United Nations

FCCC/ARR/2021/GBR

Framework Convention on Climate Change

Distr.: General
1 March 2022

English only

Report on the individual review of the annual submission of the United Kingdom of Great Britain and Northern Ireland submitted in 2021*

Note by the expert review team

Summary

Each Party included in Annex I to the Convention must submit an annual inventory of emissions and removals of greenhouse gases for all years from the base year (or period) to two years before the inventory due date (decision 24/CP.19). Parties included in Annex I to the Convention that are Parties to the Kyoto Protocol are also required to report supplementary information under Article 7, paragraph 1, of the Kyoto Protocol with the inventory submission due under the Convention. This report presents the results of the individual review of the 2021 annual submission of the United Kingdom of Great Britain and Northern Ireland, conducted by an expert review team in accordance with the "Guidelines for review under Article 8 of the Kyoto Protocol". The review took place from 30 August to 4 September 2021.

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

Contents

Abbreviations and acronyms

2006 IPCC Guidelines	*2006 IPCC Guidelines for National Greenhouse Gas Inventories*
2019 Refinement to the 2006 IPCC Guidelines	*2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories*
AAU	assigned amount unit
AD	activity data
Annex A source	source category included in Annex A to the Kyoto Protocol
AR	afforestation and reforestation
Article 8 review guidelines	"Guidelines for review under Article 8 of the Kyoto Protocol"
AWMS	animal waste management system(s)
BOD	biochemical oxygen demand
C	carbon
CER	certified emission reduction
CH_4	methane
CM	cropland management
CO_2	carbon dioxide
CO_2 eq	carbon dioxide equivalent
Convention reporting adherence	adherence to the "Guidelines for the preparation of national communications by Parties included in Annex I to the Convention, Part I: UNFCCC reporting guidelines on annual greenhouse gas inventories"
CP	commitment period
CPR	commitment period reserve
CRF	common reporting format
DOC	degradable organic carbon
DOC_f	fraction of degradable organic carbon that decomposes
DUKES	Digest of United Kingdom Energy Statistics
EF	emission factor
ERT	expert review team
ERU	emission reduction unit
EU ETS	European Union Emissions Trading System
FGD	flue gas desulfurization
FK	fluoroketone
FM	forest management
FMRL	forest management reference level
FOD	first-order decay
GHG	greenhouse gas
GM	grazing land management
HCFC	hydrochlorofluorocarbon
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
k	methane generation rate
KP-LULUCF	activities under Article 3, paragraphs 3–4, of the Kyoto Protocol
KP reporting adherence	adherence to the reporting guidelines under Article 7, paragraph 1, of the Kyoto Protocol

Kyoto Protocol Supplement	*2013 Revised Supplementary Methods and Good Practice Guidance Arising from the Kyoto Protocol*
LULUCF	land use, land-use change and forestry
MELMod	methane emissions from landfill model
MMS	manure management system(s)
N	nitrogen
N_2O	nitrous oxide
NA	not applicable
NE	not estimated
NF_3	nitrogen trifluoride
NFI	national forest inventory
NIR	national inventory report
NO	not occurring
PFC	perfluorocarbon
QA/QC	quality assurance/quality control
RMU	removal unit
RV	revegetation
SEF	standard electronic format
SF_6	sulfur hexafluoride
SIAR	standard independent assessment report
SOC	soil organic carbon
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"
WDR	wetland drainage and rewetting
Wetlands Supplement	*2013 Supplement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories: Wetlands*

I. Introduction

1. This report covers the review of the 2021 annual submission of the United Kingdom of Great Britain and Northern Ireland, organized by the secretariat in accordance with the Article 8 review guidelines (adopted by decision 22/CMP.1 and revised by decision 4/CMP.11). In accordance with the Article 8 review guidelines, this review process also encompasses the review under the Convention as described in the UNFCCC review guidelines, particularly in part III thereof, namely the "UNFCCC guidelines for the technical review of greenhouse gas inventories from Parties included in Annex I to the Convention" (annex to decision 13/CP.20). The review took place from 30 August to 4 September 2021 and was coordinated by Jongikhaya Witi and Roman Payo (secretariat). Table 1 provides information on the composition of the ERT that conducted the review for the United Kingdom.

Table 1
Composition of the expert review team that conducted the review for the United Kingdom of Great Britain and Northern Ireland

Area of expertise	*Name*	*Party*
Generalist	Tomas Gustafsson	Sweden
	Ioannis Sempos	Greece
Energy	Lindiwe Chola Dlamini	Eswatini
	Regine Röthlisberger	Switzerland
IPPU	Pia Forsell	Finland
	Kristina Gonchar	Belarus
Agriculture	Marta Alfaro	Chile
	Andrea Pickering	New Zealand
LULUCF and KP-LULUCF	Sandro Federici	San Marino
	Heather Frances Martindale	New Zealand
Waste	Fatma Betül Demirok	Turkey
	Excellent Hachileka	Zambia
Lead reviewers	Sandro Federici	
	Ioannis Sempos	

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

3. The ERT has made recommendations that the United Kingdom resolve identified findings, including issues[1] designated as problems.[2] Other findings, and, if applicable, the encouragements of the ERT to the United Kingdom to resolve related issues, are also included in this report.

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

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

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

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

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

7. In accordance with paragraph 76 of the UNFCCC review guidelines and paragraphs 47 and 65 of the Article 8 review guidelines, the ERT has prioritized the review of issues and problems identified in previous review reports or in the initial assessment, recalculations that have changed the estimated emissions or removals for a category by more than 2 per cent or national total emissions by more than 0.5 per cent for any of the recalculated years, and supplementary information reported under the Kyoto Protocol. Table 2 provides the assessment by the ERT of the Party's 2021 annual submission with respect to the tasks undertaken during the desk review. Further information on the issues identified, as well as additional findings, may be found in tables 3, 5 and 6.

Table 2
Summary of review results and general assessment of the 2021 annual submission of the United Kingdom of Great Britain and Northern Ireland

Assessment			*Issue/problem ID#(s) in table 3, 5 or 6*[a]
Date of submission	Original submission: NIR, 15 April 2021; CRF tables (version 1), 15 April 2021; SEF tables (SEF-CP2-2020), 15 April 2021		
Review format	Desk review		
Application of the requirements of the UNFCCC Annex I inventory reporting guidelines and the Wetlands Supplement (if applicable)	Have any issues been identified in the following areas:		
	(a) Identification of key categories?	No	
	(b) Selection and use of methodologies and assumptions?	Yes	I.11, I.12, A4, L.9, L.23, L.25, W.9, W.12, KL.10, KL.13
	(c) Development and selection of EFs?	Yes	A.3
	(d) Collection and selection of AD?	Yes	E.4, E.7, I.25, L21, W.11, W.16
	(e) Reporting of recalculations?	Yes	I.26
	(f) Reporting of a consistent time series?	Yes	I.10, L.24
	(g) Reporting of uncertainties, including methodologies?	Yes	A.2
	(h) QA/QC?	QA/QC procedures were assessed in the context of the national system (see supplementary information under the Kyoto Protocol below)	
	(i) Missing categories, or completeness?[b]	Yes	E.8, I.9, A.1, L.12, L.17, KL.14
	(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?	Yes	
Description of trends	Did the ERT conclude that the description in the NIR of the trends for the different gases and sectors is reasonable?	Yes	
Supplementary information under the Kyoto Protocol	Have any issues been identified related to the following aspects of the national system:		
	(a) Overall organization of the national system, including the effectiveness and reliability of the institutional, procedural and legal arrangements?	No	

Assessment			*Issue/problem ID#(s) in table 3, 5 or 6*[a]
	(b) Performance of the national system functions?	No	
	Have any issues been identified related to the national registry:		
	(a) Overall functioning of the national registry?	Yes	G.10
	(b) Performance of the functions of the national registry and the adherence to technical standards for data exchange?	No	
	Have any issues been identified related to the reporting of information on AAUs, CERs, ERUs and RMUs and on discrepancies in accordance with decision 15/CMP.1, annex, chapter I.E, in conjunction with decision 3/CMP.11, taking into consideration any findings or recommendations contained in the SIAR?	No	
	Have any issues been identified in matters related to Article 3, paragraph 14, of the Kyoto Protocol, specifically problems related to the transparency, completeness or timeliness of the reporting on the Party's activities related to the priority actions listed in decision 15/CMP.1, annex, paragraph 24, in conjunction with decision 3/CMP.11, including any changes since the previous annual submission?	No	
	Have any issues been identified related to the following reporting requirements for KP-LULUCF:		
	(a) Reporting requirements of decision 2/CMP.8, annex II, paragraphs 1–5?	No	
	(b) Demonstration of methodological consistency between the reference level and reporting on FM in accordance with decision 2/CMP.7, annex, paragraph 14?	Yes	KL.17, KL.18
	(c) Reporting requirements of decision 6/CMP.9?	No	
	(d) Country-specific information to support provisions for natural disturbances in accordance with decision 2/CMP.7, annex, paragraphs 33–34?	Yes	KL.12
CPR	Was the CPR reported in accordance with decision 18/CP.7, annex; decision 11/CMP.1, annex; and decision 1/CMP.8, paragraph 18?	Yes	
Adjustments	Has the ERT applied any adjustments under Article 5, paragraph 2, of the Kyoto Protocol?	No	
	Has the Party submitted a revised estimate to replace a previously applied adjustment?	NA	The Party does not have a previously applied adjustment
Response from the Party during the review	Has the Party provided the ERT with responses to the questions raised, including the data and information necessary for assessing conformity with the UNFCCC Annex I inventory reporting guidelines and any further guidance adopted by the Conference of the Parties?	Yes	
Recommendation for an exceptional in-country review	On the basis of the issues identified, does the ERT recommend that the next review be conducted as an in-country review?	No	
Questions of implementation	Did the ERT list any questions of implementation?	No	

[a] Further information on the issues identified, as well as additional findings, may be found in tables 3, 5 and 6.
[b] Missing categories for which methods are provided in the 2006 IPCC Guidelines may affect completeness and are listed in annex III.

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

8. Table 3 compiles the recommendations from previous review reports that were included in the most recent previous review report, published on 7 February 2020,[3] and had not been resolved by the time of publication of the report on the review of the Party's 2021 annual submission. The ERT has specified whether it believes the Party had resolved, was addressing or had not resolved each issue or problem by the time of publication of this review report and has provided the rationale for its determination, which takes into consideration the publication date of the most recent previous review report and national circumstances.

Table 3
Status of implementation of recommendations included in the previous review report for the United Kingdom of Great Britain and Northern Ireland

ID#	*Issue/problem classification[a, b]*	*Recommendation made in previous review report*	*ERT assessment and rationale*
General			
G.1	Annual submission (G.1, 2019) (G.1, 2017) (G.3, 2016) (G.3, 2015) (15, 2014) Transparency	Improve the transparency of the NIR by including sufficient information in the annual submission.	Resolved. The outstanding recommendation in the previous review report, related to provision of actual AD and EF used for estimating emissions in the overseas territories and Crown dependencies in CRF table 5.A, has been resolved (see ID# W.1 below).
G.2	CPR (G.2, 2019) (G.7, 2017) (G.11, 2016) (G.11, 2015) KP reporting adherence	When preparing the NIR, compare the 90 per cent of assigned amount value against the total GHG emissions, excluding LULUCF, in the most recent year.	Resolved. The Party reported such a comparison in its NIR (section 12.5), noting that the most recent review before the 2021 review was done in 2019 and covered the 1990–2017 time series.
G.3	Key category analysis (G.9, 2019) Convention reporting adherence	Conduct a key category analysis, following at least approach 1, for the sources and sinks of the territory reported under the Kyoto Protocol.	Resolved. The Party reported a key category analysis for the sources and sinks of the territory reported under the Kyoto Protocol in its NIR (section A.1.6).
G.4	Methods (G.4, 2019) (G.3, 2017) (G.7, 2016) (G.7, 2015) Transparency	Address the transparency issues identified in the previous review reports.	Resolved. The outstanding recommendation related to this issue in the previous review report has been resolved (see ID#s G.1 above and W.1 below).
G.5	National system (G.5, 2019) (G.8. 2017) (G.13, 2016) (G.13, 2015) Completeness	Strengthen the national system in order to ensure the completeness of the coverage of the LULUCF and KP-LULUCF estimates of emissions and removals, and report on improvements made in the NIR.	Resolved. The Party reported on GHG estimates for Bermuda, the Cayman Islands and Gibraltar for LULUCF and for KP-LULUCF in its NIR (pp.405–407 and 902–908, and pp.559–582, respectively) and in the relevant CRF tables. The Party also reported on improvements made in the

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

ID#	Issue/problem classification[a, b]	Recommendation made in previous review report	ERT assessment and rationale
			LULUCF sector since its last submission (p.405). During the review, the Party clarified that the overseas territory of Monserrat is not included in its reporting under the Convention or the Kyoto Protocol, consistently with its ratification instruments.
G.6	Other (G.11, 2019) Transparency	Improve the transparency of the reporting regarding completeness by including in the NIR a table or other form of appropriate documentation summarizing the categories determined to be insignificant and the level of assumed emissions for each of those categories; the table or other form of documentation may include a reference to the value of the threshold of 0.05 per cent of the total CO_2 eq, excluding LULUCF, each category should be compared with, and ensure that the sum of missing categories excluded does not exceed the value of the threshold of 0.1 per cent of the total CO_2 eq, excluding LULUCF.	Resolved. The Party reported in its NIR a table (1.13, pp.99–103) summarizing the categories determined to be insignificant and the level of assumed emissions for each of those categories, including references to the relevant values, to ensure that the sum of missing categories excluded does not exceed the threshold of 0.1 per cent of the total CO_2 eq, excluding LULUCF.
G.7	Uncertainty analysis (G.12, 2019) Convention reporting adherence	Conduct an uncertainty analysis, following at least approach 1, for the territory reported under the Kyoto Protocol.	Resolved. The Party reported in its NIR (table A.2.1.1, pp.729–737) an uncertainty analysis following approach 1, which included overall uncertainties for the territories reported under the Convention and the Kyoto Protocol at the end of the table.
G.8	Uncertainty analysis (G.13, 2019) Convention reporting adherence	Conduct uncertainty analyses, following at least approach 1, at the appropriate level of category disaggregation in accordance with paragraph 15 of the UNFCCC Annex I inventory reporting guidelines.	Resolved. The Party reported such uncertainty analyses in its NIR (section A.2.1.2, pp.729–737).
Energy			
E.1	1. General (energy sector) – all fuels – CO_2, CH_4 and N_2O (E.1, 2019) (E.1, 2017) (E.20, 2016) (E.20, 2015) Transparency	Clearly indicate the geographical coverage of DUKES and demonstrate how fuel consumption data at the subcategory level for each overseas territory and Crown dependency are obtained and incorporated into the national totals for that subcategory.	Addressing. The United Kingdom clarified in its NIR (section 1.1.2.2, pp.47–48, and section A.3.6, p.902) the geographical coverage of DUKES and explained that AD, including those on fuel consumption, are obtained from the relevant government departments of the overseas territories. In response to a question raised by the ERT during the review, the Party confirmed that such AD include data at the subcategory level, if applicable. The ERT noted that the NIR does not explicitly indicate that AD on fuel consumption are available at the subcategory level.
E.2	Feedstocks, reductants and other non-energy use of fuels – liquid fuels – CO_2	Ensure reporting is complete as well as consistent between CRF tables 1.A(b) and 1.A(d) by reporting data or notation keys for other gaseous fuels in CRF table 1.A(b) and by using the same data or notation keys for other liquid fossil fuels, other gaseous fuels and other	Resolved. The Party ensured that reporting is complete and consistent between CRF tables 1.A(b) and 1.A(d), using "NO" as appropriate.

