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Report on the individual review of the inventory submission of Kazakhstan submitted in 2023*

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 also 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 2023 inventory submission of Kazakhstan, conducted by an expert review team in accordance with the "Guidelines for the preparation of national communications by Parties included in Annex I to the Convention, Part I: UNFCCC reporting guidelines on annual greenhouse gas inventories" and the "Guidelines for review under Article 8 of the Kyoto Protocol", as appropriate. The review took place from 18 to 22 September 2023 in Bonn.

* In the symbol for this document, 2023 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*
AD	activity data
Article 8 review guidelines	"Guidelines for review under Article 8 of the Kyoto Protocol"
BKB	brown coal briquette
B_o	maximum methane-producing capacity
BOD	biochemical oxygen demand
C	carbon
CaO	calcium oxide
CH_4	methane
CKD	cement kiln dust
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"
COPERT	software tool for calculating road transport emissions
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
EF	emission factor
ERT	expert review team
FAOSTAT	statistical database of the Food and Agriculture Organization of the United Nations
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
GWP	global warming potential
GWP-100	100-year global warming potential values
HFC	hydrofluorocarbon
IE	included elsewhere
IEF	implied emission factor
IPCC	Intergovernmental Panel on Climate Change
IPPU	industrial processes and product use
JSC	joint stock company
k	methane generation rate
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
LULUCF	land use, land-use change and forestry
MCF	methane correction factor
MMS	manure management system(s)
MSW	municipal solid waste
N	nitrogen
N_2O	nitrous oxide
NA	not applicable

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
SF_6	sulfur hexafluoride
SIAR	standard independent assessment report
SWDS	solid waste disposal site(s)
UNDP	United Nations Development Programme
UNEP	United Nations Environment 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"
Wetlands Supplement	*2013 Supplement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories: Wetlands*

I. Introduction

1. This report covers the review of the 2023 inventory submission of Kazakhstan, organized by the secretariat in accordance with the UNFCCC review guidelines, particularly 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), and the Article 8 review guidelines (adopted by decision 22/CMP.1 and revised by decision 4/CMP.11). The review took place from 18 to 22 September 2023 in Bonn and was coordinated by Sevdalina Todorova (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	Violeta Hristova	Bulgaria
	Batimaa Punsalmaa	Mongolia
Energy	Hossein Khajeh Pour	Islamic Republic of Iran
	Mandana Maghsoodi Darbeh	Islamic Republic of Iran
	Victoria Novikova	Belarus
	Irina Vasiliev	Republic of Moldova
	Songli Zhu	China
IPPU	Menouer Boughedaoui	Algeria
	Stephen Isaacs	Bahamas
	Samir Tantawi	Egypt
Agriculture	Evgeniya Bertash	Belarus
	Yu'e Li	China
	Rosemary Lopez	Cuba
	Noura Mohamed Lotfy	Egypt
LULUCF	Tatenda Gotore	Zimbabwe
	Admore Mureva	Zimbabwe
	Pinar Pamukcu Albers	Türkiye
	Marina Shvangiradze	Georgia
Waste	Natalia Efros	Republic of Moldova
	Excellent Hachileka	Zambia
	Guadalupe Martinez	Uruguay
	Kyoko Miwa	Japan
	Tatiana Tugui	Republic of Moldova
Lead reviewers	Violeta Hristova	
	Songli Zhu	

2. The basis of the findings in this report is the assessment by the ERT of the Party's 2023 inventory 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[1] designated as problems.[2] Other findings, and, if applicable, the

[1] Issues are defined in decision 13/CP.20, annex, para. 81.
[2] Problems are defined in decision 22/CMP.1, annex, paras. 68–69, as revised by decision 4/CMP.11.

encouragements of the ERT to Kazakhstan to resolve related issues, are also included in this report.

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.

II. Summary and general assessment of the Party's 2023 inventory submission

6. Table 2 provides the assessment by the ERT of the Party's 2023 inventory 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 2023 inventory submission of Kazakhstan

Assessment			*Issue/problem ID#(s) in table 3 or 5[a]*
Date of submission	Original submission: NIR, 15 April 2023; CRF tables (version 1), 15 April 2023		
Review format	Centralized		
Source of GWP-100	IPCC Fourth Assessment Report		
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?	No	
	(b) Selection and use of methodologies and assumptions?	Yes	E.10, E.26, E.36, A.4, A.5, A.17, A.18, L.12, W.9, W.10, W.17, W.31, W.35
	(c) Development and selection of EFs?	Yes	E.16, E.53, E.65, E.66, E.67, E.68, I.36, I.37, A.1, W.14, W.27
	(d) Collection and selection of AD?	Yes	E.8, E.10, E.11, E.22. E.34, E.37, E.69, A.2, A.15, L.6, L.7, W.36
	(e) Reporting of recalculations?	Yes	G.10, E.3, E.51, I.25, W.11
	(f) Reporting of a consistent time series?	Yes	E.5, E.19
	(g) Reporting of uncertainties, including methodologies?	No	
	(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	I.21, A.11, A.16, L.1, L.3, L.18, L.21, W.19, W.21
	(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 level of emissions meets the criteria in paragraph 37(b) of the UNFCCC Annex I inventory reporting guidelines?	No	G.7
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.31, E.32, I.8

Assessment			*Issue/problem ID#(s) in table 3 or 5*[a]
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?	No	
	(b) Performance of the national system functions?	Yes	G.11
	Have any issues been identified related to the national registry:		
	(a) Overall functioning of the national registry?	NA	
	(b) Performance of the functions of the national registry and the adherence to technical standards for data exchange?	NA	
	Have any issues been identified related to the reporting of information on assigned amount units, certified emission reductions, emission reduction units and removal units, 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?	NA	
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?	NA	
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?	No	
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 II.

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

7. Table 3 compiles the recommendations from previous review reports that were included in the most recent previous review report, published on 18 May 2022,[1] and had not been resolved by the time of publication of the report on the review of the Party's 2021 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 from previous review report*	*ERT assessment and rationale*
General			
G.1	National system (G.3, 2021) (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) Identifying roles and responsibilities for QA/QC and data verification for each inventory sector to ensure data quality and reliability; (b) Implementing arrangements for review, approval and sign-off processes to ensure timely annual submission of the NIR by the agreed submission due date.	Resolved. (a) The Party provided a description of the roles and responsibilities for QA/QC procedures (NIR section 1.2.3, p.24) and a figure illustrating the QA/QC system (NIR figure 2, p.25), which shows the roles and responsibilities for initial verification of data, verification of calculations, final verification of the inventory and QA conducted by third-party organizations. The new rules for monitoring the completeness, transparency and reliability of the State inventory of GHG emissions and removals, approved on 22 February 2022 through order 46 of the Ministry of Ecology, Geology and Natural Resources of Kazakhstan (see https://adilet.zan.kz/rus/docs/V2200026905), sets out the arrangements for developing and approving a QA/QC plan and for implementing QA/QC procedures and verification of the inventory by third-party organizations. For the 2023 submission, external verification of the data and calculations for the energy sector was undertaken by experts under the United States Agency for International Development Power Central Asia project and from the UNEP Copenhagen Climate Centre, while external verification of the data and calculations for the LULUCF sector was carried out under the UNDP project "Development of the Eighth National Communication of the Republic of Kazakhstan within the Framework of the UNFCCC and Preparation of Two (Fourth and Fifth) Biennial Reports". (b) The NIR was submitted by the deadline (15 April 2023), in line with the procedures set out in Kazakhstan's recently adopted order 46, which sets out the mechanisms for preparing, reviewing and approving the GHG inventory (NIR pp.21–24). The functioning of the national GHG inventory system is facilitated by meetings of the Interinstitutional Working Group established through order 46, which consists

[1] FCCC/ARR/2021/KAZ. The ERT notes that the report on the review of Kazakhstan's 2022 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 2021 annual submission.

ID#	*Issue/problem classification*[a, b]	*Recommendation from previous review report*	*ERT assessment and rationale*
			of State bodies providing initial inventory data and participating in determining emission coefficients and other parameters for the inventory. The NIR (p.23) indicates that four meetings of the Working Group have been held. At the first meeting, representatives of the Working Group approved the dates of subsequent meetings, and reviewed and approved the proposed QA/QC plan. As per order 46, the NIR should be approved by the Interinstitutional Working Group at its meeting held before 10 April each year. The 2023 NIR was approved at the fourth meeting of the group, held on 7 April 2023.
G.2	National system (G.4, 2021) (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 timely access to AD by the designated inventory agency from other organizations.	Resolved. (a) The Party reported in its NIR (section 1.2.4, p.33) various ongoing capacity-building activities conducted with the support of UNDP and other international and national organizations. For example, a training session was conducted on methodological requirements for the calculation of GHG emissions and the preparation of reports by the Institute of Global Climate and Ecology with the support of UNDP under the project "Assistance in updating Kazakhstan's nationally determined contributions (NDCs)". The Party reported that the establishment and meetings of the Working Group (see ID# G.1 above) is also a capacity-building activity aimed at strengthening coordination and interaction between State bodies and improving the quality of the provision of initial data and the functioning of the national system. (b) Order 46 (annexes 1–5) (see ID# G.1 above) includes a list of data required for compiling emission estimates and the list of data providers for each sector. The Interinstitutional Working Group is responsible for data flow to ensure uninterrupted and timely access to AD for the inventory team. For the preparation of the 2023 submission, the second and third meetings of the Working Group were focused on data collection, review and verification.
G.3	National system (G.5, 2021) (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) Resolved. The Party reported in its NIR (section 1.2.2, pp.21–23) an updated figure on the national inventory system (figure 1, p.22), with a description of the inventory development steps and a list of organizations involved in data collection and processing as part of the Interinstitutional Working Group established under order 46, along with information on the roles of the group in that process and the outcomes of its meetings (see ID#s G.1 and G.2 above). (c) Addressing. Regarding the verification of plant- and country-specific data and EFs, the NIR (section 1.2.3) includes, among the general QC procedures reported, information on a check to ensure that the correct recording and archiving process is implemented for the EFs and other parameters used for the emission estimates. However, the main QA procedures reported in the NIR (pp.27–30) still do not provide specific information on how the quality and reliability of plant- and country-specific EFs are ensured or who is responsible for this process. During the review, the Party clarified that initial data are provided by enterprises through responses to

ID#	Issue/problem classification[a, b]	Recommendation from previous review report	ERT assessment and rationale
			official requests for information issued by the Ministry of Ecology, Geology and Natural Resources. In addition, the Party has an internal emissions trading system, according to which each enterprise submits an annual GHG inventory report to Zhasyl Damu JSC, the designated national entity. These inventory reports are internally validated and verified. The national inventory team checks and compares the data contained in the validated inventory reports submitted by enterprises and the responses to requests for information. The ERT considers that the recommendation has not yet been fully addressed because the Party has not yet included clear information in the NIR on the specific arrangements for ensuring the quality and reliability of plant- and country-specific EFs and on who is responsible for this process.
G.4	Inventory management (G.10, 2021) (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.	Resolved. In its NIR (section 1.3, pp.33–35), the Party reported information on how Zhasyl Damu JSC (formerly the Kazakh Scientific Research Institute of Ecology and Climate) archives and maintains inventory-related information. In accordance with order 46, the archive includes information on AD, emission coefficients, parameters, calculation procedures, documentation on QA/QC procedures, digital and textual calculation materials, assumptions made, and other internal information necessary for the preparation of the individual sections of the national GHG inventory, as well as data on key and non-key categories and planned inventory improvements. Order 46 also includes provisions to ensure access to the archive for representatives of authorized bodies, and national and independent experts.
G.5	Inventory management (G.11, 2021) (G.22, 2019) Transparency	Make fully functional the inventory management function described in decision 19/CMP.1, annex, paragraph 16(c), in conjunction with decisions 3/CMP.11 and 4/CMP.11.	Resolved. The inventory management function has been improved regarding the function described in decision 19/CMP.1, annex, paragraph 16(c), in conjunction with decisions 3/CMP.11 and 4/CMP.11, largely as a result of the approval of order 46, which sets out the mechanisms for preparing, reviewing and approving the GHG inventory (NIR pp.21–24). Articles 27–33 of order 46 set time frames for the different steps of national inventory preparation and submission. The ERT commends the Party for its timely responses to the questions raised during the various stages of the review process, in line with the inventory management function described in decision 19/CMP.1, annex, paragraph 16(c), in conjunction with decisions 3/CMP.11 and 4/CMP.11.
G.6	Inventory management (G.12, 2021) (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,	Resolved. The adoption of order 46, as described in the NIR (pp.22–23), has addressed all the requirements for a functional inventory management system and has ensured the timely submission of responses to queries raised during the review process. The improvements made to inventory management (see ID#s G.1–G.5 above) were demonstrated by the timely responses provided during the review. Information on the communication plan was provided in the third and fourth progress reports under the plan of the enforcement branch of the Compliance Committee referenced in the NIR (p.32) and provided during the review in tabular format. The ERT also took note of decision CC-2020-1-10/Kazakhstan/EB of the enforcement

ID#	Issue/problem classification[a, b]	Recommendation from previous review report	ERT assessment and rationale
		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.	branch dated 6 September 2023 on the questions of implementation with respect to Kazakhstan and its conclusion that the information made available is sufficient to determine that the questions of implementation raised by the ERT in the 2017 in-depth review report as contained in the 2017 and 2019 annual review reports are no longer relevant.
G.7	NIR (G.15, 2021) (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 include a section in its NIR on a general assessment of completeness, as in the NIR outline described in the appendix of annex I to the UNFCCC Annex I inventory reporting guidelines. An annex was provided for completeness, as recommended, but although explanations were provided for some categories considered insignificant, there is still no summary information in the NIR providing an assessment of completeness, including information and explanations in relation to categories not estimated (by category) or 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 in accordance with paragraph 37(b) of the UNFCCC Annex I inventory reporting guidelines. The ERT also noted a number of completeness issues linked to categories reported as "NE" (see ID#s I.21, A.11, L.1, L.3, L.18, L.21, W.19 and W.21 below). During the review, the Party expressed its intention to resolve this issue for the next inventory submission.
G.8	CRF tables (G.16, 2021) (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.	Resolved. The ERT noted that all cells in the CRF tables were filled. Most notation keys were corrected in line with decision 24/CP.19, annex I, paragraph 37, and the Party indicated during the review that it makes efforts to ensure the correct use of notation keys in the CRF tables. Although some remaining issues have been identified with regard to the use of correct notation keys, the ERT concluded that the general recommendation may be considered resolved as the pending issues with the use of the notation keys are covered by specific recommendations in the sectoral sections of this report (e.g. see ID#s E.2, E.61, L.7 and W.23 below).

ID#	*Issue/problem classification*[a, b]	*Recommendation from previous review report*	*ERT assessment and rationale*
G.9	Notation keys (G.18, 2021) (G.14, 2019) (G.1, 2017) (G.2, 2016) (G.2, 2015) (table 3, 2013) Convention reporting adherence	Use the notation key "NO" if the activity is not occurring and "IE" if emissions are included elsewhere.	Resolved. The Party made corrections to the notation keys used in the CRF tables across the sectors (e.g. corrected the notation key "NA" to "NO" for CO_2, CH_4 and N_2O emissions from gaseous fuel consumption for subcategory 1.A.2.d pulp, paper and print). Although there were some remaining issues with the use of the notation keys "NO" and "IE", the ERT concluded that these are covered in the sectoral sections of this report (e.g. ID# E.2 for the energy sector).
G.10	Recalculations (G.19, 2021) (G.15, 2019) (G.11, 2017) Transparency	In the NIR, 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 included a section on recalculations in its NIR (section 1.7, pp.46–47) and the recalculated emission estimates were presented in CRF tables 8s1–8s4 in an annex to the NIR. However, the NIR does not contain an explanatory chapter on recalculations and improvements (chap. 10), as per the suggested NIR outline in the appendix of annex I to the UNFCCC Annex I inventory reporting guidelines. In NIR section 1.7 the Party reported that detailed reasons for the recalculations are described in the relevant sector- and category-specific sections of the NIR. Noting that the relevant sections on recalculations are provided at the category level in the NIR and that there have been some improvements (e.g. for the IPPU sector), the ERT concluded that the explanations on recalculations are not always sufficient to understand the reasons for them for most of the sectors (see ID#s E.3, E.63, I.25(c), A.3, A.5(c) and W.11 below and W.35 in table 5). During the review, the Party provided a reference to section 1.7 of and annex 3 to the NIR, together with responses to the specific questions raised at the category level, and expressed its intention to resolve this issue for the next inventory submission.
G.11	QA/QC and verification (G.20, 2021) (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.	Addressing. Even though a QA/QC plan was prepared in accordance with order 46 and approved at the first meeting of the Interinstitutional Working Group and the QA/QC procedures were reported in the NIR, the implementation of QA/QC procedures is lacking. The Party corrected some previous inconsistencies identified between the CRF tables and the NIR (e.g. see ID#s I.13 and A.8 below), but the ERT found remaining inconsistencies in the reporting between the NIR and the CRF tables, and in the reporting of estimates within sectors. For example, the LULUCF sector includes different values for the total cropland area, reported as 35,566.80 kha for 2021 in CRF tables 4.1, 4.B and 4(III) and as 31,957.3 kha in NIR table 6.3.5. Similar issues were identified for each of the sectors and some of them are covered in the sector-specific sections of this report (e.g. see ID#s E.6, E.50, E.51, E.65, E.66, A.5, W.2, W.4 and W.35 below). During the review, the Party acknowledged the numerous technical errors to be resolved for the next inventory submission.
G.12	Uncertainty analysis (G.21, 2021) (G.17, 2019) (G.9, 2017) (G.19, 2016) (G.18, 2015)	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	Resolved. The Party improved the reporting of uncertainties and reported the uncertainty for the base year and the most recent inventory year in NIR section 1.6 (p.46). Kazakhstan also provided a list of the highest contributing categories including and excluding LULUCF. It also provided a table with qualitative uncertainty estimates (annex 2 to the NIR, pp.444–492), in accordance with table 3.3

ID#	Issue/problem classification[a, b]	Recommendation from previous review report	ERT assessment and rationale
	Convention reporting adherence	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.	of the 2006 IPCC Guidelines (vol. 1, chap. 3). The Party provided information on how the uncertainty estimates help in prioritizing efforts to improve the accuracy of the national inventory. Information on the uncertainties and the underlying assumptions used to estimate them at the category level was provided in the relevant sections of the sectoral chapters of the NIR.
Energy			
E.1	1. General (energy sector) – other fossil fuels – CO_2, CH_4 and N_2O (E.1, 2021) (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.	Resolved. In the NIR (p.111) and during the review, the Party noted that additional training has been provided to the national inventory experts on the correct use of notation keys including the necessary steps for using them in the CRF tables and including relevant comments in the NIR. The ERT noted improvements in the use of the notation key "IE" in the reporting on the energy sector and in the consistency of reporting emission estimates as "IE" in CRF table 9 for the sectoral approach (for subcategories 1.A.5.b other – mobile and 1.B.2.b.1 natural gas exploration). Any remaining issues linked to the use of notation keys are covered by ID# E.2 below.
E.2	1. General (energy sector) – all fuels – CO_2, CH_4 and N_2O (E.2, 2021) (E.57, 2019) Comparability	Use the notation keys in strict accordance with the definitions provided in paragraph 37 of the UNFCCC Annex I inventory reporting guidelines.	Addressing. The ERT noted that the Party improved the use of notation keys in the CRF tables, as recommended in the previous review report (see ID# E.1 above). However, the Party still uses the notation key "NA" incorrectly to report some categories for part of the time series, for example for the AD and emissions for gaseous fuels for 2021 for subcategory 1.A.1.b petroleum refining, or for the AD and emissions for other fossil fuels for subcategory 1.A.1.a public electricity and heat production for 1992–1998, 2004–2005 and 2009–2019. The Party continues to use the notation key "NA" instead of "NO" to report the AD and emissions for category 1.C.2 injection and storage, which does not occur in the country. In addition, the Party reported the AD and CO_2 and CH_4 emissions for subcategories 1.B.2.c.1.ii gas – venting and 1.B.2.c.1.iii venting – combined under subcategory 1.B.2.c venting and flaring as "NO" for the entire time series instead of "IE". During the review, the Party stated that training was conducted for national inventory experts on the use of notation keys but acknowledged that some categories are not reported in strict accordance with the definitions provided in paragraph 37 of the UNFCCC Annex I inventory reporting guidelines and require additional coordination, which the Party is working to improve. Although the ERT notes the progress made, it considers that the recommendation has not yet been fully addressed because of the remaining issues linked to the use of the notation keys in accordance with the definitions provided in paragraph 37 of the UNFCCC Annex I inventory reporting guidelines.
E.3	1. General (energy sector) – all fuels – CO_2, CH_4 and N_2O (E.3, 2021) (E.2, 2019)	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. in sections 3.3.6 (pp.69–70), 3.3.7 (p.70), 3.4.1.5 (p.81), 3.4.1.6 (p.82), 3.4.2.5 (p.96), 3.4.2.6 (pp.96–97), 3.4.3.5 (pp.110–111), 3.4.3.6 (p.111), 3.4.11.2 (pp.143–144), 3.4.11.3 (p.145), 3.5.2.5 (pp.160–161) and 3.5.3.5 (p.177)), brief information on the reasons for the

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	(E.2, 2017) (E.3, 2016) (E.3, 2015) (23, 2013) (32, 2012) Transparency		recalculations performed for the energy sector. However, Kazakhstan did not transparently and systematically report all the reasons for and methodological changes applied to the recalculated estimates. For example, for category 1.B.1.b solid fuel transformation, the reported AD have changed significantly in the 2023 submission compared with the 2022 submission (e.g. from 4.00 to 98.83 Mt for 2020), but no explanation for this was provided in the NIR. For category 1.B.2 oil and natural gas, recalculations were performed for the whole category with relatively clear explanations provided for the choice of EFs, but no explanation was included for the change in AD, for example for gas transmission and storage. The AD for CH_4, CO_2 and N_2O emissions from other (non-pipeline) transportation changed significantly between the 2022 and 2023 submissions for liquid fuels (e.g. from 649.50 to 9,982.32 TJ for 2020), but the information provided in the NIR (section 3.4.11.2, pp.143–144) does not clearly explain the reasons for the recalculations. The text of NIR section 3.4.2.5, which refers to the recalculations for category 1.A.2 manufacturing industries and construction, has not changed compared with the 2022 NIR. Therefore, it is not clear whether it reflects the changes compared with the previous submission only, whether the recalculations cover the period up until 2017 (or 2019), which gases and subcategories are affected and the impact of the recalculations on the sectoral emissions and the trend. In some instances, the reason for the recalculations refers to the provisional main findings prepared by the previous ERT, which is an unofficial document that is difficult for the next ERT to check as a reference, rather than to the final published annual review report. During the review, the Party referred to information on the reasons for the recalculations and methodologies presented in the "Improvements" or "Category description" sections of the NIR for each category and provided further relevant clarification. The Party considers the 2023 NIR to be more informative compared with the previous NIRs, but recognized the shortcomings in the sections on recalculations, which the Party will continue to improve. The ERT notes the efforts made by the Party but considers that the recommendation has not been fully addressed because of the issues detected in relation to the presentation of information on the recalculations for the various categories in the energy sector in the NIR.
E.4	1. General (energy sector) – all fuels – CO_2, CH_4 and N_2O (E.4, 2021) (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. The ERT noted that the Party reported in its NIR explanations for the methodological approach used for the calculations and recalculations and for ensuring time-series consistency at the category level. Expert judgment and interpolation were not specifically discussed as gap-filling methods in these sections of the NIR for cases where AD are missing for a given time period, although lack of data for given time periods was reported in the NIR (e.g. for 1990–1998 when there was a lack of national energy balance (NIR section 3.2.2, p.58)). During the review, the Party clarified that relevant experts were involved in cases where AD were missing and conclusions were drawn on the basis of expert data from the relevant industry. The

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			Party further explained that an interpolation methodology was used to fill in the time series of AD of national statistics for the energy sector, as for other sectors, and was applied in strict accordance with the 2006 IPCC Guidelines (vol. 1, chap. 2.2.3, pp.2.10–2.11). The ERT considers that the recommendation has not yet been fully addressed because the information provided in the NIR is not sufficiently detailed with regard to the expert judgment and interpolation methodology used.
E.5	1. General (energy sector) – all fuels – CO_2, CH_4 and N_2O (E.5, 2021) (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. Although the Party included some sections on time-series consistency for the energy sector in the NIR (e.g. sections 3.3.6 (p.69), 3.5.2.3 (p.159) and 3.5.3.3 (p. 175)), the ERT noted that there is no systematic information dedicated to ensuring time-series consistency at the category level for the energy sector (as was included, for example, for the IPPU sector). The Party did not provide any comparisons in the NIR between the AD obtained from different national energy data sources (i.e. data for 1990–1998 for which energy balance tables are not available, and data for 1999–2021 for which energy balance tables are available) and international energy data sources used across the time series. During the review, the Party clarified that it is constantly working to verify and harmonize the data time series. The Party further noted that it is developing an application to compare data obtained from different national sources with data from international sources under the Capacity-building Initiative for Transparency. If the application is approved and the project is implemented, the results of the comparison will be presented in the NIR. The ERT considers that the recommendation has not yet been fully addressed because the Party has not yet included in the NIR information on comparisons between different international and national data sources and has not included specific paragraphs in the NIR on how time-series consistency is ensured for the categories in the energy sector.
E.6	1. General (energy sector) – all fuels – CO_2, CH_4 and N_2O (E.7, 2021) (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.	Addressing. The Party improved its reporting and included a description of the AD in CRF table 1.B.2 along with the associated units. The AD presented in CRF table 1.B.2 for subcategory 1.B.2.a oil – production are consistent with those presented in CRF table 1.A(b) across the whole time series, except for 2021, where 86,879.31 kt is reported in CRF table 1.B.2 but 74,733.22 kt is reported in CRF table 1.A(b). In addition, the Party reported in its NIR (section 3.5.3.1, p.162) that the amount of oil produced for 2021 is 85,879 kt, which is different from the data reported in CRF tables 1.B.2 and 1.A(b). For natural gas production, the data presented in CRF table 1.B.2 are also consistent with those presented in CRF table 1.A(b) across the whole time series, except for 2021, where a value of 54,179 Mm^3 is reported in CRF table 1.B.2, but 26,746.57 Mm^3 is reported in CRF table 1.A(b). In addition, there is a minor discrepancy for 1990, for which natural gas production is reported as 7,114.00 Mm^3 and 7,123.00 Mm^3 in CRF tables 1.B.2 and 1.A(b) respectively.

