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Framework Convention on Climate Change

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Report on the individual review of the inventory submission of the United States of America submitted in 2019*

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). This report presents the results of the individual inventory review of the 2019 inventory submission of the United States of America, 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". The review took place from 7 to 12 October 2019 in Bonn.

* In the symbol for this document, 2019 refers to the year in which the inventory was submitted, not to the year of publication.

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Abbreviations and acronyms

2006 IPCC Guidelines	*2006 IPCC Guidelines for National Greenhouse Gas Inventories*
AD	activity data
C	carbon
CCS	carbon dioxide capture and storage
CH_4	methane
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"
CRF	common reporting format
DAYCENT	Daily Century (model)
DOC	degradable organic carbon
DOM	dead organic matter
EF	emission factor
EIA	United States Energy Information Administration of the Department of Energy
EOR	enhanced oil recovery
EPA	United States Environmental Protection Agency
ERT	expert review team
FIA	Forest Inventory and Analysis
GE	gross energy intake
GHG	greenhouse gas
GHGRP	Greenhouse Gas Reporting Program of the United States Environmental Protection Agency
GREET	Greenhouse Gases, Regulated Emissions and Energy Use in Transportation
HFC	hydrofluorocarbon
HWP	harvested wood products
IE	included elsewhere
IEF	implied emission factor
IPCC	Intergovernmental Panel on Climate Change
IPPU	industrial processes and product use
LULUCF	land use, land-use change and forestry
MMS	manure management system(s)
MMT	million metric tonnes
MOVES	Motor Vehicle Emission Simulator
MSW	municipal solid waste
N	nitrogen
N_2O	nitrous oxide
NA	not applicable
NE	not estimated
NEU	non-energy use
Nex	nitrogen excretion
NF_3	nitrogen trifluoride
NIR	national inventory report
NLCD	National Land Cover Database

NO	not occurring
NRI	United States Department of Agriculture National Resources Inventory
PFC	perfluorocarbon
QA/QC	quality assurance/quality control
SF_6	sulfur hexafluoride
SOC	soil organic carbon
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*
Ym	methane conversion rate

I. Introduction

1. This report covers the review of the 2019 inventory submission of the United States of America 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" (decision 13/CP.20). The review took place from 7 to 12 October 2019 in Bonn and was coordinated by Claudia do Valle and Sohel Pasha (secretariat). Table 1 provides information on the composition of the ERT that conducted the review of the United States.

Table 1
Composition of the expert review team that conducted the review of the United States of America

Area of expertise	*Name*	*Party*
Generalist	Elsa Hatanaka	Japan
	Baasansuren Jamsranjav	Mongolia
Energy	Matej Gasperic	Slovenia
	Haakon Marold	Australia
IPPU	Lorenz Moosmann	European Union
	Clemêncio Nhantumbo	Mozambique
	Samir Tantawi	Egypt
Agriculture	Britta Maria Hoem	Norway
	Mark Hunstone	Australia
LULUCF	Sekai Ngarize	Zimbabwe
	Atsushi Sato	Japan
Waste	Mayra Rocha	Brazil
	Sirinthornthep Towprayoon	Thailand
Lead reviewers	Mark Hunstone	
	Baasansuren Jamsranjav	

2. The basis of the findings in this report is the assessment by the ERT of the consistency of the Party's 2019 inventory submission with the UNFCCC review guidelines.

3. The ERT has made recommendations that the United States resolve the findings related to issues.[1] Other findings, and, if applicable, the encouragements of the ERT to the United States to resolve them, are also included.

4. A draft version of this report was communicated to the Government of the United States, which provided comments that were considered and incorporated, as appropriate, into this final version of the report.

5. Annex I shows annual GHG emissions for the United States, including totals excluding and including the LULUCF sector, indirect CO_2 emissions, and emissions by gas and by sector.

[1] Issues are defined in decision 13/CP.20, annex, para. 81.

II. Summary and general assessment of the 2019 inventory submission

6. Table 2 provides the assessment by the ERT of the 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 inventory of the United States of America

Assessment			*Issue ID#(s) in table 3 and/or 5*[a]
Date of submission	Original submission: 13 April 2019 (NIR), 13 April 2019 (CRF tables) version 1		
Review format	Centralized		
Application of the requirements of the UNFCCC Annex I inventory reporting guidelines and 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.6, E.15, L.19
	(c) Development and selection of EFs?	Yes	E.16, I.1, I.11, A.4, A.6, L.11, L.23, L.35, W.2
	(d) Collection and selection of AD?	Yes	E.14, E.22, A.5, A.7, A.12, A.14, L.8, L.17, L.29, L.42, L.43, W.8
	(e) Reporting of recalculations?	Yes	A.33
	(f) Reporting of a consistent time series?	Yes	A.26
	(g) Reporting of uncertainties, including methodologies?	Yes	G.4, E.2, A.2
	(h) QA/QC?	Yes	I.21, A.27, A.28, A.32, A.33, L.45
	(i) Missing categories/completeness?[b]	Yes	G.2, E.9, E.17, I.3, I.7, I.9, I.13, I.22, A.19, A.25, L.1, L.2, L.16, L.18, L.24, L.26, L.27, L.28, L.32, L.33, L.37, L.38, L.39, W.13
	(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.2
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	I.6, I.15, I.24, I.25
National inventory arrangements	Have any issues been identified with the effectiveness and reliability of the institutional, procedural and legal arrangements for estimating GHG emissions?	No	
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 the assessment of conformity with the UNFCCC Annex I inventory reporting guidelines and any further guidance adopted by the Conference of the Parties?	Yes	

Assessment			*Issue ID#(s) in table 3 and/or 5[a]*
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	

[a] The ERT identified additional issues in all sectors that are not listed in this table but are included in table 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 issues raised in the previous review report

7. Table 3 compiles all the recommendations made in previous review reports that were included in the previous review report, published on 5 November 2019.[2] For each issue, the ERT specified whether it believes the issue has been resolved by the conclusion of the review of the 2019 inventory submission and provided the rationale for its determination, which takes into consideration the publication date of the previous review report and national circumstances.

Table 3
Status of implementation of issues raised in the previous review report of the United States of America

ID#	*Issue classification[a, b]*	*Recommendation made in previous review report*	*ERT assessment and rationale*
General			
G.1	Annual submission (G.1, 2018) (G.1, 2016) (G.1, 2015) (9, 2013) (8, 2012) Completeness	Improve the completeness of the inventory, in particular for those categories for which there are methodologies in the 2006 IPCC Guidelines.	Addressing. The United States improved the completeness of the inventory. The Party still reports "NE" for a number of categories (see annex II for a list of the completeness issues identified by the ERT). The ERT noted that the Party's planned improvements include incorporating some of these categories into future submissions and/or providing additional information on the likely level of emissions and removals in annex 5 to the NIR (see also ID# G.2 in table 5).
Energy			
E.1	1. General (energy sector) – gaseous fuels – CO_2 and CH_4 (E.18, 2018) Accuracy	Implement the stated methodology (2018 NIR, annex 2.2, p.A-76, step 4) across the time series, conduct research and update, where necessary, the time series for 2007 onward of natural gas CO_2 EFs and natural gas composition data to determine CH_4 content, in order either to update the CO_2 EFs and CH_4 content applied in the national inventory, or to clearly show in the NIR that the EFs applied are accurate and representative of emissions across the time series.	Resolved. The CO_2 and CH_4 EFs reflect the updates to the annual carbon content for gaseous fuels for the entire time series. The Party reported (NIR p.3-36) that the annual natural gas carbon content was updated across the time series to incorporate annual heat content data for natural gas obtained from EIA. The CO_2 EF for natural gas, which has been reported as constant since 2007 (50.24 t/TJ) for categories 1.A.1, 1.A.2 and 1.A.4, now ranges from 50.26 t/TJ in 2007 to 50.16 t/TJ in 2017, and the CH_4 EF from 3.08 t/TJ in 2007 to 3.42 t/TJ in 2017. Annex 2.2 (p.A-82) describes how the natural gas carbon factors were determined.
E.2	1. General (energy sector) – gaseous fuels – CO_2 and CH_4 (E.18, 2018) Convention reporting adherence	Examine if the uncertainty analysis needs to be updated to reflect the findings of the research on the natural gas combustion and document the findings in future submissions.	Addressing. The United States examined but did not include an explanation in the NIR to clarify whether the uncertainty analysis for natural gas needs to be updated owing to the update in the CO_2 EF and CH_4 content (see ID# E.1 above). In NIR table 3-17 reported uncertainty continues

[2] FCCC/ARR/2018/USA.

ID#	*Issue classification*[a, b]	*Recommendation made in previous review report*	*ERT assessment and rationale*
			to range between –3 and 7 per cent for residential, commercial, industrial and transportation, –3 to 5 per cent for electric power and –13 to 17 per cent for United States territories. During the review, the Party explained that the uncertainty associated with the updated EFs (as discussed in ID# E.1 above) did not have an impact on the overall uncertainty, as the general findings regarding the carbon content of fuels still apply, meaning that the amount of carbon contained in the fuel per unit of useful energy can vary. The United States documented in broad terms (NIR p.3-33) that the impact of these uncertainties on the overall CO_2 emission estimates is considered to be minor. However, the information provided is not specific to the updates made to the natural gas CO_2 EF.
E.3	1. General (energy sector) – gaseous fuels – CO_2 and CH_4 (E.18, 2018) Transparency	Research CO_2 EF data for fuel gas used by upstream oil and gas producers, and natural gas that has been processed and injected into downstream distribution networks, in order to determine whether a different CO_2 EF for fuel gas used in offshore oil and gas production than the CO_2 EF for the processed gas that enters the transmission, storage and distribution networks used in power and industrial plants and by other users is warranted and whether it can be determined; and document the findings of the research on the CO_2 EFs in the NIR.	Addressing. During the review, the Party noted that, as reported in the NIR (section 3, p.3-36 and annex 2.2), the annual natural gas carbon content was updated across the time series to reflect annual heat content data for natural gas obtained from EIA. The CO_2 EF was based on the heat content of natural gas. EIA also reports the heat content of natural gas produced as the same value as natural gas consumed, meaning that the same EF would be used in both upstream and downstream operations. However, the Party did not document the findings of this research on CO_2 EFs in the NIR.
E.4	Fuel combustion – reference approach – all fuels – CO_2 (E.3, 2018) (E.5, 2016) (E.5, 2015) (32, 2013) (41, 2012) Transparency	Provide a more transparent clarification of how the difference in emissions between the reference and the sectoral approach is determined and which fuels are subtracted as NEU and feedstocks.	Addressing. The comparison between the reference approach and the sectoral approach is provided in annex 4 to the NIR. The energy data presented in the NIR (table A-244) for the reference approach fuel consumption of gaseous and petroleum fuels match the data presented in CRF table 1.A(c). The ERT noted, however, that values for the apparent energy consumption and apparent energy consumption excluding NEU are still the same in CRF table 1.A(c). During the review, the Party explained that the total amount of carbon stored in products produced from NEU of fossil fuels is subtracted from the emissions in both the sectoral and reference approaches (NIR table A-243). Emissions from carbon that was not stored during NEU of fuels are subtracted from the sectoral approach and reported under the NEU of fossil fuels source category (NIR section 3.2). These emissions, however, are not subtracted in the reference approach and are reported as their own line item in CRF table 1.A(b) (lubricants and petrochemical feedstocks). As a result, the reference approach emission estimates are comparable to those of the sectoral approach, with the exception that the NEU source category

ID#	*Issue classification*[a, b]	*Recommendation made in previous review report*	*ERT assessment and rationale*
			emissions are included in the reference approach. The ERT noted that this explanation was not provided in the NIR. In response to the draft report, the Party informed the ERT that there is some language in the NIR (annex 4, p.A-399) describing the different treatments of NEU under the reference and sectoral approaches and that it will include further clarification in the next submission (in NIR chap. 3 and annex 4).
E.5	Feedstocks, reductants and other NEU of fuels – all fuels – CO_2 (E.4, 2018) (E.7, 2016) (E.7, 2015) (38, 2013) (47, 2012) Comparability	Report only emissions from fuels combusted for the use of energy under fuel combustion, and reallocate the relevant emissions currently reported under the subcategory NEU (other) and part of the fuel used under the subcategory United States territories (other).	Not resolved. The Party explained during the review that it does not currently collect or hold data to be able to disaggregate overall NEU emissions into categories that can be reported under IPPU (such as emissions from calcium carbide, lubricants and paraffin waxes). The ERT acknowledges that reallocating the emissions to IPPU may not improve the overall accuracy of the Party's inventory, but it would improve the comparability against other reporting Parties. The ERT notes that if emissions cannot be reported under NEU owing to national circumstances, this should be clarified in the NIR.
E.6	Feedstocks, reductants and other NEU of fuels – CO_2 (E.19, 2018) Accuracy	Continue to research the data for the emissions from NEU of fuels reported under the energy and IPPU sectors mass-balance method used across petrochemical production to estimate CO_2 emissions from NEU of fuels and the method based on process emissions reported under facility-level reporting used to estimate emissions from feedstock consumption under IPPU, and further clarify the country-specific approach used in the NIR consistently with paragraph 10 of the UNFCCC Annex I inventory reporting guidelines.	Not resolved. The Party continues to use a mass-balance method across petrochemical production to estimate CO_2 emissions from NEU of fuels, in conjunction with reporting separate emissions from feedstock consumption under IPPU, which may lead to double counting of emissions. See ID# E.5 above.
E.7	International aviation – liquid fuels – CO_2, CH_4 and N_2O (E.5, 2018) (E.6, 2016) (E.6, 2015) (35, 2013) Transparency	Harmonize and reconcile the data between the reference and the sectoral approach for the reporting of jet kerosene consumption between CRF tables 1.A(b) and 1.D or furnish an adequate explanation of inconsistencies, where appropriate.	Not resolved. There are still inconsistencies in the reporting of jet kerosene consumption between CRF tables 1.A(b) (–1,158,833.17 TJ) and 1.D (1,163,988.07 TJ) for 2017. During the review, the Party explained that this is due to different data sources used for the values reported in the tables: its country-specific values for the consumption of fuels under the reference approach (CRF table 1.A(b)) come from EIA, which is responsible for gathering the official fuel production and consumption statistics for the country, and are the most appropriate AD for the energy sector of the Party's inventory. The Party also clarified that the inventory relies on data on individual flights to determine the split between domestic and international fuel use in the sectoral approach and further explanation of the calculation used is included in the NIR (annex 3.3, p.A-189). According to the Party, the approach used could be leading to

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			differences in the consumption of jet kerosene in international aviation (CRF table 1.D). The Party further clarified that the above information will be included in the next NIR.
E.8	1.A Fuel combustion – sectoral approach – all fuels – CO_2, CH_4 and N_2O (E.6, 2018) (E.2, 2016) (E.2, 2015) (29, 2013) (32 and 51, 2012) Completeness	Collect the necessary AD and EFs to prepare emission estimates for the combustion of biomass and other fuels for the following categories, including those used in the United States territories, focusing resources, as appropriate, on improvements in line with the 2006 IPCC Guidelines, and report the corresponding emissions: (a) CO_2, CH_4 and N_2O emissions from gaseous fuel use in rail transport; (b) CO_2, CH_4 and N_2O emissions from gaseous fuel use in navigation; (c) CH_4 and N_2O emissions from gaseous fuel use in other transportation (pipeline transport); (d) CH_4 and N_2O emissions from the use of biomass in the United States territories in the category other (stationary fuel combustion); (e) CO_2, CH_4 and N_2O emissions from solid and gaseous fuel and biomass use in other mobile (military); (f) N_2O emissions from oil flaring.	Resolved. Issues (a), (b) and (e) were resolved in the 2018 submission. The Party clarified that AD are not available to estimate emissions for issues (c) and (d), and that these emissions are considered to be insignificant (74.8 kt CO_2 eq). In annex 5 to the NIR (p.A-409), the United States provided additional information on the reasons for the categories not being estimated in accordance with paragraph 37(b) of the UNFCCC Annex I inventory reporting guidelines (decision 24/CP.19). N_2O emissions from oil flaring were estimated and information was provided in the NIR (section 3.6, tables 3-41–3-42, and section 3.7, tables 3-69–3-70).
E.9	1.A Fuel combustion – sectoral approach – biomass – CH_4 and N_2O (E.20, 2018) Completeness	Advance the research on CH_4 and N_2O emissions from the combustion of landfill gas, sewage gas and other biogas in order to review data sources for biogas, review the reporting of non-CO_2 emissions in the waste sector and assess the need to add new estimates.	Not resolved. The United States did not review the data sources for biogas to determine the completeness of non-CO_2 emissions reported in the waste sector. The planned improvements described in the NIR (p.3-109) continue to indicate that the Party intends to research data on biogas for future inclusion in the inventory. During the review, the Party explained that it is investigating sources of data on biogas use and combustion for energy and confirming whether these emissions are not reported elsewhere. Updates will be implemented as needed, or described in future submissions.
E.10	1.A.1 Energy industries – solid fuels – CO_2 (E.21, 2018) Accuracy	Review the time series of coal CO_2 EFs applied to energy industries, using the available annual data on coal heating values and continuous emission monitoring systems for CO_2 emissions from power stations and the regional production of coal that are supplied to power stations.	Resolved. The annual coal carbon content was updated across the time series to incorporate domestic coal production data obtained from EIA, as well as state-specific coal sample data for Montana, Illinois and Indiana (NIR p.3-36). In the NIR, table A-47 (annex 2.2, p.A-80) shows the updated carbon content coefficients for coal. The CO_2 IEF between the 2018 and 2019 submissions changes by approximately ± 0.07 per cent across the time series. In the planned improvements section of its NIR (p.3-37) the Party explained that EPA will continue to evaluate updates to the annual coal carbon content coefficients, such as continuing to

ID#	*Issue classification*[a, b]	*Recommendation made in previous review report*	*ERT assessment and rationale*
			integrate new information from state-level geological surveys.
E.11	1.A.1 Energy industries – solid fuels – CO_2 (E.21, 2018) Accuracy	Either recalculate emissions using updated CO_2 EFs derived from the available data, or present a clear justification in the NIR that the CO_2 EFs applied are accurate and representative of the emissions across the time series, and update the uncertainty analysis for this source accordingly as needed.	Resolved. The Party recalculated the CO_2 emissions using updated CO_2 EFs (see ID# E.10 above). As noted in the NIR (p.3-35), methodological recalculations were applied to the uncertainty analysis for the entire time series to ensure time-series consistency from 1990 to 2017.
E.12	1.A.2.g Other (manufacturing industries and construction) – liquid fuels – CO_2, CH_4 and N_2O (E.22, 2018) Transparency	Document the impacts of the new model and the validity of the outputs and transparently document the recalculations in the NIR when the latest version of the model (MOVES2014b) is incorporated in the inventory.	Addressing. The Party applied the MOVES2014b model in the 2019 submission. The NIR (section 3.1, p.3-43) describes the recalculations and the impact on CH_4 and N_2O emissions. The Party made no reference to CO_2 emissions but the ERT noted that they increased across the time series following the recalculation. Documentation on the validity of the model was not included in the NIR.
E.13	1.A.2.g Other (manufacturing industries and construction) – liquid fuels – CO_2, CH_4 and N_2O (E.23, 2018) Comparability	Research whether data are available to accurately reallocate emissions from fuel use by agricultural mobile machinery from subcategory 1.A.2.g to 1.A.4.c.ii and fuel use for fishing vessels to 1.A.4.c.iii in order to improve the comparability of the submission and ensure that emissions of all gases from a given source are reported under the same IPCC category. If data are not available to accurately reallocate emissions to the different categories, clarify, in the NIR, the country-specific approach taken consistently with paragraph 10 of the UNFCCC Annex I inventory reporting guidelines.	Not resolved. The NIR did not state that such data are not available or clarify the use of the country-specific approach. The Party stated during the review that it is researching and comparing various AD sources, in addition to updating the MOVES model inputs (see ID# E.12 above). This will include researching the availability of data for addressing the allocation of emissions from fuel use by agricultural mobile machinery from subcategory 1.A.2.g (other) to 1.A.4.c.ii (off-road vehicles and other machinery) and fuel use for fishing vessels to 1.A.4.c.iii (fishing).
E.14	1.A.2.g Other (manufacturing industries and construction) – liquid fuels – CO_2, CH_4 and N_2O (E.24, 2018) Accuracy	Research data by non-road mobile machinery vehicle type across the different data sets, including the Federal Highway Administration and MOVES model outputs, to determine the optimum AD estimate for each subsource under non-road mobile machinery, and improve inventory accuracy, as necessary, including for CO_2, CH_4 and N_2O emissions from industrial, commercial, agricultural machinery and fishing vessels.	Not resolved. The United States did not provide information on the optimum AD estimate for each subsource under non-road mobile machinery for improving the accuracy of the inventory. The Party continued to estimate emissions for this category using AD from different sources (NIR p.3-30). During the review, the Party explained that it is researching and comparing various AD sources, in addition to planning to update the MOVES model inputs to address this issue (see also ID#s E.12 and E.13 above). The Party noted that updating the MOVES model inputs is a longer-term effort.
E.15	1.A.3 Transport – liquid fuels – CO_2, CH_4 and N_2O (E.25, 2018) Accuracy	Advance the research in order to implement as soon as practicable	Not resolved. The Party explained during the review that the improvements will be undertaken in stages over the 2021 and 2022 submissions, pending data availability.