ID#	Issue/problem classification[a, b]	Recommendation made in previous review report	ERT assessment and rationale
	(E.3, 2019) (E.13, 2017) Comparability	fossil fuels in CRF table 1.A(b) in the corresponding cells in CRF table 1.A(d).	
E.3	1.A.1.c Manufacture of solid fuels and other energy industries – refinery gas – CO_2 (E.24, 2019) Transparency	Apply the lower net calorific value when inputting information in the models in order to estimate refinery gas emissions and clarify in the NIR the description of the methodology used and source of the CO_2 EF.	Resolved. According to the NIR (method statement 2, pp.149–152), the CO_2 EF for other petroleum gases used at gas separation plants is the EF for ethane from the 2006 IPCC Guidelines (vol. 2, chap. 1, table 1.3). In response to a question raised by the ERT during the review, the United Kingdom confirmed that the net calorific value and the correct ethane CO_2 EF were used in the models, as shown in the background data file provided by the Party.
E.4	1.A.3.e.ii Other (other transportation) – liquid and gaseous fuels – CO_2, CH_4 and N_2O (E.25, 2019) Accuracy	Evaluate the relevance of the current equipment data used in the 2004 model for estimating off-road emissions, and on the basis of the results of the evaluation, either document in the NIR how the model still reflects current circumstances or make efforts to update the model and report on progress in the NIR.	Addressing. The United Kingdom reported in the NIR (method statement 6, pp.165–167) that off-road emissions are estimated on the basis of a one-off study from 2004 that provided data on the population, usage and lifetime of different types of off-road machinery. Expert judgment and activity drivers are then applied to estimate current machinery population and usage. The Party reported in the NIR (table 10.17) that it is currently conducting a survey on machinery population and usage, which is at an advanced stage. The initial results are being shared with relevant stakeholders in order to develop an approach to implementing the data into the Party's model for estimating off-road emissions. During the review, the United Kingdom stated that it expects to integrate the results of the survey into its 2023 submission.
E.5	1.A.4.a Commercial/institutional – biomass – CH_4 (E.11, 2019) (E.18, 2017) Transparency	Ensure that "NO" is used for biomass combustion in CRF table 1.A(a)s4, and that a brief mention in the corresponding method statement in the NIR is made about this source not occurring.	Resolved. The Party made the required changes in the NIR (method statement 5, pp.162–164) and reported "IE" in CRF table 1.A(a)s4 for biomass after the original recommendation to report "NO" was found to no longer be appropriate. This was due to a reassessment of the reporting of biogas blended with natural gas in the distribution network. See ID# E.9 in table 6 for a follow-up recommendation.
E.6	1.B.2 Oil, natural gas and other emissions from energy production – all fuels – CO_2, CH_4 and N_2O (E.16, 2019) (E.25, 2017) Transparency	Include all IPCC subcategories in NIR table 3.5 as they are reported in CRF table 1.B.2 (e.g. if a subcategory is reported as "IE" in CRF table 1.B.2, include the respective IPCC category in the appropriate row of NIR table 3.5 where the emissions are reported).	Resolved. The Party made the required changes in the NIR (method statement 18, p.209, and table 3.5, pp.142–143).
E.7	1.B.2 Oil, natural gas and other emissions from energy production – all fuels – CO_2 and CH_4	Describe in the NIR the coverage of the AD, methods and EFs for estimating emissions from well drilling, well testing and well completions in oil and natural gas exploration and clarify whether these emissions are	Addressing. According to the NIR (method statement 18, p.210), all emissions from well testing are reported under subcategories 1.B.2.a.i and 1.B.2.b.i. Emission estimates, including AD and EFs, are derived from data reported by operators using the Environmental and Emissions Reporting System for 1998–2016. For earlier years, emission estimates are only

ID#	Issue/problem classification[a, b]	Recommendation made in previous review report	ERT assessment and rationale
	(E.18, 2019) (E.27, 2017) Accuracy	reported under category 1.A fuel combustion activities or 1.B fugitive emissions from fuels.	available at a more aggregated level. These emissions are then disaggregated using the relative contribution of each subcategory in 1998, in order to make the time series as consistent as possible. As data on well testing for 2017–2019 were outliers compared with earlier years, emission estimates for 2016 were extrapolated, taking into account production trends in the country, to estimate emissions for 2017–2019. In response to a question raised by the ERT during the review, the United Kingdom stated that a research study on upstream oil and gas sector emissions is under way, the results of which will be included in the 2022 submission.
E.8	1.B.2.b Natural gas – gaseous fuels – CO_2 and CH_4 (E.21, 2019) (E.29, 2017) Completeness	Estimate and report CO_2 and CH_4 emissions from exploratory activities or, if they are considered insignificant, report them as "NE" and justify that the likely level of emissions is below the significance threshold established in paragraph 37(b) of the UNFCCC Annex I inventory reporting guidelines.	Addressing. According to the NIR (method statement 18, pp.212–213), exploratory activities for onshore shale gas sites are not included in the estimates for well drilling and completions. No production activities take place at these sites, meaning that no AD are available that would allow a tier 1 approach to be taken. The Party is conducting a research study to investigate upstream oil and gas sector emissions, including onshore shale gas exploration, the results of which will be included in the 2022 submission. On the basis of an estimate provided by the United Kingdom in the NIR (p.213), the ERT noted that the omitted emissions are below the significance threshold for including this issue in the list of potential problems in accordance with decision 22/CMP.1, annex, paragraph 80(b), in conjunction with decision 4/CMP.11. The ERT agrees with the previous ERT that the source cannot be reported as "NE", as it is a subset of the IPCC source category for fugitive CH_4 emissions from well drilling and completions, for which the United Kingdom does report emission estimates.
IPPU			
I.1	2. General (IPPU) (I.14, 2019) Transparency	Improve the transparency of the reporting by correcting in the NIR the following issues: (a) For category 2.A.1 cement production, include in NIR figure 4.1 the year for which the data are presented, use the correct units for data in NIR figure 4.2 (data are presented as CO_2 emissions, not as carbon emissions), clarify that the data provided in NIR table 4.3 are IEFs not EFs, and define the abbreviation "CEF" in NIR table 4.3; (b) For category 2.A.2 lime production, identify in NIR table 4.1 the correct tiers applied for estimating CO_2 emissions (i.e. tier 1 for 1990–1993 and tier 3 for 1994 onward);	(a) Resolved. NIR figure 4.1 (p.229) includes the year for which the data are presented, which is the most recent inventory year; NIR figure 4.2 refers to units of CO_2 and the description in NIR table 4.3 was revised; (b) Resolved. The tiers for category 2.A.2 were corrected in NIR table 4.1; (c) Resolved. The units in NIR table 4.4 were changed; (d) Resolved. The description of FGD systems was revised in the NIR (section 4.5.1); (e) Resolved. The description of soda ash production was updated in the NIR (section 4.12.1) to note that emissions from soda ash used in manufacture of soda lime glasses are reported under category 2.A.3; (f) Addressing. The Party made some changes to the description in the NIR (section 4.8.2), but did not transparently describe how N_2O emissions were reported for 1990–1994;

ID#	*Issue/problem classification*[a, b]	*Recommendation made in previous review report*	*ERT assessment and rationale*
		(c) In NIR table 4.4, change the units of the EF applied for CO_2 emissions from lime production from kt C/kt carbonate to t C/kt carbonate; (d) On page 224 of the NIR, update the text regarding the year in which FGD systems were introduced in the United Kingdom to clarify that CO_2 emissions from FGD systems have been reported since 1994, consistently with CO_2 emissions for category 2.A.4 other process uses of carbonates reported in CRF table 2(I)A-Hs1; (e) On page 239 of the NIR, correct the information stating that emissions from soda ash used in the manufacture of soda lime glasses are reported under category 2.A.4 other process uses of carbonates to clarify that these emissions are in fact reported under category 2.A.3 glass production; (f) On page 236 of the NIR, correct the information stating that N_2O emissions from nitric acid production and adipic acid production were reported together for 1990–1994 under category 2.B.3 adipic acid production to clarify that these emissions have been reported separately for the entire time series in CRF table 2(I)s1; (g) On page 238 of the NIR, correct the name of category 2.B.7 so that it reads soda ash production, instead of soda ash production and use, which is consistent with the title in CRF table 2(I).A-Hs1 and with the corresponding data reported by the Party in that table.	(g) Resolved. The name of category 2.B.7 was revised in the NIR to read soda ash production (section 4.12).
I.2	2.A.2 Lime production – CO_2 (I.1, 2019) (I.14, 2017) Convention reporting adherence	Collect lime production data so that they may be made available upon request to future ERTs in order to enable them to assess the accuracy, comparability and completeness of the emissions reported under this subcategory in accordance with the UNFCCC review guidelines.	Resolved. The Party reported in its NIR (section 4.3.6) that it asked the Office for National Statistics for any data on lime production available via the Prodcom surveys and database, but that it did not find a complete or consistent time series of annual production data from national producers. However, the Party noted that its reporting on EU ETS emissions covers all existing lime plants, and is therefore complete and accurate for 2008 onward. It thus considered that it is not practicable to gather further AD since there are other competing priorities taking up inventory improvement resources. In addition, the Party described in its NIR (section 4.3.2) that, although AD on limestone and dolomite use are back-calculated, its plant-specific CO_2 emissions are derived from the EU ETS for 2008 onward and estimated from the total emissions from lime plants reported to the Pollution Inventory by each site for 1994–2007. British Geological Survey data were used to calculate CO_2 emissions for 1990–1993. The Party also

ID#	Issue/problem classification[a, b]	Recommendation made in previous review report	ERT assessment and rationale
			reported that EU ETS data on production amounts cannot be published for confidentiality reasons, but the figures were made available to the ERT on request. During the review, the ERT reviewed the data on lime production for 2008–2019. The average IEF for CO_2 emissions calculated from lime production was 0.730 t/t, which is comparable to the IEF reported by other Parties included in Annex I to the Convention (the range of IEF was 0.725–0.736 t/t).
I.3	2.A.2 Lime production – CO_2 (I.15, 2019) Transparency	Include in the NIR a more detailed description of the methodology used for estimating CO_2 emissions from lime production at sugar plants, including documenting the assumption that 24 per cent of lime produced at sugar plants is not recarbonated.	Resolved. The Party included in the NIR (section 4.3.2) a more detailed description of the methodology used, including the assumption that 24 per cent of lime produced at sugar plants is not recarbonated, which is used to estimate emissions from lime production.
I.4	2.A.2 Lime production – CO_2 (I.16, 2019) Transparency	Clarify in the description of the AD for category 2.A.2 in CRF table 2(I).A-Hs1 that both limestone and dolomite are used for lime production.	Resolved. The Party reported in CRF table 2(I).A-Hs1 that both limestone and dolomite are used for lime production.
I.5	2.A.4 Other process uses of carbonates – CO_2 (I.2, 2019) (I.15, 2017) Completeness	Either estimate and include in the inventory the CO_2 emissions associated with the non-glass use of soda ash or include in the NIR a justification, consistent with paragraph 37(b) of the UNFCCC Annex I inventory reporting guidelines, for these emissions being considered insignificant.	Resolved. The Party reported in its NIR (section 4.5.1) that it has included in the inventory emission estimates for the use of soda ash in applications other than glass production, under category 2.A.4. The Party also reported CO_2 emissions in CRF table 2(I).A-Hs1 over the entire time series under category 2.A.4.b since the 2020 submission and included a summary of the activities in NIR table 4.8.
I.6	2.A.4 Other process uses of carbonates – CO_2 (I.17, 2019) Comparability	Report CO_2 emissions from stone wool production under subcategory 2.A.4.d other along with emissions from other sources currently reported under that category to avoid disclosing confidential data, or, if the number of facilities reporting under that category is insufficient to enable the confidential data from stone wool producers to be masked, report them at an aggregated level under one of the other categories under the mineral industry and use the appropriate notation key under subcategory 2.A.4.d, if needed, providing a relevant explanation in the NIR as to where emissions are reported.	Not resolved. The Party reported in its NIR (section 4.4.1) that emissions from stone wool production are still reported under category 2.A.3 instead of under subcategory 2.A.4.d. During the review, the Party clarified that it reviewed the issue, but that, since there are very few stone wool facilities in the country, it considers reporting emissions from stone wool production at the aggregated level under category 2.A.3 to be the most sensible option.
I.7	2.A.4 Other process uses of carbonates – CO_2 (I.18, 2019) Comparability	Report CO_2 emissions from limestone use for FGD systems used at energy plants in the country under category 1.B.2.d other (oil, natural gas and other emissions from energy production).	Resolved. The Party reported in its NIR (p.521) that it considered reporting emissions from limestone use for FGD systems under category 1.B.2.d but did not do so. It noted that allocating these emissions to this new category will not improve transparency or comparability, as these data, which are reported confidentially to the Inventory Agency by a few facilities, would have to be reported as commercially confidential if presented individually

ID#	Issue/problem classification[a, b]	Recommendation made in previous review report	ERT assessment and rationale
			under this category. The ERT therefore considers the recommendation to be fully addressed.
I.8	2.A.4 Other process uses of carbonates – CO_2 (I.19, 2019) Completeness	Complete the ongoing study on the non-glass uses of soda ash in the country, and estimate and report CO_2 emissions from sodium bicarbonate use under subcategory 2.A.4.d other as well as update the NIR to include the relevant AD, EF and methods used for estimating these emissions.	Addressing. The Party reported in its NIR (section 4.5.1) that the use of soda ash in applications other than glass production is reported under subcategory 2.A.4.b (see ID# I.5 above). The Party also reported in its NIR (section 4.5.1) that the estimates of CO_2 emissions from sodium bicarbonate use are reported under subcategory 2.G.4 (during the review, the Party stated that these emissions have been reported under subcategory 2.A.4.d since the 2021 submission, but the description in NIR section 4.5.1 has not been updated) and described the corresponding methodology in NIR section 4.5.2. The EFs for soda ash and sodium bicarbonate use are reported in NIR section 4.5.2 but the relevant AD are not reported.
I.9	2.A.4 Other process uses of carbonates – CO_2 (I.20, 2019) Completeness	Estimate CO_2 emissions from ceramic products other than bricks either by using the assumption that the clay consumption of these products is on average 11 per cent of the clay consumption of brick production, according to the available data for 2008–2012, or by applying a country-specific method (e.g. based on the AD for clay consumption for different applications as provided in the *United Kingdom Minerals Yearbook 2018*), and report these emissions under subcategory 2.A.4.a ceramics.	Not resolved. The Party reported in its NIR (section 4.5.2) that emissions from ceramic products other than bricks were considered insignificant following simple calculations of the production, import and export of four types of clay. During the review, it clarified that the issue is being researched further, and that corresponding emission estimates are expected to be included in the 2022 submission.
I.10	2.B Chemical industry – CO_2 (I.21, 2019) Consistency	Use the standard splicing techniques in the 2006 IPCC Guidelines (vol. 1, chaps. 5.5.3.1–5.5.3.4) to fill the gaps of AD and CO_2 emissions for categories 2.B.6 titanium dioxide production in 1990–1998, 2.B.7 soda ash production in 1990–1998, 2.B.8.a petrochemical and carbon black production (methanol) in 1990–1997, 2.B.8.d petrochemical and carbon black production (ethylene oxide) in 1990–1995 and 2.B.8.f petrochemical and carbon black production (carbon black) in 1990–1998, revise the CO_2 emission estimates accordingly, and explain in the NIR which techniques were used to fill the gaps (e.g. the ERT considers that the surrogate data or overlap approach may be appropriate for developing a consistent time series). If it is not possible to apply the standard splicing techniques, follow the 2006 IPCC Guidelines (vol. 1, chaps. 5.3.3.5–5.3.3.6) and apply an alternative technique for splicing, providing an explanation in the NIR as to why the standard techniques are not valid, documenting the alternative technique	Addressing. The Party reported in its NIR (pp.524–525) that an improvement item has been raised to evaluate the potential application of splicing techniques to the categories identified by the ERT. The work is awaiting completion, but currently no changes have been proposed owing to a lack of appropriate data. However, the Party indicated that one of the splicing techniques described in the 2006 IPCC Guidelines (vol. 1, chaps. 5.5.3.1–5.5.3.4) is not suitable for filling gaps in AD in the early years of the time series (from 1990 to 1998). Two techniques in the 2006 IPCC Guidelines mention use of surrogate data to simulate and extrapolate trends. Therefore, for each identified category, available surrogate data sets were evaluated and the implications of trend extrapolation considered. These data sets pertained to specific chemical production quantities, export quantities and export values from the statistical office of the European Union or, in the case of titanium dioxide, from the British Geological Survey. General financial indices of chemical production from the Office for National Statistics were also evaluated. However, none of these data sets showed a correlation when tested against the current approach, which uses plant capacity as a surrogate. Trend extrapolation was considered, but ultimately deemed inappropriate as reported data showed the trend to be non-linear

ID#	Issue/problem classification[a, b]	Recommendation made in previous review report	ERT assessment and rationale
		applied and comparing the results with one of the standard techniques contained in the 2006 IPCC Guidelines.	and the change between years not to be constant over time. The United Kingdom therefore continues to consider the relationship between plant capacity and emissions sufficient for simulating AD back to 1990, in the absence of available surrogate data.
I.11	2.B.1 Ammonia production – CH_4 and N_2O (I.22, 2019) Accuracy	Either avoid the double counting between categories 2.B.1 and 2.B.10 other (chemical industry) or explain in the NIR that double counting of the emissions may occur between these categories.	Addressing. The Party updated the description of the methodologies in the NIR for the 2020 submission. It described in the NIR (section 4.6.1) that CH_4 emissions from the steam reforming processes and the associated ammonia production facilities are reported partly under category 2.B.1 and partly under category 2.B.10. N_2O emissions from natural gas combustion in ammonia production are also estimated and reported in category 2.B.1. According to the NIR (section 4.15.1) the Party reported CH_4 emissions from general petrochemical processes in category 2.B.10 and these emissions are taken from the plant operator reports submitted to national regulators (section 4.6.2). CH_4 emissions are reported together with process emissions from other chemical sites and these operator-reported emissions may include estimates of CH_4 from fuel combustion and hence there is potential for a small risk of double counting in emissions reported across categories 2.B.1 and 2.B.10. The Party reported in its NIR (p.526) that the issue of any double counting between categories 2.B.1 and 2.B.10 will be addressed in future annual submissions.
I.12	2.B.1 Ammonia production – CH_4 and N_2O (I.22, 2019) Accuracy	Provide in the NIR a description of the methodology used for estimating CH_4 and N_2O emissions from ammonia production reported under category 2.B.1 and provide the correct reference (i.e. to category 2.B.1 instead of 2.B.10) in CRF table 2(I).A-Hs1, where these emissions are reported.	Addressing. The Party described in its NIR (section 4.6.2) the methodologies used for estimating CH_4 and N_2O emissions from ammonia production. Removal of double counting between categories 2.B.1 and 2.B.10 will be addressed in a future cycle.
I.13	2.B.8 Petrochemical and carbon black production – CO_2 (I.23, 2019) Transparency	Specify in CRF table 2(I).A-Hs1 that CO_2 emissions from other petroleum gases are reported under subcategory 2.B.8.g other by changing the category description from "Other (please specify)" to "Other petroleum gases (OPG)".	Resolved. The Party changed the description of subcategory 2.B.8.g in CRF table 2(I).A-Hs1 to "Other petroleum gases (OPG)".
I.14	2.B.9 Fluorochemical production – HFCs (I.24, 2019) Transparency	Investigate why the operator of the plant manufacturing HCFC-22 continued to report HFC-23 emissions after production of HCFC-22 ended in the country in 2016 and, pending the outcome of this investigation, recalculate the HFC-23 emission estimates, as appropriate.	Resolved. The Party reported in its NIR (section 4.14.5 and p.527) that, according to the operator of the plant manufacturing HCFC-22, HFC-23 emissions do not stem from the production of HCFC-22, but originate from fluorinated gas handling and have therefore been reallocated to subcategory 2.F.6.b (other applications) in CRF table 2(II) and CRF table 2(II).B-Hs2 for 2017 onward.
I.15	2.C.1 Iron and steel production – CO_2	Reallocate CO_2 emissions from iron and steel production related to the use of blast furnace gas, coke oven coke,	Not resolved. The Party did not reallocate CO_2 emissions from iron and steel production to the IPPU sector in accordance with the 2006 IPCC

