out using independent information from two monitoring systems of agricultural land simultaneously.
L.17	4.C.1 Grassland remaining grassland – CO_2 (L.16, 2019) (L.18, 2017) (L.10, 2016) (L.10, 2015) (84, 2013)	Check the reliability of the AD for the degree of grassland degradation for the entire time series.	Not resolved. The ERT noted that information on the degree of grassland degradation and the areas of different groups of grassland affected by degradation were reported in the NIR (section 6.4.5, table 6.4.5, p.356) with the coefficients used for the AD but there was no information regarding a data reliability check. During the review, the Party informed the ERT that it checks the AD for degree of pasture degradation annually for the entire time series and aims to improve the AD quality. The assessment of the dynamics of carbon in pastures was carried out using cartographic data on the

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	(125, 2012) Transparency		natural potential of pastures, including the potential of biomass (living and dead, calculated on the restored vegetation cover) used to estimate carbon stock in biomass and in soil (carbon standards). The ERT noted that detailed information on the verification of the AD is not provided, for example in section 6.5.4 (p.358) of the NIR on QA/QC and verification.
L.18	4.C.1 Grassland remaining grassland – CO_2 (L.17, 2019) (L.19, 2017) (L.11, 2016) (L.11, 2015) (85, 2013) (126, 2012) (111, 2011) Convention reporting adherence	Implement the procedures included in the QA/QC plan and correct the error leading to inconsistent reporting of areas of grassland.	Addressing. The Party consistently reported the area of grassland in CRF table 4.C and table 6.4.2 (section 6.4.1, p.352) of the NIR across the time series. However, the ERT noted that the areas reported for grassland still remain inconsistent within the NIR (section 6.4.1, tables 6.4.1–6.4.3, pp.351–353) but also observed that a total area of 188,708 ha is reported in table 6.4.2 for 2019 but 188,718 ha is reported in CRF table 4.C. No information on the implementation of QA/QC procedures for resolving the inconsistencies was included in the NIR, apart from a reference to the general QA/QC procedures (section 6.5.4, p.358). During the review, the Party explained that it had attempted to improve the transparency of the reporting by specifying the area of pastures and hayfields, and solely pastures, for example in table 6.4.3 (section 6.4.1, p.353) of the NIR.
L.19	4.C.1 Grassland remaining grassland – CO_2 (L.18, 2019) (L.20, 2017) (L.24, 2016) (L.24, 2015) Transparency	Consistently report grassland area in the submission and report information on the methodology applied for calculating the values contained in NIR table 6.11, as well as on information on the data used to validate them.	Addressing. The Party reported consistent data on pastures under grassland for the entire time series. The Party has also included a new table in the NIR (section 6.4.5, table 6.4.5, p.356) with the country-specific CSC EFs for the category of grassland for biomass and soil. However, the table was not supported with additional information on the methodology applied for calculating the values of the coefficients of the management regime influencing the CSCs in biomass and soil for grassland in the country, and no references for the values are included in the NIR. In addition, there is no information in the NIR as to whether these data were validated (e.g. in section 6.5.4, p.358). During the review, the Party explained that national carbon standards and activity factors are included in the NIR (section 6.4.5, table 6.4.5, p.356).
L.20	4.C.2 Land converted to grassland – CO_2 (L.19, 2019) (L.21, 2017) (L.12, 2016) (L.12, 2015) (86, 2013) (130, 2012) Completeness	Include AD in the CRF tables and estimate CSC in all pools.	Not resolved. The ERT noted that all land conversions to grassland in CRF table 4.C are reported using the notation key "NO" for the AD and CSC estimates for all pools. During the review, the Party stated that it will clarify the representation of lands in its next annual submission in revised matrices, including the area of cultivated land temporarily withdrawn to fallow land (pastures) with subsequent return to crop rotation, and the areas of pastures transferred to forest lands, with the redistribution of the calculated carbon stocks by pool.
L.21	4.E.2 Land converted to settlements – CO_2 (L.21, 2019) Accuracy	Report CSCs and corresponding CO_2 emissions/removals for land converted to settlements in line with the 2006 IPCC Guidelines (vol. 4, chap. 8, section 8.3, pp.8.17–8.25).	Not resolved. The ERT noted that no explanation is provided for the use of a tier 2a method (crown cover area method) from the 2006 IPCC Guidelines (vol. 4, chap. 8, section 8.3.1, pp.8.18–8.20) for settlements remaining settlements to calculate CO_2 emissions/removals for land converted to settlements. During the review, the Party explained that it plans to request additional information on tree cover per unit area and land-use change to settlements from the Bureau of National Statistics. Updated

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			information on CSCs on land converted to settlements will be provided in the next annual submission.
L.22	4(I) Direct N_2O emissions from N inputs to managed soils – N_2O (L.22, 2019) Transparency	Provide transparent and documented information in the NIR justifying that there is no N fertilization activity on forest land, wetlands and settlements, as reported in CRF table 4(I). If this is not possible, report N_2O emissions in the next annual submission in accordance with the recommendations of the 2006 IPCC Guidelines (vol. 4, chap. 11, section 11.2.1, pp.11.6–11.14).	Not resolved. The Party reported the notation key "NO" for forest land, wetlands and settlements in CRF table 4(I) for direct N_2O emissions from N inputs to managed soils without any transparent or documented information in the NIR to justify that there is no N fertilization activity on these lands. During the review, the Party stated that it had only limited information on the application of mineral fertilizer and has requested additional data to clarify the volumes of possible application of mineral fertilizer to forest and settlement soils from the Bureau of National Statistics. The adjusted volumes of mineral fertilizer applied to soils by land category will be included in the next annual submission.
L.23	4(III) Direct N_2O emissions from N mineralization/ immobilization – N_2O (L.23, 2019) Completeness	Calculate direct N_2O emissions from N mineralization associated with loss/gain of soil organic matter resulting from a change of land use or management of mineral soils for each land-use category present in the country using the methodology provided in the 2006 IPCC Guidelines (vol. 4, chap. 11, section 11.2.1, pp.11.6–11.16) and report them in CRF table 4(III) and the NIR, including a description of the methodology applied, in the next annual submission.	Not resolved. The ERT noted that the Party did not report N mineralization associated with loss or gain of soil organic matter resulting from a change of land use or management of mineral soils. The use of the notation key "NO" for the AD and N_2O emissions for all land-use categories in CRF table 4(III) was not justified. During the review, the Party noted that the methodology for calculating N_2O emissions will be described in detail in the next annual submission. As the Party intends to improve the reporting of land-use change, it should also consider reporting the associated loss or gain of carbon and direct N_2O emissions from N mineralization and immobilization.
L.24	4(V) Biomass burning – CO_2, CH_4 and N_2O (L.24, 2019) Transparency	Report GHG emissions from wildfires for forest land and grassland using actual AD for 2017 and onward and provide transparent information in the NIR on improvements performed, including on the collection of relevant data.	Addressing. In the previous review report, it was noted that the same area was used for wildfires for both 2016 and 2017 for forest land (275 ha) and grassland (38,645 ha) and that no information was presented in the NIR on the collection of relevant data. The ERT noted that the values for 2017 were recalculated in the 2020 submission and the recalculation relating to the improved AD was reported in the 2020 NIR (section 6.3.5 (p.305)), thus resolving the issue relating to reported areas of wildfires for forest land and grassland in CRF table 4(V). However, section 6.2.1 (pp.322–329) of the current NIR contains no information on improvements performed or the collection of relevant data for wildfires on forest land, although the area of fires for the entire time series is provided in table 6.2.8 (section 6.2.1, p.329). According to the current NIR (section 6.4.2, p.355) information about the burned area from steppe fires (section 6.4.2, table 6.4.4, p.354) was provided by the Ministry for Emergency Situations. Data regarding fires on non-forested lands of the national forest fund were received from the State Enterprise Kazakh Base for Aviation Forest Protection and Forestry Services. During the review, the Party explained that a more detailed description of the methodology for assessing emissions from forest and steppe fires, including calculations of the amount of fuel burned, will be included in the next annual submission.

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Waste			
W.1	5. General (waste) – CO_2, CH_4 and N_2O (W.1, 2019) (W.1, 2017) (W.5, 2016) Completeness	Provide estimates for the CH_4 and N_2O emissions from composting, and CO_2, CH_4 and N_2O emissions from waste incineration and biogenic open burning, or report the appropriate notation keys in line with decision 24/CP.19, annex I, paragraph 37.	Addressing. The Party reallocated its CO_2 (non-biogenic), CH_4 and N_2O emissions from incineration of clinical waste for category 5.E other under category 5.C.1 waste incineration (see ID# W.17 below). However, Kazakhstan did not estimate CO_2, CH_4 and N_2O emissions from open burning of waste, CH_4 and N_2O emissions from open burning of biogenic MSW were reported using the notation key "NE" and CO_2, CH_4 and N_2O emissions from open burning of non-biogenic MSW were reported using the notation key "NO" in CRF table 5.C (see ID# W.18 below). Further, the Party did not estimate CH_4 and N_2O emissions from composting and used the notation key "NO" to report CH_4 and N_2O emissions from composting in CRF table 5.B but did not provide any justification or reference in the NIR to support its assertion that composting did not occur in the country (see ID# W.27 in table 5).
W.2	5. General (waste) – CO_2, CH_4 and N_2O (W.2, 2019) (W.2, 2017) (W.6, 2016) Convention reporting adherence	Implement a QA/QC check to ensure that data provided in the NIR are consistent with the latest data in the submitted CRF tables.	Addressing. The Party reported in the NIR (sections 7.2.5 (p.372), 7.3.4 (p.381), 7.3.10 (p.387), 7.4.3 (pp.390–391) and 7.5.5 (pp.396–397)) that QA/QC procedures were implemented for categories 5.A solid waste disposal, 5.C.1 waste incineration and 5.D wastewater treatment and discharge. Further, it corrected an error noted in the previous review report and provided consistent information on MCF values between the NIR and CRF table 5.A (see ID# W.13 below). However, the ERT noted further inconsistencies between the CRF and NIR, such as: (a) Kazakhstan stated in the NIR (section 7.2.1, p.368) that DOC_f generated in landfills is assumed to be 0.5, meaning that the default value of DOC_f equal to 50 per cent was used, but the values reported in CRF table 5.A for 2019 for managed waste disposal sites were 9.50 per cent for anaerobic, 14.38 per cent for semi-aerobic and 18.88 per cent for unmanaged waste disposal sites. This discrepancy between the NIR and CRF table 5.A occurs across the entire time series (see ID# W.13 below); (b) In the NIR (section 7.4.1, table 7.15, p.389), it states that the protein consumption for 2003 was 32.85 kg/capita/year and the size of the population in 2013 was 17,160,855. However, in CRF table 5.D the protein consumption for 2003 was reported as 15,074.77 kg/capita/year and the size of the population in 2013 was 171,111,160.86 thousand. During the review, the Party confirmed that the figures in the CRF tables were incorrect and it will aim to ensure that the data in the CRF tables match the data in the NIR.
W.3	5. General (waste) – CO_2, CH_4 and N_2O (W.3, 2019) (W.3, 2017) (W.7, 2016) (W.5, 2015) Transparency	Provide consistent information on the methods applied in the CRF tables and the NIR, as well as detailed information on the tiers used for the estimated categories in the sector and how they are consistent with the IPCC decision trees used for method selection.	Not resolved. The Party did not provide in its NIR information on the methodological tiers used by category in the overview section of the waste sector and did not clarify how the methods used are consistent with the IPCC decision trees, as required by the UNFCCC Annex I inventory reporting guidelines. In addition, the ERT noted inconsistent information on the methods applied in the NIR itself, as well as between the NIR and CRF tables regarding the methods and EFs used for CH_4 emission

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			estimation for solid waste disposal. According to sections 7.2.1 (p.366), 7.2.1 (p.369) and 7.3.2 (p.375) of the NIR, CH_4 emissions from solid waste disposal were estimated applying a tier 1 method, but in section 7.2.2 (p.369) of the NIR it states that a tier 2 method was used and, according to CRF table summary 3s2, CH_4 emissions are calculated using "M" (model). According to the NIR (section 7.2.1), a number of default values were used to estimate CH_4 emissions from solid waste disposal, such as MCF by type of SWDS, CH_4 generation rate and DOC_f, but in CRF table summary 3s2 the EFs or parameters used were indicated as "M" (model) and "CS" (country-specific). During the review, the Party explained that the IPCC FOD method was applied to statistics from the Bureau of National Statistics. Further, Kazakhstan confirmed that the tier 2 method was applied to estimate CH_4 emissions from solid waste disposal in combination with default and country-specific values.
W.4	5. General (waste) – CO_2, CH_4 and N_2O (W.4, 2019) (W.15, 2017) Transparency	Ensure that in the NIR the contribution of emissions for the categories within the waste sector for the latest reported year is correct and make it consistent with the information reported in the CRF tables.	Not resolved. The Party reported in its NIR (table 7.1, pp.363–364) that the total emissions in the waste sector for 2019 were 5,017.68 Gg CO_2 eq but reported 5,017.63 Gg CO_2 eq in CRF table summary 2. Similar discrepancies were observed for 1991–1997, 1999–2001, 2003–2011 and 2013–2018. Further, the ERT noted that there is a minor difference between the total emissions for most of the reported years in category 5.D wastewater treatment and discharge between NIR table 7.4 (section 7.3, p.373) and CRF table 5.D (e.g. for 2019 the NIR gives 2,387.93 kt CO_2 eq and the CRF table gives 2,387.96 kt CO_2 eq). During the review, the Party explained that these technical mistakes took place during data transfer and were the result of rounding the data in the NIR tables.
W.5	5.A Solid waste disposal on land – CH_4 (W.5, 2019) (W.4, 2017) (W.1, 2016) (W.1, 2015) (90, 2013) Completeness	Provide a justification, based on statistical data, that confirms how industrial waste is treated and disposed, and estimate and report the emissions from industrial waste, if applicable.	Not resolved. The Party did not provide in the NIR any information regarding the treatment and disposal of industrial waste. During the review, Kazakhstan informed the ERT that collecting data on industrial waste as a separate category is difficult, and so comprehensive and explanatory information on the treatment and disposal of industrial waste is not provided in the NIR. Further, the Party explained that 6.4 per cent of disposed waste is industrial ("used", NIR section 7.1, p.362) waste. In response to a question raised by the ERT, Kazakhstan stated that the volume of industrial waste that is similar to MSW in composition and origin was 66,708 t in 2019, according to the Taldau Information and Analytical System of the Bureau of National Statistics, and this volume was accounted and assessed for CH_4 emission estimation for SWDS. However, no verifiable information was provided in the NIR or during the review as to whether CH_4 emissions from different types of industrial waste were estimated and reflected in the annual submission in accordance with the 2006 IPCC Guidelines (vol. 5, chap. 2, section 2.2.3, pp.2.8–2.10).
W.6	5.A Solid waste disposal on land – CH_4 (W.8, 2019) (W.16,	Obtain good-quality country-specific AD in order to estimate CH_4 emissions for this category using the tier 2 IPCC FOD method.	Addressing. The Party reported in its NIR (section 7.2.1, p.365) that data on waste generation per capita for 2005–2019 and on municipal waste generation were produced by the Bureau of National Statistics and data on per capita waste generation for 1990–2004 were interpolated. Data on waste generation for 1950–1989 were

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	2017) Transparency		derived on the basis of population statistics. The ERT noted, however, that the NIR provides inconsistent information on the tier level applied (see ID# W.3 above) and only limited information on the AD used. For example, the amount of waste disposal for unmanaged SWDS for 1990–2019 (section 7.2.1, table 7.3, p.367) does not include information as to how the AD were distributed by different type of SWDS, so the ERT was not able to assess the quality of the AD used for the emission calculations. During the review, the Party provided data on solid waste generation and disposal by area, corresponding to managed anaerobic (Nur-Sultan), managed semi-aerobic (Almaty) and unmanaged shallow (other cities in Kazakhstan) SWDS. The ERT noted that the information provided is sufficient for it to conclude that Kazakhstan used good-quality country-specific AD to estimate CH_4 emissions from category 5.A solid waste disposal using the tier 2 IPCC FOD method, although this information was not presented transparently in the NIR (see ID# W.7 below).
W.7	5.A Solid waste disposal on land – CH_4 (W.9 and W.18, 2019) (W.17, 2017) Transparency	Provide in the NIR clear and comprehensive descriptions of the AD used for the calculation of annual waste generation for CH_4 emission estimates for category 5.A solid waste disposal, including values for the complete time series on the AD used for the emission estimates, such as per capita waste generation, total population and urban population, as well as collected waste volume and waste density for the years when these AD are used, as appropriate.	Addressing. The Party improved its reporting on the AD for the category and reported in its NIR (section 7.2.1, table 7.3, p.367) the amount of municipal waste, total population and urban population for 1990–2019, general information on MSW composition for the cities of Nur-Sultan and Almaty and the other cities in Kazakhstan (section 7.2.1, table 7.2, p.366) and general information on the per capita waste generation rate for these cities (section 7.2.1, p.366) and rural areas (section 7.2.1, p.368). The ERT noted, however, that the annual per capita waste generation rate (in kg/cap/year) for the entire time series was not provided in the NIR, nor is the coverage clear of the data provided on the amount of municipal waste in column 5 of table 7.3 (section 7.2.1, p.367). During the review, the Party explained that table 7.3 provides solid waste disposal information only for waste generated in cities other than Nur-Sultan and Almaty, as the data for Nur-Sultan and Almaty were assessed separately and not included in the NIR. The ERT noted that the following AD were used to estimate CH_4 emissions from solid waste disposal for 2019 according to CRF table 5.A: managed anaerobic SWDS – 351.34 kt, managed semi-aerobic – 1,000.06 kt and unmanaged (shallow) – 3,673.94 kt, which produces a total of 5,025.35 kt solid waste disposal in Kazakhstan for 2019. The NIR, however, provides the following information on solid waste generation and disposal for 2019: (a) approximately 4.7 Mt waste, including 2.9 Mt MSW, was disposed of at SWDS in 2019 (section 7.1, p.361) according to the Ministry of Ecology, Geology and Natural Resources; (b) 3.9 Mt waste was disposed of at official SWDS in 2019 (section 7.1, p.361); and (c) the amount of MSW was 3.674 Mt in 2019 (table 7.3, p.367). The ERT therefore concluded that the NIR did not provide clear and comprehensive descriptions of the AD used for the calculation of annual waste generation for CH_4 emission estimates for category 5.A solid waste disposal. During the review, the Party provided data on solid waste generation and disposal by area, corresponding to managed anaerobic (Nur-Sultan), managed semi-aerobic (Almaty) and unmanaged shallow (other cities in Kazakhstan) SWDS, demonstrating the

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			availability of AD for all the types of SWDS. Kazakhstan also stated that the share of population covered by the national waste collection system is 58 per cent. The ERT considers that the recommendation has not yet been fully addressed because the following information was not included in the NIR: (a) The AD used for CH_4 emission estimates by type of SWDS, such as the amount of solid waste disposal at different types of SWDS and consistent data on the total amount of disposed solid waste in Kazakhstan for 1990–2019; (b) A comprehensive description of the AD trends by type of SWDS; (c) Waste generation rates per capita in kg/cap/year for the whole country and by area, corresponding to managed anaerobic (Nur-Sultan), managed semi-aerobic (Almaty) and unmanaged shallow (other cities in Kazakhstan) SWDS for the entire time series; (d) The main assumptions supported by relevant references, which were used to derive the AD for the whole time series since 1950, including for waste composition, per capita waste generation rate and share of waste disposed at SWDS; (e) The percentage of the population covered by the national waste collection system.
W.8	5.A Solid waste disposal on land – CH_4 (W.18, 2019) Transparency	Justify the unexpected low per capita waste generation values compared with values reported by similar or neighbouring countries and with the values presented in table 2A.1 of the 2006 IPCC Guidelines (vol. 5, chap. 2, annex 2A.1, pp.2.17–2.19), or, if this is not possible, revise the CH_4 emission estimates for category 5.A solid waste disposal for the whole time series using revised data for per capita waste generation of the urban population.	Addressing. The Party reported in its NIR (section 7.2.1, p.366) that the waste generation rate per capita in the cities of Nur-Sultan and Almaty is almost 400 kg/cap/year and the typical rate for rural areas is 150–300 kg/cap/year (section 7.2.1, p.368), but did not provide a rate for other cities. The ERT noted that the annual waste generation rate per capita (in kg/cap/year) for the entire time series was not provided in the NIR. During the review, the Party provided data on waste generation per capita rates for 1950–2019 by area, corresponding to specific types of SWDS: Nur-Sultan (managed anaerobic: 138–270 kg/cap/year for 1990–2015; 346 kg/cap/year for 2016; 292–309 kg/cap/year for 2017–2019), Almaty (managed semi-aerobic: 354–623 kg/cap/year for 1990–2019) and other cities in Kazakhstan (unmanaged shallow: 251–304 kg/cap/year for 1990–2005; 344 kg/cap/year for 2006; 466–580 kg/cap/year for 2006–2019). The ERT commends the Party for the information provided on waste generation rates per capita but notes that the Party has not provided any explanation for general per capita waste generation rate trends or observed low per capita generation rates for Nur-Sultan for 1990–2015 and 2017–2019 and other cities in Kazakhstan for 1990–2005 when compared with the values in neighbouring countries, including those in table 2A.1 of the 2006 IPCC Guidelines (vol. 5, chap. 2, annex 2A.1, pp.2.17–2.19), such as 0.34 t/cap/year for 2000 in the Russian Federation.
W.9	5.A Solid waste disposal on land – CH_4 (W.6, 2019) (W.5, 2017) (W.2, 2016) (W.2, 2015)	Continue country-specific studies or use relevant DOC values from a country with similar economic and geographical conditions as a reference, and recalculate the emissions	Resolved. The Party recalculated the emissions based on updated DOC values, in particular for 1990–2011, applying country specific DOC values instead of the constant value of 0.21 for DOC for the 1990–2011 time series. The results of a