ID#	Issue classification[a, b]	Recommendation made in previous review report	ERT assessment and rationale
		the following improvements indicated during the review: (a) Updating on-road diesel CH_4 and N_2O EFs; (b) Developing improved methodology and data sources to estimate emissions from class II and III (short-line and regional) rail locomotives; (c) Applying a consistent methodology over time to estimate vehicle miles travelled for on-road vehicles by vehicle type, defined by wheel base; (d) Including ongoing research and documentation of minor emissions sources currently not included in the inventory, such as urea use in trucks, bio jet fuel, and compressed natural gas or liquefied petroleum gas use in shipping.	
E.16	1.A.3.b Road transportation – liquid fuels – CO_2 (E.26, 2018) Accuracy	Review and update the time series of diesel and gasoline CO_2 EFs, including, where necessary, the data on fuel densities and carbon share by fuel grade, and report on progress, or document in the NIR that the EFs applied are accurate and representative of emissions across the time series, and update the uncertainty analysis as needed to reflect the findings of the research.	Not resolved. The United States did not recalculate CO_2 emissions from diesel and gasoline for the 2019 submission and continues to use constant EFs for gasoline (67.62 t CO_2/TJ) for 2008–2017 and for diesel (70.10 t CO_2/TJ) for the entire time series. The Party explained during the review that the update of the time series of diesel and gasoline is under way. The gasoline EF is expected to be addressed in the 2020 submission, and the diesel EF in the 2021 submission.
E.17	1.A.3.b Road transportation – liquid fuels – CO_2 (E.27, 2018) Completeness	Either present information in the NIR to justify the omission of any fossil carbon component in the CO_2 EF for biofuel use (e.g. fatty acid methyl ester use) or update the inventory estimates to account for emissions from the fossil carbon component of biofuels and explain the estimations in the NIR.	Not resolved. The Party added a footnote in the NIR (p.3-21) clarifying that biofuel estimates are presented in the energy sector and that carbon fluxes from changes in biogenic carbon reservoirs in croplands are accounted for in the estimates for LULUCF. However, this does not fully justify the omission of emissions from the combustion of the fossil fraction of the biodiesel. According to the 2006 IPCC Guidelines (vol. 2, chap. 3, p.3.17), biodiesel produced using methanol as a feedstock will contain fossil carbon if the methanol is produced from a fossil fuel (such as natural gas). In addition, the tier 1 method used for estimating emissions for the production of methanol (in CRF table 2(I).A-Hs1) does not account for the carbon stored in products (in this case, methanol that is later combusted in the transport sector). Moreover, the Party did not clarify whether imports of methanol are used in the production of biodiesel or whether there are imports of pre-blended liquid fuels. During the review, the Party clarified that the NIR (section 4.13, p.4-51) explains that, owing to national circumstances, natural gas for non-fuel purposes in the production of petrochemicals (such as

ID#	*Issue classification*[a, b]	*Recommendation made in previous review report*	*ERT assessment and rationale*
			methanol) is accounted for in the NEU calculations. While the NIR does not explicitly mention methanol as part of the NEU calculations for carbon storage from petrochemical feedstocks, it is implied that it is part of those calculations. The Party also explained that it has recently become a net exporter of methanol and that the import-export analysis conducted for NEU provides an adjustment for methanol imports and exports. The ERT considers that the Party should explain clearly in the NIR how the fossil fraction of the biodiesel in road transportation is estimated and allocated. The ERT believes that future ERTs should consider this issue further to ensure that emissions from this category are not underestimated.
E.18	1.A.3.b Road transportation – liquid fuels – CH_4 and N_2O (E.28, 2018) Convention reporting adherence	Include descriptions of the MOVES model used to estimate CH_4 and N_2O emissions from road transportation and the 2016 GREET model used to generate EF inputs for alternative fuel vehicles, and information to verify that the models have been tested and calibrated to be representative of the United States fleet, fuels, driving conditions, road types and vehicle types.	Not resolved. The Party did not include a description of the MOVES model in the NIR indicating the process used to evaluate and improve the model in order to ensure adherence to the UNFCCC Annex I inventory reporting guidelines for tier 3 model verification. The ERT noted that the time series of CH_4 EFs for biofuel use in alternative fuel vehicles, derived from the 2016 GREET model, was updated and no longer shows a large increase beginning in 2011 (NIR annex 3.2, table A-113). During the review, the Party explained that it plans to improve the discussion incrementally in future submissions, including by adding more descriptive text to annex 3 (section 3.2) and providing cross-references to the annex throughout section 3 (energy) of the NIR.
E.19	1.A.3.b Road transportation – liquid fuels – CH_4 (E.29, 2018) Accuracy	Correct the error in the CH_4 EFs for 2011–2016.	Resolved. The error in the CH_4 EFs for biodiesel for 2011–2016 was corrected. The CH_4 EFs ranging from 0.01 to 1.76 kg/TJ in the previous submission were recalculated and now range from 0.01 to 0.08 kg/TJ for 1990–2016.
E.20	1.A.3.d Domestic navigation – liquid fuels – CO_2, CH_4 and N_2O (E.30, 2018) Transparency	Enhance the transparency of the descriptions of the scope of the surveys and how the total AD for shipping, both national sales and bunker fuels, are split and allocated to international shipping (not included in national totals) from other domestic shipping (included in national totals).	Resolved. The Party enhanced the transparency of the NIR by explaining how the total AD for shipping, both national sales and bunker fuels, are split and allocated to international shipping. The Party described in the NIR (p.3-107) the sources of AD for shipping, with descriptions of how the total AD for shipping, both national sales and bunker fuels, are split and allocated to international shipping (not included in national totals) from other domestic shipping (included in national totals). Data on military international bunker fuel are also described in annex 3.8 to the NIR.
E.21	1.A.5.b Mobile – solid and gaseous fuels, and biomass use – CO_2, CH_4 and N_2O (E.31, 2018) Transparency	Report AD and emissions of activities not occurring as "NO" instead of "NA".	Not resolved. The Party explained during the review that this change will be made in the 2020 submission.
E.22	1.B.2 Oil, natural gas and other emissions	Implement the planned improvements for this category	Addressing. For item (a) the United States did not estimate emissions from natural gas

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	from energy production – all fuels – CO_2, CH_4 and N_2O (E.32, 2018) Accuracy	discussed during the review, including the following: (a) Estimating emissions from natural gas gathering systems using component-level annual data instead of whole-facility study data; (b) Estimating emissions from hydraulically fractured oil well completions using annually reported facility emission data instead of production-based estimates; (c) Estimating fugitive emissions releases from liquefied natural gas storage and transfer using GHGRP data rather than data from an older reference; (d) Estimating emissions from natural gas transmission pipeline blowdowns using GHGRP data rather than data from an older reference, ensuring that the recalculations are described transparently and that a consistent time series of estimates is maintained.	gathering systems using component-level annual data instead of whole-facility study data. During the review, the Party explained that a new data source has been identified for item (a) and is expected to be used for the 2020 submission. For items (b), (c) and (d), the United States implemented the planned improvements and explained the recalculations undertaken in the NIR (section 3.7, pp.3-88–3-98).
E.23	1.B.2.c Venting and flaring – CO_2 and CH_4 (E.16, 2018) (E.20, 2016) (E.20, 2015) Transparency	Enhance transparency in reporting CH_4 emissions from petroleum systems from venting and flaring, in accordance with the UNFCCC Annex I inventory reporting guidelines.	Addressing. The Party provided new estimates for venting and flaring (NIR section 3.7, pp.3-88–3-98) (see ID# E.22 above). The ERT noted that the descriptions of additional recalculations, using improved data and methods including several data tables, indicate that increasing levels of detail in the data are available on emissions from several venting and flaring sources in the oil and gas sector across the time series, even though the Party still reports "IE" for venting and flaring in CRF table 1.B.2. During the review, the Party clarified that providing an estimate of disaggregated flaring emissions would involve the application of many assumptions and would result in inconsistent reporting and potentially decreased transparency. The Party stated that there are inconsistencies in data availability across subcategories (such as gathering) within oil and gas, and noted that EF data available for activities that include flaring (such as heavy fuel oil well completions with flaring) include emissions from multiple sources (flaring, venting and leaks).
E.24	1.B.2.c Venting and flaring – gaseous fuels – N_2O (E. 33, 2018) Completeness	Estimate and report N_2O emissions from all flaring sources in the upstream oil and gas sector, in CRF table 1.B.2, for the entire time series and explain the estimation methods, AD and EFs in the NIR, applying	Resolved. Emission estimates were included for N_2O from flaring activities in the exploration, production and refineries segments. NIR sections 3.6 (tables 3-41–3-42) and 3.7 (tables 3-69–3-70) explain the estimation methods, AD and EFs used.

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		methodologies in line with the 2006 IPCC Guidelines.	
IPPU			
I.1	2. General (IPPU) – CO_2 (I.26, 2018) Accuracy	Review the basis of EFs applied and, where appropriate, apply consistent carbon content factors to ensure consistency across the energy and IPPU sectors, reflecting any annual variations in the factors.	Not resolved. The Party did not update the EFs in order to improve consistency across the energy and IPPU sectors. The Party explained during the review that it is reviewing the basis of EFs and will report on any applicable updates as part of recalculations in the 2020 submission. The Party clarified that it does not expect updates to have a discernible impact on emissions.
I.2	2.A.1 Cement production – CO_2 (I.28, 2018) Transparency	Justify the applicability of the 2 per cent value of the cement kiln dust factor to national circumstances or investigate further the availability of the data required to derive a country-specific cement kiln dust factor for cement production and report on the outcome of this investigation.	Not resolved. The 2006 IPCC Guidelines (vol. 3, chap. 2.2.1.2, pp.2.11–2.13) allow the use of the default cement kiln dust factor for the tier 2 approach if data are unavailable. However, the ERT noted that the Party did not justify the applicability of the 2 per cent cement kiln dust factor for this key category in the NIR. During the review, the United States confirmed that it will explain the use of the default cement kiln dust factor in the next submission.
I.3	2.A.4 Other process uses of carbonates – CO_2 (I.5, 2018) (I.17, 2016) (I.17, 2015) Completeness	Conduct further research and consultation with industry, state-level regulators and/or statistical agencies to access additional AD and EFs and/or to seek verification of the current method and assumptions for estimating emissions from ceramics, non-metallurgical magnesium production and from other limestone and dolomite use; and report on progress in the NIR.	Addressing. The Party continues to report "NE" for categories 2.A.4.a (ceramics) and 2.A.4.c (non-metallurgical magnesium production) in CRF table 2(I).A-Hs1. The Party partially addressed this recommendation in its 2018 NIR by providing information on how unspecified uses are accounted for within the estimates (NIR section 4.4, p.4-20). During the review, the Party explained that further outreach work continues with trade associations, including consultation with current data providers. At this time, the research has not yielded any alternative data on national levels of carbonates to verify United States Geological Survey data or provide information on carbonates consumed in these industries. The Party further explained that ceramics and non-metallurgical magnesia are currently not included in the United States Geological Survey. The Survey currently allows respondents to enter magnesia (dolomite) data but no data were reported.
I.4	2.B.1 Ammonia production – CO_2 (I.7, 2018) (I.19, 2016) (I.19, 2015) Comparability	Allocate emissions from all fossil fuel uses (i.e. fuel and feedstock use) for ammonia production under subcategory 2.B.1 of the IPPU sector in accordance with the 2006 IPCC Guidelines.	Addressing. The Party included in the NIR (section 4.5) an explanation of the use of the country-specific methodology to estimate emissions from ammonia production consistently with paragraphs 10–11 of the UNFCCC Annex I inventory reporting guidelines. The Party indicated in the NIR (p.4-28, under planned improvements) that it has been obtaining data (since 2018) on feedstock quantities from ammonia production facilities via GHGRP and it is verifying these data to use in future inventories. During the review, the Party clarified that it was not able to address this issue in the 2019 submission and that it continues to work on collecting data to improve the inventory.

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I.5	2.B.1 Ammonia production – CO_2 (I.29, 2018) Comparability	Report separately the removals from CO_2 recovered for urea production in CRF table 2(I).A-Hs1 and the NIR.	Resolved. The Party reported the removals of CO_2 recovered during urea production in CRF table 2(I).A-Hs1. In the NIR (p.4-25), an explanation is provided on how emissions from ammonia production are adjusted to account for CO_2 recovered during urea production and the removals are also reported separately (NIR p.4-26), as requested by the previous ERT.
I.6	2.B.3 Adipic acid production – CO_2, CH_4, N_2O and PFCs (I.30, 2018) Transparency	Include a trend analysis of the IEF in order to explain observed inter-annual changes and irregularities in these trends for adipic acid production (2.B.3).	Not resolved. The Party did not include a trend analysis to explain the IEF variations in the NIR. During the review, the Party explained that inter-annual changes or trends in emissions are associated with the use of abatement equipment at the largest production facility. The Party indicated that the requested information will be included in the next submission as part of QA/QC and verification activities.
I.7	2.B.4 Caprolactam, glyoxal and glyoxylic acid production – N_2O (I.31, 2018) Completeness	Gather the necessary data and report N_2O emissions from glyoxal and glyoxylic acid production.	Not resolved. The Party still reports AD and N_2O emissions from glyoxal and glyoxylic acid production as "NE" in CRF table2(I).A-Hs1. During the review, the Party clarified that it has been researching available data sources but has not yet obtained any usable information for addressing this issue (either for estimating and reporting these emissions or for continuing to report "NE" and providing justification for exclusion in terms of the likely level of emissions in accordance with paragraph 37(b) of the UNFCCC Annex I inventory reporting guidelines). The Party also stated that it was not able to invest resources in this review in 2019 and that it hopes to update planned improvements and the annex listing the emissions not estimated for the 2020 submission.
I.8	2.B.5 Carbide production – CO_2 (I.32, 2018) Comparability	Allocate CO_2 emissions from production of calcium carbide to the IPPU sector in line with the 2006 IPCC Guidelines or provide clarity in the NIR as to the country-specific approach taken.	Not resolved. The Party did not allocate the CO_2 emissions from the production of calcium carbide (category 2.B.5.b) to the IPPU sector. The NIR (p.4-42) stated that CO_2 from calcium carbide is accounted for within the NEUs of petroleum coke in the energy chapter. During the review, the Party stated that, overall, it is continuing to look for data enabling it to disaggregate and reallocate CO_2 emissions from calcium carbide.
I.9	2.B.8 Petrochemical and carbon black production – CH_4 and N_2O (I.10, 2018) (I.22, 2016) (I.22, 2015) Completeness	Progress with plans to analyse new data reported by facilities (i.e. GHGRP data) and include emissions from combustion and flaring from installations not currently included in the inventory.	Addressing. The United States reported in the NIR (p.4-53) that a preliminary analysis of aggregated annual reports shows that flared CH_4 and N_2O emissions are less than 500 kt CO_2 eq/year. The Party also reported that the GHGRP is still reviewing these data across reported years to facilitate an update of category-specific QC documentation and EPA plans to address this more fully in future submissions.
I.10	2.B.8 Petrochemical and carbon black production – CO_2 and CH_4	Develop a methodology that is consistent with the 2006 IPCC Guidelines as soon as is practicable, allocating relevant fuel	Not resolved. The United States did not update the methodology for allocating the relevant fuel and feedstock emissions within the IPPU sector. During the review, the Party stated that it is

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	(I.12, 2018) (I.25, 2016) (I.25, 2015) Comparability	and feedstock emissions within the IPPU sector.	reassessing data with EIA and the GHGRP to assess possible options. The Party also stated that, given how data are reported under the GHGRP and how data for the energy sector were received from EIA, this would require a longer-term effort. The Party further highlighted that the NIR (section 4.13) explains the use of the country-specific methodology for estimating emissions from petrochemical and carbon black production consistently with paragraphs 10–11 of the UNFCCC Annex I inventory reporting guidelines.
I.11	2.B.8 Petrochemical and carbon black production – CO_2 (I.33, 2018) Accuracy	Review the backcasting methods to estimate the CO_2 EF for the period 1990–2009 for subcategories 2.B.8.b (ethylene), 2.B.8.c (ethylene dichloride and vinyl chloride monomer), 2.B.8.d (ethylene oxide) and 2.B.8.f (carbon black) with improved accuracy; and report transparently on the backcasting methodology for the CO_2 EF that it chooses to apply.	Addressing. The United States explained in the NIR (p.4-57) that the CO_2 EF for 1990–2009 for category 2.B.8.d (ethylene oxide) was updated using data for 2010–2013, rather than data for 2010–2016. As the EF decreased after 2013, the ERT considers this to be a good approach to characterizing the emissions for 1990–2009. During the review, the Party explained that this approach was not extended to other petrochemical production subcategories (2.B.8.b (ethylene), 2.B.8.c (ethylene dichloride and vinyl chloride monomer) and 2.B.8.f (carbon black)) because GHGRP data for 2017 were not available to the inventory staff until after the 2019 submission had been compiled.
I.12	2.B.8.b Ethylene – CO_2 (I.13, 2018) (I.26, 2016) (I.26, 2015) Transparency	Provide an explanation for the country-specific approaches using the EFs for ethylene production derived from GHGRP data, including the outcome of consultation with industry experts, and the results of the quality checks between GHGRP production estimates and data from trade association membership surveys.	Addressing. The United States reported in the NIR (pp.4-53–4-55) that a country-specific approach was taken to estimate emissions from ethylene production. The description in the NIR addresses the data sources and methods used over the reporting period and the Party added further information on quality checks, taking into account data from production facilities (pp.4-56–4-57). However, the Party did not refer specifically to the outcome of other quality checks comparing country-specific GHGRP data with other data (e.g. data from trade association surveys).
I.13	2.C.1 Iron and steel production – CO_2 (I.16, 2018) (I.27, 2016) (I.27, 2015) Completeness	Conduct further research and consultation with industry, regulators and statistical agencies as necessary in order to access complete AD on natural gas consumption and coke oven gas production at merchant coke plants, and obtain EFs and/or emission estimates.	Not resolved. The United States reported in its NIR (p.4-72) that data on natural gas use and coke oven gas production at merchant coke production plants were not included in the emission estimates owing to data being unavailable. The Party indicated during the review that it has begun an analysis, the first step being to assess and gather relevant data related to iron and steel merchant coke plants. The Party indicated that this planned improvement is unlikely to occur before the 2021 submission.
I.14	2.C.1 Iron and steel production – CO_2 (I.17, 2018) (I.28, 2016) (I.28, 2015) Transparency	Explain the allocation of the emissions from coke production and iron and steel production across both the energy and IPPU sectors, including the amount of carbon stored in the products of iron and steel production (this could be done, for example,	Addressing. The United States did not report a carbon balance supporting the allocation of emissions from coke production or iron and steel production across both the energy and IPPU sectors. However, the Party reported transparently in its NIR (pp.4-68–4-77) on the allocation of emissions and carbon stored from iron and steel production. The ERT noted that,