ID#	Issue/problem classification[a, b]	Recommendation made in previous review report	ERT assessment and rationale
	(I.25, 2019) Comparability	fluxing agents, fuel oil and coal from the energy sector to the IPPU sector in accordance with the 2006 IPCC Guidelines (vol. 3, chap. 4).	Guidelines (vol. 3, chap. 4, p.28). The Party reported in its NIR (p.528) that it will consider whether this is possible without creating new problems.
I.16	2.C.4 Magnesium production – HFCs and PFCs (I.6, 2019) (I.19, 2017) Transparency	Either estimate and include in the submission emissions of PFCs and/or HFCs that are the decomposition products from the use of FK 5-1-12 and HFC-134a by magnesium dye casters or include in the next NIR the information presented to the ERT during the review that justifies, in accordance with the UNFCCC Annex I inventory reporting guidelines, these emissions being considered insignificant.	Resolved. The Party reported in its NIR (section 4.19.2) the existence of FK 5-1-12 and explained that emissions resulting from the use of FK 5-1-12 are not estimated or reported as they fall below the threshold of significance in accordance with the UNFCCC Annex I inventory reporting guidelines. The Party also included information on decomposition products from the use of HFC-134a, explaining that only 20 per cent of the HFC-134a consumed is emitted and the rest reacts with magnesium, emissions from which are already included in the conservative estimate of the proportion of HFC-134a emitted.
I.17	2.C.5 Lead production – CO_2 (I.26, 2019) Transparency	Describe in the NIR the process or processes for secondary lead production in the country and report AD for lead production in CRF table 2(I).A-Hs2 on the basis of, for example, data on lead production provided in the *United Kingdom Minerals Yearbook 2018* (p.37) and earlier editions.	Resolved. The Party described in its NIR (section 4.20) the process for secondary lead production and reported AD for lead production in CRF table 2(I).A-Hs2. Non-process CO_2 emissions from secondary lead processes are reported under the energy sector.
I.18	2.C.5 Lead production – CO_2 (I.26, 2019) Transparency	Report CO_2 emissions from lead production either as "NA" in CRF table 2(I).A-Hs2, explaining in the NIR that the technologies applied for lead production do not result in process emissions and that energy-related emissions from lead production are reported under the energy sector, or as "IE" if the process emissions occur but are reported under another category, specifying the category.	Resolved. The Party reported in its NIR (section 4.20) that emissions from primary lead production are included under category 2.C.6 zinc production as it was not possible to split the emissions between categories 2.C.5 and 2.C.6. The notation key was corrected to "IE" under category 2.C.5 in CRF table 2(I).A-Hs2 for 1990–2003 (the plant in question closed in 2003).
I.19	2.D.1 Lubricant use – CO_2 (I.27, 2019) Transparency	Provide in the NIR a description of all types of lubricants included in the estimates of CO_2 emissions from lubricant use, including motor oils/industrial oils and greases.	Resolved. The Party reported in its NIR (section 4.22.1) that emissions from all lubricant uses (industrial, agricultural, marine and road vehicle engines) were estimated, with the exception of lubricants used in moped engines. In mopeds, lubricant is blended into petrol and used for combustion purposes and is therefore reported under category 1.A.3.b.
I.20	2.E.4 Heat transfer fluid – PFCs (I.28, 2019) Comparability	Report perfluorohexane emissions for category 2.E.4 in CRF table 2(II)B-Hs1, or report the emissions as "NE" instead of as "NO" and provide in the NIR information demonstrating that these emissions are below the threshold of significance in accordance with paragraph 37(b) of the UNFCCC Annex I inventory reporting guidelines.	Resolved. The Party explained in its NIR (section 4.28.2) that these emissions are below the threshold of significance, in accordance with paragraph 37(b) of the UNFCCC Annex I inventory reporting guidelines, it has done a market analysis and discussed with companies that manufacture PFCs. The Party changed the emissions reported for unspecified mix of PFCs in CRF table 2(II).B-Hs1 from "NO" to "NE". In addition, the Party gave in its NIR (section 1.8, table 1.13) a summary of sources reported as "NE" and an estimation of emissions by category, including category 2.E.4.

ID#	Issue/problem classification[a, b]	Recommendation made in previous review report	ERT assessment and rationale
I.21	2.F.1 Refrigeration and air conditioning – HFCs (I.12, 2019) (I.23, 2017) Convention reporting adherence	Improve the description in the NIR of the tier level of the methodology that is applied for the estimation of emissions for subcategory 2.F.1, noting a tier 2a method, in line with the 2006 IPCC Guidelines, has been implemented.	Resolved. The Party improved the description in the NIR (p.279) of the tier level of the methodology applied for estimating emissions for subcategory 2.F.1 (namely tier 2a).
I.22	2.F.1 Refrigeration and air conditioning – HFCs (I.29, 2019) Transparency	Include in the NIR a justification that the assumptions made in the HFC model accurately reflect the actual HFC trends, and include in that justification an explanation of how the HFC emission estimates obtained from the model are consistent with the European Union's overall HFC emission trends for category 2.F.1.	Resolved. The Party reported in its NIR (section 4.29.2) a new model (HFC Outlook) for estimating emissions from refrigeration, air conditioning and heat pumps, which involves reviewing the latest data and introducing a general phase-down of HFC consumption. During the review, the United Kingdom clarified that national HFC emissions are still higher than those estimated for other countries with a similar regulation on fluorinated gases, which the Party believes is justified given that its emission estimates are derived from bottom-up AD and a top-down inversion technique for emissions modelling, which combines atmospheric concentration data with meteorological data. The new model resulted in lower emission estimates that are much closer to the measurements derived from the inversion technique for emissions modelling than the old model. In the NIR (section 4.29.4) the Party reported a steeper decline in emissions in recent years than in European Union member States subject to the same fluorinated gas regulations. The reasons for this steeper decline have been addressed in the NIR (p.285).
I.23	2.F.1 Refrigeration and air conditioning – HFCs (I.29, 2019) Transparency	Implement the provisions of paragraph 50(a) of the UNFCCC Annex I inventory reporting guidelines and include in the NIR information that will improve the transparency of the HFC model.	Resolved. The Party reported in its NIR (section 4.29.2) the descriptions, references and sources of information underlying the new model (HFC Outlook) used to estimate HFC emissions for category 2.F.1. More weight was given to assumptions that are specific to the United Kingdom or a region thereof and/or are more recent. Where such information was not available, the default assumptions from the 2006 IPCC Guidelines were used.
I.24	2.F.4 Aerosols – HFCs (I.31, 2019) Accuracy	Include in the NIR a justification for the choice of the current EFs for aerosols production and use (i.e. 1 per cent of HFC emissions from aerosols occur during product manufacture, 97 per cent during product lifetime and 2 per cent at the end product of life) or estimate HFC emissions from aerosols in accordance with the 2006 IPCC Guidelines.	Resolved. The Party reported in its NIR (section 4.33.2.2) that it reviewed its methodology for aerosols and now reports 50 per cent of emissions from aerosols in the year they are placed on the market and 50 per cent in the following year in accordance with the 2006 IPCC Guidelines (vol. 3, chap. 7).
I.25	2.G.2 SF_6 and PFCs from other product use – SF_6 and PFCs	Continue to include in the improvement plan the need for an update of the AD, based on actual consumption, for the estimation of SF_6 and PFC emissions from	Addressing. The Party reported in its NIR (section 4.39.6 and p.485) that a study is being conducted to investigate the approach to estimating emissions from semiconductor manufacture, and better proxy data for the time series since 2001 are being reviewed.

ID#	*Issue/problem classification*[a, b]	*Recommendation made in previous review report*	*ERT assessment and rationale*
	(I.13, 2019) (I.24, 2017) Accuracy	semiconductor manufacture and report any progress thereon in the NIR.	
Agriculture			
A.1	3. General (agriculture) (A.1, 2019) (A.6, 2017) Completeness	Estimate and report emissions for categories 3.F, 3.G and 3.H for overseas territories and Crown dependencies or, if they are considered insignificant, report them as "NE" and provide a detailed explanation in the NIR on the likely level of emissions for categories 3.F, 3.G and 3.H for overseas territories and Crown dependencies in accordance with paragraph 37(b) of the UNFCCC Annex I inventory reporting guidelines.	Addressing. The Party reported in the NIR (chap. 10, p.485) as follows: For 3.F (field burning): the inventory now includes estimates of field burning for Crown dependencies based on United Kingdom IEFs. Emissions are reported as "NE" for all overseas territories, as there are no data available from in-country contacts, and, on the basis of estimated cropland areas, the Party considers emissions to be well below 0.05 per cent of United Kingdom GHG emissions. In the Falkland Islands (Malvinas), grass burning is undertaken by a "minority of farmers", according to the in-country contact, but there are no data available on areas burned. 3.G (liming): there continues to be no data available for Bermuda. For the Cayman Islands, the latest information from the in-country contact stated that no liming currently occurs and therefore emissions are estimated as zero. 3.H (urea application): there continues to be no data available for Bermuda. For the Falkland Islands (Malvinas), no data are available but information from the in-country contact suggests that fertilizer use (including urea) is "minimal", as most of the land is extensive rangeland (NIR section 5.6.2.1).
A.2	3. General (agriculture) – CO_2, CH_4 and N_2O (A.10, 2019) Convention reporting adherence	Update the uncertainty analysis for all categories, including enteric fermentation, for which significant data or methodological changes have occurred since the previous uncertainty analysis was conducted.	Addressing. The Party reported in its NIR (section 5.3.3) that, owing to time constraints, the uncertainty analysis has not been updated to fully reflect the adoption of new methods and data for estimating emissions from agriculture. The Party noted in its NIR that uncertainties related to emissions from goats, deer and horses are not currently included in its reporting (section 5.4.3) and that estimates of the uncertainty in the amount of sewage applied to land were omitted (section 5.5.3). During the review, the Party clarified that the emission estimation model and data tables are complex and that it is time-consuming to run the Monte Carlo simulation model, hence its decision to only run it approximately every five years. The ERT agreed that a Monte Carlo simulation may not be necessary every year, especially if only minor changes have been made to the methodology for estimating emissions. However, in the event of major methodological changes, it would be beneficial for the Party to factor running a simulation into its inventory compilation timeline. The United Kingdom noted that a full Monte Carlo simulation was due to be conducted in 2021 and will be reported in its 2022 submission.
A.3	3. General (agriculture) – CH_4 and N_2O	Improve the accuracy of emission estimates for enteric fermentation, manure management and agricultural soils	Addressing. The Party reported in its NIR (p.538) that, for the 2020 submission, the latest IEFs for enteric fermentation, manure management

ID#	*Issue/problem classification*[a, b]	*Recommendation made in previous review report*	*ERT assessment and rationale*
	(A.12, 2019) Accuracy	reported for the Crown dependencies by applying a splicing technique (e.g. extrapolation) from the 2006 IPCC Guidelines (vol. 1, chap. 5), to estimate the IEFs for the Crown dependencies instead of maintaining a constant IEF in years for which updated United Kingdom IEFs are not available in sufficient time to apply them to the emission estimates for the Crown dependencies.	and agricultural soils for the United Kingdom were applied to the Crown dependencies, but that it is considering changes to the institutional arrangements to make this process more robust in future. During the 2021 review the Party confirmed this was the case for the 2021 submission as well.
A.4	3.B Manure management – CH_4 and N_2O (A.13, 2019) Accuracy	Estimate the animal distribution in composting and digester MMS to estimate CH_4 and N_2O emissions from manure management, using expert judgment to estimate the animal distribution in both MMS until such time that country-specific data are available for inclusion in the submission.	Addressing. The Party reported in its NIR (section 5.4.5) that recalculations have been performed to ensure that anaerobic digestion of livestock manure is fully represented in the emission estimation model. However, there is no mention of composting or whether this has been assessed using expert judgment to be occurring in the country. During the review, the Party clarified that it is reviewing its AD on composting and its application to land. It also provided some information on the methane conversion factors used for manure managed in digesters in the United Kingdom for cattle, pig and poultry manure, noting that relevant values and information will be included in its next annual submission.
A.5	3.B.4 Other livestock – N_2O (A.14, 2019) Comparability	Report "NO" instead of "NE" in CRF table 3.B(b) for the amount of N from burned poultry manure to reflect the fact that poultry manure is burned after treatment and the combustion-related CH_4 and N_2O emissions are reported under the energy sector (when the manure is burned for energy purposes) or under the waste sector (when the manure is burned without energy recovery).	Resolved. The Party reported in CRF table 3.B(b) "NO" for the amount of N from burned poultry manure.
A.6	3.B.4 Other livestock – N_2O (A.14, 2019) Transparency	Include in the NIR an explanation of the poultry manure management practice and the final destination of the manure.	Addressing. The United Kingdom did not clearly explain in the agriculture section of the NIR about poultry manure management practice in the United Kingdom but did report proportions of manure managed in each AWMS in annex 3 (table A.3.3.5). The proportion of poultry manure incinerated was not reported. During the review, the Party stated that it included relevant information in NIR table 10.17 and sections 5.5.2.8–5.5.2.9, including additional information on the method for calculating emissions from the N content of manure used as fuel (poultry litter incineration) and therefore not applied to land. However, the ERT noted that table 10.17 and sections 5.5.2.8–5.5.2.9 do not appear to explain the poultry manure management practice or clarify whether all poultry litter is incinerated, noting that only one comment is provided in those sections explaining that the method used for atmospheric deposition and leaching and run-off was corrected for the N content of manure used as fuel. The United Kingdom provided further clarification during the review on the methodology used for manure that is incinerated, explaining that transfer of litter between devolved

ID#	Issue/problem classification[a, b]	Recommendation made in previous review report	ERT assessment and rationale
			administrations is taken into account. The ERT considers that the recommendation has not yet been fully addressed because the Party did not provide a clearer explanation of how poultry manure is managed. The Party could enhance the transparency of its reporting by including the data provided during the review.
A.7	3.D.a.6 Cultivation of organic soils (i.e. histosols) – N_2O (A.8, 2019) (A.8, 2017) Transparency	Provide in the NIR an explanation and further supporting evidence for the classification of organic soils in the Falkland Islands (Malvinas) as unmanaged, and explain why the areas of organic soils in overseas territories and Crown dependencies are not included as a contributing source to N_2O emissions from the cultivation of organic soils.	Addressing. The Party reported in its NIR (section 5.5.2.10) general information on emissions from agricultural soils for overseas territories and Crown dependencies, but did not provide specific information on emissions from the cultivation of organic soils, except for the Falkland Islands (Malvinas). During the review, the Party clarified that the in-country contact and Falkland Islands Department of Agriculture website (http://www.fig.gov.fk/agriculture/) confirms that grassland on histosols is characterized as an extensive rangeland system, which receives no fertilizer, liming, cultivation or drainage. According to the Party, although this may technically qualify as managed under the 2006 IPCC Guidelines definition as it is used for production, the rationale for calling it "unmanaged" is that there are no management activities that would lead to release of N_2O following loss of soil carbon. The United Kingdom also clarified that it understands managed organic soils to be present only in the Falkland Islands (Malvinas) and the Isle of Man, and absent from all the other Crown dependencies and overseas territories in scope, information on which will be included in future submissions. It did not have sufficient information on organic soils in the Isle of Man to include an estimate in the 2021 submission; however, this is being reviewed and is expected to be included in the 2022 submission.
A.8	3.J Other (CO_2 emissions from liming, urea application and other carbon-containing fertilizers) – CO_2, CH_4 and N_2O (A.15, 2019) Comparability	Report emissions from overseas territories and Crown dependencies in the respective categories (3.A enteric fermentation, 3.B manure management, 3.D direct and indirect N_2O emissions from agricultural soils, 3.G liming and 3.H urea application).	Addressing. The Party reported in its NIR (p.540) that it will include in its improvement plan an item to discuss changes to the institutional structure to make it more feasible to fully integrate emissions from overseas territories and Crown dependencies and other data into CRF tables in future submissions. The ERT noted that data on emissions in overseas territories and Crown dependencies from livestock, soil and other sources were provided in aggregate under category 3.J (other) in CRF table 3s2.
LULUCF			
L.1	4. General (LULUCF) 4.B Cropland 4.C Grassland – CO_2 (L.1, 2019) (L.1, 2017) (L.9, 2016) (L.9, 2015) Comparability	Report mineral and organic soils separately under cropland and grassland.	Resolved. The Party reported in NIR sections 6.3.4, 6.4.4, A.3.4.2 and A.3.4.6 and CRF tables 4.B, 4.C, 4.II and 4.III estimates of emissions and removals from mineral and organic soils separately under cropland and grassland.

ID#	*Issue/problem classification[a, b]*	*Recommendation made in previous review report*	*ERT assessment and rationale*
L.2	4. General (LULUCF) 4.B Cropland – CO_2 4.C Grassland – CO_2 (L.2, 2019) (L.1, 2017) (L.9, 2016) (L.9, 2015) Transparency	Assess the use of notation keys for the reporting of organic cropland and grassland soils, as appropriate.	Resolved. As for ID# L.1 above, the Party reported separate estimates for organic and mineral soils in CRF tables 4.B, 4.C, 4.II and 4.III, which ensured that incorrect use of notation keys did not occur.
L.3	4. General (LULUCF) 4.B Cropland – CO_2 4.C Grassland – CO_2 (L.3, 2019) (L.21, 2017) Comparability	(a) Provide information in the NIR about areas of organic soils for all lands, separating drained and undrained cropland and grassland; (b) Report organic soils separately from mineral soils in CRF tables 4.B, 4.C and 4(II), including overseas territories and Crown dependencies; (c) Report CO_2 emissions from organic soil drainage in CRF tables 4.B and 4.C, avoiding double counting of emissions in table 4(II); (d) Provide an explanation in the NIR for the discrepancies between areas of organic soils reported in CRF table 3.D and in CRF tables 4.B, 4.C and 4(II).	(a) Resolved. The Party reported in NIR sections 6.3.4, 6.4.2, 6.4.4, A.3.4.2 and A.3.4.6 and CRF tables 4.B, 4.C, 4.II and 4.III estimates of emissions and removals from mineral and organic soils and drainage and rewetting activities separately under cropland and grassland; (b) Resolved. The Party has reported data on area of mineral soil and area of organic soil for all land-use categories in CRF tables 4.B and 4.C, and has duly filled CRF table 4(II); further, the overseas territories and Crown dependencies are reported as a subdivision of the national total; (c) Resolved. The Party has reported data on area of mineral soil and area of organic soil for all land-use categories in CRF tables 4.B and 4.C, and has duly filled CRF table 4(II); further, the overseas territories and Crown dependencies are reported as a subdivision of the national total. Double counting has been avoided by using notation key "IE" in CRF table 4(II); (d) Addressing. The area of cultivated histosols is not reported in table 3.D. The Party reported in its NIR (p.345) that the area of cultivated histosols includes the area of drained cropland and intensive managed grassland. The ERT noted that these discrepancies should be checked during the next in-country review by accessing the data sets used to prepare the estimates reported in CRF table 3.D and in CRF tables 4.B and 4.C.
L.4	4. General (LULUCF) (L.5, 2019) (L.15, 2017) Convention reporting adherence	Implement a significance analysis to determine which carbon pools and subcategories are significant in each key category using the guidance provided in the 2006 IPCC Guidelines, and provide in the NIR detailed information on the results of the analysis.	Resolved. The Party reported in NIR tables 6.6, 6.8, 6.10 and 6.13 a significance analysis to determine which subcategories and carbon pools are significant for forest land, cropland, grassland and settlements.
L.5	4. General (LULUCF) (L.33, 2019) Transparency	Clarify either in the heading of NIR table A.3.6.5 or in a footnote to that table the specific overseas territories and/or Crown dependencies included in the emission estimates for specific categories of the LULUCF sector (if different from the heading).	Resolved. The Party reported in the heading of each table in NIR section A.3.6 the Crown dependencies and overseas territories to which the data in the table in question refer.
L.6	4. General (LULUCF) (L.34, 2019)	Correct the inconsistencies for grassland area between the NIR and CRF tables 4.1 and 4.C for the entire times series.	Resolved. The Party reported in its NIR (section 6.4) and in CRF tables 4.1 and 4.C consistent information on grassland area.