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			Additionally, the inconsistencies within the CRF tables between the reported AD and the associated units (which the Party previously explained was due to a technical error in the data set that needed to be corrected) remain. For example, in the 2023 submission, the AD for all subcategories under 1.B.2.a oil are described as "oil produced" (kt) but with different values: in addition to the values of 86,879.31 and 74,733.22 kt mentioned above, for 2021 a value of 132,600.00 kt was reported for subcategory 1.B.2.a.3 oil – transport and a value of 17,590.46 kt was reported for subcategory 1.B.2.a.4 oil – refining/storage in CRF table 1.B.2. The AD for several subcategories under 1.B.2.b natural gas were defined as "gas produced" but with different inputs: for subcategories 1.B.2.b.2 natural gas – production and 1.B.2.b.3 natural gas – processing, a value of 54,179.00 Mm^3 was reported, for subcategory 1.B.2.b.5 natural gas – distribution a value of 4,774.84 Mm^3 was reported and for subcategory 1.B.2.b.6 natural gas – other "NO" was reported for 2021. These inconsistencies were observed across the time series. During the review, the Party explained that the discrepancies in the initial data for 2021 within and between CRF tables 1.B.2 and 1.A(b) are the result of addressing the recommendation from the previous review report, which was applied for some parts of the inventory but not consistently across all categories. The Party stated that it is planning to check the latest data from the Bureau of National Statistics of Kazakhstan, which may also be subject to change, and make appropriate corrections to the CRF tables and include relevant explanations in the NIR. The Party also acknowledge some input errors in CRF table 1.B.2 (e.g. the description of the AD for subcategory 1.B.2.b.5 should be gas distributed, not gas produced). The Party further explained that technical errors probably occurred when importing data from the calculation sheets into the CRF tables, and efforts will be made to improve controls at all stages of working with data, especially during the final stage of inventory preparation, which involves inputting data into the CRF tables. The ERT considers that the recommendation has not yet been addressed because inconsistencies remain in the reported AD and associated units in the NIR and CRF tables.
E.7	1. General (energy sector) – gaseous fuels – CO_2, CH_4 and N_2O (E.74, 2021) Convention reporting adherence	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.	(a) Resolved. The N_2O IEF for subcategories 1.A.1.c solid fuels and 1.A.1.c manufacture of solid fuels and other energy industries for 2017 was recalculated (from 2.0 to 1.5 kg/TJ) and is now consistent with the rest of the time series and within the range of IPCC default values (0.1–1.5 kg/TJ). (b) Not resolved. The CO_2 IEF for liquid fuels for category 1.A.2 manufacturing industries and construction for 2006 (42.66 t/TJ) was not corrected and is outside the range of the IPCC default values (57.6–97.5 t/TJ), the lowest among all reporting Parties (42.7–86.4 t/TJ) and below the values reported for the other years of the time series, with significant inter-annual changes in 2005/2006 (–44.3 per cent) and 2006/2007 (77.7 per cent). During the previous review, the Party clarified that this

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			was caused by a typographical error and that liquid fuel consumption for the category should be reported as 51,600.5 TJ, not 91,610.8 TJ. (c) Resolved. The CO_2 IEF for gaseous fuels for subcategory 1.A.2.d pulp, paper and print for 1999 was revised from 100 to 58.00 t/TJ. (d) Resolved. The N_2O IEFs for subcategory 1.A.2.f non-metallic minerals (liquid fuels) for 2004, 2005 and 2009 were corrected (e.g. from 0.06 to 0.60 kg/TJ for 2005 and from 1.08 to 0.54 kg/TJ for 2009). (e) Not resolved. The carbon EF for BKB and patent fuel for 2017–2019 (20.6 t/TJ) was not corrected and is outside the range of the IPCC default values (23.8–29.6 t/TJ) and the lowest among all reporting Parties (20.6–28.9 t/TJ). The carbon EF replaces the constant value of 26.6 t/TJ used for 1990–2016 and was also used for 2020 and 2021. During the review, the Party stated that QA/QC work is being carried out within the inventory team, and that input data and inventory results are also verified by government agencies. The ERT noted that some of the detected errors still need to be corrected in order to completely resolve this issue.
E.8	Fuel combustion – reference approach – solid fuels – CO_2 (E.8, 2021) (E.8, 2019) (E.8, 2017) (E.9, 2016) (E.9, 2015) (34, 2013) Comparability	Carry out the planned improvement to separate coking coal consumption from the total other bituminous coal consumption.	Addressing. The ERT noted that coking coal consumption was reported separately for 2014 onward. However, it was still reported as "IE" (AD) until 2013 in CRF table 1.A(b) as the fuel was aggregated with other solid fuels. The Party reported consumption of sub-bituminous coal as "NO" for 2015–2021 and reported consumption of other bituminous coal as "NO" for the entire time series. During the review, the Party clarified that joint work with government agencies and a number of experts is being carried out in addition to a study of technical literature and that it is planning to make efforts to report coking coal consumption separately for 1990 onward in its next inventory submission.
E.9	Fuel combustion – reference approach – all fuels – CO_2, CH_4 and N_2O (E.9, 2021) (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 the sectoral approaches.	Addressing. The differences in estimated CO_2 emissions between the reference and sectoral approaches for 1990–2013 (excluding 2005) range between 1.2 and 28.5 per cent, with higher emissions estimated under the reference approach. For 2005 and 2014–2018, the differences range between –0.3 and –7.2 per cent, with higher emissions estimated under the sectoral approach. The differences for 2019 and 2020 are 6.5 and 4.8 per cent respectively. The difference for 2021 is –2.0 per cent, with higher emissions estimated under the sectoral approach. The Party indicated in the NIR (section 3.2.2, pp.58–59) that the differences are caused by difficulties in collecting AD for the production, export and import of liquid fuels (crude oil) and solid fuels (coking coal and other types of coal), which also explains the inter-annual changes in the values of the differences between the reference and sectoral approaches. The reason for the change from a positive to a negative difference for some years, particularly between 2020 and 2021, and for the overall trend was not clarified. The explanation provided by the Party is therefore not sufficient to clarify

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			the magnitude and the observed trend in the differences in inter-annual changes between the two approaches. During the review, the Party clarified that the differences in inter-annual changes between the reference and sectoral approaches are due to changes in the energy balance provided by the Bureau of National Statistics. The Bureau of National Statistics did not provide an energy balance in the updated format for the earlier years of the time series. The Party indicated that a cross-check of the AD and explanations for any identified errors, if relevant, will be included in the next NIR.
E.10	Fuel combustion – reference approach – all fuels – CO_2 (E.10, 2021) (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 (see ID# E.9 above). The Party provided in the NIR (section 3.3.4) explanations for the uncertainty of the emissions based on the reference approach. However, this is not sufficient to justify the significant difference between the results of the emission calculations under the two approaches and no specific information was provided on the NEU of fuels and their impact on the comparison between the two approaches. During the review, the Party clarified that a cross-check of the AD and explanations for any identified errors, if relevant, will be included in the next submission and that additional information will also be included as an appendix to or as a separate chapter in the NIR. Recalculations will be performed after updated information from the Bureau of National Statistics has been received.
E.11	Fuel combustion – reference approach – liquid, solid, gaseous and other fossil fuels – CO_2 (E.12, 2021) (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) 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) Resolved. The ERT concluded that the QA/QC procedures for the reference approach are covered by ID# E.9 above. (b) Addressing. The Party continues to report the consumption and corresponding emissions for category 1.A.5 other at an aggregated level under subcategory 1.A.5.a stationary in CRF table 1.A(a)s4, including a value equivalent to the difference in consumption of coking coal between the reference and sectoral approaches. The Party explained in the NIR (p.59) that the difference between the two approaches was reduced by using data on consumption of coking coal from ArcelorMittal Temirtau JSC and the time series was recalculated for categories 1.A.5 other and 1.A.1.b petroleum refining. Although the value reported for category 1.A.5 has been reduced for 2014 onward (e.g. CO_2 emissions for 2019 have decreased from 46,667.12 kt CO_2 in the 2021 submission to 28,759.52 kt CO_2 in the 2023 submission) large differences remain between the two approaches (e.g. 29.1 per cent in 1992 or 6.5 per cent in 2019). From the information provided in the NIR, it is not clear for which years the new data on coking coal have been used and the recalculations made. (c) Addressing. Carbon excluded from NEU and feedstocks of NGLs was reported for additional years, namely 1990 and 1999–2021, but was still reported as “NA” for the other years of the time series. (d) Resolved. The ERT notes that this issue is covered by ID# E.10 above.

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			During the review, the Party clarified that the national inventory team will strengthen the cross-checks between the reference and sectoral approaches for the next submission and address any pending issues.
E.12	Fuel combustion – reference approach – liquid fuels – CO_2, CH_4 and N_2O (E.13, 2021) (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.	Addressing. The Party reported consistent AD for jet kerosene under aviation bunkers and AD for gas/diesel oil under marine bunkers in CRF tables 1.D and 1.A(b). Nevertheless, Kazakhstan continues to report the AD for residual fuel oil as "NO" in CRF table 1.A(b) for both international bunkers, while the fuel used is reported in CRF table 1.D for marine bunkers for 2021. 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 inventory submission. The ERT considers that the recommendation has not yet been fully addressed because the Party has not yet corrected the data reported in CRF table 1.A(b) for all international bunker fuels.
E.13	Feedstocks, reductants and other NEU of fuels – all fuels – CO_2 (E.15, 2021) (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 issue regarding the inconsistent values for lubricants between CRF tables 1.A(b) and 1.A(d) for 2014 has been corrected, but inconsistencies have been identified for other years and fuels (e.g. for 2021 for lubricants, LPG and bitumen). The Party continued to report the carbon excluded for crude oil and NGL as "NE" and "NA" in CRF table 1.A(b) respectively, while in CRF table 1.A(d) carbon excluded was reported as "NO". In addition, CRF table 1.A(d) indicates that NEU of NGLs occurs for petrochemical production, but the AD and relevant emissions were reported as "NA". During the review, the Party indicated its intention to correct the inconsistencies in line with the available data.
E.14	International aviation – liquid fuels – CO_2, CH_4 and N_2O (E.16, 2021) (E.13, 2019) (E.45, 2017) (E.59, 2016) Convention reporting adherence	Ensure consistency between CRF table 1.D (fuel consumption of international aviation/ international bunkers) and CRF table 1.A(b) (reference approach – fuel consumption of international bunkers).	Resolved. The Party reported consistent (corrected) AD for jet kerosene (the only fuel used in international aviation) under aviation bunkers in CRF tables 1.D and 1.A(b).
E.15	International navigation – liquid fuels – CO_2, CH_4 and N_2O (E.19, 2021) (E.61,	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	Addressing. Residual fuel oil use was reported for international navigation for 2006 onward and was reported as "NO" until 2005. The Party reported in its NIR (section 3.4.11.2, p.143) that, taking into consideration the comments of the previous ERT, recalculations were made for some of the data related to international navigation.

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	2019) Transparency	fuel oil consumption under international navigation to "NO".	The ERT notes that including data for the entire time series or an explanation for reporting "NO" for the years before 2006 will help to completely resolve the issue. For the pending inconsistency related to CRF table 1.A(b), see ID# E.12 above.
E.16	1.A Fuel combustion – sectoral approach – solid fuels – CO_2 (E.20, 2021) (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.	Addressing. The ERT noted that, since the majority of coal used in Kazakhstan is from domestic production, the Party investigated the possibility of calculating country-specific CO_2 EFs for lignite and sub-bituminous coal (NIR p.82), but still uses default EFs from the 2006 IPCC Guidelines (vol. 2, chap. 1, tables 1.2–1.4) for lignite and sub-bituminous coal (NIR table 3.8, p.68). During the review, the Party clarified that part of the work on developing country-specific EFs has been carried out, but work to improve the estimation approaches continues. The Party indicated that it will make efforts to calculate country-specific EFs for coal for the next inventory submission.
E.17	1.A Fuel combustion – sectoral approach – all fuels – CO_2, CH_4 and N_2O (E.21, 2021) (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.	Resolved. In addition to the AD reported in the CRF tables, the Party reported in its NIR (e.g. in tables 3.9, 3.15 and 3.21 on pp.72, 84 and 98 respectively) information on energy consumption data disaggregated by fuel type for the subcategories under category 1.A.
E.18	1.A Fuel combustion – sectoral approach – all fuels – CO_2 (E.22, 2021) (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.	Not resolved. In CRF table 1.A(d), the Party still reported NEU of coking coal for the ferroalloys industry only, while in the NIR (section 4.4.1.2.1, p.214) it 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. In addition, in CRF table 1.A(d), the Party reported NEU of coking coal as "NA" for 2021 without providing an explanation for doing so. The ERT also noted other errors related to NEU of fuels and inconsistencies between CRF table 1.A(d) on the energy sector and CRF table 2(I).A-H on the IPPU sector. For example, in the CRF tables for 2020, the reported value for NEU of lubricants in CRF table 2(I).A-Hs2 for the IPPU sector was 51.80 kt, which is equivalent to 2,082 TJ, while in CRF table 1.A(d), the reported value was 119.91 TJ; for 2021, the reported value of lubricant use in CRF table 2(I).A-Hs2 for the IPPU sector was 61.30 kt, which is equivalent to 1,760 TJ, while in CRF table 1.A(d) the reported value was 632.79 TJ. During the review, the Party noted that it is working to improve the consistency of the data reported in the CRF tables and in the NIR and that the national inventory team has received training, which will reduce the risk of error.
E.19	1.A Fuel combustion – sectoral approach – solid fuels – CO_2, CH_4	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	Addressing. The ERT noted that the emission estimates have been revised to avoid double counting for the energy and IPPU sectors for 2014–2017 and subsequent years, but no recalculations were made to apply the same approach for the complete

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	and N_2O (E.25, 2021) (E.62, 2019) Accuracy	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 net calorific values and EFs for coking coal and other fuels used.	time series. No additional information was provided on the source and method of calculation used for the emission estimates, including the net calorific values and EFs for coking coal and other fuels used. During the review, the Party indicated that it is constantly working to avoid double counting of fuels and that relevant information is presented in the sections of the NIR on the energy and IPPU sectors. The Party further explained that recalculations were not performed for categories 1.A.5 and 1.A.1.b and for coking coal because the Bureau of National Statistics did not provide the energy balance for the previous years of the time series in an updated format. The Party indicated that it will make efforts to further enhance the GHG inventory.
E.20	1.A Fuel combustion – sectoral approach – other fossil fuels – CO_2, CH_4 and N_2O (E.27, 2021) (E.20, 2019) (E.49, 2017) Comparability	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.	Addressing. In the NIR (section 3.2.2, p.58) the Party clarified that, for 2009 onward, the national statistics do not separate consumption of other fossil fuels from liquid, solid or gaseous fuels, but that fuels and emissions are included in the consumption of the corresponding type of fuel (liquid, solid or gaseous). 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 as "NO" and "NA" for 2009–2021. Considering the definitions of fuel types for reporting other fossil fuels (municipal wastes (non-biomass fraction), industrial wastes and waste oils) provided in the 2006 IPCC Guidelines (vol. 2, chap. 1, table 1.1, pp.1.12–1.16) and the definitions of notation keys that are 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). During the review, the Party noted that appropriate corrections will be made to enhance the comparability of its national inventory reporting for the next inventory submission.
E.21	1.A.2.a Iron and steel – solid fuels – CO_2, CH_4 and N_2O (E.26, 2021) (E.21, 2019) (E.50, 2017) Transparency	In the NIR, provide information on AD for coking coal combusted for its 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 perform recalculations for 1990–2013 (see ID# E.19 above) or report AD for coking coal combusted or used for its own needs by ArcelorMittal Temirtau JSC. The ERT noted that, despite the explanation in the NIR (pp.58–59) that solid fuel was recalculated owing to the disaggregation of coking coal, the Party continued 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. The NIR (section 4.4.1.2.1, pp.214–216) indicates that, upon request, ArcelorMittal Temirtau JSC provided a wide range of data, including on the consumption of coking coke for iron production. During the review, the Party explained that the AD based on data from ArcelorMittal Temirtau JSC were presented in the CRF tables and described in the IPPU section of the NIR. Noting the established practice for data to be received directly from plants, the ERT considers that the recommendation has not been addressed because the information in the NIR and the CRF tables is not sufficient for defining the amount of coking coal combusted or used for its own needs by ArcelorMittal Temirtau JSC or for clarifying the amount of coking coal allocated to the energy and IPPU sectors.

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E.22	1.A.2.a Iron and steel – gaseous fuels – CO_2, CH_4 and N_2O (E.75, 2021) Accuracy	Revise the AD for the entire time series for gaseous fuels under subcategory 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 paragraphs 43–45 of the UNFCCC Annex I inventory reporting guidelines.	Addressing. The Party revised the AD for some years of the time series for gaseous fuels under subcategory 1.A.2.a iron and steel using a consistent data source, recalculated the CO_2, CH_4 and N_2O emission estimates and provided some information on the trend in the NIR (e.g. in figure 3.10 and pp.91–92 and 96). However, there are still large fluctuations in the trend of the AD and resulting emissions and the values for 2018 and 2019 have not changed as a result of the recalculations and continue to be reported as 14,596.76 TJ for 2018 and 1,131.69 TJ for 2019. No explanations were provided in the NIR on the significant inter-annual changes in the AD. During the review, the Party expressed its intention to address this recommendation for the next inventory submission. The ERT noted that the recommendation has not been fully addressed because the Party has not recalculated the AD for the entire time series or explained the remaining inconsistencies in the trend in the NIR.
E.23	1.A.2.d Pulp, paper and print – all fuels – CH_4 and N_2O (E.28, 2021) (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. As noted in the previous review report, the Party included estimates for CH_4 and N_2O emissions for all fuels across the time series, despite their insignificance. The previous ERT noted, however, that for some fuels (e.g. gaseous fuels and biomass) the time series was not complete and emissions were reported as "NA" for some years. The current ERT noted that the Party has improved its reporting of subcategory 1.A.2.d pulp, paper and print; for example, gaseous fuel consumption and emissions of CO_2, CH_4 and N_2O were reported as "NO" instead of "NA" for 1990–1998 and clarification was included in the NIR (p.96). However, the ERT noted the Party has not fully addressed the recommendation because it still reported CH_4 and N_2O emissions from biomass as "NA" instead of "NO" for subcategory 1.A.2.d for 1990–1991, 2009–2016 and 2019–2021.
E.24	1.A.3.a Domestic aviation – liquid fuels – CO_2 (E.29, 2021) (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. The Party reported in the NIR (section 3.4.8.2, p.138) that a tier 2 method was used to estimate emissions for this subcategory. This information is consistent with the method reported in the CRF tables. The Party provided explanations in its NIR (section 3.4.8.1, pp.135–137) for the methodological approaches used for the emission estimates for the subcategory, as well as for the selection of AD. However, the EFs were classified as default in the CRF tables and the ERT noted that the CO_2 IEFs reported in CRF table 1.A(a)s3 are constant values, namely 71.5 and 69.30 t/TJ for jet kerosene and aviation gasoline respectively, corresponding to the tier 1 default values provided in the 2006 IPCC Guidelines (vol. 2, chap. 3, table 3.6.4, p.3.64). The ERT also noted an error in the IEF reported for 2021 for jet kerosene (7.15 t/TJ instead of 71.5 t/TJ) in CRF table 1.A(a)s3 (see ID# E.62 in table 5). During the review, the Party confirmed the use of a tier 2 method: before calculating the emission estimates, all flight data are checked and divided by type of aircraft used, number of flights, cruising time and take-off time to landing, and only after

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			those calculations are the data compiled and presented in the CRF tables for subcategory 1.A.3.a domestic aviation. The ERT considers that the recommendation has not yet been resolved since the CO_2 EF values across the time series were not clarified in the NIR.
E.25	1.A.3.b Road transportation – liquid fuels – CO_2, CH_4 and N_2O (E.30, 2021) (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.	Resolved. The Party performed recalculations, resulting in increased emission estimates for subcategory 1.A.3.e.ii other and a decrease in the reported emission estimates for subcategory 1.A.4.c.ii off-road vehicles and other machinery. In the NIR (section 3.4.11.2, pp.143–144), the Party explained that recalculations were made considering the redistribution of off-road transportation within fuel combustion categories by fuel type. In particular, the initial data were revised and emissions were regrouped by fuel type and emissions source. The ERT noted that 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) and the residential sector, as well as in ground support facilities at airports, agricultural machinery (tractors, combine harvesters, loaders, etc.) and construction. In addition, the Party reported in the NIR (section 3.4.2.2, pp.94–95) that GHG emissions from off-road transportation in industry and construction (gasoline, kerosene and diesel fuel) were included under subcategory 1.A.3.e.ii in order to eliminate double counting in the subcategories under category 1.A.2 manufacturing industries and construction. During the review, the Party clarified that it reallocated AD and emissions and performed recalculations using more accurate AD for vehicles used in agriculture, industry (including construction and maintenance) and the residential sector, as well as in ground support facilities at airports, agricultural machinery (tractors, combine harvesters, loaders, etc.) and construction.
E.26	1.A.3.b Road transportation – liquid fuels – N_2O (E.32, 2021) (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.	Addressing. No recalculations of the N_2O emission estimates for gasoline for road transportation have been performed since the 2021 submission. Kazakhstan used a default N_2O EF of 3.2 kg/TJ from the 2006 IPCC Guidelines (vol. 2, chap. 3, table 3.2.2, p.3.21) for uncontrolled technologies, given that the number of vehicles with oxidation catalysts is relatively small and does not have a significant impact on N_2O emissions. The Party stated in its NIR (pp.124 and 145) that, to ensure a more accurate estimation of GHG emissions, the entire time series for road transportation was also calculated for the first time using COPERT, and the results align well for the first half of the time series, while there are some differences for recent years owing to the impact of the increased use of cars with technological improvements. However, since significant discrepancies were identified for several years of the time series, which are apparently due to technical errors in modelling, the results of the calculations using COPERT have so far been considered only as an independent data verification tool and not used in the inventory. Although the Party included the timeline of the adoption of EURO emission standards in Kazakhstan and mentioned data limitations in categorizing cars by age,

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			the use of catalytic converters in gasoline engines has not yet been taken into account in the calculation of N_2O emissions. Therefore, the ERT considers that the issue has not yet been fully addressed.
E.27	1.A.3.b Road transportation – liquid fuels – N_2O (E.34, 2021) (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 Party provided in its NIR (sections 3.4.5.2–3.4.5.3, pp.123–132) information on the data-collection procedure and the results of categorizing cars by age and emission standard. In addition to the description provided in the 2021 submission, the Party stated in the NIR (p.124) that it is planning to use COPERT for a more accurate estimation of N_2O and CH_4 emissions from road transportation (see ID# E.26 above). However, the ERT noted that Kazakhstan has provided limited information on the number of vehicles with oxidation catalysts (NIR figure 3.23, p.128) and the evolution of the share of such vehicles over the time series. During the review, the Party clarified that the proportion of new cars is increasing and it is likely that the emission estimates reported for recent years of the time series will be recalculated for the next inventory submission.
E.28	1.A.3.b Road transportation – liquid fuels – N_2O (E.76, 2021) Accuracy	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.	Resolved. The Party corrected the EF applied for the estimates of N_2O emissions from diesel fuel in road transportation from 5.7 kg/TJ to 3.9 kg/TJ across the time series and provided revised estimates of N_2O emissions. The updated EF value is the IPCC default value provided in the 2006 IPCC Guidelines (vol. 2, chap. 3, p.3.21, table 3.2.2).
E.29	1.A.3.b.i Cars – liquid fuels – CH_4 (E.36, 2021) (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.	Resolved. The Party continued to report a CH_4 IEF value of 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). The Party provided more detailed background information on road transportation and explained that more than 60 per cent of all vehicles are more than 10 years old, which determines the use of high coefficients for vehicles. The Party clarified in the NIR (p.128) that the EURO 5 standard was introduced in 2016 and explained in section 3.4.11.3 (p.145) that the national inventory experts are planning to use COPERT for the next inventory submission for a more accurate estimation of N_2O and CH_4 emissions from road transportation (see ID# E.27 above).
E.30	1.A.3.d Domestic navigation – liquid fuels – CO_2, CH_4 and N_2O (E.37, 2021) (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 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.	Resolved. The Party reported in its NIR (section 3.4.10, pp.140 and 142) that domestic and international navigation was disaggregated considering the national technical capabilities, reporting emissions separately for domestic and international navigation. The calculation method used is based on a tier 1 method and the Party clarified some of the assumptions used, for example that gasoline is not taken into account for international navigation, while fuel oil is not considered for domestic navigation. The main data source for domestic and international navigation is the Bureau of National Statistics. A relatively large number of parameters are used for determining the appropriate AD, on the basis of which a conclusion is made about the fuel balance for the needs of the fleet. Some of the criteria applied include the type of

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			ship and fuel used, as well as the volume of cargo transported by domestic and international navigation.
E.31	1.A.3.d Domestic navigation – liquid fuels – CO_2, CH_4 and N_2O (E.38, 2021) (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.	Not resolved. No recalculations were made for the emission estimates for gas/diesel oil across the time series. The Party provided the same explanation for the trend of fuel use in domestic navigation in the NIR (section 3.4.10) as in the previous annual submission and no well-documented justification for the decrease in gas/diesel oil consumption in subcategory 1.A.3.d domestic navigation was included. The Party clarified in its NIR (p.136) that the calculations are based on the balance of transported goods for domestic and international navigation. During the review, the Party clarified that possible significant changes in fuel consumption by river navigation can be explained by the wear and tear of the country's main infrastructure, as well as by the significant shallowing of some rivers in the north of Kazakhstan, as a result of which no domestic navigation is possible along those routes. The ERT considers that the recommendation has not yet been fully addressed because the Party has not yet included in its NIR a well-documented justification for the decrease in the gas/diesel oil consumption in subcategory 1.A.3.d domestic navigation.
E.32	1.A.3.d Domestic navigation – liquid fuels – CO_2, CH_4 and N_2O (E.39, 2021) (E.65, 2019) Transparency	Include in the NIR a well-documented justification for the decrease in gasoline consumption in subcategory 1.A.3.d domestic navigation and ensure the consistency of the emission estimates for the complete time series.	Not resolved. No recalculations were made or additional information provided in the NIR on gasoline consumption in domestic navigation compared with the information on diesel oil (see ID# E.31 above).
E.33	1.A.4.c Agriculture/forestry/ fishing – liquid fuels – CO_2, CH_4 and N_2O (E.40, 2021) (E.33, 2019) (E.54, 2017) Transparency	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. As indicated in the NIR (section 3.4.6, p.133) and during the review, the Party disaggregated CO_2, CH_4 and N_2O emissions for subcategory 1.A.4.c by type of fuel under the relevant subcategories (i.e. 1.A.4.c.i stationary, 1.A.4.c.ii off-road vehicles and other machinery and 1.A.4.c.iii fishing) and the results were presented in CRF table 1.A(a). However, the ERT noted that the recommendation has not been fully addressed because no explanation was provided in the NIR on the method used to allocate the fuels to the correct subcategory.
E.34	1.A.5 Other (fuel combustion activities) – all fuels – CO_2, CH_4 and N_2O (E.41, 2021) (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, include information on the revised allocations, provide detailed explanations on all reallocations and provide revised emission estimates.	Addressing. The Party indicated in the NIR (section 3.4.3.5, p.111) that recalculations were performed for category 1.A.5 to reduce the difference between the sectoral and reference approaches (see ID# E.11 above), but no reallocation of emissions was indicated. Further in the NIR (section 3.4.3.1, p.97) the Party indicated that it reported fuel combustion emissions not included elsewhere under category 1.A.5, with subcategories 1.A.5.a stationary (covering also military emissions) and 1.A.5.b mobile sources. However, the Party continued to report all emissions under the category in an aggregated manner and reported emissions for subcategory 1.A.5.b mobile sources as "NO, IE" in CRF table 1.A(a)s4, even though emissions in this

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			subcategory are likely to occur, in line with the 2006 IPCC Guidelines (vol. 2, chap. 2, table 2.1, p.2.10). During the review, the Party clarified that all emissions not included elsewhere, including mobile, are taken into account and reported under subcategory 1.A.5.a stationary and that it makes efforts to ensure the completeness of the estimates. Since all fuel purchases (for all fuel types) occur through open tenders, it is difficult to separate military fuel from civilian fuel. Although the Party stated that the emission estimates for the listed activities are included in the inventory, the ERT noted that the comparability of the reporting has still not been achieved, as the emissions were aggregated, without providing sufficient explanatory notes in the NIR.
E.35	1.A.5.a Stationary – all fuels – CO_2, CH_4 and N_2O (E.42, 2021) (E.66, 2019) Comparability	Report in CRF table 1.A(a)s4 the fuel consumption and corresponding GHG emissions for subcategory 1.A.5.a stationary by type of fuel.	Addressing. The Party reported in NIR tables 3.22 and 3.24 (pp.99–100 and 103–104 respectively) data on fuel consumption and CO_2 emissions by fuel type for category 1.A.5 other. However, in CRF table 1.A(a)s4, the AD and GHG emissions for category 1.A.5 were aggregated under subcategory 1.A.5.a stationary, without specifying the type of fuel. During the review, the Party stated that in CRF table 1.A(a)s4 the fuel consumption and associated GHG emissions for subcategory 1.A.5.a by fuel type were updated and corresponding comments included in the NIR. The Party noted that it was not able to provide disaggregated AD in the CRF tables owing to technical issues and that it will provide disaggregated AD in the next inventory submission. The ERT noted that the Party has not yet fully addressed the recommendation because it has still not reported disaggregated AD and GHG emissions by type of fuel under category 1.A.5 other in CRF table 1.A(a)s4.
E.36	1.B.1 Solid fuels – CO_2 and CH_4 (E.77, 2021) Accuracy	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.	Addressing. For CH_4 emissions from abandoned underground mines, the Party reported in its NIR (p.154) that a tier 1 method was used together with the CH_4 EF from the 2006 IPCC Guidelines (vol. 2, chap. 4, table 4.1.6, p.4.25) and provided information on the quantity of abandoned underground mines for different time periods (1997–1996, 1997–2000 and 2001–2021). However, the Party still did not include more detailed information on which specific parameters were used or transparently document in its NIR the calculation procedure used, as table 4.1.6 of the 2006 IPCC Guidelines provides sets of default data by different time intervals up until 2016. For CO_2 and CH_4 emissions from solid fuel transformation reported in CRF table 1.B.1, no information was provided in the NIR on the background data and methods (formulas, assumptions or parameters) used. During the review, no additional information was provided by the Party regarding CH_4 emissions from abandoned underground mines. For subcategory 1.B.1.b solid fuel transformation, the Party clarified that the scope of this subcategory is uncontrolled combustion of waste heaps located near the extraction sites. The ERT notes that the coverage of the subcategory is not transparently explained in the NIR. In terms of methodological information, the Party referred to the NIR (section