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	(91, 2013) Accuracy	based on updated DOC values for 1990–2011 (instead of the constant value of 0.21 for DOC for the 1990–2011 time series).	national study on MSW composition in Nur-Sultan, Almaty and nine other cities were reported in the NIR (section 7.2.1, table 7.2, p.366).
W.10	5.A Solid waste disposal on land – CH_4 (W.10, 2019) (W.18, 2017) Accuracy	Update DOC values for relevant years of the time series based on representative values of waste composition in the country reflecting changes in the waste management practices over time and ensure that CH_4 emissions for category 5.A solid waste disposal are estimated in accordance with the 2006 IPCC Guidelines.	Addressing. The Party reported in its NIR (section 7.2.1, p.366) that DOC values used in the estimates are based on the results of MSW composition studies carried out in Nur-Sultan, Almaty and nine other cities in Kazakhstan and provided data on MSW composition in table 7.2 (section 7.2.1, p.366) (see ID# W.9 above). However, Kazakhstan did not report in its NIR the DOC values for 1990–2019, as well as justification that the applied DOC values are based on representative values of waste composition in the country reflecting changes in the waste management practices over time and did not provide any information on the updating of DOC values or corresponding recalculation of CH_4 emissions in the recalculation section of the NIR. During the review, the Party provided a range of data on waste composition and DOC values by type of SWDS for 1950–2019. The ERT noted that the data on waste composition for 1950–2019 are based on limited background information, namely data from Fichtner GmbH & Co. KG for nine cities in Kazakhstan for 2011 (Programme for Modernization of the Solid Waste Management System for 2014–2050, available at https://greenkaz.org/images/for_news/pdf/npa/programma-modernizacii-tbo.pdf (in Russian)) and the data for Astana (now Nur-Sultan) and Almaty (Inglezakis et al., 2017), without specifying the year of investigation or scientific background for the data. Further, the ERT noted that, according to the 2006 IPCC Guidelines (vol. 5, chap. 2, p.2.15), the analysis conducted to determine national waste composition should be based on appropriate sampling methods and repeated periodically to cover changes in waste generation and management, and the sampling methods, frequency of sampling and implications on the time series should be documented. The ERT considers that the recommendation has not yet been fully addressed because national waste composition data and the respective DOC values for 1950–2019 are based on only a few references, which do not provide information about the sampling strategy or period covered, for example, and the Party has therefore not demonstrated that the data are sufficiently robust, to allow the ERT to conclude that the DOC values are fully representative of waste composition in the country, in particular not reflecting changes in waste management practices over time, which is good practice according to the 2006 IPCC Guidelines (vol. 5, chap. 2, p.2.15).
W.11	5.A Solid waste disposal on land – CH_4 (W.17, 2019) Accuracy	Provide an explanation for the unusual ratio between the IEFs for managed anaerobic and unmanaged waste disposal sites, and/or revise the corresponding CH_4 emission estimates for the complete time series, if necessary.	Not resolved. The ERT noted that the reported CH_4 IEFs for managed anaerobic SWDS continue to be lower than the CH_4 IEFs for unmanaged SWDS for most years of the time series, namely 1990–2005, 2014–2017 and 2019, which raises questions regarding the accuracy of the CH_4 emission estimates, given that CH_4 generation is usually higher in anaerobic conditions. For 2016, for example, the CH_4 IEF for unmanaged SWDS is 66.4 per cent higher than the CH_4 IEF for managed SWDS (0.026 t CH_4/t waste compared with 0.015 t CH_4/t waste). For 2019, the values for managed and unmanaged SWDS are 0.019 and 0.020 t CH_4/t waste, respectively. The

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			Party did not provide in its NIR an explanation of the ratio between the IEFs for managed anaerobic and unmanaged SWDS. During the review, Kazakhstan explained that the ratio of population size to waste composition and volume of waste generated at managed facilities including anaerobic and semi-aerobic (Nur-Sultan and Almaty) and unmanaged landfills (other cities) were taken into account in the estimates, but has not explained the resulting unusual ratio between the IEFs for managed anaerobic and unmanaged SWDS.
W.12	5.A Solid waste disposal on land – CH_4 (W.19, 2019) Transparency	Provide, in accordance with the UNFCCC Annex I inventory reporting guidelines, comprehensive, verifiable and documented information explaining significant changes caused by recalculations in the NIR, in particular when key parameters such as waste generation per capita and the MCF are revised.	Not resolved. The ERT noted that further recalculations were performed for the category both in the 2020 and current submissions, with a significant reduction of CH_4 emissions across the time series (between 41.0 and 45.7 per cent) (see ID# W.24 in table 5) compared with the emissions reported in the 2019 submission. Section 7.2.6 of the NIR (p.372) indicates only that the recalculations were performed for the entire time series owing to a revision of the MCF value for unmanaged SWDS and does not provide any further explanation of the changes made. During the review, the Party confirmed that the amount of solid waste disposal was revised, as were the DOC values (see ID# W.9 above).
W.13	5.A Solid waste disposal on land – CH_4 (W.20, 2019) Transparency	Provide comprehensive, verifiable and documented information on the reported country-specific DOC_f values or, if this is not possible, use the default value of DOC_f (0.5) for revising CH_4 emission estimates for category 5.A solid waste disposal.	Addressing. The Party reported in its NIR (section 7.2.1, p.368) that the default DOC_f value of 0.5 was used to estimate CH_4 emissions from solid waste disposal. However, the ERT noted that Kazakhstan has reported different DOC_f values in CRF table 5.A (see ID# W.2 above). During the review, the Party confirmed that it used the default DOC_f value and explained that the information in CRF table 5.A on the DOC_f value is a misprint.
W.14	5.A Solid waste disposal on land – CH_4 (W.21, 2019) Convention reporting adherence	Ensure the consistency of the information reported in the CRF tables and the NIR on the MCF values used for unmanaged deep SWDS in accordance with the 2006 IPCC Guidelines (vol. 5, chap. 3, table 3.1, p.3.14) for the complete time series, and implement QC checks to ensure the consistency of the data used and reported.	Resolved. The Party reclassified unmanaged deep SWDS as unmanaged shallow SWDS in its current submission (see ID# W.24 in table 5). Kazakhstan used and reported consistent information on MCF values for the complete time series in its NIR (section 7.2.1, p.368) and CRF table 5.A for all types of SWDS, which suggests that its QC has improved. The MCF values reported, including those for unmanaged shallow SWDS (1.0 for managed anaerobic; 0.5 for semi-aerobic; and 0.4 for unmanaged shallow) are in accordance with the 2006 IPCC Guidelines (vol. 5, chap. 3, table 3.1, p.3.14).
W.15	5.A.1 Managed waste disposal sites – CH_4 (W.11, 2019) (W.19, 2017) Completeness	Ensure that CH_4 emissions from industrial waste containing DOC (e.g. from food, wood processing and fishing industries) disposed at SWDS are estimated and reported in accordance with the 2006 IPCC Guidelines.	Not resolved. There is no verifiable information in the NIR to indicate that CH_4 emissions from industrial waste containing DOC (e.g. from food, wood processing and fishing industries) disposed of at SWDS were estimated or reported by the Party. During the review, Kazakhstan explained that data on industrial waste generated from the food, wood processing and fishing industries are part of the MSW data, and CH_4 emissions from these types of waste were estimated and reflected in the annual submission in accordance with the 2006 IPCC Guidelines. Further, the Party provided information to show that the volume of industrial waste similar to MSW in both composition and origin was 66,708 t for 2019, according to the Taldau Information and Analytical System of the Bureau of National Statistics and confirmed that this

ID#	Issue/problem classification[a, b]	Recommendation made in previous review report	ERT assessment and rationale
			volume is included in the 2021 submission. The ERT noted that the calculation file on CH_4 emissions from solid waste disposal provided by the Party during the review demonstrated that industrial waste was not estimated separately. The ERT could therefore not verify whether or not the emissions from industrial waste were estimated and included in the CH_4 emissions for category 5.A solid waste disposal. The ERT considers that this may result in an underestimation of CH_4 emissions for this category (see ID# W.5 above).
W.16	5.A.1 Managed waste disposal sites – CH_4 (W.12, 2019) (W.19, 2017) Transparency	Provide in the NIR information and verifiable documentation showing the methods of treatment or disposal of industrial waste in the country, including the amount that is not treated and used, and particularly the biodegradable portion of this industrial waste.	Not resolved. The Party did not provide information or verifiable documentation in the NIR showing the methods of treatment or disposal of industrial waste and the biodegradable portion of industrial waste was not reported. During the review, Kazakhstan explained that collecting data on industrial waste as a separate category is difficult and it therefore did not provide comprehensive information in the NIR on the processing and disposal of industrial waste. It also explained that 6.4 per cent of waste disposed of in the country is industrial waste (see ID# W.5 above).
W.17	5.C Incineration and open burning of waste – CO_2, CH_4 and N_2O (W.13, 2019) (W.10, 2017) (W.12, 2016) (W.10, 2015) Completeness	Include CO_2, CH_4 and N_2O emissions from the incineration of clinical waste under waste incineration in CRF table 5.C.	Resolved. The Party included CO_2, CH_4 and N_2O emissions from the incineration of clinical waste under waste incineration in CRF table 5.C (see ID# W.18 below).
W.18	5.C.1 Waste incineration – CO_2, CH_4 and N_2O (W.14, 2019) (W.11, 2017) (W.14, 2016) (W.12, 2015) Comparability	Use the appropriate notation key for waste incineration consistent with decision 24/CP.19, annex I, paragraph 37.	Addressing. The Party reported CO_2, CH_4 and N_2O emissions from clinical waste incineration for 2006–2019 under 5.C.1 waste incineration in CRF table 5.C and used the notation key "NO" to report MSW incineration. The ERT noted that in CRF table 5.C the Party used the notation key "NO" for AD and CO_2, CH_4 and N_2O emissions under biogenic and non-biogenic waste incineration for 1990–2005 but did not provide justification in the NIR as to why it considered that clinical waste incineration did not occur in the country for 1990–2005. During the review, the Party explained that, up until 2006, medical waste was buried as solid waste and not incinerated. The ERT also noted that the notation key "NO" was used for the AD of amount of waste incinerated in CRF table 5.C for biogenic waste incineration – other and non-biogenic waste incineration – other for 2006–2019, although the NIR (section 7.5.1, p.392) provides the annual data for clinical waste incineration since 2006 (see ID# W.17 above). The ERT also noted that the notation key "NO" was used for biogenic CO_2 emissions for biogenic waste incineration – other for 2006–2019, despite the fact that the biogenic fraction of clinical waste was incinerated. The fossil carbon fraction was considered to be 40 per cent of the total carbon content (NIR equation 7 (section 7.5.2.1, p.392)). Further, the ERT noted that the notation key "NO" was used for CH_4 and N_2O emissions under biogenic waste incineration for 2006–2019, but according to equations 8 (section 7.5.2.2, p.393) and 9 (section 7.5.2.3, p.394) of the NIR, these

ID#	Issue/problem classification[a, b]	Recommendation made in previous review report	ERT assessment and rationale
			emissions were included under non-biogenic waste incineration – other for 2006–2019 in CRF table 5.C. During the review, the Party did not provide any relevant explanation for the choice of notation key. The ERT considers that the recommendation has not yet been fully addressed because in the following cases the notation key "NO" was improperly used in CRF tables 5.C and 5.D instead of the notation keys listed below: (a) For the amount of incinerated waste and CO_2, CH_4 and N_2O emissions under biogenic and non-biogenic waste incineration for 1990–2005, the notation key "NE" should be used in CRF table 5.C until the NIR contains a justification that clinical waste incineration did not occur in the country for 1990–2005; (b) For the AD for the amount of waste incineration under biogenic and non-biogenic waste incineration – other for 2006–2019, a value or the notation key "NE" should be used, as the data on waste incineration have not been reported in CRF table 5.C; (c) For biogenic CO_2 emissions under biogenic waste incineration – other for 2006–2019, the notation key "NE" should be used, as the corresponding biogenic CO_2 emissions have not been included in CRF table 5.C; (d) For CH_4 and N_2O emissions under biogenic waste incineration for 2006–2019, the notation key "IE" should be used in CRF table 5.C, as CH_4 and N_2O emissions from clinical waste incineration have not been disaggregated by biogenic and non-biogenic fraction.
W.19	5.C.2 Open burning of waste – CO_2, CH_4 and N_2O (W.15, 2019) (W.12, 2017) (W.13, 2016) (W.11, 2015) Completeness	Further investigate the potential CO_2, CH_4 and N_2O emissions from open burning in unauthorized SWDS and include the estimates of emissions from open burning, as needed.	Not resolved. The Party reported in the NIR (section 7.2.3, pp.370–371) that CO_2, CH_4 and N_2O emissions from open burning of waste were not estimated because it considers these emissions to be insignificant, as they do not exceed 500 kt CO_2 eq. CO_2, CH_4 and N_2O emissions from open burning of MSW were therefore reported using the notation key "NE" in CRF table 5.C for biogenic MSW. Kazakhstan also provided in its NIR (section 7.2.3, p.371) an estimation of potential emissions from open burning of waste. According to these estimates, these emissions could not exceed 254.33 kt CO_2 eq for 2019 (see ID# W.1 above). The ERT noted that, according to decision 24/CP.19, annex I, paragraph 37(b), emissions could only be considered as insignificant if the likely level is below 0.05 per cent of the national total emissions (without LULUCF for the latest reported inventory year) and do not exceed 500 kt CO_2 eq. The ERT also noted that the value of 254.33 kt CO_2 eq estimated by the Party exceeds the significance threshold of 0.05 per cent of the national total (177.43 kt CO_2 eq for 2019). Further, the ERT noted that the category was subject to adjustment in accordance with the guidance for adjustments under Article 5, paragraph 2, of the Kyoto Protocol (annex to decision 20/CMP.1, in conjunction with decision 4/CMP.11) in the 2019 review report (FCCC/ARR/2019/KAZ, chap. VI and tables 13–14 of annex IV).

ID#	Issue/problem classification[a, b]	Recommendation made in previous review report	ERT assessment and rationale
			The ERT considers that the recommendation has not yet been resolved because Kazakhstan has neither estimated CO_2, CH_4 and N_2O emissions from open burning of waste, nor provided solid justification that these emissions are insignificant, which, in accordance with decision 24/CP.19, means that the emissions are below 0.05 per cent of the national total emissions (without LULUCF for the latest reported inventory year) and do not exceed 500 kt CO_2 eq, whichever is lower. The ERT considers that there is a potential underestimation of the emissions for the category.
KP-LULUCF			
KL.1	General (KP-LULUCF) – CO_2, CH_4 and N_2O (KL.2, 2019) (KL.2, 2017) Completeness	Provide CSC estimates and verifiable information on litter and SOC pools for AR, deforestation and FM by using the results of research work (i.e. as described in the NIR, section 6.3.6), which was planned with the aim of using the results for preparing the 2016 submission and the methodologies described in the 2006 IPCC Guidelines (vol. 4) and the Kyoto Protocol Supplement, as well as provide disaggregated CSC estimates for the above-ground biomass, below-ground biomass and deadwood pools in future annual submissions.	Addressing. The Party reported in chapter 8 of its NIR (pp.398–414) and corresponding CRF tables information on KP-LULUCF, including a reference to corresponding methods in chapter 6 (pp.306–360) for the estimation of CSC for AR, deforestation and FM. As summarized below, below-ground biomass is still not estimated separately for all activities, and litter and deadwood are not reported separately under deforestation: (a) Above-ground biomass, litter, deadwood and SOC for AR were reported with numerical values but below-ground biomass was reported using the notation key "IE" (under above-ground biomass) in CRF table 4(KP-I)A.1; (b) Above-ground biomass was reported with numerical values for deforestation; below-ground biomass, litter and deadwood were reported using the notation key "IE" and noted as reported under living biomass; and SOC was reported using the notation key "NE" in CRF table 4(KP-I)A.2. The NIR did not include justification for omitting CSC from the SOC pool under deforestation; (c) Above-ground biomass for FM was reported with numerical values, whereas below-ground biomass was reported using the notation key "IE" (under above-ground biomass). Litter, deadwood and SOC for FM were also reported with numerical values in CRF table 4(KP-I)B.1. During the review, the Party clarified that it will continue to improve the methodologies for estimating CSC and CO_2 emissions and removals on the basis of the information available, presenting results by activity within each administrative region and for all carbon pools, including forest litter and mineral soils, in its next annual submission.
KL.2	General (KP-LULUCF) – CO_2, CH_4 and N_2O (KL.3, 2019) (KL.3, 2017) KP reporting adherence	Report clear data and information distinguishing lands where AR, deforestation, FM and GM activities occurred and corresponding emissions by sources and removals by sinks resulting from these activities under Article 3, paragraphs 3–4, of the Kyoto Protocol.	Addressing. The ERT noted that the Party reported information on emissions and removals from AR, deforestation and FM for the entire time series 2013–2019 in the CRF tables. However, the ERT noted that, in the NIR, Kazakhstan still did not report any data or specific information (including maps) distinguishing lands where AR, deforestation, FM and GM activities occurred or the corresponding emissions by sources and removals by sinks resulting from these activities under Article 3, paragraphs 3–4, of the Kyoto Protocol.

ID#	Issue/problem classification[a, b]	Recommendation made in previous review report	ERT assessment and rationale
			During the review, the Party clarified that a geographic map will be included in its next annual submission indicating clear boundaries of administrative regions for which specific information will be provided in tabular form on the selected types of additional activities under the Kyoto Protocol, the area of each activity with distribution by territory area and emissions or removals by type of activity within each area.
KL.3	General (KP-LULUCF) (KL.4, 2019) (KL.5, 2017) KP reporting adherence	Improve the reporting on KP-LULUCF by providing the missing information on key categories in CRF table NIR-3 in line with the UNFCCC Annex I inventory reporting guidelines.	Not resolved. The ERT noted that information on key categories in CRF table NIR-3 is missing. During the review, the Party explained that it will aim to provide the information in the next annual submission.
KL.4	General (KP-LULUCF) – CO_2, CH_4 and N_2O (KL.6, 2019) KP reporting adherence	Provide information demonstrating that the national inventory system of Kazakhstan established under Article 5, paragraph 1, of the Kyoto Protocol ensures that areas of land subject to KP-LULUCF are identifiable and provide information on these areas in accordance with the requirements of decision 2/CMP.7, annex, paragraph 25, in the next annual submission.	Not resolved. The NIR (section 8.3.3, p.409) states that the method for identification of land is based on method 1 (broad area identification) in the IPCC good practice guidance for LULUCF (chap. 4, p.4.24) and the AD for KP-LULUF depend on statistical data from different organizations such as the Bureau of National Statistics and the Forestry and Wildlife Committee of the Ministry of Ecology, Geology and Natural Resources (section 8.3.3, p.410). However, the Party did not include information that demonstrates that the national inventory system established under Article 5, paragraph 1, of the Kyoto Protocol ensures that areas of land subject to KP-LULUCF (AR, deforestation and FM) are identifiable and information on these areas is in accordance with the requirements of decision 2/CMP.7, annex, paragraph 25. During the review, the Party explained that it will provide in its next annual submission additional information, including examples of individual areas, in the form of forest land maps with a degree grid of various scales. It will also contain legends for those maps with detailed descriptions of forest tree species and their growing conditions, and natural potential of forest land, in accordance with the requirements of decision 2/CMP.7, annex, paragraph 25 (see ID# G.8 above).
KL.5	General (KP-LULUCF) – CO_2, CH_4 and N_2O (KL.7, 2019) KP reporting adherence	Provide the required information on KP-LULUCF in accordance with decision 2/CMP.8, annex II, paragraphs 2(a–e) and (g), 3(a–c), 4(a–b) and 5(a–c) and (e), in the next annual submission, and apply, as appropriate, the methodologies provided in the 2006 IPCC Guidelines (vol. 4) and the Kyoto Protocol Supplement for the development of the requested information.	Not resolved. The Party indicated in its NIR (section 8.2, p.400 and section 8.3.3, p.406) that that the choices of methodology for KP-LULUCF are in accordance with the requirements of the 2006 IPCC Guidelines and the Kyoto Protocol Supplement but did not specify how inventory methodologies have been applied. The NIR also does not provide information to demonstrate that activities under Article 3, paragraph 3, of the Kyoto Protocol began on or after 1 January 1990 and before 31 December of the last year of the commitment period, and are directly human-induced, or any other information relating to the requirements under decision 2/CMP.8, annex II, paragraphs 2(a–e) and (g), 3(a–c), 4(a–b) and 5(a–c) and (e). During the review, Kazakhstan explained that additional information relating to the activities reported will be provided in the next annual submission.