ID#	Issue/problem classification[a, b]	Recommendation made in previous review report	ERT assessment and rationale
	Convention reporting adherence		
L.7	4. General (LULUCF) (L.35, 2019) Convention reporting adherence	Refer to HWP as a pool rather than a land-use category in the annual submission and consider as land-use categories only those six land uses included in the 2006 IPCC Guidelines (vol. 4, pp.3.6–3.7), that is categories 4.A forest land, 4.B cropland, 4.C grassland, 4.D wetlands, 4.E settlements and 4.F other land.	Resolved. The Party revised the wording referring to the HWP to read "inventory category" rather than "land-use category" and reported in its NIR (p.356) that the LULUCF sector covers emissions and removals of direct GHGs under eight categories, of which forest land, grassland and HWP are net sinks, and cropland, wetlands and settlements are net sources, as well as indirect N_2O emissions, and that the United Kingdom does not report any emissions or removals from other land.
L.8	Land representation – CO_2 (L.6, 2019) (L.4, 2017) (L.19, 2016) (L.19, 2015) Completeness	Provide estimates of emissions and removals for the missing land areas (Bermuda, Cayman Islands, Gibraltar and Montserrat).	Resolved. The Party reported in its NIR (section A.3.6) as well as in relevant CRF tables GHG estimates for Bermuda, the Cayman Islands and Gibraltar. During the review, the Party clarified that the overseas territory of Monserrat is not included in its reporting under the Convention or the Kyoto Protocol, consistently with its ratification instruments.
L.9	Land representation (L.7, 2019) (L.16, 2017) Convention reporting adherence	Correct all inconsistencies with regard to the representation of land use and land-use changes. In particular:	Resolved. The land-use transition matrix was revised for the 2020 submission and all land areas are reported in CRF table 4.1 and the background sectoral CRF tables 4.A–4.F:
		(a) Report, for all land-use categories, final land areas for each year in CRF table 4.1 that equal initial land areas in the next year;	(a) Resolved. In addition to the information reported in CRF table 4.1, the Party has reported in its NIR table 6.3 (p.360) a complete time series of annual land-use matrices;
		(b) Report, for all land-use categories, final land areas for each year in CRF table 4.1 that equal the total land areas in the background sectoral CRF tables 4.A–4.F;	(b) Resolved. Such consistency has been ensured. The ERT advised the Party to continue to ensure consistency, as this will be checked in future reviews;
		(c) Report all land areas under their territorial coverage (United Kingdom, overseas territories and Crown dependencies) in CRF table 4.1 and the background sectoral CRF tables 4.A–4.F;	(c) Resolved. The total country area has been revised to include additional land area in Bermuda, the Cayman Islands and Gibraltar;
		(d) Ensure that the total country area reported in CRF table 4.1 and the background sectoral CRF tables 4.A–4.F remains constant throughout the time series.	(d) Resolved. Consistency in total national area between CRF table 4.1 and CRF tables 4.A–4.F is ensured by the check performed as part of subparagraph (b) above, which is on consistency in land-category areas between CRF table 4.1 and CRF tables 4.A–4.F. Further, the constancy of total land area across the time series has been ensured by including a small area of unmanaged wetlands to account for land reclamation from the sea in Jersey.
L.10	4.A Forest land – CO_2 (L.12, 2019) (L.9, 2017) (L.15, 2016) (L.15, 2015) Convention reporting adherence	Include information in the NIR on the verification of all carbon stock changes estimated using tier 3 methods and/or models (CARBINE, C-Flow and BSORT models).	Addressing. The Party reported in its NIR (section 6.2.6) that a comparison performed as part of a research project showed that the C-Flow and CARBINE models produce consistent predictions when given the same input data and assumptions. The same comparison was also performed by Matthews et al. (2014), detailing the changes in the assumptions that drive the changes in the inventory. The Party plans to verify the carbon stock

ID#	Issue/problem classification[a, b]	Recommendation made in previous review report	ERT assessment and rationale
			changes estimated using tier 3 methods after the second cycle of the NFI (2015–2020). During the review, the Party provided a draft report on CARBINE and the validation of the soil carbon accounting model SCOTIA, noting that further work on this report is planned and that the growth and yield models that form the basis of CARBINE have been subject to ongoing validation. The ERT considers that the recommendation has not yet been fully addressed because the Party has not yet verified the model outputs with independent measurements to confirm that the tier 3 method used is capable of estimating emissions and removals as per the 2006 IPCC Guidelines (vol. 4, chap. 2.6.2). According to the 2006 IPCC Guidelines, model outputs should be evaluated using a completely independent set of data, ideally using measurements from a monitoring network or research sites that were not used to calibrate the model parameters. NFI data, as reported by the Party, are likely to provide the basis for such verification.
L.11	4.A Forest land – CO_2 (L.13, 2019) (L.17, 2017) Accuracy	Obtain the necessary input data so as to be able to apply the CARBINE model for estimating carbon stock changes in forest land in overseas territories and Crown dependencies.	Resolved. The Party reported in its NIR (sections A.3.4.11 and A.3.6) that it used the tier 1 method to estimate forest land carbon stock changes. In the NIR (p.488) and during the review, the Party clarified that there are insufficient data to use the CARBINE model for the overseas territories and Crown dependencies. The ERT notes that, given their lack of significance in terms of the national emission total, the United Kingdom is complying with reporting requirements and good practice by applying a tier 1 method for estimating carbon stock changes in forest land in overseas territories and Crown dependencies.
L.12	4.A Forest land – CO_2 (L.14, 2019) (L.18, 2017) Completeness	Estimate and report carbon stock changes in biomass from forests not used for timber production in accordance with the 2006 IPCC Guidelines (vol. 4, chap. 4) owing to biomass losses associated with harvesting and/or gathering (e.g. fuelwood) or provide transparent information justifying that such losses are not occurring.	Addressing. See ID# KL.10 below.
L.13	4.A.1 Forest land remaining forest land – CO_2 (L.15, 2019) (L.19, 2017) Consistency	Adjust wood harvest data derived from the modelling of the management of forests to take into account data from recent forest inventories (NFI in 2011 and an inventory of the Public Forest Estate in 2014) in order to avoid an inconsistent time series, using the overlap or any other method consistent with those described in the 2006 IPCC Guidelines (vol. 1, chap. 5).	Resolved. The Party reported the following in its NIR (p.370): "In 2018, a new automatic algorithm was introduced in CARBINE to adjust the assumptions about forest management to ensure a good match between modelled forest harvest, and thus HWP, and the wood production statistics. This has also improved the repeatability and QC of this part of the inventory. As part of this project, the timber volume production module of CARBINE was re-implemented to enable that automation. This semi-independent implementation of this part of the model was cross-validated against the version in the CARBINE model." Accordingly, this adjustment was integrated into the 2021 submission.

ID#	*Issue/problem classification*[a, b]	*Recommendation made in previous review report*	*ERT assessment and rationale*
L.14	4.B.1 Cropland remaining cropland – CO_2 (L.20, 2019) (L.23, 2017) Accuracy	Develop country-specific EFs for manure and residue inputs or continue to investigate the appropriateness of the application of default EFs to reference SOC stocks for 1 m layer soil.	Resolved. In the 2021 submission, the Party applied a 30 cm increment in SOC estimates, instead of the previously applied 1 m increment, owing to changes in management practices, meaning that addressing this recommendation is no longer relevant. The Party reported in its NIR (section A.3.4.2.2.1) the values of the reference SOC stocks for 0–30 cm soil depth to which IPCC default stock change factors are applied, with the exception of the stock change factor for tillage, which, according to a literature review and modelling work, does not have a significant effect on soil carbon stocks under United Kingdom conditions.
L.15	4.B.1 Cropland remaining cropland – CO_2 (L.36, 2019) Accuracy	Develop a plan for estimating the annual change in inorganic carbon stock in soils, even if this is not a priority at present, and until the estimates can be included in the submission, include in the NIR information on the possible contribution of inorganic carbon stocks to changes in carbon stocks in soils based on the available literature.	Resolved. The Party reported in its NIR (section 6.3.8) on the process currently under way to determine how to incorporate inorganic carbon stocks into its inventory as an inventory improvement item, but noted during the review that this was not addressed in the 2021 submission. However, the ERT noted that changes in the inorganic carbon component of soils can only be reported by applying tier 3 modelling. As the United Kingdom does not have such modelling in place, this recommendation is considered fulfilled by the Party, noting the possibility of extending its reporting on SOC changes to the inorganic carbon component when such modelling capacity, the necessary data and a monitoring system for routinely collecting such data become available.
L.16	4.C Grassland – CO_2 (L.22, 2019) (L.25, 2017) Comparability	Allocate rural hedges to settlements or grassland, ensuring time-series consistency of the accounting of these areas to a single land-use category, and clearly indicate in the NIR where they are included.	Addressing. The Party reported in its NIR (section 6.4.4.2) that all carbon stock changes associated with changes in the length and condition of hedgerows are reported under grassland. However, the ERT considers that the recommendation has not yet been fully addressed because the Party reported in its NIR (section 6.4.8) that there remains a small inconsistency in its reporting on hedgerow areas, as some hedges fall within the boundary and linear features broad habitat under the settlements land-use category. A coordinated plan of improvements to the land-use change matrices is under consideration, which may include resolving all remaining inconsistencies in the definition and allocation of hedgerows.
L.17	4.D Wetlands – CO_2, CH_4 and N_2O (L.25, 2019) (L.28, 2017) Completeness	Collect the necessary data to enable reporting of emissions/removals from peat extraction remaining peat extraction in overseas territories and Crown dependencies.	Addressing. The Party provided information on the current lack of data on peat extraction in overseas territories and Crown dependencies in its NIR (table 1.13, p.101). During the review, it clarified that the Isle of Man and the Falkland Islands (Malvinas) are the only overseas territories and Crown dependencies with large areas of inland organic soils. A 2017 study by Evans et al. assessed the extent and condition of peatland and emissions from organic soils for the Isle of Man, which was assessed as having 0.001 kha domestic (non-commercial) peat extraction, with no conversion to peat extraction occurring since 1990. No comprehensive, reliable data were available for the Falkland Islands (Malvinas), but communications with

ID#	Issue/problem classification[a, b]	Recommendation made in previous review report	ERT assessment and rationale
			local land experts have established that there is no commercial peat extraction, and only very limited domestic peat extraction. The Party reported that emissions from the drainage and rewetting of organic soils, including any peat extraction, on the Isle of Man will be reported in its 2022 submission. Longer-term research projects on organic soils and emissions in the Falkland Islands (Malvinas) are ongoing, the results of which will feed into the inventory in due course.
L.18	4.D Wetlands – CO_2, CH_4 and N_2O (L.26, 2019) (L.28, 2017) Transparency	Provide in the NIR detailed information to describe that land conversion to peat extraction in overseas territories and Crown dependencies is not occurring.	Addressing. The assessment provided in ID# L.17 above also applies to this issue.
L.19	4.D.1 Wetlands remaining wetlands – CO_2, CH_4 and N_2O (L.27, 2019) (L.29, 2017) Completeness	Report areas of flooded land remaining flooded land for overseas territories and Crown dependencies and the associated emissions, or, if that is not possible, report in the NIR on the progress in collecting suitable data in order to estimate emissions and removals from flooded land remaining flooded land for overseas territories and Crown dependencies.	Resolved. The Party provided information in the NIR (p.491) on the absence in overseas territories and Crown dependencies of flooded land exceeding the area threshold of 1 km^2 used for the United Kingdom, resulting in it reporting "IE" for areas of flooded land remaining flooded land included with other wetland remaining other wetland.
L.20	4(II) Emissions/removals from drainage and rewetting and other management of organic/mineral soils – CO_2 and CH_4 (L.37, 2019) Transparency	Until the notation keys can be replaced with actual estimates, review the final submission to ensure that the use of "IE" in CRF table 4(II) for the area of organic soils drained in cropland in mainland United Kingdom is explained in CRF table 9.	Resolved. The Party reported in CRF table 4(II) areas of organic soils drained in cropland. The use of "IE" for the CO_2 emissions reported in CRF table 4(II) and the allocation of areas of organic soils drained in cropland is explained in CRF table 9.
L.21	4(V) Biomass burning – CO_2, CH_4 and N_2O (L.28, 2019) (L.30, 2017) Accuracy	Assess the areas of and emissions from wildfires on forest land remaining forest land, land converted to forest land, grassland remaining grassland and land converted to grassland for all overseas territories and Crown dependencies.	Addressing. The Party reported in its NIR (table A.3.4.32) proxy rates of burning in its Crown dependencies and overseas territories based on information collected in other geographical areas, mainly in mainland United Kingdom. During the review, the Party clarified that these rates were derived by assessing available information on wildfires in the Crown dependencies and overseas territories, including published government data on fire occurrences. It also reviewed data collected from international monitoring systems (Global Forest Watch, Global Fire Emissions Database and Global Wildfire Information System), which recorded zero occurrences of fires or burned areas in 2002–2019, except in the Falkland Islands (Malvinas). The ERT considers that this recommendation has not yet been addressed because the Party has not created a procedure or system for monitoring the occurrence of fires in forest land and grassland in its Crown dependencies and overseas territories and deriving associated emissions.

ID#	*Issue/problem classification*[a, b]	*Recommendation made in previous review report*	*ERT assessment and rationale*
			Noting the generally low emissions from these sources, the ERT advised the Party to consider establishing an interim procedure for annual data collection for all overseas territories and Crown dependencies by using the international monitoring systems referred to by the Party. The Party stated that it has no plans to implement such a procedure or system, also noting that this was not part of the original recommendation, as this is a low priority for inventory resource allocation, given the small land areas and low estimated rates of wildfires involved.
L.22	4.G.3 Other (HWP) – CO_2 (L.31, 2019) (L.13, 2017) (L.18, 2016) (L.18, 2015) Transparency	Include verifiable production data from the CARBINE model and the corresponding factors used to convert the production data to C, and report those data in CRF table 4.Gs2 to enable a more thorough verification of the HWP estimates.	Addressing. The Party reported in CRF table 4.Gs2 a truncated time series for production in 1960–1989 and 2019 and did not provide any values for factors used to convert production data to carbon. During the review, it clarified that a problem occurring when importing data to CRF Reporter caused the incomplete reporting and provided the ERT with the entire time series and the relevant values. Complete data will be reported in the 2022 submission.
Waste			
W.1	5.A Solid waste disposal on land – CH_4 (W.1, 2019) (W.1, 2017) (W.2, 2016) (W.2, 2015) (91, 2014) (98, 2013) Transparency	Implement the proposed improvements of the emission estimates for solid waste disposal sites in the overseas territories and Crown dependencies by providing further information on the methodologies used to estimate the emissions and by completing the CRF tables with specific parameters such as AD, methane correction factor and DOC.	Addressing. The Party provided in its NIR (section A.3.5.1.3, table A.3.5.5) additional information on the methodologies and parameters used to estimate emissions from solid waste disposal sites in the overseas territories and Crown dependencies, such as references to the sources of AD, methane correction factors, DOC and k value used. However, the actual AD and other parameters used are not provided.
W.2	5.A Solid waste disposal on land – CH_4 (W.2, 2019) (W.2, 2017) (W.5, 2016) (W.5, 2015) Transparency	Include in the NIR information on the parameters used in the MELMod model, including the exact figures and background information on their origin or method of derivation, and a weblink to the report on the review of landfill CH_4 emission modelling.	Resolved. The Party reported in its NIR the parameters used in the MELMod model, such as the methane correction factor used (p.417), the country-specific DOC and DOC_f values used for each waste stream (table A.3.5.2) and information on CH_4 recovery (sections 7.2.3.1–7.2.3.3 and table A.3.5.4) and waste composition (sections 7.2.3 and A.3.5.1.1 and table A.3.5.1). It also provided a weblink to the report on the review of landfill CH_4 emission modelling (p.638).
W.3	5.A Solid waste disposal on land – CH_4 (W.18, 2019) Accuracy	Investigate the availability of alternative data sources for the composition of mixed waste and update the waste composition data used for estimating emissions from this category accordingly, or, if this is not possible for a given annual submission, provide a justification in the NIR that the waste composition data used are representative of current national circumstances.	Not resolved. The composition of the waste used in the estimation of emissions continues to be assumed as constant over the entire time series. The United Kingdom explained in its NIR that, in the absence of new data sources for the composition of mixed waste, the waste composition data used from a survey conducted in 2012 (section A.3.5.1, p.882) are representative of current national circumstances. The ERT considers this issue to be unresolved because the study has not been updated.