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		through the provision of a quantitative summary of the carbon balance that the Party uses to compile and quality check the inventory estimates).	to enhance the transparency of the NIR, the Party still needs to include all the conversion factors to allow the reported CO_2 emission estimate to be reproduced. During the review, the Party explained that it is reviewing ways to improve the presentation of information, but it currently seems unlikely that a full update will be included in the 2020 submission.
I.15	2.C.4 Magnesium production – SF_6 (I.35, 2018) Consistency	Investigate the reasons for the SF_6 IEF increase between 2009 and 2011 and report in the NIR on the outcome of the investigation and on any recalculations of AD, IEF or emissions resulting from those investigations.	Addressing. The United States recalculated SF_6 emissions from die casting for 2009–2017 in CRF table 2(I).A-Hs2. In the NIR (p.4-90) the Party explained that the emissions were updated on the basis of revised AD. However, the Party did not report on the outcomes of the investigation explaining the reasons for the SF_6 IEF increase between 2009 and 2011 and how the new AD used in the recalculations improved the trend in the SF_6 IEF between 2009 and 2011. The ERT notes that the AD and EF are reported as confidential in the CRF table and that SF_6 emissions in 2011 are still considered as an outlier (an increase of 41 per cent between 2010 and 2011).
I.16	2.D Non-energy products from fuels and solvent use – CO_2 (I.36, 2018) Comparability	Estimate separately CO_2 emissions from lubricants and paraffin wax use and report them under category 2.D.	Not resolved. The United States continues to report CO_2 emissions from lubricants and paraffin wax use under the energy sector and to report "IE" under category 2.D (non-energy products from fuels and solvent use). During the review, the Party explained that it uses a country-specific methodology to portray as accurately as possible the emissions from this category and stated that reallocating emissions will not necessarily produce a more accurate or comparable result. However, the ERT is of the view that reporting these emissions under category 2.D will improve comparability across Parties.
I.17	2.F Product uses as substitutes for ozone-depleting substances – HFCs and PFCs (I.19, 2018) (I.29, 2016) (I.29, 2015) Transparency	Improve the documentation of the refrigeration and air-conditioning model by including the clarifications on model assumptions, data sources and calculation methodologies provided to the ERT during the 2016 review, including (a) the assumed linear substitution trend between "start" and "full penetration" dates for substitution gases; (b) additional information on the annual growth rates cited in the NIR; (c) the model calculation approach for overlapping equipment technology substitutions; (d) details of country-specific circumstances and key references for the annual emission rates for servicing and leaks applied; and (e) information on assumed recovery, reuse and	Addressing. The United States improved the documentation and described in the NIR (annex 3.9, pp.A-227–A-237) (a) the assumed linear substitution trend between "start" and "full penetration" dates for substitution gases; (b) the average annual growth rates for individual market sectors; and (c) the calculation approach relevant to overlapping equipment. Related to (d) the Party also provided information on country-specific circumstances and key references in the NIR (p.4-120). Related to (e), in annex 3.9 (pp.A-238–A-247), the Party provided information on assumed recovery, reuse and recycling in various subcategories. However, specific information on recovery and reuse of agents at end of life in fire extinguishers is not provided. During the review, the Party explained that all remaining fire protection agent from equipment reaching disposal (i.e. the full amount less the assumed annual emission rate) is recovered and reused, and indicated that it will provide this information in annex 3.9 to its 2020 submission. In response to the draft report, the Party

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		recycling of fluids at end of life (e.g. for fire extinguishers).	explained that it will include in the NIR the sentence "At end-of-life, remaining agent is recovered from equipment being disposed and is reused" in the 2020 NIR.
I.18	2.F.1 Refrigeration and air conditioning – HFCs and PFCs (I.20, 2018) (I.30, 2016) (I.30, 2015) Accuracy	Either review and update the assumptions regarding product manufacture losses, or provide information in the NIR to justify the assumption that all such losses are "negligible" and accurately reflect country-specific circumstances.	Resolved. The Party updated the model and it now includes HFC and PFC emissions from product manufacture losses in CRF table 2(II)B-Hs2. Explanations were included in the NIR (p.4-120). The calculations consider the first-fill emissions for all refrigeration and air-conditioning equipment which is charged with refrigerant within the United States, including that which is produced for export (excluding equipment that is imported pre-charged).
I.19	2.F.5 Solvents – HFCs and PFCs (I.22, 2018) (I.32, 2016) (I.32, 2015) Transparency	Either review and update the assumptions regarding solvent emissions, or provide country-specific information to justify the assumption that only 90 per cent of solvents are emitted.	Addressing. The United States added a reference to a report (EPA, 2004) to justify the sentence in the NIR (annex 3.9, p.A-239) that 10 per cent of solvents are not emitted. The Party stated in the NIR that, since the previous submission, the remainder of the consumed solvent is assumed to be entrained in sludge or waste and disposed of by incineration or other destruction technologies without being released into the atmosphere. However, the ERT checked the information in the EPA report (2004) and found that, in addition to the information provided in the NIR, the annual release rate is assumed to be 90 per cent on the basis of expert opinion (EPA, 2001), which assumes that, during the cleaning process, the solvent is recycled or is continuously reused through a distilling and cleaning process until it is eventually almost entirely emitted. However, no further detail or documentation was provided to clarify the expert judgment assumptions, for example by means of a mass balance assessment or details of common practice in the industry or demonstration of how the 90 per cent assumption was calculated (see the document found by the ERT at https://www.epa.ie/pubs/advice/air/emissions/air%20advise%20no%201.pdf).
I.20	2.F.5 Solvents (I.23, 2018) (I.32, 2016) (I.32, 2015) Comparability	Revise the reporting of emissions from solvents in the CRF tables (reported as "NA").	Not resolved. Emissions from solvents are still reported as "NA" in CRF tables 2(I)s2 and 2(II). During the review, the Party explained that, for the 2020 submission, fluorinated gas emissions from solvents will be reported as "IE" in CRF table 2(II)B-Hs2, because solvents only consist of confidential gases and therefore will be reported within the unspecified mix of HFCs and PFCs.
I.21	2.F.6 Other applications (product uses as substitutes for ozone-depleting substances) – HFCs and PFCs (I.24, 2018) (I.33, 2016) (I.33, 2015) Transparency	Provide in the NIR detailed information including the quality checks for all gases and sources included in the unspecified mix of HFCs and PFCs in the subcategory other applications under the category product uses as substitutes for ozone-depleting substances.	Not resolved. The United States did not provide in the NIR detailed information including the quality checks for the unspecified mix of HFCs and PFCs. During the review, the Party explained that it will add a section on QA/QC and verification procedures discussing QA/QC efforts for all gases and sources under the category product uses as substitutes for ozone-depleting substances and, in particular, for the

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			unspecified mix of HFCs and PFCs in the subcategory other applications.
I.22	2.G.2 SF_6 and PFCs from other product use – SF_6 (I.37, 2018) Completeness	Investigate possible SF_6 emissions from airborne warning and control systems, particle accelerators and radars and include them in the next submission, providing a description of the identified sources, the SF_6 emissions from them for the entire time series, a methodology description and an uncertainty analysis, in accordance with the 2006 IPCC Guidelines (vol. 2, chap. 8, pp.8.23–8.25 and 8.26–8.30).	Addressing. The United States stated in the NIR (annex 5, p.A-411) that the Government reported 1.8 Mt CO_2 eq (or 1,800 kt CO_2 eq) of fugitive fluorinated gases and other fugitive emissions, including SF_6 and HFC emissions, for 2017 to the Federal Energy Management Program. EPA is still reviewing the reported emissions and methods used by reporters to ensure consistency with the 2006 IPCC Guidelines. The Party also stated that EPA is planning to investigate these emissions further to determine the fraction that actually consists of SF_6. The ERT believes that future ERTs should consider this issue further to ensure that emissions from this category are not underestimated.
I.23	2.H Other (IPPU) – N_2O (I.38, 2018) Transparency	Increase the transparency of the reporting of N_2O emissions from semiconductor manufacturing by including in both the NIR and the CRF tables a clear indication of where the emissions are reported and explaining that this is because CRF table 2(I).A-H does not allow for reporting N_2O emissions under category 2.E.1.	Not resolved. The ERT noted that there is no footnote added to table 2(I)A-Hs2 or additional text included in the NIR regarding the reporting of N_2O emissions from semiconductor manufacturing. During the review, the United States explained that the issue will be addressed in the 2020 submission through a note in both the CRF tables and the NIR.
Agriculture			
A.1	3. General (agriculture) – CH_4 and N_2O (A.14, 2018) Consistency	Report AD and other related information for all years of the time series in all CRF tables regardless of whether emissions are estimated from surrogate data, trend analysis or statistical sources.	Resolved. The Party reported the AD for the later years of the time series regardless of whether the emissions are estimated from surrogate data, trend analysis or statistical sources under categories 3.C.1 (rice cultivation, irrigated), 3.D.a.1 (inorganic N fertilizers, 3.D.a.2.a (animal manure applied to soils), 3.D.a.2.c (other organic fertilizers applied to soils), 3.D.a.3 (urine and dung deposited by grazing animals), 3.D.a.4 (crop residues), 3.D.a.5 (mineralization/immobilization associated with loss/gain of soil organic matter), 3.D.a.6. (cultivation of organic soils), 3.D.b.1 (atmospheric deposition) and 3.D.b.2 (N leaching and run-off).
A.2	3.A Enteric fermentation – CH_4 (A.16, 2018) Convention reporting adherence	Undertake a quantitative uncertainty assessment in conjunction with future planned methodological updates.	Not resolved. During the review, the Party indicated that a quantitative uncertainty assessment for CH_4 emissions from enteric fermentation will be undertaken as soon as methodological improvements are completed in the inventory in order to prioritize the use of resources. During the review, the Party acknowledged that this assessment should be updated (consistently with good practice) but, owing to resource constraints, the current focus is to improve AD. The ERT noted that the last quantitative uncertainty analysis for CH_4 emissions for the category was undertaken for the 2003 GHG inventory submission.

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A.3	3.A.1 Cattle – CH_4 (A.17, 2018) Transparency	Use the notation key "NA" to report cattle population size, AD and other related information under options A and B for this subcategory in CRF table 3.As1.	Resolved. Parties can enter data in only one option in the CRF Reporter tool. The cells for the other options (A and B) will be blank. Therefore, it is not possible to report in two options at the same time (i.e. if the United States selects option C, the other options (A and B) will be blank).
A.4	3.A.1 Cattle – CH_4 (A.18, 2018) Accuracy	Improve the accuracy of the milk fat percentage, for example by investigating the possibility of using additional data sources for information on milk fat percentage values, such as creameries and agricultural extension services.	Not resolved. The Party continues to use the default value of 4 per cent for milk fat percentage for dairy cattle (NIR p.A-263). During the review, the Party explained that it has identified one potential data source and plans to update the calculation of emission estimates for future submissions. However, it is unlikely that the improvement will be made before the 2021 submission.
A.5	3.A.1 Cattle – CH_4 (A.19, 2018) Accuracy	Investigate the possibility of using additional data sources (e.g. farm extension services) to derive country-specific information on calf births from dairy cows throughout the year and report on the results of this investigation in the NIR.	Not resolved. The Party continues to assume an even distribution of dairy calf births throughout the year (NIR p.A-253). During the review, the Party indicated that it is considering potential sources of information on the distribution of dairy calf births throughout the year and plans to use any available data in the calculation of emission estimates for future submissions. However, it is unlikely that the improvement will be made before the 2021 submission.
A.6	3.A.1 Cattle – CH_4 (A.20, 2018) Accuracy	Update regional diet characterization data used in the estimation of CH_4 emissions from cattle in order to more accurately reflect the differences in diets across farms and states.	Not resolved. Regional diet data are reported in the NIR (p.5-5) and in more detail in annex 3.10. The Party lists in its planned improvements section (NIR p.5-8) that it is investigating the availability of annual data for the digestible energy, Ym and crude protein values of specific diet and feed components for grazing and feedlot animals and dairy cattle but there is no clarity in the NIR on the progress made to date. The Party explained during the review that it is working to update regional diet data for future inventories. In response to the draft report, the Party explained that it continuously assesses available diet data and is working to incorporate these data into the inventory. The Party also indicated that it will be unable to obtain state- and/or farm-specific data because many of the diets are likely to be proprietary; in addition, farm surveys are not conducted on an annual basis, but periodically. The ERT commends the Party for this additional information but considers that the issue remains unresolved as the diet characteristics have not been updated as recommended.
A.7	3.A.2 Sheep – CH_4 (A.21, 2018) Accuracy	Update the sheep population distribution as data availability allows, focusing resources as appropriate, in line with the 2006 IPCC Guidelines.	Not resolved. The ERT noted that the AD for sheep were not recalculated. During the review, the United States clarified that it is assessing the availability of data and anticipates reporting estimates on the basis of available updated sheep population distribution data in the 2021 submission.

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A.8	3.A.2 Sheep – CH_4 (A.22, 2018) Transparency	Include the average GE and Ym associated with the use of the default EF.	Resolved. The United States estimates CH_4 emissions for this category using a tier 1 method, and therefore the default EFs (8 kg CH_4/head/year) from the 2006 IPCC Guidelines (vol. 4, chap. 10, table 10.10) were applied for the entire time series. The reporting of Ym and GE is not mandatory for the tier 1 method and the ERT considers that the use of "NA" is in accordance with the UNFCCC Annex I inventory reporting guidelines.
A.9	3.A Enteric fermentation – CH_4 (A.23, 2018) Comparability	Remove the subcategory other from under categories 3.A.2 (sheep) and 3.A.3 (swine) and report the associated emissions, AD and other related information either directly at the most aggregated level or report emissions disaggregated by subspecies, and include an appropriate description of the estimation methodologies in the NIR.	Resolved. The reporting of sheep and swine in CRF table 3.As1 is consistent with the reporting of other Parties. The ERT concludes that it is not possible to remove the subcategory other from the CRF Reporter tool. The description of the methodology in NIR section 5.1 is appropriated to the Party's reporting of this category.
A.10	3.A.3 Swine – CH_4 (A.24, 2018) Transparency	Include values for average GE and Ym in CRF table 3.As1.	Resolved. The United States estimates CH_4 emissions for this category using a tier 1 method, and therefore the default EFs (1.5 kg CH_4/head/year) from the 2006 IPCC Guidelines (vol. 4, chap. 10, table 10.10) were applied for the entire time series. The reporting of Ym and GE is not mandatory for a tier 1 method and the use of "NA" is in accordance with the UNFCCC Annex I inventory reporting guidelines.
A.11	3.B Manure management – CH_4 (A.25, 2018) Convention reporting adherence	Update the quantitative uncertainty assessment.	Not resolved. During the review, the Party indicated that a quantitative uncertainty assessment for CH_4 emissions from manure management will be undertaken as soon as methodological improvements are completed in the inventory in order to prioritize the use of resources. During the review, the Party acknowledged that this assessment should be updated (consistently with good practice) but, owing to resource constraints, the current focus is to improve AD. The ERT noted that the last quantitative uncertainty analysis for CH_4 emissions for the category was undertaken in the 2003 GHG inventory submission.
A.12	3.B Manure management – CH_4 and N_2O (A.5, 2018) (A.14, 2016) (A.14, 2015) Accuracy	Obtain updated MMS data and estimate emissions using the updated MMS usage data; if this is not possible, report on progress in the effort to update the MMS data.	Addressing. The Party reported in the NIR (annex 3.11) updated MMS data for cattle (p.A-291) and swine (p.A-293) but other livestock types, such as sheep, have not been updated since 2001. During the review, the Party informed the ERT that it aims to include further updated information in future submissions as it becomes available. In addition, the Party reported in its planned improvements (NIR p.5-16) its aim of continuing to obtain and incorporate existing data sources (such as the 2016 Department of Agriculture agricultural resource management survey dairy data) to update MMS distributions.