ID#	*Issue/problem classification*[a, b]	*Recommendation made in previous review report*	*ERT assessment and rationale*
KL.6	AR – CO_2, CH_4 and N_2O (KL.8, 2019) Transparency	Report the appropriate notation key ("NA") for the AD and CO_2, CH_4 and N_2O emissions from natural disturbances on lands under AR in CRF table 4(KP-I)A.1.1 or the corresponding AD and emissions, as appropriate, according to any corrections to be made to the addendum to the report to facilitate the calculation of the assigned amount of Kazakhstan and provide transparent information thereon.	Addressing. The ERT noted that the Party used the notation key "NE" for emissions from natural disturbances in CRF table 4(KP-I)A.1.1. However, in section 8.3.3 (p.409) of the NIR, the Party explained that the impact of natural disturbances to the normal state of the forest associated with the invasion of insects and parasite infestation, as well as extreme weather events causing significant emissions in forests, was not assessed in the annual submission, including reporting on KP-LULUCF, owing to the lack of systematic monitoring of these phenomena in the country. During the review, the Party clarified that the notation key "NE" will be changed to "NA" for AD and CO_2, CH_4 and N_2O emissions in CRF table 4(KP-I)A.1.1 in the next annual submission.
KL.7	Deforestation – CO_2 (KL.9, 2019) Completeness	Report CSCs in mineral soils on land under deforestation for the entire time series.	Not resolved. The ERT noted that the Party used the notation key "NE" for CSCs in mineral soils under deforestation in CRF table 4(KP-I)A.2 for the entire time series, explaining that it assumed that the net carbon volume in soil does not change. No further information has been provided in the NIR to justify the omission of carbon pools from the reporting, nor detailed information on the methods used to estimate the CSCs in mineral soils. During the review, the Party clarified that CSCs in mineral soils on land under deforestation will be calculated for the entire time series and presented in CRF table 4(KP)A.2 in the next annual submission.
KL.8	FM – CO_2 (KL.5, 2019) (KL.4, 2017) Comparability	Report AD for FM activities under Article 3, paragraph 4, of the Kyoto Protocol, including both subtotals and the components that form the subtotals, for the entire time series, ensuring their completeness, as well as the data consistency between the CRF tables and the NIR.	Not resolved. The Party reported AD for FM activities under Article 3, paragraph 4, of the Kyoto Protocol in CRF table 4(KP-I)B.1 and in the NIR (section 8.3.3, tables 8.1–8.2, pp.407–408). The ERT noted that the Party continues to use the notation keys "NO", "IE" and "NE" without providing subtotals or their components in the CRF tables (i.e. losses for above-ground biomass, gains and losses for below-ground biomass and net change for organic soils). In addition, it is not clear how the data in the NIR relate to the data reported in CRF table 4(KP-I)B.1, as the total net removal reported in CRF table 4(KP-I)B.1 is –7,898.73 kt CO_2 but –22,522.8 kt CO_2 in the NIR (section 8.3.3, table 8.1, p.407). During the review, the Party explained that calculations in the NIR were performed in two different ways: both including and excluding shrubs in forest areas, as they do not correspond to the parameters for determining FM. However, no clear explanation was provided as to how to map values in the NIR compare with those in CRF table 4(KP-I)B.1.
KL.9	FM – CO_2, CH_4 and N_2O (KL.10, 2019) Comparability	Report the appropriate notation key ("NA") for the AD and CO_2, CH_4 and N_2O emissions from natural disturbances on lands under FM in CRF table 4(KP-I)B.1.3 or the corresponding AD and emissions, as appropriate, according to any corrections to be made in the addendum to the report to facilitate the calculation of the assigned amount of Kazakhstan and provide transparent information thereon.	Addressing. The ERT noted that the Party uses the notation key "NE" for emissions from natural disturbances in CRF table 4(KP)A.1.1 (see ID# KL.6 above). During the review, Kazakhstan clarified that the notation key "NE" will be changed to "NA" for AD and CO_2, CH_4 and N_2O emissions in CRF table 4(KP)A.1.1 in its next annual submission.

[a] References in parentheses are to the paragraph(s) and the year(s) of the previous review report(s) in which the issue was raised. Issues are identified in accordance with paras. 80–83 of the UNFCCC review guidelines and classified as per para. 81 of the same guidelines. Problems are identified and classified as problems of transparency, accuracy, consistency, completeness or comparability in accordance with para. 69 of the Article 8 review guidelines in conjunction with decision 4/CMP.11.

[b] The report on the review of the 2020 annual submission of Kazakhstan was not available at the time of this review. Therefore, the recommendations reflected in this table are taken from the 2019 annual review report. For the same reason, 2020 and 2018 are excluded from the list of review years in which issues could have been identified.

IV. Issues and problems identified in three or more successive reviews and not addressed by the Party

9. In accordance with paragraph 83 of the UNFCCC review guidelines, the ERT noted that the issues and/or problems included in table 4 have been identified in three or more successive reviews, including the review of the 2021 annual submission of Kazakhstan, and had not been addressed by the Party at the time of publication of this review report.

Table 4
Issues and/or problems identified in three or more successive reviews and not addressed by Kazakhstan

ID#	*Previous recommendation for issue*	*Number of successive reviews issue not addressed*[a]
General		
G.1	Establish and maintain the national registry and report information on how the national registry performs the functions defined in the mandatory requirements for the registry's functionality for the second commitment period of the Kyoto Protocol, in accordance with the requirements set out in decision 13/CMP.1, annex, chapter II, in conjunction with decision 3/CMP.11, and the annex to decision 5/CMP.1, and thereafter report information on any change in the national registry in subsequent annual submissions.	3 (2017–2021)
G.3	Provide an action plan and information on its implementation to address the issues identified, in particular on the steps, including those already achieved, and expected time frames for: (b) Identifying roles and responsibilities for QA/QC and data verification for each inventory sector to ensure data quality and reliability; (c) Implementing arrangements for review, approval and sign-off processes to ensure timely annual submission of the NIR by the agreed submission due date.	3 (2017–2021)
G.4	In the NIR, provide information on planned capacity-building steps and report on progress regarding the capacity-building activities in the inventory improvement plan. Specifically, it should include the planned actions, roles and responsibilities for those actions and the time frame for implementation of each action regarding: (a) Building technical capacity of the personnel participating in the inventory preparation and management; (b) Making specific arrangements for data-sharing and data communication to ensure uninterrupted and timely access to AD by the designated inventory agency from other organizations.	3 (2017–2021)
G.5	In the NIR, include details of the national system structure and operation regarding the different stages of inventory data collection and processing. Specifically, it should include detailed information on:	3 (2017–2021)

ID#	*Previous recommendation for issue*	*Number of successive reviews issue not addressed*[a]
	(a) Which organizations participate in data collection for each sector and whether those data providers are the same every year; (b) Who is responsible for the preliminary (raw data) processing; (c) How the quality and reliability of plant-specific and country-specific EFs are ensured and who is responsible for this.	
G.6	Through the national system, which ensures that areas of land subject to KP-LULUCF are identifiable, include in the NIR a detailed and transparent description of the process established for this purpose.	3 (2017–2021)
G.8	In the NIR, include transparent information on geographical identification of lands where deforestation, AR, FM and GM activities occurred on the territory, in line with the methodological recommendations of the 2006 IPCC Guidelines (vol. 4) and the Kyoto Protocol Supplement.	3 (2017–2021)
G.10	Provide, in the NIR, more information on: the archiving system, including the responsibilities of different institutions for the flow of data and archiving; whether the archiving system includes information generated through external and internal reviews, documentation on annual key category analysis, key category identification and planned inventory improvements; and how this system is maintained by the Kazakh Scientific Research Institute of Ecology and Climate.	6 (2012–2021)
G.13	Report in subsequent annual submissions any change to the information under Article 3, paragraph 14, in accordance with decision 15/CMP.1, in conjunction with decision 3/CMP.11.	3 (2017–2021)
G.15	Provide detailed information on the assessment of completeness (e.g. in an annex) in the NIR.	4 (2015/2016–2021)
G.16	Complete all cells and do not leave blank cells in the CRF tables and ensure the correct use of the notation keys (including “NA”) in the CRF tables in line with decision 24/CP.19, annex I, paragraph 37.	4 (2015/2016–2021)
G.18	Use the notation key “NO” if the activity is not occurring and “IE” if emissions are included elsewhere.	5 (2013–2021)
G.19	In the NIR of the future annual submissions, include detailed information explaining the reasons for recalculations, the specifics of methods and assumptions, and the impact of recalculations on the emissions for the particular category, on the entire sector and the total emissions (including and excluding LULUCF).	3 (2017–2021)
G.20	In the NIR, include a specific procedure in the QA/QC process to ensure that the number of inconsistencies between the NIR and the CRF tables across all inventory sectors is minimized and report the updated QA/QC plan, and include information on this procedure.	3 (2017–2021)
G.21	Improve on the reporting of uncertainty by including information on the quantitative estimates of the uncertainty of data used for all source and sink categories using the 2006 IPCC Guidelines, and report uncertainties for the base year and the latest inventory year, as well as the methods and underlying assumptions used, and how the analysis helps in prioritizing efforts to improve the accuracy of national inventories in the future, in line with decision 24/CP.19, annex I, paragraph 42.	4 (2015/2016–2021)
Energy		
E.1	Use the notation key “IE” instead of “NO” or “NA” in cases in which emissions are included elsewhere, and include appropriate explanations in CRF table 9 and the NIR.	5 (2013–2021)

ID#	*Previous recommendation for issue*	*Number of successive reviews issue not addressed*[a]
E.3	Report in the NIR all information regarding the reasons for recalculations and the methodologies used for the recalculated categories.	6 (2012–2021)
E.4	Explain the underlying assumptions and the degree of expert judgment used in the applied interpolation methodology to fill in the time series for AD of national statistics and report it in the NIR.	7 (2011–2021)
E.5	Ensure the consistency of the entire time series and provide comparisons of AD obtained from different sources.	6 (2012–2021)
E.8	Carry out the planned improvement to separate coking coal consumption from the total other bituminous coal consumption.	5 (2013–2021)
E.9	Cross-check the AD and provide explanations for the differences in inter-annual changes between the reference and sectoral approaches.	7 (2011–2021)
E.10	Reconsider the accuracy of the data concerning the combusted fuels and the fuels used as feedstocks in order to further reduce the level of difference between the sectoral and reference approaches across the time series and include additional information in the NIR explaining the observed differences in the CO_2 emission estimated from the two approaches.	4 (2015/2016–2021)
E.12	In order to improve the alignment between the reference and the sectoral approaches and to increase the transparency of reporting in the energy sector: (a) Strengthen the QC procedures for the AD used for the emission estimates across fuel combustion activities; (b) Disaggregate the AD included in category 1.A.5 other and reallocate emissions to appropriate categories; (c) Estimate carbon excluded from NEU and feedstocks of NGLs and associated petroleum gas separately from natural gas.	3 (2017–2021)
E.15	Improve the QA/QC procedures relevant to the estimation of the use of the feedstocks, reductants and NEU of fuels and ensure consistent reporting across CRF table 1.A(b) and table 1.A(d).	4 (2016–2021)
E.16	Ensure consistency between CRF table 1.D (fuel consumption of the international aviation/international bunkers) and CRF table 1.A(b) (reference approach – fuel consumption of the international bunkers).	4 (2016–2021)
E.20	Investigate the possibility of calculating country-specific CO_2 EFs for lignite and sub-bituminous coal as weighted average values based on information on specific coal production and CO_2 EFs for each mining field, as the majority of coal used in Kazakhstan is from domestic production.	6 (2012–2021)
E.21	Include detailed data on energy consumption by fuel for all subcategories in the energy sector.	5 (2013–2021)
E.22	Investigate the allocation of AD and emissions from the energy sector to the industrial processes sector and correct any misallocations.	7 (2011–2021)
E.26	In the NIR, provide information on AD for coking coal combusted for own needs by ArcelorMittal Temirtau JSC for all relevant years of the time series and ensure the consistency of the time series by performing relevant recalculations for 1990–2013, as necessary.	3 (2017–2021)

ID#	*Previous recommendation for issue*	*Number of successive reviews issue not addressed*[a]
E.27	In the NIR, include detailed information on the allocation of other fossil fuels to ensure transparency of reporting emissions from these fuels and use appropriate notation keys, where necessary.	3 (2017–2021)
E.28	Include emissions of CH_4 and N_2O for the subcategory 1.A.2.d pulp, paper and print or provide justification to support that these emissions are insignificant and use a notation key in accordance with decision 24/CP.19, annex I, paragraph 37.	4 (2015/2016–2021)
E.29	In the NIR, report correct CO_2 EFs and provide a detailed explanation on the methodological approaches used for the emission estimates for the category, as well as on selection of the AD.	3 (2017–2021)
E.30	Reallocate AD and emissions from transportation in agriculture/forestry/fisheries to the subcategory agriculture/forestry/fishing and emissions from industrial and construction off-road transport to the category manufacturing industries and construction.	5 (2013–2021)
E.32	Improve the accuracy of the N_2O emission estimates for gasoline consumption, taking into account the pollution control technologies introduced over time in the vehicle fleet.	6 (2012–2021)
E.36	Finalize the investigation of the technologies used in the country, provide more detailed background information about road transportation and, with this information, justify the relatively high CH_4 EF used for gasoline, in particular for the latest years of the time series, or revise the estimates using corresponding more appropriate IPCC default values.	3 (2017–2021)
E.37	Estimate emissions for subcategory 1.A.3.d domestic navigation in accordance with the 2006 IPCC Guidelines by: (a) Collecting relevant data on fuel consumption by type of fuel, separately for domestic and international navigation, or use appropriate interpolation/extrapolation techniques based on existing indicators or expert judgment to allow this disaggregation, and documenting comprehensively these data in the NIR.	3 (2017–2021)
E.40	Disaggregate CO_2, CH_4 and N_2O emissions for subcategory 1.A.4.c by type of fuels under the correct subcategories (i.e. 1.A.4.c.ii off-road vehicles and other machinery and 1.A.4.c.iii fishing) for the entire time series and, in the NIR, provide detailed explanations on the methods used to allow such reallocation.	3 (2017–2021)
E.41	Revise the AD and emission allocations to ensure that they are included in the appropriate categories in the CRF tables according to the UNFCCC Annex I inventory reporting guidelines and, in the NIR, include information on the revised allocations, provide detailed explanations on all reallocations and provide revised emission estimates.	3 (2017–2021)
E.45	Include the background information about the measurements made and time series of the CH_4 concentration in the NIR (underground mines).	6 (2012–2021)
E.46	Report the recovery/flaring of CH_4 from underground mines in CRF table 1.B.1 or use the relevant notation key in accordance with decision 24/CP.19, annex I, paragraph 37.	4 (2015/2016–2021)
E.48	Include all relevant information about the calculation of the country-specific CH_4 EF for coal mining and handling (surface mines) in the NIR and ensure the consistency of the time series.	6 (2012–2021)
E.50	Transparently document in each NIR the methodology and the background information used for the estimation of the CO_2 EF for surface mining activities.	4 (2015/2016–2021)

ID#	*Previous recommendation for issue*	*Number of successive reviews issue not addressed*[a]
E.53	Ensure that the description and units regarding the AD for the calculation of fugitive CO_2 and CH_4 emissions are provided in a consistent and complete manner in CRF table 1.B.2.	4 (2015/2016–2021)
E.57	Improve the QA/QC procedures to verify the CH_4 EF for oil production and ensure the time-series consistency for the IEF for the whole time series.	4 (2016–2021)
E.60	Ensure consistency in the estimation of the CH_4 emissions from transport (1.B.2.a.3), fill the gaps for 1990–1996, verify the CH_4 IEF for 2014, and ensure consistency in the IEF for the entire time series.	4 (2016–2021)
E.61	Validate the AD for the subcategory and strengthen QC procedures to ensure that AD for 1990–1996 for the subcategory oil transport are correct; include the AD description and units in the CRF tables; and use an appropriate and consistent CH_4 EF to estimate emissions for the subcategory for 1990–1996.	3 (2017–2021)
E.67	(b) Ensure time-series consistency of the EFs; (c) Describe the emission trends in the NIR.	4 (2015/2016–2021)
E.69	Verify the CH_4 emission estimates for 2014 for the transmission and storage of natural gas, provide a consistent time series for 1990–2014, estimate the CO_2 emissions for the same subcategory for 1990–2013 and provide a consistent time series for the CO_2 emissions.	4 (2016–2021)
E.70	Verify the CH_4 emission estimate for 2014 for the distribution of natural gas, ensure time-series consistency for 1990–2014, estimate the CO_2 emissions for the same subcategory for 1990–2013 and provide a consistent time series for the CO_2 emissions.	4 (2016–2021)
E.71	Review and estimate the CO_2 and CH_4 emissions from the relevant venting and flaring of the liquid and gaseous fuels for 2013 and 2014, and provide a complete and consistent estimate of the emissions for this subcategory.	4 (2016–2021)
E.73	Estimate CO_2 emissions for this category or ensure the correct use of notation keys in CRF table 1.C, and include a category-specific discussion in the NIR for this activity, in accordance with paragraph 50 of the UNFCCC Annex I inventory reporting guidelines.	4 (2016–2021)
IPPU		
I.1	Strengthen the QA/QC processes to ensure correct use of notation keys and consistency of the information provided in the inventory submission. Explain in CRF table 9(a) in which category the emissions reported as “IE” are included.	6 (2012–2021)
I.2	Strengthen the QA/QC procedures and update all comments in the CRF tables, and make the reporting consistent between the NIR and the CRF tables of the same submission.	4 (2015/2016–2021)
I.3	Include the relevant AD descriptions in CRF table 2(I).A-H in order to improve the comparability and transparency of reported data.	4 (2015/2016–2021)
I.4	Apply the structure and names of the inventory categories in the NIR following the UNFCCC Annex I inventory reporting guidelines, as per decision 24/CP.19.	4 (2015/2016–2021)