ID#	*Issue/problem classification[a, b]*	*Recommendation made in previous review report*	*ERT assessment and rationale*
W.4	5.A Solid waste disposal on land – CH_4 (W.19, 2019) Transparency	Provide in NIR table A.3.5.5 the FOD rate constant (k) values used for estimating landfill emissions for the overseas territories and Crown dependencies.	Resolved. The United Kingdom included in NIR table A.3.5.5 an additional column on the parameters used for calculating the FOD rate constant (k) values, identifying which region and k constant were used in the IPCC FOD model.
W.5	5.A Solid waste disposal on land – CH_4 (W.20, 2019) Transparency	Provide in the NIR a clear explanation of and justification for the assumption used for conversion between the CH_4 used for power generation reported in the waste sector and electricity produced from landfill gas reported in the energy sector.	Resolved. The Party included the requested information in the NIR (section 7.2.3.2 and table A.3.5.4).
W.6	5.B.1 Composting – CH_4 and N_2O (W.21, 2019) Transparency	Report in NIR table A.3.5.6 the AD for the annual amount of waste treated in the composting process in the same units as those in CRF table 5.B and explain in the NIR the assumption used in converting the AD between weight and dry weight.	Resolved. The Party reported in the NIR (p.548) that AD for municipal solid waste treated by composting are reported on a wet weight basis, while these values are required to be reported on a dry weight basis in the CRF tables. While the AD reported in NIR table A.3.5.6 continue to be expressed on a wet weight basis, the assumption used in converting the AD from wet weight to dry weight has been added to the NIR (p.892).
W.7	5.D.1 Domestic wastewater – CH_4 (W.8, 2019) (W.15, 2017) Comparability	Report AD for domestic wastewater in BOD and ensure that the organic product in private wastewater treatment systems is included in the total organic product.	Resolved. For the population served by private wastewater treatment systems, population and per capita BOD load were used for estimating total BOD load (in kt BOD/year). AD on both of these variables were combined and reported as total degradable organic product in kt in CRF table 5.D, and sludge mass unit (total dissolved solids) was assumed to be comparable with BOD. In response to a question raised by the ERT during the review, the United Kingdom explained that CH_4 emissions were estimated by multiplying the total organic product by the CH_4 IEF (0.0196 kg CH_4/kg degradable organic component in 2017) derived from the CH_4 EF for sludge treatment (0.0109 kg CH_4/kg degradable organic component in 2017) and default CH_4 EF for septic tanks (0.3 kg CH_4/kg BOD), which is in line with the 2006 IPCC Guidelines (vol. 5, chap. 6, tables 6.2–6.3).
W.8	5.D.1 Domestic wastewater – CH_4 (W.9, 2019) (W.19, 2017) Comparability	Report CH_4 recovery consistently with the energy statistics.	Not resolved. The United Kingdom reported in the NIR (p.495) and during the review that this issue is currently being researched with a view to addressing it by the 2022 submission. It further indicated that, since energy statistics do not include CH_4 from wastewater treatment plants, it needs to liaise with national water companies so as to receive the more robust data needed to address the issue.
W.9	5.D.1 Domestic wastewater – N_2O (W.12, 2019) (W.17, 2017) Accuracy	Exclude N removed with sludge in the calculation of the emission estimates for the waste sector, as suggested by equations 6.7 and 6.8 in the 2006 IPCC Guidelines, and report the AD in the relevant CRF table.	Not resolved. The Party reported in the NIR (p.494) that this issue is being considered as part of a wider wastewater improvement plan for the GHG inventory and will be implemented subject to priorities and available resources. During the review, it was clarified that, although the Party has finalized the wastewater improvement plan, this issue has not been resolved owing to data uncertainty.

ID#	*Issue/problem classification*[a, b]	*Recommendation made in previous review report*	*ERT assessment and rationale*
W.10	5.D.1 Domestic wastewater – CH_4 (W.22, 2019) Transparency	Calculate the emissions from sludge treatment at sewage treatment plants and private wastewater management systems using the EFs for sludge treatment and septic tanks, respectively, and report the emissions transparently in the NIR.	Resolved. The Party provided a documentation box to CRF table 5.D explaining that the EFs used to calculate emissions from sewage treatment plants and private wastewater management systems were derived as aggregated IEFs for sludge treatment and septic tanks. The Party reported EFs in the NIR for sludge treatment (section A.3.5.4, table A.3.5.11) and septic tanks (section 7.5.2.2, p.438) to calculate CH_4 emissions from sludge treatment at sewage treatment plants and private wastewater management systems.
W.11	5.D.2 Industrial wastewater – CH_4 (W.13, 2019) (W.10, 2017) (W.11, 2016) (W.11, 2015) Accuracy	Report on any progress in collecting the data needed to report AD and emissions from industrial wastewater separately from domestic wastewater.	Addressing. The United Kingdom reported in the NIR (section 7.5, p.441) a revised methodology for reporting AD and emissions for industrial wastewater separately from those for domestic wastewater, which will be included in its 2022 submission. The Party also reported industrial wastewater AD in the NIR (section A.3.5.4.2, table A3.5.14). Information is still not available on how much wastewater from the chemical and food and drinks industries are treated on-site and how much wastewater is included in emissions from wastewater sent to sewers.
W.12	5.D.2 Industrial wastewater – CH_4 (W.14, 2019) (W.20, 2017) Accuracy	Collect information on the proportions of aerobic and anaerobic treatment systems and revise the methane correction factor used accordingly.	Addressing. The Party explained, in its NIR (p.495) and during the review that it has developed a revised methodology for estimating CH_4 emissions from industrial wastewater, which involves estimating the proportions of aerobic and anaerobic treatment systems and using a revised methane correction factor. While this revised methodology was not taken into account in the 2021 submission, the development will be reflected in the 2022 submission.
W.13	5.D.2 Industrial wastewater – CH_4 (W.23, 2019) Transparency	Improve the transparency of the industrial wastewater AD by presenting the assumptions used to convert these data to units suitable for applying IPCC default EFs and how these AD estimates differ from estimates derived from the methodology described in the 2006 IPCC Guidelines.	Resolved. The United Kingdom indicated in the NIR (section 7.5.2.4) that it has revised its methodology for estimating CH_4 emissions from industrial wastewater treatment, which is based on equation 6.6 from the 2006 IPCC Guidelines (vol. 5, chap. 6). This indirectly addresses the ERT recommendations.
KP-LULUCF			
KL.1	General (KP-LULUCF) (KL.1, 2019) (KL.1, 2017) (KL.3, 2016) (KL.3, 2015) Transparency	Include specific information on how land under CM, GM and WDR is identified, especially related to the report developed as part of the ongoing project on areas of WDR.	Addressing. The Party reported in its NIR (p.551) that WDR reporting for peatland was implemented in accordance with the Kyoto Protocol Supplement and the results of a 2017 study by Evans et al., which identified AD and EFs specific to the United Kingdom, which were then updated and presented in the NIR (section A.3.4.6). This more comprehensive reporting of emissions and removals from the drainage and rewetting of organic soils affects all KP-LULUCF. A detailed analysis and discussion of the impacts of this more comprehensive reporting on the 1990–2019 time series have been added to the NIR (section 11.3.1.3). An additional project is under

ID#	Issue/problem classification[a, b]	Recommendation made in previous review report	ERT assessment and rationale
			way to review the EFs for wasted peat in England, involving results from the country's first flux tower on wasted peat. Furthermore, a recent project funded by the Department for Business, Energy and Industrial Strategy on tracking land-use change in 1990–2020 will enable better identification of land under CM, GM and WDR. However, the ERT is concerned about the expected completion dates of this project, since 2022 is the last year of the second commitment period of the Kyoto Protocol, meaning that the Party may not have complete information to ensure accurate and consistent representation of land under CM, GM and WDR for its final accounting.
KL.2	General (KP-LULUCF) (KL.4, 2019) (KL.5, 2017) (KL.16, 2016) (KL.16, 2015) Completeness	Provide estimates of emissions and removals for the Cayman Islands and Gibraltar.	Resolved. The Party reported in its NIR (table A.3.4.32) emissions from Bermuda, the Cayman Islands and the Falkland Islands (Malvinas) and methodological information for all land-use categories (table A.3.4.32), which were used to estimate areas of deforestation and GM for the Cayman Islands. Further, the NIR (section 11.2.3) notes that the entire area of Gibraltar is classified under settlements and as such is not subject to KP-LULUCF.
KL.3	General (KP-LULUCF) (KL.5, 2019) (KL.15, 2017) Convention reporting adherence	Revise the land areas reported in different CRF tables (in particular the areas of afforestation, deforestation and CM reported in CRF table NIR-2, the areas of CM and GM reported in CRF tables NIR-2, 4(KP-I)B.2 and 4(KP-I)B.3, and the total area of the country reported in CRF table NIR-2 as well as the total land area reported under the Convention and for KP-LULUCF) ensuring the consistency of the reported information among CRF tables as well as between the CRF tables and the NIR, and provide a transparent explanation for any differences remaining.	Resolved. The areas of afforestation, deforestation and CM reported in CRF table NIR-2 are consistent across the time series and with the areas of CM and GM reported in CRF tables 4(KP-I)B.2 and 4(KP-I)B.3. During the review, the Party clarified that the land areas were revised to ensure consistency of the reported information among the CRF tables and under the Convention and for KP-LULUCF. Further, the total country area was revised to take into account the additional land area in Bermuda, the Cayman Islands and Gibraltar and the consistency of land area ensured by using land conversion from unmanaged wetlands to account for a small area of reclaimed land in Jersey.
KL.4	Deforestation – CO_2 (KL.7, 2019) (KL.8, 2017) (KL.9, 2016) (KL.9, 2015) Accuracy	Find a method to verify that the carbon stocks in living biomass prior to deforestation are not underestimated.	Resolved. The Party reported in its NIR (p.509) that the previous ERT noted that if deforestation occurs randomly in the country, using a weighted average carbon stock to estimate changes in carbon stocks from deforestation (the method currently applied by the United Kingdom) may result in emissions not being overestimated or underestimated in the long run. Further, the ERT notes that accuracy is achieved by avoiding systematic overestimation or underestimation, since single estimates in any sector are highly likely to overestimate or underestimate the true value depending on the proximity of the distribution of the population around the mean value. As there is no evidence that deforestation in the United Kingdom occurs in a particular subset of the Public Forest Estate with a biomass carbon stock distribution that differs significantly from the national-level distribution, the ERT cannot conclude that any bias is likely

ID#	Issue/problem classification[a, b]	Recommendation made in previous review report	ERT assessment and rationale
			occurring in estimates of changes in carbon stocks in biomass from deforested land. However, the ERT encourages the Party (see ID# KL.19 in table 6) to assess whether deforestation, across time, systematically occurs in forest land with a biomass carbon stock distribution that differs significantly from the national-level distribution.
KL.5	Article 3.4 activities – CO_2 (KL.9, 2019) (KL.9, 2017) (KL.10, 2016) (KL.10, 2015) Completeness	(a) Provide estimates of the carbon stock changes in litter and deadwood for CM; litter, deadwood and organic soils for GM; and all carbon pools under WDR; (b) Include a description of how these changes are estimated.	(a) Resolved. Regarding the litter and deadwood carbon pools for land subject to CM and GM, the ERT notes that litter and deadwood are not usually significant pools under cropland and grassland and there is no evidence to suggest that they are in the United Kingdom. Accordingly, it is sufficient to assume that those carbon pools are at long-term equilibrium, in accordance with the tier 1 method from the 2006 IPCC Guidelines (vol. 2, chap. 2), with the exception of forest land converted to cropland and grassland. The ERT notes that the Party reported dead organic matter losses associated with such conversions in CRF table 4(KP-I)A.2 and corresponding CRF tables 4.B and 4.C in the inventory years in which deforestation occurred; (b) Resolved. The Party reported in its NIR (sections 11.5 and A.3.4.6) and CRF tables 4(KP-I)B.2, 4(KP-I)B.3, 4(KP-I)B.5 and 4(KP-II)2 complete estimates and associated methodological information for CM, GM and WDR.
KL.6	Article 3.4 activities – CO_2, CH_4 and N_2O (KL.10, 2019) (KL.21, 2017) Transparency	Establish a hierarchy of elected activities under Article 3, paragraph 4; apply consistently the specified hierarchy to determine under which activity the land is to be reported in accordance with the Kyoto Protocol Supplement (section 1.2); in the cases in which land falls into two activities, report over time that land under only one activity according to the established hierarchy; and provide detailed information in the NIR on the hierarchy and how it is consistently applied. Alternatively, in the cases of rotation of land between CM and GM, consider reporting all land subject to CM and GM under a single activity.	Resolved. The Party reported in its NIR (section 11.1.4) that CM and GM are considered to be equivalent in its hierarchy of elected activities and that there is no risk of double counting resulting from the methods applied to identify and track land as well as to estimate associated emissions. The ERT did not identify any double counting in land subject to CM and GM within the scope of the review. Further, it did not find any information in the Kyoto Protocol Supplement that indicated including CM and GM at the same hierarchical level would lead to conflicts, noting that land subject to CM and GM may be reported under a single activity according to the Supplement. The Supplement (chap. 1, p.1.9) further clarifies that emissions and removals must follow the relevant methodologies established for CM or GM, which, as far as can be judged, is in accordance with the Party's approach.
KL.7	Article 3.4 activities – CO_2, CH_4 and N_2O (KL.23, 2019) KP reporting adherence	Explore how to make the best possible use of available data to meet the reporting requirements under the Kyoto Protocol for elected Article 3, paragraph 4, activities, a process that may benefit from expert meetings with potential data providers, and then prepare and implement a workplan to enable the use of these data.	Resolved. The Party reported in the NIR on improvements and associated recalculations made in this regard (sections 6.1.1, 6.2.7, 6.3.7, 6.4.7, 6.5.7, 6.6.7, 6.7.4, 6.8.5, 6.9.4 and 10.1) and on all further planned improvements (sections 6.1.1, 6.3.8, 6.4.8, 6.5.8, 6.5.8, 6.7.5 and 6.9.5).

ID#	*Issue/problem classification*[a, b]	*Recommendation made in previous review report*	*ERT assessment and rationale*
KL.8	Article 3.4 activities – CO_2, CH_4 and N_2O (KL.24, 2019) Transparency	Update the text in the NIR to explain (1) that the difference between the areas of GM under the Kyoto Protocol and grassland under the Convention arises from the different definitions used for grassland and GM and (2) the adjustment made to account for the area that has been converted from grassland but remains subject to GM.	Resolved. The Party reported in its NIR (section 11.1.3.5) that the area of GM reported under the Kyoto Protocol is consistent with that reported as grassland under the Convention, as all grassland in the United Kingdom is considered to be grazed and managed to some degree. According to hierarchy rules for KP-LULUCF, however, some grassland areas must be reported under other activities, such as deforestation, and some non-grassland areas under GM. This resulted in a 2.1 per cent difference between the area of grassland reported under the Convention and the grazing land area under GM for 2019.
KL.9	FM – CO_2, CH_4 and N_2O (KL.11, 2019) (KL.10, 2017) (KL.12, 2016) (KL.12, 2015) Accuracy	Correct the value of the FM cap in the CRF table "Accounting".	Resolved. The FM cap is fixed for the second commitment period of the Kyoto Protocol, and is as contained in the report on the review of the initial report (FCCC/IRR/2016/GBR): 224,824.677 kt CO_2 eq. The ERT noted that the correct value was used in the 2021 submission. The Party reported in its NIR that the FM cap was corrected within the CRF table "Accounting" in time for its 2020 submission.
KL.10	FM – CO_2 (KL.13, 2019) (KL.18, 2017) Accuracy	Estimate and report, in accordance with the 2006 IPCC Guidelines (vol. 4, chap. 4), carbon stock changes in biomass from forests not used for timber production owing to biomass losses associated with harvesting and/or gathering (e.g. fuelwood) or provide transparent information justifying that such losses are not occurring.	Addressing. The Party reported in its NIR (p.488) that the carbon increment of forests not used for timber production is already estimated using the CARBINE model. No reliable estimates of the quantity of wood removed by gathering or disturbances are currently available. During the review, the Party clarified that estimates of the amount of timber harvested or gathered for uses such as wood fuel from all forest land are included in the estimates of wood production included in national forestry statistics and therefore in the GHG inventory. The second cycle of the NFI (2015–2020) will provide additional information to resolve this issue. However, the ERT notes that, since increments are calculated by the CARBINE model on the basis of forest age, not allocating biomass losses that rejuvenate the forests is likely to result in a bias in the estimated increments. A comparative analysis of the second cycle of the NFI will allow any bias in the estimated increments for forests not used for timber production to be determined.
KL.11	FM – CO_2 (KL.14, 2019) (KL.19, 2017) Comparability	Report separately carbon stock changes for above-ground and below-ground biomass.	Resolved. The Party reported in CRF table 4(KP-I)B.1 carbon pool estimates for above-ground and below-ground biomass.
KL.12	FM – CO_2 (KL.15, 2019) (KL.20, 2017) Accuracy	(a) Estimate the background level and margin using a consistent and initially complete time series containing emissions for 1990–2009, in accordance with decision 2/CMP.7, annex, paragraph 33, using, if appropriate, methodologies from the 2006 IPCC Guidelines (e.g. vol. 1, chap. 5);	(a) Addressing. The Party reported in its NIR (section 11.4.4) that the background level and margin were calculated by applying the method provided in the Kyoto Protocol Supplement, despite the time frames covered by the individual data sets of each natural disturbance not overlapping in all cases, with the longest continuous data set covering 2000–2013 (for windstorms), which was taken as the calibration period. However, the ERT notes that the Party has not yet compiled a 20-year time