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			3.5.2.2) and provided the country-specific parameters used to estimate the emissions from waste heaps (see ID# E.63 in table 5).
E.37	1.B.1.a Coal mining and handling – solid fuels – CO_2 and CH_4 (E.44, 2021) (E.67, 2019) Accuracy	Provide consistent and accurate information on the 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.	Addressing. The Party reported coal production for 2021 amounting to 106.65 Mt in CRF table 1.B.1, which corresponds to the amount reported in NIR figure 3.5.1 (p.149). (The Party reported coal production in a figure instead of in a table, as was provided in the 2021 submission.) However, coal production is reported as 107.50 Mt in CRF table 1.A(b), which is the sum of all primary coal production (i.e. 4,143.70 kt for coking coal, 4,861.28 kt for lignite and 98,494.50 kt for energy coal). There are inconsistencies of this type across the entire time series to a varying extent, with the highest variation reported for 2019 at –14.7 per cent, for which the AD were reported as 98.83 Mt in CRF table 1.B.1, but as 113.40 Mt in CRF table 1.A(b). In addition, the fugitive emissions from lignite production seem not to be accounted for in 2019 because lignite production (5,928.90 kt) reported in CRF table 1.A(b) is not accounted for in CRF table 1.B.1. During the review, the Party clarified that this inconsistency is likely due to data updates from the Bureau of National Statistics provided during the finalization of the submission that were not consistently reflected in the CRF tables and the NIR and that further cross-checking procedures will be included in future inventory improvement plans. The Party also provided spreadsheets with quantitative information on coal production from underground and surface mining for the entire time series. Regarding lignite, the Party clarified that all lignite is produced in surface mining activities and the related emissions were included in subcategory 1.B.1.a.ii surface mines.
E.38	1.B.1.a Coal mining and handling – solid fuels – CH_4 (E.45, 2021) (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).	Resolved. The CH_4 emission estimates for underground mines in Kazakhstan in the 2023 submission are not based on measurements, but on default EFs. The Party reported in CRF table 1.B.1 that the CH_4 EF for underground mining is a constant value of 16.75 kg/t across the time series, equivalent to the higher default value of 25 m^3/t when a conversion factor of 0.67 kg/m^3 is used, as provided in the 2006 IPCC Guidelines (vol. 2, chap. 4, p.4.12). The Party explained (NIR p.150) that underground coal mining is carried out at a depth of 400 m or more with a high CH_4 content, and the higher default value is therefore applicable.
E.39	1.B.1.a Coal mining and handling – solid fuels – CH_4 (E.46, 2021) (E.37, 2019) (E.28, 2017) (E.38, 2016) (E.35, 2015) Transparency	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 changed the notation key used for reporting CH_4 recovery/flaring from underground mines – mining activities from "NA" to "NE" and for the other subcategories to "NO" in CRF table 1.B.1 for the entire time series. The Party did not provide further explanation or justification in CRF table 9 for reporting CH_4 recovery/flaring from underground mines – mining activities as "NE". The Party provided limited information in its NIR on CH_4 recovery/flaring from underground mines – mining activities, mentioning (on p.145) that no information is currently available on the amount of burned gas in flares from well drainage, and it is believed

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			that all extracted gas is consumed for the needs of the relevant company and accounted for in the energy sector. The ERT considered that this approach may result in double counting since the CH_4 recovered for energy purposes is not subtracted from this subcategory. During the review, the Party clarified that all gas removed as a result of degassing coal seams is used for its own needs and is not taken into account anywhere else, as confirmed with the relevant company. The ERT concluded that, even if there is no double counting of emissions, the explanation regarding CH_4 recovery/flaring provided in the NIR should be improved, such as by including the information provided during the review.
E.40	1.B.1.a Coal mining and handling – solid fuels – CO_2 (E.50, 2021) (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.	Addressing. The Party reported in its NIR (section 3.5.2.2, p.156) that the parameters used to calculate CO_2 emissions from surface mining activities are based on direct measurements following the methodological guidelines of the Ministry of Environment of Kazakhstan (order 280 of 2010), and no further information on the way in which the measurements were made or their scope was provided in the NIR. During the review, the Party clarified that one of the largest mining companies has an automated system for continuously monitoring the presence of gases from operated mines and that this information was verified by an independent company. The ERT concludes that the issue has not yet been fully resolved as the background information was not transparently provided in the NIR.
E.41	1.B.1.a Coal mining and handling – solid fuels – CH_4 (E.78, 2021) Accuracy	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.	Resolved. The Party reported in its NIR (p.156) and in CRF table 1.B.1 that the high IPCC default value (2 m^3/t) from the 2006 IPCC Guidelines (vol. 2, chap. 4.1.4.2, p.4.18) was used to estimate CH_4 emissions from surface mining activities across the whole time series (i.e. 1.34 kg/t, corresponding to 2 m^3/t converted by a CH_4 density of 0.67 kg/m^3).
E.42	1.B.2 Oil, natural gas and other emissions from energy production – liquid and gaseous fuels – CO_2, CH_4 and N_2O (E.53, 2021) (E.44, 2019) (E.33, 2017) (E.44, 2016) (E.41, 2015) Transparency	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.	Resolved. The Party included the description and the units for the AD in CRF table 1.B.2. Regarding inconsistencies detected in the AD, see ID# E.6 above.
E.43	1.B.2 Oil, natural gas and other emissions from energy production – liquid and gaseous fuels – CO_2, CH_4 and	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	Resolved. For the oil industry, the Party reported in its NIR (section 3.5.3.2, pp.174–175) that three timelines were used to transition from the use of default EFs for developing countries listed in table 4.2.5 of the 2006 IPCC Guidelines (vol. 2, chap. 4, p.4.55) to those for developed countries listed in table 4.2.4 (vol. 2, chap. 4, p.4.48), namely 1990–1997, 1998–2010 and 2011–2021. For 1990–1997, data from

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	N_2O (E.54, 2021) (E.68, 2019) Transparency	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.	table 4.2.5 were used (if there was an upper and lower threshold, the average data were used); for 2011–2021, data from table 4.2.4 were used; and for the transition period 1998–2010, the EF was determined by assuming that the share of updated equipment grew by 8 per cent each year between 1997 to 2011. For the natural gas industry, the same transition approach was used to select the EFs used to calculate CH_4 and CO_2 emissions from natural gas production, processing, transmission and distribution. The Party also included information in the NIR (section 3.5.3.2, pp.167–169) on legislation adopted for the oil and natural gas industry to improve the technology and regulate emissions. It further indicated that the approach to identifying the three timelines is justified because of the measures introduced to update the technology, infrastructure and equipment (NIR p.171).
E.44	1.B.2 Oil, natural gas and other emissions from energy production – liquid and gaseous fuels – CO_2, CH_4 and N_2O (E.55, 2021) (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).	Resolved. Although the Party did not use a tier 2 method and continues to use default EFs from the 2006 IPCC Guidelines for the emission estimates across the oil and natural gas industry, the Party provided revised CO_2, CH_4 and N_2O emission estimates using a gradual linear introduction of default EFs for developing and developed countries provided in the 2006 IPCC Guidelines (vol. 2, chap. 4, tables 4.2.4–4.2.5, pp.4.48 and 4.55 respectively), by identifying three timelines (see ID# E.43 above), namely 1990–1997, 1998–2010 and 2011–2021.
E.45	1.B.2.a Oil – liquid fuels – CH_4 (E.57, 2021) (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.	Resolved. The Party reported in CRF table 1.B.2 a gradually declining CH_4 IEF for subcategory 1.B.2.a.2 oil production, moving from the use of the EFs in table 4.2.5 to those in table 4.2.4 of the 2006 IPCC Guidelines (vol. 2, chap. 4, pp.4.55 and 4.48 respectively) across three timelines (see ID# E.43 above) by applying a linear extrapolation approach, taking into consideration the modernization of technology. For 1990–1997, the CH_4 and CO_2 EFs were reported as 34,925.20 and 2,502.97 kg/kt respectively, corresponding to 3.00E-02 $Gg/10^3$ m^3 and 2.15E-03 $Gg/10^3$ m^3 (assuming the density is 859 kg/m^3, as provided by the Party during the review), which is consistent with the data provided in table 4.2.5 (the average of the given range). For 2010–2021, consistency between the Party's data and the IPCC default data was also maintained. Regarding the issue of information on oil density, which is needed for unit conversation but was not provided in the NIR, see ID# E.64 in table 5.
E.46	1.B.2.a Oil – liquid fuels – CO_2 and CH_4 (E.58, 2021) (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	Resolved. The Party reported in the NIR (section 3.5.3.3, p.1) that a consistent time series of initial data obtained from official sources was used to calculate the fugitive emissions, and the CO_2 and CH_4 EFs used are from tables 4.2.4–4.2.5 of the 2006 IPCC Guidelines (vol. 2, chap. 4, pp.4.48 and 4.55 respectively). The remaining inconsistency in the AD between CRF table 1.A(b) and the NIR regarding the reported CO_2 and CH_4 emissions for subcategory 1.B.2.a.2 oil – production is covered by ID#

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		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).	E.6 above). The ERT also noted that the CO_2 and CH_4 EFs used are consistent with the data in tables 4.2.4–4.2.5 of the 2006 IPCC Guidelines (see ID# E.45 above).
E.47	1.B.2.a Oil – liquid fuels – CO_2 and CH_4 (E.59, 2021) (E.69, 2019) Accuracy	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).	Resolved. The Party reported revised and consistent data for crude oil production for 1990–2014 in CRF table 1.B.2 and confirmed that the data are from official sources (see ID# E.46 above). Using the revised and corresponding transition EFs across three timelines (see ID# E.43 above), the revised CO_2 and CH_4 emission estimates for subcategory 1.B.2.a.2 oil – production were calculated and reported in CRF table 1.B.2. The remaining inconsistency regarding the reporting of oil production for 2021 between CRF tables 1.B.2 and 1.A(b) is covered by ID# E.6 above.
E.48	1.B.2.a Oil – liquid fuels – CH_4 (E.60, 2021) (E.49, 2019) (E.38, 2017) (E.49, 2016) Transparency	(a) Ensure consistency in the estimation of the CH_4 emissions from transport (1.B.2.a.3), (b) fill the gaps for 1990–1996, (c) verify the CH_4 IEF for 2014 and (d) ensure consistency in the IEF for the entire time series.	(a–c) Resolved. The Party reported the AD and CH_4 emission estimates for transport (1.B.2.a.3) for the entire time series, including 1990–1996 and, as reported in the NIR (p.174), it used default EFs (i.e. for pipelines, tanker trucks and rail cars) from the 2006 IPCC Guidelines (vol. 2, chap. 4, tables 4.2.4–4.2.5, pp.4.48 and 4.55 respectively), where the EFs for developed and developing Parties are the same and the internal variation in the IEF was caused by the changing structure of the mode of oil transport. The 2014 CH_4 IEF (9.30 kg/kt) is consistent across the reported time series. (d) Addressing. The CH_4 IEFs for this subcategory vary between 20.18 kg/kt for 1990 and 7.92 kg/kt for 2020, following a continuous downward trend, except for 1996–1999, where the IEF increases from 12.75 to 16.67kg/kt, and for 2020–2021, with an increase from 7.92 to 8.40 kg/kt. A similar trend was also noted for the CO_2 IEFs. As no specific explanation was provided in the NIR for the trend or detailed information on the share of each transport mode, as provided in the 2021 NIR (section 3.5.4.3, table 3.30, p.157), the ERT was not able to confirm that there are no accuracy issues for this subcategory. During the review, the Party clarified that the development of different transport modes across the time series was affected by various factors, including the economic situation, oil trade with neighbouring countries and infrastructure construction. The Party provided a table which included the quantity of oil transported by different transport modes (pipelines, tanker trucks, rail cars and shipping (maritime transport was introduced in 2007)) for 1990 and 2021. The ERT considers that the recommendation has not yet been fully addressed because the Party has not provided in the NIR sufficient information on the shares of the oil transported via different modes across the time series to confirm the consistency of the CH_4 IEFs.
E.49	1.B.2.a Oil – liquid fuels – CH_4 (E.61, 2021) (E.50,	Validate the AD for the subcategory and strengthen QC procedures to ensure that AD for 1990–1996 for the subcategory oil transport are	Addressing. A consistent time series of the AD for 1990–1996 was provided and CH_4 emissions from oil transport were reported for the entire time series. Default EFs from the 2006 IPCC Guidelines (vol. 2, chap. 4, tables 4.2.4–4.2.5, pp.4.48 and 4.55

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	2019) (E.57, 2017) Transparency	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.	respectively) were used (see ID# E.48 above). However, the Party still reported in CRF table 1.B.2 the AD as oil produced, not oil transported. In addition, it reported the AD as 132,600.00 kt oil produced for 2021, which is different from the value used for oil exploration and oil production (86,879.31 kt), where the AD are also those used for oil produced. This inconsistency occurs across the whole time series. As the Party did not provide detailed information on the amount of oil transported, the ERT was not able to conclude whether the AD are actually for oil transported (rather than oil produced) and whether QC procedures were strengthened. During the review, the Party clarified that the AD used to calculate the emissions for subcategory 1.B.2.a.3 oil – transport are the amounts of oil transported, which is the sum of oil transported by pipeline, rail, road and ship, not oil produced.
E.50	1.B.2.a Oil – liquid fuels – CO_2, CH_4 and N_2O (E.62, 2021) (E.70, 2019) Transparency	Report in the NIR and CRF table 1.B.2 accurate, consistent and documented AD from 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.	Addressing. The Party reported in the NIR (table 3.27, p.164) and in CRF table 1.B.2 documented AD for subcategory 1.B.2.a.4 oil – refining/storage for the whole time series for the first time. However, the two data sets are not consistent. In NIR table 3.27, the Party reported the "initial data on oil refining volumes" for 2021, which are taken from the official data of the Bureau of National Statistics, namely 19,493.5 kt. However, the Party reported the AD in CRF table 1.B.2 as 17,590.46 kt, which it referred to as oil produced. This discrepancy was observed across the whole time series. In addition, the value reported in CRF table 1.B.2 for 2021 (17,590.46 kt), which was used as AD for this subcategory, was referred to as oil produced, while other values for oil produced in CRF table 1.B.2 were reported as 86,879.31 kt for subcategories 1.B.2.a.1 oil – exploration and 1.B.2.a.2 oil – production, and as 132,600.00 kt for subcategory 1.B.2.a.3 oil – transport. During the review, the Party clarified that a technical error was made when importing the data set for subcategory 1.B.2.a.4 oil – refining/storage and that it will be corrected for the next inventory submission.
E.51	1.B.2.a Oil – liquid fuels – CO_2, CH_4 and N_2O (E.63, 2021) (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, and document the EFs and method used in the NIR.	Addressing. The Party made recalculations for subcategory 1.B.2.a.4 oil – refining/storage for the whole time series and reported the revised AD and CH_4 emission estimates for the first time for the entire time series. In the 2021 submission, the estimates of CO_2, CH_4 and N_2O emissions were reported as "NA" until 2009, but emission estimates were reported for 2010–2019. The ERT noted that the CO_2 and N_2O emissions, although insignificant in the previous annual submission, were reported as "NO" for the entire time series in the 2023 submission without proper justification in the NIR. The Party reported in its NIR (p.173) that the default EFs from the 2006 IPCC Guidelines (vol. 2, chap. 4, table 4.2.4, p.4.48), namely 2.6E-06–41.0E-06 $Gg/10^3m^3$ oil refined, with an average of 2.18E-05 $Gg/10^3m^3$, was used to estimate the CH_4 emissions. However, the ERT noted that the CH_4 IEF for this subcategory fluctuates significantly across the whole time series; for example, it changes from 51,236.53 kg/kt for 1993 to 4,468.96 kg/kt for 1998 (equivalent to

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			3.84E-03–4.40E-02 Gg/10^{3}m^3, assuming the density of oil is 859 kg/m^3), which is significantly different from the IPCC default values. During the review, the Party clarified with regard to the CH_4 IEF that a technical error occurred when importing the data set and that the time series of data for subcategory 1.B.2.a.4 oil – refining/storage will be revised for the next inventory submission. The Party provided no further clarification for the CO_2 and N_2O emission estimates, which were reported for 2010–2019 in the 2021 submission, but as "NO" in the 2023 submission. The ERT notes that, in accordance with paragraph 37(b) of the UNFCCC Annex I inventory reporting guidelines, once reported, the emissions for a specific category should continue to be reported in subsequent inventories.
E.52	1.B.2.b Natural gas – gaseous fuels – CO_2 and CH_4 (E.64, 2021) (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 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.	Resolved. The Party reported CH_4 and CO_2 emissions for subcategory 1.B.2.b.1 natural gas – exploration as "IE" and stated in the NIR (pp.164 and 174) that the emissions were included in subcategory 1.B.2.a.1 oil – exploration. The Party explained that most gas produced in Kazakhstan is associated with crude oil production, and the emissions for subcategory 1.B.2.a.1 oil – exploration were estimated using the default EFs provided in the 2006 IPCC Guidelines for well drilling, testing and servicing (vol. 2, chap. 4, tables 4.2.4–4.2.5, pp.4.48 and 4.55 respectively), as recommended in the previous review report.
E.53	1.B.2.b Natural gas – gaseous fuels – CO_2 and CH_4 (E.65, 2021) (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 for 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).	Addressing. As mentioned in ID# E.6 above, the Party reported the AD for the volume of natural gas production as provided by the Bureau of National Statistics, consistently with the reported values in CRF table 1.A(b) across the whole time series, except for 2021. The Party reported CH_4 and CO_2 emissions for this subcategory for the whole time series. However, the ERT noted that the CH_4 IEF for natural gas production (subcategory 1.B.2.b.2) increased gradually from 31.70 kg/Mm^3 in 1990 to 49.47 kg/Mm^3 in 2021, which is contrary to the declining trend indicated in the NIR for the transition EFs applied from tables 4.2.4–4.2.5 of the 2006 IPCC Guidelines (vol. 2, chap. 4, pp.4.48 and 4.55 respectively), and much lower than the IPCC default data listed in table 4.2.4 (3.8E-04–2.3E-03 Gg/Mm^3, corresponding to 380–2,300 kg/Mm^3, with an average of 1,340 kg/Mm^3). For CO_2

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			emissions, the IEF increases from 21,302.59 kg/Mm^3 in 1990 to 32,134.03 kg/Mm^3 in 2021, which is also contrary to the declining trend indicated in the NIR, and much higher than the IPCC default data listed in table 4.2.4 (1.40E-05–8.20E-05 Gg/Mm^3, corresponding to 14–82 kg/Mm^3, with an average of 48 kg/Mm^3). During the review, the Party clarified that the CH_4 and CO_2 EFs will be further checked and that procedures to check the results and other possible changes will be incorporated into the preparation of the next inventory submission. For the issue regarding the inconsistency of the AD defined as "gas produced" in CRF table 1.B.2, see ID#s E.6 above and E.58 below.
E.54	1.B.2.b Natural gas – gaseous fuels – CO_2 and CH_4 (E.66, 2021) (E.72, 2019) Accuracy	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).	Resolved. The Party reported the revised emission estimates for natural gas production in CRF table 1.B.2 for the whole time series using data from the Bureau of National Statistics and explained in the NIR (section 3.5.3.1, p.162) that the fluctuations in natural gas production volumes for different periods are mainly due to the change in the cost of fuel, which has a significant impact on small and medium-sized companies. The issue relating to the use of EFs is covered by ID# E.53 above.
E.55	1.B.2.b Natural gas – gaseous fuels – CO_2 and CH_4 (E.67, 2021) (E.51, 2019) (E.39, 2017) (E.52, 2016) (E.46, 2015) Transparency	(a) Ensure time-series consistency of the EFs; (b) Describe the emission trends of natural gas production in the NIR.	Resolved. (a) This issue is covered by ID# E.53 above. (b) The Party explained in the NIR (sections 3.5.3.1–3.5.3.2) the general increase in natural gas production, the fluctuations in natural gas production for different periods and the implementation of new technologies in the natural gas production sector. The Party also reported and explained in the NIR (pp.164–165) the changes in the overall emissions from natural gas production over the entire time series, which are associated with changes in production volumes, as well as changes in the coefficients used to calculate the emissions.
E.56	1.B.2.b Natural gas – gaseous fuels – CO_2 and CH_4 (E.69, 2021) (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.	Resolved. The data entry error for 2014 was corrected and revised estimates for subcategory 1.B.2.b.4 natural gas – transmission and storage were provided. 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 and 4.55 respectively) across three timelines, as discussed in ID# E.43 above. The type of AD reported in the CRF tables 1.B.2 has changed from gas produced, as reported in the 2021 submission, to gas transmission, as reported in the 2023 submission.
E.57	1.B.2.b Natural gas – gaseous fuels – CO_2 and CH_4 (E.70, 2021) (E.54,	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–	Resolved. The data entry error for 2014 was corrected and revised estimates for subcategory 1.B.2.b.5 natural gas – distribution were provided since the 2018 submission. The Party recalculated and reported in CRF table 1.B.2 the CO_2 and CH_4 emission estimates for subcategory 1.B.2.b.5 for the entire time series. The default

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	2019) (E.42, 2017) (E.55, 2016) Consistency	2013 and provide a consistent time series for the CO_2 emissions.	EFs from the 2006 IPCC Guidelines (vol. 2, chap. 4, tables 4.2.4–4.2.5, pp.4.48 and 4.55 respectively) were used across three timelines (see ID# E.43 above). For the issue on the reported AD, see ID# E.6 above.
E.58	1.B.2.b Natural gas – gaseous fuels – CO_2 and CH_4 (E.79, 2021) Transparency	Include detailed information on the AD, methodology and EF used for estimating emissions from natural gas processing.	Addressing. The Party provided a complete time series of estimates of fugitive CH_4 and CO_2 emissions from processing of natural gas in CRF table 1.B.2. The methodology and EF used to estimate the emissions from natural gas processing are briefly explained in the NIR (e.g. p.174), showing that a tier 1 method and IPCC default EFs from the 2006 IPCC Guidelines (vol. 2, chap. 4, tables 4.2.4–4.2.5, pp.4.48 and 4.55 respectively) were used across three different timelines. However, the AD were not specifically discussed, except for a general explanation that the missing AD were provided by the Bureau of National Statistics. According to CRF table 1.B.2, the AD for subcategory 1.B.2.b.3 natural gas – processing are gas produced, using a unit of "10^6m^4" for 2021 and "10^6m^3" for other years of the time series. During the review, the Party clarified that there is a technical error in the unit reported in CRF table 1.B.2 for 2021 for gas production, which will be revised for the next inventory submission. The ERT considers that the recommendation has not yet been fully addressed because the Party has not provided clear AD used for estimating the emissions from natural gas processing.
E.59	1.B.2.c Venting and flaring – liquid and gaseous fuels – CO_2 and CH_4 (E.71, 2021) (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.	Resolved. The recalculation of the emission estimates for subcategory 1.B.2.c venting and flaring in the 2023 submission resulted in significant changes. For venting, CH_4 and CO_2 emissions were reported under subcategory 1.B.2.c.i venting – oil for the entire time series for the first time, and "NO" was reported for the emissions for subcategories 1.B.2.c.ii venting – gas and 1.B.2.c.iii venting – combined. For flaring, the emissions increased across the entire time series (e.g. for CO_2 from 2.37 to 7,690.55 kt for 2013). The downward trend of AD for oil flaring since 2014 is explained in the NIR (p.175) as being related to the prohibition of flaring gas, which is regulated by national legislation.
E.60	1.B.2.c Venting and flaring – oil and natural gas – CO_2 and CH_4 (E.72, 2021) (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.	Addressing. The emission estimates for subcategory 1.B.2.c flaring were recalculated by disaggregating emissions into oil and gas flaring, and emissions for subcategory 1.B.2.c.2.iii flaring – combined were reported as "NO". The AD used for gas flaring are for natural gas production, which is consistent with the data reported in CRF table 1.A(b), and the AD for oil flaring are associated with petroleum gas. The CH_4, CO_2 and N_2O EFs used for gas flaring, as indicated in the NIR (p.175), are from the 2006 IPCC Guidelines (vol. 2, chap. 4, tables 4.2.4–4.2.5, pp.4.48 and 4.55 respectively) applied across three timelines (see ID# E.43 above); for oil flaring, the NIR states that the EFs have not changed over the entire time series. Information on the oil density, which is necessary for the conversion, was still not provided in the NIR (see ID# E.64 in table 5). During the review, the Party clarified that for oil flaring the EFs from table 4.2.4 of the 2006 IPCC Guidelines were used for the entire time series. The Party also provided the oil density used for calculation, which is 859 kg/m^3.

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			The ERT considers that the recommendation has not yet been fully addressed because the Party has not provided in the NIR the conversion factors used and an explanation on the constant CO_2, CH_4 and N_2O EFs for oil flaring.
E.61	1.C CO_2 transport and storage – CO_2 (E.73, 2021) (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 report as "NA" the CO_2 emissions for category 1.C.2 injection and storage and all associated relevant information, such as the AD and IEF. The NIR still does not include a category-specific discussion on category 1.C CO_2 transport and storage. During the review, the Party clarified that it is considering CO_2 capture and storage as a possible project for the future, but that the project might not start until 2035 when the cost of undertaking the project might be acceptable. The Party is planning to change the reporting of emissions for category 1.C.2 from "NA" to "NO" in future inventory submissions. The ERT considers that inclusion of this information in the NIR along with the planned change of the notation key would address the recommendation.
IPPU			
I.1	2. General (IPPU) – CO_2 (I.1, 2021) (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.	Resolved. The Party significantly improved the QA/QC procedures, mainly by ensuring the correct use of notation keys and internal consistency of the information provided in the submission. Subcategories 2.C.1.b pig iron (CH_4) and 2.G.3.a medical applications (N_2O) were reported as "NE", with relevant justification included in CRF table 9. The Party also included an explanation in CRF table 9 for the use of the notation key "IE" for coke production under subcategory 2.C.1.f other to indicate the allocation of the emissions under energy sector (1.A.1.c).
I.2	2. General (IPPU) – CO_2 and HFCs (I.2, 2021) (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.	Resolved. The Party improved the QA/QC procedures for the IPPU sector; all comments in the CRF tables were updated, the names of the types of activities were indicated and the AD were specified. The inconsistency between the AD for subcategory 2.C.1.b pig iron in CRF table 2(I).A-Hs2 and NIR table 4.15 noted in the previous review report was corrected and no further inconsistencies between the CRF tables and the NIR were detected for the 2023 submission.
I.3	2. General (IPPU) – CO_2, CH_4 and N_2O (I.3, 2021) (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.	Resolved. The Party reported all AD descriptions in CRF table 2(I).A-H, thus improving the comparability and transparency of the reported data.
I.4	2. General (IPPU) (I.4, 2021) (I.4, 2019) (I.4, 2017) (I.12, 2016)	Apply the structure and names of the inventory categories in the NIR following the UNFCCC	Resolved. The Party used 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. Regarding the issues noted in the previous review report, the Party reported

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	(I.12, 2015) Convention reporting adherence	Annex I inventory reporting guidelines, as per decision 24/CP.19.	a section on category 2.E electronics industry (NIR section 4.6, pp.253–354) and included a description of category 2.G.3 N_2O from product uses under NIR section 4.10 (p.282). In addition, the Party reported in the NIR emissions for categories 2.C.4 magnesium production (section 4.4.4, p.233), 2.C.5 lead production (section 4.4.5, pp.233–235) and 2.C.6 zinc production (section 4.4.6, pp. 236–238) as subcategories under category 2.C metal industry (section 4.4, pp. 212–239) as suggested by the previous ERT.
I.5	2. General (IPPU) (I.5, 2021) (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 paragraph 50(c) of the UNFCCC Annex I inventory reporting guidelines.	Addressing. The Party reported in the NIR (section 4.1.2, pp.183–184) that tier 2 methods and plant-specific data were used for the key categories in the IPPU sector. However, there is no specific mention of category 2.A.4 other process uses of carbonates, which is a key category by level according to the information reported in CRF table 7. At a disaggregated level, subcategories 2.A.4.a ceramics (NIR section 4.2.4.1.1, p.193) and 2.A.4.b other uses of soda ash (NIR section 4.2.4.2.2, p.198) were considered not to be key categories, while subcategory 2.A.4.d other – use of limestone and dolomite was not assessed in terms of whether or not it is a key category in the NIR (section 4.2.4.3). The Party reported in the NIR (section 4.2.4.3.2, p.199) that the IPCC default method was used to calculate GHG emissions from limestone and dolomite use. According to the results reported in the GHG inventory (NIR section 4.2.2.1, table 4.9, pp.202–202), there was a significant increase in emissions from limestone and dolomite use in 2021 compared with 2020, amounting to 35.5 per cent. Total GHG emissions from limestone and dolomite use in 2021 exceeded the 1990 level by more than 10 times, caused by the increase in industrial production of limestone and dolomite in the country throughout the time series. During the review, the Party clarified that in CRF table 7 and in annex 1 (key category analysis) to the NIR, it was reported that category 2.A.4 is a key category, and that the inconsistent reporting in the NIR (section 4.2.4.1) will be corrected in the next submission. The ERT also noted that the Party's planned inventory improvements reported in the NIR (section 4.2.4.3.6, p.203) include the transition to the use of a higher-tier method for category 2.A.4.d. The ERT considers that the recommendation has not yet been fully addressed because the Party has not fully reported 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 paragraph 50(c) of the UNFCCC Annex I inventory reporting guidelines.
I.6	2. General (IPPU) (I.6, 2021) (I.6, 2019) (I.26, 2017) Transparency	Provide the description of the recalculations of emissions in the IPPU sector in accordance with paragraphs 43–45 of the UNFCCC Annex I inventory reporting guidelines, and report in the NIR the reasons for recalculations, the assessment of the impact of recalculations on	Resolved. The Party reported in the NIR the recalculations made under the relevant section for each subcategory, as also referred to during the review. The Party also reported additional information on recalculations in some sections of the NIR, for example for categories 2.F.1 refrigeration and air conditioning (NIR section 4.7.3.11, pp.274–275) and 2.F.4.a metered dose inhalers (NIR section 4.8.4, p.279), where