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A.13	3.B Manure management – N_2O (A.26, 2018) Accuracy	Use the updated animal MMS data for estimating emissions as soon as they become available and provide an update on developments in the improvement plan.	Resolved. This issue is being considered under ID# A.12 above.
A.14	3.B Manure management – N_2O (A.26, 2018) Accuracy	Investigate other potential data sources of animal MMS data, such as extension services (i.e. agricultural advisory services).	Addressing. During the review, the Party informed the ERT that it held an internal workshop where aspects of the United States manure management method and AD sources were discussed. No new data sources were identified at this workshop. The Party also informed the ERT that the Department of Agriculture is working to collect additional MMS data through its surveys (see ID# A.12 above).
A.15	3.B Manure management – CH_4 (A.28, 2018) Comparability	Remove the subcategory other under categories 3.B.2 (sheep) and 3.B.3 (swine) in CRF table 3.B(a)s1 and report the associated emissions, AD and other related information either directly at the most aggregated level or report emissions disaggregated by subspecies, and include an appropriate description of the estimation methodology in the NIR.	Resolved. The reporting of sheep and swine in CRF table 3.B(a)s1 is consistent with the reporting of other Parties. The ERT concludes that the CRF software does not allow removal of the subcategory other from the CRF Reporter tool and to report directly at the most aggregated level. The description of the methodology in NIR section 5.2 is appropriate to the Party's reporting of this category.
A.16	3.B.1 Cattle – CH_4 (A.7, 2018) (A.15, 2016) (A.15, 2015) Transparency	If not using a more disaggregated livestock categorization in estimating emissions, use option A in reporting data and emissions for cattle in the CRF tables; if applying option C, report the values for population size, allocation by climate region to cool and temperate regions, typical animal mass, volatile solid daily excretion and CH_4 producing potential for all other cattle subcategories of option C in CRF tables 3.B(a)s1 and 3.B(a)s2.	Addressing. The United States applied option C in CRF table 3.B(a)s1. Between the 2017 and 2018 submissions, the Party increased the disaggregation of the cattle characterization in CRF table 3.B(a)s1 for livestock population, typical animal mass, volatile solid daily excretion and CH_4 producing potential, but has not yet reported disaggregated information on allocations to climate regions in CRF table 3.B(a)s2. Information in CRF table 3.B(a)s2 is still reported according to dairy and non-dairy cattle only. During the review, the Party informed the ERT that it is assessing the possibility of reporting climate parameters for certain individual non-dairy subcategories currently reported as "IE" and plans to update the CRF table in a future submission.
A.17	3.B.1 Cattle – CH_4 (A.27, 2018) Comparability	Report MMS that are not used as "NO" instead of "NE" in CRF table 3.B(a)s2 or, if they occur but are not estimated, replace "NE" with the appropriate estimate.	Not resolved. The Party indicated that it is considering the most appropriate notation key for the MMS data reported in CRF table 3.B(a)s2 and will update the table accordingly in the 2020 submission.
A.18	3.B.4 Other livestock – CH_4 (A.29, 2018) Transparency	Include values for GE and Ym in CRF table 3.As1.	Resolved. The United States estimated CH_4 emissions for this category using a tier 1 method and therefore the default EFs (5 kg CH_4/head/year for goats, 18 kg CH_4/head/year for horses, 10 kg CH_4/head/year for mules and asses and 55 kg CH_4/head/year for bison) from the 2006 IPCC Guidelines (vol. 4, chap. 10, table 10.10) were applied for the entire time series. The reporting of Ym and GE is not mandatory for the tier 1 approach and the use of

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			"NA" is in accordance with the UNFCCC Annex I inventory reporting guidelines.
A.19	3.D Direct and indirect N_2O emissions from agricultural soils – N_2O (A.30, 2018) Completeness	Include all N_2O emissions from the States of Alaska and Hawaii in the emissions reported under this category or clearly outline in the improvement plan steps for including those emissions in the inventory.	Not resolved. The Party did not report N_2O emissions from N inputs from manure, sewage sludge and biosolids, crop residue, N mineralization or the cultivation of organic soils for Alaska or Hawaii. During the review, the Party informed the ERT that it will include these estimates in the future as resources allow, but not before the 2020 submission. This issue is identified in the Party's planned improvements in its NIR (p.5-42). During the previous review, the Party had explained that the impact of N inputs on N_2O emissions had not been estimated for either Alaska or Hawaii, and that those emissions were likely to be less than 0.05 per cent of the total GHG emissions for the country, but may exceed the 500 kt CO_2 eq threshold defined in paragraph 37(b) of the UNFCCC Annex I inventory reporting guidelines (see ID# A.25 in table 5).
A.20	3.D Direct and indirect N_2O emissions from agricultural soils – N_2O (A.32, 2018) Transparency	Provide additional information in the NIR on the quantities and N content of commercial organic amendments (e.g. biosolids, dried blood and compost) applied to agricultural soils.	Not resolved. There is no additional disaggregated information on the commercial organic amendments included in the NIR (section 5.4). The ERT notes that a footnote to NIR table 5-17 explained that organic amendment inputs include managed manure, daily spread manure and commercial organic fertilizers (i.e. dried blood, dried manure, tankage, compost and other). The Party explained during the review that it will include further information on commercial organic amendments in future inventories provided that the unique N content of each of the commercial organic amendments can be determined.
A.21	3.D.a.3 Urine and dung deposited by grazing animals – N_2O (A.8, 2018) (A.8, 2016) (A.8, 2015) (77, 2013) (92, 2012) Consistency	Resolve the inconsistency in the total N excretion on pasture, range and paddock reported between CRF table 4.B(b), N_2O emissions from manure management, and CRF table 4.D, agricultural soils.	Resolved. Data on N excretion on pasture, range and paddock reported in CRF table 3.B(b) (total of categories 3.B.1–3.B.4 in 2017: 3,885.75 Gg N) are now consistent with the data on N in urine and dung deposited by grazing animals reported in CRF table 3.D (3,885,750,115.77 kg N in 2017). The data are consistent for the entire time series.
A.22	3.D.a.3 Urine and dung deposited by grazing animals – N_2O (A.9, 2018) (A.9, 2016) (A.9, 2015) (77, 2013) (92, 2012) Convention reporting adherence	Improve QC procedures to avoid inconsistencies in the total N excretion on pasture, range and paddock reported between CRF tables 4.B(b) and 4.D and provide information on this improvement.	Resolved. QC procedures were improved, and the Party reported consistent data on Nex in CRF tables 3.B(b) (N_2O emissions from manure management) and 3.D (agricultural soils). See ID# A.21 above.
A.23	3.D.a.3 Urine and dung deposited by grazing animals – N_2O (A.33, 2018) Accuracy	Refine the emission estimates with available data on N deposited by soil type and document this in the planned improvements.	Resolved. The United States estimated N_2O emissions for this category considering N deposited by soil types. The Party explained during the review that, although the 2006 IPCC Guidelines (vol. 4, chap. 11.2.1) do not require that estimates for this category be estimated by soil type, the tier 3 model used to estimate N_2O emissions for this category considers soil types.

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			The Party further explained that the model captures the effect of soil characteristics on rates of nitrification and denitrification and made reference to box 5-3 of the NIR (p.5-33) for more information. The ERT checked page 5-38 of the NIR, which states that the total amount of N excreted in each county is divided by the grassland area to estimate the N input rate associated with pasture range and paddock manure. The resulting input rates are used in the DAYCENT model simulations, which account for different soil characteristics. However, a clearer explanation is not provided in the NIR to improve transparency (see ID# A.35 in table 5).
A.24	3.D.b Indirect N_2O emissions from managed soils – N_2O (A.12, 2018) (A.18, 2016) (A.18, 2015) Transparency	Provide an explanation of how the methodology and the DAYCENT model used to estimate N volatilized and N loss are both compatible with the 2006 IPCC Guidelines and based on science.	Addressing. The United States included in the 2018 NIR a detailed explanation of how the DAYCENT model is used. During the review, the Party explained that methods are described in the publications that are referenced in the NIR and that the DAYCENT model volatilization (~1 per cent) and leaching (~1 per cent) factors are within the confidence intervals of the respective IPCC default tier 1 factors. However, the ERT was unable to identify any additional explanation in the NIR on how the methodology and the DAYCENT model used to estimate N volatilized and N loss are both compatible with the 2006 IPCC Guidelines and based on science. The Party could include the above information provided during the review along with clear references to the documents (e.g. relevant chapters) to explain the methodology of the DAYCENT model for estimating N volatilized and N loss.
LULUCF			
L.1	4. General (LULUCF) – CO_2, CH_4 and N_2O (L.2, 2018) (L.2, 2016) (L.2, 2015) (81, 2013) Completeness	Conclude the technical work under way to be able to provide estimates for the carbon stock changes in the living biomass and DOM pools for each conversion category from forest land to any other land use for each year based on a reliable land-use change matrix, and report on the achievements made.	Addressing. The United States reported carbon losses in the living biomass and DOM pools for categories 4.B.2.1 (forest land converted to cropland), 4.C.2.1 (forest land converted to grassland), 4.D.2.3.1 (forest land converted to other wetlands) and 4.E.2.1 (forest land converted to settlements). Categories 4.D.2.2.1 (forest land converted to flooded land) and 4.F.2.1 (forest land converted to other land) are still reported as "NE".
L.2	4. General (LULUCF) – CO_2, CH_4 and N_2O (L.3, 2018) (L.3, 2016) (L.3, 2015) (82, 2013) (97, 2012) Completeness	Include all managed United States lands in the inventory; improve the consistency of the time series of national areas; and report on the achievements made.	Addressing. The land-use matrix of CRF table 4.1 and the land representation tables in the NIR (tables 6-6–6-7, pp.6-9–6-10) include all areas of managed and unmanaged land in the United States, except for United States territories (see ID# L.41 in table 5). In addition, the "Total area" columns of CRF background tables 4.A, 4.B, 4.C, 4.D, 4.E and 4.F do not include managed land areas where emissions or removals do not occur. Instead, this information is provided in a documentation box for each CRF background table. During the review, the Party explained that the result of initial testing including all managed land in the CRF tables caused issues with the calculated IEFs.

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			Therefore, the Party plans to improve transparency in the 2020 submission to indicate more clearly the areas of managed land that are not estimated in order to clarify why there is a difference between the areas reported in CRF table 4.1 and the CRF background land-use tables.
L.3	4. General (LULUCF) – CO_2, CH_4 and N_2O (L.36, 2018) Convention reporting adherence	Until the Party is able to report anthropogenic emissions and removals from the entire national managed land area, report non-estimated managed land as a subdivision in the relevant CRF tables (i.e. tables 4.A, 4.B, 4.C, 4.D and 4.E), so that the managed land area for each land category reported in CRF table 4.1 corresponds with that reported for the same category in CRF tables 4.A, 4.B, 4.C, 4.D and 4.E.	Not resolved. The Party did not report non-estimated managed land as a subdivision in CRF tables 4.A, 4.B, 4.C, 4.D and 4.E. See ID# L.2 above for the Party's action regarding this issue. During the review, the Party explained that the addition of the subdivision will have an impact on the IEF and introduce inconsistencies within the CRF tables. However, the ERT considers that adding a subdivision for reporting non-estimated managed land and applying the correct use of notation keys will not introduce inconsistencies within the CRF tables and will be important in improving the understanding of the Party's GHG inventory. The ERT also notes that, if emissions are insignificant, the Party can report "NE" and justify their exclusion in accordance with paragraph 37(b) of the UNFCCC Annex I inventory reporting guidelines.
L.4	Land representation – CO_2, CH_4 and N_2O (L.7, 2018) (L.21, 2016) Consistency	Resolve the inconsistencies in land-use areas in the time series reported in the CRF tables.	Not resolved. The discrepancy between land-use areas in the time series reported in CRF table 4.1, where the final area at the end of a given year is not the same as the initial area of the subsequent year, remains unresolved. For example, the final area reported in CRF table 4.1 for 2016 is 278,948.81 kha, while the total initial area reported in CRF table 4.1 for 2017 is 281,666.66 kha. During the review, the Party explained that the land-use areas in CRF table 4.1 were entered according to the definitions of remaining land (land that remains in the same land use over 20 years) and converted land (the cumulative area of conversion over the past 20 years) and also explained that the heading of CRF table 4.1 can be understood to allow it to be compiled according to the IPCC definition (namely, using the 20-year conversion). The ERT notes that the UNFCCC Annex I inventory reporting guidelines do not clearly mention whether annual area changes or 20 years of cumulative area change should be used in CRF table 4.1, as indicated by the Party; however, the consistency of areas in CRF table 4.1 between the final area in a land matrix of a given year and the initial area in a land matrix of the subsequent year is only achieved when the matrices are prepared using annual area changes rather than 20 years of cumulative area change. The Party further clarified during the review that preparing the annual change area requires land representation to be reanalysed and so the Party will note in the documentation boxes what it is reporting in the interim.

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L.5	Land representation – CO_2, CH_4 and N_2O (L.7, 2018) (L.21, 2016) Consistency	Resolve the inconsistences in information on land-use areas between the NIR and CRF table 4.1 by subcategorizing the managed lands for which estimates are calculated in order to separate them from those for which there are currently no methodologies available, noting that the notation keys "NE" or "NA" can be used for the latter subcategory.	Resolved. The United States resolved the inconsistency, and the total areas in each of the six broad land-use categories in table 6-7 of the NIR are now consistent with those in CRF table 4.1. Further issues related to subcategorizing managed lands for which estimates have been calculated in order to separate them from those for which there are currently no methodologies available are being considered under ID#s L.2 and L.3 above.
L.6	Land representation – CO_2, CH_4 and N_2O (L.9, 2018) (L.23, 2016) (L.22, 2015) Transparency	When providing detailed information in the NIR on how the different data sources were harmonized, provide explicit information on how the model ensures consistent integration of the three data sources, for example by including a visual flow chart of data processing during the harmonization process.	Addressing. Three sets of land-use data are used: NRI, FIA and NLCD (see also ID# L.8 below). The Party updated land representation by including new FIA data in the 2019 submission and explained in the NIR (pp.6-17–6-22) how the different land data sources are used and harmonized to classify their national land data into IPCC land-use categories. The Party further explained during the review that a figure showing the process of harmonizing the different data sources will be included in the submission for 2021 or 2022.
L.7	Land representation – CO_2, CH_4 and N_2O (L.10, 2018) (L.25, 2016) Accuracy	Estimate emissions from forest land converted to another land use over a 20-year timespan by subdividing the conversion category into area actually converted and area converted during the past 19 years.	Resolved. The United States reported the areas of land conversion in CRF tables 4.B and 4.C on the basis of the cumulation of historical land-use change areas "not only one year after the conversion", but also for subsequent years up to 20 years from the conversion, as per the original recommendation. The ERT notes that the recommendation of subdividing the conversion category into area actually converted and area converted during the past 19 years is not considered mandatory because there is no such reporting guidance in the revised UNFCCC Annex I inventory reporting guidelines or in the 2006 IPCC Guidelines (see also ID# L.42 in table 5).
L.8	Land representation – CO_2, CH_4 and N_2O (L.37, 2018) Accuracy	Update the land representation with the latest available data from NRI, and proceed with plans to improve the coordination and timing of sharing data between federal agencies if necessary.	Addressing. The land-use data from NRI and NLCD were not updated in the 2019 submission and the land-use areas of cropland, grassland and settlements for 2013 onward were based on the land representation data from the previous submission. The ERT notes that the reporting of almost identical net emissions and removals from these land uses for 2013–2017 was affected by this land representation method. During the review, the Party explained that it will include new NRI data up to and including 2015, and updated land representation is planned for the 2020 submission. The Party further explained that data from NRI/NLCD currently used in its land representation are updated every two to four years, and that as part of the current compilation process and arrangements, it incorporates new NRI/NLCD data as soon they become available. There is currently no annual alternative to NRI for obtaining land-use/conversion and management data on croplands, grasslands or settlements, so

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			the Party must continue to rely on these data until new annual data become available.
L.9	Land representation – CO_2, CH_4 and N_2O (L.38, 2018) Comparability	Report disaggregated areas and changes in areas for every type of unmanaged land in CRF table 4.1.	Resolved. The Party reported the area of unmanaged land aggregated as a single total for each year in the land transition matrix (the value being reported in cell K16 in CRF table 4.1). However, disaggregated unmanaged land areas for forest land, grassland and other land are available in the NIR (table 6-6, p.6-9). The Party plans to update CRF table 4.1 in the 2020 submission. The ERT notes that footnote 3 to table 4.1 states that parties may report only the total area of unmanaged land area and enter "IE" under the individual unmanaged land-uses categories, so reporting a single total national unmanaged area in CRF table 4.1 is allowed and consistent with the reporting requirement.
L.10	4.A Forest land – CO_2 (L.39, 2018) Convention reporting adherence	Report up-to-date information on the verification of the outputs of the model used to estimate SOC changes in mineral soils, for example, at the level of annual fluxes in single specific sites representative of the variability of the population or, as done for the DAYCENT model for agricultural soils (NIR figure A-12), at the level of the total cumulated (across the time series and the entire territory modelled) net flux.	Addressing. The ERT notes that the explanation of forest soil in the annexes to the NIR (A-361–A-366) has been updated but that the verification information on forest soil estimation by model is not provided in the NIR, despite a background research paper on the soil estimation approach being cited in the annexes to the NIR (p.A-361). During the review, the Party explained that it is currently analysing remeasurements of soil attributes from national forest inventory plots, which will be used to test and verify model results for SOC changes in mineral soils.
L.11	4.A Forest land – CO_2 (L.40, 2018) Accuracy	Apply as the carbon conversion factor for forest biomass either a country-specific value or the default value provided in the 2006 IPCC Guidelines (vol. 4, chap. 4, table 4.3), and, for mangrove forests, either a country-specific value or the default value provided in the Wetlands Supplement.	Addressing. In the estimation of living biomass for forest land, the Party applies the same carbon conversion factor (0.50 t C/t dead matter) as that used in the previous submission for all forest types. During the review, the Party explained that the carbon conversion factor of 0.50 was used as a country-specific value for living biomass, although this was not clearly explained in the NIR. As the use of 0.50 for the estimation of living biomass in forest land is not consistent with the 2006 IPCC Guidelines or the Wetlands Supplement (for mangrove forests), a further explanation is needed for the ERT to evaluate the use of 0.50 t C/t dead matter as a country-specific value. During the review, the Party explained that it will improve the relevant documentation in the NIR for the 2020 submission.
L.12	4.A Forest land 4(II) Emissions and removals from drainage and rewetting and other management of organic/mineral soils – CO_2, CH_4 and N_2O (L.41, 2018) Accuracy	Review the AD and estimates of CO_2, CH_4 and N_2O emissions from organic soils reported in CRF tables 4.A and 4(II), confirming that the values are consistent, and explain any recalculation in the NIR; and ensure the accuracy of the information reported in the CRF tables, in particular whether there is consistency between reported CO_2 and N_2O fluxes in organic soils and between GHG	Resolved. The ERT noted significant recalculations in the AD for organic soils reported in CRF table 4.A, which are explained in the NIR (pp.6-34–6-35). The CO_2, CH_4 and N_2O emissions reported are considered accurate by the ERT. During the review, the Party explained that carbon stock changes in forest organic soils (reported in CRF table 4.A) and CO_2 emissions from drained forest organic soils (reported in CRF table 4(II)) are calculated separately so that there is no double counting of emissions. The ERT checked the method

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		fluxes and the area of organic soils in which such fluxes originate.	applied by the Party and the AD for drained organic soils reported in CRF table 4(II) (70.80 kha) are the area of drained organic soils on forest land (constant for the entire time series), which is only used for the estimation of emissions reported in CRF table 4(II) and not applied to the calculation in CRF table 4.A. The method used to estimate the drained area is clearly explained in the NIR (p.6-42). The estimation has not been updated since the previous submission. The carbon stock changes in organic soils are also reported in CRF table 4.A and reported separately from the emissions of drained organic soils in forest land in the NIR (tables 6-10–6.11, p.6-26). The AD will therefore not be the same between the carbon stock changes in forest organic soils and the GHG emissions from drained forest organic soils. However, more transparency in the NIR is needed (see ID# L.44 in table 5).
L.13	4.A Forest land – CO_2 and N_2O (L.42, 2018) Transparency	Calculate the carbon stock change in each carbon pool at the level of each single plot and then aggregate the results at the state and national level, and explain any recalculations in the NIR.	Addressing. The methodology applied in the stock-difference method for forest land has not changed since the previous submission. However, during the review, the Party provided additional information on the methodology in response to the concern about double counting of carbon raised during the previous review. The Party explained that plot-level national forest inventory information is used for land-use classification relating to forest land, and confirmed that the stock-difference method is applied at each land-use category level (e.g. forest land remaining forest land) instead of for the entire forest land area. The Party also explained that applying the stock changes at the plot versus population level will not change the result, given how the estimators and expansion factors are used in the national forest inventory and incorporated into the current compilation approach. Additionally, the Party explained that it is moving towards a more spatially and temporally resolved system for compiling emission and removal estimates for the forest land category and has already started testing the new system. The system will include tracking individual trees through remeasurements at plot level along with all other carbon pools. The transition will be noted in the planned improvements section in future submissions. The ERT noted that current methodology for calculating carbon stock change in forest land is considered appropriately applied taking into account the information provided by the Party. However, the ERT also noted that this understanding was not clear from the information provided in the NIR and considers that the Party should include information in the NIR to demonstrate that the stock-difference method for forest land is applied at each land-use category level.