ID#	*Previous recommendation for issue*	*Number of successive reviews issue not addressed*[a]
I.5	Report in the NIR, for the key categories identified by the trend or level, an explanation if the recommended methods from the appropriate decision trees in the 2006 IPCC Guidelines are not used, as required by the UNFCCC Annex I inventory reporting guidelines, paragraph 50(c).	3 (2017–2021)
I.6	Provide the description of the recalculations of emissions in the IPPU sector in accordance with the UNFCCC Annex I inventory reporting guidelines, paragraphs 43–45, and report in the NIR the reasons for recalculations, the assessment of the impact of recalculations on GHG emission trends, and changes of calculation methods, AD and EFs.	3 (2017–2021)
I.9	Provide in the NIR clear and consistent information on the AD, CKD correction factor and methods used for CO_2 emission estimates for category 2.A.1 cement production, and include clarifications on changes to the methods and AD sources for 2000 onward.	3 (2017–2021)
I.14	Improve the transparency of the information on the category 2.A.2 lime production in the NIR by providing the list of industries where the lime is produced and which are included in the aggregated data on lime production in Kazakhstan (e.g. pig iron and steel plants, copper plants, construction industry, sugar plants, etc.) and clarify, based on the procedures used for the compilation of national statistics, whether non-marketed lime production is included in the total national lime production used for the CO_2 emission calculation for the category.	3 (2017–2021)
I.19	Move to a tier 2 method to calculate CO_2 emissions from ammonia production, based on the amount of natural gas used and ensure consistent reporting of the category across the time series.	4 (2015/2016–2021)
I.25	Investigate the ratio of sinter + pellets to steel + pig iron and describe the reasons for the observed ratio in the NIR, including the possibility of exports of sinter and/or pellets, which could explain the ratio; and review the AD for the whole time series, if found necessary.	4 (2015/2016–2021)
I.26	Include in the NIR clear descriptions of the method, AD and EFs used in the emission estimates for subcategory 2.C.1.a steel in accordance with paragraph 50(a–b) of the UNFCCC Annex I inventory reporting guidelines.	3 (2017–2021)
I.27	Provide in the NIR clear and complete information on the method, AD and EFs used for the estimates of pig iron and ensure consistency of this information with the information reported in the CRF tables.	3 (2017–2021)
I.28	Revise the description of category 2.C.1 in the NIR to improve the transparency of the inventory by providing a clear statement that direct reduced iron production is not occurring in the country, including relevant references to the existing iron and steel plants.	3 (2017–2021)
I.29	Collect AD for fuels, reducing agents (coke breeze) and limestone used for sinter production, revise the CO_2 emission estimates for 2.C.1.d sinter for the complete time series using tier 2 or 3 methods from the 2006 IPCC Guidelines and demonstrate that emissions from fuels used for sinter production are excluded from the energy sector.	3 (2017–2021)
I.30	Collect AD for fuels (natural gas), reducing agents and limestone used for pellet production, revise the CO_2 emission estimates for category 2.C.1.e pellet for the complete time series using tier 2 or 3 methods from the 2006 IPCC Guidelines and demonstrate that emissions from fuels used for pellet production are excluded from the energy sector.	3 (2017–2021)
I.31	Provide in the NIR clear and documented information justifying that CO_2 and CH_4 emissions from coke production are not double counted under categories 2.C.1 iron and steel production, 1.A.1.b pig iron and 1.A.2.a iron and steel.	3 (2017–2021)

ID#	*Previous recommendation for issue*	*Number of successive reviews issue not addressed*[a]
I.33	Include in the NIR clear descriptions of the method, AD and EFs used for the emission estimates for category 2.C.2 ferroalloys production in accordance with paragraph 50(a–b) of the UNFCCC Annex I inventory reporting guidelines.	3 (2017–2021)
I.34	Improve the reporting of information on aluminium technology and parameters provided in the NIR and strengthen the QA/QC procedures in preparing the report with a view to eliminating internal inconsistencies in the NIR.	4 (2015/2016–2021)
I.37	Provide estimates for the emissions for the category or evidence to show the insignificance of this category, in accordance with decision 24/CP.19, annex I, paragraph 37(b); and include clear information of the category included under other in CRF table 2(I).A-H.	4 (2015/2016–2021)
I.40	Provide a transparent explanation in the NIR to justify the choice of the notation key "NO" for years prior to 2007, or collect AD and estimate emissions of HFC-32, HFC-125 and HFC-143a from refrigeration and air-conditioning equipment for the entire time series.	5 (2013–2021)
I.41	(a) Provide transparent information on methods, AD and EFs for this category; (b) Provide information on how time-series consistency is ensured for the category; (c) Provide clear information on the recalculations made across the entire time series; (d) Correct the reporting of the emissions in the CRF tables by providing data per subcategory, and clearly distinguish emissions from manufacturing, from stocks and from disposal.	4 (2015/2016–2021)
I.42	Collect relevant AD (manufacturing, stocks and recovery), in particular for equipment in operation and disposal, and estimate HFC emissions for category 2.F.1 refrigeration and air conditioning by applying the corresponding method from the 2006 IPCC Guidelines; however, if that is not possible, estimate HFC emissions for this category using the techniques on data gathering presented in the 2006 IPCC Guidelines (vol. 1, chap. 2) and apply the corresponding method from the 2006 IPCC Guidelines.	3 (2017–2021)
I.48	Estimate N_2O emissions for subcategory 2.G.3.a medical applications and report these emissions and include in the NIR information in accordance with paragraph 50(a–b) of the UNFCCC Annex I inventory reporting guidelines.	3 (2017–2021)
Agriculture		
A.9	Provide detailed information on the absence of organic soils in the country in the NIR.	3 (2017–2021)
A.12	Provide, in the NIR, detailed justification for reporting CO_2 emissions from liming as "NO".	3 (2017–2021)
LULUCF		
L.1	Improve completeness by including estimates for all mandatory categories, together with the relevant documentation supporting the estimates: (a) Net CO_2 emissions from forest land remaining forest land – mineral soils; (b) Net CO_2 emissions from grassland converted to forest land – mineral soils; (c) Net CO_2 emissions from wetlands converted to forest land – organic soils;	7 (2011–2021)

ID#	*Previous recommendation for issue*	*Number of successive reviews issue not addressed*[a]
	(f) Net CO_2 emissions from forest land converted to grassland – dead organic matter and mineral soils;	
	(g) Net CO_2 emissions from other land converted to wetlands;	
	(h) N_2O emissions from disturbance associated with land-use conversion to cropland, grassland converted to cropland – mineral soils.	
L.2	Improve the completeness of the reporting for the sector by providing estimates for all mandatory categories and pools (as listed in ID# L.1 (FCCC/ARR/2017/KAZ) and for the relevant land conversions, currently reported as "NO").	4 (2015/2016–2021)
L.3	Report areas of conversion from forest land to other land-use categories in land-use change matrices and provide estimations of GHG net emissions from deforestation in appropriate subcategories.	5 (2013–2021)
L.4	Improve the methodological information for the estimated categories by including:	4 (2015/2016–2021)
	(c) A description of the methodology applied, which includes: assumptions (and for each assumption, its logical basis and evidence of its reliability with regard to the condition to which it is applied) and the equations applied (noting that when an IPCC method is used, information on assumptions is not needed and equations may simply be quoted);	
	(d) A description of the AD and their quality, including information on data collection (methodology and timing), data compilation (methodology) and uncertainties.	
L.6	Include in the NIR a description of any QA/QC checks undertaken, and the results of such checks.	4 (2015/2016–2021)
L.7	Fully resolve the inconsistencies identified in the reporting of land-use areas and report an accurate and consistent land representation used for the estimates in accordance with the 2006 IPCC Guidelines.	3 (2017–2021)
L.8	Make efforts to convert existing statistics into the IPCC land-use categories, taking into consideration, among other issues, that:	6 (2012–2021)
	(a) Even if land use results in no emissions, it is good practice to report its area and use appropriate notation keys for net emissions and IEFs;	
	(c) The definitions of land-use categories in the IPCC good practice guidance for LULUCF are rather flexible, and this should facilitate the use of available statistics, with the help of proxy data, expert judgment and justified assumptions, which should be documented in the NIR;	
	(d) Lands that do not change land use should be reported separately from lands with land-use conversion; the Party may report aggregated estimates for all land conversions to a particular land use, when data are not available to report them separately. This should be clearly stated in the documentation boxes and documented in the NIR;	
	(e) The category other land remaining other land is intended to allow the total reported land area to match the total area of the country.	

ID#	*Previous recommendation for issue*	*Number of successive reviews issue not addressed*[a]
L.9	Include information on: (a) Ancillary data used for land classification, comprising timing and methodology of data collection and any further elaboration before their use for land classification; (b) The methodology applied for classifying land under land categories; (c) Explanations on how consistency is maintained when different sources of data and/or different methodologies are used for preparing the land representation.	4 (2015/2016–2021)
L.10	Revise the methodology according to good practice provided in the 2006 IPCC Guidelines (vol. 4, chap. 3) in order to build a consistent land representation, and develop and implement QA/QC procedures in order to check the consistency of conversions between land uses, to ensure that the total land area is constant over time and to ensure that the GHG inventory estimates are not affected by technical mistakes.	4 (2015/2016–2021)
L.12	Verify reported values of deadwood and biomass carbon stock of the forest subcategories hardwood and other trees and revise them, as needed, as well as include the relevant explanations on the national circumstances in the NIR.	4 (2015/2016–2021)
L.13	Report CSC separately for all the pools; report both biomass gains and biomass losses separately.	7 (2011–2021)
L.15	Apply the necessary procedures for the verification of emissions from soils, including any procedures in accordance with the QA/QC plan, and include these emissions in the CRF tables.	6 (2012–2021)
L.16	Estimate carbon stock losses from biomass in cropland and report all information on the method and background data used for calculating the rates used for estimating the CSC.	4 (2015/2016–2021)
L.17	Check the reliability of the AD for the degree of grassland degradation for the entire time series.	6 (2012–2021)
L.18	Implement the procedures included in the QA/QC plan and correct the error leading to inconsistent reporting of areas of grassland.	7 (2011–2021)
L.19	Consistently report grassland area in the submission and report information on the methodology applied for calculating the values contained in NIR table 6.11, as well as on information on the data used to validate them.	4 (2015/2016–2021)
L.20	Include AD in the CRF tables and estimate CSC in all pools.	6 (2012–2021)
Waste		
W.1	Provide estimates for the CH_4 and N_2O emissions from composting, and CO_2, CH_4 and N_2O emissions from waste incineration and biogenic open burning, or report the appropriate notation keys in line with decision 24/CP.19, annex I, paragraph 37.	4 (2016–2021)
W.2	Implement a QA/QC check to ensure that data provided in the NIR are consistent with the latest data in the submitted CRF tables.	4 (2016–2021)
W.3	Provide consistent information on the methods applied in the CRF tables and the NIR, as well as detailed information on the tiers used for the estimated categories in the sector and how they are consistent with the IPCC decision trees used for method selection.	4 (2015/2016–2021)

ID#	*Previous recommendation for issue*	*Number of successive reviews issue not addressed*[a]
W.4	Ensure that in the NIR the contribution of emissions for the categories within the waste sector for the latest reported year is correct and make it consistent with the information reported in the CRF tables.	3 (2017–2021)
W.5	Provide a justification, based on statistical data, that confirms how industrial waste is treated and disposed, and estimate and report the emissions from industrial waste, if applicable.	5 (2013–2021)
W.6	Obtain good-quality country-specific AD in order to estimate CH_4 emissions for this category using the tier 2 IPCC FOD method.	3 (2017–2021)
W.7	Provide in the NIR clear and comprehensive descriptions of the AD used for the calculation of annual waste generation for CH_4 emission estimates for category 5.A solid waste disposal, including values for the complete time series on the AD used for the emission estimates, such as per capita waste generation, total population and urban population, as well as collected waste volume and waste density for the years when these AD are used, as appropriate.	3 (2017–2021)
W.10	Update DOC values for relevant years of the time series based on representative values of waste composition in the country reflecting changes in the waste management practices over time and ensure that CH_4 emissions for category 5.A solid waste disposal are estimated in accordance with the 2006 IPCC Guidelines.	3 (2017–2021)
W.15	Ensure that CH_4 emissions from industrial waste containing DOC (e.g. from food, wood processing and fishing industries) disposed at SWDS are estimated and reported in future annual submissions in accordance with the 2006 IPCC Guidelines.	3 (2017–2021)
W.16	Provide in the NIR information and verifiable documentation showing the methods of treatment or disposal of industrial waste in the country, including the amount that is not treated and used, and particularly the biodegradable portion of this industrial waste.	3 (2017–2021)
W.18	Use the appropriate notation key for waste incineration consistent with decision 24/CP.19, annex I, paragraph 37.	4 (2015/2016–2021)
W.19	Further investigate the potential CO_2, CH_4 and N_2O emissions from open burning in unauthorized SWDS and include the estimates of emissions from open burning, as needed.	4 (2015/2016–2021)
KP-LULUCF		
KL.1	Provide CSC estimates and verifiable information on litter and SOC pools for AR, deforestation and FM by using the results of research work (i.e. as described in the NIR, section 6.3.6), which was planned with the aim of using the results for preparing the 2016 submission and the methodologies described in the 2006 IPCC Guidelines (vol. 4) and the Kyoto Protocol Supplement, as well as provide disaggregated CSC estimates for the above-ground biomass, below-ground biomass and deadwood pools in future annual submissions.	3 (2017–2021)
KL.2	Report clear data and information distinguishing lands where AR, deforestation, FM and GM activities occurred and corresponding emissions by sources and removals by sinks resulting from these activities under Article 3, paragraphs 3–4, of the Kyoto Protocol.	3 (2017–2021)
KL.3	Improve the reporting on KP-LULUCF by providing the missing information on key categories in CRF table NIR-3 in line with the UNFCCC Annex I inventory reporting guidelines.	3 (2017–2021)

ID#	*Previous recommendation for issue*	*Number of successive reviews issue not addressed*[a]
KL.8	Report AD for FM activities under Article 3, paragraph 4, of the Kyoto Protocol, including both subtotals and the components that form the subtotals, for the entire time series, ensuring their completeness as well as the data consistency between the CRF tables and the NIR.	3 (2017–2021)

[a] Reports on the reviews of the 2018 and 2020 annual submissions of Kazakhstan have not yet been published. Therefore, 2018 and 2020 were not included when counting the number of successive years for this table. In addition, as the reviews of the Party's 2015 and 2016 annual submissions were conducted together, they are not considered successive reviews and 2015/2016 is counted as one year.

V. Additional findings made during the individual review of the Party's 2021 annual submission

10. Table 5 presents findings made by the ERT during the individual review of the 2021 annual submission of Kazakhstan that are additional to those identified in table 3.

Table 5
Additional findings made during the individual review of the 2021 annual submission of Kazakhstan

ID#	*Finding classification*	*Description of finding with recommendation or encouragement*	*Is finding an issue/problem?*[a]
General			
		No general findings additional to those included in table 3 were made by the ERT during the review.	
Energy			
E.74	1. General (energy sector) – gaseous fuels – CO_2, CH_4 and N_2O	The ERT noted a number of issues relating to QA/QC for the energy sector: (a) 1.A.1.c/solid fuels/N_2O IEF – category 1.A.1.c – manufacture of solid fuels and other energy industries: the ERT noted that the 2017 N_2O EF (2.0 kg/TJ) for the category is outside the range of IPCC default values (0.1–1.5 kg/TJ) and is among the highest of all reporting Parties (0.1–5.4 kg/TJ). During the review, the Party clarified that this discrepancy in the N_2O EF for 2017 occurred owing to incorrect rounding of digits, as 0.001527 Gg N_2O was rounded to 0.002 Gg N_2O in CRF table 1.A(a)s1; (b) 1.A.2/liquid fuels/CO_2 IEF – category 1.A.2 – manufacturing industries and construction: the ERT noted that the 2006 CO_2 EF for the category (42.7 t/TJ) is outside the range of IPCC default values (57.6–97.5 t/TJ), the lowest of all reporting Parties (42.7–86.4 t/TJ) and below the values reported in the time series, with significant inter-annual changes in 2005/2006 (–44.3 per cent) and 2006/2007 (77.7 per cent). During the review, the Party clarified that this was caused by a typing error and the liquid fuel consumption for the category should be 51,600.5 TJ, not 91,610.8 TJ; (c) 1.A.2.d/gaseous fuels/CO_2 IEF – category 1.A.2.d – pulp, paper and print: the ERT noted that the 1999 CO_2 EF (100.0 t/TJ) is outside the range of IPCC default values (54.3–58.3 t/TJ) and the highest of all reporting Parties (54.4–100.0 t/TJ), with an inter-annual change for 1999/2000 (–44.9 per cent). During the review, the Party	Yes. Convention reporting adherence

ID#	*Finding classification*	*Description of finding with recommendation or encouragement*	*Is finding an issue/problem?*[a]
		clarified that the discrepancy in the CO_2 EF for 1999 is due to incorrect rounding of digits, so the CO_2 emissions from gaseous fuels are 0.005853 kt and not 0.01 as shown in CRF table 1.A(a)s2; (d) 1.A.2.f/liquid fuels/N_2O IEF trend – category 1.A.2.f – non-metallic minerals: the ERT noted that the inter-annual changes in the N_2O EF for the category for the following years have been identified as significant and larger than expected, when compared with those of other Parties: 2003/2004 (–90.2 per cent), 2005/2006 (702.8 per cent), 2008/2009 (55.0 per cent) and 2009/2010 (–51.8 per cent). During the review, the Party clarified that these were data entry errors. The N_2O emissions should be 0.0006159 (not 0.00006) for 2004, 0.00017 (not 0.000017) for 2005 and 0.0005554 (not 0.001) for 2009; (e) Reference approach/BKB/carbon EF: the ERT noted that the carbon EF for BKB and patent fuel for 2017–2019 (20.6 t/TJ) is outside the range of IPCC default values (23.8–29.6 t/TJ) and the lowest of all reporting Parties (20.6–28.9 t/TJ). It replaces the constant value of 26.6 t/TJ used for 1990–2016. During the review, the Party clarified that this is a mistake caused by a typing error. During the review, the Party reported that all the discrepancies will be corrected in the next annual submission. The ERT recommends that the Party correct the errors detected by the ERT for categories (a) 1.A.1.c (solid fuels), (b) 1.A.2 (liquid fuels), (c) 1.A.2.d (gaseous fuels), (d) 1.A.2.f (liquid fuels) and (e) reference approach (BKB), and strengthen the QA/QC activities to limit the data entry mistakes in the next annual submission.	
E.75	1.A.2.a Iron and steel – gaseous fuels – CO_2, CH_4 and N_2O	The gaseous fuel combustion for category 1.A.2.a iron and steel was reported as 14,596.76 TJ for 2018 and 1,131.69 TJ for 2019. The Party stated in the NIR (section 3.4.2.1, pp.90–91) that the decrease in CO_2 emissions compared with 2018 was mainly due to a decrease in the consumption of associated petroleum gas used for ferrous metallurgy and due to an accident which took place at ArcelorMittal Temirtau JSC. During the review, the Party provided a file containing the AD for 1999–2019 and the energy balance for 2019. The ERT identified inconsistencies in the trends for the consumption of natural gas and associated petroleum gas for 1999–2019, as well as inconsistencies between the data reported in the file and in the CRF tables. For example, for 1999 the file contains consumption of gaseous fuels of 11.57 TJ, while CRF table 1.A(a) gives 405.05 TJ. For 2019, the reported consumption in the file is 22.47 TJ, while in CRF table 1.A(a) it is 1,113.69 TJ. In the energy balance provided by the Party, the consumption of natural gas for 2019 was estimated to be 19,207,000 m^3, which is approximately 653 TJ, but the consumption of associated petroleum gas is not reported. During the review, the Party clarified that the inconsistency is due to changes in the way the AD for this category are collected by the Bureau of National Statistics. For the previous years, consumption of associated petroleum gas in category 1.A.2.a iron and steel was recorded in an aggregated manner and the amount reported was not actually consumed in the iron and steel industry. This mistake has been rectified for 2019 onward, but the Bureau of National Statistics is unable to provide revised AD for the previous years. The ERT recommends that the Party revise the AD for the entire time series for gaseous fuels under category 1.A.2.a iron and steel using a consistent approach and data source and recalculate the CO_2, CH_4 and N_2O emissions for the entire period, clearly explaining the recalculation in the NIR in accordance with the UNFCCC Annex I inventory reporting guidelines, paragraphs 43–45.	Yes. Accuracy