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		GHG emission trends, and changes of calculation methods, AD and EFs.	omissions were detected in previous reviews. Remaining issues on recalculations are covered by the sector-specific issues, as relevant (see ID# I.25(c) below).
I.7	2.A.1 Cement production – CO_2 (I.9, 2021) (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.184–187) information on the AD, CKD correction factor and methods used to calculate CO_2 emissions for category 2.A.1 cement production across the time series, with an increase in emissions from 2.00 to 3,840.90 kt from 2000 to 2021. No information on any changes to the methods and AD sources for 2000 onward was included in the NIR. No additional information was provided on the methodology used to define the country-specific value of the CaO content in clinker (65.72 per cent), as requested by the previous ERT, besides indicating in the NIR (p.186) that the content of CaO in the clinker was determined on the basis of data of the average content of CaO in the clinker obtained from 9 of the 12 operating full-cycle cement plants. During the review, the Party clarified that it cannot provide more detailed information on clinker, including the CaO and clinker production values provided by individual cement companies, since the AD received from cement companies are considered confidential. However, the Party indicated its intention to provide information in the next NIR on the methodology used to determine the value of the CaO content in clinker across the time series. The ERT considers that the recommendation has not yet been fully addressed because the Party has not reported fully transparent information on the consistent use of the methodology or any changes to it across the time series, the methodology used to define the country-specific value of the CaO content in clinker or indicated its representativeness for all cement plants across the time series.
I.8	2.A.1 Cement production – CO_2 (I.49, 2021) Transparency	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.	Not resolved. The AD reported in CRF table 2(I).A-Hs1 and in NIR table 4.2 (section 4.2.1.1, p.170) range from 1.00 kt for 2003 to 8,453.00 kt for 2020. The inter-annual changes in the AD for cement production for 2011/2012 (117.7 per cent), 2012/2013 (30.6 per cent) and 2020/2021 (–13.7 per cent) were identified as significant. The change in AD between 1990 and 2021 is 278.2 per cent. The ERT noted that the Party reported in the NIR (section 4.2.1.1, table 4.2, p.185) the trend in the GHG emissions from clinker production for the entire time series. However, there is no specific discussion in the NIR on the significant inter-annual changes in the AD used for estimating CO_2 emissions from cement production. During the review, the Party clarified that the driving force behind the significant inter-annual changes in AD, according to data from the Bureau of National Statistics, is the increase in the growth of industrial production of cement due to the increased demand for building materials. The Party indicated that it plans to include this information in the next NIR.
I.9	2.A.2 Lime production – CO_2 (I.14, 2021) (I.14, 2019)	Improve the transparency of the information on category 2.A.2 lime production in the NIR by providing the list of industries where the lime is	Resolved. The Party reported in the NIR (section 4.2.2.1, p.188) more information on the list of industries where the lime is produced and which are included in the aggregated data on lime production in Kazakhstan. In addition, the Party reported that

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	(I.31, 2017) Transparency	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.	the aggregated data used in the estimates include all lime production activities in Kazakhstan, including non-marketed lime production (i.e. lime that is used by enterprises for their own consumption), and that the data reflect all available information on lime production in the country.
I.10	2.B.1 Ammonia production – CO_2 (I.19, 2021) (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.	Resolved. The emission estimates for ammonia production were recalculated for the 2023 submission for the entire time series using a tier 2 method, as specified in the NIR (section 4.3.1.5 and table 4.12, p.207). As a result, the CO_2 emission estimates increased by 3.8 per cent for 1990 and decreased by 20.3 per cent for 2020.
I.11	2.C.1 Iron and steel production – CO_2 and CH_4 (I.25, 2021) (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.	Resolved. The Party reported in the NIR (section 4.4.1.5, table 4.22, pp.223–224) a comparative analysis of the ratio of production volumes (sinter + pellets to steel + pig iron) for 1990–2021. The analysis showed that the sum of the production volume for sinter + pellets for the entire time series is on average 60.9 per cent, and the sum of the production volume for pig iron + steel for the entire time series is on average 39.1 per cent of the total production volume (sinter + pellets to steel + pig iron). The NIR also 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.
I.12	2.C.1 Iron and steel production – CO_2 (I.26, 2021) (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. The Party reported in the NIR (section 4.4.1.2.2, p.216) that data on steel production volumes were provided by the Bureau of National Statistics and ArcelorMittal Temirtau JSC. When assessing CO_2 emissions, data were used on the amount of pig iron used (for steel production) at ArcelorMittal Temirtau JSC, considering the amount of reducing agent used in the production of steel (0.043 t/t) and the carbon content of steel (0.04 per cent). Separately, CO_2 emissions from electric steel production were estimated using the tier 3 method on the basis of data on steel production provided by ArcelorMittal Temirtau JSC, including consumption of metallized pellets, steel scrap and carbon electrodes, and carbon content in raw materials and final products. However, the ERT noted that, compared with the 2021 NIR, the Party did not include detailed information on how the AD from the largest steel production company, ArcelorMittal Temirtau JSC, and from the Bureau of National Statistics were used in the estimates across the time series. During the review, no additional clarifications were provided, but the Party informed the ERT

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			that additional information on the method, AD and EFs used in the estimates will be provided in the next NIR.
I.13	2.C.1 Iron and steel production – CO_2 (I.27, 2021) (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.	Resolved. The Party reported in the NIR (section 4.4.1.2.1 and table 4.15, pp.200–201) overall information on the tier 3 method from the 2006 IPCC Guidelines (vol. 3, chap. 4, section 4.2.2, p.4.18) and AD used to estimate CO_2 emissions from pig iron production. Regarding the inconsistencies noted in the previous review report, the CO_2 emission estimates reported in NIR table 4.16 are now consistent with those reported in the CRF tables and the Party added a description to the AD in CRF table 2(I).A-Hs2. The reference to the EF source has been corrected to a country-specific instead of a default source.
I.14	2.C.1 Iron and steel production – CO_2 (I.28, 2021) (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.	Resolved. The Party provided in the NIR (section 4.4, p.212) a clear statement that no direct reduced iron production occurs in the country, supported by relevant references (e.g. to information from a company in the Russian Federation that supplies raw materials for the steel industry in Kazakhstan), which confirm that, owing to a lack of accessible coke in the country, the production of direct reduced iron does not occur (see https://metallplace.ru/about/stati-o-chernoy-metalurgii/zhelezo-pryamogo-vosstanovleniya/).
I.15	2.C.1 Iron and steel production – CO_2 (I.29, 2021) (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.	Resolved. The Party reported in the NIR (section 4.4.1.2.3, p.217) that the 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. The Party also reported in the NIR (p.205) that, to avoid double counting of emissions, the volumes of gases (coke oven and blast furnace gas) and coke breeze used to produce sinter were excluded from the reporting on the energy sector.
I.16	2.C.1 Iron and steel production – CO_2 (I.30, 2021) (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 subcategory 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.	Resolved. The Party reported in the NIR (section 4.4.1.2.4, p.220) that to calculate CO_2 emissions for subcategory 2.C.1.e pellet it used a tier 2 method for the 2021 submission and that further changes were made for the 2023 submission using a different calculation, where (1) the volume of the total consumption of natural gas to produce pellets (10^3 m^3) was converted to t of reference fuel and then to TJ; and (2) the value obtained was multiplied by the carbon content in natural gas (14.836 t/TJ), which provided the amount of emissions from pellet production in kt CO_2 eq. The Party also reported that applying the new methodology resulted in an increase in the CO_2 emission estimates for pellet production for 2021 by 64.16 per cent compared with the 1990 level and by 22.3 per cent compared with the 2020 level, which was caused by an increase in pellet production and, accordingly, an increase in natural gas consumption for pellet production (NIR table 4.20, p.221). The Party reported in the NIR (p.222) that to avoid double counting of emissions, the volume of natural gas used to produce pellets was excluded from the reporting on the energy sector.

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I.17	2.C.1 Iron and steel production – CO_2 and CH_4 (I.31, 2021) (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.	Resolved. The Party reported in the NIR (section 4.4.1.2.1, p.214) 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. Category 2.C.1 takes into account emissions from the use of coke, but not from coke production. The Party explained that emissions from coke production are accounted for under the energy sector and included the relevant explanations in CRF table 9 for the use of "IE" for category 2.C.1.f other (metal industry).
I.18	2.C.2 Ferroalloys production – CO_2 (I.33, 2021) (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.	Resolved. The Party provided in the NIR (section 4.4.2.2, p.225, and table 4.23, p.226) clarification of the tier 2 method and AD used and information on the basis on which the EFs used were chosen.
I.19	2.C.3 Aluminium production – CO_2 (I.34, 2021) (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.	Resolved. The Party reported in the NIR (section 4.4.3.2, p.231) information on category 2.C.3 aluminium production, including on the technology and parameters for aluminium production in the country. The Party also corrected the reference to equation 4.21 (instead of 4.17) 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) noted in the previous review report, indicating that the QA/QC procedures have been strengthened.
I.20	2.D Non-energy products from fuels and solvent use – CO_2 and N_2O (I.37, 2021) (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.	Resolved. In its 2021 submission, the Party reported CO_2 emission estimates and information on lubricant use for the entire time series, while in CRF table 2(I).A-Hs2 CO_2 and N_2O emissions for subcategory 2.D.2 paraffin wax use were reported as "NA", and CO_2 and N_2O emissions for subcategory 2.D.3 other were reported as "NO" without providing explanations for the notation keys used. In addition, there was no specific section in the NIR chapter on the IPPU sector on possible emissions for these subcategories. The N_2O emissions used in anaesthesia reported under subcategory 2.D.3 other in the 2015 submission were considered under category 2.G in the previous annual submissions (see ID# I.33 below). In the 2023 submission, the Party included in the NIR (section 4.5.5, p.246) a new subsection on the use of paraffin and updated the information reported in CRF table 2(I).A-Hs2 for subcategory 2.D.1 lubricant use (section 4.5.2). The completeness of the estimates for CO_2 emissions from paraffin wax use reported as "NA" for 1990–2006 is covered by ID# I.21 below. The reporting for subcategory 2.D.3 other including CO_2 emissions from urea-based catalytic converters (NIR section 4.1, p.179) is covered by ID# I.22 below.
I.21	2.D.2 Paraffin wax use – CO_2	Collect AD and estimate CO_2 emissions for category 2.D.2 paraffin wax use using the default methodology provided in the 2006 IPCC	Addressing. The Party reported estimates of paraffin wax use for 2007–2021 and included in the NIR (section 4.5.5, p.246) a new subsection on the use of paraffin, including information on the methodology used. The ERT noted that the Party

ID#	Issue/problem classification[a, b]	Recommendation from previous review report	ERT assessment and rationale
	(I.38, 2021) (I.53, 2019) Completeness	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.	reported AD for category 2.D.2 paraffin wax use for 2007–2021 (NIR table 4.35, p.247, and figure 4.7, p.246), while the AD and CO_2 emissions for 1990–2006 were reported as "NA" in CRF tables 2(I)s2 and 2(I).A-Hs2. During the review, the Party clarified that the Bureau of National Statistics does not have any information available for 1990–2006 and that applying an extrapolation approach for these years of the time series is difficult owing to the non-linearity of the volume of emissions. The Party added that CO_2 emissions for 2021 amounted to 0.082 kt (82 t), which is a negligible fraction of the total emissions under category 2.D (0.046 per cent) and well below the threshold of significance set out in paragraph 37(b) of the UNFCCC Annex I inventory reporting guidelines (169.06 kt CO_2 eq for Kazakhstan's 2023 submission). The ERT considers that the recommendation has not yet been fully addressed because the Party has not reported emissions for category 2.D.2 paraffin wax use for 1990–2006 and notes that the significance threshold could not be used to justify lack of reporting for parts of a time series. The ERT further notes that the Party could consider using the gap-filling techniques suggested in the 2006 IPCC Guidelines (vol. 1, chap. 5) for the missing years of the time series.
I.22	2.D.3 Other (non-energy products from fuels and solvent use) – CO_2 (I.39, 2021) (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 for this subcategory are insignificant according to paragraph 37(b) of the UNFCCC Annex I inventory reporting guidelines.	Resolved. Emissions from urea-based catalytic converters were estimated using the default methodology in the 2006 IPCC Guidelines (vol. 2, chap. 3, p.3.12) and reported under the IPPU sector. However, the Party reported in the NIR (section 3.4.5.3, p.125) the accounting of urea-based catalytic converters for road transport under the energy sector, including the methodological approaches used, the initial data set and the estimates obtained to demonstrate the magnitude of the emissions. Emissions from urea-based catalytic converters were estimated for 2009–2021 and reports as "NO" for 1990–2008 on the basis of the information on national circumstances presented in the NIR (section 3.4.5.3, pp.125–130). The Party clarified that this technology started being used on a large scale after 2008 with an increase in the share of new cars, while before 2008 the majority of cars were not equipped with this technology, which is why CO_2 emissions for 1990–2008 were reported as "NO". The ERT concluded that the completeness issue is resolved and the related transparency issue is covered by ID# I.23 below.
I.23	2.D.3 Other (non-energy products from fuels and solvent use) – CO_2 (I.50, 2021) Transparency	Report CO_2 emissions from urea-based catalytic converters under category 2.D.3 non-energy products from fuels and solvent use – other 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.	Addressing. The Party reported in the energy chapter of the NIR (section 3.4.5.3, p.125) the accounting of urea-based catalytic converters for road transport, including the methodological approaches used, the initial data set and the estimates obtained (see ID# I.22 above). As the emissions should be reported under category 2.D.3 other, the ERT noted that providing a description in the energy chapter of the NIR instead of in the IPPU chapter without including relevant paragraph cross references in the IPPU chapter is not transparent or consistent with the reporting in the CRF tables. During the review, the Party clarified that since category 2.D.3 includes the use of

ID#	Issue/problem classification[a, b]	Recommendation from previous review report	ERT assessment and rationale
			urea from vehicles, it included all information on their use under the category road transportation. The ERT considers that the issue has not yet been fully resolved as the CO_2 emissions are reported but the allocation of CO_2 emissions from urea-based catalytic converters under category 2.D.3 is not clearly explained in the IPPU chapter of the NIR.
I.24	2.F.1 Refrigeration and air conditioning – HFCs (I.40, 2021) (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.	Resolved. The Party revised the HFC emission estimates for category 2.F.1 refrigeration and air conditioning and reported the emissions of HFC-32, HFC-125 and HFC-143a from refrigeration and air-conditioning equipment for 1995 onward, reporting the preceding years as "NO" and providing an explanation in its NIR (section 4.7, pp.256–260) justifying that the notation key was used because technologies using fluorinated gases were being gradually introduced in the country after the gradual phase out of the traditionally used gases and the ban on the use of chlorofluorocarbons and hydrochlorofluorocarbons under the Montreal Protocol (p.255). The justification is provided at the subcategory level and describes in detail the national conditions of the Kazakhstan market of industrial refrigeration equipment (e.g. the use of ammonia-based equipment for commercial and industrial refrigeration (NIR pp.255 and 265)).
I.25	2.F.1 Refrigeration and air conditioning – HFCs (I.41, 2021) (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) Resolved. The Party reported in its NIR (section 4.7.3.1, pp.257–260) that it used a tier 2b method for the category and provided information on how AD were collected, the review and verification of data by the Working Group and the use of EFs from the 2006 IPCC Guidelines (vol. 3, chap. 7, table 7.9). In the NIR (p.241), the Party referenced the IPCC equations used for the estimates, namely equations 7.11, 7.13 and 7.14 (2006 IPCC Guidelines vol. 3, chap. 7, pp.7.49–7.51) and provided the lifecycle information used for the EFs (NIR table 4.41). (b) Addressing. The Party reported in its NIR (section 4.7.3.1, p.257) the methods used to estimate emissions by accounting for consumption using gross domestic product as a driver for 1990–2015 and using direct data from 30 companies in the latest years. However, the NIR does not contain an explanation of the steps taken to ensure time-series consistency. During the review, the Party stated that the times series was harmonized in accordance with the relevant criteria contained in the 2006 IPCC Guidelines. The ERT concludes that the provided information was insufficient to explain the consistency of the AD across the time series and therefore considers that the recommendation has not been fully addressed. (c) Addressing. The Party reported in its NIR (section 4.7.3.11, p.275) overall information on the recalculations for category 2.F.1 refrigeration and air conditioning. However, the information does not specify the years, gases affected, or methodological, AD and EF changes or their impacts on the emission trends. The Party stated in the NIR that its data-collection methodology has changed but did not state specifically how it has changed or refer to the QA/QC process undertaken following the change. During the review, the Party stated that all calculations were

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			made on the basis of easily accessible and verifiable data. The Party mentioned that the main source of data is the Kazakh Refrigeration Industry Association (comprising 30 companies) and that the AD are continuously improved through updates to its database. The Party is planning to provide additional information on the reasons for the recalculations in the next NIR. (d) Resolved. The Party improved the reporting in CRF table 2(II).B-Hs2 by providing data per subcategory and separating emissions sources (manufacturing, stocks, disposal). In addition, in its NIR (section 4.7.3.1, pp. 257–260) the Party described the methodology used to disaggregate the data.
I.26	2.F.1 Refrigeration and air conditioning – HFCs (I.42, 2021) (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.	Resolved. The Party reported in its NIR (section 4.7.1, p.256) details of the AD collection process, explaining that experts and representatives of the Kazakh Refrigeration Industry Association, including more than 30 companies, came together to provide and verify the data. The NIR (section 4.7 pp.254–275) provides general and specific information on the assumptions used for manufacturing, stocks, operation, disposal, destruction and recovery. The Party explained that it imports equipment, there is no recovery or destruction taking place in the country, and each category was estimated using a tier 2a method from the 2006 IPCC Guidelines (vol. 3, chap. 7, p.7.49). The Party's reporting in CRF table 2(II).B-Hs2 has been updated and provides disaggregated data in accordance with the 2006 IPCC Guidelines.
I.27	2.F.1 Refrigeration and air conditioning – HFCs (I.43, 2021) (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.	Resolved. The Party reported in its NIR (section 4.7.3.11, p.275) recalculations for all subcategories under category 2.F.1, including emissions for subcategory 2.F.1.c industrial refrigeration, which were reported separately. The Party explained that improvements were made in line with the recommendations of the previous ERT and as a result of training provided in 2022 (NIR section 1.2.4, p.33). The collected AD result from the work of the inventory team with the Kazakh Refrigeration Industry Association and the discussions during the Working Group meetings (see ID# G.1 above), which is currently the source of all AD for category 2.F.1. The Party is planning to mobilize finance to develop a monitoring system for future emission estimates with UNDP support (NIR p.258). In the NIR (section 4.7.3.1, p.259) the Party reported that a tier 2a method (EF approach from the 2006 IPCC Guidelines (vol. 3, chap. 7, p.7.49)) was used. CRF table 2(II).B-Hs2 now reflects the improved data reporting. Section 4.7.3.5 of the NIR specifically addresses emissions from industrial refrigeration.
I.28	2.F.1 Refrigeration and air conditioning – HFCs (I.44, 2021) (I.56, 2019) Accuracy	Calculate HFC emission estimates for subcategory 2.F.1.e mobile air conditioning using the default methodology provided in the 2006 IPCC Guidelines, with the EF for operation emissions from mobile air conditioning taken	Resolved. Recalculations were performed for subcategory 2.F.1.e mobile air conditioning, resulting in a significant increase in the emission estimates for the category (e.g. by 535.4 per cent for 2020). The NIR (section 4.7.3.11, pp.274–275) explains that the recalculations were performed on the basis of experience in applying calculation methods and applying a methodology that allowed for the separate

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		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.	reporting of emissions from stock and disposal. The Party reported on the IPCC equations used and described the methodologies used in the NIR (section 4.7.3.1, p.257–259). NIR table 4.41 contains values consistent with the range provided in the 2006 IPCC Guidelines (vol. 3, chap. 7, table 7.9, p.7.52) (e.g. NIR table 4.41 (p.252) reports a lifespan of 20 years and end-of-life loss of 40 per cent for domestic refrigeration, while in the above-mentioned IPCC table 7.9 the lifespan ranges between 12 and 20 years, the end-of-life recovery efficiency of 0–70 per cent and the remaining charge is in the range 0–80 per cent). The NIR (section 4.7.3.6, p.266–268) also includes information on the national circumstances, including on the AD, refill factors, percentage of vehicles sold with air conditioning as well as the number of vehicles and typical service life. CRF table 2(II).B-Hs2 reflects the estimates and includes disaggregated information. NIR figure 4.16 (p.254) reflects the changes in the assumptions and AD used by the Party compared with the previous version of the figure in the 2021 NIR (figure 4.11).
I.29	2.F.1 Refrigeration and air conditioning – HFCs (I.45, 2021) (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.	Resolved. The emission estimates for subcategories 2.F.1.a commercial refrigeration and 2.F.1.f stationary air conditioning were recalculated, resulting in an increase in the emission estimates of 298.2 and 188.6 per cent respectively compared with the 2022 submission. Improved methodological information was provided in NIR section 4.7.3.1. The Party reported in its NIR (section 4.7.3.11, p.275) that the AD were disaggregated in accordance with the recommendation of the previous ERT. The methodology used is tier 2a as provided in the 2006 IPCC Guidelines (vol. 3, chap. 7, pp.7.49–7.51). Information on the assumptions used was provided in the subcategory descriptions of the NIR (sections 4.7.3.2, 4.7.3.3 and 4.7.3.9). In addition, the Party reported in NIR table 4.42 (p.259) the constituent blends of the relevant gases. CRF table 2(II).B-Hs2 now provides data on HFC-125, as recommended by the previous ERT.
I.30	2.F.1 Refrigeration and air conditioning – HFCs (I.46, 2021) (I.57, 2019) Transparency	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 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.	Resolved. The Party reported the types of refrigeration and air-conditioning applications in CRF table 2(II).B-Hs2, while in the NIR (section 4.7.3.1, pp.257–260) the Party provided an improved description of the calculation method, AD and other parameters used, referencing the 2006 IPCC Guidelines and equations applied. The Party provided information on the types of refrigeration per subcategory and the data on market use by type of vehicle and circumstances under which the refrigerants are used or not used. As noted by the previous ERT, the NIR (table 4.43, p.259) contains a matrix of compressor types and refrigerants used, as well as their constituents, for each subcategory.
I.31	2.F.1 Refrigeration and air conditioning – HFC-32 (I.51, 2021) Accuracy	Improve the accuracy of the emission estimates for HFC-32 for subcategory 2.F.1.f stationary air conditioning by reporting the corrected emission estimate for 2009 in CRF table 2(II).B-Hs2.	Resolved. The Party reported in CRF table 2(II).B-Hs2 a corrected value for the emission estimate for HFC-32 emissions for 2009 for subcategory 2.F.1.f stationary air conditioning (from 5.37 to 29.23 t). The corrected value is consistent with the trend in HFC-32 emissions, thus resolving the error.

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I.32	2.F.4 Aerosols – HFCs (I.52, 2021) Transparency	Improve the transparency of the 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.	Resolved. The Party improved the transparency of its NIR (section 4.8.2, p.276) by documenting the AD used and providing the assumptions used for developing the EFs and the calculations and the equation used for the emission estimates. NIR figure 4.18 (p.277) shows the correlation between the population and the number of patients with bronchial asthma. The assumptions used to determine the market share of metered dose inhalers and the improvements to the reporting method are reflected in the NIR (section 4.8.4, p.279).
I.33	2.G.3 N_2O from product uses – N_2O (I.48, 2021) (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 and include in the NIR information in accordance with paragraph 50(a–b) of the UNFCCC Annex I inventory reporting guidelines.	Resolved. The Party reported AD and N_2O emissions for subcategory 2.G.3.a medical applications as "NA" and "NE" respectively in CRF table 2(I).A-Hs2. The Party included a subsection in the NIR (section 4.10, p.282) on category 2.G.3 N_2O from product uses, in which it reported that, on the basis of the total amount of consumption of N_2O for medical purposes and the population, proportions of patients with bronchial asthma and those using metered dose inhalers were determined and an estimated consumption value for Kazakhstan was obtained (80 kt CO_2 eq). The ERT noted that the Party provided an explanation in CRF table 9 for reporting emissions as "NE", stating that it calculated the likely level of N_2O emissions from the use of anaesthesia on the basis of data from countries with similar conditions, and that this category was determined to be insignificant in accordance with the threshold defined in paragraph 37(b) of the UNFCCC Annex I inventory reporting guidelines (169.06 kt CO_2 eq for Kazakhstan's 2023 submission).
Agriculture			
A.1	3. General (agriculture) – CH_4 and N_2O (A.14, 2021) Accuracy	Make every effort to develop country-specific coefficients for feed digestibility for dairy and non-dairy cattle, and sheep.	Addressing. No recalculations for dairy and non-dairy cattle, and sheep were made for the 2023 submission. The Party reported in its NIR (section 5.2.2, table 5.7, p.294) a feed digestibility coefficient of 60 per cent for dairy cattle, non-dairy cattle and sheep. The same information was also provided in CRF table 3.A(a)s2. Kazakhstan reported additional information in its NIR (section 5.2.2, p.294) on how this coefficient was derived. It explained that it used the default coefficient value for feed digestibility from the 2006 IPCC Guidelines (vol. 4, chap. 10, table 10A.1, p.10.72) for Eastern Europe as the most suitable for the national conditions. However, Kazakhstan did not include information on refining the default feed digestibility coefficient value used in the estimates or on developing country-specific coefficients for feed digestibility for dairy and non-dairy cattle, and sheep. During the review, the Party clarified that work on developing country-specific coefficients for feed digestibility for dairy and non-dairy cattle, and sheep is under way. Data are being collected on the types and quality of feed; however, the Party is experiencing difficulties in obtaining initial data on dietary composition for dairy and non-dairy cattle, and sheep.
A.2	3.B Manure management – CH_4 and	Collect robust information on MMS used for all animal species for the whole time series,	Not resolved. The Party reported in its NIR (table 5.25, p.308) the shares of various MMS in livestock production (e.g. 35 per cent to solid storage and dry lot and 65 per

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	N_2O (A.2, 2021) (A.13, 2019) Accuracy	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.	cent to pasture, range and paddock for cattle). This ratio does not change for all animal species for the whole time series, and therefore does not take into account any changes and progress in agriculture production systems. The same information was also provided in CRF table 3.B(a)s2. Kazakhstan reported in its NIR (section 5.3.2.2, p.308) that information on the distribution of manure by collection, storage and use systems is based on the analysis of scientific literature, local meteorological conditions and the distribution of livestock by region, and directly depends on the share of different methods of animal management. During the review, the Party clarified that work on MMS is under way, but that it is experiencing difficulties in obtaining reliable historical data on MMS for the 1990s. The ERT considers that the Party may use the method for estimating the percentage of time spent in stalls that is presented for 2015 for cattle, sheep, goats, horses and camel (NIR tables 5.8–5.12, pp.295–297) for representative years of the time series until reliable historical data on MMS are obtained.
A.3	3.D Direct and indirect N_2O emissions from agricultural soils – N_2O (A.5, 2021) (A.17, 2019) Transparency	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 recalculation sections of the NIR, and tables showing the resulting differences among annual submissions.	Addressing. The Party provided information in the NIR (section 5.5.5, pp.322–323) on the recalculations performed for the N_2O emission estimates for agricultural soils. The recalculations cover subcategory 3.D.a.2.a animal manure applied to soils (owing to a revision of the number of asses and buffaloes for 2015–2019), subcategory 3.D.a.5 mineralization/immobilization associated with loss/gain of soil organic matter and subcategory 3.D.b.2 N leaching and run-off. The Party provided explanations in its NIR (figure 5.9 and table 5.32) for the recalculations of N_2O emission estimates for mineralization associated with the loss of soil organic matter, including the difference between the estimates for the 2022 and 2023 submissions. However, the ERT noted some omissions in the information reported; for example, N_2O emissions from animal manure applied to soils were reported for the entire time series except for 2015–2019. The N_2O emission estimates for urine and dung deposited by grazing animals were also recalculated for the whole time series, but the Party did not explain why the estimates were recalculated between the 2022 and 2023 submissions. During the review, the Party referred to the detailed information on the recalculations of the emission estimates for subcategory 3.D.a.5, including a figure, table and explanation for the recalculations, as provided in NIR section 5.5.5, and indicated its intention to improve the explanations for recalculations in the next inventory submission. The ERT considers that the recommendation has not yet been fully addressed because the Party has not yet reported all changes in the estimates of emissions and indicated the reason for the changes in the estimates between submissions for some of the subcategories under category 3.D (e.g. subcategories 3.D.a.2.a and 3.D.a.3).
A.4	3.D.a.4 Crop residues – N_2O (A.16, 2021) Accuracy	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	Not resolved. The Party reported the same country-specific methodology in its 2023 NIR (p.316) for N input to soils from crop residues as in the 2021 NIR. As noted by the previous ERT, the equation used does not include a variable for removal of crop residues annually for purposes such as feed, bedding and construction, as is included