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L.14	4.A.1 Forest land remaining forest land – CO_2 (L.13, 2018) (L.26, 2016) Transparency	Provide in an annex to the NIR detailed tables on average carbon fluxes by region and type (e.g. the region and forest type classifications described in Smith et al. (2006) and used for estimating downed deadwood and understory, which might better reflect the diversity of forest types and age classes).	Not resolved. The United States did not provide tables with carbon stock changes disaggregated by region, state or forest type. During the review, the Party explained that this information will be included in future submissions.
L.15	4.A.2 Land converted to forest land – CO_2 (L.44, 2018) Accuracy	Recalculate SOC changes in mineral soils for all areas converted to forest land in the CRF tables and explain the recalculations in the NIR.	Resolved. The Party recalculated and reported SOC changes for land converted to forest land reflecting the different land uses (NIR pp.6-47–6-49 and A-326–A-327).
L.16	4.B Cropland – CO_2 (L.18, 2018) (L.14, 2016) (L.14, 2015) (93, 2013) (107, 2012) Completeness	Estimate the carbon stock changes in living biomass in perennial crops for all years in the time series.	Not resolved. The United States did not report the biomass carbon stock changes in perennial cropland for either cropland remaining cropland or land converted to cropland. The Party explained that data are currently not available for estimation.
L.17	4.B Cropland – CO_2 (L.45, 2018) Accuracy	Check the quality of the data from which the land representation is derived, investigate the reasons for the sudden and temporary decrease in the area of organic soils by about 80 kha between 1999 and 2000 for cropland remaining cropland reported in CRF table 4.B, explain the result of this investigation in the NIR, correct any identified inconsistencies and explain any recalculations in the NIR.	Not resolved. During the review, the Party explained that an investigation is under way and further information will be provided in the 2020 submission.
L.18	4.B.2.2 Grassland converted to cropland – CO_2 (L.46, 2018) Completeness	Estimate biomass carbon stock changes using the IPCC default method and factors or, where available, country-specific methods and factors, and report the estimations in the NIR.	Not resolved. The Party did not provide estimates and "NE" was reported for carbon stock changes in biomass in grassland converted to cropland in CRF table 4.B. During the review, the Party explained that it is working to address completeness over time as improved data become available and to prioritize the work in line with other improvements to make best use of available resources.
L.19	4.B Cropland 4.C Grassland – CO_2 and N_2O (L.47, 2018) Convention reporting adherence	Verify the model's output for the entire time series from 1990 onward and for all applicable land categories (e.g. by verifying the model's output for each land-use category, or for the total of the land-use categories, or for any subaggregation, as long as the total estimate of all land-use categories modelled is verified) and report on the verification and the results in the NIR.	Not resolved. The Party reported in the NIR the same verification information comparing SOC changes with lower tiers (figure A-13) as in the previous submission. Therefore, the concern of the previous ERT remains regarding coverage of land categories (i.e. that verification of the DAYCENT model was implemented for carbon stock change in cropland remaining cropland, but not implemented for other land-use categories and gases). Regarding the issue of time series covered by the verification flagged in the previous review, the ERT believes that the Party would not be required to provide that information under verification, considering the exchange of views with the Party during the review and noting that covering the entire time

ID#	*Issue classification*[a, b]	*Recommendation made in previous review report*	*ERT assessment and rationale*
			series is not specifically mentioned in the 2006 IPCC Guidelines as a verification step. The ERT notes that, in terms of accuracy of the time series estimated by the model, the Party provided in the NIR (annex 3, p.A-342–A-345) detailed information on the calibration step as part of QA/QC of the model development. The ERT understands that recalibration of the model or modifications to the structure (i.e. algorithms) may be necessary if the model does not capture general trends or there are large systematic biases. During the review, the Party explained that plans to improve the documentation and calibration are ongoing as well as implementation of additional verification, in step with ongoing methodological refinements for estimating soil carbon, soil nitrous oxide and soil methane.
L.20	4.B Cropland 4.C Grassland – CO_2 and N_2O (L.48, 2018) Comparability	Report SOC changes and associated CO_2 and N_2O emissions from cropland and grassland mineral soils using a depth increment of at least 30 cm in line with the 2006 IPCC Guidelines (vol. 4, chap. 2).	Not resolved. The Party did not estimate SOC changes using a depth increment of at least 30 cm. Instead, the estimate was made using a depth of 20 cm. During the review, the Party explained that it will implement this recommendation in the 2020 submission.
L.21	4.C Grassland – CO_2 (L.49, 2018) Transparency	Report woody grassland as a subdivision of the grassland category, estimate accordingly the area and carbon stock change for all carbon pools of woody grassland within the category grassland remaining grassland and within all land-use categories of conversion from and to grassland, and report the estimations in the NIR.	Not resolved. The Party did not estimate carbon stock changes in woody grassland. The Party provided information on its progress in the NIR (box 6-6, p.6-71) and explained during the review that further work will be done to estimate the carbon stock changes in biomass and DOM in woody grassland. The Party clarified that it plans to provide the information in its 2021 submission.
L.22	4.C.1 Grassland remaining grassland – CO_2 (L.50, 2018) Consistency	Revise the time series of the area of unmanaged grassland, ensuring that once a land area is classified as managed it is thereafter tracked as managed land within the inventory.	Resolved. During the review, the Party explained that land-use change from managed grassland to unmanaged grassland (NIR table 6-6) is considered to take place when the land is no longer directly influenced by humans so there are no further effects on anthropogenic emissions and removals to be estimated after the 20-year period without direct human intervention. The ERT noted that, in the land representation system of the United States, areas that are considered inaccessible to human activities are classified as unmanaged land according to the predetermined procedure of land representation, as explained in the NIR (pp.6-13–6-18). In the case of grassland, the conversion from managed to unmanaged is considered to take place when the land has last been used for grazing 40 or more years previously and so has now returned to its natural state. During the transition period, any carbon stock changes taking place until the new state is reached are reported under the managed land category. See also ID# L.43 in table 5 for the remaining transparency issue.

ID#	*Issue classification*[a, b]	*Recommendation made in previous review report*	*ERT assessment and rationale*
L.23	4.C.2 Land converted to grassland – CO_2 (L.23, 2018) (L.33, 2016) (L.26, 2015) Accuracy	Revise the estimates of carbon stock change in mineral soils under forest land converted to grassland using the updated data for mineral soils and report the results in the NIR.	Not resolved. No updates were made in the estimation of mineral soils since the previous submission. During the review, the Party explained that the improvement of SOC estimation associated with land-use conversions is a planned improvement.
L.24	4.C.2.2 Cropland converted to grassland – CO_2 (L.51, 2018) Completeness	Estimate biomass carbon stock change using the IPCC default method and factors or, where available, country-specific methods or factors, and explain the estimations in the NIR.	Not resolved. The Party did not provide estimates and "NE" was reported for carbon stock changes in biomass in cropland converted to grassland. During the review, the Party explained that it will work to address completeness over time as improved data become available and to prioritize this work in line with other improvements to make best use of available resources.
L.25	4.D.1 Wetlands remaining wetlands – CO_2, CH_4 and N_2O (L.25, 2018) (L.34, 2016) (L.27, 2015) Transparency	Noting the need to determine the quantity of peat harvested per ha and the total area undergoing peat extraction, provide the respective AD and IEFs for the on-site CH_4 and N_2O emission estimates in CRF table 4(II) for organic soils under peat extraction.	Addressing. The quantity of peat harvested per ha used for determining the peat extraction area (100 t/ha) is noted in the NIR (p.6-83) and has not changed since the previous submission. The Party added to the NIR (p.6-84) an explanation that the AD for on-site CH_4 emissions are the total peat extraction area and the AD for on-site N_2O emissions are the nutrient-rich peat production area. However, these AD were not included in CRF table 4(II). During the review, the Party explained that the omission will be addressed in the 2020 submission.
L.26	4.D.2.2 Land converted to flooded land – CO_2 (L.53, 2018) Completeness	Estimate carbon stock change in flooded land using the 2006 IPCC Guidelines (vol. 4, chap. 7) default method and factors or, where available, country-specific methods or factors, and explain the estimations in the NIR.	Not resolved. Carbon stock changes in all carbon pools for land converted to flooded land are reported as "NE". During the review, the Party explained that improvements are planned for future inventory submissions. See ID# L.1 above for the case of forest land converted to flooded land.
L.27	4.D.2.3 Land converted to wetlands – CO_2 (L.54, 2018) Completeness	Estimate biomass and DOM carbon stock changes for forest land converted to other wetlands as planned for the 2020 submission, and explain the estimations in the NIR.	Not resolved. Carbon stock changes in DOM for land (forest land) converted to other wetlands (vegetated coastal wetlands) were not estimated. During the review, the Party explained that improvements are planned for future inventory submissions.
L.28	4.D.2.3 Land converted to wetlands – CO_2 (L.54, 2018) Completeness	Estimate carbon stock changes in biomass for the conversion of cropland and grassland to other wetlands using IPCC default methods and factors (2006 IPCC Guidelines, vol. 4, chap. 7) or, where available, country-specific methods or factors, and explain the estimations in the NIR.	Not resolved. Carbon stock changes in biomass for land (cropland and grassland) converted to other wetlands (vegetated coastal wetlands) are estimated for one year of removals after conversion. During the review, the Party explained that improvement by including biomass losses due to land conversion to other wetlands is planned for future inventory submissions.
L.29	4.E Settlements – CO_2 (L.27, 2018) (L.15, 2016) (L.15, 2015) (94, 2013) Accuracy	Eliminate the overlap between the urban forest inventory and the forest inventory.	Addressing. The tree cover area in settlements (urban forest area) has been updated in the 2019 submission, even though the Party indicated its plan to address the overlap between forest and urban forest in the NIR (planned improvements in settlements, p.6-112). During the review, the Party indicated that there may be a minor overlap with forest and urban forest and this will be considered when new NLCD data become available.

ID#	*Issue classification*[a, b]	*Recommendation made in previous review report*	*ERT assessment and rationale*
L.30	4.E.1 Settlements remaining settlements – CO_2 (L.55, 2018) Comparability	Remove the reporting of the carbon stock change associated with yard trimmings and food scraps from under the settlements category and allocate it to the category other under the relevant sector.	Not resolved. The Party continues to report carbon stock changes associated with yard trimmings and food scraps under the settlements category instead of 4.H (other). During the review, the Party indicated that this reallocation will be addressed in the 2020 submission.
L.31	4.E.1 Settlements remaining settlements – CO_2 (L.55, 2018) Comparability	Report information on the long-term stored carbon stock of yard trimmings and food scraps, as well as on its annual changes, in the memo item in CRF table 5.	Not resolved. The Party did not report on the memo items on the long-term storage of carbon in waste disposal sites or on the annual change in total long-term carbon storage in CRF table 5. During the review, the Party indicated that this will be addressed in the 2020 submission.
L.32	4.E.2.2 Cropland converted to settlements 4.E.2.3 Grassland converted to settlements – CO_2 (L.56, 2018) Completeness	Estimate biomass carbon stock change for cropland converted to settlements (category 4.E.2.2) and grassland converted to settlements (category 4.E.2.3) using the IPCC default method and factors (2006 IPCC Guidelines, vol. 4, chap. 8) or, where available, country-specific methods or factors, and explain the estimations in the NIR.	Not resolved. Carbon stock changes in biomass for cropland converted to settlements and grassland converted to settlements were not estimated. During the review, the Party explained that it will work to address completeness over time as improved data become available and to prioritize the work in line with other improvements to make best use of available resources.
L.33	4.F.2 Land converted to other land – CO_2 (L.57, 2018) Completeness	Report estimates of carbon stock change for land converted to other land using the IPCC default method and factors (2006 IPCC Guidelines, vol. 4, chap. 9) or, where available, country-specific methods or factors, and explain the estimations in the NIR.	Not resolved. The Party reported all carbon stock changes in all carbon pools as "NE". During the review, the Party explained that this will be improved in future submissions. See ID# L.1 above for the issue of forest land converted to other land.
L.34	4.G HWP – CO_2 (L.58, 2018) Transparency	Complete CRF table 4.Gs2 with aggregated values in t carbon for each of the three HWP subcategories (solid wood, paper and paperboard, and other) and report in the NIR a table with all subcategories used by the model to calculate the HWP contribution as well as the conversion factors to carbon weight applied for each subcategory.	Not resolved. The United States did not complete CRF table 4.Gs2 and only reported the values of paper and paperboard for 1990–2017 and changed the notation key from "NA" to "IE" for sawnwood and wood panels. During the review, the Party explained that the relevant information for HWP will be provided in its 2020 submission.
L.35	4.H Other (LULUCF) – CO_2 (L.31, 2018) (L.17, 2016) (L.17, 2015) (96, 2013) (112, 2012) Accuracy	Reflect the intersectoral linkages and document the differences in the decay values for yard trimmings and food scraps to ensure the consistent use of decay values across the whole inventory.	Not resolved. The CH_4 emissions from yard trimmings and food scraps are reported in the waste sector as part of total CH_4 emissions from MSW. As disaggregated CH_4 emissions from yard trimmings and food scraps are not reported in the waste sector (NIR p.6-120), it is not possible to check the relationship or consistency between the carbon storage and the CH_4 emissions from yard trimmings and food scraps. During the review, the Party explained that the relevant information will be provided in future submissions. See also ID# L.36 below for information on documentation.
L.36	4.H Other (LULUCF) – CH_4 (L.60, 2018) Transparency	Report the complete calculation of the decay rates applied to yard trimmings and food scraps as well as information on the impact that	Not resolved. The Party did not provide in the NIR a complete description of the calculation of decay rates (including an explanation as to how the decay rates were derived), or information on

ID#	Issue classification[a, b]	Recommendation made in previous review report	ERT assessment and rationale
		the calculation has on the CH_4 emission rates applied to other MSW.	the impact of these decay rates on the CH_4 emission rates applied to other MSW. During the review, the Party clarified that it will address this recommendation in the 2021 submission.
L.37	4(III) Direct N_2O emissions from N mineralization/ immobilization – N_2O (L.61, 2018) Completeness	Estimate N_2O emissions associated with the mineralization of the N content of SOC losses in mineral soils for forest land, wetlands, settlements and other land, as well as for their conversion to and from cropland and grassland, using the IPCC default method and factors (2006 IPCC Guidelines, vol. 4, chap. 11) or, where available, country-specific methods or factors, and report the estimations in CRF table 4(III) and the NIR.	Not resolved. Direct N_2O emissions associated with the mineralization of the N content of SOC losses in mineral soils were not estimated. The Party continued to report "NE" in CRF table 4(III) for forest land remaining forest land and settlements (both remaining and converted) and "NA" for land converted to forest land, land converted to cropland, grassland (both remaining and converted), wetlands (both remaining and converted) and other land. During the review, the Party acknowledged that the correct notation keys should be "IE" for land converted to cropland and grassland, and "NE" for land converted to forest land and other land. The Party also clarified that land converted to wetlands leads to a gain in soil carbon and so "NA" is the appropriate notation key to use.
L.38	4(IV) Indirect N_2O emissions from managed soils – N_2O (L.62, 2018) Completeness	Estimate indirect N_2O emissions associated with the mineralization of the N content of SOC losses in mineral soils for forest land, wetlands, settlements and other land and report them in CRF table 4(IV), and explain the estimations in the NIR.	Not resolved. Both direct and indirect N_2O emissions associated with the mineralization of the N content of SOC losses in mineral soils were explained as not estimated in the NIR for forest land (p.6-50) and settlements (p.6-112) and therefore not included in the reported indirect N_2O emissions in CRF table 4(IV) (the ERT notes that this is relevant to N fertilization only). During the review, the Party clarified that indirect N_2O emissions associated with the mineralization of the N content of SOC losses in mineral soils for wetlands and other land are not estimated either. The Party explained that estimating indirect N_2O from N mineralization for all land-use categories is a planned improvement that will be implemented for either the 2020 or 2021 inventory submission.
L.39	4(V) Biomass burning – CO_2, CH_4 and N_2O (L.35, 2018) (L.42, 2016) (L.33, 2015) Completeness	Noting that CH_4 and N_2O emissions from forest fires are key categories, estimate CH_4 and N_2O emissions from biomass burning for land converted to forest land, land converted to wetlands, cropland, grassland and settlements; and populate CRF table 4(V).	Not resolved. CH_4 and N_2O emissions from biomass burning from forest land and grassland are estimated but all burning is reported under forest land remaining forest land and grassland remaining grassland. The Party explained that it is currently unable to report separately the emissions from land converted to forest land and land converted to grassland. Biomass burning from wildfires on cropland and biomass burning on wetlands and settlements were not estimated owing to a lack of data.
L.40	4(V) Biomass burning – CH_4 and N_2O (L.63, 2018) Transparency	Explain in the NIR the reasons for not using an estimation method in accordance with the decision tree in the 2006 IPCC Guidelines (vol. 4, chap. 2, figure 2.6).	Resolved. The Party improved the estimation of biomass burning due to forest fires by using new country-specific fuel mass data, and country-specific combustion factors where data are available from the forest plot inventory. The update of the estimation and the estimation method used were explained in the NIR (pp.6-29–6-30, 6-36–6-37 and A377–A-379). The ERT notes that the method applied is in accordance with the decision tree in the 2006 IPCC Guidelines (vol. 4, chap. 2, figure 2.6).

ID#	*Issue classification*[a, b]	*Recommendation made in previous review report*	*ERT assessment and rationale*
Waste			
W.1	5. General (waste) – CO_2, CH_4 and N_2O (W.1, 2018) (W.9, 2016) (W.9, 2015) Transparency	Provide background information that is consistent with the data actually used for the emission estimates, including the waste management practices.	Not resolved. The United States did not provide background information that is consistent with the data used for emission estimates. The Party continues to report data from different data sources in table 3-27 (p.3-53, energy section), figure 7-3 (p.7-17) and table A-235 (annex 3.14, p.A-387). During the review, the Party explained that it provided information on waste management practices in accordance with national circumstances and is still looking into differences between the data provided by BioCycle and the Earth Engineering Center of Columbia University in surveys on the state of waste in the country and EPA data on MSW in the country, including for AD for waste incineration. The Party indicated that this issue will be resolved in future submissions.
W.2	5.A Solid waste disposal on land – CH_4 (W.3, 2018) (W.3, 2016) (W.3, 2015) (101 and 104, 2013) Accuracy	Revise the estimates of emissions from solid waste disposal on land by incorporating the revised DOC values into the emission estimation.	Not resolved. The United States continues to use a constant value for DOC across the time series which does not capture any changes in waste composition over the time series. During the review, the Party explained that the composition of MSW sent to landfill is generally not available for many of the 1,500 active MSW landfills in the United States and therefore the composition is estimated at the national level. The Party is investigating possible variations on the national waste composition on the basis of site-specific waste composition studies and will summarize this information in the 2021 submission at the earliest. See ID# W.3 below.
W.3	5.A Solid waste disposal on land – CH_4 (W.4, 2018) (W.4, 2016) (W.4, 2015) (104, 2013) (125, 2012) Transparency	Report the composition of waste landfilled, with the amounts/shares and corresponding coefficients, including DOC.	Not resolved. The United States clarified during the review that it is still investigating studies of waste characteristics which are due to be completed across the country, including any variations on the national waste composition. The Party also clarified that landfill-specific waste composition studies are only available for a small number of landfills and for specific years and that, owing to national circumstances, it is unlikely that efforts to obtain such information will be supported in the near future, as it would jeopardize resources for estimating other key categories. It therefore requested that the ERT consider this issue to be resolved on the basis of national circumstances. However, the ERT noted that, as per the original recommendation, this issue relates to ID# W.2 above. Therefore, as soon as the Party provides the summary of the results of the investigation (as mentioned in ID# W.2 above) the ERT will be able to evaluate this issue further.
W.4	5.A.1 Managed waste disposal sites – CH_4 (W.15, 2018) Transparency	Include detailed information on the methods and parameters used by the facilities to estimate net CH_4 emissions and how the estimates are chosen for the national inventory when alternative estimates of net CH_4 emissions	Not resolved. The United State clarified during the review that this recommendation will be addressed in the 2020 submission.