ID#	*Finding classification*	*Description of finding with recommendation or encouragement*	*Is finding an issue/problem?*[a]
E.76	1.A.3.b Road transportation – liquid fuels – N_2O	The Party reported in CRF table 1.A(a) an N_2O IEF for diesel oil of 5.7 kg/TJ. In the NIR (section 3.4.5.2, p.121) Kazakhstan clarified that it uses a tier 1 approach and default EFs to calculate the emissions for the category. The ERT noted that 3.9 kg/TJ is the default EF for diesel oil/road transport and the value of 5.7 kg/TJ is the default N_2O EF for motor gasoline (low mileage light-duty vehicle vintage 1995 or later) provided in the 2006 IPCC Guidelines (vol. 2, chap. 3, table 3.2.2, p.3.21). During the review, the Party clarified that this inconsistency was caused by a technical error and will be addressed in the next annual submission. The ERT considers that the issue leads to an underestimation of N_2O emissions for this category. The ERT recommends that the Party correct the EF applied for the estimates of N_2O emissions from diesel fuel in road transportation across the time series and provide revised estimates of N_2O emissions.	Yes. Accuracy
E.77	1.B.1 Solid fuels – solid fuels – CO_2 and CH_4	The Party calculated the CH_4 emissions of abandoned underground mines for 1997–2019 for the first time in the current submission (see ID# E.51 in table 3). In the NIR (section 3.5.2.2, p.150), the Party reported that it used a tier 1 methodology to estimate the CH_4 emissions for the category but has not provided additional information or transparently documented in its NIR the entire calculation of CH_4 emissions from the abandoned underground mines, or the parameters and EFs used. Kazakhstan also included estimates for CO_2 and CH_4 emissions for category 1.B.1.b solid fuel transformation (see ID# E.52 in table 3), for which a country-specific methodology is used (section 3.5.2.2, p.150). The ERT noted that the information provided in the NIR in both cases is very limited and provides no information on the background data or methods (formulae, assumptions or parameters) used, with the section on fugitive emissions presenting the information for various subcategories at an aggregated level. The ERT recommends that the Party include detailed information on the newly added estimates for subcategory 1.B.1.a.i abandoned underground mines and subcategory 1.B.1.b solid fuel transformation, including specific information on the methodologies used for estimating CO_2 and CH_4 emissions. The ERT encourages the Party to include separate sections in the NIR for each subcategory of fugitive emissions from solid fuels.	Yes. Transparency
E.78	1.B.1.a Coal mining and handling – solid fuels – CH_4	According to the NIR (section 3.5.2.2, p.150), the Party used default CH_4 EFs for mining activities for surface mining. In CRF table 1.B.1, an EF of 0.8 kg/t is reported, which is the average default EF for surface mines from the 2006 IPCC Guidelines (vol. 2, chap. 4.1.4.2, p.4.18). Having assessed the characteristics of the mines in Kazakhstan (e.g. see http://www.globalchange.umd.edu/data/aisu/publications/kazakemm.pdf), the ERT considers that the higher value of the range of default CH_4 EFs for surface mines may be more appropriate. During the review, the Party stated that it is developing country-specific EFs for coal mines and plans to revise its estimates once country-specific data are available. The ERT recommends that the Party verify the applicability of the average default value for the CH_4 EF of 0.8 kg/t reported for mining activities and either justify its use in the NIR or revise it in line with the characteristics of the mine fields in the country.	Yes. Accuracy
E.79	1.B.2.b Natural gas – gaseous fuels – CO_2 and CH_4	In response to a previous recommendation (see ID# E.68 in table 3), the Party provided a complete time series of estimates of fugitive CH_4 and CO_2 emissions from processing of natural gas. However, the NIR (section 3.5.4.8, pp.159–161, and table 3.33, p.160) does not contain information on the method or EF used for estimating emissions from natural gas processing or the AD time series used for the estimates. During the review, the Party noted that there are problems with the initial data for natural gas processing, but the annual submission takes into account all potential emissions by considering the level of production in the country.	Yes. Transparency

ID#	*Finding classification*	*Description of finding with recommendation or encouragement*	*Is finding an issue/problem?*[a]
		The ERT recommends that the Party include detailed information on the AD, methodology and EF used for estimating emissions from natural gas processing in its next annual submission.	
IPPU			
I.49	2.A.1 Cement production – CO_2	The Party reported in its NIR (section 4.2.1, pp.169–172) information on the AD, CKD correction factor and methods used for estimating CO_2 emissions for category 2.A.1 cement production (see ID# I.9 in table 3). The ERT noted that the AD reported in CRF table 2(I).A-Hs1 and in table 4.2 (section 4.2.1.1, p.170) of the NIR range from 1.00 kt (2003) to 7,393.80 kt (2018). The inter-annual changes in the AD for cement production for 2011/2012 (117.7 per cent) and 2012/2013 (30.6 per cent) have been identified as significant and the changes for 2000/2001 (7,810.5 per cent) and 2003/2004 (65,640.0 per cent) have been identified as both significant and larger than those of other reporting Parties. The change between 1990 and 2019 is 274.4 per cent. The ERT noted that there was no specific explanation for the trend in cement production in the NIR. Both in the NIR (section 4.1.1, pp.166–167) and during the review, the Party clarified that until 1997–1998 there was a significant decline in the development of industry in the country owing to the collapse of the Union of Soviet Socialist Republics and the establishment of the Republic of Kazakhstan. The beginning of the 2000s saw the start of industrial development in the country (section 4.1.1, figure 4.1, p.166). During the review, the Party explained that the inter-annual AD changes for cement production for 2000/2001 and 2003/2004 were caused by the instability of economic development and those for 2011/2012 and 2012/2013 were caused by sharp growth in the construction business, leading to high demand for cement and the establishment of new cement plants in the country. The ERT recommends that the Party explain in the NIR the drivers for the significant inter-annual changes in the AD used in the estimation of CO_2 emissions from cement production.	Yes. Transparency
I.50	2.D.3 Other (non-energy products from fuels and solvent use) – CO_2	As noted in ID# I.39 in table 3, the Party reported in its NIR (section 3.4.5.3, pp.122–130) accounting of urea converters for road transport for the first time. The ERT noted that the information on emissions was included under the energy chapter of the NIR and no cross-reference was given to the information in the IPPU chapter of the NIR. The ERT noted that, according to footnote 6 to CRF table 2(I).A-Hs2, the emissions from urea used as a catalyst should be reported under category 2.D.3 non-energy products from fuels and solvent use – other. The Party reported the notation key "NA" for category 2.D.3 other. The Party explained in its NIR (section 3.4.5.3, pp.122–130) and during the review that the share of CO_2 emissions from the use of urea additives is relatively small and on average is about 0.24 per cent of the CO_2 emissions generated from direct combustion of fuel in road transportation. The relevant CO_2 emissions from the urea additives are provided in table 3.27 (section 3.4.5.3, p.129) of the NIR, but not included in the CRF tables. The ERT noted that the reported emissions in table 3.27 (section 3.4.5.3, p.129) of the NIR (387,400 kt CO_2 for 2019) are above the significance threshold (177.43 kt CO_2 eq for 2019), suggesting an underestimation of emissions. The ERT recommends that the Party report CO_2 emissions from urea-based catalytic converters under category 2.D.3 non-energy products from fuels and solvent use – other in the next annual submission and include clear information on their allocation in the relevant sections of the energy and IPPU chapters of the NIR, along with relevant methodological information and cross-references.	Yes. Completeness

ID#	*Finding classification*	*Description of finding with recommendation or encouragement*	*Is finding an issue/problem?*[a]
I.51	2.F.1 Refrigeration and air conditioning – HFC-32	The ERT noted a significant drop in HFC-32 emissions reported in CRF table 2(II).B-Hs2 by the Party for subcategory 2.F.1.f stationary air conditioning from 28.37 t for 2008 to 5.37 t for 2009, followed by a significant increase to 25.45 t for 2010. During the review, the Party provided a spreadsheet of HFC emission estimates for category 2.F.1 refrigeration and air conditioning at the subcategory and compressor type level, indicating 2009 emissions of HFC-32 in subcategory 2.F.1.f as 28.1 t, and stated that the reported value of 5.37 t of HFC-32 is an error and will be updated to the correct value of 28.1 t in the next annual submission. The ERT recommends that the Party improve the accuracy of its emission estimates for HFC-32 in subcategory 2.F.1.f stationary air conditioning by reporting the corrected emission estimate for 2009 in CRF table 2(II).B-Hs2.	Yes. Accuracy
I.52	2.F.4 Aerosols – HFCs	The ERT noted that the Party reported for the first time on HFC emissions for category 2.F.4 aerosols and included estimates for HFC-134a from metered dose inhalers for 2002–2019 (see ID# I.47 in table 3), and the ERT commends the Party on the progress made. In the NIR (section 4.10, pp.253–256), Kazakhstan reported on estimates of the number of asthma patients and medical units sold used for the AD, but has not provided information on the methodology used to estimate the emissions, such as the formula used, or explained assumptions made for the calculation of HFC emissions. During the review, the Party provided additional information explaining that emission calculations were based on assumptions of the number of asthma patients per year, the corresponding demand for metered dose inhalers, the market share of various brands of metered dose inhaler for each year covered by the time series, and HFC-134a content for each metered dose inhaler brand. Furthermore, the Party provided a scientific paper (Cherednichenko et al., 2021a) underpinning the assumptions made regarding asthma patients in the country. The ERT recommends that the Party improve the transparency of its reporting by explaining (e.g. by using a formula) the approach taken for the estimation of HFC emissions from metered dose inhalers and by transparently documenting AD and EFs and all other relevant assumptions used for the estimates in the NIR.	Yes. Transparency
Agriculture			
A.14	3. General (agriculture) – CH_4 and N_2O	The Party reported a feed digestibility coefficient of 60 per cent for cows, non-dairy cattle and sheep in the NIR (section 5.2.2, table 5.7, p.271), but did not explain how this value was derived or sourced. During the review, Kazakhstan clarified that this represents the default feed digestibility coefficient value from the 2006 IPCC Guidelines (vol. 4, chap. 10, table 10A.1, p.10.72) for Eastern European countries (data based on estimates for the former Union of Soviet Socialist Republics). Kazakhstan further clarified that it aims to refine the values used in the estimates with the support of national agricultural research institutes. The ERT notes that this coefficient has a significant impact on emission estimates of enteric fermentation and manure management. The 2006 IPCC Guidelines (vol. 4, chap. 10, p.10.14) state that, owing to significant variation, digestibility coefficients should be obtained from local scientific data wherever possible. Improved estimates of the feed digestibility coefficient also reduce uncertainty for all livestock emission categories. The ERT recommends that the Party make every effort to develop country-specific coefficients for feed digestibility for dairy and non-dairy cattle, and sheep.	Yes. Accuracy
A.15	3.B.3 Swine – CH_4	The ERT noted that CH_4 emissions from MMS for swine accounted for about 35.2 and 12.7 per cent of total CH_4 emissions from MMS for 1990 and 2019, respectively, making the contribution from the species significant for this	Not an issue/problem

ID#	*Finding classification*	*Description of finding with recommendation or encouragement*	*Is finding an issue/problem?*[a]
		category. However, the Party continues to apply a tier 1 methodology to calculate CH_4 emissions from swine under enteric fermentation. The ERT reiterates the encouragement from the 2016, 2017 and 2019 annual review reports (FCCC/ARR/2016/KAZ, ID# A.17, FCCC/ARR/2017/KAZ, ID# A.13, and FCCC/ARR/2019/KAZ, ID# A.15, respectively) for the Party to make efforts to apply tier 2 methodology for the estimation of CH_4 emissions from MMS for swine. Default values for B_o of manure and VS from the 2006 IPCC Guidelines (vol. 4, chap. 10, annex 10A.2, table 10.A-7, p.10.80) could be applied.	
A.16	3.D.a.4 Crop residues – N_2O	The Party reported in its NIR (section 5.5.2, pp.293–294) a country-specific methodology for the calculation of biomass from crop residues, which allows for the calculation of the mass of N added to the soil annually from the annual yield. The methodology relies on the following data: N content in crop and root residues, share of crop and root residues as a percentage of harvested crop and a water correction factor (NIR section 5.5.2, equation 5.1, p.293). The ERT notes that the equation provided does not include a variable for removal of crop residues annually for purposes such as feed, bedding and construction, as is included in the default equation 11.6 of the 2006 IPCC Guidelines (vol. 4, chap. 11, p.11.14). Further, the country-specific equation does not include a variable for removal of residues through burning (see ID# A.19 below). The ERT would consider the country-specific methodology an appropriate method if these variables are included and estimated or if the Party provides well-documented justification that these practices do not occur. The NIR (section 5.5.2, p.294) states that the small share of crop residues used as fodder, livestock bedding and fuel has not been considered in the emission calculations owing to the lack of data at the national level. During the review, Kazakhstan clarified that no specific expert studies have been carried out regarding the removal of crop residues and it does not consider the amount removed significant but will research further and provide relevant information in its next annual submission. The ERT recommends that the Party conduct an expert survey on the removal of crop residues in the country or provide evidence in the form of published reports that removal of crop residues is not practised in the country, and present the results in the NIR to justify the accuracy of the method applied. If removal of crop residues is significant, the Party should modify its country-specific methodology to include a variable for removal of crop residues and, if required, removal through burning when calculating the biomass that remains in the field, in line with the 2006 IPCC Guidelines (vol. 4, chap. 11, equation 11.6, p.11.14).	Yes. Accuracy
A.17	3.D.a.5 Mineralization/ immobilization associated with loss/ gain of soil organic matter – N_2O	The Party reported in CRF table 3.D for 1990 the AD for N in mineral soils that is mineralized in association with loss of soil carbon under subcategory 3.D.a.5 (mineralization/immobilization associated with loss/gain of soil organic matter) using the notation key "NO" even though the NIR (section 6.3.2, table 6.3.5, p.339) and CRF table 4.B show a net loss for soil CSC in mineral soils for that year. The ERT noted that, according to the 2006 IPCC Guidelines (vol. 4, chap. 11, p.11.15), "where a loss of soil carbon occurs, this mineralized N is regarded as an additional source of N available for conversion to N_2O". During the review, the Party noted that there had been a technical error in transferring AD from the cropland category and it therefore agrees with the emission estimate provided by the ERT and will recalculate this category for its next annual submission. The Party also reported in its NIR in figure 5.9 (section 5.5.5, p.300) increasing N_2O emissions from 1990 onward which peaked in 2006 and then decreased until 2013, when they became constant. This trend, however, does not correlate with the loss of carbon in mineral soils as reported by the Party in the NIR (section 6.3.2, table 6.3.5, p.339). The ERT was unable to replicate the calculations of N_2O emissions associated with the mineralization of	Yes. Accuracy

ID#	Finding classification	Description of finding with recommendation or encouragement	Is finding an issue/problem?[a]
		soil organic matter using a C:N ratio of 10:1. During the review, the Party noted that this is due to the same error as above, and that it will be corrected in the next annual submission. The ERT recommends that the Party (a) apply equation 11.8 of the 2006 IPCC Guidelines (vol. 4, chap. 11, p.11.16) to the AD reported for net CSC in soils for mineral soils in cropland and land converted to cropland, which should be reported as the net annual amount of N mineralized in mineral soils as a result of loss of soil carbon through change in land use or management, and revise the estimates for subcategory 3.D.a.5 mineralization/immobilization associated with loss/gain of soil organic matter in CRF table 3.D for the entire time series; (b) report the methodology and AD used; and (c) report the comparison of the emission calculations between submissions in the recalculation section of the NIR, in accordance with the UNFCCC Annex I inventory reporting guidelines, paragraphs 43–45.	
A.18	3.D.b.2 N leaching and run-off – N_2O	The ERT notes that the Party uses a tier 2 method for indirect N_2O emissions from leaching and run-off for cropland soils. The Party used a $Frac_{LEACH-(H)}$ value of 0.1, reported in the NIR (table 5.31, p.297) and CRF table 3.D, with some explanation of how the value was derived provided in section 5.5.2 (pp.292–298) of the NIR. The ERT notes that the IPCC default value for $Frac_{LEACH-(H)}$ is 0.3 (2006 IPCC Guidelines, vol. 4, chap. 11, table 11.3, p.11.24) and that the decision tree in figure 11.3 of the 2006 IPCC Guidelines (vol. 4, chap. 11, p.11.20) indicates that country-specific partitioning fractions such as $Frac_{LEACH-(H)}$ should be rigorously documented. However, the ERT finds that the country-specific $Frac_{LEACH-(H)}$ value of 0.1 lacks rigorous documentation for the value and the uncertainty range, owing to a lack of references to published research or reports. The NIR also lacks detailed explanation of the calculation according to the equation shown in table 11.3 of the 2006 IPCC Guidelines (vol. 4, chap. 11, p.11.24). During the review, the Party stated that the assumptions and conclusions used to select the appropriate value were presented in the NIR (section 5.5.2, pp.292–298) and it will provide specific references justifying the choice of the EF in its next annual submission. The Party did not provide any references during the review. The ERT recommends that the Party rigorously document the county-specific value of $Frac_{LEACH-(H)}$ of 0.1 in the NIR.	Yes. Transparency
A.19	3.F Field burning of agricultural residues – CH_4 and N_2O	The Party reported field burning of agricultural residues using the notation key "NO" in CRF table 3.F for the entire time series and explained in the NIR (section 5.7, p.301) that the activity is prohibited by several pieces of legislation, including Article 47 of the Environmental Protection Act 160-1 of 15 July 1997. The ERT noted that there are several academic publications which indicate burning of crop residues in Kazakhstan (Dara et al., 2020; Lin et al., 2012; and Warneke et al., 2009), as well as the FAOSTAT emissions database. The assessment of the ERT of the data from Lin et al. (2012) and FAOSTAT (accessed in October 2021) indicates that the burning of crop residues could be a significant category for Kazakhstan, with 450 kt CO_2 eq estimated by FAOSTAT for 2019, which is approximately 0.13 per cent of the total emissions of the country for 2019 (FAOSTAT, 2021). During the review, the Party clarified that field burning of crop residues has not occurred across the entire time series owing to direct and indirect bans on the practice. The Party provided a list of relevant policies and stated that, on the basis of an analysis of studies from the country, it did not find any evidence of the mass burning of crop residues since 1990. The Party suggested that the international studies mentioned by the ERT could be accounting for spontaneous steppe and forest fires that are taken into account in the LULUCF sector, reported in CRF table 4(V) biomass burning under wildfires.	Yes. Completeness

ID#	*Finding classification*	*Description of finding with recommendation or encouragement*	*Is finding an issue/problem?*[a]
		The ERT recommends that the Party conduct an expert survey and desk review of the literature regarding field burning of crop residues and report its finding in the NIR. On the basis of the findings, the Party should provide well-documented justification that crop residue burning does not occur or is insignificant according to paragraph 37(b) of the UNFCCC Annex I inventory reporting guidelines. If the potential emissions prove to be above the significance threshold, the Party should provide emission estimates for the entire time series.	
LULUCF			
L.25	4.A.1 Forest land remaining forest land – CO_2	The Party reported in its NIR (section 6.2.1, table 6.2.1, p.324) that, at the national level, the area covered by forests varied between 9,391.4 kha and 12,933.1 kha, with an increase in standing timber stock from 354.03 to 441.94 million m^3 from 1988 to 2019. The ERT also noted a significant inter-annual variation in the IEF from 1990 to 2019 for mineral soils (a range of 0.013 (1990) to 0.43 (1998) and 0.030 t C/ha (2019)) and asked Kazakhstan if there had been a reassessment of the percentage of forest in different categories for the entire time series that explained the change or if there are other reasons (such as data availability or methodology) for this change. During the review, the Party clarified that annual changes in the carbon stock per unit area of forest land are mainly determined by the percentage share of forest (coniferous, deciduous, saxaul and shrubs) that form the total carbon budget for forest land in a particular region of the country. The Party provided further details on the changes in tree species share over the time series and explained that the forest area and standing timber stock is classified by main species, forest age category and purpose every five years in each region. Systematic forest accounting is carried out by the Kazakh Forest Management Republican State Enterprise of the Forestry and Wildlife Committee of the Ministry of Ecology, Geology and Natural Resources. The ERT recommends that the Party include in the NIR detailed information about the forest survey (i.e. the size of plot used for the inventory and the parameters covered that are relevant to the annual submission) and the updated calculation methodology for mineral soils on forest land.	Yes. Accuracy
L.26	4(V) Biomass burning – CO_2, CH_4 and N_2O	The Party reported in CRF table 4(V) CH_4 and N_2O emissions from wildfires on forest land. The relevant CO_2 emissions are reported using the notation key "IE" without any information on their allocation provided in the documentation box of the table or in the NIR (in line with footnote 5 to CRF table 5(V)). Further, the NIR (section 6.2.1, table 6.2.8, p.329) provides the areas of forest fires and the CO_2, CH_4 and N_2O emissions but there is no information in the NIR on the methods or EFs used, or the amount of biomass burned (i.e. t dry matter per ha). During the review, the Party clarified that the annual variability in emissions from forest fires, as natural phenomena, is determined by the climatic and economic conditions of the country. The Party also provided detailed information regarding biomass burned and the EFs used in the calculations. The ERT recommends that the Party complement the information in the NIR on areas of forest fires with information on the amount of biomass burned for different land types, the methodology and CO_2, CH_4 and N_2O EFs applied, and the allocation of CO_2 emissions from biomass burning.	Yes. Transparency
Waste			
W.20	5.A Solid waste disposal on land – CH_4	The Party has not provided in its NIR any information on CH_4 flaring or energy recovery at landfills, reporting this activity using the notation key "NO" in CRF table 5.A. During the review, the Party explained that, according to national studies (Inglezakis et al., 2017), a new landfill was established in 2017 in Astana (now Nur-Sultan) using	Yes. Transparency