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		present the results in the NIR to justify the accuracy of the method applied. (If removal of crop residues is significant, 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)).	in default equation 11.6 of the 2006 IPCC Guidelines (vol. 4, chap. 11, p.11.14), or a variable for removal of residues through burning. No justification was provided in the NIR for excluding those key parameters from the methodology (e.g. removal of crop residues annually for purposes such as feed, bedding and construction, removal of residues through burning). During the review, the Party clarified that no expert surveys have been conducted to date on the removal of crop residues in the country. The Party also clarified that legislation is in place prohibiting residue-burning activities, as described in NIR section 5.7 (p.324). The ERT considers that the recommendation has not yet been addressed because the Party has not yet conducted an expert survey on the removal of crop residues, or provided evidence in the form of published reports that removal of crop residues was not practised in the country across the time series, and has not presented the results in the NIR to justify the accuracy of the method applied.
A.5	3.D.a.5 Mineralization/ immobilization associated with loss/ gain of soil organic matter – N_2O (A.17, 2021) Accuracy	(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; (c) Report the comparison of the emission calculations between submissions in the recalculation section of the NIR, in accordance with paragraphs 43–45 of the UNFCCC Annex I inventory reporting guidelines.	(a) Addressing. The Party reported in the NIR (p.318) that the amount of N released during the mineralization of soil organic matter was calculated using equation 11.8 of the 2006 IPCC Guidelines (vol. 4, chap. 11, p.11.16) and data on changes in the reserves of soil organic carbon in arable land. The ERT was unable to replicate the calculations for the AD of N in mineral soils that is mineralized in association with the loss of soil carbon reported in CRF table 3.D (see ID# A.16 in table 5). During the review, the Party clarified that only arable land that is in crop rotation, rather than entire volume of carbon loss from cultivated land, was included in the calculation of N mineralization associated with loss of soil carbon. The ERT considers that the recommendation has not yet been fully addressed because the Party has not yet reported the net CSC in soils for mineral soils in cropland and land converted to cropland, which should be used to calculate 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. (b) Not resolved. The Party reported in the NIR (p.318) the same text for the estimation of N_2O emissions from mineralization/immobilization of N associated with loss/gain of soil organic matter as in the 2021 NIR, including a reference to chapter 6 of the NIR. The Party did not report AD or methodological information in section 5.5 of the agriculture chapter of its NIR. During the review, the Party referred to information provided in NIR section 6.4 on the methodology used. However, the ERT noted that NIR section 6.4 is not relevant to mineralization/immobilization of N associated with loss/gain of soil organic matter in the agriculture sector because it deals with grassland and hayfields. (c) Not resolved. The Party reported recalculations and carried out a comparison of the emission estimates between the 2022 and 2023 submissions in the NIR (pp.322–

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			323) without referring to subcategory 3.D.a.5, even if there were recalculations for this category between the 2022 and 2023 submissions. The ERT notes that the implementation of this recommendation is dependent on the recalculations suggested in point (a) above. During the review, the Party indicated its intention to address the recommendation for the next inventory submission.
A.6	3.D.a.6 Cultivation of organic soils (i.e. histosols) – N_2O (A.9, 2021) (A.10, 2019) (A.19, 2017) Transparency	In the NIR, provide detailed information on the absence of organic soils in the country.	Resolved. The Party reported a reference and the related weblink in its NIR (p.318) showing that the humus content in soils in northern Kazakhstan, the most fertile part of the country, does not exceed 7 per cent, which is below the percentage set out in the definition of organic soils (>12 per cent) according to the 2006 IPCC Guidelines (vol. 4, chap. 11, p.11.6, footnote 4).
A.7	3.D.a.6 Cultivation of organic soils (i.e. histosols) – N_2O (A.10, 2021) (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).	Resolved. The Party included the references to Borovsky and Uspanov (1971) and Faizov, Urazaliev and Iorgansky (2001) in the NIR (p.319). The Party also included a more up-to-date reference from 2020 and the related weblink in the NIR (p.319) to further explain that there are no organic soils in Kazakhstan.
A.8	3.D.b.2 N leaching and run-off (A.11, 2021) (A.22, 2019) Convention reporting adherence	(a) Improve the QC procedures for ensuring complete consistency of the reporting of the agriculture sector in the NIR and CRF tables; (b) Describe the specific QA/QC activities performed for the agriculture sector in the NIR.	Resolved. (a) The Party reported consistent N_2O emissions from N lost through leaching and run-off in the NIR (p.313) and in CRF table 3.D, demonstrating that the QA/QC procedures have been improved. (b) The Party described the specific QA/QC activities performed for the agriculture sector in the NIR (p.322), including a comparison of the AD with the database of the Food and Agriculture Organization of the United Nations, a comparison of the EF with that contained in the IPCC emission factor database for countries with similar climate conditions, and an assessment of initial data and parameters carried out at the meetings of the Working Group by relevant experts from different institutions.
A.9	3.D.b.2 N leaching and run-off – N_2O (A.18, 2021) Transparency	Rigorously document the county-specific value of $Frac_{LEACH-(H)}$ of 0.1 in the NIR.	Not resolved. The Party reported in its NIR (footnote to table 5.31, p.321) and in CRF table 3.D that the country-specific value of 0.1 for $Frac_{LEACH-(H)}$ with an uncertainty range of 0.1–0.8 was applied to estimate indirect N_2O emissions from N leaching and run-off for cropland soils. The ERT noted that the Party did not improve the documentation provided on the country-specific $Frac_{LEACH-(H)}$ value and its uncertainty range compared with that provided in the 2021 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. During the review, the Party informed the ERT that it will make efforts to resolve this issue for the next inventory submission. Alternatively, the ERT noted that using the default

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			$Frac_{LEACH-(H)}$ of 0.3 (2006 IPCC Guidelines, vol. 4, chap. 11, table 11.3, p.11.24) would resolve this issue.
A.10	3.F Field burning of agricultural residues – CH_4 and N_2O (A.19, 2021) Completeness	Conduct an expert survey and desk review of the literature regarding field burning of crop residues and report the findings in the NIR. On the basis of the findings, 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, provide emission estimates for the entire time series.	Resolved. Kazakhstan reported field burning of agricultural residues as "NO" in CRF table 3.F for the entire time series and provided a well-documented justification in the NIR (section 5.7, p.324) that this activity is prohibited by several laws, including article 47 of the Environmental Protection Act 160-1 of 15 July 1997. The situation is similar to other neighbouring Parties included in Annex I to the Convention that report field burning of agricultural residues as "NO". The ERT checked the data referenced in the previous review report and concluded that FAOSTAT takes into account spontaneous steppe and forest fires, which are considered in the LULUCF sector and reported in CRF table 4(V) for biomass burning under wildfires and not burning of crop residues only.
A.11	3.G Liming – CO_2 (A.12, 2021) (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 continues to report liming as "NO" in CRF table 3.G for the entire time series, providing the same explanation and website reference in the 2023 NIR (section 5.8, p.324) as in the 2021 NIR. The Party did not refer to any national statistics such as the import or sale of lime for agricultural use. During the review, the Party referred to the information provided in the NIR (section 5.8, p.324) and informed the ERT that it will make efforts to resolve this issue for the next inventory submission. The ERT considers that the recommendation has not yet been fully addressed because the Party has not yet provided well-documented justification that liming does not occur. Since, according to the reference provided by the Party (https://agroinfo.kz/est-li-perspektivy-u-dolomitovoj-muki/), dolomite can be used in some cases in Kazakhstan (Bakumenko, 2014), the ERT concluded that emissions may still occur under the category.
LULUCF			
L.1	4. General (LULUCF) – CO_2, CH_4 and N_2O (L.1, 2021) (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 grassland converted to forest land – mineral soils; (b) Net CO_2 emissions from wetlands converted to forest land – organic soils; (c) Net CO_2 emissions from forest land converted to grassland – dead organic matter and mineral soils;	(a) and (c–d) Addressing. The Party reported in its NIR (p.507) that, owing to the unavailability of data and the approach used to develop the land-use matrix, it is not able to estimate separately the CSCs for individual land conversion categories. As explained in the NIR (p.507) and during the review, the Party applied the approach 1 methodology for land representation in accordance with the 2006 IPCC Guidelines (vol. 4, chap. 3.3.1). In the CRF tables, the Party reported the AD as "IE" and the net CO_2 emissions as "NA". This way of reporting does not provide transparent and comparable information on land conversions that are actually taken into account, or on the pools considered for the conversions. (b) Resolved. The Party reported in its NIR (p.318) and in CRF table 4.A that there are no organic soils in the country (see also ID# A.7 above).

ID#	Issue/problem classification[a, b]	Recommendation from previous review report	ERT assessment and rationale
		(d) Net CO_2 emissions from other land converted to wetlands; (e) N_2O emissions from disturbance associated with land-use conversion to cropland, grassland converted to cropland – mineral soils.	(e) Resolved. The Party reported in its NIR (p.507) that it carried out an assessment of N_2O emissions from disturbance associated with land-use conversion to cropland, including grassland converted to cropland. AD for 1990–2021 were reported in CRF table 4(III) and emissions were reported as "IE" over the time series. The Party explained in CRF table 9 that the emissions are included under the agriculture sector. During the review, the Party clarified the use of a tier 1 method, namely equations 11.1, 11.8 and 11.10 provided in the 2006 IPCC Guidelines (vol. 4, chap. 11, pp.11.7, 11.16 and 11.21 respectively), to estimate changes in N_2O emissions from mineral soils due to soil carbon mineralization. The assessment was made using calculations of soil carbon by region. The reporting in CRF table 4(III) is discussed in ID# L.21 below.
L.2	4. General (LULUCF) – CO_2, CH_4 and N_2O (L.2, 2021) (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").	Resolved. The Party reported in its NIR (p.507) that its land-use matrix was developed using approach 1 (simplified land-use conversion matrix) in accordance with the 2006 IPCC Guidelines (vol. 4, chap. 3) owing to the unavailability of data. The resulting emissions and removals for land-use conversions were included in the emissions and removals for land remaining in the same land-use category for each of the categories, while the AD were reported as "NO, IE" and emissions were reported as "NA" in the relevant CRF tables. The ERT concluded that any pending completeness issues are covered by ID# L.1 above.
L.3	4. General (LULUCF) – CO_2 (L.3, 2021) (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 CRF table 4.1 and continues to report "NO" across the time series. Estimates of emissions from forest land converted to other land-use categories were reported as "NA" in CRF tables 4.B–4.F. In its NIR (p.507), the Party reported that there is insufficient data to report land conversions and estimate the associated emissions. During the review, the Party clarified that it is continually improving its data-collection methods and will soon have sufficient data to compile a full land-use change matrix and that it will make efforts to resolve this issue for the next inventory submission.
L.4	4. General (LULUCF) – CO_2, CH_4 and N_2O (L.4, 2021) (L.5, 2019) (L.6, 2017) (L.17, 2016) (L.17, 2015) Transparency	Improve the methodological information for the estimated categories by including: (a) 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); (b) A description of the AD and their quality, including information on data collection	(a) Resolved. The Party improved the description of the methods applied in the dedicated sections of the NIR. The Party used methods from the 2006 IPCC Guidelines (vol.4), equations and assumptions and provided the correct references when reporting CSCs for all pools in forest land (NIR section 6.2.3, pp. 357–362). For CSCs for perennial crops on cropland, where issues were noted in the previous review report, a new method was used in accordance with the 2006 IPCC Guidelines (vol. 4, chap. 2.3.1.1, equation 2.7, p.2.12), as reported in the NIR (section 6.3.2, p.377). (b) Not resolved. The Party reported in its NIR (pp.343, 362, 376, 386–387 and 390) the sources of AD used for assessing the carbon stock and other GHG emissions in relation to the LULUCF sector. However, limited information was provided on methods used for data collection, the temporal resolution of data and data compilation

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		(methodology and timing), data compilation (methodology) and uncertainties.	methods. A description of the quality of the AD was not provided in the relevant sections on uncertainty in the LULUCF chapter of the NIR (section 6, pp. 329–392). During the review, the Party clarified that when assessing the carbon stock and other GHG emissions for the LULUCF sector, it mainly used data from departments within the Ministry of Ecology, Geology and Natural Resources, the Ministry of Agriculture and the Ministry of Digital Development, Innovations and Aerospace Industry, which regularly perform land registration activities in the country. The Party explained that it mainly used statistical data on land areas in the territory of Kazakhstan obtained from various land cadastres combined with information from the State register of all lands. The Party indicated that it will make further efforts to enhance the information on AD in the next inventory submission.
L.5	4. General (LULUCF) – CO_2, CH_4 and N_2O (L.6, 2021) (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 (section 6.2.4 (p.363–364), section 6.3.4 (p.378), section 6.4.4 (p.387), section 6.5.4 (p.390) and section 6.6.3 (p.391)), as well as a general overview of the QA/QC procedures undertaken. However, the ERT noted that the information reported in the NIR on QA/QC procedures for the LULUCF sector is the same across the categories referring to the QA/QC plan and undertaken QA for the sector and does not specify the checks and verification procedures undertaken and their results for the LULUCF categories. During the review, the Party explained that the QA procedures were carried out by an independent expert within the framework of the joint project of the Government of Kazakhstan, UNDP and the Global Environment Facility, entitled "Development of the Eighth National Communication of the Republic of Kazakhstan within the Framework of the UNFCCC and Preparation of Two (Fourth and Fifth) Biennial Reports" and provided the QA summary results. In particular, the initial data, EFs and methods used in the calculations were considered during the QA/QC activities. As a result of the checks, recommendations were made regarding the calculations for the categories in the LULUCF sector that were used when performing the relevant recalculations. The ERT considers that including summary information on specific checks and verification procedures undertaken for the LULUCF categories and their results in the NIR will address the recommendation.
L.6	4. General (LULUCF) – CO_2, CH_4 and N_2O (L.7, 2021) (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 inconsistences in the land-use areas reported between NIR table 6.1.7 and CRF tables 4.A–4.F. However, there are still some inconsistencies in the AD for forest land within the CRF tables and between the CRF tables and the NIR. For example, in CRF tables 4.1 and 4.A, changes in the area of forest land for 1990–2021 were reported as 19,334.10 kha, but as 18,834.30 kha in CRF table 4(III) and in the NIR (p. 339 and table 6.1.6, p.341). Furthermore, in the NIR (p.339), the Party reported that the forest land area is 19,085.9 kha.

ID#	*Issue/problem classification*[a, b]	*Recommendation from previous review report*	*ERT assessment and rationale*
			During the review, the Party clarified that the changes in the area of forest land for 1990–2021 correspond to the areas of forest land reported in NIR table 6.1.6 based on statistical data from the cadastre of forest land of the Forestry and Wildlife Committee of the Ministry of Ecology, Geology of and Natural Resources. The Party indicated that it will specify the total area of forest land and eliminate the inconsistencies in the total area of forest land reported in the NIR and CRF tables in the next submission. The Party informed the ERT that interdepartmental inconsistencies in the data on areas of forest land is one of the reasons why it has not developed a complete land-use change matrix for the purposes of the GHG inventory.
L.7	Land representation – CO_2 (L.8, 2021) (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; (b) The definitions of land-use categories in the IPCC *Good Practice Guidance for Land Use, Land-Use Change and Forestry* 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; (c) 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; (d) The category other land remaining other land is intended to allow the total reported land area to match the total area of the country.	(a) Addressing. The Party systematically used notation keys to report the AD, emissions and IEFs across the CRF tables on the LULUCF sector. The Party reported land-use areas for land remaining in the same category as "NO, IE" for land transitions in all categories except other lands, which creates ambiguity. The notation keys used to report CSCs were still not appropriately reported; for example, all land conversions were reported as "NA" although the AD were reported as "NO, IE" for forest land, cropland and grassland. For all pools for land converted to settlements, CSCs were reported as "NA" instead of "NO", although AD were reported as "IE" and settlements remaining settlements were reported as "NO". During the review, the Party highlighted its efforts to correct the use of notation keys in the CRF tables and the methods used, which do not currently allow carbon gains and losses to be reported separately. (b) Addressing. The Party reported in its NIR (section 6.1.2, table 6.1.1, pp.330-332) its national land uses according to the national land code and their equivalent IPCC land categories (2006 IPCC Guidelines, vol.3, chap.3.2, pp.3.5-3.7). However, no information was included on the assumptions, expert judgment or proxy data used to facilitate the use of available statistics. During the review, the Party clarified that State statistical data on the availability of land and its distribution by ownership, category, land and user were used to compile the land-use conversion matrix, but provided no further clarification. (c) Not resolved. No land-use conversions were reported separately. The Party reported in its NIR (p.507) that its land-use matrix was compiled using approach 1 for land-use representation in accordance with the 2006 IPCC Guidelines (vol. 4, chap. 3.3.1). The Party clarified that it is continually improving its data-collection methods and will soon be able to use a higher-level approach. (d) Resolved. The Party reported in its NIR (p.332) the definition of other land as including land with soil devoid of vegetation, rocks, ice and all other land not included in any of the other land-use categories. Kazakhstan reported areas of other land remaining other land in CRF table 4.F and in the NIR (section 6.1, table 6.1.7, p.342). In the NIR (section 6.7, p.369) the Party explained that these areas are considered unmanaged and were included to balance the total national area.

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L.8	Land representation – CO_2 (L.9, 2021) (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.	(a) Addressing. Kazakhstan reported in the NIR (section 6.1.2, p.342) general information on the AD providers involved in the preparation of 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. However, the Party has still not provided information in the NIR or during the review on the ancillary data used (e.g. the type of data obtained from each organization, the methods used by the organizations to collect the data, and the periods when the data were collected) for preparing land representation. (b) Resolved. The Party reported in its NIR (table 6.1.1, p.330) information on how the land types of Kazakhstan correspond to the definitions of the IPCC land categories and on how the national land-use classes were aggregated into the six IPCC land-use categories in accordance with the 2006 IPCC Guidelines (vol. 4, chap. 3.2). (c) Addressing. The Party reported in the NIR (p.344) that it was impossible to fully resolve the issue of consistency of land representation and data received from various national institutions. During the review, the Party explained that the inconsistency in land areas in the country is the reason why it constructed a simplified land-use matrix. The Party further explained that it is continuously improving its data-collection methods and will soon be able to use IPCC approach 2 for the land representation.
L.9	Land representation – CO_2 (L.10, 2021) (L.10, 2019) (L.10, 2017) (L.19, 2016) (L.19, 2015) Accuracy	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.	Resolved. The Party reported the area of land-use categories and a national total area for the entire time series in NIR table 6.1.7 (section 6.1, p.342) and CRF table 4.1 and explained in the NIR (section 6.1 and pp.513–515) how it improved the methodology used. The Party reported in its NIR that it used approach 1 for land representation in line with the 2006 IPCC Guidelines (vol. 4, chap. 3, section 3.3). The ERT noted that the reported national total area is constant over time (except for a minor deviation by 0.10 kha for 2011 and 2014), suggesting that improved QA/QC procedures were implemented to check the consistency of information on land representation.
L.10	4.A Forest land – CO_2 (L.12, 2021) (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.	Resolved. The Party reported CSCs separately for living biomass, deadwood, litter and soil for forest land in CRF table 4.A and the NIR (table 6.2.4, p.356), and provided information on the wood stock (NIR table 6.2.2, pp.349–352) and conversion coefficients used for the regions of Kazakhstan (NIR table 6.2.6, pp.359–360), together with the data source used, including archival materials on periodic forest accounting (NIR section 6.2.3, pp.357–362). The Party stated that the conversion coefficients used for calculating the carbon stock in biomass and deadwood reservoirs by species and age group of trees and shrubs were from the State Forest Fund for the various regions of Kazakhstan, and referred to the recently developed national methodological guidelines (for calculations of anthropogenic

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			emissions from sources and removals by sinks of GHGs in forestry and agriculture for the annual national report of the Republic of Kazakhstan: methodological approaches taking into account local conditions and information). During the review, the Party provided the source scientific article (Lebed et al., 2023) containing the results of a detailed analysis of the country's system of ground-based monitoring of land use and land resources at various territorial levels, which was published during the review.
L.11	4.A.1 Forest land remaining forest land – CO_2 (L.13, 2021) (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.	Resolved. The Party reported CSCs in living biomass, dead organic matter and soils separately for forest land remaining forest land. The notation key used for reporting CSCs in living biomass losses was corrected to "IE" in CRF table 4.A, as required when using the stock change method.
L.12	4.A.1 Forest land remaining forest land – CO_2 (L.25, 2021) Accuracy	Include in the NIR: (a) 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); (b) Updated calculation methodology for mineral soils on forest land.	(a) Addressing. The Party summarized the information on data sources used in annex 4 to the NIR (p.521). However, there is still no information about the forest survey (i.e. the size of plot used for the inventory). In addition, there are still significant inter-annual variations in the IEFs for mineral soils in forest land remaining forest land from 1990 to 2021 (a range of 0.04 (1990) to –0.09 (1998) and 0.13 t C/ha (2021)) and no information was provided in the NIR on these changes or on the national data used and their verification. The Party reported in its NIR (section 6.2.1, table 6.2.1, p.348) that, at the national level, the area covered by forests varied between 9,391. and 13,293.6 kha with an increase in standing timber stock from 354.03 to 445.86 Mm^3 between 1988 and 2021. However, the ERT noted that the values reported for standing timber stock and total land covered by forests are still inconsistent within the NIR. The wood stock for 2021 was reported as 456.85 Mm^3 in the NIR (p.346) and 13,317 kha was reported for the total land covered by forests (p.339 and table 6.1.6, p.341). Furthermore, the Party reported in its NIR (section 6.2.1, table 6.2.4, p.356) annual changes in the carbon stock for forests but these data are inconsistent with the information reported in CRF table 4.A for the entire time series. During the review, the Party clarified that the correct information is included in NIR table 6.1.6 (p.341) (area covered by forests varies from 9,309.9 to 13,317.0 kha, while the stock of wood in roots increased from 354.0 to 445.86 Mm^3 between 1988 and 2021). This information was obtained from the archive of the Forestry and Wildlife Committee of the Ministry of Ecology, Geology and Natural Resources and the State Archive of Land Resources of the Ministry of Agriculture. The Party indicated that it

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			will implement additional actions in order to provide the required information in the next NIR. (b) Addressing. The Party reported the updated calculation methodology for mineral soils on forest land in its NIR (section 6.2.3, p.358) using the 2006 IPCC Guidelines (vol. 4, chap. 2, equation 2.25, p.2.30). All forest areas by region were included in the calculation, including unvegetated areas (clearings, areas with sparse forest vegetation). During the review, the Party clarified that for soils on forest land, the carbon stock was calculated using the IPCC default methodology and national benchmarks for soil organic carbon stock from recently developed national methodological guidelines on stock change factors, also noted in the NIR (section 6.3.2, pp.376–377). As the referenced documentation was provided late in the review process, the ERT was not able to check the data source in detail.
L.13	4.B.1 Cropland remaining cropland – CO_2 (L.15, 2021) (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.	Resolved. 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.355–361). Kazakhstan reported in the NIR (section 6.3.1, pp.364–376) that additional analyses of humus content in soils obtained during agrochemical surveys of agricultural land were performed and the results of long-term soil observations on a network of monitoring stationary and semi-stationary ecological sites for 1993–2021 were used to verify the calculations. During the review, the Party clarified that an external review was conducted to verify the initial data, EFs and methods used in the calculations. The ERT considers that the recommendation has been addressed.
L.14	4.B.1 Cropland remaining cropland – CO_2 (L.16, 2021) (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.	Resolved. The Party reported carbon stock gains and losses for biomass separately and mineral soils in cropland remaining cropland in CRF table 4.B for the first time, covering the entire time series, and provided information in its NIR (section 6.3.2, pp.376–377), including on CSCs in cropland (table 6.3.5, pp.375–376). In addition, the Party provided information in the NIR (section 6.3.2, p.377) on the approach and methodology used to calculate CSCs in biomass of restored natural vegetation and perennial crops.
L.15	4.C.1 Grassland remaining grassland – CO_2 (L.17, 2021) (L.16, 2019) (L.18, 2017) (L.10, 2016) (L.10, 2015) (84, 2013) (125, 2012) Transparency	Check the reliability of the AD for the degree of grassland degradation for the entire time series.	Resolved. The Party reported information on the distribution of pasture areas by degree of degradation in its NIR (section 6.4.2, pp.375–376) and indicated the data source (section 6.4.2, p.386) and calculation methodology used. The coefficients F1 (vegetation) and F2 (soil carbon) were presented in the NIR (section 6.4.2, table 6.4.6, p.385) to express the type of management regime, which primarily reflects the load of livestock on grassland vegetation cover and soil, as well as the distribution of livestock across the territory. In the NIR (section 6.4.4, p.387), the Party reported that QA/QC procedures for the pasture category were carried out in accordance with the approved rules for monitoring the completeness, transparency and reliability of the State inventory of GHG emissions and removals through the general QA/QC plan for 1990–2021 (see ID# L.16 below). During the review, the Party clarified that an

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			external review was conducted to verify the initial data, EFs and methods used in the calculations and described in its NIR (section 6.4.4). The ERT considers that the Party took into account the previously issued comments regarding an external review and improved the reliability of the AD for the degree of grassland degradation (section 6.4.2).
L.16	4.C.1 Grassland remaining grassland – CO_2 (L.18, 2021) (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.	Resolved. The Party recalculated the AD reported for the category across the time series and consistently reported the area of grassland in CRF table 4.C and NIR table 6.4.2 (section 6.4.1, pp.380–381) across the time series. In CRF table 4.C, the grassland area for 2021 was reported as 189,111.6 kha, while the pasture area was reported as 183,994 kha and hayfields as 5,117.4 kha in the NIR (tables 6.4.1–6.4.2 and 6.4.6, pp.380–381 and 385 respectively). In the NIR (section 6.4.4, p.387), the Party reported that the QA/QC procedures for pasture land were carried out in accordance with the approved rules for monitoring the completeness, transparency and reliability of the State inventory of GHG emissions and removals through the general QA/QC plan for 1990–2021.
L.17	4.C.1 Grassland remaining grassland – CO_2 (L.19, 2021) (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 information on the data used to validate them.	Resolved. The Party consistently reported the area of grassland in CRF table 4.C and NIR table 6.4.2 (section 6.4.1, pp.380–381) across the time series (see ID# L.16 above) and reported in its NIR (section 6.4.2, pp.383–387) information on the methodology applied for the country-specific CSC factors for grassland for biomass and soil. The calculation methodology was described and the coefficients F1 and F2 were presented to express the type of management regime, which primarily reflects the load of livestock on pasture vegetation cover and soil, as well as the distribution of livestock across the territory. For the validation of coefficients and standards, the Party recently developed national methodological guidelines as referenced in the NIR (p.386) that had not been published at the time of the review. In the NIR (section 6.4.5, p.388), the Party noted that it is planning to improve the quality of the calculations by aggregating them for the different regions of Kazakhstan using the specifications for carbon standards for soil and biomass reservoirs, as well as the coefficients for the different types of pasture management regime for individual areas.
L.18	4.C.2 Land converted to grassland – CO_2 (L.20, 2021) (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.	Addressing. The Party reported in CRF table 4.C all land conversions to grassland as "NO, IE" for the AD and "NA" for the CSC estimates for all pools, which were previously reported as "NO". In the NIR (section 6.3.1, table 6.3.4) and during the review, Kazakhstan indicated that the calculations for cropland temporarily out of crop rotation to grassland were reported as a separate subcategory under cropland. The ERT considers that the recommendation has not yet been fully addressed even though there was an improvement in the AD, because the Party has not reported CSCs by pool in CRF table 4.C.
L.19	4.E.2 Land converted to settlements – CO_2	Report CSCs and corresponding CO_2 emissions and removals for land converted to settlements in	Resolved. The Party reported the area of mineral soils as "IE", the area of organic soils as "NO" and all CSCs and net CO_2 emissions and removals as "NA" in CRF

ID#	*Issue/problem classification*[a, b]	*Recommendation from previous review report*	*ERT assessment and rationale*
	(L.21, 2021) (L.21, 2019) Accuracy	line with the 2006 IPCC Guidelines (vol. 4, chap. 8, section 8.3, pp.8.17–8.25).	table 4.E. The ERT noted that, instead of providing an explanation for the use of a tier 2a method (crown cover area method) from the 2006 IPCC Guidelines (vol. 4, chap. 8.3.1, pp.8.18–8.20) to calculate CO_2 emissions and removals for land converted to settlements, the Party decided to use a tier 1 method for estimating the emissions from land converted to settlements and reported that settlements is not a key category (NIR section 6.6.1, p.390, and annex 4, p.518). The change in the methodology used by the Party was justified by referring to the insignificance of the category following a recommendation resulting from external verification by an international expert. The ERT considers that the Party's reporting is appropriate because there is not enough information about the green canopy in the settlement category to conduct an assessment and the category is not a key category (NIR annex 4, p.489).
L.20	4(I) Direct N_2O emissions from N inputs to managed soils – N_2O (L.22, 2021) (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).	Resolved. In CRF table 4(I), the Party reported direct N_2O emissions from N inputs to managed soils as "NO, NA" with the emissions from organic N fertilizers in forest land remaining forest land reported as "NA" and all emissions from wetlands, settlements, other land and land converted to forest land reported as "NO". In the NIR (p.519) and during the review, the Party clarified that it made an official request for data on land fertilization and received an official letter from the Bureau of National Statistics confirming that there are no official data regarding the application of N fertilizers on land that is accounted for as forest land, wetlands and settlements (NIR annex 4, p.489). The official response of the Bureau of National Statistics was provided during the review, along with available data on fertilization on cropland.
L.21	4(III) Direct N_2O emissions from N mineralization/ immobilization – N_2O (L.23, 2021) (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.	Addressing. The Party reported in the NIR (section 6.2.3) that, with the help of an international expert, it estimated direct N_2O emissions associated with the loss of soil carbon for the first time. The calculation was made using a tier 1 method with default coefficients according to the 2006 IPCC Guidelines (vol. 4, chap. 11, section 11.2.1, pp.11.6–11.16). The Party reported in its NIR (section 6.2.3, p.361) that a regional assessment was made for soil carbon which found that the emissions associated with direct N_2O emissions are insignificant for forest land soil carbon. However, the ERT noted that emissions from forest land remaining forest land were reported in CRF table 4(III) for 1990–2008, but were reported as "NA" for 2009 onward. The AD for the areas of land use were reported for forest land, cropland and grassland across the entire time series, but emissions were reported using notation keys, except for 1990–2008 for forest land remaining forest land. The ERT noted that reporting emissions as "NA" for forest land remaining forest land appears to be incorrect when emissions were already reported for other years of the time series. The "NA" for land converted to grassland is also not explained. The Party explained in CRF table 9 that N_2O emissions from cropland were reported as "IE" in CRF table 4(III) because of the allocation of those emissions under the agriculture sector. During the review, the Party explained that in Kazakhstan most land that has been converted between land uses is included in the areas of land remaining in the same category. The Party