ID#	*Issue classification*[a, b]	*Recommendation made in previous review report*	*ERT assessment and rationale*
		(e.g. from facilities that recover CH_4) are also produced.	
W.5	5.A.1 Managed waste disposal sites – CH_4 (W.15, 2018) Transparency	Include in the NIR a summary of the process to select the year to start using the new bottom-up method.	Not resolved. See ID# W.4 above.
W.6	5.A.1 Managed waste disposal sites – CH_4 (W.15, 2018) Transparency	Include in the NIR a summary of the methodologies used and analysis conducted in order to produce a scale-up factor for non-reporting facilities.	Not resolved. The United States provided a link during the review to the same technical report (RTI, 2018) that was provided to the previous ERT. The report covers the methodologies used and analysis conducted in order to produce a scale-up factor for non-reporting facilities. However, the Party did not include a summary of the methodologies or provide a text with a reference to the link for the technical report (RTI, 2018) to clarify the methodologies used or analysis conducted. During the review, the Party clarified that it will address this recommendation in the 2020 submission.
W.7	5.A.1.a Anaerobic – CH_4 (W.16, 2018) Comparability	Estimate and report the amounts of CH_4 flared and CH_4 for energy recovery for anaerobic waste disposal sites, but, until that is possible, report them as "NE" instead of "IE" in CRF table 5.A.	Addressing. The Party reported both the amount of CH_4 flared and the amount of CH_4 for energy recovery using "NE" in CRF table 5.A instead of estimating the amount of CH_4 flared and the amount of CH_4 for energy recovery. During the review, the Party explained the use of directly reported GHGRP net emissions and the rule that does not require facilities to report separately the total amounts of CH_4 recovered for energy versus CH_4 flared. The 2006 IPCC Guidelines (vol. 5, chap. 3, p.3.18) state that emissions from flaring are however not significant, as the CO_2 emissions are of biogenic origin and the CH_4 and N_2O emissions are very small. However, in the case of the amount of CH_4 for energy recovery, the Party identified the quantity of recovered CH_4 using equation HH-4 of the GHGRP (NIR p.A-391) and explained that CH_4 recovery was based on data from the LandFill Gas-to-Energy project (NIR p.A-390). The ERT notes that the 2006 IPCC Guidelines (vol. 5, chap. 3, p.3.18) state that if the recovered gas is used for energy, then the resulting GHG emissions should be reported under the energy sector. They also state (p.3.19) that reporting based on metering of all gas recovered for energy and flaring, or reporting gas recovery based on the monitoring of produced amount of electricity from the gas, is consistent with good practice. The ERT is of the view that CH_4 recovery for energy could be calculated using the estimation from electricity monitoring (in accordance with the 2006 IPCC Guidelines). The Party could report the amount of CH_4 for energy recovery in CRF table 5.A and include an explanation in the NIR, taking into account the good practice outlined in the 2006 IPCC Guidelines.
W.8	5.A.1.a Anaerobic – CH_4 (W.7, 2018) (W.12,	Obtain up-to-date data on the type and fractions of organic waste placed in industrial waste landfills;	Addressing. The NIR (p.7-11) referred to a technical memorandum mentioned during the previous review (RTI, 2018). The Party

ID#	Issue classification[a, b]	Recommendation made in previous review report	ERT assessment and rationale
	2016) (W.11, 2015) Accuracy	and revise the CH_4 estimates for all major industrial waste landfills.	explained during the review that this technical memorandum provides information on an EPA analysis to validate the assumption that most of the organic waste which would result in CH_4 emissions is disposed of at pulp, paper and food processing facilities (54 per cent) and food manufacturing facilities (7 per cent). According to the analysis, the total waste disposed of by facilities under each primary North American Industrial Classification System reported in 2016 was calculated in order to determine that 93 per cent of the total organic waste quantity originates from either the pulp and paper, or food and beverages sector (NIR p.7-11). The Party also made reference to the uncertainty section (NIR p.7-13), which explains the uncertainty values applied to the waste disposal and CH_4 generation information on industrial waste landfills. The ERT notes that there are approximately 1,200 industrial waste landfills in the country but only 172 meet the reporting threshold of the GHGRP (for which data are available).
W.9	5.B.2 Anaerobic digestion at biogas facilities – CH_4 (W.8, 2018) (W.14, 2016) (W.13, 2015) Transparency	Estimate and report CH_4 emissions from unintentional leakages using the default value of 5 per cent provided in the 2006 IPCC Guidelines.	Not resolved. The United States did not estimate CH_4 emissions as required. The Party explained during the review that it is investigating the data sources and practices of anaerobic digestion and will assess the addition of a 5 per cent factor to account for unintentional leakages for the 2021 submission.
W.10	5.B.2 Anaerobic digestion at biogas facilities – CH_4 and N_2O (W.17, 2018) Transparency	Review and complete the explanation in CRF table 9 for category 5.B.2.b for CH_4 and N_2O.	Not resolved. The Party did not add the required information for "NE" used for CH_4 and N_2O under category 2.B.2.b (other) in CRF table 9. During the review the Party explained that basic research has been initiated which indicates that some activity for this category occurs in the United States, but EPA needs to conduct further research on available AD for estimating emissions.
W.11	5.C.1 Waste incineration – CO_2, CH_4 and N_2O (W.10, 2018) (W.15, 2016) (W.14, 2015) Transparency	Provide in the NIR consistent information on the data that are used for the estimation of emissions from waste incineration (e.g. on the percentage of waste incinerated in 2013 reported in figure 7-2 and tables 3-26 and A-272 of the 2016 NIR).	Not resolved. There are still inconsistencies in the information on MSW incineration in the NIR, such as between figure 7-2 (p.7-16) (12.8 per cent) and table 3-27 (p.3-53) (7.6 per cent). The ERT also notes that table A-133 (p.A-214) presents the amount of plastic incinerated (7 per cent). The table A-272 mentioned by the previous ERT corresponds to table A-235 (p.A-387) in the 2019 submission, but the ERT could not find any reference to the amount of waste incinerated in this table. The main difference between table A-235 and figure 7-2 relates to the amount of waste landfilled (52.5 per cent in figure 7-2 and 64 per cent in table A-235) (see ID# W.1 above). During the review, the United States explained that the percentage of waste incineration shown in figure 7.2 comes from a different source from that used in table 3-27 and does not represent the data used in the analysis for estimating emissions from waste incineration. However, the ERT is of the view that data in the NIR should be consistent across

ID#	*Issue classification*[a, b]	*Recommendation made in previous review report*	*ERT assessment and rationale*
			the waste and energy sectors and cross-references should be provided in the NIR for the descriptions of the methodology and AD used and any inconsistencies should be clearly explained.
W.12	5.C.1 Waste incineration – CO_2, CH_4 and N_2O (W.18, 2018) Transparency	Ensure that the 2019 NIR indicates that the emissions from the incineration of non-hazardous industrial waste referred to in the 2018 NIR are in fact emissions from the incineration of hazardous industrial waste and already included in the inventory by (a) correcting the entry in annex 5 to the NIR, p.A-427, section on category 1.A.5.a (CO_2 emissions from non-hazardous industrial waste incineration and medical waste incineration); (b) correcting the entry in annex 5 to the NIR, table A-266, row on category 1.A.5.a; and (c) changing the notation key reported for CO_2, CH_4 and N_2O emissions for category 5.C.1 (non-biogenic (other)) from "NA" to "IE" in CRF table 5.C and explaining in CRF table 9 where the emissions are included.	Not resolved. There are no changes to the NIR or CRF table 5.C in the 2019 submission. The Party indicated during the review that this recommendation will be addressed in the 2020 submission.
W.13	5.D.2 Industrial wastewater – CH_4 (W.14, 2018) (W.5, 2016) (W.5, 2015) (105, 2013) Completeness	Include information on the non-estimation of CH_4 emissions from sludge under industrial wastewater.	Not resolved. The Party did not include information on emissions from sludge in the NIR. During the review, the Party explained that sludge removed from industrial wastewater is not estimated owing to insufficient data and that an explanation will be added in annex 5 to the next submission in line with paragraph 37(b) of the UNFCCC Annex I inventory reporting guidelines.

[a] References in parentheses are to the paragraph(s) and the year(s) of the previous review report(s) in which the issue was raised. Issues are identified in accordance with paras. 80–83 of the UNFCCC review guidelines and classified as per para. 81 of the same guidelines.

[b] The reviews of the 2014 and 2017 inventory submissions of the United States of America did not take place. Therefore, 2014 and 2017 are excluded from the list of review years in which the issue could have been identified.

IV. Issues identified in three 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 included in table 4 have been identified in three successive reviews, including the review of the 2019 inventory submission of the United States, and have not been addressed by the Party.

Table 4
Issues identified in three successive reviews and not addressed by the United States of America

ID#	*Previous recommendation for the issue identified*	*Number of successive reviews issue not addressed*[a]
General		

ID#	*Previous recommendation for the issue identified*	*Number of successive reviews issue not addressed*[a]
G.1	Improve the completeness of the inventory, in particular for those categories for which there are methodologies in the 2006 IPCC Guidelines	5 (2012–2019)
Energy		
E.4	Provide a more transparent clarification of how the difference in emissions between the reference and the sectoral approach is determined and which fuels are subtracted as NEU and feedstocks	5 (2012–2019)
E.5	Report only emissions from fuels combusted for the use of energy under fuel combustion, and reallocate the relevant emissions currently reported under the subcategory NEU (other) and part of the fuel used under the subcategory United States territories (other)	5 (2012–2019)
E.7	Harmonize and reconcile the data between the reference and the sectoral approach for the reporting of jet kerosene consumption between CRF tables 1.A(b) and 1.D or furnish an adequate explanation of inconsistencies, where appropriate	4 (2013–2019)
E.23	Enhance transparency in reporting CH_4 emissions from petroleum systems from venting and flaring, in accordance with the UNFCCC Annex I inventory reporting guidelines	3 (2015/2016–2019)
IPPU		
I.3	Conduct further research and consultation with industry, state-level regulators and/or statistical agencies to access additional AD and EFs and/or to seek verification of the current method and assumptions for estimating emissions from ceramics, non-metallurgical magnesium production and from other limestone and dolomite use; and report on progress in the NIR	3 (2015/2016–2019)
I.4	Allocate emissions from all fossil fuel uses (i.e. fuel and feedstock use) for ammonia production under subcategory 2.B.1 of the IPPU sector in accordance with the 2006 IPCC Guidelines	3 (2015/2016–2019)
I.9	Progress with plans to analyse new data reported by facilities (i.e. GHGRP data) and include emissions from combustion and flaring from installations not currently included in the inventory	3 (2015/2016–2019)
I.10	Develop a methodology that is consistent with the 2006 IPCC Guidelines as soon as is practicable, allocating relevant fuel and feedstock emissions within the IPPU sector	3 (2015/2016–2019)
I.12	Provide an explanation for the country-specific approaches using the EFs for ethylene production derived from GHGRP data, including the outcome of consultation with industry experts, and the results of the quality checks between GHGRP production estimates and data from trade association membership surveys	3 (2015/2016–2019)
I.13	Conduct further research and consultation with industry, regulators and statistical agencies as necessary in order to access complete AD on natural gas consumption and coke oven gas production at merchant coke plants, and obtain EFs and/or emission estimates	3 (2015/2016–2019)
I.14	Explain the allocation of the emissions from coke production and iron and steel production across both the energy and IPPU sectors, including the amount of carbon stored in the products of iron and steel production; this could be done, for example, through the provision of a quantitative summary of	3 (2015/2016–2019)

ID#	*Previous recommendation for the issue identified*	*Number of successive reviews issue not addressed*[a]
	the carbon balance that the Party uses to compile and quality check the inventory estimates	
I.17	Improve the documentation of the refrigeration and air-conditioning model by including the clarifications on model assumptions, data sources and calculation methodologies provided to the ERT during the 2016 review, including (a) the assumed linear substitution trend between "start" and "full penetration" dates for substitution gases; (b) additional information on the annual growth rates cited in the NIR; (c) the model calculation approach for overlapping equipment technology substitutions; (d) details of country-specific circumstances and key references for the annual emission rates for servicing and leaks applied; and (e) information on assumed recovery, reuse and recycling of fluids at end of life (e.g. for fire extinguishers)	3 (2015/2016–2019)
I.19	Either review and update the assumptions regarding solvent emissions, or provide country-specific information to justify the assumption that only 90 per cent of solvents are emitted	3 (2015/2016–2019)
I.20	Revise the reporting of emissions from solvents in the CRF tables (reported as "NA")	3 (2015/2016–2019)
I.21	Provide in the NIR detailed information including the quality checks for all gases and sources included in the unspecified mix of HFCs and PFCs in the subcategory other applications under the category product uses as substitutes for ozone-depleting substances	3 (2015/2016–2019)
Agriculture		
A.12	Obtain updated MMS data and estimate emissions using the updated MMS usage data; if this is not possible, report on progress in the effort to update the MMS data	3 (2015/2016–2019)
A.16	If not using a more disaggregated livestock categorization in estimating emissions, use option A in reporting data and emissions for cattle in the CRF tables; if applying option C, report the values for population size, allocation by climate region to cool and temperate regions, typical animal mass, volatile solid daily excretion and CH_4 producing potential for all other cattle subcategories of option C in CRF tables 3.B(a)s1 and 3.B(a)s2	3 (2015/2016–2019)
A.24	Provide an explanation of how the methodology and the DAYCENT model used to estimate N volatilized and N loss are both compatible with the 2006 IPCC Guidelines and based on science	3 (2015/2016–2019)
LULUCF		
L.1	Conclude the technical work under way to be able to provide estimates for the carbon stock changes in the living biomass and DOM pools for each conversion category from forest land to any other land use for each year based on a reliable land-use change matrix, and report on the achievements made	4 (2013–2019)
L.2	Include all managed United States lands in the inventory; improve the consistency of the time series of national areas; and report on the achievements made	5 (2012–2019)
L.4	Resolve the inconsistencies in land-use areas in the time series reported in the CRF tables	3 (2016–2019)
L.6	When providing detailed information in the NIR on how the different data sources were harmonized, provide explicit information on how the model ensures consistent integration	3 (2015/2016–2019)

ID#	*Previous recommendation for the issue identified*	*Number of successive reviews issue not addressed*[a]
	of the three data sources; for example by including a visual flow chart of data processing during the harmonization process	
L.14	Provide in an annex to the NIR detailed tables on average carbon fluxes by region and type (e.g. the region and forest type classifications described in Smith et al. (2006) and used for estimating downed deadwood and understory, which might better reflect the diversity of forest types and age classes)	3 (2016–2019)
L.16	Estimate the carbon stock changes in living biomass in perennial crops for all years in the time series	5 (2012–2019)
L.23	Revise the estimates of carbon stock change in mineral soils under forest land converted to grassland using the updated data for mineral soils and report the results in the NIR	3 (2015/2016–2019)
L.25	Noting the need to determine the quantity of peat harvested per ha and the total area undergoing peat extraction, provide the respective AD and IEFs for the on-site CH_4 and N_2O emission estimates in CRF table 4(II) for organic soils under peat extraction	3 (2015/2016–2019)
L.29	Eliminate the overlap between the urban forest inventory and the forest inventory	4 (2013–2019)
L.35	Reflect the intersectoral linkages and document the differences in the decay values for yard trimmings and food scraps to ensure the consistent use of decay values across the whole inventory	5 (2012–2019)
L.39	Noting that CH_4 and N_2O emissions from forest fires are key categories, estimate CH_4 and N_2O emissions from biomass burning for land converted to forest land, land converted to wetlands, cropland, grassland and settlements; and populate CRF table 4(V)	3 (2015/2016–2019)
Waste		
W.1	Provide background information that is consistent with the data actually used for the emission estimates, including the waste management practices	3 (2015/2016–2019)
W.2	Revise the estimates of emissions from solid waste disposal on land by incorporating the revised DOC values into the emission estimation	4 (2013–2019)
W.3	Report the composition of waste landfilled, with the amounts/shares and corresponding coefficients, including DOC	5 (2012–2019)
W.8	Obtain up-to-date data on the type and fractions of organic waste placed in industrial waste landfills; and revise the CH_4 estimates for all major industrial waste landfills	3 (2015/2016–2019)
W.9	Estimate and report CH_4 emissions from unintentional leakages using the default value of 5 per cent provided in the 2006 IPCC Guidelines	3 (2015/2016–2019)
W.11	Provide in the NIR consistent information on the data that are used for the estimation of emissions from waste incineration (e.g. on the percentage of waste incinerated in 2013 reported in figure 7-2 and tables 3-26 and A-272 of the 2016 NIR)	3 (2015/2016–2019)
W.13	Include information on the non-estimation of CH_4 emissions from sludge under industrial wastewater	4 (2013–2019)

[a] The reports on the reviews of the 2014 and 2017 inventory submissions of the United States have not yet been published. Therefore, 2014 and 2017 were not included when counting the number of successive years in table 4. As

the reviews of the Party's 2015 and 2016 inventory submissions were conducted together, they are not considered successive and 2015/2016 is considered as one year.

V. Additional findings made during the individual review of the 2019 inventory submission

9. Table 5 contains findings made by the ERT during the individual review of the 2019 inventory submission of the United States that are additional to those identified in table 3.