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		modern technologies, including a system for collecting and using the CH_4 generated. Kazakhstan has not, however, provided any evidence as to whether or not CH_4 flaring occurs at the Nur-Sultan landfill. The Party did confirm that there are no waste-to-energy plants in the country, as there is no centralized incineration or biological plant producing green energy from solid waste. The ERT recommends that the Party investigate whether CH_4 flaring or energy recovery occurs at landfills in the country, including in Nur-Sultan, and report on this in its next annual submission, including a justification, if relevant, for the assumption that CH_4 energy recovery does not occur at any landfills. If landfill CH_4 flaring or energy recovery is found to occur in the country, the ERT recommends that the Party collect data on the amount of landfill CH_4 flaring or energy recovery across the entire time series, document these data and include the amount of flared landfill CH_4 or CH_4 for energy recovery in estimates of CH_4 emissions for category 5.A solid waste disposal.	
W.21	5.A Solid waste disposal on land – CH_4	The Party reported in its NIR (section 7.2.1, p.369) the values of reaction rates, which correspond to wet boreal and temperate climate zone rates according to the 2006 IPCC Guidelines (vol. 5, chap. 3, table 3.3, p.3.17). The ERT noted that most of the country is covered by desert, semi-desert and dry steppe zones, which are arid natural zones, as also explained in the Party's seventh national communication and third biennial report (p.12). Therefore, the ERT noted that, by default, dry boreal and temperate climate zone reaction rate values should be used to estimate CH_4 emissions from solid waste disposal, in line with the 2006 IPCC Guidelines (vol. 5, chap. 3, table 3.3, p.3.17). During the review, Kazakhstan explained that the latitude of its geographical location corresponds to Mediterranean countries, which have a humid subtropical climate, and the countries of Central Europe, which have a moderate continental climate. As most of Kazakhstan is landlocked and situated at a considerable distance from any ocean or major sea, their mitigating effect on the climate of the country is insignificant. The country is located in the southern part of the temperate climate zone and has four distinct seasons. In winter, severe Siberian frosts prevail and in summer tropical air masses dominate, forming over Kazakhstan, and Central Asia as a whole. The continental nature of the climate is in evidence in the extremes between summer and winter temperatures. The Party also supported its argument by referring to a web page (https://ru.wikipedia.org/wiki/Kazakhstan (in Russian)). In the light of this, Kazakhstan applied the default reaction rate values for the humid boreal and temperate climate zone. The ERT noted, however, that according to the reference provided by the Party, the climate of Kazakhstan varies between arid and semi-arid conditions, with winters being particularly dry, which actually supports the argument for reporting under the dry boreal and temperate climate zone. The ERT recommends that the Party revise its estimates of CH_4 emissions from solid waste disposal on land by applying reaction rate values that correspond to the dry boreal and temperate climate zone, in line with the 2006 IPCC Guidelines (vol. 5, chap. 3, table 3.3, p.3.17).	Yes. Accuracy
W.22	5.A Solid waste disposal on land – CH_4	The Party did not report in its NIR any information on the delay time used to estimate CH_4 emissions from solid waste disposal. During the review, Kazakhstan explained that it used a default value of six months for the lag time to estimate CH_4 emissions from landfills. The ERT commends the Party for the explanation on the applied default delay time value of six months, which is in line with the 2006 IPCC Guidelines (vol. 5, chap. 3, p.3.19). The ERT recommends that the Party include information on applied delay time in the NIR.	Yes. Transparency

ID#	*Finding classification*	*Description of finding with recommendation or encouragement*	*Is finding an issue/problem?*[a]
W.23	5.A Solid waste disposal on land – CH_4	The Party reported in its NIR (section 7.2.1, p.368) that there are three types of SWDS in the country: managed anaerobic, managed semi-aerobic and unmanaged shallow. The ERT noted that figure 7.3 of the NIR (section 7.2.1, p.368) illustrates emissions from managed anaerobic, managed semi-aerobic and unmanaged deep SWDS but during the review Kazakhstan explained that figure 7.3 only illustrates emissions from unmanaged shallow SWDS and that unmanaged deep SWDS are not included. The ERT recommends that the Party report consistent information on types of SWDS in its NIR, including textual information, figures and tables.	Yes. Convention reporting adherence
W.24	5.A Solid waste disposal on land – CH_4	Kazakhstan reported in its NIR (section 7.2.6, p.372) that the MCF value for unmanaged SWDS for the entire time series has been revised so that unmanaged SWDS (MCF value of 0.8) were reconsidered as shallow (MCF value of 0.4). Along with other minor recalculations, such as a revision of the amount of waste disposal by type of SWDS (see ID#s W.12 and W.14 in table 3), the reconsideration of the MCF value led to a decrease of CH_4 emissions for category 5.A solid waste disposal by 41.64–45.67 per cent for the entire time series compared with the 2020 submission. The ERT noted that neither background data, justification nor a documented explanation for the reclassification of unmanaged deep SWDS as unmanaged shallow SWDS was provided in the NIR. During the review, the Party explained that waste disposal sites are often difficult to classify as solid waste landfills in the country, as they are, in fact, unauthorized garbage dumps. Further, Kazakhstan explained that, according to the Programme for Modernization of the Solid Waste Management System for 2014–2050, these solid waste landfills do not comply with the requirements of sanitary regulations and environmental standards for disposal. In this regard, the MCF value for the estimation of CH_4 emissions from waste disposal from unmanaged SWDS was revised for the entire time series. The ERT noted that, according to the 2006 IPCC Guidelines (vol. 5, chap. 3, table 3.1, p.3.14), the SWDS are classified as unmanaged deep (with an MCF value of 0.8) where they are more than 5 m deep and otherwise unmanaged SWDS are considered as shallow (with an MCF value of 0.4). Where a country cannot categorize its SWDS into managed anaerobic and semi-aerobic or unmanaged deep and shallow SWDS, these SWDS can be considered as uncategorized with an MCF value of 0.6. The ERT also noted that, according to the 2006 IPCC Guidelines (vol. 5, chap. 3, p.3.28), the distribution of waste to managed and unmanaged sites for the purpose of MCF estimation should also be documented with supporting information. In this regard, the ERT found that Kazakhstan has not provided a relevant explanation with supporting documented information for the revision of the MCF value for unmanaged SWDS from 0.8 to 0.4i n its 2021 submission, because no corresponding justification was provided that the typical depth of unmanaged SWDS in Kazakhstan is less than 5 m. The ERT considers that the issue may indicate an underestimation of CH_4 emissions for this category. The ERT recommends that the Party provide in its NIR a clear explanation and well-documented justification as to why unmanaged SWDS are considered shallow with a corresponding MCF value of 0.4. If justification cannot be provided, the ERT recommends that the Party reconsider the type of unmanaged SWDS in accordance with the 2006 IPCC Guidelines (vol. 5, chap. 3, table 3.1, p.3.14) and document the choice for the applied MCF values in its NIR.	Yes. Accuracy
W.25	5.A.1 Managed waste disposal sites – CH_4	The Party reported in its NIR (section 7.2.1, p.368) that Nur-Sultan (formerly Astana) landfill is considered to be managed anaerobic with an MCF value of 1.0 and Almaty landfill is considered to be managed semi-aerobic with an MCF value of 0.5. The ERT noted that the Party has not provided any explanation for the classification of the	Yes. Transparency

ID#	Finding classification	Description of finding with recommendation or encouragement	Is finding an issue/problem?[a]
		two landfills. During the review, Kazakhstan explained that Nur-Sultan is the only landfill in the country designed in accordance with international standards. The collected waste in Nur-Sultan is processed at the mechanical-biological treatment plant (see ID #W.29 below) or is sent to landfill. However, only about 6 per cent of the incoming waste is recycled (paper, plastic, glass and metal), while the rest is briquetted and disposed of in landfill. The new landfill has been built using modern technologies, including a system for collecting and using the CH_4 generated (see ID# W.20 above), rainwater collection and wastewater treatment and drainage systems. The Party explained that waste in Almaty is collected by 73 private companies, with Tartyp JSC covering 70 per cent of the population. There are no waste recycling facilities in the city and all waste is disposed of in landfill. There were six landfills near Almaty in 2009 but now there is only one active landfill with an area of 44 ha, where most waste is disposed of. Further, the Party provided a reference (Inglezakis et al., 2017) to support its decisions regarding the MCF values applied. The ERT noted that, in accordance with the 2006 IPCC Guidelines (vol. 5, chap. 3, table 3.1, p.3.14), managed anaerobic landfills must have controlled placement of waste (i.e. waste directed to specific deposition areas, a degree of control of scavenging and a degree of control of fires) and include at least one of cover material, mechanical compacting or levelling of the waste. On the other hand, managed semi-aerobic landfills must have controlled placement of waste and include all of the following structures for introducing air to waste layer: permeable cover material, leachate drainage system, regulating pondage and gas ventilation system. The ERT therefore considers that the Party did not provide relevant information to demonstrate that Nur-Sultan landfill can be classified as managed anaerobic, as no information was provided on the conditions of waste disposal at this landfill, or that Almaty landfill can be classified as managed semi-aerobic, as no information was provided that this landfill is covered by permeable material. The ERT considers that the issue may result in an underestimation of CH_4 emissions for this category, especially for the landfills located near big cities such as Almaty. The ERT recommends that the Party include in the NIR background information with relevant references to support the classification of Nur-Sultan landfill as managed anaerobic and Almaty landfill as managed semi-aerobic in line with the 2006 IPCC Guidelines (vol. 5, chap. 3, table 3.1, p.3.14). Such information can be collected directly from the operators of Nur-Sultan and Almaty landfills.	
W.26	5.A Solid waste disposal on land – CH_4	The Party reported in its NIR (section 7.2.1, table 7.2, p.366) the results of a national study on MSW composition in Nur-Sultan, Almaty and nine other cities. In the NIR, the only information on DOC values in the NIR (section 7.2.1, p.369) indicates that DOC values were evaluated on the basis of long-term results of MSW composition and that the average DOC values obtained are as follows: 0.21 for the cities other than Nur-Sultan and Almaty, 0.14 for Nur-Sultan and 0.17 for Almaty. Kazakhstan did not provide any information on DOC values for 1990–2011 (see ID# W.9 in table 3). The ERT noted that DOC values for the entire time series are not reported in the NIR, nor is there an explanation as to how these data were derived. During the review, the Party provided country-specific data on DOC values by different type of SWDS for 1950–2019: managed anaerobic (Nur-Sultan), managed semi-aerobic (Almaty) and unmanaged shallow (other cities in Kazakhstan). The ERT commends the Party for the detailed data provided on DOC values and notes that, according to the 2006 IPCC Guidelines (vol. 5, chap. 3, p.3.28), if country-specific data are used for any part of the time series in CRF category 5.A solid waste disposal, they should be documented, and changes in parameters from year to year should be clearly explained and referenced. The ERT recommends that the Party include in its NIR the following information:	Yes. Transparency

ID#	*Finding classification*	*Description of finding with recommendation or encouragement*	*Is finding an issue/problem?*[a]
		(a) DOC values by type of SWDS and average annual national DOC values for 1990–2019; (b) Relevant explanation as to how DOC values were derived for 1950–2019; (c) References and main assumptions used to derive DOC values for 1950–2019; (d) Explanation of changes in DOC values across the time series.	
W.27	5.B Biological treatment of solid waste – CH_4 and N_2O	The Party did not estimate CH_4 or N_2O from biological treatment of waste and reports using the notation key "NO" in CRF table 5.B. No information on solid waste biological treatment (composting or anaerobic digestion at biogas facilities) was provided in the NIR (see ID# W.1 in table 3). During the review, the Party referred to the 2013 Concept for the Transition of the Republic of Kazakhstan to Green Economy indicating an insignificant level of organic waste recycling. The ERT noted that the publication (Inglezakis et al., 2017), provided by the Party during the review, states that a Programme for Modernization of the Municipal Solid Waste Management for 2014–2050 was issued by the Ministry of Environment and Water Resources under the Concept for the Transition of the Republic of Kazakhstan to Green Economy Act 577 of 30 May 2013 and under Act 750 of 6 August 2013, which is the action plan to implement this concept. This programme is considered one of the most important documents for implementing a green economy in the country and it includes plans to update MSW recycling and storage standards using new technologies, such as anaerobic digestion, composting and biogas. By the end of 2019, the programme had been operational for more than five years and could be expected to lead to composting taking place and included in the annual submission. During the review, the Party explained that there is no information available as to whether composting is carried out in the country and noted that, according to the 2013 Concept for the Transition of the Republic of Kazakhstan to Green Economy, the level of organic waste recycling in the country is insignificant. Further, the Party explained that the waste collected in Nur-Sultan is either processed at the mechanical-biological treatment plant or sent to landfill. The projected capacity of the mechanical-biological treatment plant complex is 600–800 t/day. The complex was projected to recover 20 per cent of incoming waste, so the remaining 80 per cent is compacted and disposed of in landfill. The facility accepts mixed (not separated) solid waste and separates out the recyclable materials. In March 2013, the waste acceptance capacity of the plant was about 300–380 t/day. However, in reality, only about 6 per cent of the incoming waste was recycled (paper, plastic, glass and metal), while the rest was compacted and disposed of in landfill. The ERT considers that the issue may result in an underestimation of CH_4 emissions for this category, as biological treatment of waste including composting and anaerobic digestion at biogas facilities is expected to occur at the mechanical-biological treatment plant in Nur-Sultan. The ERT recommends that the Party collect information on any possible emissions linked to the operation of the Nur-Sultan mechanical-biological treatment plant and report them in CRF table 5.B. In addition, the ERT recommends that the Party include in its NIR an individual section on biological treatment, to include information on the mechanical-biological treatment plant in Nur-Sultan including information as to whether composting or anaerobic digestion of waste occur at this facility; information on common practice for food waste and garden waste treatment in rural areas and the private sector in the country; and an overview of the recycling practices used in line with the 2013 Concept for the Transition of the Republic of Kazakhstan to Green Economy, as provided to the ERT during the review.	Yes. Transparency

ID#	*Finding classification*	*Description of finding with recommendation or encouragement*	*Is finding an issue/problem?*[a]
W.28	5.C Incineration and open burning of waste – CO_2, CH_4 and N_2O	The Party reported in CRF table 5.C only one category of waste incinerated under category 5.C.1, namely clinical waste, included under other non-biogenic waste. During the review, the ERT asked the Party to clarify whether industrial waste is incinerated in the country, for example, for the thermal neutralization of hazardous components. The ERT also asked Kazakhstan to provide corresponding justification in case it considers that industrial waste (not including clinical waste) is not incinerated in the country. The ERT considers that the issue may result in an underestimation of CH_4 emissions for this category. During the review, the Party stated that industrial waste is not incinerated in Kazakhstan. The ERT recommends that the Party include in its NIR: (a) Justification that the thermal treatment of industrial waste (other than clinical waste) did not take place in the country for the entire time series or that the emissions from industrial waste incineration are below the significance threshold in accordance with paragraph 37(b) of the UNFCCC Annex I inventory reporting guidelines; (b) Comprehensive explanation of industrial waste treatment in Kazakhstan, including typical practice for hazardous waste neutralization in the country.	Yes. Transparency
W.29	5.C.1 Waste incineration – CO_2	The Party reported in its NIR (section 7.3.2.1, p.393) that it used the default value of an oxidation factor of 0.95 to estimate CO_2 emissions from clinical waste incineration. The ERT noted that the default value of waste incineration oxidation factor is 1.0, in accordance with the 2006 IPCC Guidelines (vol. 5, chap. 5, table 5.2, p.5.18). During the review, the Party confirmed that the wrong oxidation factor was used and that it will correct this in its next annual submission. The ERT recommends that the Party revise the oxidation factor used to estimate CO_2 emissions from clinical waste for waste incineration by applying the default value of 1.0 provided in the 2006 IPCC Guidelines (vol. 5, chap. 5, table 5.2, p.5.18) or by applying a well-documented and justified country-specific value.	Yes. Accuracy
W.30	5.C.1 Waste incineration – CO_2, CH_4 and N_2O	The Party included CO_2, CH_4 and N_2O emissions from the incineration of clinical waste under waste incineration in CRF table 5.C (see ID# W.17 in table 3). The ERT noted that these emissions were reported as other under category 5.C.1 non-biogenic MSW incineration, without specifying the subcategory using the predefined list under other suggested in CRF table 5.C (e.g. clinical waste). This reporting prevents AD and IEF reporting within the table for this subcategory. The ERT noted that, according to the 2006 IPCC Guidelines, (vol. 5, chap. 5, p.5.6), for waste incineration, the most accurate emission estimates can be developed by determining the emissions on a plant-by-plant basis and/or by differentiating for each waste category (e.g. MSW, sewage sludge, industrial waste and other waste including clinical waste and hazardous waste). The ERT noted that information on the amount of clinical waste incineration is available in Kazakhstan. The ERT recommends that the Party specify clinical waste incineration as an individual subcategory under other in CRF table 5.C and transparently report the AD, emissions and IEFs for this subcategory.	Yes. Comparability
W.31	5.C.1 Waste incineration – CH_4 and N_2O	The Party reported in CRF table 5.C that CH_4 and N_2O emissions from clinical waste incineration were both 0.409 kt in 2019. In its NIR (section 7.5.1, p.392), however, it reported that 6,819.097 t of clinical waste (reported using the notation key "NO" in CRF table 5.C, see ID# W.18 in table 3) was incinerated in 2019. The ERT noted that the estimated CH_4 and N_2O IEFs could be derived by dividing the emissions by waste incineration, both equal to $60 \cdot 10^3$ g/Gg. Further, the ERT noted that the CH_4 and N_2O EFs applied for clinical waste incineration are hundreds of times higher than the default values in the 2006 IPCC Guidelines (vol. 5, chap. 5, table 5.3, p.5.20 for CH_4, and	Yes. Accuracy

ID#	*Finding classification*	*Description of finding with recommendation or encouragement*	*Is finding an issue/problem?*[a]
		table 5.4, p.5.21 for N_2O). During the review, the Party explained that the technical error took place when estimating the emissions and it will correct the error for future annual submissions. The ERT noted that this error leads to a thousandfold overestimation of CH_4 and N_2O emissions from clinical waste incineration for 2006–2019 owing to the incorrect use of CH_4 and N_2O EFs. The ERT recommends that the Party revise the CH_4 and N_2O EFs either by applying default EFs provided in the 2006 IPCC Guidelines (vol. 5, chap. 5, table 5.3, p.5.20 for CH_4, and table 5.4, p.5.21 for N_2O) or using well-documented country-specific EFs, if available; correct detected technical errors by enhancing QA/QC checks; and ensure that CH_4 and N_2O EFs are consistently applied across the entire time series.	
W.32	5.C.1 Waste incineration – CO_2, CH_4 and N_2O	The Party did not report in its NIR any information on waste incineration with energy recovery and used the notation key "NO" in CRF table 5.C. During the review, the Party explained that there was no incineration of waste with energy recovery in the country for 1990–2019 and stated that there were plans to start construction of a waste incineration plant in 2021. The ERT recommends that the Party include in its NIR the statement that there was no incineration of waste with energy recovery in the country in 1990–2019 and that the start of construction of a waste incineration plant is planned for 2021.	Yes. Transparency
W.33	5.C.1 Waste incineration – CO_2, CH_4 and N_2O	The Party reported in its NIR (section 7.5.2.1, p.392) that the emissions from clinical waste incineration were estimated in accordance with the IPCC good practice guidance for LULUCF (in Russian) (available at https://www.ipcc.ch/site/assets/uploads/2018/03/GPG_Russ.pdf). In response to a request from the ERT to confirm that the 2006 IPCC Guidelines (vol. 5, chap. 5, section 5.2.1) were used as a methodological basis for the estimation of the corresponding estimations, the Party explained that the wrong link was reported in the NIR due to a technical problem and stated that the mistake will be rectified in the next annual submission. The ERT recommends that the Party provide correct references to the methodological basis for estimating emissions from clinical waste incineration in the NIR.	Yes. Convention reporting adherence
W.34	5.D Wastewater treatment and discharge – CH_4	The Party reported in its NIR (key category analyses, annex 3, pp.421–433) that CH_4 emissions for category 5.D wastewater treatment and discharge are a key source of emissions both by level and trend. The ERT noted that CH_4 emissions from wastewater treatment and discharge were estimated using a tier 1 method and asked during the review why higher-tier methods had not been used. The Party explained that the tier 1 method was used owing to a lack of data availability and shared plans to apply higher-tier methods to estimate CH_4 emissions for category 5.D wastewater treatment and discharge for future annual submissions. The ERT recommends that the Party apply higher-tier methods in accordance with the decision tree in the 2006 IPCC Guidelines (vol. 5, chap. 6, figure 6.2, p.6.10) to estimate CH_4 emissions from wastewater treatment and discharge or clearly explain in the NIR the reason why it was unable to implement the recommended method.	Yes. Accuracy
W.35	5.D Wastewater treatment and discharge – CH_4 and N_2O	The Party did not estimate N_2O emissions from industrial wastewater treatment and reported using the notation key "NO" in CRF table 5.D. The ERT noted that the 2006 IPCC Guidelines do not provide a methodology for the estimation of N_2O emissions from industrial wastewater. During the review, the Party explained that the notation key "NO" for N_2O emissions from industrial wastewater was used because, compared with emissions from domestic wastewater, the emissions of N_2O from industrial sources are insignificant. The ERT noted that, according to decision 24/CP.19, the notation key "NE" could be used when an activity occurs in a country but the 2006 IPCC	Yes. Comparability