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			indicated that it will make efforts to further improve the reporting for the direct N_2O emissions from N mineralization for the next inventory submission. The ERT considers that the recommendation has not yet been fully addressed because of the inconsistent reporting across the time series and the lack of clarification for the notation keys used (e.g. "NA") to report direct N_2O emissions from N mineralization/immobilization in CRF table 4(III).
L.22	4(V) Biomass burning – CO_2, CH_4 and N_2O (L.24, 2021) (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.	Resolved. The Party reported annual GHG emissions from forest fires on forested land and grassland (steppe) for the entire time series in its NIR (table 6.2.5, p.357, and table 6.4.3, pp.382–383, respectively) and in CRF table 4(V). The Party provided information on the methodology and data used for calculating wildfires from forests and steppe covering grassland and cropland in its NIR (sections 6.2.1, 6.2.3, 6.4.1 and 6.4.2) and indicated the improvements in data sources. The Party stated in its NIR (annex 4, p.490) that the data on the official area of annual forest fires were obtained from a department within the Forestry and Wildlife Committee of the Ministry of Agriculture in accordance with order 46 (see https://adilet.zan.kz/rus/docs/V2200026905).
L.23	4(V) Biomass burning – CO_2, CH_4 and N_2O (L.26, 2021) Transparency	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.	Addressing. The Party reported in CRF table 4(V) CO_2, CH_4 and N_2O emissions from wildfires on forest land and grassland. The Party provided information on the methodology used in its NIR (formula 1, p.361, and sections 6.2.1 and 6.2.3) and the burned area in ha as AD (table 6.2.5) for calculating forest (steppe) fires. The source of data was also provided, namely a link to an article containing a full review of the methodology used. However, no information was provided on the EFs used in the NIR (table 6.2.7) for CH_4 and N_2O emissions from wildfires in forests, or on biomass burned for different land types. The Party clarified in CRF table 9 that CO_2 emissions from wildfires reported as "IE" for land converted to forest land were accounted for in CRF table 4.A in CSCs in forest land. During the review, the Party clarified that the data on the official area of annual forest fires were obtained from a department within the Forestry and Wildlife Committee of the Ministry of Agriculture. The collection of information for the NIR was carried out in accordance with order 46 (see https://adilet.zan.kz/rus/docs/V2200026905). The Party indicated that information on methods for monitoring forest and steppe fires will be included in the next NIR. The ERT considers that the recommendation has not yet been fully addressed because of the absence of information on the EFs used in the NIR (table 6.2.7) for CH_4 and N_2O emissions from wildfires in forests and on biomass burned for different land types.
Waste			
W.1	5. General (waste) – CO_2, CH_4 and N_2O	Provide estimates for the CH_4 and N_2O emissions from composting, and CO_2, CH_4 and N_2O	Resolved. The Party reported emissions from incineration of clinical waste. CO_2, CH_4 and N_2O emissions from open burning of both biogenic and non-biogenic MSW were

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	(W.1, 2021) (W.1, 2019) (W.1, 2017) (W.5, 2016) Completeness	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.	reported as insignificant in the NIR (section 7.2.3, p.402) in accordance with paragraph 37(b) of the UNFCCC Annex I inventory reporting guidelines. For the pending transparency issue for reporting emissions for those categories as "NO" in CRF table 5.C instead of "NE", see ID# W.37 in table 5. The completeness issue regarding CH_4 and N_2O emissions from biological treatment of solid waste, both for composting and anaerobic digestion at biogas facilities, is covered under ID# W.21 below.
W.2	5. General (waste) – CO_2, CH_4 and N_2O (W.2, 2021) (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 is making efforts to improve the consistency of the information provided in the NIR and the CRF tables. For example, the Party corrected the DOC_f value of 0.5 in both the NIR and CRF table 5.A. The population data reported in CRF table 5.D and NIR table 7.17 are consistent. However, the ERT noted some examples of other inconsistencies. For example, in CRF table 5.D, the protein consumption for 2003 was reported as 15,074.77 kg/capita/year, while in NIR table 7.17 it was reported as 32.85 kg/capita/year for 2003. Further, during the review, the ERT noted other inconsistencies between the NIR, the CRF tables and the new information provided in response to the questions raised by the ERT. During the review, the Party explained that, as part of the preparation of its ninth national communication, it is planning to use external peer reviews for all sectors and introduce cross-checking to eliminate typographical errors. The ERT considers that the recommendation has not yet been fully addressed as inconsistencies between the CRF tables and the NIR were still noted in the 2023 inventory submission.
W.3	5. General (waste) – CO_2, CH_4 and N_2O (W.3, 2021) (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.	Resolved. The ERT noted that the NIR continues to lack consistent information on the methods applied and how they are consistent with the IPCC decision trees, particularly for CH_4 emissions for category 5.A solid waste disposal and 5.D wastewater treatment and discharge. However, as the pending issues on the consistency and transparency of the information on the methods used for these two categories are addressed under ID#s W.6 and W.31 below respectively, the ERT concludes that the general issue may be considered resolved.
W.4	5. General (waste) – CO_2, CH_4 and N_2O (W.4, 2021) (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.	Addressing. The Party reported in the NIR (p.394) the contributions of emissions for categories under the waste sector for 1990 in figure 7.1 and for 2021 in figure 7.2, which are consistent with the information reported in the CRF tables. However, although the Party reported in NIR table 7.1 (pp.394–395) emissions by subcategory and the total emissions in the waste sector in CO_2 eq for most cases, the emissions reported in table 7.1 are not consistent with the values reported in CRF summary table 2 and CRF table 10. Observed discrepancies were not, however, systematically identified across the sector. The ERT noted that, in uploading the emission estimates to CRF Reporter, the Party used rounded numbers in most of the sectoral tables; however, the approach to rounding the decimal numbers was not consistent. During the review, the Party explained that typographical errors were introduced when filling

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			in the CRF tables and the rounding of numbers in the data reported may not be consistent. The Party also explained that it is planning to use external peer reviews for all sectors and introduce cross-checking to eliminate typographical errors and/or ensure consistency (see ID# W.2 above). The ERT considers that the recommendation has not yet been fully resolved because of the inconsistencies noted above.
W.5	5.A Solid waste disposal on land – CH_4 (W.5, 2021) (W.5, 2019) (W.4, 2017) (W.1, 2016) (W.1, 2015) (90, 2013) Transparency	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. In NIR section 7.1 (p.393) the Party explained that 20.2 per cent of collected waste in Kazakhstan in 2021 was from industry, which represents the second largest waste type after household waste (with a share of 65.6 per cent). However, the NIR contains no information on whether and, if so, how industrial waste is considered in the emission estimates. During the review, the Party explained that the information on the 20.2 per cent share of industrial waste was contained in the official bulletin of the Bureau of National Statistics. However, emissions from industrial waste, beside those treated together with household waste, were not taken into account in the 2023 inventory submission. The Party indicated that information on industrial waste management is being collected and analysed and will be presented in the next NIR (see also ID# W.19 below).
W.6	5.A Solid waste disposal on land – CH_4 (W.6, 2021) (W.8, 2019) (W.16, 2017) Transparency	Obtain good-quality country-specific AD in order to estimate CH_4 emissions for this category using the tier 2 IPCC FOD method.	Not resolved. Although the Party stated in the NIR (section 7.2.3, p.402) that it used a tier 2 method (equations 3.4–3.5 from the 2006 IPCC Guidelines, vol. 5, chap. 3) together with national statistical data and default data, the information in the NIR is not clear on how the waste data were obtained and used to determine the country-specific AD. In the NIR (section 7.2.1, p.397), the Party explained that an analysis of a national study on the morphological composition of waste by region revealed very large discrepancies in the data. Additional studies on waste composition for Astana and Almaty were conducted by a group of experts, but no further information was provided on how those studies were used to improve the AD. Further, the Party did not report emissions for the subcategory 5.A.1.b semi-aerobic landfills under managed landfills, despite reporting emissions from the landfill site in Almaty, the largest city in the country, under that subcategory in the 2021 submission. Emissions from SWDS for Almaty were reported under unmanaged landfills in the 2023 submission, without considering the possible differences in the waste profiles of other cities. During the review, the Party explained that the approach and methodologies used to estimate CH_4 emissions from SWDS have changed since the previous annual submission. The emissions were estimated using the total volume of MSW generated at the national level as provided by the Bureau of National Statistics and the bulk waste option of the IPCC FOD model, instead of estimating emissions for individual waste types (see ID# W.7 below and ID# W.35 in table 5).

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			The ERT concluded that the detailed country-specific AD required for a tier 2 method, as presented in the NIR and provided to the ERT during the previous review, were not used in the estimates for the SWDS category.
W.7	5.A Solid waste disposal on land – CH_4 (W.7, 2021) (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 of 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. In the NIR (p.373), the Party included information on the average volume of waste per capita per year for urban and rural areas, together with an updated table on the total urban and rural population and the amount of municipal waste for each year for 1990–2021 (NIR table 7.3, pp.397–398). The Party also reported in its NIR (p.397 and table 7.4, pp.398–399), CH_4 and CO_2 emissions from managed (anaerobic) landfill and uncontrolled (deep) landfill SWDS. The Party explained that landfills in Astana are considered to be managed and anaerobic, while for the other cities of Kazakhstan the landfills are considered to be unmanaged and shallow, which is not consistent with the information in NIR table 7.4. During the review, the Party clarified that the information on landfills was obtained from official permits for releasing emissions into the atmosphere issued by the authorized body. However, the Party did not provide information on the classification applied for SWDS and how the AD provided in the NIR were used to calculate the estimates (see ID# W.6 above). Further, during the review the Party explained that the data provided in the NIR were more for information purposes and not directly used in the estimates, as the IPCC bulk waste option was applied in the calculations. The ERT therefore concluded that the information reported in the NIR does not contain clear and comprehensive descriptions of the AD used for the calculation of annual waste generation for CH_4 emission estimates (see also ID# W.35 in table 5).
W.8	5.A Solid waste disposal on land – CH_4 (W.8, 2021) (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.	Resolved. In the NIR, the Party indicated that the average volume of waste per capita per year in urban areas is about 300–400 kg/capita/year, while for rural areas the Party explained that there are no data on the average accumulation of solid household waste, and realistic values would be around 150–300 kg/capita/year, which would be in accordance with values reported by other countries (NIR p.397). The reference provided in the NIR (footnote 140, p.400) on the assumption of 150–300 kg/capita/year was not accessible. The Party did not provide in the NIR any explanation for the waste generation rate trends or observed low waste generation rates per capita for the cities of Kazakhstan compared with the values of neighbouring countries, including those presented in the 2006 IPCC Guidelines (vol. 5, chap. 2, annex 2A.1, table 2A.1, pp.2.17–2.19), such as 0.34 t/capita/year for 2000 for the Russian Federation. During the review, the Party clarified that the annual waste generation rate and population data were not actually used to obtain the total volume of MSW for estimating emissions, and the waste generation rate is a calculated value based on collected waste data and annual population (see also ID# W.7 above). In view of the information received, the ERT considers this issue on transparency resolved because reporting the waste generation data needs to be considered in the context of the revised estimates, as discussed in ID# W.35 in table 5.

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W.9	5.A Solid waste disposal on land – CH_4 (W.10, 2021) (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.	Not resolved. In the NIR (p.401), the Party reported that the DOC values were estimated on the basis of the long-term results of studies on the composition of solid waste, and the average DOC values are 0.21 for Kazakhstan (excluding Astana) and 0.14 for Astana. However, Kazakhstan did not report in its NIR the DOC values for 1990–2021, nor justify 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, nor provide any information on the updated DOC values or the corresponding recalculation of CH_4 emission estimates in the recalculations section of the NIR. During the review, the Party confirmed that the IPCC default DOC value for bulk waste (0.15) was used to estimate the emissions for the entire time series (see also ID#s W.6 and W.7 above). The Party also stated that it will take the recommendation into account for its next inventory submission. The ERT considers that the recommendation has not yet been addressed because the Party applied a constant IPCC default DOC value for bulk waste (see ID# W.18 below).
W.10	5.A Solid waste disposal on land – CH_4 (W.11, 2021) (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 Party recalculated the emission estimates for this category in the 2021 submission. The CH_4 IEFs for anaerobic landfills reported in CRF table 5.A in the 2023 submission are the same as those reported in the 2021 submission for the entire time series. However, the ERT noted that the IEFs for unmanaged landfills reported for the whole time series were higher than those in the 2021 submission, ranging between 48.1 per cent for 1991 to 64.8 per cent for 2006. The ERT also noted the opposite trend in the time series of CH_4 IEFs for anaerobic landfills and unmanaged landfills. For 1990–1997 and 2007–2011, the IEFs for unmanaged landfills are slightly lower (0.030–0.036 t/t waste and 0.023–0.025 t/t waste respectively) than those for managed anaerobic landfills (0.044–0.045 t/t waste and 0.032–0.039 t/t waste respectively), while for 1998–2006 and 2012–2021 the IEFs for managed anaerobic landfills (0.018–0.031 t/t waste and 0.018–0.028 t/t waste respectively) are slightly lower than those for unmanaged landfills (0.034–0.039 t/t waste and 0.028–0.040 t/t waste respectively). The NIR contains no discussion on the trend in the IEFs. During the review, the Party stated that this recommendation will be taken into account for the next NIR. The ERT considers that resolving the issue discussed in ID# W.35 in table 5 will probably also resolve this issue.
W.11	5.A Solid waste disposal on land – CH_4 (W.12, 2021) (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 Party reported in its NIR (section 7.2.6, p.404) that the CH_4 emissions from solid waste disposal on land were recalculated for the entire time series and that the values obtained are reflected in the NIR. The recalculations resulted in a reduction in the emission estimates across the time series (e.g. –16.56 per cent for 2020). However, the Party did not provide descriptions of the recalculations, such as changes in the values of AD and parameters, the reasons for the changes and the impact of the recalculations and justification, including how the

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			recalculations reflect an improvement compared with the previous annual submission. During the review, the Party provided the ERT with additional information on the recalculations undertaken and the reasons for them. The ERT noted that there has been a change in the inventory team for the waste sector, but no relevant communication with former waste sector experts was undertaken when preparing the inventory, thereby resulting in significant recalculations and issues in relation to the continuity of the estimates and the transparent description of the recalculations. The ERT considers that the issue has not been resolved because the Party did not provide comprehensive, verifiable and documented information explaining significant changes caused by recalculations in the NIR.
W.12	5.A Solid waste disposal on land – CH_4 (W.13, 2021) (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.	Resolved. In the NIR (p.400) and in CRF table 5.A, the Party used the default value of DOC_f (0.5) for estimating CH_4 emissions from both managed anaerobic and unmanaged landfills for all years of the time series. During the review, the Party confirmed its use of the default value provided in the 2006 IPCC Guidelines (vol. 5, chap. 3, p.3.13).
W.13	5.A Solid waste disposal on land – CH_4 (W.20, 2021) Transparency	Investigate whether CH_4 flaring or energy recovery occurs at landfills in the country, including in Nur-Sultan, and report on this, 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, 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.	Not resolved. The Party reported CH_4 flaring and energy recovery occurring at landfills in Kazakhstan as "NO" in CRF table 5.A. However, the Party did not report this information in its NIR and did not provide any explanation for or the assumptions justifying the notation key used. During the review, the Party clarified that, according to the responses requested from local executive bodies by region, energy recovery is not carried out at landfills, including for the managed landfill in Astana. The Party did not clarify whether CH_4 flaring occurs.
W.14	5.A Solid waste disposal on land – CH_4 (W.21, 2021) Accuracy	Revise the 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).	Not resolved. The Party did not report in its NIR on the use of 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), as suggested by the previous ERT, but Kazakhstan continues to use reaction rate values for wet boreal and temperate climate (NIR section 7.2.1). The ERT noted that according to the eighth national communication of Kazakhstan the climatic conditions in the country are predominantly dry. During the review, the Party clarified that the climatic conditions selected for the calculations were default wet, temperate for all regions of the country, including Astana. The Party indicated that the climatic conditions will be revised for different landfills in the next inventory submission.

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W.15	5.A Solid waste disposal on land – CH_4 (W.22, 2021) Transparency	Include information on applied delay time in the NIR.	Not resolved. The Party did not report in its NIR any information on the use of delay time 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, in line with the 2006 IPCC Guidelines (vol. 5, chap. 3, p.3.19). The Party stated that this information will be included in the next NIR.
W.16	5.A Solid waste disposal on land – CH_4 (W.23, 2021) Convention reporting adherence	Report consistent information on types of SWDS in the NIR, including textual information, figures and tables.	Not resolved. The Party reported in its NIR (table 7.4, pp. 398–399) emissions from urban managed (anaerobic) landfills for Astana and unmanaged (deep) landfills of solid waste for other cities in Kazakhstan for 1990–2021. The Party further reported in its NIR (p.400) that, in accordance with the definition provided in the 2006 IPCC Guidelines (vol. 5, chap. 3, table 3.1, p.3.14), the MCF value for Astana is considered to be equal to 1.0 owing to the fact that landfills in the capital of Kazakhstan are considered to be managed and anaerobic. For the other cities of Kazakhstan, the MCF value is equal to 0.4, since the landfills are considered to be unmanaged and shallow. The same values were also reported in CRF table 5.A. The Party did not provide any justification for classifying unmanaged sites as deep or shallow and for using an MCF value of 0.4 instead of 0.8 for deep unmanaged SWDS (see also ID# W.7 above). During the review, the Party provided calculation sheets for the estimates and confirmed that the MCF values for deep landfills were used in the estimates. Noting the inconsistency in the information provided by the Party, the ERT considers that the recommendation has not been fully addressed.
W.17	5.A Solid waste disposal on land – CH_4 (W.24, 2021) Accuracy	Provide in the 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, 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 the NIR.	Not resolved. The Party reported in the NIR (section 7.2.1) that, in accordance with the definition provided in the 2006 IPCC Guidelines (vol. 5, chap. 3, table 3.1, p.3.14), the MCF value for other cities (except for Astana where the landfills are managed) is equal to 0.4 as their landfills are considered to be unmanaged and shallow. No justification was included in the NIR for the selection of MCF value. During the review, no further justification on the landfill categorization or information on the depth of the landfills above or below 5 m was provided, besides stating that information on landfills was gathered from official permits issued by the authorized body. However, the Party confirmed that an MCF value of 0.8 (for unmanaged deep landfills) was applied in estimating the emissions and indicated that it will provide the necessary explanations in the next inventory submission.
W.18	5.A Solid waste disposal on land – CH_4 (W.26, 2021) Transparency	Include in the NIR the following information: (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;	Not resolved. The Party did not update the information on the description of the DOC values in its NIR (p.401). The Party reported that the content of DOC depends on the composition of the waste and is different for different waste fractions, that the DOC value was estimated on the basis of the long-term results of studying the composition of solid waste, and that the average DOC values obtained are 0.21 for the cities of Kazakhstan (for estimating emissions from unmanaged landfills) and 0.14 for Astana (for estimating emissions from managed anaerobic landfills). However, no detailed information was provided in the NIR on the findings of the study and how the

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		(c) References and main assumptions used to derive DOC values for 1950–2019; (d) Explanation of changes in DOC values across the time series.	country-specific values were derived on the basis of those findings, or on the assumptions used. The ERT also noted that the Party did not report in the NIR whether those DOC values were applied for all years of the time series or whether there were any changes over the period. During the review, the ERT identified that constant default DOC value were used across the time series (see ID# W.9 above).
W.19	5.A.1 Managed waste disposal sites – CH_4 (W.15, 2021) (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. The Party did not report in the NIR how it estimated CH_4 emissions from solid industrial waste. During the review, the Party clarified that emissions from industrial waste were not estimated and that the recommendation will be taken into consideration for the next inventory submission (see ID# W.5 above).
W.20	5.A.1 Managed waste disposal sites – CH_4 (W.25, 2021) Transparency	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.	Not resolved. The Party reported in its NIR (section 7.2.1, p.399) that the Astana landfill is considered to be managed anaerobic and all other landfills are classified as unmanaged, including the Almaty landfill, which was previously classified as semi-aerobic. The ERT noted that Kazakhstan did not provide any explanation or justification with relevant references to support the classification of landfills in accordance with the 2006 IPCC Guidelines (vol. 5, chap. 3, table 3.1, p.3.14) (see ID# W.7 above). During the review, the Party explained that there is no landfill in the city of Almaty and the landfill in the Almaty region, where waste is sent from the city, is included in the category of other landfills in the country. The Party stated that it will provide the relevant explanation and justification in the next NIR.
W.21	5.B Biological treatment of solid waste – CH_4 and N_2O (W.27, 2021) Completeness	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.	Not resolved. The Party did not report in its NIR emissions from biological treatment of waste and reported this category as "NO" in CRF table 5.B. Kazakhstan did not provide any background information on the mechanical-biological treatment of waste in the NIR, even though it provided information during the review of the 2021 submission that implied the possibility of emissions for this category. In addition, the ERT noted some publicly available sources of information on biological treatment practices and composting in Kazakhstan in recent years (e.g. https://astanatimes.com/2018/10/kazakhstan-to-ban-plastic-paper-and-glass-burying-by-2019-construction-and-food-waste-by-2021/ and https://worldbiomarketinsights.com/kazakhstan-oilfield-composts-255-tonnes-of-food-waste-after-new-law/). During the review, the Party clarified that biological treatment was not included in the calculation of emissions because of the lack of information on the volume of composting and that work is under way to establish contact with private organizations that are engaged in biological processing of waste. The Party indicated that it will take this recommendation into account for the next inventory submission. The ERT considers that the recommendation has not yet been addressed because the Party has not justified the non-existence of biological treatment of solid waste in Kazakhstan. Further, the ERT considers that not estimating emissions from biological

ID#	Issue/problem classification[a, b]	Recommendation from previous review report	ERT assessment and rationale
			treatment of solid waste results in an underestimation of CH_4 emissions for this category.
W.22	5.B Biological treatment of solid waste – CH_4 and N_2O (W.27, 2021) Transparency	Include in the 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 2021 review.	Not resolved. The NIR does not contain a section on biological treatment of solid waste (see ID# W.21 above). During the review, the Party explained that this recommendation will be taken into account for the next NIR.
W.23	5.C.1 Waste incineration – CO_2, CH_4 and N_2O (W.18, 2021) (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. Similarly to in the 2021 submission, in the 2023 submission the Party reported CO_2, CH_4 and N_2O emission estimates for the combustion of clinical waste under subcategory 5.C.1.b non-biogenic – other for 2006–2021. However, the AD for those emissions were still reported as "NO", while the AD and emissions for the subcategory for 1990–2005 were also reported as "NO" instead of "NE". The Party reported CO_2, CH_4 and N_2O emissions under biogenic waste incineration – other as "NO" for the entire time series, even though a fraction of biogenic clinical waste was incinerated for 2006–2019. The ERT considers that CO_2, CH_4 and N_2O emissions should be reported as "IE" for 2006–2019 in CRF table 5.C until the biogenic fraction is reported separately from the non-biogenic fraction. In CRF table 5.C, the Party reported the AD for MSW and the related CO_2, CH_4 and N_2O emissions as "NO" across the time series. The Party did not report any new information to justify the reporting of "NO" in the NIR. During the review, the Party stated that the source of the information on solid waste incineration was article 365 of Environmental Code 184-VII of 2 January 2023. However, the information provided does not confirm the non-existence of incineration facilities or equipment that treat MSW and other types of solid waste in the country. The Party indicated its intention to resolve this issue for the next inventory submission.
W.24	5.C Incineration and open burning of waste – CO_2, CH_4 and N_2O (W.28, 2021) Transparency	Include in the 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	(a–b) Not resolved. Kazakhstan 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. The NIR does not include any justification for not reporting emissions other than clinical waste or information on the industrial waste treatment practices in Kazakhstan. During the review, the Party clarified that heat treatment is prohibited for the main types of hazardous waste, that there are separate landfills for

ID#	Issue/problem classification[a, b]	Recommendation from previous review report	ERT assessment and rationale
		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.	industrial waste and that some types of waste are buried. Work is under way to collect information on industrial waste to calculate and report emissions in the next NIR (see also ID# W.7 above).
W.25	5.C.1 Waste incineration – CO_2 (W.29, 2021) Accuracy	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.	Resolved. The Party recalculated CO_2 emissions for the entire time series (NIR section 7.6, p.430) and updated the oxidation factor used for estimating CO_2 emissions from clinical waste reported in CRF table 5.C; namely, using the default value of 1.0 provided in the 2006 IPCC Guidelines (vol. 5, chap. 5, table 5.2, p.5.18).
W.26	5.C.1 Waste incineration – CO_2, CH_4 and N_2O (W.30, 2021) Comparability	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.	Not resolved. The Party reported clinical waste incineration emissions under subcategory 5.C.1.2.b non-biogenic – other, but not as a separate subcategory in CRF table 5.C, thus not reporting the AD and IEFs for that subcategory. During the review, the Party clarified that it is planning to take this recommendation into account for the next inventory submission.
W.27	5.C.1 Waste incineration – CH_4 and N_2O (W.31, 2021) Accuracy	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.	Addressing. The Party recalculated the emissions from clinical waste incineration across the time series, resulting in a decrease in the emission estimates by between 96 and 99 per cent for 2006–2020. (For 1990–2005, the Party reported emissions as "NO".) In the NIR (tables 7.20–7.21, pp.427–428) and in CRF table summary 3, Kazakhstan reported that default EFs were used for CH_4 (0.6 kg/kt waste incinerated on a wet-weight basis for periodic stokers) and N_2O (0.6 kg/Gg waste incinerated on a wet-weight basis for periodic stokers). However, the ERT noted that these values differ from the default values provided in the 2006 IPCC Guidelines (vol. 5, chap. 5, pp.5.20–5.21) in table 5.3 for CH_4 (e.g. 6 kg/Gg waste incinerated on a wet-weight basis for semi-continuous incineration stokers) and in table 5.4 for N_2O (e.g. 41 kg/Gg waste incinerated on a wet-weight basis for semi-continuous incineration stokers). However, no technical information justifying the values used for the country-specific EFs was provided in the NIR. During the review, the Party clarified that the entire time series will be recalculated in accordance with the values provided in the 2006 IPCC Guidelines (vol. 5, chap. 5, tables 5.3–5.4, pp.5.20–5.21) for CH_4 (e.g. 6 kg/Gg waste incinerated on a wet-weight basis for semi-continuous combustion stokers) and for N_2O (e.g. 41 kg/Gg waste incinerated on a wet-weight basis for semi-continuous incineration stokers).
W.28	5.C.1 Waste incineration – CO_2, CH_4 and N_2O	Include in the NIR the statement that there was no incineration of waste with energy recovery in the country in 1990–2019 and that the start of	Not resolved. The Party did not report in its NIR any information on waste incineration with energy recovery, which was reported as "NO" in CRF table 5.C. During the review, the Party clarified that the construction of the incineration plant

ID#	*Issue/problem classification*[a, b]	*Recommendation from previous review report*	*ERT assessment and rationale*
	(W.32, 2021) Transparency	construction of a waste incineration plant is planned for 2021.	has not yet begun. The Party indicated that this recommendation will be taken into account for the next inventory submission. The ERT considers that the recommendation has not yet been addressed because the Party has not yet provided a justification in its NIR to support the reporting of waste incineration with energy recovery as "NO" in CRF table 5.C.
W.29	5.C.1 Waste incineration – CO_2, CH_4 and N_2O (W.33, 2021) Convention reporting adherence	Provide correct references to the methodological basis for estimating emissions from clinical waste incineration in the NIR.	Not resolved. The Party continued to report in its NIR (p.427) that the default coefficient values used for calculating CO_2 emissions from clinical waste incineration were taken from the IPCC *Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories* (vol. 5, chap. 5, table 5.6, p.5.29). The ERT noted that the methodology used is consistent with the 2006 IPCC Guidelines (vol. 5, chap. 5, section 5.2.1). For CH_4 and N_2O emissions from clinical waste incineration, see ID# W.27 above. During the review, the Party clarified that there was a typographical error in the provided reference, and that the correct reference for calculating CO_2 emissions will be provided in the next inventory submission.
W.30	5.C.2 Open burning of waste – CO_2, CH_4 and N_2O (W.19, 2021) (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.	Resolved. The Party reported in the NIR (section 7.2.3, pp.401–403) estimates of CO_2, CH_4 and N_2O emissions from open burning of waste applying the IPCC tier 1 method to demonstrate that those emissions were insignificant, in accordance with paragraph 37(b) of the UNFCCC Annex I inventory reporting guidelines. Regarding the transparency of the reporting, see ID# W.37 in table 5.
W.31	5.D Wastewater treatment and discharge – CH_4 (W.34, 2021) Accuracy	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 the Party was unable to implement the recommended method.	Not resolved. Although some recalculations were made for CH_4 emissions from wastewater treatment and discharge, they were not carried out as a result of changes in the methodology used. The Party reported in its NIR (section 7.3.1.1, p.407) that the assessment of CH_4 emissions from municipal wastewater treatment was carried out on the basis of the 2006 IPCC Guidelines, and the methodology used corresponds to tier 2, since country-specific coefficient values for the degree of wastewater treatment/discharge routes and methods were used in the calculations. The ERT noted that according to the 2006 IPCC Guidelines (vol. 5, chap. 6, p.6.9) the tier 2 method follows the same approach as tier 1 but allows for the incorporation of country-specific EFs and AD. The decision tree for CH_4 emissions from domestic wastewater (vol. 5, chap. 6, p.6.10) requires country-specific EFs including B_o and MCF values in order to apply a tier 2 method. The ERT noted that the Party used country-specific AD and default EFs (for B_o and MCF), which corresponds to a tier 1 method. During the review, the Party clarified that the use of country-specific B_o and MCF values is not currently planned owing to the lack of possibility of conducting research and that default values were selected according to national conditions. The Party

ID#	Issue/problem classification[a, b]	Recommendation from previous review report	ERT assessment and rationale
			indicated that this recommendation will be taken into consideration for the next inventory submission.
W.32	5.D Wastewater treatment and discharge – CH_4 and N_2O (W.35, 2021) Comparability	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.	(a) Not resolved. The Party still reported N_2O emissions from industrial wastewater for 1990–2021 as "NO" in CRF table 5.D and did not include any relevant explanation for doing so in the NIR or in CRF table 9. The ERT considers that "NE" is more appropriate until the NIR contains a justification that N_2O emissions from industrial wastewater did not occur in the country since 1990 or an explanation that the emissions were not estimated, even though they occur, because the 2006 IPCC Guidelines does not include a default methodology. During the review, the Party clarified that this recommendation will be taken into account for the next inventory submission. (b) Resolved. The Party reported AD for sludge removal as "NO" in CRF table 5.D in accordance with the 2006 IPCC Guidelines (vol. 5, chap. 6, section 6.2) since the default value of zero was used for sludge removed, as explained in the NIR (p.408) and as recommended by the previous ERT.
W.33	5.D.2 Industrial wastewater – CH_4 (W.37, 2021) Accuracy	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.	Resolved. Recalculations of the CH_4 emission estimates for category 5.D.2 industrial wastewater were made for the entire time series. As a result of the meetings of the Interinstitutional Working Group, updated data on the volume of industrial production were obtained. The Party included data on output volumes for paper production and estimated CH_4 emissions from pulp and paper manufacturing under category 5.D.2, as reported in its NIR (table 7.13, pp.418–419). The ERT considers that the recommendation has been addressed because the Party collected data on pulp and paper manufacturing in the country for the entire time series, corrected the estimates and reported the corresponding CH_4 emissions from pulp and paper manufacturing under category 5.D.2.
W.34	5.D.2 Industrial wastewater – CH_4 (W.38, 2021) Transparency	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 the 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.	Not resolved. The Party did not report in its NIR an explanation of the CH_4 emission trend for category 5.D.2 industrial wastewater. However, the ERT noted that the inter-annual changes in the total organic product for industrial wastewater continue to be significant for the following years: 1992/1993 (–35.1 per cent), 1993/1994 (–41.8 per cent), 1994/1995 (–41.2 per cent), 2000/2001 (70.8 per cent), 2008/2009 (57.0 per cent) 2010/2011 (–42.8 per cent) and 2020/2021 (32.4 per cent). Although the NIR shows the production volume for the different industries (table 7.13) and the parameters used to estimate the emissions (table 7.12), there is no explanation for the variations in the AD that impact the emission trend. During the review, the Party clarified that the significant inter-annual fluctuations are associated with the inclusion of the pulp and paper industry, for which the data on production volumes fluctuate. Since the coefficient value for wastewater generation for this type of industry is very high, the production volumes affect the emission trend.