ID#	Issue/problem classification[a, b]	Recommendation made in previous review report	ERT assessment and rationale
		(b) Report in the NIR detailed information on the background level of emissions associated with annual natural disturbances that have been included in the FMRL, on how the background levels and margins for AR and FM have been estimated, on how the Party avoids the expectation of net credits or net debits during the commitment period, and on how the FMRL technical correction addresses emissions from natural disturbances for which the provision (e.g. substitution of natural disturbances emissions in the FMRL by the background level estimated) is intended to be applied; (c) Report the background level and margin estimated for AR and FM in CRF tables 4(KP-I)A.1.1 and 4(KP-I)B.1.3.	series of historical data for estimating the background level and the margin, noting that the Party could extend the time series past 2013 where data are available; (b) Addressing. The Party reported in its NIR (section 11.5.2.3) that the technical correction of its FMRL replaces estimates of emissions from wildfires with the background level of natural disturbances estimated for areas under FM. During the review, the Party clarified that dead organic matter stocks originating from natural disturbances were assumed to instantaneously oxidize in the calculations underlying the background level. However, the ERT notes that the Party has not reported all of the background information used to calculate the background level and its margin, or the step-by-step calculation procedures applied. The ERT also notes that applying the IPCC methodology for FM avoids any expectation or net credits or debits from the background level and margin, provided that the method for calculating GHG emissions and subsequent removals applied to the background level is identical to that for estimating GHG emissions and subsequent removals under FM during the commitment period (see ID# KL.17 in table 6); (c) Resolved. The Party reported in CRF tables 4(KP-I)A.1.1 and 4(KP-I)B.1.3 and NIR section 11.5.2.3 the background level and margin estimated for AR and FM, respectively.
KL.13	GM – CO_2 (KL.17, 2019) (KL.22, 2017) Consistency	Define the category of land under which hedges are to be accounted, ensure that corresponding GHG emissions and removals are estimated, and report consistently thereon for the entire time series.	Addressing. The Party reported in its NIR (p.498) and during the review that hedges are reported under GM. However, the ERT considers that the recommendation has not yet been fully addressed because the Party reported in its NIR (section 6.4.8) that there remains a small inconsistency in its reporting on hedgerow areas, as some hedges fall within the boundary and linear features broad habitat under the settlements land-use category. A coordinated plan of improvements to the land-use change matrices is under consideration, which may include resolving all remaining inconsistencies in the definition and allocation of hedgerows.
KL.14	GM – CO_2, CH_4 and N_2O (KL.19, 2019) (KL.24, 2017) Completeness	Develop the necessary AD on controlled burning throughout the year and in land areas smaller than 1 ha, and estimate and report the associated CO_2 and non-CO_2 emissions for the entire territory.	Addressing. The Party reported in its NIR (p.498) that an assessment of the available data on controlled burning on grassland showed that such data are not sufficient. The United Kingdom will continue to assess new data as they become available. Policy experts believe that the area of controlled burning on grassland has been on a downward trend since 1990. During the review, the Party provided an initial assessment supporting the view that emissions from controlled biomass burning are insignificant (e.g. emissions from biomass associated with prescribed burning amount to approximately 163 Gg CO_2 eq/year without accounting for post-fire vegetation regrowth). The ERT noted the information reported and considers that including a

ID#	Issue/problem classification[a, b]	Recommendation made in previous review report	ERT assessment and rationale
			summary of it in the next annual submission would resolve the recommendation.
KL.15	WDR – CO_2, CH_4 and N_2O (KL.20, 2019) (KL.25, 2017) Completeness	(a) Report the timetable for the ongoing project to incorporate WDR into the annual submission, including when the final results will be available for use in estimating CO_2 and non-CO_2 emissions from lands in the entire territory subject to WDR; (b) Follow, until the final results from the project are available, an interim approach (using alternative data sources) to obtain the necessary AD and use appropriate methodologies from the Wetlands Supplement to estimate CO_2 and non-CO_2 emissions for all the carbon pools from lands in the entire territory subject to WDR, noting the provisions of decision 2/CMP.7, annex, paragraph 26, decision 2/CMP.8, annex II, paragraph 2(a), (d) and (e), and decision 6/CMP.9, paragraph 10; (c) Report CO_2 and non-CO_2 emissions in CRF tables 4(KP-I)B.5, 4(KP-II)1, 4(KP-II)2 and 4(KP-II)4, and explain in the NIR how they have been estimated.	Resolved. The Party reported methodological information in its NIR (sections 6.5, 11.5.3 and A.3.4.6) and GHG estimates in CRF tables 4(KP-I)B.5 and 4(KP-II)2 relating to WDR in its 2021 submission.

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

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

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

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

Table 4
Issues and/or problems identified in three or more successive reviews and not addressed by the United Kingdom of Great Britain and Northern Ireland

ID#	Previous recommendation for issue	Number of successive reviews issue not addressed[a]
General	No issues identified.	

ID#	*Previous recommendation for issue*	*Number of successive reviews issue not addressed*[a]
Energy		
E.1	Clearly indicate the geographical coverage of DUKES and demonstrate how fuel consumption data at the subcategory level for each overseas territory and Crown dependency are obtained and incorporated into the national totals for that subcategory.	4 (2015/2016–2021)
E.7	Describe in the NIR the coverage of the AD, methods and EFs for estimating emissions from well drilling, well testing and well completions in oil and natural gas exploration and clarify whether these emissions are reported under category 1.A fuel combustion activities or 1.B fugitive emissions from fuels.	3 (2017–2021)
E.8	Estimate and report CO_2 and CH_4 emissions from exploratory activities or, if they are considered insignificant, report them as "NE" and justify that the likely level of emissions is below the significance threshold established in paragraph 37(b) of the UNFCCC Annex I inventory reporting guidelines.	3 (2017–2021)
IPPU		
I.25	Continue to include in the improvement plan the need for an update of the AD, based on actual consumption, for the estimation of SF_6 and PFC emissions from semiconductor manufacture and report any progress thereon in the NIR.	3 (2017–2021)
Agriculture		
A.1	Estimate and report emissions for categories 3.F, 3.G and 3.H for overseas territories and Crown dependencies or, if they are considered insignificant, report them as "NE" and provide a detailed explanation in the NIR on the likely level of emissions for categories 3.F, 3.G and 3.H for overseas territories and Crown dependencies in accordance with paragraph 37(b) of the UNFCCC Annex I inventory reporting guidelines.	3 (2017–2021)
A.7	Provide in the NIR an explanation and further supporting evidence for the classification of organic soils in the Falkland Islands (Malvinas) as unmanaged, and explain why the areas of organic soils in overseas territories and Crown dependencies are not included as a contributing source to N_2O emissions from the cultivation of organic soils.	3 (2017–2021)
LULUCF		
L.10	Include information in the NIR on the verification of all carbon stock changes estimated using tier 3 methods and/or models (CARBINE, C-Flow and BSORT models).	4 (2015/2016–2021)
L.12	Estimate and report carbon stock changes in biomass from forests not used for timber production in accordance with the 2006 IPCC Guidelines (vol. 4, chap. 4) owing to biomass losses associated with harvesting and/or gathering (e.g. fuelwood) or provide transparent information justifying that such losses are not occurring.	3 (2017–2021)
L.16	Allocate rural hedges to settlements or grassland, ensuring time-series consistency of the accounting of these areas to a single land-use category, and clearly indicate in the NIR where they are included.	3 (2017–2021)
L.17	Collect the necessary data to enable reporting of emissions/removals from peat extraction remaining peat extraction in overseas territories and Crown dependencies.	3 (2017–2021)

ID#	*Previous recommendation for issue*	*Number of successive reviews issue not addressed*[a]
L.18	Provide in the NIR detailed information to describe that land conversion to peat extraction in overseas territories and Crown dependencies is not occurring.	3 (2017–2021)
L.21	Assess the areas of and emissions from wildfires on forest land remaining forest land, land converted to forest land, grassland remaining grassland and land converted to grassland for all overseas territories and Crown dependencies.	3 (2017–2021)
L.22	Include verifiable production data from the CARBINE model and the corresponding factors used to convert the production data to carbon, and report those data in CRF table 4.Gs2 to enable a more thorough verification of the HWP estimates.	4 (2015/2016–2021)
Waste		
W.1	Implement the proposed improvements of the emission estimates for solid waste disposal sites in the overseas territories and Crown dependencies by providing further information on the methodologies used to estimate the emissions and by completing the CRF tables with specific parameters such as AD, methane correction factor and DOC.	6 (2013–2021)
W.8	Report CH_4 recovery consistently with the energy statistics.	3 (2017–2021)
W.9	Exclude N removed with sludge in the calculation of the emission estimates for the waste sector, as suggested by equations 6.7 and 6.8 in the 2006 IPCC Guidelines, and report the AD in the relevant CRF table.	3 (2017–2021)
W.11	Report on any progress in collecting the data needed to report AD and emissions from industrial wastewater separately from domestic wastewater.	4 (2015/2016–2021)
W.12	Collect information on the proportions of aerobic and anaerobic treatment systems and revise the methane correction factor used accordingly.	3 (2017–2021)
KP-LULUCF		
KL.1	Include specific information on how land under CM, GM and WDR is identified, especially related to the report developed as part of the ongoing project on areas of WDR.	4 (2015/2016–2021)
KL.10	Estimate and report, in accordance with the 2006 IPCC Guidelines (vol. 4, chap. 4), carbon stock changes in biomass from forests not used for timber production owing to biomass losses associated with harvesting and/or gathering (e.g. fuelwood) or provide transparent information justifying that such losses are not occurring.	3 (2017–2021)
KL.12	(a) Estimate the background level and margin using a consistent and initially complete time series containing emissions for 1990–2009, in accordance with decision 2/CMP.7, annex, paragraph 33, using, if appropriate, methodologies from the 2006 IPCC Guidelines (e.g. vol. 1, chap. 5); (b) Report in the NIR detailed information on the background level of emissions associated with annual natural disturbances that have been included in the FMRL, on how the background levels and margins for AR and FM have been estimated, on how the Party avoids the expectation of net credits or net debits during the commitment period, and on how the FMRL technical correction addresses emissions from natural disturbances for which the provision (e.g. substitution of natural disturbances emissions in the FMRL by the background level estimated) is intended to be applied.	3 (2017–2021)

ID#	*Previous recommendation for issue*	*Number of successive reviews issue not addressed*[a]
KL.13	Define the category of land under which hedges are to be accounted, ensure that corresponding GHG emissions and removals are estimated, and report consistently thereon for the entire time series.	3 (2017–2021)
KL.14	Develop the necessary AD on controlled burning throughout the year and in land areas smaller than 1 ha, and estimate and report the associated CO_2 and non-CO_2 emissions for the entire territory.	3 (2017–2021)

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

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

10. Tables 5–6 present findings made by the ERT during the individual review of the 2021 annual submission of the United Kingdom that are additional to those identified in table 3. In accordance with paragraph 76(b) of the UNFCCC review guidelines, the ERT has prioritized in table 5 recalculations that changed the estimated total emissions or removals for a category by more than 2 per cent and/or national total emissions by more than 0.5 per cent for any of the recalculated years.

Table 5
Additional findings made during the individual review of the 2021 annual submission of the United Kingdom of Great Britain and Northern Ireland related to recalculations

ID#	*Finding classification*	*Description of finding with recommendation or encouragement*	*Is finding an issue/problem?*[a]
Energy			
		Recalculations made for the energy sector changed the estimated emissions for a category by more than 2 per cent and/or national total emissions by more than 0.5 per cent; however, the ERT did not identify any issues or problems with these recalculations.	
IPPU			
I.26	2. General (IPPU)	Recalculations made for the IPPU sector were not always reported in accordance with paragraph 43 of the UNFCCC Annex I inventory reporting guidelines. For example, the Party included the following reference in its NIR (section 4.33.5): "For information on the magnitude of recalculations, see section 10." However, section 10 only contains a brief explanation of the recalculations performed and the differences between the emissions reported in the previous and the latest submission. In the NIR (sections 4.13.5, 4.34.5, 4.35.5 and 4.36.1), the Party specified that no recalculations were performed despite recalculations being provided in the corresponding CRF tables (2(I).A-Hs1 and 2(II).B-Hs2 for categories 2.B.8.b, 2.F.5, 2.F.6 and 2.G.1). In addition, reallocation of CO_2 emissions from use of sodium bicarbonate (the emissions were previously reported in category 2.G.4 and were reallocated to category 2.A.4.d for the 2021 submission) were not reported in accordance with paragraph 45 of the UNFCCC Annex I	Yes. Convention reporting adherence

ID#	Finding classification	Description of finding with recommendation or encouragement	Is finding an issue/problem?[a]
		inventory reporting guidelines since they are missing from the descriptions of recalculation in sections 4.5.5 and 4.42.5.	
		The ERT recommends that the Party report recalculations or reallocations of emissions in accordance with paragraphs 43–45 of the UNFCCC Annex I inventory reporting guidelines.	
Agriculture			
		Recalculations made for the agriculture sector changed the estimated emissions for a category by more than 2 per cent and/or national total emissions by more than 0.5 per cent; however, the ERT did not identify any issues or problems with these recalculations.	
LULUCF			
		Recalculations made for the LULUCF sector changed the estimated emissions or removals for a category by more than 2 per cent and/or national total emissions by more than 0.5 per cent; however, the ERT did not identify any issues or problems with these recalculations.	
Waste			
		Recalculations made for the waste sector changed the estimated emissions for a category by more than 2 per cent and/or national total emissions by more than 0.5 per cent; however, the ERT did not identify any issues or problems with these recalculations.	
KP-LULUCF			
		Recalculations made for KP-LULUCF changed the estimated emissions or removals for a category by more than 2 per cent and/or national total emissions by more than 0.5 per cent; however, the ERT did not identify any issues or problems with these recalculations.	

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

11. Table 6 contains additional findings made by the ERT during the individual review of the 2021 annual submission that are not covered in table 3 or 5, but are within the scope of the desk review as specified in paragraph 76 of the UNFCCC review guidelines or paragraph 65 of the Article 8 review guidelines and are findings that the ERT wishes to convey to the Party.

Table 6
Additional findings made during the individual review of the 2021 annual submission of the United Kingdom of Great Britain and Northern Ireland

ID#	Finding classification	Description of finding with recommendation or encouragement	Is finding an issue/problem?[a]
General			
G.9	NIR	The sector-specific sections of the NIR do not include the results of the uncertainty analyses at the category level for most categories, but refer to annex 2 to the NIR for this information (e.g. railways (p.186), enteric fermentation (p.329)	Not an issue/problem

ID#	*Finding classification*	*Description of finding with recommendation or encouragement*	*Is finding an issue/problem?*[a]
		and waste incineration (p.430)). The ERT acknowledged that annex 2 sufficiently describes the uncertainties of AD and EFs applied and the rationale used to determine them, but considered that providing a summary of the uncertainty analyses for each category in the relevant NIR section would improve readability. The ERT reiterates the encouragement made in the previous review report (see ID# G.10 in table 6) that the United Kingdom include a brief description (e.g. a sentence or a summary table, as already included for some categories) of the uncertainty associated with each category in the "Uncertainties and time series consistency" section under each category in the NIR.	
G.10	National registry	The United Kingdom provided a link to publicly accessible information related to the national registry in the NIR (section 12.4). However, the ERT was unable to access any information using the link, which seemed to be broken. This issue was also noted in the 2021 SIAR for the United Kingdom. During the review, the Party provided a working link (https://view-emissions-trading-registry.service.gov.uk/kp-reports/). The ERT noted that the United Kingdom emissions trading scheme reports are not currently available online, but the Party explained during the review that it is working to make them available as soon as possible. The ERT recommends that the United Kingdom make information related to the national registry publicly available and provide the correct link in its next annual submission.	Yes. KP reporting adherence
G.11	Uncertainty analysis	In several cases, the Party reported uncertainties for aggregated categories (e.g. 1.A coal (CO_2) and 2.B chemical industry (CO_2)) instead of by CRF category in its NIR (annex 2). During the review, it explained that it has higher confidence in the higher-level AD and emission estimates than in individual sectoral allocations, noting that many of the sectoral allocations within these categories are a disaggregation of the totals reported at a higher level. The ERT encourages the United Kingdom to transparently explain in its NIR its rationale for estimating uncertainties for aggregated categories, as described in the 2006 IPCC Guidelines (vol. 1, chap. 3.5, pp.3.40–3.41).	Not an issue/problem
Energy			
E.9	1.A Fuel combustion – sectoral approach – biogas – CO_2, CH_4 and N_2O	The Party reported in its NIR (method statement 5, p.163) that no biomass combustion is reported under category 1.A.4.a commercial/institutional combustion and this source is not reported in the CRF tables. However, in CRF table 1.A(a)s4, CO_2 emissions from biomass are reported under category 1.A.4.a (stationary combustion), with AD as well as CH_4 and N_2O emissions reported as "IE". According to CRF table 9, the emissions are allocated under gaseous fuels. During the review, the United Kingdom clarified that it has reviewed its reporting of biogas blended with natural gas in the distribution network. It obtains information on the percentage of biogenic CH_4 in the natural gas distribution network from DUKES. Using this information, the CO_2 EF for gaseous fuels is adjusted to account for the fossil share only. AD for gaseous fuels represent natural gas plus the blended biogas in the natural gas distribution network. Therefore, CH_4 and N_2O emissions are calculated for the fossil and the biogenic share of the AD. Biogenic CO_2 emissions are reported separately under biomass, but in order to avoid double counting the AD, "IE" is reported for AD under biomass. The ERT acknowledged that this method means that the Party reports all emissions arising from natural gas consumption, but noted that this may impact the CO_2, CH_4 and N_2O IEFs for gaseous fuels because the AD also contain a small percentage of biogas. The ERT recommends that the Party describe in the NIR how much biogas is blended with natural gas, consider ways of reporting AD on and related CO_2, CH_4 and N_2O emissions from biogas separately under biomass, ensuring that any	Yes. Comparability