ID#	*Finding classification*	*Description of finding with recommendation or encouragement*	*Is finding an issue/problem?*[a]
		Guidelines do not provide a methodology to estimate the emissions. The ERT also noted that Kazakhstan reported in its NIR that a tier 1 method was used to estimate CH_4 emissions from wastewater treatment (section 7.3.2, p.375) and that the organic component removed as sludge was reported as zero both for domestic wastewater (section 7.3.2, p.376, equation 3) and industrial wastewater (section 7.3.8, p.382, equation 7.4). Further, the ERT noted that the amount of sludge removed was reported using the notation key "IE" in CRF table 5.C both for domestic and industrial wastewater. The ERT also noted that, according to the 2006 IPCC Guidelines (vol. 5, chap. 6, p.6.9), the tier 1 method assumes that the default for sludge removal is zero. The ERT recommends that the Party replace: (a) The notation key "NO" for N_2O emissions from industrial wastewater for 1990–2019 with the notation key "NE", since these emissions are not estimated and may occur and the 2006 IPCC Guidelines do not provide a corresponding methodology to estimate these emissions, and provide the relevant explanation in CRF table 9; (b) The notation key "IE" for sludge removed in CRF table 5.D with the notation key "NO", because the default value of zero was used for sludge removed.	
W.36	5.D.1 Domestic wastewater – N_2O	The Party reported in the NIR (section 7.4.1, table 7.15, p.389) the protein consumption per capita for 1990–2019. The ERT noted that FAO publishes three-year average data on per capita protein supply specifically for Kazakhstan (available at https://www.fao.org/faostat/en/#country/108). These data represent the average value for 2000–2002, 2001–2003 and 2016–2018. A similar time series can be derived for the data on protein consumption reported by Kazakhstan in the NIR. In a comparison of the two sets of three-year average data, the difference between the data is quite small and varies from 0 to 1.6 per cent for 1990–2013. The difference increases significantly, however, for 2014–2018, namely to between 2.6 and 9.5 per cent. During the review, Kazakhstan explained that the data on per capita protein consumption reported in the NIR for 2013–2019 are based on the results of a sample survey of households by living standards according to the Bureau of National Statistics (Department of Labour and Living Standards Statistics). The ERT encourages the Party to include in its NIR a comparative analysis of per capita protein consumption data provided by the Bureau of National Statistics and the corresponding FAO statistics.	Not an issue/problem
W.37	5.D.2 Industrial wastewater – CH_4	The Party did not estimate CH_4 emissions from pulp and paper manufacturing under category 5.D.2 industrial wastewater for its inventory (NIR section 7.3.8, p.383). The ERT noted that pulp and paper manufacturing do occur in the country (as, for example, more than 200 kt paper and cardboard was produced in 2019 (see https://paperonweb.com/Kazakhstan.htm). During the review, the Party explained its plans to estimate CH_4 emissions from pulp and paper manufacturing in the category after clarifying the data from the Bureau of National Statistics and include them in the next annual submission. The ERT recommends that the Party collect data on pulp and paper manufacturing in the country for the entire time series, correct the estimates and report corresponding CH_4 emissions from pulp and paper manufacturing under category 5.D.2 industrial wastewater.	Yes. Accuracy
W.38	5.D.2 Industrial wastewater – CH_4	The ERT noted that the inter-annual changes in the total organic product for category 5.D.2 industrial wastewater for the following years has been identified as significant and relatively larger than those of other reporting Parties: 1991/1992 (–35.34 per cent), 1992/1993 (–45.23 per cent), 1993/1994 (–38.04 per cent), 1997/1998 (–41.83 per cent), 2001/2002 (36.07 per cent) and 2006/2007 (46.21 per cent). The Party did not report in its NIR an	Yes. Transparency

ID#	*Finding classification*	*Description of finding with recommendation or encouragement*	*Is finding an issue/problem?*[a]
		explanation of the CH_4 emission trend for the category. During the review, the Party explained that inter-annual changes in the total volume of organic product for 5.D.2 industrial wastewater are based on the data received from the Bureau of National Statistics and the volume of production of certain types of industrial product is presented in table 7.11 (section 7.3.9, p.385) of the NIR. The ERT therefore concluded that no relevant reason for the large inter-annual changes observed has been provided by the Party. The ERT recommends that the Party include a description of the CH_4 emission trend for category 5.D.2 industrial wastewater and a relevant explanation for the large inter-annual changes in the total organic product in its NIR, demonstrating that these inter-annual changes are caused by the changes in the industrial sector of Kazakhstan and not by any error that could occur during primary data collection, processing or data transfer.	
KP-LULUCF			
KL.10	AR – CO_2	The Party reported in CRF tables NIR-2 and (KP-I)A.1 under Article 3, paragraph 3, activities – AR an area of 550 kha for 2019. For 2018, the reported value for the activity is 525 kha. The ERT noted that the reported values represent the total area in the category, whereas the rationale in CRF table NIR-2 is to report the area at the beginning of the reporting year and the new area that has been added under the activity during the year. Information explaining on which land category these AR activities took place should be included in CRF table NIR-2. In addition, as AR has been reported, it can be expected that land converted to forest land would be reported under the LULUCF sector. However, the ERT noted that land converted to forest land is reported using the notation key "NO" across the entire time series in CRF table 4.A under the LULUCF sector. During the review, the Party clarified that it continues to collect information for the reporting of land in accordance with the guidance documents of the Convention and its Kyoto Protocol. In particular, the Party clarified that, in most cases, lands falling under the definition of AR can be characterized as developed forest land on forest land plots occupied by open spaces and clearings, which are not wooded in terms of forest parameters. An exception is the green belt of Nur-Sultan in the Akmola region, which, as part of the AR, was transformed from agricultural land to forest land. After receiving full information on the areas of unclosed tree crops that are classified as "young" in the Akmola region, the Party will make the appropriate corrections to the land-use matrix (section 6.1, table 6.1.6, p.317) and to the CRF tables in its next annual submission. The ERT recommends that the Party revise the reporting in CRF table NIR-2 to reflect the annual changes under AR, as indicated by the successive changes in area in CRF table 4(KP-I)A.1. If the previous land use is not known, the area can be entered under other. The ERT also recommends that the Party strengthen consistency with the reporting of land-use change under the Convention.	Yes. Transparency
KL.11	GM – all gases	The Party reported estimates for GM in CRF table 4(KP-I)B.3 in its 2020 submission but, in the current annual submission, it reported AD and CSC using the notation key "NO" even though, according to its report to facilitate the calculation of the assigned amount, it elected to report GM under Article 3, paragraph 4, of the Kyoto Protocol. During the review, Kazakhstan explained that information relating to the reporting of CRF table 4(KP-I)B.3 is expected to be presented in the next annual submission, with CSC and CO_2 calculations at the regional level. The Party also explained that the reporting presented in its 2020 submission was based on experimental calculations at the national level of former arable land withdrawn from crop rotation. During the analysis performed at the regional	Yes, Completeness

ID#	*Finding classification*	*Description of finding with recommendation or encouragement*	*Is finding an issue/problem?*[a]
		level, preliminary calculations showed that the trends in the dynamics of CSC for GM are not the same across regions, so the methodological approach needs to be adjusted before the calculations can be used in the reporting. The ERT recommends that the Party report GM in its next annual submission or clearly justify in the NIR why this elected activity under Article 3, paragraph 4, of the Kyoto Protocol is not reported.	

[a] Recommendations made by the ERT during the review are related to issues as defined in para. 81 of the UNFCCC review guidelines or problems as defined in para. 69 of the Article 8 review guidelines.

VI. Application of adjustments

11. The ERT did not identify the need to apply any adjustments for the 2021 annual submission of Kazakhstan.

VII. Accounting quantities for activities under Article 3, paragraph 3, and, if any, activities under Article 3, paragraph 4, of the Kyoto Protocol

12. Kazakhstan elected commitment period accounting and therefore the issuance and cancellation of units for KP-LULUCF is not applicable to the 2021 review.

VIII. Questions of implementation

13. No questions of implementation were identified by the ERT during the individual review of the Party's 2021 annual submission.

Annex I

Overview of greenhouse gas emissions and removals and data and information on activities under Article 3, paragraphs 3–4, of the Kyoto Protocol, as submitted by Kazakhstan in its 2021 annual submission

1. Tables I.1–I.4 provide an overview of the total GHG emissions and removals as submitted by Kazakhstan.

Table I.1

Total greenhouse gas emissions and removals for Kazakhstan, base year–2019

(kt CO_2 eq)

	Total GHG emissions excluding indirect CO_2 emissions		*Total GHG emissions and removals including indirect CO_2 emissions*[a]		*Land-use change (Article 3.7 bis as contained in the Doha Amendment)*[b]	*KP-LULUCF (Article 3.3 of the Kyoto Protocol)*[c]	*KP-LULUCF (Article 3.4 of the Kyoto Protocol)*	
	Total including LULUCF	*Total excluding LULUCF*	*Total including LULUCF*	*Total excluding LULUCF*			*CM, GM, RV, WDR*	*FM*
FMRL								–
Base year[d]	373 395.81	385 025.66	NA	NA	NA		NO	
1990	373 392.17	385 022.01	NA	NA				
1995	287 960.56	244 275.60	NA	NA				
2000	314 490.43	219 030.46	NA	NA				
2010	292 953.96	303 286.40	NA	NA				
2011	282 588.40	293 268.93	NA	NA				
2012	285 310.23	296 890.24	NA	NA				
2013	292 181.35	304 663.39	NA	NA		–2 358.88	NO	–8 047.71
2014	323 930.14	331 205.22	NA	NA		–2 321.00	NO, IE	–7 054.35
2015	339 036.69	341 342.71	NA	NA		–2 308.53	NO, IE	–6 376.84
2016	344 477.76	342 616.69	NA	NA		–2 316.97	NO, IE	–5 718.23
2017	371 064.08	364 180.03	NA	NA		–2 282.13	NO, IE	–5 031.91
2018	388 019.11	375 581.98	NA	NA		–2 260.50	NO, IE	–4 214.50
2019	364 483.07	354 869.62	NA	NA		–2 346.30	NO	–7 865.36

Note: Emissions and removals reported in the sector other (sector 6) are not included in the total GHG emissions.

[a] The Party did not report indirect CO_2 emissions in CRF table 6.

[b] The value reported in this column relates to GHG emissions from conversion of forests (deforestation) in 1990 as contained in the report on the review of the Party's report to facilitate the calculation of the assigned amount for the second commitment period of the Kyoto Protocol.

[c] Activities under Article 3, para. 3, of the Kyoto Protocol, namely AR and deforestation.

[d] "Base year" refers to the base year under the Kyoto Protocol, which is 1990 for CO_2, CH_4 and N_2O, 1995 for HFCs, PFCs and SF_6, and 2000 for NF_3. The base year for GM under Article 3, para. 4, of the Kyoto Protocol is 1990. For activities under Article 3, para. 3, of the Kyoto Protocol and FM under Article 3, para. 4, only the inventory years of the commitment period must be reported.

Table I.2
Greenhouse gas emissions and removals by gas for Kazakhstan, excluding land use, land-use change and forestry, 1990–2019
(kt CO_2 eq)

	CO_2[a]	*CH_4*	*N_2O*	*HFCs*	*PFCs*	*Unspecified mix of HFCs and PFCs*	*SF_6*	*NF_3*
1990	281 461.06	85 773.89	17 787.06	NO, NA	NA, NO	NO, NA	NA, NO	NO, NA
1995	178 381.11	51 007.57	14 883.27	3.65	NA, NO	NO, NA	NA, NO	NO, NA
2000	149 054.08	51 836.11	17 926.48	213.79	NA, NO	NO, NA	NA, NO	NO, NA
2010	249 066.91	34 073.80	18 695.42	877.90	570.63	NO, NA	1.73	NO, NA
2011	239 660.09	34 299.82	17 751.11	931.66	624.50	NO, NA	1.75	NO, NA
2012	245 836.49	33 205.15	16 269.00	952.83	624.95	NO, NA	1.83	NO, NA
2013	253 728.84	34 166.70	15 174.91	961.73	629.28	NO, NA	1.93	NO, NA
2014	279 032.10	34 860.70	15 700.45	1 083.99	525.97	NA, NO	2.01	NA, NO
2015	288 582.40	35 105.52	15 979.66	1 116.84	556.28	NO, NA	2.01	NO, NA
2016	288 685.80	35 855.49	16 325.52	1 156.46	591.36	NO, NA	2.06	NO, NA
2017	307 908.89	37 577.22	16 927.86	1 123.84	640.13	NO, NA	2.10	NO, NA
2018	317 279.66	39 179.17	17 341.67	1 130.61	648.73	NO, NA	2.15	NO, NA
2019	295 868.53	39 888.00	17 310.82	1 139.56	660.40	NO, NA	2.32	NO, NA
Percentage change 1990–2019	**5.1**	**–53.5**	**–2.7**	**NA**	**NA**	**NA**	**NA**	**NA**

Note: Emissions and removals reported in the sector other (sector 6) are not included in this table.
[a] Kazakhstan did not report indirect CO_2 emissions in CRF table 6.

Table I.3
Greenhouse gas emissions and removals by sector for Kazakhstan, 1990–2019
(kt CO_2 eq)

	Energy	*IPPU*	*Agriculture*	*LULUCF*	*Waste*	*Other*
1990	317 963.50	19 405.85	43 869.00	–11 629.85	3 783.65	NO
1995	200 422.41	8 904.59	31 684.96	43 684.96	3 263.63	NO
2000	174 629.25	12 703.25	28 518.64	95 459.98	3 179.32	NO
2010	248 126.18	16 878.06	34 182.99	–10 332.45	4 099.16	NO
2011	238 763.71	18 060.47	32 251.68	–10 680.53	4 193.07	NO
2012	244 035.20	17 704.52	30 870.50	–11 580.01	4 280.03	NO
2013	249 831.38	20 187.59	30 235.63	–12 482.04	4 408.80	NO
2014	274 742.58	20 610.10	31 305.12	–7 275.08	4 547.42	NO
2015	282 438.16	21 992.73	32 301.20	–2 306.01	4 610.61	NO

	Energy	*IPPU*	*Agriculture*	*LULUCF*	*Waste*	*Other*
2016	281 846.03	22 702.56	33 353.33	1 861.06	4 714.78	NO
2017	301 678.46	22 906.45	34 799.94	6 884.05	4 795.18	NO
2018	312 761.01	21 697.52	36 217.43	12 437.13	4 906.02	NO
2019	291 084.50	21 678.15	37 089.34	9 613.45	5 017.63	NO
Percentage change 1990–2019	**–8.5**	**11.7**	**–15.5**	**–182.7**	**32.6**	**NA**

Notes: (1) Kazakhstan did not report emissions or removals in the sector other (sector 6); (2) Kazakhstan did not report indirect CO_2 emissions in CRF table 6.

Table I.4

Greenhouse gas emissions and removals from activities under Article 3, paragraphs 3–4, of the Kyoto Protocol by activity, base year–2019, for Kazakhstan

(kt CO_2 eq)

	Article 3.7 bis as contained in the Doha Amendment[a]	*Activities under Article 3.3 of the Kyoto Protocol*		*FM and elected activities under Article 3.4 of the Kyoto Protocol*				
	Land-use change	*AR*	*Deforestation*	*FM*	*CM*	*GM*	*RV*	*WDR*
FMRL				–				
Technical correction				–				
1990[b]	NA				NO	NO	NO	NO
2013		–2 388.21	29.33	–8 047.71	NO	NO	NO	NO
2014		–2 343.00	22.00	–7 054.35	NO	NO, IE	NO	NO
2015		–2 319.53	11.00	–6 376.84	NO	NO	NO	NO
2016		–2 318.07	1.10	–5 718.23	NO	NO, IE	NO	NO
2017		–2 293.13	11.00	–5 031.91	NO	NO, IE	NO	NO
2018		–2 271.50	11.00	–4 214.50	NO	NO, IE	NO	NO
2019		–2 357.30	11.00	–7 865.36	NO	NO	NO	NO
Percentage change base year–2019					**NA**	**NA**	**NA**	**NA**

Notes: Values in this table include emissions from land subject to natural disturbances, if applicable.

[a] The value reported in this column relates to 1990.

[b] The base year for GM under Article 3, para. 4, of the Kyoto Protocol is 1990. For activities under Article 3, para. 3, of the Kyoto Protocol and FM under Article 3, para. 4, only the inventory years of the commitment period must be reported.

2. Table I.5 provides an overview of key relevant data from Kazakhstan's reporting under Article 3, paragraphs 3–4, of the Kyoto Protocol.

Table I.5
Key relevant data for Kazakhstan under Article 3, paragraphs 3–4, of the Kyoto Protocol from its 2021 annual submission[a]

Parameter	*Data values*
Periodicity of accounting	(a) AR: commitment period accounting (b) Deforestation: commitment period accounting (c) FM: commitment period accounting (d) CM: not elected (e) GM: commitment period accounting (f) RV: not elected (g) WDR: not elected
Elected activities under Article 3, paragraph 4, of the Kyoto Protocol	GM
Election of application of provisions for natural disturbances	No
3.5% of total base-year GHG emissions, excluding LULUCF	12 995.329 kt CO_2 eq (103 962.632 kt CO_2 eq for the duration of the commitment period)
Cancellation of AAUs, CERs and ERUs and/or issuance of RMUs in the national registry for:	
1. AR	NA
2. Deforestation	NA
3. FM	NA
4. GM	NA

[a] The Doha Amendment entered into force on 31 December 2020. At the time of publication of this report, Kazakhstan had not ratified the Amendment.

Annex II

Information to be included in the compilation and accounting database[1]

Tables II.1–II.7 include the information to be included in the compilation and accounting database for Kazakhstan. Data shown are from the Party's annual submission, including the latest revised estimates submitted, adjustments (if applicable) and the final data to be included in the compilation and accounting database.

Table II.1
Information to be included in the compilation and accounting database for 2019, including on the commitment period reserve, for Kazakhstan
($t CO_2 eq$)

	Original submission	*Revised submission*	*Adjustment*	*Final value*
CPR	–	–	–	–
Annex A emissions				
CO_2	295 868 526	–	–	295 868 526
CH_4	39 888 002	–	–	39 888 002
N_2O	17 310 818	–	–	17 310 818
HFCs	1 139 563	–	–	1 139 563
PFCs	660 395	–	–	660 395
Unspecified mix of HFCs and PFCs	NO, NA	–	–	NO, NA
SF_6	2 319	–	–	2 319
NF_3	NO, NA	–	–	NO, NA
Total Annex A sources	**354 869 623**	**–**	**–**	**354 869 623**
Activities under Article 3, paragraph 3, of the Kyoto Protocol				
AR	–2 357 300	–	–	–2 357 300
Deforestation	11 000	–	–	11 000
FM and elected activities under Article 3, paragraph 4, of the Kyoto Protocol				
FM	–7 865 365	–	–	–7 865 365
GM	NO	–	–	NO
GM for the base year	NO	–	–	NO

Table II.2
Information to be included in the compilation and accounting database for 2018 for Kazakhstan
($t CO_2 eq$)

	Original submission	*Revised submission*	*Adjustment*	*Final value*
Annex A emissions				
CO_2	317 279 662	–	–	317 279 662
CH_4	39 179 169	–	–	39 179 169
N_2O	17 341 667	–	–	17 341 667
HFCs	1 130 606	–	–	1 130 606
PFCs	648 726	–	–	648 726
Unspecified mix of HFCs and PFCs	NO, NA	–	–	NO, NA
SF_6	2 152	–	–	2 152
NF_3	NO, NA	–	–	NO, NA
Total Annex A sources	**375 581 983**	**–**	**–**	**375 581 983**

[1] The Doha Amendment entered into force on 31 December 2020. At the time of publication of this report, Kazakhstan had not ratified the Amendment.