Table 5
Additional findings made during the individual review of the 2019 inventory submission of the United States of America

ID#	*Finding classification*	*Description of the finding with recommendation or encouragement*	*Is finding an issue and/or a problem?*[a]
General			
G.2	Annual submission	The United States reported in the NIR (annex 5, table A-247, p.A-416) a summary of sources and sinks not included in the inventory. This table covers both sources and sinks for which methodologies are provided in the 2006 IPCC Guidelines and those without methodologies. The ERT commends the Party for the transparency provided by the table but notes that a numerical value was not provided in the "Estimated 2017 emissions" column for all sources and sinks that occur in the United States and for which there are methodologies in the 2006 IPCC Guidelines. During the review, the Party stated that, in some cases, approximated AD are currently unavailable to derive a likely level of emissions or removals. Further, the effort to develop a proxy estimate is better invested in developing estimates to include in the inventory itself as part of ongoing planned improvements. The ERT acknowledges the point made by the Party but notes that in accordance with paragraph 37(b) of the UNFCCC Annex I inventory reporting guidelines, Parties should provide justifications for exclusions in terms of the likely level of emissions for all mandatory sources and sinks considered insignificant and the total national aggregate of estimated emissions for all gases and categories considered insignificant shall remain below 0.1 per cent of national total GHG emissions. The ERT recommends that the United States provide a justification in the NIR, based on the likely level of emissions as per paragraph 37(b) of the UNFCCC Annex I inventory reporting guidelines, for all sources and sinks that occur but are considered insignificant and excluded from the inventory and for which there are methodologies provided in the 2006 IPCC Guidelines. The ERT recommends that the Party provide in its next NIR evidence that the total national aggregate of estimated emissions for all mandatory gases and categories considered insignificant remains below 0.1 per cent of national total GHG emissions.	Yes. Completeness
G.3	Key category analysis	The ERT noted a difference between the 2017 estimate for category 1.A.3.b (CO_2 emissions from mobile combustion: road) in table A-6 (NIR p.A-21: 1,504.1 MMT CO_2 eq) and the value for emissions provided in CRF table 1.A(a)s3 (category 1.A.3.b (road transportation): 1,507,192.43 kt CO_2). During the review, the Party explained that the difference arose because the value in table A-6 is for on-road transportation excluding motorcycles, whereas the value in CRF table 1.A(a)s3 is for on-road transportation emissions including motorcycles but excluding gasoline and diesel emissions for military fuel use, with each of the excluded emissions included under categories 1.A.3.e (other transportation) and 1.A.5.b (mobile, military), respectively. The ERT notes that the Party may disaggregate categories for key category analyses at its own discretion, but also notes the ambiguity introduced by naming the disaggregation "1.A.3.b CO_2 Emissions from Mobile Combustion: Road" in table A-6 of the NIR. The ERT also noted that CRF table 7 is automatically generated using sectoral background tables. The ERT encourages the United States to either clarify the difference between category 1.A.3.b in table A-6 of the NIR and category 1.A.3.b in CRF table 1.A(a)s3 in a footnote to table A-6 in the NIR, or to remove the code "1.A.3.b" from the disaggregation in table A-6 in order to enhance the transparency of the Party's key category analysis.	Not an issue/problem
G.4	Uncertainty analysis	The ERT noted that the uncertainty analyses provided in table A-265 (NIR annex 7, p.A-451) show the results for the latest inventory year (2017) but do not show the results for the base year (1990). According to paragraph 15 of the UNFCCC Annex I inventory reporting guidelines, the quantitative uncertainty analysis should be reported for at	Yes. Convention reporting adherence

ID#	*Finding classification*	*Description of the finding with recommendation or encouragement*	*Is finding an issue and/or a problem?*[a]
		least the base year and the latest inventory year. During the review, the Party clarified that it performed an uncertainty analysis for the base year (1990), but was unable to incorporate the results in the final version of section 1 of and annex 7 to the NIR because the issue was identified late, and the Party decided to postpone their inclusion until the following submission year. The ERT recommends that the United States include the results of the uncertainty analysis for 1990 in the relevant tables of section 1 and annex 7 in its next submission.	
Energy			
E.25	1.C CO_2 transport and storage – CO_2	The ERT noted in the NIR (box 3-7, p.3-79) that emissions of CO_2 from EOR are treated differently depending on the source of CO_2. When CO_2 from naturally occurring CO_2 reservoirs is used in EOR, the subsequent leakage of injected CO_2 from the EOR site is not reported separately for injection and storage under category 1.C.2 (injection and storage) and, as described in the NIR (box 3-7), is assumed to be fully sequestered. When the CO_2 is sourced from anthropogenic sources (such as gas processing or post-combustion capture at a coal-fired power station), it is assumed that complete loss of the CO_2 occurs at the point of capture. While dedicated CCS sites are subject to GHGRP methods for estimating emissions from the geological storage formation, it is not clear whether the permanence of CO_2 sequestration at EOR sites is assessed. When naturally occurring CO_2 is sourced and injected into a geological formation as part of EOR operations, there is the potential for subsequent long-term leakage and loss of CO_2 through pathways, as described in the 2006 IPCC Guidelines (vol. 2, table 5.3, p.5.12), and therefore the ERT could not identify whether this emission category is being accounted for in the inventory. During the review, the Party explained that it continues to review new data from the GHGRP and other sources for consideration in updating emission estimates for categories 1.C.1 (transport of CO_2), 1.C.2.a (injection) and 1.C.2.b (storage). The ERT recommends that the United States report on the progress on the research to enable estimation of emissions for category 1.C.2, and provide a description of emission pathways associated with EOR and CCS processes for all relevant categories, including how leakage from CO_2 geological storage formations is assessed for both EOR and CCS projects. The ERT recognizes that there is no method in the 2006 IPCC Guidelines and encourages the Party to report emissions under category 1.C.2, including emissions from naturally occurring CO_2.	Yes. Transparency
E.26	1.C CO_2 transport and storage – CO_2	In addition to ID# E.25 above, the ERT noted that the notation keys in CRF table 1.C are not used consistently. For example, the total amount of CO_2 injected at storage sites and the total leakage from transport, injection and storage are reported as "NA", while category 1.C.1 (transport of CO_2) and category 1.C.2 (injection and storage) are reported as "IE". The ERT recommends that the United States change the total amount of CO_2 captured for storage to "IE" in line with the Party's existing approach of reporting EOR and CCS emissions in the sectors where the emissions are captured for use in EOR. The ERT also recommends that the Party report the total amounts of CO_2 injected at storage sites and the total leakage from transport, injection and storage as "IE".	Yes. Comparability

ID#	*Finding classification*	*Description of the finding with recommendation or encouragement*	*Is finding an issue and/or a problem?*[a]
IPPU			
I.24	2.B.1 Ammonia production – CO_2	The ERT identified significant changes in the CO_2 IEF for category 2.B.1 (ammonia production) between 2000 (1.20 t/t) and 2001 (1.24 t/t), and between 2015 (1.27 t/t) and 2016 (1.32 t/t). The ERT noted that these outliers represent an increase in the CO_2 IEF across the time series. For example, from 1990 to 2000, the CO_2 IEF was constant (1.20 t/t), and increased by 3.4 per cent (1.24 t/t) in 2001. Between 2001 and 2015, the values of the CO_2 IEF were in a similar range and increased again between 2015 and 2016 by 4.0 per cent (to 1.32 t/t). During the review, the United States explained that this might be because the CO_2 IEF values in CRF table 2(I).A-Hs1 are based on the combined total of CO_2 emissions and recovery emissions compared with production values and the change in annual recovery levels alters the CO_2 IEF value in CRF table 2(I).A-Hs1. The ERT commends the Party for the information but notes that between 2000 and 2001 the AD, CO_2 emissions and recovery values decreased while the CO_2 IEF increased, and between 2015 and 2016, the AD, CO_2 emissions, recovery values and CO_2 IEF values increased. The ERT recommends that the United States further investigate the reasons behind the trends in the CO_2 IEF and underlying AD and emission and removal trends and report on the matter in its next submission.	Yes. Transparency
I.25	2.B.2 Nitric acid production – N_2O	The ERT noted that the AD for nitric acid production decreased by 6 per cent, from 7.7 to 7.2 Mt, between 2014 and 2015 but increased by 8 per cent to 7.8 Mt between 2015 and 2016. The ERT noted that N_2O emissions follow the opposite trend and increased in 2015 by 6 per cent, from 36.7 to 38.8 kt. During the review, the United States explained that the changes are driven by the use of abatement technologies and that it will include information on the trends in the 2020 submission. The ERT recommends that the United States include in the NIR an explanation of the trends observed for N_2O emissions and AD for nitric acid production.	Yes. Transparency
I.26	2.E.4 Heat transfer fluid – HFCs, PFCs and SF_6	The ERT noted that the emissions from category 2.E.4 are reported in CRF table 2(II) but the NIR does not contain a section on, or reference to, this category. It was not clear to the ERT whether this category is included in NIR section 4.23 on semiconductor manufacture (p.4-99). During the review, the United States confirmed that heat transfer fluids are covered in NIR section 4.23 and informed the ERT that it will update the title of the section in its next submission. The ERT encourages the United States to update the title of NIR section 4.23 to reflect that it contains category 2.E.4.	Not an issue/problem
I.27	2.B.5 Carbide production – CO_2	The ERT noted that the United States reported AD, CO_2 and CH_4 emissions from category 2.B.5.b (calcium carbide production) as "NE" in CRF table 2(I).A-Hs1. However, as noted in ID# I.8 (in table 3), emissions from calcium carbide are allocated in the energy sector (NEU of petroleum coke) and therefore "IE" should be reported for AD and CO_2 emissions in CRF table 2(I).A-Hs1. For CH_4 emissions, "NE" should continue to be reported, as there is no method for its calculation under the tier 1 method applied by the Party for this non-key category. The ERT acknowledges the recommendation in ID# I.8 in table 3 for the United States to allocate CO_2 emissions from category 2.B.5.b to the IPPU sector. However, until this is possible, the ERT recommends that the Party report the correct notation key "IE" for AD and CO_2 emissions in CRF table 2(I).A-Hs1 and provide the necessary explanation in CRF table 9.	Yes. Comparability

ID#	*Finding classification*	*Description of the finding with recommendation or encouragement*	*Is finding an issue and/or a problem?*[a]
I.28	2.B.5 Carbide production	The ERT noted that in NIR section 4.10 (p.4-42), the United States refers in the title to silicon carbide production, whereas all the information relating to calcium carbide production is also included under this section. The ERT is of the view that the title should reflect the correct categories included in the explanation under this section. The ERT encourages the United States to change the title of NIR section 4.10 to "Carbide production and consumption", to reflect that the section includes information for categories 2.B.5.a (silicon carbide), 2.B.5.b (calcium carbide) and 2.B.10 (silicon carbide consumption).	Not an issue/problem
Agriculture			
A.25	3. General (agriculture) – CH_4 and N_2O	The ERT noted that the United States reported in the annex 5 to the NIR (p. 5-40) on the uncertainty associated with an incomplete estimation of N_2O emissions for Alaska and Hawaii. During the review, the Party clarified that N_2O emissions from inorganic mineral fertilizer, N additions for pasture, range and paddock in Alaska and Hawaii, and drained organic soils in Hawaii are reported in the inventory and that other sources are small and the emissions are likely to be insignificant. However, the ERT could not clearly deduce from the information in the NIR which other N sources are not estimated in the inventory for Alaska and Hawaii or whether they are insignificant. The ERT further noted that CH_4 and N_2O emissions for category 3.F (field burning of agricultural residues) for Alaska and Hawaii are also not estimated in the inventory (NIR p.5-50). The ERT recommends that the United States include in the NIR (e.g. in annex 5) an indication of the sources and categories not estimated for Hawaii and Alaska. If the emissions are insignificant, the ERT recommends that the Party justify their exclusion on the basis of the likely level of emissions in accordance with paragraph 37(b) of the UNFCCC Annex I inventory reporting guidelines.	Yes. Completeness
A.26	3. General (agriculture) – CH_4 and N_2O	In response to a previous review recommendation (see ID# A.1 in table 3) the United States reported in CRF tables AD for category 3.C.1 (rice cultivation, irrigated) and for all subcategories under categories 3.D.a and 3.D.b (direct and indirect N_2O emissions from managed soils) and 3.F (field burning of agricultural residues) for all years of the time series (2013–2017) for which emissions were estimated using surrogate data, trend analysis and statistical approaches. The Party included in the NIR (pp.5-21 and 5-34) information on the approaches used for reporting AD for those categories for 2013–2017: it used a surrogate data method for categories 3.C, 3.D.a and 3.D.b, and linear regression for category 3.F. However, the ERT noted that the AD reported in CRF tables 3.C, 3.D and 3.F for 2013–2017 are simply the figures for the most recent years for which NRI data are available (2012 for the current submission) held constant for the remainder of the time series (2013–2017). During the review, the Party informed the ERT that it may be possible to use alternative data sources such as the United States agricultural resource management survey, Landsat-based products or other data sets to inform the derivation of AD where NRI data are not available. The ERT recommends that the United States explore the use of alternative data sources to derive AD for the years of the time series where no DAYCENT data are available (2013–2017). If alternative data sets are not available, the ERT recommends that the Party use proxy data or extrapolation methods to derive AD.	Yes. Consistency
A.27	3.A Enteric fermentation – CH_4	The ERT noted that the average GE for heifer feedlot cattle in CRF table 3.As1 is incorrectly reported for 2000 (161.01 MJ/head/day). For the other years of the time series, the reported GE value is 0.17 MJ/head/day. The ERT noted that the CH_4 emissions and IEF are not affected by the reporting of 161.01 MJ/head/day in CRF table 3.As1.	Yes. Convention reporting adherence

ID#	*Finding classification*	*Description of the finding with recommendation or encouragement*	*Is finding an issue and/or a problem?*[a]
		The ERT recommends that the United States correct the value of the GE reported in CRF table 3.As1 for 2000 for heifer feedlot cattle.	
A.28	3.A Enteric fermentation – CH_4	In the NIR (annex 3.10, table A-160, p.A-253), the United States reported the monthly average population from the calf transition matrix. The ERT noted that the populations in the table for each cohort remain constant, for example the population for calves aged 0 years old in January was the same as for calves aged 1 year old in February (2,431 units). However, populations should be declining each month, on the basis of losses due to mortality and slaughter, rather than remaining constant. During the review, the Party clarified that the values in table A-160 were reported incorrectly and provided a new table with the correct values to the ERT, where, for example, there are 2,562 calves aged 0 years old in January and 2,560 calves aged 1 year old in February. The ERT recommends that the United States correct the values reported in table A-160 of the NIR to reflect the correct values of the monthly average calf population by including losses due to mortality and slaughter.	Yes. Convention reporting adherence
A.29	3.B.1 Cattle – N_2O	The ERT noted discrepancies in the values of the Nex rate in CRF table 3.B(b) for beef calves, dairy calves and beef replacements. When multiplying the population by the Nex rates reported in the CRF table, the result does not match the value of the total Nex reported in CRF table 3.B(b). For example, if the beef calf population (15,970,718) is multiplied by the Nex rate (20.07 kg N/head/year), the result is 320,510,941 kg N. However, the value reported in CRF table 3.B(b) (cell N31) is 309,748,493 kg N. During the review, the Party explained that it calculates Nex for each state using a state-specific Nex rate factor and then adds together the totals for all states to calculate and report the total national Nex value shown in CRF table 3.B(b). Therefore, the values will not be the same as if the average rate reported for each animal class were used to calculate the total Nex. The ERT recommends that the United States report the correct Nex values for beef calves, dairy calves and beef replacements in CRF table 3.B(b) so that they reflect the true average Nex rate.	Yes. Transparency
A.30	3.B.1 Cattle – N_2O	The ERT noted that the United States used “IE” to report the Nex rate for heifer stockers and beef replacements in CRF table 3.B(b) without providing an explanation as to where the Nex rates were included. During the review, the Party clarified that the Nex rate for non-dairy cattle was used for heifer stockers and beef replacements. However, the ERT noted that although the Nex rate was reported in CRF table 3.B(b) for non-dairy cattle (52.81 kg N/head in 2017), the population and total Nex were reported as “IE”. This is also the case for dairy cattle, where the Nex rate is 100.09 kg N/head in 2017 and the population and total Nex is reported as “IE”. The Party explained that the total Nex for dairy and non-dairy cattle is reported against individual cattle subcategories. The ERT recommends that the United States replace “IE” for the Nex rate for heifer stockers and beef replacements with the actual Nex rates applied for those individual animals in CRF table 3.B(b). The ERT further recommends that the Party replace the Nex rates for dairy cattle and non-dairy cattle with “IE” and explain in the documentation box of CRF table 3.B(b) that the Nex rates are reported against individual livestock classes.	Yes. Transparency
A.31	3.B.2 Sheep – CH_4 and N_2O	The United States provided information on MMS distribution among waste management systems by operation in annex 3.11 to the NIR (tables A-188–A-189, pp. A-291 and A-293). However, the ERT noted that table A-189 does not include information on manure management allocations for sheep. During the review, the Party informed the ERT that this was due to the small level of emissions from manure management for sheep.	Yes. Transparency

ID#	*Finding classification*	*Description of the finding with recommendation or encouragement*	*Is finding an issue and/or a problem?*[a]
		The ERT considers that this information would enhance the transparency of the NIR and recommends that the United States include information on MMS distribution for sheep in NIR table A-189.	
A.32	3.D Direct and indirect N_2O emissions from agricultural soils – N_2O	The United States reported in box 5-3 of its NIR that the DAYCENT model (tier 3 method) is used to estimate N_2O emissions from tobacco crops while in a following sentence it is reported that the DAYCENT model is not applied to estimate N_2O emissions and a tier 1 method is used for other crops including tobacco (p.5-34). During the review, the Party clarified that tobacco crops are included in the DAYCENT model (tier 3 method) and stated that it would correct the information in the next submission. The ERT recommends that the United States correct the text in its NIR to reflect the actual method applied, namely that N_2O emissions from tobacco crops are estimated using the DAYCENT model (tier 3 method).	Yes. Convention reporting adherence
A.33	3.D.a Direct N_2O emissions from managed soils – N_2O	The ERT noted that recalculations were performed for N_2O emissions for categories 3.D.a.1 (inorganic fertilizers), 3.D.a.4 (crop residues), 3.D.a.5 (mineralization/immobilization associated with loss/gain of soil organic matter) and 3.D.a.6 (cultivation of organic soils). However, these recalculations were not described in the recalculations section of the NIR (p.5-41) in accordance with paragraphs 43–45 of the UNFCCC Annex I inventory reporting guidelines. During the review, the United States explained that it will investigate the reasons why the data for these categories were not updated. The ERT checked the CRF tables and found that the values reported for those categories in the 2019 submission are different from those reported in the 2018 submission. In CRF table 8s2, the recalculation for category 3.D reduced emissions by 5.63 per cent. The ERT was not able to check the changes that occurred in the AD, methods or EFs used and if these changes were made in response to the review process. The ERT recommends that the United States include in the NIR an explanation of the AD, methods and EFs used to estimate emissions under categories 3.D.a.1, 3.D.a.5 and 3.D.a.6 and explain why the new N_2O emission values are more accurate than the previous ones. The ERT also recommends that the United States report on the recalculations in accordance with paragraphs 43–45 of the UNFCCC Annex I inventory reporting guidelines, if the Party performs recalculations for those categories in the next submission.	Yes. Convention reporting adherence
A.34	3.D.a.3 Urine and dung deposited by grazing animals – N_2O	In response to a question raised by the ERT relating to ID# A.23 in table 3, the United States explained the approach to allocating N deposited in urine and dung to each county. The Party clarified during the review that N deposited on pasture, range and paddock MMS is provided at the county level but, owing to QC issues, the data are aggregated to the state level. The data are then applied to NRI survey locations at the same rate for a state (dividing the total N deposited in pasture, range and paddock by the total area of grassland in the state). The total input of N deposited for individual survey locations in the NRI was determined by multiplying the rate by the weight. The ERT considers that this information should be included in the NIR to increase transparency and that the Party should explain that emission estimates are performed using the DAYCENT model by using data of N deposited by soil types. The ERT recommends that the United States include in the NIR the information provided to the ERT explaining the approach used to allocate N deposited in urine and dung to each county and how the DAYCENT model uses these data in the estimation of N_2O emissions.	Yes. Transparency