ID#	Finding classification	Description of finding with recommendation or encouragement	Is finding an issue/problem?[a]
		changes do not affect the accuracy of the reporting on CH_4 and N_2O emissions, and update the NIR section on biomass (section 3.2.5) and the relevant method statements accordingly.	
E.10	1.A.1.a Public electricity and heat production – biogas	The Party reported in its NIR (p.144) that electricity is generated in a large number of engines running on biogas at landfill sites and sewage treatment plants. AD on landfill and sewage gas recovery are provided by DUKES and considered complete. AD allocated to unclassified fuel consumption and public administration in DUKES are reported under category 1.A.2.g.viii, while AD on other engines are reported under category 1.A.1.a.i. The ERT was unable to reconcile the AD reported in the background energy sector file provided by the Party on landfill and sewage gas consumption with CH_4 recovery data reported for the waste sector under categories 5.A and 5.D. During the review, the United Kingdom clarified that the data used for reporting emissions for category 1.A.1.a.i stem from statistics on energy generated by landfill gas engines, but that no estimates for landfill gas flaring have been made. For sewage gas, the United Kingdom energy statistics are used as a proxy to extrapolate the time series of recovered CH_4 reported in the inventory. However, given that the CH_4 recovery estimate reported in the inventory under the waste sector does not directly feed into emissions estimates, the Party has not investigated how these estimates relate. The ERT recommends that the Party enhance the transparency of allocation and reporting of recovered CH_4 originating from the waste sector that is used in the energy sector.	Yes. Transparency
IPPU			
I.27	2.A.4 Other process uses of carbonates – CO_2	The Party reported in its NIR (sections 4.5.1 and 4.12.1) that CO_2 emissions occur from the subsequent use of sodium bicarbonate. The methodology for estimating emissions from sodium bicarbonate use is described in subcategory 2.A.4.d but it is indicated in the NIR (p.256) that these emissions are reported under subcategory 2.G.4 other. In CRF table 2(I)s2 no CO_2 emissions are reported for subcategory 2.G.4. During the review, the Party clarified that CO_2 emissions from the use of sodium bicarbonate were previously reported under subcategory 2.G.4 but in the 2021 submission were reported under subcategory 2.A.4.d. The ERT recommends that the Party update the descriptions of the emissions from sodium bicarbonate use and their allocation in the inventory in the next NIR.	Yes. Transparency
I.28	2.F.1 Refrigeration and air conditioning – HFCs	The Party reported in its NIR (section 4.29.2) that it is using a new comprehensive model called HFC Outlook to estimate AD and HFC emissions for subcategory 2.F.1 refrigeration and air conditioning. The model uses a bottom-up approach with assumptions about EFs and stock levels and is verified by comparing predicted HFC consumption for refrigeration, air conditioning and heat pumps with top-down data on national sales of HFCs. The ERT noted that the NIR did not mention to which IPCC tier method (2006 IPCC Guidelines, vol. 3, chap. 7, table 7.2) the approach corresponds. The information provided in CRF summary 3 noted the use of a "T2" method. During the review, the Party clarified that HFC Outlook uses a tier 2a modelling approach. The ERT recommends that the Party include in the NIR the tier level of the methodology for estimating emissions for subcategory 2.F.1.	Yes. Transparency
Agriculture			
A.9	3. General (agriculture) –	The United Kingdom did not include in the agriculture sector section of its 2019 NIR a description of trends and inter-annual variations in or the main drivers of emissions by category in line with the UNFCCC Annex I inventory reporting guidelines. During the 2019 review, the United Kingdom explained that the occurrence of foot and mouth disease	Not an issue/problem

ID#	*Finding classification*	*Description of finding with recommendation or encouragement*	*Is finding an issue/problem?*[a]
	CO_2, CH_4 and N_2O	resulted in the culling of cattle in 2001, causing the population of cattle and resulting emissions to decrease in 2001. As indicated during the review and in the NIR (p.536), the ERT noted that the Party included in the 2021 submission some brief trend information comparing 1990 with 2019 for all sections within the agriculture chapter. However, this information tended to indicate whether emissions had gone up or down with no or little description of the variables driving the trend or any inter-annual variation. The ERT reiterates the encouragement made in the previous review report (see ID# A.9 in table 5) that the United Kingdom enhance the transparency of the agriculture sector chapter of its NIR by including detailed descriptions of trends and inter-annual variations in emissions and the main drivers of the trends for each category, including events that influence emissions such as disease and weather.	
A.10	3. General (agriculture) – CH_4 and N_2O	The United Kingdom applied an agriculture sector model with a fully revised structure for the 2019 submission to enable better representation of the key underlying drivers of GHG emissions from the sector, including soil, climate, livestock and cropping characteristics; farm management practices; and uptake of specific climate change mitigation methods. The ERT reviewed the model during the 2019 review and commended the Party for improving its estimation methods, which increased the accuracy of its inventory, but noted that the transparency of the model description in the NIR could be improved. During the 2021 review, the ERT recognized that the Party improved the transparency of the model by providing further information in NIR section 5.1 and working to better document the underlying model(s) and data flows used in the inventory compilation process. While some information on the latter was included in the NIR (section 5.1), a detailed stand-alone description, including the suggested comparison with the tier 1 approach from the 2006 IPCC Guidelines, has not yet been included. During the review the Party explained that it has included a description of the model in the NIR (section 5.1) describing what sources are included in the model, how the model deals with the AD (e.g. soils and climate, farm types, livestock types and numbers, crop types and crop areas, crop residues, inorganic fertilizer types and application rates, organic fertilizers) and the calculation of EFs for N_2O emissions from soils. The Party confirmed that a stand-alone detailed description, including the suggested comparative analysis with the IPCC tier 1 approach, has not yet been completed. The ERT reiterates the encouragement made in the previous review report (see ID# A.11 in table 5) that the United Kingdom continue to improve the transparency of its NIR (e.g. annex 3) and complete and include the stand-alone detailed description they are currently working on. The following should be included in future NIRs: (1) detailed information on the agriculture sector model, including in relation to its basis, type, application, model adaptation, main equations and processes, key assumptions, domain of application, parameters (and how they were estimated), key inputs and outputs, calibration, evaluation, uncertainty and sensitivity analyses and QA/QC procedures, as well as references to peer-reviewed literature, in line with footnote 11 in the UNFCCC Annex I inventory reporting guidelines; (2) a comparative analysis of emissions derived using the agriculture sector model and those derived using tier 1, 2 or 3 methodologies; and (3) a diagram showing the procedures and data flows for the agriculture sector model.	Not an issue/problem
A.11	3. General (agriculture) – CH_4 and N_2O	The Party applied mainland United Kingdom IEFs to estimate CH_4 and N_2O emissions from enteric fermentation, manure management and agricultural soils in the Crown dependencies. During the 2019 review, the ERT checked the Party's calculations for estimating emissions for these categories and found that the IEFs used in the spreadsheet for calculating emissions in 2016 and 2017 were from 2015. The Party explained that it applied the 2015 IEFs owing to the limited time available for preparing the estimates between receiving the data from the Crown dependencies and submitting the inventory to the European Union and subsequently the secretariat. The ERT noted in 2019 that, considering the relatively	Not an issue/problem

ID#	Finding classification	Description of finding with recommendation or encouragement	Is finding an issue/problem?[a]
		small amount of emissions from the Crown dependencies, any error resulting from use of constant IEFs for 2016 and 2017 would be below the threshold of significance in accordance with paragraph 37(b) of the UNFCCC Annex I inventory reporting guidelines and therefore below the threshold of significance for inclusion of this issue in the list of potential problems and further questions raised in accordance with decision 22/CMP.1, annex, paragraph 80(b), in conjunction with decision 4/CMP.11. In the 2021 NIR, the latest IEFs from the United Kingdom were applied to the Crown dependencies, but the Party is discussing changes to the institutional structure with a view to making this process more robust in the future. The ERT encourages the Party to continue to assess, and if appropriate improve, the inventory planning processes for mainland United Kingdom and the Crown dependencies to ensure that emission estimates for the latter are based on the latest available data from mainland United Kingdom.	
A.12	3. General (agriculture) – CO_2, CH_4 and N_2O	The ERT acknowledges that the United Kingdom has implemented many methodological improvements over the last few submissions to build upon the investment in research to derive country-specific EFs per key category, based on national field research across 2010–2016, and that now many methods used by the United Kingdom are tier 2 or higher. In the current annual submission, many method improvements are set out that use the latest available national data and research, including revisions to beef cattle live weights, milk yields and livestock numbers; revisions to the beef cattle herd structure in the early part of the time series; revisions to sheep energy maintenance requirements to use data specific to the United Kingdom; full representation of anaerobic digestion of livestock manure in the model at the manure storage and digestate spreading stages, including revision to EFs; revision to livestock housing practice and manure management AD for Northern Ireland; revision of straw amounts and N content; and scaled emissions for 2018 replaced with actual values. Noting that there is scope for further improvements, subject to the availability of data, time and resources, the ERT considers that the Party's NIR includes only limited information on future planned improvements, for example to energy maintenance equations for non-lactating cattle. In response to questions during the review, the Party indicated a number of other areas of improvement that are planned for the next annual submission. The ERT therefore encourages the Party to include more detailed information on planned future improvements under the categories of the agriculture sector in future annual submissions.	Not an issue/problem
A.13	3. General (agriculture) – CH_4 and N_2O	During the review, the ERT found an error in the conversion of the uncertainty estimates for categories 3.B manure management and 3.D agricultural soils to percentages, where the value was divided by the range maximum rather than by the mean, causing these estimates to be underestimated. During the review, the Party explained that this occurred during the post-processing stage of the inventory reporting and thus did not influence the emission estimates reported. The ERT recommends that the Party implement general QC procedures in accordance with its QA/QC plan to avoid such errors in future annual submissions.	Yes. Convention reporting adherence
A.14	3. General (agriculture) – CO_2, CH_4 and N_2O	The ERT found multiple cross-referencing and reference errors in the Party's NIR. For example, the United Kingdom wrongly stated that the description of partitioning of dung and urine from cattle (NIR p.344) was contained in section 5.3.2.2 and that the country-specific N_2O EF was contained in table A.3.3.7. During the review, the United Kingdom explained that it meant section 5.4.2.2 and table A.3.3.8, respectively. In addition, the NIR referenced the incorrect December survey of agriculture for sheep data and the incorrect status of a 2016 Topp et al. publication. During the review, the Party confirmed that there is a QA/QC plan for the agriculture sector, and that the team of agriculture inventory compilers will submit proposals for potential improvements to the inventory-wide improvement list that is	Not an issue/problem

ID#	Finding classification	Description of finding with recommendation or encouragement	Is finding an issue/problem?[a]
		considered by the National Inventory Steering Committee. These improvements are then considered alongside all other proposed improvements to the national GHG inventory. The ERT encourages the Party to continue to aim for continuous improvement in its methods and submissions, and to further improve the QA/QC procedures for the agriculture sector to minimize errors in the NIR text.	
A.15	3. General (agriculture) – CH_4 and N_2O	According to the NIR (p.485), emissions for category 3.F field burning are now reported using United Kingdom IEFs for Crown dependencies and as "NE" for overseas territories. However, this information is not reported in the relevant NIR section (section 5.7). For emissions for category 3.G liming, the United Kingdom mentioned the overseas territories of Bermuda and the Cayman Islands on page 485 but not any Crown dependencies, and did not report any related information in the relevant NIR section (section 5.8). For emissions for category 3.H urea application, the Party noted on page 485 that there are no data for Bermuda and the Falkland Islands (Malvinas). However, this is not reported in the relevant section of the NIR (section 5.9). While section 5.9.1 reports that emissions from urea application were estimated for all overseas territories and Crown dependencies excluding Bermuda and the Falkland Islands (Malvinas), the emission estimation methodology and the reasons for there being no data are not reported. During the review, the Party clarified that it will review its reporting of agriculture data relating to overseas territories and Crown dependencies in future submissions and explained that there are no agriculture activities in Gibraltar. It also clarified that page 485 accurately describes the data reported, leading the ERT to assume that the information contained in sections 5.7.1 and 5.8.1 is incorrect. The ERT recommends that the Party clearly report the methodology used to estimate emissions for each of the overseas territories and Crown dependencies in the relevant section of the NIR and ensure that this information is consistent across the NIR, including clearly stating that there are no agriculture activities in Gibraltar.	Yes. Transparency
A.16	3. General (agriculture) – CO_2, CH_4 and N_2O	The Party reported in its NIR (section 5.3.1) that a separate category (category 3.A.4) is used for livestock for all overseas territories and Crown dependencies in the CRF tables, that N_2O emissions for manure management are reported under category 3.G other (section 5.4.1) and that emissions from agricultural soils from overseas territories and Crown dependencies are reported in category 3.D.1.7 (other) (section 5.5.1). The ERT noted that category 3.G represents emissions from liming; however, the ERT was unable to find these emissions in the CRF tables mentioned, indicating inaccurate references. It noted that overseas territories and Crown dependencies are, however, included in CRF tables 3s2 and 3.G-I under category 3.J (other). The Party reported in the NIR (p.540) that it will include an item in its improvement plan to discuss changes to the institutional structure with a view to making it more feasible to fully integrate overseas territory and Crown dependency emissions and other data into CRF tables for future reporting. The ERT also noted that, while reporting emissions from agricultural soils in CRF tables 3s2 and 3.G-I may not be ideal, emissions from overseas territories and Crown dependencies are minor in relation to total national emissions, and acknowledged the complexity of transparently reporting these emissions in the CRF tables. During the review the Party noted that, while the current reporting may not be ideal, the reporting was sufficiently transparent for the ERT to be able to assess the 2021 submission for completeness, accuracy and time series consistency. The Party felt that the inventory data set was sufficiently useful to meet wider national communications, policy and target-setting requirements. It is important to the Party that reporting of overseas territories and Crown dependencies is straightforward to manage, and that emissions from those territories and dependencies can be easily excluded. The Party confirmed that it will continue to consider possible changes to its improvement programme.	Yes. Transparency

ID#	Finding classification	Description of finding with recommendation or encouragement	Is finding an issue/problem?[a]
		The ERT recommends that, until the Party is able to determine a more transparent way of reporting emissions from overseas territories and Crown dependencies in the CRF tables, the Party enhance the transparency of its reporting by correcting the CRF table references in the agriculture section of the NIR.	
A.17	3.B Manure management – CH_4 and N_2O	The Party reported in its NIR (section 5.4.1) that recalculations were performed to ensure that anaerobic digestion of livestock manure is fully represented in its emission estimation model. However, the methane conversion factor was not reported in NIR table 3.3.3. During the review, the Party provided some details on and a reference for the methane conversion factor used for manure managed in digesters for cattle, pig and poultry manure. Although the methane conversion factor for anaerobic digestion of livestock manure was reported in CRF table 3.B(a)s2, the ERT noted the importance of also reporting it in the NIR together with its documentation.	Yes. Transparency
		The ERT recommends that the Party include the methane conversion factor for anaerobic digestion in table 3.3.3 and include the details on and reference for the methane conversion factor used for manure managed in digesters for cattle, pig and poultry manure provided during the review in the NIR.	
A.18	3.B Manure management – N_2O	The Party reported in its NIR (section 5.4.2.2) that the AWMS used in the country that are reported under manure management are animal manure, slurries and digestates applied to soils. Pasture range and paddock is reported under agricultural soils. However, the Party did not provide any evidence or references for the assumptions underlying the use of these AWMS, or a clear reference for the country-specific N_2O EFs for cattle, pig, sheep, goat, deer and horse deep litter systems, or poultry manure. During the review, the Party provided a comprehensive summary of the research, justification and references used to determine the AWMS used in the United Kingdom, as well as sound references for the country-specific N_2O EFs used.	Yes. Transparency
		The ERT recommends that the Party include a summary in the NIR of the research and justification used to determine the different AWMS used in the United Kingdom, together with the relevant references, as provided during the review. The ERT also recommends that the Party clarify the data source, methodology used and references for the country-specific N_2O EFs in the NIR.	
A.19	3.D.a.2 Organic N fertilizers – N_2O	The Party reported in its NIR (section 5.5.2.2) a summary of the methodology for estimating emissions from application of livestock manures. However, it did not provide any references for the country-specific N_2O EFs used, the proportion of managed manure N applied to cropland after 2004 or the assumptions made for poultry. During the review, the Party provided a summary of the assumptions, and some of the related references, made for the proportion of managed manure applied to land, including poultry manure, as well as references for the country-specific N_2O EFs used.	Yes. Transparency
		The ERT recommends that the Party include in its next NIR references for all assumptions made for managed manure N applied to grassland and cropland, whether it be a published reference, a reference or report under preparation, or simply expert judgment.	
A.20	3.D.a.3 Urine and dung deposited by grazing animals – N_2O	The Party reported in its NIR (section 5.5.2.4) that, because there are no experimental data specific to the United Kingdom for sheep grazing, the EF value from the 2019 Refinement to the 2006 IPCC Guidelines was used, but did not include a justification for this. The ERT noted that this is not in accordance with the UNFCCC Annex I inventory reporting guidelines because the 2019 Refinement to the 2006 IPCC Guidelines has not yet been adopted by the Conference of the Parties, meaning that any use of the information contained therein must be justified. During the review, the Party clarified that it used a country-specific N_2O EF for cattle urine and dung, based on measurements, but that it does not have much country-specific data for N_2O emissions from sheep excreta during grazing. According to the 2006 IPCC Guidelines (vol. 4, chap.	Yes. Transparency

ID#	Finding classification	Description of finding with recommendation or encouragement	Is finding an issue/problem?[a]
		11, table 11.1), the N_2O EF for sheep excreta is 50 per cent of the value for cattle excreta. This is supported, for sheep urine, by information in the 2019 Refinement to the 2006 IPCC Guidelines (table 4A.1 on wet climates gives a revised value of 0.0039 for sheep compared with 0.0077 for cattle), while the EF for sheep dung contained therein is less than 50 per cent of the value for cattle (0.0004 for sheep compared with 0.0013 for cattle). On the basis of this information, the Party derived an N_2O EF for sheep urine and dung by halving the country-specific values for cattle urine and dung. The resulting values (0.00315 and 0.00097 for sheep urine and dung, respectively) are supported by the revised values for sheep given in the 2019 Refinement to the 2006 IPCC Guidelines, but not completely based thereon. The Party noted that the current NIR text is misleading and committed to correcting it in the next NIR. On the basis of this information, the ERT concludes that there is no issue with the use of the 2019 Refinement to the 2006 IPCC Guidelines, but recommends that the Party include in future annual submissions a summary of how the country-specific N_2O EFs for sheep urine and dung were determined, including references.	
LULUCF			
L.23	4. General (LULUCF) – CO_2 and N_2O	The Party reported in its NIR (section A.3.4.2.2) that its model for estimating SOC changes in mineral soils associated with land-use changes calculates changes in equilibrium carbon density for each land-use category, from initial to final land use, using single category-specific SOC change values calculated for each of the devolved administrations of Scotland, England, Wales and Northern Ireland. These category-specific values are weighted by the area of land-use change occurring in each soil group to account for the actual carbon density where the change occurred. The Party reported that this weighting was performed as a one-off exercise using land-use data for 1990–1998. However, the Party also reported in its NIR (section 6.1.1) a complete time series of annual matrices of area data on land use and land-use change, used to derive the annual area of soil types subject to land-use change. The ERT noted that this is not in accordance with the 2006 IPCC Guidelines, which establishes the principle that "national inventories contain estimates for the calendar year during which the emissions to (or removals from) the atmosphere occur" (vol. 1, chap. 1.1), and provides for stratification by soil type in calculating SOC changes associated with land-use changes (vol. 4, chap. 2, equation 2.25). During the review, the Party reported that, although a time series of annual land use and land-use change matrices for 1990–2019 is reported, this time series is based on several outputs (listed in NIR table 6.2) and is not spatial in nature. It is therefore not possible to derive the area of soil types subject to land-use change. In addition, the Party uses a Monte Carlo approach to calculating soil carbon stock changes to take account of ranges of soil carbon densities and transition times, rather than single values of carbon density at equilibrium. A current project on land-use tracking funded by the Department of Business, Energy and Industrial Strategy aims to produce spatial and temporal vectors of land-use change, which may enable the Party to estimate more accurate soil carbon stock changes based on spatially explicit data in future submissions. On the basis of the above information, the ERT recommends that the Party calculate SOC change values for each soil type, under each land-use category and for each devolved administration, and use those values to calculate SOC changes associated with land-use changes.	Yes. Accuracy
L.24	4. General (LULUCF) – CO_2 and N_2O	The Party reported in its NIR (table A.3.4.13) the range of times for SOC in mineral soils to reach 99 per cent of a new value after a land-use change in the devolved administrations, as applied to its model for estimating SOC changes in mineral soils associated with land-use changes. The times range from 50 to 750 years, which means that annual SOC changes associated with each single land-use change event are calculated and reported in the inventory for a conversion	Yes. Consistency