	Original submission	*Revised submission*	*Adjustment*	*Final value*
Activities under Article 3, paragraph 3, of the Kyoto Protocol				
AR	–2 271 500	–	–	–2 271 500
Deforestation	11 000	–	–	11 000
FM and elected activities under Article 3, paragraph 4, of the Kyoto Protocol				
FM	–4 214 496	–	–	–4 214 496
GM	NO	–	–	NO
GM for the base year	NO	–	–	NO

Table II.3
Information to be included in the compilation and accounting database for 2017 for Kazakhstan
(t CO_2 eq)

	Original submission	*Revised submission*	*Adjustment*	*Final value*
Annex A emissions				
CO_2	307 908 886	–	–	307 908 886
CH_4	37 577 221	–	–	37 577 221
N_2O	16 927 861	–	–	16 927 861
HFCs	1 123 841	–	–	1 123 841
PFCs	640 128	–	–	640 128
Unspecified mix of HFCs and PFCs	NO, NA	–	–	NO, NA
SF_6	2 097	–	–	2 097
NF_3	NO, NA	–	–	NO, NA
Total Annex A sources	**364 180 034**	**–**	**–**	**364 180 034**
Activities under Article 3, paragraph 3, of the Kyoto Protocol				
AR	–2 293 133	–	–	–2 293 133
Deforestation	11 000	–	–	11 000
FM and elected activities under Article 3, paragraph 4, of the Kyoto Protocol				
FM	–5 031 912	–	–	–5 031 912
GM	NO	–	–	NO
GM for the base year	NO	–	–	NO

Table II.4
Information to be included in the compilation and accounting database for 2016 for Kazakhstan
(t CO_2 eq)

	Original submission	*Revised submission*	*Adjustment*	*Final value*
Annex A emissions				
CO_2	288 685 797	–	–	288 685 797
CH_4	35 855 495	–	–	35 855 495
N_2O	16 325 520	–	–	16 325 520
HFCs	1 156 458	–	–	1 156 458
PFCs	591 360	–	–	591 360
Unspecified mix of HFCs and PFCs	NO, NA	–	–	NO, NA
SF_6	2 062	–	–	2 062
NF_3	NO, NA	–	–	NO, NA
Total Annex A sources	**342 616 691**	**–**	**–**	**342 616 691**
Activities under Article 3, paragraph 3, of the Kyoto Protocol				
AR	–2 318 067	–	–	–2 318 067
Deforestation	1 100	–	–	1 100
FM and elected activities under Article 3, paragraph 4, of the Kyoto Protocol				
FM	–5 718 230	–	–	–5 718 230
GM	NO	–	–	NO

	Original submission	*Revised submission*	*Adjustment*	*Final value*
GM for the base year	NO	–	–	NO

Table II.5
Information to be included in the compilation and accounting database for 2015 for Kazakhstan
(t CO_2 eq)

	Original submission	*Revised submission*	*Adjustment*	*Final value*
Annex A emissions				
CO_2	288 582 401	–	–	288 582 401
CH_4	35 105 517	–	–	35 105 517
N_2O	15 979 657	–	–	15 979 657
HFCs	1 116 835	–	–	1 116 835
PFCs	556 283	–	–	556 283
Unspecified mix of HFCs and PFCs	NO, NA	–	–	NO, NA
SF_6	2 013	–	–	2 013
NF_3	NO, NA	–	–	NO, NA
Total Annex A sources	**341 342 706**	**–**	**–**	**341 342 706**
Activities under Article 3, paragraph 3, of the Kyoto Protocol				
AR	–2 319 533	–	–	–2 319 533
Deforestation	11 000	–	–	11 000
FM and elected activities under Article 3, paragraph 4, of the Kyoto Protocol				
FM	–6 376 841	–	–	–6 376 841
GM	NO	–	–	NO
GM for the base year	NO	–	–	NO

Table II.6
Information to be included in the compilation and accounting database for 2014 for Kazakhstan
(t CO_2 eq)

	Original submission	*Revised submission*	*Adjustment*	*Final value*
Annex A emissions				
CO_2	279 032 098	–	–	279 032 098
CH_4	34 860 703	–	–	34 860 703
N_2O	15 700 447	–	–	15 700 447
HFCs	1 083 994	–	–	1 083 994
PFCs	525 973	–	–	525 973
Unspecified mix of HFCs and PFCs	NA, NO	–	–	NA, NO
SF_6	2 009	–	–	2 009
NF_3	NA, NO	–	–	NA, NO
Total Annex A sources	**331 205 224**	**–**	**–**	**331 205 224**
Activities under Article 3, paragraph 3, of the Kyoto Protocol				
AR	–2 343 000	–	–	–2 343 000
Deforestation	22 000	–	–	22 000
FM and elected activities under Article 3, paragraph 4, of the Kyoto Protocol				
FM	–7 054 348	–	–	–7 054 348
GM	NO	–	–	NO
GM for the base year	NO	–	–	NO

Table II.7
Information to be included in the compilation and accounting database for 2013 for Kazakhstan
(t CO_2 eq)

	Original submission	*Revised submission*	*Adjustment*	*Final value*
Annex A emissions				
CO_2	253 728 845	–	–	253 728 845
CH_4	34 166 702	–	–	34 166 702
N_2O	15 174 906	–	–	15 174 906
HFCs	961 731	–	–	961 731
PFCs	629 278	–	–	629 278
Unspecified mix of HFCs and PFCs	NO, NA	–	–	NO, NA
SF_6	1 925	–	–	1 925
NF_3	NO, NA	–	–	NO, NA
Total Annex A sources	**304 663 387**	**–**	**–**	**304 663 387**
Activities under Article 3, paragraph 3, of the Kyoto Protocol				
AR	–2 388 210	–	–	–2 388 210
Deforestation	29 333	–	–	29 333
FM and elected activities under Article 3, paragraph 4, of the Kyoto Protocol				
FM	–8 047 713	–	–	–8 047 713
GM	NO	–	–	NO
GM for the base year	NO	–	–	NO

Annex III

Additional information to support findings in table 2

A. Missing categories that may affect completeness

1. The categories for which estimation methods are included in the 2006 IPCC Guidelines that were reported as "NE" or for which the ERT otherwise determined that there may be an issue with the completeness of the reporting in the Party's inventory are the following:

(a) 1.B.2.c Venting and flaring – venting (CO_2 and CH_4) (see ID# E.71 in table 3);

(b) 2.D.2 Paraffin wax use (CO_2) (see ID# I.38 in table 3);

(c) 2.D.3 Urea-based catalytic converters (see ID#s I.39 in table 3 and I.50 in table 5);

(d) 3.G Liming (CO_2) (see ID# A.12 in table 3);

(e) 3.F Field burning of agricultural residues (CH_4 and N_2O) (see ID# A.19 in table 5);

(f) 4.A.2 Land converted to forest land (CO_2) (see ID# L.1 in table 3);

(g) 4.B.2 Land converted to cropland (CO_2) (see ID#s L.3 and L.8 in table 3);

(h) 4.C.2 Land converted to grassland (CO_2) (see ID#s L.3 and L.20 in table 3);

(i) 4.D.2. Land converted to wetlands (CO_2, CH_4 and N_2O) (see ID# L.2 in table 3);

(j) 4.C.2 Forest land, cropland, wetlands and other land converted to settlements (CO_2) (see ID#s L.2 in table 3);

(k) 4.D.2 Land converted to other land (CO_2) (see ID#s L.2 and L.3 in table 3);

(l) 4(III) Direct N_2O emissions from N mineralization/immobilization – forest land remaining forest land, lands converted to forest land, lands converted to cropland, grassland remaining grassland, lands converted to grassland, wetlands remaining wetlands, lands converted to wetlands, settlements remaining settlements and lands converted to settlements (N_2O) (see ID#s L.1 and L.23 in table 3);

(m) 4(III)B.2 N_2O emissions from disturbance associated with land-use conversion to cropland – grassland converted to cropland – mineral soils (N_2O) (see ID# L.1 in table 3);

(n) 5.A Solid waste disposal (industrial waste) (CH_4) (see ID#s W.5 and W.15 in table 3);

(o) 5.B.1 Composting (CH_4 and N_2O) (see ID# W.1 in table 3);

(p) 5.C.1 Waste incineration (CO_2 (non-biogenic), CH_4 and N_2O) (see ID# W.1 in table 3);

(q) 5.C.2 Open burning of waste (CO_2 (non-biogenic), CH_4 and N_2O) (see ID# W.19 in table 3);

(r) 4(KP-I)A.1 AR – below-ground biomass and SOC in organic soils (CO_2) (see ID# KL.2 in table 3);

(s) 4(KP-I)A.2 Deforestation – below-ground biomass, litter, deadwood and SOC (CO_2) (see ID#s KL.1 and KL.7 in table 3);

(t) 4(KP-I)B.1 FM – below-ground biomass and SOC in organic soils (CO_2) (see ID# KL.1 in table 3);

(u) 4(KP-I)B.1 GM – all carbon pools (CO_2, CH_4 and N_2O) (see ID# KL.11 in table 5).

B. Recommendation for an in-country review: list of issues

2. The ERT recommends that the next review for Kazakhstan be conducted as an in-country review. The ERT noted that a number of issues associated with the national system remained unresolved at the end of the 2021 review cycle, in addition to a number of issues of a quantitative character in the inventory calculations that are mainly related to the methodological choice and availability of robust AD. During the review, the Party stated that it is planning to resolve most of these issues in the next annual submission. A comprehensive progress assessment of issue resolution is only possible if the ERT can assess in person the functionality of general and specific functions of the national system, access the relevant documents and discuss the improvement plan and other requested plans and their implementation with the relevant national personnel, which requires an in-country review, as opposed to a centralized review.

3. In accordance with decision 13/CP.20, annex, paragraph 64, the ERT has set out below a list of questions and issues additional to those identified in tables 3 and 5 that are to be addressed during the in-country review. Key areas that the next ERT conducting the in-country review should consider are listed in paragraphs 4–10 below.

4. **Inventory arrangements under the national system**. The ERT noted that Kazakhstan reported significant changes to the inventory arrangements under the national system, including legal and procedural changes that had taken place in 2021 and were expected to have a strong impact on the functions pertaining to the national inventory arrangements in the next inventory cycles (see ID#s G.3, G.4 and G.11 in table 3). The recommended in-country review should comprehensively address the issues relating to inventory planning, preparation and management, and enhancing the inventory capacity and technical competence of the inventory staff. The ERT also noted that the performance of recalculations (see ID# G.19 in table 3) requires attention from the ERT given that, as part of the inventory preparation functions, they are strongly related to the improvement of the accuracy, completeness and consistency of the inventory. Key areas that the next ERT conducting the in-country review should consider are:

(a) Did the legal and procedural changes to the national system provide the expected positive changes in its planning, management and performance (see ID#s G.3, G.4(b) and G.11 in table 3)?

(b) What are the specific actions taken on resource training and allocation to ensure the delivery of a high-quality inventory (see ID# G.4(a) in table 3)?

(c) How are improvements prioritized for recurring issues (see table 4 in this report)?

5. **Fugitive emissions from oil and gas**. The Party has made efforts to improve its estimates for the fugitive emissions from oil and natural gas (e.g. adding estimates for oil and gas exploration). However, in the light of the format of the present review and given the technical issues detected and numerous inconsistencies in the reporting data on fugitive emissions, the ERT was not able to thoroughly assess and review the EFs and methodology applied by the Party, leading to the majority of the previously opened issues (see ID#s E.53–E.55, E.56–E.67 and E.69–E.72 in table 3) remain unresolved. Key areas that the next ERT conducting the in-country review should consider are:

(a) Has the Party improved data collection for the subcategories in the sector (e.g. see ID# E.64 in table 3)?

(b) Has the Party provided verification information for the AD used in the estimates? Does the information support the accuracy of the method used (e.g. see ID# E.63 in table 3)?

(c) What are the assumptions used to apply a step approach with different years for the transition to the developed country default EFs across various subcategories (e.g. see ID# E.54 in table 3)?

(d) How has the choice of the EFs for the subcategories been made (e.g. see ID# E.55 in table 3)?

(e) What progress has been made in moving to tier 2 for this category (e.g. see ID# E.55 in table 3)?

(f) Does oil transport and storage include the emissions from transit (e.g. see ID# E.61 in table 3)?

(g) How have the venting and flaring emissions been accounted for (see ID# E.72 in table 3)?

6. **Fluorinated gases**. The Party has made efforts to improve its estimates for HFC emissions in category 2.F.1 (see ID# I.41 in table 3) but the description of the estimates in the NIR did not allow the ERT to fully understand the approach taken. The notation key "NO" is widely used in the submission, even for AD in cases where emissions are reported. Key areas that the next ERT conducting the in-country review should consider are:

(a) What attempts are being made to collect AD on fluorinated gases and who are the possible data providers (see ID#s I.42, I.43 and I.47 in table 3)?

(b) What steps are being taken to collect further information (see ID#s I.40 and I.44 in table 3)?

(c) Which AD, methods and assumptions are used in the estimation process and are these consistent with the 2006 IPCC Guidelines (see ID#s I.41, I.45 and I.46 in table 3)?

(d) Why are the emissions from manufacturing and disposal of equipment not reported (see ID# I.42 in table 3)?

7. **Land representation and estimates under the LULUCF and KP-LULUCF sectors**. The ERT noted several recurring recommendations relating to land representation (see ID#s L.1–L.3 and L.7–L.10 in table 3) in the LULUCF and KP-LULUCF sectors. During the review, the Party explained that it will improve the data and information on land representation and identify all land-use categories for the entire time series for its next annual submission. Key areas that the next ERT conducting the in-country review should consider are:

(a) Has the Party provided data and information on land representation, namely data or specific information (including maps) identifying lands where AR, deforestation, FM and GM activities occurred?

(b) Has the Party included information that demonstrates that the national inventory system of Kazakhstan established under Article 5, paragraph 1, of the Kyoto Protocol ensures that areas of land subject to KP-LULUCF (AR, deforestation and FM) are identifiable in accordance with the requirements of decision 2/CMP.7, annex, paragraph 25?

(c) Has all the required information on the technical correction of the FMRL been reported?

(d) Has the technical correction been revised to ensure methodological consistency between the FMRL and the actual FM emission estimates?

(e) Have all activities under Article 3, paragraphs 3–4, of the Kyoto Protocol been correctly identified and tracked across the entire time series?

8. **SWDS**. The ERT noted a number of transparency, accuracy and completeness issues in category 5.A solid waste disposal. During the review, the Party could not provide a relevant explanation for the following issues, making them the key areas that the next ERT conducting the in-country review should consider:

(a) Has the Party estimated CH_4 emissions from industrial waste disposal? If so, were the estimates calculated in accordance with the 2006 IPCC Guidelines (vol. 5, chap. 2, section 2.2.3, pp.2.8–2.10) (see ID# W.5 in table 3)?

(b) What is the reason for the unusual ratio between the IEFs for managed anaerobic and unmanaged waste disposal sites (see ID# W.11 in table 3)?

(c) Has the Party used in its estimations good-quality AD and country-specific DOC values based on representative values of waste composition in the country and reflecting changes in waste management practices over time (see ID#s W.6 and W.10 in table 3)?

9. **Biological treatment of solid waste**. The ERT noted that Kazakhstan did not estimate CH_4 and N_2O emissions from biological treatment of waste but did not state in its NIR that this activity does not occur. During the review, the Party explained that it considers that this activity does not occur, despite the fact that there is an operational mechanical-biological treatment plant in Nur-Sultan. Further, the Party did not explain how food and garden waste is treated in rural areas and the private sector. The key area that the next ERT conducting the in-country review should consider is whether the Party able to justify its reporting by providing:

(a) Information on the mechanical-biological treatment plant operating in Nur-Sultan including whether composting or anaerobic digestion of waste occur at this facility;

(b) Information on common practice for food waste and garden waste treatment in rural areas and the private sector in Kazakhstan;

(c) An explanation as to whether a certain amount of organic waste is recycled under the 2013 Concept for the Transition of the Republic of Kazakhstan to Green Economy, including details on the type of organic waste recycling (e.g. composting);

(d) Justification that emissions from the biological treatment of waste do not occur, are insignificant or, otherwise, have been estimated and included in the total national emissions (see ID#s W.1 in table 3 and W.27 in table 5).

10. **Incineration and open burning of waste**. The ERT noted that the value of 254.33 kt CO_2 eq estimated by Kazakhstan for open burning of waste as potential emissions exceed the significance threshold of 0.05 per cent of the national total (177.43 kt CO_2 eq for 2019) but CO_2, CH_4 and N_2O emissions from open burning of waste were not estimated. A key area that the next ERT conducting the in-country review should consider is whether the Party could provide scientifically based and well-documented justification that emissions from open burning of waste are insignificant, or, if the Party has estimated these emissions and included them in its total national emissions, how were the estimates calculated and what AD were used (see ID#s W.1 and W.19 in table 3).

Annex IV

Reference documents

A. Reports of the Intergovernmental Panel on Climate Change

IPCC. 2003. *Good Practice Guidance for Land Use, Land-Use Change and Forestry*. J Penman, M Gytarsky, T Hiraishi, et al. (eds.). Hayama, Japan: Institute for Global Environmental Strategies. Available at https://www.ipcc.ch/publication/good–practice–guidance–for–land–use–land–use–change–and–forestry/.

IPCC. 2006. *2006 IPCC Guidelines for National Greenhouse Gas Inventories*. S Eggleston, L Buendia, K Miwa, et al. (eds.). Hayama, Japan: Institute for Global Environmental Strategies. Available at http://www.ipcc–nggip.iges.or.jp/public/2006gl.

IPCC. 2014. *2013 Revised Supplementary Methods and Good Practice Guidance Arising from the Kyoto Protocol*. T Hiraishi, T Krug, K Tanabe, et al. (eds.). Hayama, Japan: Institute for Global Environmental Strategies. Available at https://www.ipcc.ch/publication/2013–revised–supplementary–methods–and–good–practice–guidance–arising–from–the–kyoto–protocol/.

IPCC. 2014. *2013 Supplement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories: Wetlands*. T Hiraishi, T Krug, K Tanabe, et al. (eds.). Geneva: IPCC. Available at https://www.ipcc.ch/publication/2013–supplement–to–the–2006–ipcc–guidelines–for–national–greenhouse–gas–inventories–wetlands/.

B. UNFCCC documents

Annual review reports

Reports on the individual reviews of the 2011, 2012, 2013, 2015, 2016, 2017 and 2019 annual submissions of Kazakhstan, contained in documents FCCC/ARR/2011/KAZ, FCCC/ARR/2012/KAZ, FCCC/ARR/2013/KAZ, FCCC/ARR/2014/KAZ, FCCC/ARR/2015/KAZ, FCCC/ARR/2016/KAZ, FCCC/ARR/2017/KAZ and FCCC/ARR/2019/KAZ, respectively.

Other

Report on the review of the report to facilitate the calculation of the assigned amount for the second commitment period of the Kyoto Protocol of Kazakhstan, contained in document FCCC/IRR/2017/KAZ.

Aggregate information on greenhouse gas emissions by sources and removals by sinks for Parties included in Annex I to the Convention. Note by the secretariat. Available at https://unfccc.int/sites/default/files/resource/AGI_2021_Final%20Version.pdf.

Annual status report for Kazakhstan for 2021. Available at https://unfccc.int/sites/default/files/resource/asr2021_KAZ.pdf.

C. Other documents used during the review

Responses to questions during the review were received from Aiman Esekina (Zhasyl Damu JSC), including additional material on the methodology and assumptions used. The following references may not conform to UNFCCC editorial style as some have been reproduced as received:

Bakumenko, I. Are there any prospects for dolomite flour? AgriInfo, 27 Aug 2014. Accessed 21 October 2021 at https://agroinfo.kz/est–li–perspektivy–u–dolomitovoj–muki/.

Borovsky V.M., Uspanov U.U (1971): Soils of Kazakhstan and ways of their national economic use.

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