[a] References in parentheses are to the paragraph(s) and the year(s) of the previous review report(s) in which the issue or problem 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 2022 annual submission of Kazakhstan was not available at the time of this review. Therefore, the recommendations reflected in this table are taken from the 2021 annual review report. For the same reason, 2018, 2020 and 2022 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

8. 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 2023 inventory submission of Kazakhstan, and had not been addressed by the Party by 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.3	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 how the quality and reliability of plant-specific and country-specific EFs are ensured and who is responsible for this.	4 (2017–2023)
G.7	Provide detailed information on the assessment of completeness (e.g. in an annex) in the NIR.	5 (2015/2016–2023)
G.10	In the NIR, 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).	4 (2017–2023)
G.11	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.	4 (2017–2023)
Energy		
E.2	Use the notation keys in strict accordance with the definitions provided in paragraph 37 of the UNFCCC Annex I inventory reporting guidelines.	3 (2019–2023)
E.3	Report in the NIR all information regarding the reasons for recalculations and the methodologies used for the recalculated categories.	7 (2012–2023)
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.	8 (2011–2023)
E.5	Ensure the consistency of the entire time series and provide comparisons of AD obtained from different sources.	7 (2012–2023)

ID#	*Previous recommendation for issue*	*Number of successive reviews issue not addressed*[a]
E.6	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.	3 (2019–2023)
E.8	Carry out the planned improvement to separate coking coal consumption from the total other bituminous coal consumption.	6 (2013–2023)
E.9	Cross-check the AD and provide explanations for the differences in inter-annual changes between the reference and the sectoral approaches.	8 (2011–2023)
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 emissions estimated from the two approaches.	5 (2015/2016–2023)
E.11	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) Disaggregate the AD included in category 1.A.5 other and reallocate emissions to appropriate categories; (b) Estimate carbon excluded from NEU and feedstocks of NGLs and associated petroleum gas separately from natural gas;	4 (2017–2023)
E.12	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.	3 (2019–2023)
E.13	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).	5 (2016–2023)
E.15	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”.	3 (2019–2023)
E.16	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.	7 (2012–2023)
E.18	Investigate the allocation of AD and emissions from the energy sector to the industrial processes sector and correct any misallocations.	8 (2011–2023)
E.19	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 net calorific values and EFs for coking coal and other fuels used.	3 (2019–2023)

ID#	*Previous recommendation for issue*	*Number of successive reviews issue not addressed*[a]
E.20	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.	4 (2017–2023)
E.21	In the NIR, provide information on AD for coking coal combusted for its 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.	4 (2017–2023)
E.23	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.	5 (2015/2016–2023)
E.24	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.	4 (2017–2023)
E.26	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.	7 (2012–2023)
E.27	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.	3 (2019–2023)
E.31	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.	3 (2019–2023)
E.32	Include in the NIR a well-documented justification for the decrease in gasoline consumption in subcategory 1.A.3.d domestic navigation and ensure the consistency of the emission estimates for the complete time series.	3 (2019–2023)
E.33	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.	4 (2017–2023)
E.34	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.	4 (2017–2023)
E.35	Report in CRF table 1.A(a)s4 the fuel consumption and corresponding GHG emissions for subcategory 1.A.5.a stationary by type of fuel.	3 (2019–2023)
E.37	Provide consistent and accurate information on the 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.	3 (2019–2023)
E.39	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.	5 (2015/2016–2023)

ID#	*Previous recommendation for issue*	*Number of successive reviews issue not addressed*[a]
E.40	Transparently document in each NIR the methodology and the background information used for the estimation of the CO_2 EF for surface mining activities.	5 (2015/2016–2023)
E.48	Ensure consistency in the IEF for the entire time series.	5 (2016–2023)
E.49	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.	4 (2017–2023)
E.50	Report in the NIR and CRF table 1.B.2 accurate, consistent and documented AD from 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	3 (2019–2023)
E.51	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, and document the EFs and method used in the NIR.	3 (2019–2023)
E.53	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 for 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).	3 (2019–2023)
E.60	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.	3 (2019–2023)
E.61	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.	5 (2016–2023)
IPPU		
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 paragraph 50(c) of the UNFCCC Annex I inventory reporting guidelines.	4 (2017–2023)
I.7	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.	4 (2017–2023)
I.12	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.	4 (2017–2023)

ID#	*Previous recommendation for issue*	*Number of successive reviews issue not addressed*[a]
I.21	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.	3 (2019–2023)
I.25	(a) Provide information on how time-series consistency is ensured for the category; (b) Provide clear information on the recalculations made across the entire time series.	5 (2015/2016–2023)
Agriculture		
A.2	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	3 (2019–2023)
A.3	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 recalculation sections of the NIR, and tables showing the resulting differences among annual submissions.	3 (2019–2023)
A.11	Provide, in the NIR, detailed justification for reporting CO_2 emissions from liming as "NO".	4 (2017–2023)
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 grassland converted to forest land – mineral soils; (b) Net CO_2 emissions from forest land converted to grassland – dead organic matter and mineral soils; (c) Net CO_2 emissions from other land converted to wetlands.	8 (2011–2023)
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.	6 (2013–2023)
L.4	Improve the methodological information for the estimated categories by including a description of the AD and their quality, including information on data collection (methodology and timing), data compilation (methodology) and uncertainties.	5 (2015/2016–2023)
L.5	Include in the NIR a description of any QA/QC checks undertaken, and the results of such checks.	5 (2015/2016–2023)
L.6	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.	4 (2017–2023)

ID#	*Previous recommendation for issue*	*Number of successive reviews issue not addressed*[a]
L.7	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; (b) The definitions of land-use categories in the IPCC *Good Practice Guidance for Land Use, Land-Use Change and Forestry* 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; (c) 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.	7 (2012–2023)
L.8	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) Explanations on how consistency is maintained when different sources of data and/or different methodologies are used for preparing the land representation.	5 (2015/2016–2023)
L.18	Include AD in the CRF tables and estimate CSC in all pools.	7 (2012–2023)
L.21	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.	3 (2019–2023)
Waste		
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.	5 (2016–2023)
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.	4 (2017–2023)
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.	6 (2013–2023)
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.	4 (2017–2023)
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 of 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.	4 (2017–2023)

ID#	*Previous recommendation for issue*	*Number of successive reviews issue not addressed*[a]
W.9	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.	4 (2017–2023)
W.10	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.	3 (2019–2023)
W.11	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.	3 (2019–2023)
W.19	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.	4 (2017–2023)
W.23	Use the appropriate notation key for waste incineration consistent with decision 24/CP.19, annex I, paragraph 37.	5 (2015/2016–2023)

[a] Reports on the reviews of the 2018, 2020 and 2022 annual submissions of Kazakhstan have not yet been published. Therefore, 2018, 2020 and 2022 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 2023 inventory submission

9. Table 5 presents findings made by the ERT during the individual review of the 2023 inventory submission of Kazakhstan that are additional to those identified in table 3.

Table 5
Additional findings made during the individual review of the 2023 inventory 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.62	1. General (energy sector) – all fuels – CO_2, CH_4 and N_2O	The ERT noted numerous errors linked to data entries that resulted in unusual IEFs (outliers) and inter-annual changes in the IEFs and related emissions, such as: (a) The inter-annual changes in the CH_4 IEF for subcategory 1.A.3.e.i pipeline transport – gaseous fuels for 2011/2012 (22.54 per cent) and 2012/2013 (62.71 per cent) are significant and not explained in the NIR; (b) The CO_2 IEF for subcategory 1.A.3.a domestic aviation – jet kerosene for 2021 (7.15 t/TJ) is outside the range of the IPCC default values (69.8–74.4 t/TJ). For 2021, the reported value (7.15 t/TJ) is the lowest of all reporting Parties (70.78–73.49 t/TJ for other reporting Parties) and almost 10 times lower than the lowest	Yes. Convention reporting adherence

ID#	Finding classification	Description of finding with recommendation or encouragement	Is finding an issue/problem?[a]
		value (70.78 t/TJ). The inter-annual change for 2020/2021 (–90 per cent) is also larger than those of other reporting Parties. The CH_4 and N_2O IEFs for domestic aviation – jet kerosene for 2021 (0.05 and 0.20 kg/TJ) are also outside the range of the IPCC default values (0.215–1.00 kg/TJ and 0.60–5.00 kg/TJ respectively); they are also the lower than all other reporting Parties (0.36–5.53 kg/TJ for CH_4 and 1.98–6.61 kg/TJ for N_2O for other reporting Parties) and several times as low as the second lowest value (0.36 kg/TJ for CH_4 and 1.98 kg/TJ for N_2O). The inter-annual change for 2020/2021 (–90 per cent) is also larger than those of other reporting Parties; (c) The N_2O IEF for gasoline for 2020–2021 (32.00 kg/TJ) for subcategory 1.A.3.d domestic navigation is the highest of all other reporting Parties (0.30–2.00 kg/TJ) and more than twice as high as the second highest value (2.00 kg/TJ). In addition, for other years (1990–2019), the reported value (3.20 kg/TJ) is also the highest of all reporting Parties (0.23–3.20 kg/TJ). The inter-annual change for 2019/2020 (900 per cent) is larger than those of other reporting Parties. During the review, the Party noted the errors and indicated its intention to correct them in the next submission. The ERT recommends that the Party correct data entry errors and ensure the reporting of accurate and consistent time series of the CH_4 IEF for subcategory 1.A.3.e.i pipeline transport – gaseous fuels; the CO_2, CH_4 and N_2O IEFs for subcategory 1.A.3.a domestic aviation – jet kerosene; and for the N_2O IEF for subcategory 1.A.3.d domestic navigation – gasoline.	
E.63	1.B.1.b Solid fuel transformation – solid fuels – CO_2 and CH_4	Significant recalculations were performed for CH_4 and CO_2 emissions for subcategory 1.B.1.b solid fuel transformation. The AD for 2019 were reported as 104.81 Mt in the 2023 submission, but as 4.24 Mt in the 2022 and 2021 submissions. The CH_4 IEF was also revised from 2.82E-05 kg/t reported in the 2019 and 2021 submissions to 1.67E-04 kg/t reported in the 2023 submission. A similar change was also observed for the CO_2 IEF. The NIR (section 3.5.2.5, p.160–161) provides only general information, explaining that the recalculations were performed for all subcategories included under category 1.B.1 solid fuels without providing a specific paragraph on solid fuel transformation. During the review, the Party clarified that recalculations were performed owing to the availability of additional information, including country-specific parameters. It further clarified that the scope of subcategory 1.B.1.b includes emissions from uncontrolled burning of coal dumps (i.e. waste dumped during coal exploitation activities) (referred to as endogenous fires in the unofficial translation of the NIR provided to the ERT), as presented in the NIR (p.147), and not from solid fuel transformation. The Party also provided additional information on underground coal mining in Kazakhstan relevant to uncontrolled combustion of waste heaps, as well as the country-specific parameters used to estimate the emissions for the category. The ERT noted that, according to the footnotes to CRF table 1.B.1, emissions from coke and charcoal production should be included under subcategory 1.B.1.b and, according to the 2006 IPCC Guidelines (vol. 2, chap. 4, p.4.8), CO_2 emissions from uncontrolled combustion due to coal exploitation activities should be reported under subcategory 1.B.1.b. The ERT further noted that no emissions from coke or charcoal production are reported by the Party. Taking into consideration the inconsistency between the 2006 IPCC Guidelines and the UNFCCC Annex I inventory reporting guidelines, the ERT recommends that the Party introduce a new subcategory under	Yes. Comparability

ID#	Finding classification	Description of finding with recommendation or encouragement	Is finding an issue/problem?[a]
		subcategory 1.B.1.c other to report emissions from uncontrolled combustion of coal dumps. The ERT also recommends that the Party include a clarification in the NIR on the allocation of these emissions in the CRF tables, along with information on the methods and country-specific parameters used in the estimates.	
E.64	1.B.2 Oil, natural gas and other emissions from energy production – liquid and gaseous fuels – CO_2 and CH_4	The Party reported in its NIR (e.g. p.171) that three timelines were applied to transition from the default EFs provided in table 4.2.5 of the 2006 IPCC Guidelines to those in table 4.2.4 (vol. 2, chap. 4, pp.4.55 and 4.48 respectively), namely 1990–1997, 1998–2010 and 2011–2021 (see ID# E.43 in table 3). However, the ERT noted that: (a) For all subcategories for which the Party used default EFs from tables 4.2.4–4.2.5 of the 2006 IPCC Guidelines, the starting year for using data from table 4.2.4 was 2010, not 2011 as indicate in the NIR; (b) The information provided in the NIR is not clear with regard to how the EF data used for the transition period (1998–2009) were determined. It states (p.171) that the Party took into account the penetration rate of advanced equipment installed in oil and gas systems (increasing by 8 per cent per year). However, no further information to illustrate the process was provided. In addition, the NIR does not provide information on the density of oil, which is essential for making a comparison against the default EFs provided by the 2006 IPCC Guidelines, where the unit used as the basis of the EFs is m^3: the AD reported by the Party in the CRF tables for subcategory 1B.2.a oil are in kt. During the review, the Party provided information on the oil density value used for the conversion (859 kg/m^3), clarified that the starting year for using data from table 4.2.4 of the 2006 IPCC Guidelines was 2010, not 2011, and provided additional documents to illustrate the approach followed to estimate the EFs for the transition period (1998–2009), taking oil exploration as an example. The ERT recommends that the Party report transparently on the way in which the EFs used for category 1.B.2 were determined by providing the necessary information on oil density, correct timelines for the application of the EFs and an example to illustrate the process for selecting the EFs for the transition period (1998–2009).	Yes. Transparency
E.65	1.B.2.a Oil – liquid fuels – CH_4	The Party reported in CRF table 1.B.2 that the CH_4 IEF for subcategory 1.B.2.a.i oil – exploration increases across the time series, from 213.12 kg/kt oil produced in 1990 to 225.72 kg/kt oil produced in 2021. However, according to the description provided in the NIR (p.171), a tier 1 method was used and the EFs used for this subcategory are based on a transition from the default EFs in table 4.2.5 of the 2006 IPCC Guidelines (applicable to developing countries and countries with economies in transition) to the EFs in table 4.2.4 (vol. 2, chap. 4, pp.4.55 and 4.48 respectively) (applicable to developed countries), which means that the IEF should be decreasing gradually across the time series. During the review, the Party clarified that the discrepancy might have been caused by a technical error and indicated that the data will be further checked and documented in the next inventory submission. The ERT recommends that the Party revise the EFs used for estimating the CH_4 EFs for subcategory 1.B.2.a.i oil – exploration, as appropriate, and include the revised emission estimates in CRF table 1.B.2 and the NIR, or explain in the NIR why the CH_4 IEF for this subcategory increases across the time series.	Yes. Accuracy
E.66	1.B.2.a Oil – liquid fuels – CO_2	The Party reported in CRF table 1.B.2 that the CO_2 IEF for subcategory 1.B.2.a.i oil – exploration generally decreases across the time series, from 11,844.93 kg/kt oil produced in 1990–1997 to 10,595.93 kg/kt oil	Yes. Accuracy

ID#	Finding classification	Description of finding with recommendation or encouragement	Is finding an issue/problem?[a]
		produced in 2010–2020 and 10,595.96 kg/kt in 2021, equivalent to 1.02E-02 Gg/10^3 m^3 and 9.10E-03 Gg/10^3 m^3 respectively (assuming the density of oil is 859 kg/m^3). However, the value of the IEF is lower for 2008 and 2009 (10,476.94 kg/kt and 10,532.47 kg/kt respectively) than for 2010–2020 (10,595.93 kg/kt), which is not consistent with the overall trend in the IEFs. In addition, although the data for 2010–2021 are consistent with the default EFs listed in table 4.2.4 of the 2006 IPCC Guidelines (vol. 2, chap. 4, p.4.48) (i.e. the sum of 1.00E-04 Gg/10^3 m^3 for well drilling, 9.00E-03 Gg/10^3 m^3 for well testing and 1.90E-06 Gg/10^3 m^3 for well services), the data for 1990–1997 are different from those in table 4.2.5 of the 2006 IPCC Guidelines (vol. 2, chap. 4, p.4.55), which provides an average value of 8.04E-02 Gg/10^3 m^3 (i.e. the sum of the average values from the range for well drilling (9.00E-04 Gg/10^3 m^3), well testing (7.95E-02 Gg/10^3 m^3) and for well services (1.70E-05 Gg/10^3 m^3)). During the review, the Party clarified that this discrepancy might have been caused by a technical error and indicated that the data will be further checked and documented in the next submission.	
		The ERT recommends that the Party revise, if appropriate, the CO_2 emission estimates for subcategory 1.B.2.a.i oil – exploration reported in CRF table 1.B.2 and the NIR, or explain why the CO_2 IEF for this subcategory fluctuates and is not consistent with the data in table 4.2.5 of the 2006 IPCC Guidelines (vol. 2, chap. 4, p.4.55) for 1990–1997.	
E.67	1.B.2.b Natural gas – gaseous fuels – CO_2 and CH_4	Similarly to the other subcategories under category 1.B.2, the Party highlighted in the NIR (p.174) that the EFs used for natural gas processing are from tables 4.2.4–4.2.5 of the 2006 IPCC Guidelines (vol. 2, chap. 4, pp.4.48 and 4.55 respectively). However, the data reported for subcategory 1.B.2.b.3 gas – processing in CRF table 1.B.2 do not correspond with those presented in tables 4.2.4–4.2.5. For example, the CH_4 IEF for 1990–1997 reported in CRF table 1.B.2 is 12,190 kg/Mm^3 (equal to 1.22E-02 Gg/Mm^3), which is different from the EFs in table 4.2.5, namely 1.59E-04 Gg/Mm^3 for sour gas plants (the average of the range 9.70E-05 Gg/Mm^3–2.20E-04 Gg/Mm^3), or 7.90E-04 Gg/Mm^3 for sweet gas plants (the average of the range 4.80E-05–1.10E-03 Gg/Mm^3). A similar inconsistency was also observed for CH_4 IEF for 2010–2021 and for the CO_2 IEF. During the review, the Party clarified that the gas processed in Kazakhstan is sour gas and that a technical error occurred when calculating the EFs using tables 4.2.4–4.2.5 of the 2006 IPCC Guidelines. In addition, the Party provided the revised CH_4 and CO_2 emission estimates for gas processing for the whole time series.	Yes. Accuracy
		The ERT recommends that the Party correct the identified errors in the EFs used for calculating the CH_4 and CO_2 emissions for subcategory 1.B.2.b.3 natural gas – processing and document the revised EF and emission estimates in CRF table 1.B.2 and the NIR, or explain why the EFs reported for subcategory 1.B.2.b.3 in CRF table 1.B.2 do not correspond with those presented in tables 4.2.4–4.2.5 of the 2006 IPCC Guidelines (vol. 2, chap. 4, pp.4.48 and 4.55 respectively).	
E.68	1.B.2.b Natural gas – gaseous fuels – CO_2 and CH_4	The CH_4 IEF of 480 kg/Mm^3 for subcategory 1.B.2.b.4 natural gas – transmission and storage for 2010–2021 corresponds to the upper end of the data range listed in table 4.2.4 of the 2006 IPCC Guidelines (vol. 2, chap. 4, p.4.48), namely 6.60E-05–4.80E-04 Gg/Mm^3 (equal to 66–480 kg/Mm^3). However, as highlighted in the NIR (p.174) the average of the IPCC range (273 kg kg/Mm^3) was generally used if the default EFs provided in the 2006 IPCC Guidelines were provided as a range of values. For 1990–1997, the Party reported a CH_4 IEF of 1,066.50 kg/Mm^3, which is different from the data listed in table 4.2.5 of the 2006 IPCC Guidelines (vol. 2, chap. 4, p.4.55), namely 16.6E-05–1.10E-03 Gg/Mm^3 (equal to 166–1,100 kg/Mm^3, with an average of 633 kg/Mm^3).	Yes. Accuracy

ID#	*Finding classification*	*Description of finding with recommendation or encouragement*	*Is finding an issue/problem?*[a]
		The CO_2 IEF was reported as 6.83 kg/Mm^3 for 1990–1997, which differs from the data listed in IPCC table 4.2.5, namely 8.80E-07–2.00E-06 Gg/Mm^3 (equal to 0.88–20 kg/Mm^3, with an average of 1.44 kg/Mm^3), and for 2020–2021 it was reported as 4.09 kg/Mm^3, which also differs from the data listed in table 4.2.4 of the 2006 IPCC Guidelines, namely 8.80E-07 Gg/Mm^3 (equal to 0.88 kg/Mm^3).	
		During the review, the Party clarified that for the CH_4 EF for 2010–2021, the upper range of EFs presented in table 4.2.4 of the 2006 IPCC Guidelines was chosen on the basis that companies have expressed their intention to improve their emission reduction performance in the future. The Party further clarified that technical errors may have led to the discrepancies identified between the CH_4 EF for 1990–1997 and the CO_2 EF for 1990–1997 and 2010–2021 presented in CRF table 1.B.2 with the data in tables 4.2.4–4.2.5 of the 2006 IPCC Guidelines and indicated that it is planning to check them.	
		The ERT recommends that the Party check the EFs used for the CH_4 and CO_2 emission estimates for subcategory 1.B.2.b.4 natural gas transmission and storage for the whole time series by including further clarification in the NIR as to why the upper range of the EFs presented in table 4.2.4 of the 2006 IPCC Guidelines was used instead of the average value, as well as correcting any possible errors and documenting the revised results in the NIR and CRF tables if any recalculations are performed.	
E.69	1.B.2.c Venting and flaring – liquid and gaseous fuels – CO_2 and CH_4	The Party reported in CRF table 1.B.2 the AD used for oil venting (category 1.B.2.c.i) with a value of 100,382.66 for 2021 described as oil production using the unit 10^3 m^3. Using the oil density value of 859 kg/m^3 provided by the Party (see ID# E.64 above), the AD is equal to 86,228.70 kt for 2021. This value differs from the data reported under subcategory 1.B.2.a.2 oil –production (86,879.31 kt) and the data reported in CRF table 1.A(b) for crude oil production (74,733.22 kt). Such differences occur across the entire time series. During the review, the Party clarified that the reasons for the differences may be related to the data updating carried out by the Bureau of National Statistics during or after the preparation of the GHG inventory, and that further checks will be made.	Yes. Accuracy
		The ERT recommends that the Party ensure the consistency of the value for oil production that is used as AD for category 1.B.2.c.i (oil venting) with the AD used for category 1.B.2.a.2 oil – production and with the data on oil production reported in CRF table 1.A(b), or include an explanation for any inconsistencies in the NIR.	
IPPU			
I.34	2.B.1 Ammonia production – CO_2	The Party reported in the NIR (section 4.3.1.5, pp.206–207) information on recalculations and improvements for category 2.B.1 ammonia production. Significant recalculations were performed for the CO_2 EF compared with the 2022 submission, as a result of which the constant CO_2 IEF (2.10 t/t) used in the 2022 submission was replaced with a constant EF for 1990–2005 (2.18 t/t) and a changing IEF from 2006 onwards (ranging from 1.59 to 2.53 t/t); for example, the recalculation for 2019 resulted in a decrease by 24.3 per cent, from 2.10 to 1.59 t/t. The ERT also noted that the CO_2 IEF for 2021 (1.64 t/t) is outside the IPCC default range of 1.67–3.27 t/t (2006 IPCC Guidelines, vol. 3, chap. 3, table 3.1, p.3.15). In addition, the inter-annual changes in the CO_2 IEF for 2009/2010 (31.04 per cent), 2010/2011 (–12.90 per cent) and 2018/2019 (–14.17 per cent) were also identified as larger than those of other reporting Parties. The NIR (pp.204–206) describes in detail the methodology used for calculating the emission estimates for this category and notes the recalculations made. However, the NIR does not provide clear information on the significant decrease in the IEF by 24.3 and 20.3	Yes. Transparency