ID#	*Finding classification*	*Description of the finding with recommendation or encouragement*	*Is finding an issue and/or a problem?*[a]
LULUCF			
L.41	4. General (LULUCF) – CO_2, CH_4 and N_2O	The United States indicated for the first time in its inventory the preliminary estimates of the land areas of the United States territories (Puerto Rico, Virgin Islands, Guam, Northern Mariana Islands, and American Samoa) in the planned improvements section of the NIR (box 6-2, p.6-21), showing the efforts made so far to incorporate area data by land-use type fully for the United States territories (see ID# L.2 in table 3). The NIR states that the preliminary estimates of these land areas represent 0.1 per cent of the total land base of the United States. The ERT is of the view that the Party could also report preliminary estimates of emissions or removals and provide a preliminary analysis of the impact and significance of emissions or removals from each of these land areas compared with the total LULUCF emission estimates, in order to increase the transparency of the information in the inventory. The ERT recommends that the United States report in the NIR preliminary emission or removal estimates for the land areas of the United States territories reported as a preliminary result of the planned improvement carried out in the Party's inventory.	Yes. Transparency
L.42	Land representation – CO_2, CH_4 and N_2O	The United States reported that, for land converted to cropland, grassland and settlements, the historical areas cumulate from 1979, so that for 1999 onward a 20-year cumulated area is reported (NIR pp.6-53, 6-68 and 6-102), and for land converted to forest land, the historical areas are cumulated from 1982, so that for 2002 onward, a 20-year cumulated area is reported (NIR p.6-44). The ERT noted that the gap in historical data from 1971 to 1978 for land converted to cropland, grassland and settlements, and from 1971 to 1981 for land converted to forest land, has an impact on the level of, and trend in, carbon stock changes and associated emissions and removals reported in all land conversion and land remaining categories. The ERT further noted that this leads to an underestimation of the areas of land conversion categories for 1990–1997 (for cropland, grassland and settlements) and 1990–2001 (for forest land) and therefore must have some impact on the time-series trend of emissions and removals in the LULUCF sector. During the review, the Party explained that it is planning to use Landsat data to fill gaps in the area data up to 1971 and that this will be included in future submissions. The ERT recommends that the United States include the land-use changes that occurred during the periods 1971–1978 for land converted to cropland, grassland and settlements, and 1971–1981 for land converted to forest land, in order to ensure that the areas of land converted categories for all inventory years since 1990 contain the accumulated total of the land-use changes over the past 20 years.	Yes. Accuracy
L.43	Land representation – CO_2, CH_4 and N_2O	The United States classified its national land into managed land and unmanaged land, as reported in the NIR (table 6-6, p. 6-9). The area of unmanaged grassland has increased over the time series owing to the conversion from managed grassland to unmanaged grassland. During the review, in response to a previous recommendation (see ID# L.22 in table 3), the Party clarified its approach to classifying managed and unmanaged land, which is that land is classified as unmanaged 20 years after the last direct human intervention on that land. The Party further clarified that this is consistent with the period of time for tracking the influence of land-use change on GHG emissions and removals. In the case of conversions from managed to unmanaged land, the land is no longer directly influenced by human activity, so there are no further effects on anthropogenic emissions and removals to be estimated after the 20-year period. The Party also informed the ERT that the current area of unmanaged grassland is considered to be overestimated for Alaska and will be corrected in the next submission.	Yes. Accuracy

ID#	*Finding classification*	*Description of the finding with recommendation or encouragement*	*Is finding an issue and/or a problem?*[a]
		The ERT recommends that the United States revise the area of unmanaged grassland for Alaska and report on the changes in the NIR. The ERT also recommends that the Party increase the transparency regarding the approach to classifying managed and unmanaged land and include a specific example of the change from managed land to unmanaged land in the NIR, because this type of land-use change is not common in the inventory reporting of other Parties.	
L.44	4.A Forest land 4(II) Emissions and removals from drainage and rewetting and other management of organic/mineral soils – CO_2, CH_4 and N_2O	In response to a previous recommendation (see ID# L.12 in table 3), the United States explained that carbon stock changes in forest organic soils (reported in CRF table 4.A) and CO_2 emissions from drained forest organic soils (reported in CRF table 4(II)) are calculated separately. The Party also explained that these emissions are not double-counted. The ERT checked the method applied by the Party and concluded that the emission estimates are consistent, but that the information should be more clearly explained in the NIR. The ERT recommends that the United States provide information regarding which emissions or removals are estimated under carbon stock change in forest organic soils (category 4.A) and drained forest organic soils (category 4(II)) and how it avoids double counting of emissions between the two sources in the NIR and in the relevant documentation boxes of CRF tables 4.A and 4(II).	Yes. Transparency
L.45	4(II) Emissions and removals from drainage and rewetting and other management of organic/mineral soils – N_2O	The United States made the assumption that 100 t peat are extracted from 1 ha peat area in a single year (NIR p.6-86). Therefore, for the same soil types (nutrient-rich or nutrient-poor), the area of peat production (ha) should be represented as a number 10 times higher than the peat production amount (kt). However, the ERT noted that the area of nutrient-rich peat production in NIR table 6-50 (660 ha) is correlated to the amount of nutrient-poor peat production (NIR table 6-48: 66 kt) for the entire time series instead of being correlated to nutrient-rich peat production (NIR table 6-48: 374 kt). During the review, the Party clarified that the area of nutrient-rich peat production in NIR table 6-50 was reported incorrectly but that the correct values (e.g. 3,740 ha in 2017) were used in the inventory to calculate N_2O emissions. The ERT checked CRF table 4(II) and confirmed that N_2O emissions were estimated using the correct area for nutrient-rich peat production. The ERT recommends that the United States correct the area of nutrient-rich peat production in NIR table 6-50.	Yes. Convention reporting adherence
Waste			
W.14	5.A Solid waste disposal on land – CH_4	The United States reported in the NIR (annex 3.14, p. A-391) the use of a default value (0.75) for collection efficiency at landfills. The 2006 IPCC Guidelines (vol. 5, chap. 3, box 3.1) note that the use of a collection efficiency will need to be researched and justified in order to be used with confidence. During the review, the United States informed the ERT that the collection efficiency value was developed by EPA and is referenced in EPA AP-42 section 2.4 (see https://www3.epa.gov/ttn/chief/ap42/ch02/index.html). The justification for the use of a collection efficiency of 0.75 includes a consideration of the availability of data such as surface monitoring under the EPA new source performance standards for MSW landfills. During the review, the Party explained that the categories of collection efficiency used in landfill gas estimation vary according to the gas collection activity and types and thickness of final soil cover included in the formula of weighted average collection efficiency of the landfill. The Party also indicated that the collection efficiency range of United States landfills with gas collection is between 60 and 85 per cent, with the average value of 75 per cent considered as the default value. The ERT considers that the information on collection efficiency used in the NIR is based on well-documented research and is justified but, for improved transparency, more information should be included in the NIR.	Yes. Transparency

ID#	*Finding classification*	*Description of the finding with recommendation or encouragement*	*Is finding an issue and/or a problem?*[a]
		The ERT recommends that the United States include in the NIR the explanation provided to the ERT above on how the collection efficiency default value of 0.75 was derived to justify its confidence in the collection efficiency value used.	
W.15	5.A.1 Managed waste disposal sites – CH_4	The ERT noted that the United States reported in the NIR (pp.7-7, 7-11 and A-394) that the oxidation factor is directly reported to the GHGRP. The GHGRP allows facilities to use varying oxidation factors depending on their facility-specific calculated CH_4 flux rate (i.e. 0, 10, 25 or 35 per cent) and an average value of 20 per cent was used in the inventory. The 2006 IPCC Guidelines state that the oxidation factor is very uncertain because it is difficult to measure, varies considerably with the thickness and nature of the cover material, atmospheric conditions and climate, the flux of methane, and the escape of methane through cracks/fissures in the cover material (vol. 5, chap. 3, p.3.26) and that the use of an oxidation value higher than 0.1 should be clearly documented, referenced and supported by data relevant to national circumstances (vol. 5, chap. 3, p.3.15). During the review, the Party explained that the methodology and oxidation factors used in the GHGRP were developed on the basis of published, peer-reviewed literature and through external stakeholder engagement. Justification for the use of an oxidation factor higher than 0.1 considers cover types of material including the thickness of the soil (RTI, 2012). This document contains default values for oxidation with seven categories of oxidation factor used. Thickness of soil cover greater than 12 inches is the main condition for considering an oxidation factor above 0.1. The 2006 IPCC Guidelines (vol. 5, chap. 3, table 3.5) indicate the uncertainty analysis of the oxidation factor for a non-zero value. The ERT considers that, according to the 2006 IPCC Guidelines, the use of an oxidation factor higher than 0.1 should be documented clearly with references and supported by data relevant to national circumstances, including an uncertainty analysis. The ERT recommends that the United States include information to justify the oxidation factor used, including references and supporting data relevant to national circumstances as well as an uncertainty analysis for the oxidation factor applied in the estimation.	Yes. Transparency

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

Annex I

Overview of greenhouse gas emissions and removals for the United States of America for submission year 2019, as submitted by the United States of America

Table 1 shows total GHG emissions, including and excluding LULUCF and, for Parties that have decided to report indirect CO_2 emissions, with and without indirect CO_2. Tables 2–3 show GHG emissions reported under the Convention by the United States by gas and by sector, respectively.

Table 1
Total greenhouse gas emissions for the United States of America, 1990–2017
(kt CO_2 eq)

	Total GHG emissions excluding indirect CO_2 emissions		*Total GHG emissions including indirect CO_2 emissions*[a]	
	Total including LULUCF	*Total excluding LULUCF*	*Total including LULUCF*	*Total excluding LULUCF*
1990	5 563 986.47	6 371 000.54	NA	NA
1995	5 956 968.76	6 710 067.30	NA	NA
2000	6 464 573.03	7 232 010.77	NA	NA
2010	6 269 233.15	6 938 591.68	NA	NA
2011	6 055 842.60	6 787 419.03	NA	NA
2012	5 819 867.59	6 545 969.33	NA	NA
2013	5 996 757.88	6 710 218.18	NA	NA
2014	6 089 976.92	6 759 995.63	NA	NA
2015	5 912 718.30	6 623 775.48	NA	NA
2016	5 769 653.51	6 492 267.42	NA	NA
2017	5 742 622.75	6 456 718.19	NA	NA

Note: Emissions/removals reported in the sector other (sector 6) are not included in the total GHG emissions.
[a] The Party did not report indirect CO_2 emissions in CRF table 6.

Table 2
Greenhouse gas emissions by gas for the United States of America, excluding land use, land-use change and forestry, 1990–2017
(kt CO_2 eq)

	CO_2[a]	*CH_4*	*N_2O*	*HFCs*	*PFCs*	*Unspecified mix of HFCs and PFCs*	*SF_6*	*NF_3*
1990	5 121 179.44	779 845.55	370 307.69	46 289.01	24 255.67	286.01	28 789.24	47.92
1995	5 436 697.99	767 845.34	388 502.83	71 702.18	18 640.47	1 774.10	24 821.15	83.24

	CO_2[a]	CH_4	N_2O	HFCs	PFCs	Unspecified mix of HFCs and PFCs	SF_6	NF_3
2000	5 997 298.91	709 304.02	376 997.25	111 029.94	15 920.08	4 709.61	16 546.84	204.11
2010	5 700 108.34	697 450.40	382 929.38	136 980.84	4 551.99	8 642.78	7 384.40	543.55
2011	5 572 584.78	675 544.90	375 073.82	139 200.84	7 126.80	9 090.93	8 231.88	565.09
2012	5 371 777.17	665 372.40	348 876.13	136 904.45	6 181.14	9 526.73	6 765.68	565.63
2013	5 522 908.37	663 042.64	365 354.28	136 161.35	5 943.69	9 964.43	6 348.15	495.27
2014	5 572 106.31	662 064.22	362 742.74	140 205.20	5 643.20	10 448.63	6 268.46	516.87
2015	5 422 965.68	661 395.92	374 108.88	142 120.10	5 117.33	11 719.82	5 775.86	571.88
2016	5 306 662.46	654 897.88	364 485.76	142 050.11	4 361.60	12 904.49	6 326.20	578.92
2017	5 270 748.53	656 316.68	360 515.66	144 267.01	4 143.77	14 023.68	6 096.25	606.61
Per cent change 1990–2017	**2.9**	**–15.8**	**–2.6**	**211.7**	**–82.9**	**4 803.2**	**–78.8**	**1 165.8**

Note: Emissions/removals reported in the sector other (sector 6) are not included in the total GHG emissions.
[a] The United States of America did not report indirect CO_2 emissions in CRF table 6.

Table 3
Greenhouse gas emissions by sector for the United States of America, 1990–2017
(kt CO_2 eq)

	Energy	IPPU	Agriculture	LULUCF	Waste	Other
1990	5 339 755.74	342 063.84	490 247.02	–807 014.07	198 933.95	NA
1995	5 631 395.86	370 759.59	512 402.03	–753 098.54	195 509.82	NA
2000	6 168 634.35	389 109.54	509 900.88	–767 437.74	164 366.01	NA
2010	5 894 378.03	350 562.48	546 638.46	–669 358.53	147 012.72	NA
2011	5 751 065.58	366 315.03	531 884.04	–731 576.43	138 154.38	NA
2012	5 538 315.74	353 588.19	514 691.20	–726 101.74	139 374.21	NA
2013	5 695 017.55	353 110.88	526 332.04	–713 460.29	135 757.71	NA
2014	5 736 385.39	365 243.41	522 795.37	–670 018.71	135 571.46	NA
2015	5 584 710.98	360 772.77	543 816.97	–711 057.18	134 474.76	NA
2016	5 465 322.32	354 611.76	541 231.89	–722 613.92	131 101.45	NA
2017	5 424 823.50	358 866.90	542 072.38	–714 095.44	130 955.42	NA
Per cent change 1990–2017	**1.6**	**4.9**	**10.6**	**–11.5**	**–34.2**	**NA**

Notes: (1) Emissions/removals reported in the sector other (sector 6) are not included in the total GHG emissions; (2) the Party did not report emissions/removals in the sector other (sector 6); (3) the Party did not report indirect CO_2 emissions in CRF table 6.

Annex II

Additional information to support findings in table 2 in this report

Missing categories that may affect completeness

The categories for which 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 reporting in the Party's inventory are the following:

(a) Annual submission (CO_2, CH_4 and N_2O) (see ID# G.2 in table 5 in this report);

(b) 1.A fuel combustion (CH_4 and N_2O emissions from combustion of landfill gas, sewage gas and other biogas) (see ID# E.9 in table 3 in this report);

(c) 1.A.3.b road transportation (CO_2 emissions from the fossil carbon component of biofuels) (see ID# E.17 in table 3 in this report);

(d) 2.A.4 other process uses of carbonates (CO_2 emissions from ceramics and non-metallurgical magnesium production) (see ID# I.3 in table 3 in this report);

(e) 2.B.4 caprolactam, glyoxal and glyoxylic acid production (N_2O emissions from glyoxal and glyoxylic acid production) (see ID# I.7 in table 3 in this report);

(f) 2.B.8 petrochemical and carbon black production (CH_4 and N_2O emissions from combustion and flaring) (see ID# I.9 in table 3 in this report);

(g) 2.C.1 iron and steel production (CO_2 emissions from natural gas consumption and coke oven gas production at merchant coke plants) (see ID# I.13 in table 3 in this report);

(h) 2.G.2 SF_6 and PFCs from other product use (SF_6 emissions from airborne warning and control systems, particle accelerators and radars) (see ID# I.22 in table 3 in this report);

(i) 3.D direct and indirect N_2O emissions from agricultural soils for the States of Alaska and Hawaii (see ID# A.19 in table 3 in this report);

(j) 3. general (agriculture) (CO_2, CH_4 and N_2O) (see ID# A.25 in table 5 in this report);

(k) 4. general (LULUCF) (carbon stock changes in the living biomass and DOM pools for each conversion category from forest land to any other land use for each year) (see ID# L.1 in table 3 in this report);

(l) 4. general (LULUCF) (CO_2, CH_4 and N_2O emissions from the LULUCF sector for some land uses in the United States territories, the State of Hawaii and a large portion of the State of Alaska) (see ID# L.2 in table 3 in this report);

(m) 4.B cropland (carbon stock changes in living biomass in perennial crops for all years) (see ID# L.16 in table 3 in this report);

(n) 4.B.2.2 grassland converted to cropland (carbon stock changes in biomass) (see ID# L.18 in table 3 in this report);

(o) 4.C.2.2 cropland converted to grassland (carbon stock changes in biomass) (see ID# L.24 in table 3 in this report);

(p) 4.D.2.2 land converted to flooded land (carbon stock changes in biomass) (see ID# L.26 in table 3 in this report);

(q) 4.D.2.3 land (forest land) converted to wetlands (carbon stock changes in biomass) (see ID# L.27 in table 3 in this report);

(r) 4.D.2.3 land (cropland and grassland) converted to wetlands (carbon stock changes in biomass) (see ID# L.28 in table 3 in this report);

(s) 4.E.2.2 cropland converted to settlements and 4.E.2.3 grassland converted to settlements (carbon stock changes) (see ID# L.32 in table 3 in this report);

(t) 4.F.2 land converted to other land (carbon stock changes) (see ID# L.33 in table 3 in this report);

(u) 4(III) direct N_2O emissions from N mineralization/immobilization (N_2O emissions associated with the mineralization of the N content of SOC losses in mineral soils for forest land, wetlands, settlements and other land, as well as for conversions of those land uses to and from cropland and grassland) (see ID# L.37 in table 3 in this report);

(v) 4(IV) indirect N_2O emissions from managed soils (indirect N_2O emissions associated with the mineralization of the N content of SOC losses in mineral soils for forest land, wetlands, settlements and other land) (see ID# L.38 in table 3 in this report);

(w) 4(V) biomass burning (CH_4 and N_2O emissions from biomass burning for land converted to forest land and land converted to wetlands, cropland, grassland and settlements) (see ID# L.39 in table 3 in this report);

(x) 5.D.2 industrial wastewater (CH_4 emissions from sludge) (see ID# W.13 in table 3 in this report).

Annex III

Reference documents

A. Reports of the Intergovernmental Panel on Climate Change

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

IPCC. 2014. *2013 Supplement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories: Wetlands*. T Hiraishi, T Krug, K Tanabe, et al. (eds.). Geneva: IPCC. Available at http://www.ipcc-nggip.iges.or.jp/public/wetlands/.

B. UNFCCC documents

Annual review reports

Reports on the individual reviews of the 2012, 2013, 2015, 2016 and 2018 inventory submissions of the United States, contained in documents FCCC/ARR/2012/USA, FCCC/ARR/2013/USA, FCCC/ARR/2015/USA, FCCC/ARR/2016/USA and FCCC/ARR/2018/USA, respectively.

Other

Aggregate information on greenhouse gas emissions by sources and removals by sinks for Parties included in Annex I to the Convention. Note by the secretariat. Available at https://unfccc.int/sites/default/files/resource/AGI%202019.pdf.

Annual status report for the United States of America for 2018. Available at https://unfccc.int/sites/default/files/resource/asr2018_USA.pdf.

C. Other documents used during the review

Responses to questions during the review were received from Mausami Desai (EPA), including additional material on the methodology and assumptions used. The following references are reproduced as received:

EPA. 2004. The U.S. Solvent Cleaning Industry and the Transition to Non Ozone Depleting Substances. September 2004. Available online at: https://www.epa.gov/sites/production/files/2014-11/documents/epasolventmarketreport.pdf.

EPA. 2001. U.S. High GWP Gas Emissions 1990-2010: Inventories, Projections, and Opportunities for Reductions. Office of Air and Radiation, U.S. Environmental Protection Agency, Report No. EPA 000-F-97-000. Washington, DC, June 2001.

RTI. 2012. Review of Weekly Landfill Gas Volumetric Flow and Methane Concentrations. Memorandum prepared by Jeff Coburn for Rachel. Schmeltz (EPA). 18 October 2012. Available at https://www.regulations.gov/document?D=EPA-HQ-OAR-2012-0934-0014.

RTI. 2018. Comparison of industrial waste data reported under Subpart TT and the Solid Waste chapter of the GHG Inventory. Memorandum prepared by K. Bronstein, B. Jackson, and M. McGrath for R, Schmeltz (EPA). In progress.

Smith JE, Heath LS, Skog KE and Birdsey RA. 2006. *Methods for Calculating Forest Ecosystem and Harvested Carbon with Standard Estimates for Forest Types of the United States.* General Technical Report NE-343. Newtown Square, Pennsylvania: United States Department of Agriculture Forest Service. Available at https://www.fs.fed.us/ecosystemservices/pdf/estimates-forest-types.pdf.