ID#	Finding classification	Description of finding with recommendation or encouragement	Is finding an issue/problem?[a]
		per cent for 2019 and 2020 respectively or whether any validation processes were applied to ensure the accuracy and reliability of the AD and emission data provided by the only ammonia plant, KazAzot JSC. During the review, the Party clarified that the calculation method was revised from tier 1 to tier 2, considering natural gas used for ammonia production as the AD. The AD were provided directly by KazAzot JSC which was founded in 2005: data on the use of natural gas for 1990–2005 were obtained by calculation as a percentage of the total production of ammonia, whereas for 2006–2021 actual data on natural gas consumption were used. The Party explained that the decrease in the CO_2 IEF (e.g. from 2.25 t/t in 2006 to 1.64 t/t in 2021) is caused by a reduction in actual fuel consumption per unit of production. The Party confirmed the reliability of the data provided by KazAzot JSC submitted officially for the purposes of the inventory. The ERT recommends that the Party enhance the transparency of the NIR by justifying the trend and values of the CO_2 EF used and the measures taken by the Party to ensure the accuracy and reliability of the input data (natural gas used and ammonia production) provided by the ammonia plant.	
I.35	2.C.1 Iron and steel production – CO_2	The Party reported in the NIR (section 4.4.1.5, pp.223–224) information on recalculations and improvements for category 2.C.1 iron and steel production. Significant recalculations were performed for subcategory 2.C.1.d sinter, resulting in an increase for the CO_2 IEF of 425.1 per cent for 2020, from 0.17 to 0.88 t/t. The 2021 value (0.82 t/t) is outside the IPCC default range of 0.15–0.25 t/t (2006 IPCC Guidelines, vol. 3, chap. 4.2.2.3, p.4.27). The CO_2 IEF ranges from 0.73 to 1.73 t/t across the time series. It was not clear from the explanation provided in the NIR what the drivers were for the substantial increase in the CO_2 IEF for sinter production, and how the newly adopted tier 2 methodology contributed to the recalculated CO_2 IEF values. The NIR also does not specify how coke breeze and gas combustion emissions were quantified, how the accuracy and reliability of the AD were verified and validated, and whether any external audits or other procedures were conducted to ensure the quality of the updated calculations. Although the Party indicated that the fuel used as feedstock in the IPPU sector is excluded from the energy sector (NIR p.219), no NEU of fuels was reported for iron and steel production in CRF table 1.A(d). During the review, the Party clarified that CO_2 emissions from sinter production were accounted for using the IPCC tier 2 method based on an extensive analysis, encompassing emissions from coke breeze use and natural gas combustion across the time series. In addition, the Party explained that ArcelorMittal Temirtau JSC (the major producer in the sector) initially used the IPCC tier 2 method for accounting CO_2 emissions from sinter production, but in response to a request from the national inventory team, it provided more detailed data on sinter production activities, including factors such as gas consumption, materials used and off-gas transport, which is likely to result in a more accurate emission calculation. In addition, the Party explained that the CO_2 emissions from sinter production were determined through two primary sources: emissions from the use of coke breeze, and emissions from natural gas combustion, including the consumption of coke oven gas by the sinter furnace and blast furnace gas for sinter production, with gas consumption calculated in “tsf” (t standard fuel) and TJ, factoring in the carbon content in natural gas, which was not considered in previous calculations that relied on default values and gas density conversions. Finally, the accuracy and reliability of the recalculated emission data for the category were verified through a process similar to the one applied for the calculations performed by counterparts in the Russian Federation following a training seminar held in September 2022 at the Institute of Global Climate and Ecology. Data verification was further ensured through checks conducted by various State bodies, including the Bureau of National Statistics and the State Revenue	Yes. Transparency

ID#	*Finding classification*	*Description of finding with recommendation or encouragement*	*Is finding an issue/problem?*[a]
		Committee of the Ministry of Finance, to maintain QC of initial data and GHG emission calculations. The Party also indicated its plans to identify the factors that led to the significant increase in the CO_2 IEF for sinter production for the next inventory submission. The ERT recommends that the Party document in the NIR the factors that drove the substantial recalculation in the CO_2 IEF for sinter production (by 425.1 per cent for 2020 compared with the 2022 submission), how coke breeze and natural gas emissions were quantified, and the assumptions used and measures taken by the Party to ensure the accuracy and reliability of the tier 2 CO_2 estimates for subcategory 2.C.1.d sinter. The ERT encourages the Party to consistently report the NEU of fuels in the IPPU sector and in CRF table 1.A(d).	
I.36	2.F.1 Refrigeration and air conditioning – HFC-143a	The Party reported in its NIR (section 4.7.3.11, pp.274–275) that the time series of the emissions from category 2.F.1 was recalculated taking into account losses from the equipment used (the total bank of refrigerants) and the lifespan of that equipment. The ERT noted that CRF table 2(II)B-Hs2 was updated and contains emissions from stocks and disposal. However, while the disposal loss factor used across all gases and subcategories is 100 per cent, for subcategory 2.F.1.a commercial refrigeration a disposal loss factor of 10 per cent was reported for HFC-143a. The NIR contains no justification for the selected disposal loss factors. During the review, the Party stated that the different disposal loss factors reported was probably due to a technical error and that it will revise the disposal loss factor for HFC-143a for subcategory 2.F.1.a reported in CRF table 2(II).B-Hs2 in the next inventory submission. The ERT recommends that the Party correct the disposal loss factor for HFC-143a (10 per cent) and the related HFC-143a emissions for subcategory 2.F.1.a commercial refrigeration and clearly describe the reasons and assumptions for the choice of the disposal loss factors used in the inventory.	Yes. Accuracy
I.37	2.F.1 Refrigeration and air conditioning – HFC-125, HFC-134a and HFC-143a	The Party reported in its NIR (section 4.7.3.7, p.267) that existing semi-trailers were produced in the last decade and, according to technical regulations, the service life of refrigerated semi-trailers is 10–12 years. The NIR (section 4.7.3.7, p.250) also states that studies show that most of the refrigerated semi-trailers in service in the country have been used for more than 10 years and that their refrigeration systems are refilled almost annually. However, in CRF table 2(II).B-Hs2, the Party reported product life factors for subcategory 2.F.1.d transport refrigeration within a range of 3–5 per cent. The Party reported that it used a default product life factor; however, the 2006 IPCC Guidelines (vol. 3, chap. 7, table 7.9) provide a default range of 15–50 per cent. The product life factor reported by the Party for HFC-125 (5 per cent), HFC-134a (3 per cent) and HFC-143 (5 per cent) are the lowest of all reporting Parties (which range from 12–100, 6.18–100 and 7–100 per cent respectively, for the other reporting Parties). During the review, the Party stated that it will revise the explanations on semi-trailers in the NIR and provided an Excel file which the ERT used to review the calculations and determined a product life factor percentage that was closer in magnitude to the 3–5 per cent value reported by the Party in the CRF tables (approximately 6.4 per cent). The ERT recommends that the Party check and revise the product life factor used, as needed, to ensure consistency with the IPCC default range (15–50 per cent in the 2006 IPCC Guidelines, vol. 3, chap. 7, table 7.9) and enhance and ensure the consistency of the description of the methodology and parameters used in estimating emissions for subcategory 2.F.1.d transport refrigeration between the CRF tables and the NIR. If the	Yes. Accuracy

ID#	Finding classification	Description of finding with recommendation or encouragement	Is finding an issue/problem?[a]
		Party continues to use the product life factor of 3–5 per cent, the ERT recommends that it include a justification in the NIR for using this country-specific value.	
Agriculture			
A.12	3.A Enteric fermentation – CH_4	The Party reported in its NIR (section 5.2.2, p.291) that a tier 2 method was used to calculate CH_4 emissions from dairy cattle, non-dairy cattle and sheep, while the key parameters used for calculating gross energy (such as daily weight gain for dairy cattle, non-dairy cattle and sheep, and the live body weight at one year old or at slaughter for sheep, if slaughtered prior to one year of age) were not reported in the NIR. In addition, according to the NIR (table 5.6, p.293) the average live weight of dairy cattle remains unchanged, but the average daily milk production changes for every year of the time series, from the lowest value of 4.12 kg/day for 1996 to the highest value of 6.48 kg/day for 2020 (a difference of 57.3 per cent). During the review, the Party clarified that the daily weight gain for cattle was assumed to be zero since there are no available dynamic and reliable data on it. In the calculations of gross energy, the Party did not distinguish sheep by age, since there is no such statistical information available in the country, nor is there any information available on the weight characteristics of sheep at slaughter at one year old. The Party indicated that it will make efforts to provide additional information in the next inventory submission. The ERT recommends that the Party transparently explain in its NIR the data, parameters and assumptions used as input for the tier 2 estimates for CH_4 emissions from dairy cattle, non-dairy cattle and sheep (such as daily weight gain and live body weight). The ERT encourages the Party to make every effort to collect data on daily weight gain for dairy and non-dairy cattle, and weight gain and live body weight at one year old or at slaughter for sheep, if slaughtered prior to one year of age, to improve the accuracy of the CH_4 emission estimates for dairy cattle, non-dairy cattle and sheep.	Yes. Transparency
A.13	3.A Enteric fermentation – CH_4	Enteric fermentation is a key category according to the key category analysis reported by the Party in its NIR (section 1.5, pp.45, and annex 1, pp.431–443). Dairy cattle, non-dairy cattle and sheep contributed more than 90 per cent of the total CH_4 emissions from enteric fermentation, accounting for 47.06, 27.38 and 15.91 per cent respectively in 2021 (section 5.2.1, p.291). According to the 2006 IPCC Guidelines (vol. 4, chap. 10, p.10.9), classifying livestock populations into subcategories for each species according to age, type of production and sex is good practice for estimating the emissions using enhanced characterization of key categories. However, the Party did not use enhanced characterization for dairy cattle, non-dairy cattle and sheep. During the review, the Party clarified that it attempted to classify livestock as much as possible in accordance with the 2006 IPCC Guidelines, but there are no AD available in the country to further disaggregate the estimates for these animal subcategories. Consequently, the calculations were carried out at the level of animal species. The Party indicated that it will make efforts to collect additional information to enhance the accuracy of the estimates. The ERT encourages the Party to make efforts to subdivide cattle and sheep by subcategory and collect the data required to calculate gross energy intake based on an enhanced characterization in order to improve the accuracy of the CH_4 emission estimates for enteric fermentation.	Not an issue/problem

ID#	*Finding classification*	*Description of finding with recommendation or encouragement*	*Is finding an issue/problem?*[a]
A.14	3.C.1 Irrigated – CH_4	The Party reported in its NIR (section 5.4.1, p.309) that rice is cultivated during a shortened period of flooding with the introduction of mineral N and organic fertilizers. The Party also reported in the NIR (p.292) that the adjusted CH_4 emission scaling factor for organic amendment is 3.10 using equation 5.3 and the default conversion factors from table 5.14 of the 2006 IPCC Guidelines (vol. 4, chap. 5, p.5.51). However, no information was provided on the type(s) of organic amendment and the application rate(s) in the NIR and in CRF table 3.C. During the review, the Party clarified that manure is usually used as an organic additive when growing rice in Kazakhstan and its application rates were estimated at 41–42 t farm manure/ha. The Party indicated its intention to provide information on the type of organic amendments used and the related application rates in the next inventory submission. The ERT considers that the scaling factor for organic amendment used in the NIR (3.10) is correct if the organic additive was manure and its application rates were at 41–42 t farm manure/ha. The ERT recommends that the Party improve the description of the methodology used to estimate CH_4 emissions for category 3.C.1 (irrigated – rice cultivation), including the data used for the types of organic amendment and the related application rates for rice cultivation.	Yes. Transparency
A.15	3.D.a Direct N_2O emissions from managed soils – N_2O	The Party reported in NIR table 5.26 (p.310) that the areas of rice cultivation between 1990 and 1996 are 90.0–124.0 kha. The Party also reported in NIR table 5.28 (pp.314–315) that zero mineral N fertilizers were applied to rice fields during the same period. The mineral N fertilizers applied to rice fields were reported for the rest of the time series. The ERT noted that as the N_2O EF for rice fields, which are not separated for the other managed soils, is lower than for the rest of the fields (NIR table 5.29, p.317), this could result in the higher estimates of N_2O emissions from managed soils regarding application of mineral N fertilizers for 1990–1996. During the review, the Party clarified that it relied on official data on application of mineral N fertilizers (NIR table 5.29, pp.314–215) from the Bureau of National Statistics to calculate the emission estimates. Further, the Party stated that the application of mineral N fertilizers to rice fields for 1990–1996 will be checked and information provided in the next NIR. The ERT recommends that the Party check the information reported on the application of mineral N fertilizers using official data from the Bureau of National Statistics. If information on the application of mineral N fertilizers is not available in the official data from the Bureau of National Statistics, the ERT recommends that the Party report AD for mineral N fertilizers applied to rice fields on the basis of an analysis of the relationship between the rice cultivation area and the mineral N fertilizers applied to rice fields using the data for 1997–2021 and, on the basis of that analysis, use assumptions for mineral N fertilizers applied to rice fields for 1990–1996, revise the related N_2O emissions and explain the recalculation in the NIR.	Yes. Accuracy
A.16	3.D.a.5 Mineralization/immobilization associated with loss/gain of soil organic matter – N_2O	The Party reported "NO" for 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 in CRF table 3.D for 1990, while the net CSC in soils was reported as –2,277.3 kt C for 1990 in the NIR (table 6.3.5, pp.375–376) and in CRF table 4.B. The ERT noted that AD and N_2O emission estimates from subcategory 3.D.a.5 were reported for 1990 in the 2022 submission.	Completeness

ID#	Finding classification	Description of finding with recommendation or encouragement	Is finding an issue/problem?[a]
		During the review, the Party explained that there appears to have been a technical error in the carbon loss AD for cropland for 1990 and that the emission estimates for this subcategory will be recalculated for the next NIR. The ERT recommends that the Party report correct carbon loss AD for cropland for 1990 and report the N_2O emissions from mineralization of soil organic matter across the entire time series reflecting the recalculation made in the NIR.	
A.17	3.D.a.5 Mineralization/immobilization associated with loss/gain of soil organic matter – N_2O	The Party reported in the NIR (p.318) that the amount of N released during the mineralization of soil organic matter was calculated using data on changes in the reserves of soil organic carbon in arable land in accordance with the 2006 IPCC Guidelines. The ERT was unable to replicate the calculations for the AD of N in mineral soils that is mineralized in association with the loss of soil carbon reported in CRF table 3.D using equation 11.8 of the 2006 IPCC Guidelines (vol. 4, chap. 11, p.11.16), the net CSC in mineral soils (NIR table 6.3.5, pp.375–376, and CRF table 4.B), or the C:N ratio of arable land (NIR p.318). During the review, the Party clarified that only arable land that is in crop rotation, rather than entire volume of carbon loss from cultivated land, was included in the calculation of N mineralization associated with loss of soil carbon. The Party also confirmed that it is not possible to provide the net soil organic CSCs for arable land remaining in crop rotation, arable land removed from crop rotation to fallow (pastures), land returned to crop rotation and perennial planting, respectively, owing to the inconsistency of the source data used for the calculations. However, the Party indicated that it will check and improve the estimates of N emissions from mineralization/immobilization associated with loss/gain of soil organic matter in its next inventory submission. The ERT recommends that the Party (a) report the N mineralization associated with loss of soil organic matter under the cropland subcategories arable land remaining in crop rotation, arable land removed from crop rotation to fallow (pastures), land returned to crop rotation and perennial plantings; (b) ensure consistency between the net CSCs used for calculating N mineralization associated with the net CSCs in cropland subcategories under the LULUCF sector; and (c) 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.	Yes. Accuracy
A.18	3.D.b Indirect N_2O emissions from managed soils – N_2O	The ERT was unable to replicate the calculation of N leaching and run-off for subcategory 3.D.b.2 for 2021 using country-specific value of $Frac_{LEACH-(H)}$ (0.1) and the AD for N inputs to soils from inorganic N fertilizers, organic N fertilizers, N from urine and dung deposited by grazing animals, N from crop residues and N mineralization/immobilization associated with loss/gain of soil organic matter reported in CRF table 3.D. N leaching and run-off was estimated by the ERT to amount to 266,718,360 kg N/year, compared with 267,431,197 kg N/year reported by the Party in CRF table 3.D. During the review, the Party provided a worksheet to show how it calculated N leaching and run-off reported in CRF table 3.D. The calculated N from crop residues (subcategory 3.D.a.4) was 187,880,000 kg N/year in the worksheet compared with 180,750,000 kg N/year reported in CRF table 3.D. The Party confirmed that a technical error occurred when calculating N from crop residues in the worksheet, which caused the incorrect estimate of total N leaching and run-off reported in CRF table 3.D for subcategory 3.D.b.2. The Party indicated that it is planning to resolve this issue for the next inventory submission.	Yes. Accuracy

ID#	*Finding classification*	*Description of finding with recommendation or encouragement*	*Is finding an issue/problem?*[a]
		The ERT recommends that the Party check the AD and emissions for N leaching and run-off and report corrected values in CRF table 3.D for 2021 and explain this recalculation in the NIR.	
LULUCF		No findings for the LULUCF sector additional to those included in table 3 were made by the ERT during the review.	
Waste			
W.35	5.A Solid waste disposal on land – CH_4 and N_2O	The Party recalculated emissions for category 5.A solid waste disposal on land (see ID#s W.11 and W.20 in table 3). The emissions from Almaty were no longer reported under semi-aerobic landfills in the 2023 submission and the recalculations were performed for the entire time series for the landfill in Astana and all other SWDS in Kazakhstan. However, details of the recalculations were not well-documented in the NIR. During the review, in order to understand the AD, methodologies and parameters used, the ERT requested the Party to share the Excel spreadsheets based on the IPCC FOD method and asked various clarifying questions on the AD and parameters used, including the DOC values. When reviewing the information provided by the Party, the ERT noted many inconsistencies between the NIR, the CRF tables and the FOD Excel spreadsheets regarding the information on, for example, the total amount of disposed waste by category of SWDS (Astana and the rest of the country) and the MCFs used (i.e. 0.4 for unmanaged, shallow landfills reported in the NIR, compared with 0.8 for unmanaged, deep landfills used in the Excel files and 1.0 for managed landfills). NIR table 7.3 contains population data; however, it was not clear to the ERT how those data were applied in the emission estimates. Annual waste generation rates were indicated (p.400) but the ERT was not able to reproduce the emission estimates based on the provided information. During the review, the Party clarified that it estimated emissions using data on the volume of total MSW generated annually provided by the Bureau of National Statistics and that the population and waste generation rates reported in the NIR were not used as input data in the estimates. The Party allocated part of the waste volume to the city of Astana and categorized it as managed, and the MSW generated in the rest of the country was categorized as unmanaged. The Party confirmed that it applied the IPCC tier 1 methodology to estimate the emissions, using the default DOC value for bulk waste (0.15). All unmanaged waste landfill sites were considered to be deep and an MCF of 0.8 was applied. Considering the approach used by the Party and the availability of data, the ERT recommends that the Party recalculate the emissions from solid waste disposal for the entire time series using the IPCC FOD tier 2 method applying the following steps: (a) Revise the AD on MSW disposed using official statistics, where available; (b) Noting that Astana was built as a new capital city in 1997, identify when the city was equipped with the managed landfill site and reallocate the historical waste data for Astana prior to that year from managed to unmanaged landfill sites when calculating the emission estimates; (c) Distribute correctly the MSW data among different categories of SWDS, namely managed and unmanaged, deep and shallow, across the time series; (d) Revise the DOC values according to the morphological composition of waste throughout the time series;	Yes. Accuracy

ID#	*Finding classification*	*Description of finding with recommendation or encouragement*	*Is finding an issue/problem?*[a]
		(e) Conduct an additional study or literature research to distinguish between different climate zones in the country and calculate emissions from these zones separately in accordance with the 2006 IPCC Guidelines (vol. 5, chap. 3, p.3.11), in order to identify appropriate values of k that are required for the IPCC FOD tier 2 method; (f) Obtain data on generation and management of industrial waste, and estimate and report the associated emissions to enhance the completeness of the reporting on category 5.A solid waste disposal on land; (g) Obtain data on generation and management of sludge disposed in landfills, and estimate and report the related emissions; (h) Ensure that the data and method applied, as reported in the NIR, are consistent with the data reported in the CRF tables; (i) Provide well-documented information on the recalculations performed in the NIR, including on MSW by category of SWDS, clear and comprehensive descriptions of the AD and other parameters used for the emission estimates and information on how time-series consistency was ensured; (j) Include references to the statistical data and other sources of information used, including weblinks where available, to allow future ERTs to understand and replicate the estimates for the category.	
W.36	5.C.1 Waste incineration – CO_2, CH_4 and N_2O	The Party reported in its NIR (table 7.23, p.429) total emissions from clinical waste incineration for 2006–2021. Emissions reported for 2016 (60.45 kt CO_2 eq) and 2017 (33.37 kt CO_2 eq) were higher than for 2020 (30.97 kt CO_2 eq) and 2021 (0.12 kt CO_2 eq). In the NIR (section 7.41, p.426), the Party explained that initial data on amounts of clinical waste incinerated were derived from two different sources of information: for 1990–2018, data were provided by the Ministry of Health, while for 2019–2021 they were provided by the Information and Analytical Centre. However, the NIR contains no overall explanation as to how time-series consistency was ensured between the AD for the years until 2018 (provided by the Ministry of Health) and the AD for the rest of the time series (provided by the Information and Analytical Centre). In addition, the Party reported in its NIR (p.426) that in 2021 there was a significant decrease in GHG emissions from the incineration of clinical waste (by 253 times). The NIR also states (p.426) that, during informal exchanges, it was found that approximately 400 enterprises out of 1,000 did not report information in 2021, which affected the final emission estimates for 2021. The ERT considers that the AD used in the Party's reporting for 2021 are incomplete, resulting in an underestimation of emissions since 40 per cent of the incineration facilities were not included in the emission estimates. During the review, the Party informed the ERT that as per the data provided by the Ministry of Health the peak in emissions was for 2016 and 2017. The Party further informed the ERT that, because the data received from the Information and Analytical Centre is very heterogeneous, data from the Ministry of Health will be used for the next submission to recalculate the entire time series. The ERT recommends that the Party take the necessary steps to collect AD from all clinical waste incineration facilities in the country for all years in the time series in order to avoid underestimating emissions for clinical waste incineration and ensure the consistency of the time series by using the same method and data source(s) for all years or, in case of data gaps, apply an appropriate splicing technique for combining different methods	Yes. Accuracy

ID#	Finding classification	Description of finding with recommendation or encouragement	Is finding an issue/problem?[a]
		or data sets in accordance with the 2006 IPCC Guidelines (vol. 1, chap. 5) or, if using different data sources, verify their consistency.	
W.37	5.C.2 Open burning of waste – CO_2, CH_4 and N_2O	Following a previous recommendation (see ID# W.30 in table 3), the Party reported in the NIR (section 7.2.3, pp.401–403) estimates of CO_2, CH_4 and N_2O emissions from open burning of waste applying the IPCC tier 1 method to demonstrate that those emissions were insignificant, in accordance with paragraph 37(b) of the UNFCCC Annex I inventory reporting guidelines. The ERT noted that emissions from the individual gases do not exceed 500 kt CO_2 eq and are below 0.05 per cent of the national total emissions (excluding LULUCF) for all years of the time series (the estimated levels of emissions reach 64.75, 42.86 and 117.90 kt CO_2 eq for CO_2, CH_4 and N_2O respectively, across the time series, while the significance threshold for Kazakhstan's 2023 submission is 169.06 kt CO_2 eq). The Party reported the overall emissions from open burning of MSW in NIR table 7.5, which were not included in the national totals. However, the ERT noted that in CRF table 5.C all AD and emissions for open burning of waste under category 5.C.2 were reported as "NO", instead of "NE", which should be used together with a relevant explanation in CRF table 9 to ensure consistency with the reporting in the NIR and the UNFCCC Annex I inventory reporting guidelines. In addition, the Party did not provide any relevant information in the NIR on the composition of the incinerated waste, including the type of burned waste and the data source used to derive a likely level of emissions for the category. During the review, the Party clarified that the reporting in the CRF tables and the explanation in the NIR will be revised in the next inventory submission. The Party further clarified that equation 5.7 from the 2006 IPCC Guidelines (vol. 5, chap. 5.3.2, p.5.16) was used to calculate the total amount of open burning of municipal waste, and the share of the population burning waste was assumed to be 35 per cent, but no further information on the composition of incinerated waste was provided. The ERT noted that according to the 2006 IPCC Guidelines (vol. 5, chap. 5.4.1, p.5.18) data on waste composition is needed for estimating the dry matter content in per cent of wet weight, the total carbon content in per cent of dry weight and the fossil carbon fraction in per cent of the total carbon content. Those parameters are needed to estimate CO_2 emissions, according to the 2006 IPCC Guidelines (vol. 5, chap.5.2.1.1, p.5.7). The ERT recommends that the Party report the AD and emissions for open burning of waste under category 5.C.2 as "NE" along with a relevant explanation in CRF table 9 indicating their insignificance to ensure consistency with the reporting in the NIR and the UNFCCC Annex I inventory reporting guidelines. The ERT further recommends that the Party include in its NIR information on the data and assumptions used for the estimates, including on the composition of the waste subject to open burning and the parameters used for deriving a likely level of CO_2, CH_4 and N_2O emissions from open burning of waste.	Yes. Transparency
W.38	5.D.1 Domestic wastewater – CH_4	The Party reported in its NIR (table 7.7, p.408) the MCF values and CH_4 EF used for the different domestic wastewater treatment and discharge systems, namely centralized aerobic wastewater treatment plants, septic systems and latrines. The NIR does not explain whether there is industrial co-discharge in the domestic wastewater treatment systems. The ERT also noted that there is no reference in the NIR as to which "I" value (the correction factor for additional industrial discharge of biochemical oxygen demand into sewers systems) was used to estimate CH_4 emissions for each system in urban and rural areas. During the review, the Party clarified that industrial wastewater is not discharged without treatment and that it will include further clarifying information in the next submission.	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 clear information in its NIR on co-discharge of industrial wastewater into domestic wastewater treatment systems and on the "I" correction factor value used to estimate CH_4 emissions in accordance with equation 6.3 of the 2006 IPCC Guidelines (vol. 5, chap. 6.2.2.3, p.6.13).	

[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. Questions of implementation

10. No questions of implementation were identified by the ERT during the individual review of the Party's 2023 inventory submission.

Annex I

Overview of greenhouse gas emissions and removals as reported by Kazakhstan in its 2023 inventory submission

Tables I.1–I.3 provide an overview of the total GHG emissions and removals as reported by Kazakhstan.

Table I.1
Total greenhouse gas emissions and removals for Kazakhstan, base year–2021
(kt CO_2 eq)

	Total GHG emissions and removals excluding indirect CO_2 emissions		*Total GHG emissions and removals including indirect CO_2 emissions*[a]	
	Total including LULUCF	*Total excluding LULUCF*	*Total including LULUCF*	*Total excluding LULUCF*
1990	380 186.58	386 682.79	NA	NA
1995	278 393.85	260 567.69	NA	NA
2000	303 144.90	260 434.12	NA	NA
2010	381 414.87	315 855.51	NA	NA
2015	367 697.33	346 827.11	NA	NA
2020	342 098.12	333 970.96	NA	NA
2021	340 837.72	338 123.36	NA	NA

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

Table I.2
Greenhouse gas emissions and removals by gas for Kazakhstan, excluding land use, land-use change and forestry, 1990–2021
(kt CO_2 eq)

	CO_2[a]	*CH_4*	*N_2O*	*HFCs*	*PFCs*	*Unspecified mix of HFCs and PFCs*	*SF_6*	*NF_3*
1990	268 173.09	100 850.95	17 658.75	NO, NA	NA, NO	NO, NA	NA, NO	NO, NA
1995	168 285.93	58 941.95	33 335.36	4.45	NA, NO	NO, NA	NA, NO	NO, NA
2000	143 380.20	56 744.47	60 036.45	273.01	NA, NO	NO, NA	NA, NO	NO, NA
2010	248 803.23	47 605.14	17 749.90	1 072.99	622.50	NO, NA	1.73	NO, NA
2015	278 661.28	49 445.34	16 823.28	1 698.54	196.66	NO, NA	2.01	NO, NA
2020	255 486.48	55 943.08	19 998.59	2 529.75	10.75	NO, NA	2.31	NO, NA
2021	255 142.93	59 921.35	20 340.56	2 706.49	9.65	NO, NA	2.37	NO, NA
Percentage change 1990–2021	**–4.9**	**–40.6**	**15.2**	**NA**	**NA**	**NA**	**NA**	**NA**

[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, 1990–2021
(kt CO_2 eq)

	Energy	*IPPU*	*Agriculture*	*LULUCF*	*Waste*	*Other*
1990	316 244.47	22 737.40	43 860.95	–6 496.21	3 839.97	NO
1995	192 991.23	13 990.09	50 143.38	17 826.15	3 442.99	NO
2000	168 959.96	17 341.32	70 620.38	42 710.78	3 512.47	NO
2010	257 820.69	20 182.94	33 385.84	65 559.36	4 466.03	NO
2015	282 816.83	25 774.75	33 304.86	20 870.22	4 930.66	NO
2020	259 502.41	27 031.37	41 419.52	8 127.16	6 017.66	NO
2021	261 932.51	27 083.92	42 845.43	2 714.36	6 261.51	NO
Percentage change 1990–2021	**–17.2**	**19.1**	**–2.3**	**–141.8**	**63.1**	**NA**

Note: Kazakhstan did not report indirect CO_2 emissions in CRF table 6.

Annex II

Additional information to support findings in table 2

Missing categories that may affect completeness

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:

(a) 2.D.2 Paraffin wax use (CO_2) for 1990–2006 (see ID# I.21 in table 3);

(b) 3.D.a.5 Mineralization/immobilization associated with loss/gain of soil organic matter (N_2O) for 1990 (see ID# A.16 in table 5);

(c) 3.G Liming (CO_2) (see ID# A.11 in table 3);

(d) 4. General (LULUCF) forest land converted to other land-use categories (CO_2) (see ID# L.3 in table 3);

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

(f) 4.C.2 Land converted to grassland (CO_2) (see ID#s L.1 and L.18 in table 3);

(g) 4.D.2. Other land converted to wetlands (CO_2) (see ID# L.1 in table 3);

(h) 4(III) Direct N_2O emissions from N mineralization/immobilization (N_2O) (see ID# L.21 in table 3);

(i) 5.A Solid waste disposal (industrial waste) (CH_4) (see ID# W.19 in table 3);

(j) 5.B Biological treatment of solid waste – CH_4 and N_2O emissions from mechanical-biological treatment plant (see ID# W.21 in table 3).

Annex III

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/.

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C. Other documents used during the review

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