ID#	Finding classification	Description of finding with recommendation or encouragement	Is finding an issue/problem?[a]
		period that ranges from 50 to 750 years. Further, the Party reported in its NIR (tables A.3.4.6 and A.3.4.7) information on the periods during which annual matrices on land use and land-use changes were derived or extrapolated from the data sets available, the initial year of the time series of the annual matrices being 1950. The ERT noted that this is not in accordance with the UNFCCC Annex I inventory reporting guidelines because the principle of consistency requires time series of estimates to aim to reflect real annual fluctuations in emissions or removals and not be subject to changes resulting from methodological differences. Therefore, a conversion period that exceeds the time series of data collected on land use and land-use changes that occurred before the base year will determine an increasing trend in SOC changes reported, owing to an accumulation of areas that have undergone a land-use change but not yet reached their new equilibrium, rather than to an increasing rate of land-use changes. During the review, the Party stated that, as noted in the NIR (p.359), an ongoing project to track land use funded by the Department of Business, Energy and Industrial Strategy aims to produce spatial and temporal vectors of land-use change. Part of this work will explore the possibility of extending land-use vectors back to (at least) 1700 and comparing the results of the SCOTIA model with assumptions of no land-use change prior to 1950 (thus examining the impact of spin-up time on the model results). The project is also exploring patterns of crop–grass rotation in the country to assess the extent of permanent and short-term land-use changes, as crop–grass conversion (and vice versa) is the largest contributor to soil carbon stock changes due to land-use changes. This work will improve the Party's understanding of the overall contribution of historical and current land-use changes to soil carbon stock changes. The ERT recommends that the Party implement methodological changes to avoid any artefact trends in SOC changes in mineral soils associated with land-use changes or identify how the accumulation of land that has undergone a land-use change but not yet reached a new equilibrium, rather than a change in the rate of land-use changes, contributes to the trend in total SOC changes in mineral soils.	
L.25	4.A Forest land – CO_2 and N_2O	The Party reported in its NIR (section A.3.4.1.1.3) on the SCOTIA model used to estimate SOC changes in mineral soils, but did not provide any information verifying the model's outputs. During the review, the Party clarified that, according to an interim progress report comparing the model's estimates with measurements of soil carbon stocks and fluxes, the predicted trends in the development of SOC stocks are reasonably consistent with what has already been observed. However, the comparison of measured and predicted soil carbon values was complicated by a number of factors, in terms of both ensuring that the model accurately reflected the site parameters and ensuring that the measurements themselves accurately represented these parameters. The ERT concludes that refining the choice of input assumptions for broad-scale input data may improve the accuracy of soil carbon estimates in national GHG inventories, and that the SCOTIA model should continue to be tested against other relevant data sets, in order to increase confidence in the model, identify potential areas for further improvement and assess sensitivities. The ERT recommends that the Party provide in its NIR verification information consistent with the 2006 IPCC Guidelines (vol. 1, chap. 6.10, p.6.19) on its estimates of emissions and/or removals prepared using tier 3 models, in accordance with paragraph 41 of the UNFCCC Annex I inventory reporting guidelines, and continue its model soil carbon stocks and flux verification exercise and report the results in future NIRs.	Yes. Convention reporting adherence

ID#	*Finding classification*	*Description of finding with recommendation or encouragement*	*Is finding an issue/problem?*[a]
Waste			
W.14	5.A Solid waste disposal on land – CH_4	The United Kingdom reported in its NIR (section 7.2.2) on its use of the MELMod model, a tier 2 methodology, based on national waste quantities, composition, properties and disposal practices, for estimating emissions from landfills. It also reported that CH_4 generation from solid waste disposal is calculated using a methodology adapted from equations 3.1–3.6 of the 2006 IPCC Guidelines (vol. 5, chap. 3). In the model, the Party uses country-specific parameters for DOC, DOC_f and the composition of waste material, as reported in NIR table A.3.5.2. The other input parameters underlying the model, including methane correction factors, oxidation factors and the fraction of CH_4 in generated landfill gas, are adapted from 2006 IPCC Guidelines default values. The IPCC default FOD rate constant (k) for wet boreal and temperate climate conditions is also applied (2006 IPCC Guidelines, vol. 5, chap. 3, equation 3.17). During the review, the United Kingdom provided to the ERT the MELMod model, which is an emission estimation spreadsheet model and input parameters, and explained that the equations in the model are the same as those used in the IPCC FOD methodology. This spreadsheet-based model allows the Party to apply country-specific DOC and DOC_f parameters based on chemical properties (i.e. lignin, cellulose, hemicellulose, fat, sugar and protein content) specific to the composition of national waste material, while applying 2006 IPCC Guidelines default values for the remaining parameters. The ERT encourages the United Kingdom to report in the NIR that it uses the MELMod model to apply the IPCC FOD methodology for calculating CH_4 emissions from solid waste disposal.	Not an issue/problem
W.15	5.A Solid waste disposal on land – CH_4	The United Kingdom performed QA/QC and verification of CH_4 emission estimates in accordance with the 2006 IPCC Guidelines (vol. 5, chap. 3.8) by comparing emissions calculated using the MELMod model (which was peer reviewed in 2011 and 2014) with emission estimates for Ireland and Italy. This comparison found that the amount of CH_4 generated in all three countries was in the range 24–50 kt CH_4/Mt waste landfilled (the same range for the United Kingdom was 28–44 kt CH_4/Mt waste landfilled), with no obvious inconsistency in the estimated CH_4 collection efficiencies (62 per cent for the United Kingdom, 63 per cent for Ireland and 81 per cent for Italy in 2015). During the review, the Party explained that the purpose of this comparison was to compare CH_4 collection efficiencies among the three countries, and not to verify the MELMod model. The Party noted that it verified the MELMod model by comparing emission estimates derived from tier 2 solid waste parameters with those derived from tier 1 FOD parameters to reflect United Kingdom waste characteristics and IPCC tier 1 default inputs. The results obtained using the two models were similar. The Party provided these results to the ERT in graphical form during the review, but information on the extent to which the estimates obtained using the two models differed was not provided. The ERT commended the Party for conducting a peer review of the MELMod model. The ERT encourages the United Kingdom to include in its NIR information on the implemented category-specific verification in the dedicated QA/QC AD verification section of the NIR and report any differences resulting from a comparison of emission estimates derived from the MELMod model and those from the IPCC tier 1 model.	Not an issue/problem
W.16	5.D.2 Industrial wastewater – CH_4	The United Kingdom reported in the NIR (p.442) that there is no information on the amount of CH_4 recovered from industrial wastewater treatment and, as such, it used the default value of zero, although this activity likely takes place. In response to a question raised by the ERT during the review on the reporting of the amount of CH_4 recovered, the Party indicated that it uses default values owing to lack of relevant and accurate measurements. The Party also indicated that there is no centralized AD source for the industrial wastewater treatment sector, the amount of CH_4 recovered is unknown and there are currently no plans to estimate the amount of CH_4 recovered from this sector.	Yes. Accuracy

ID#	Finding classification	Description of finding with recommendation or encouragement	Is finding an issue/problem?[a]
		The ERT, while noting that this will not lead to emissions being underestimated as the Party does not subtract recovered emissions, recommends that the Party collect the necessary data to complete the estimates of CH_4 recovery from industrial wastewater.	
KP-LULUCF			
KL.16	FM – CO_2, CH_4 and N_2O	The Party did not report in its NIR information, to be provided in accordance with the Kyoto Protocol Supplement (p.2.97), on the main factors involved in generating the accounting quantity, namely the difference in net emissions under FM during the second commitment period and what was assumed in the FMRL, and whether the accounting quantity (FM – FMRL) is consistent with those factors. The aim of this information is to show that the accounting quantity can be explained as deviations in actual policies compared with historical policies included in the FMRL, rather than as differences in methodological elements, such as factors, parameters and increments. During the review, the Party clarified that, since no policy changes after 2009 have been quantified that would affect the calculation of GHG emissions, emission calculations in 2013–2020 are on average roughly the same as those shown in the FMRL and its technical correction. Emissions from FM increased between 2013 and 2019, a trend that is expected to continue in 2020. Using the current technical correction, the overall accounting quantity is a small sink of 0.2 Mt CO_2 eq/year in 2013–2020 (using a linear trend to estimate the accounting quantity in 2020), likely due to an absence of emissions and removals from Crown dependencies and overseas territories in the technical correction and a minor inconsistency in the treatment of windthrows and pests between the background level and the calculation of emissions. The Party plans to address those inconsistencies in the 2022 submission. The ERT recommends that the Party correct the identified inconsistencies in the technical correction and all the information required by the Kyoto Protocol Supplement in its next annual submission, noting that it will be the Party's last submission in the second commitment period of the Kyoto Protocol, therefore marking the conclusion of its accounting in the second commitment period.	Yes. KP reporting adherence
KL.17	FM – CO_2	In response to a question raised by the ERT during the review, the Party clarified that dead organic matter was assumed to oxidize instantaneously when calculating the background level of emissions from disturbances and the associated margin. The ERT noted that this is not in accordance with the Kyoto Protocol Supplement (pp.2.96–2.98) because the method for estimating transfers of carbon stocks from the biomass pool to the dead organic matter pool differs, given that the CARBINE model simulates transfers caused by disturbances and calculates carbon stock losses associated with the subsequent decay. The ERT noted that this methodological discrepancy results in higher emissions in the background level and its margin in any given inventory year than those caused by natural disturbances in the same year. Consequently, emissions in the technical correction are overestimated, while the probability in any year that disturbances will trigger the application of the natural disturbances provision is lower than it should be, since the threshold determined by the background level and twice its margin is higher than it should be. The ERT recommends that the Party resolve this inconsistency and recalculate its technical correction accordingly by using a recalculated and consistent background level of emissions.	Yes. KP reporting adherence
KL.18	FM – CO_2	The Party reported in its NIR (p.488) that an automated algorithm was introduced to adjust the assumed FM harvest to harmonize with timber production statistics, ensuring better time-series consistency and accuracy. During the review, the Party clarified that the calculations for its GHG inventory assume a fixed set of rotations and thinning regimes, based on species and yield class (indicators of the potential growth rate). These management regimes (including a proportion of	Yes. Transparency

ID#	Finding classification	Description of finding with recommendation or encouragement	Is finding an issue/problem?[a]
		the Public Forest Estate assigned no harvesting) are selected by the automated algorithm by matching timber production throughout the period for which timber production statistics are available. For consistency with the GHG inventory, the calculations underlying the technical correction use the same management assumptions and the same age class distribution, with no further correction factor applied. The ERT noted that the Party should ensure consistency between its FMRL and FM estimates during the commitment period (Kyoto Protocol Supplement, pp.2.96–2.98) and provide information on the drivers of any divergences between the two during the commitment period (Kyoto Protocol Supplement, p.2.97). The ERT recommends that the Party clarify in the NIR how the automated algorithm is used to prepare timber production statistics for the CARBINE model used to produce the technical correction on the one hand, and FM estimates during the second commitment period on the other. Further, the ERT recommends that the Party provide an assessment of whether and to what extent differing application of the algorithm results in a divergence between the technical correction and the FM estimates during the second commitment period.	

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

VI. Application of adjustments

12. The ERT did not identify the need to apply any adjustments for the 2021 annual submission of the United Kingdom.

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

13. The United Kingdom elected commitment period accounting and therefore the issuance and cancellation of units for KP-LULUCF is not applicable to the 2021 review.

VIII. Questions of implementation

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

Annex I

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

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

Table I.1

Total greenhouse gas emissions and removals for the United Kingdom of Great Britain and Northern Ireland, base year–2019

(kt CO_2 eq)

	Total GHG emissions excluding indirect CO_2 emissions		*Total GHG emissions and removals including indirect CO_2 emissions*[a]		*Land-use change (Article 3.7 bis as contained in the Doha Amendment)*[b]	*KP-LULUCF (Article 3.3 of the Kyoto Protocol)*[c]	*KP-LULUCF (Article 3.4 of the Kyoto Protocol)*	
	Total including LULUCF	*Total excluding LULUCF*	*Total including LULUCF*	*Total excluding LULUCF*			*CM, GM, RV, WDR*	*FM*
FMRL								–8 268.00
Base year[d]	815 277.41	797 182.76	NA	NA	246.05		23 782.15	
1990	812 165.92	794 071.27	NA	NA				
1995	762 492.63	747 712.38	NA	NA				
2000	723 290.75	711 191.84	NA	NA				
2010	614 009.80	607 816.86	NA	NA				
2011	568 489.48	562 786.53	NA	NA				
2012	585 393.74	579 642.62	NA	NA				
2013	571 633.35	565 770.17	NA	NA		413.76	19 596.75	–18 474.10
2014	531 215.34	525 783.79	NA	NA		89.79	19 411.86	–18 110.24
2015	514 084.73	508 275.53	NA	NA		372.64	19 306.32	–17 619.59
2016	488 800.66	483 366.68	NA	NA		–183.41	19 184.70	–17 272.86
2017	477 725.29	472 610.13	NA	NA		–847.35	19 109.96	–16 797.63
2018	471 548.43	465 893.28	NA	NA		–660.48	18 951.76	–16 036.88
2019	458 367.88	452 321.77	NA	NA		–612.23	18 921.90	–15 454.60

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

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

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

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

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

Table I.2

Greenhouse gas emissions and removals by gas for the United Kingdom of Great Britain and Northern Ireland, excluding land use, land-use change and forestry, 1990–2019

(kt CO_2 eq)

	CO_2[a]	*CH_4*	*N_2O*	*HFCs*	*PFCs*	*Unspecified mix of HFCs and PFCs*	*SF_6*	*NF_3*
1990	600 343.89	129 573.75	46 786.90	14 399.46	1 651.35	NO, NE	1 315.50	0.42
1995	566 567.96	123 372.28	37 293.92	18 566.83	596.76	NO, NE	1 313.79	0.83
2000	567 585.03	106 055.45	27 303.30	7 790.38	596.79	NO, NE	1 859.21	1.69
2010	511 631.63	62 535.49	20 770.86	11 881.94	287.71	NO, NE	708.96	0.27
2011	469 453.67	59 827.90	19 974.62	12 485.11	416.89	NO, NE	628.03	0.30
2012	487 516.55	58 314.65	19 853.55	13 094.15	254.98	NO, NE	608.40	0.33
2013	477 387.49	54 216.57	19 805.68	13 519.28	318.71	NO, NE	522.07	0.36
2014	438 541.00	52 263.81	20 501.46	13 698.51	278.31	NO	500.29	0.40
2015	422 340.11	51 346.16	20 097.78	13 687.87	327.23	NO	475.95	0.44
2016	399 337.39	49 622.51	19 881.03	13 671.77	353.94	NO	499.56	0.48
2017	387 565.18	50 115.97	20 361.78	13 563.85	493.20	NO	509.63	0.53
2018	381 889.66	49 769.80	20 140.29	13 220.68	256.84	NO	615.42	0.58
2019	369 009.69	49 466.09	20 318.97	12 592.30	344.69	NO	589.39	0.64
Percentage change 1990–2019	**–38.5**	**–61.8**	**–56.6**	**–12.6**	**–79.1**	**NA**	**–55.2**	**54.7**

Note: Emissions and removals reported in the sector other (sector 6) are not included in this table.

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

Table I.3

Greenhouse gas emissions and removals by sector for the United Kingdom of Great Britain and Northern Ireland, 1990–2019

(kt CO_2 eq)

	Energy	*IPPU*	*Agriculture*	*LULUCF*	*Waste*	*Other*
1990	614 091.71	66 745.00	48 309.40	18 094.65	64 925.15	NO
1995	572 186.20	60 393.89	47 503.46	14 780.25	67 628.83	NO
2000	565 377.31	38 753.16	45 767.95	12 098.91	61 293.43	NO
2010	506 529.95	31 181.81	41 492.98	6 192.95	28 612.12	NO
2011	465 029.01	29 688.75	41 509.06	5 702.94	26 559.71	NO
2012	483 129.35	30 271.84	41 175.52	5 751.12	25 065.91	NO
2013	470 280.14	32 418.22	40 835.93	5 863.18	22 235.89	NO
2014	430 964.81	32 182.12	42 503.53	5 431.55	20 133.33	NO
2015	415 131.70	31 646.45	42 012.25	5 809.19	19 485.13	NO

	Energy	*IPPU*	*Agriculture*	*LULUCF*	*Waste*	*Other*
2016	393 254.85	29 501.83	41 795.50	5 433.98	18 814.51	NO
2017	381 064.95	30 031.28	42 255.80	5 115.15	19 258.11	NO
2018	376 075.02	28 762.90	41 689.89	5 655.15	19 365.47	NO
2019	362 858.62	28 071.97	42 131.50	6 046.11	19 259.67	NO
Percentage change 1990–2019	**–40.9**	**–57.9**	**–12.8**	**–66.6**	**–70.3**	**NA**

Note: The United Kingdom did not report indirect CO_2 emissions in CRF table 6.

Table I.4

Greenhouse gas emissions and removals from activities under Article 3, paragraphs 3–4, of the Kyoto Protocol by activity, base year–2019, for the United Kingdom of Great Britain and Northern Ireland

(kt CO_2 eq)

	Article 3.7 bis as contained in the Doha Amendment[a]	*Activities under Article 3.3 of the Kyoto Protocol*		*FM and elected activities under Article 3.4 of the Kyoto Protocol*				
	Land-use change	*AR*	*Deforestation*	*FM*	*CM*	*GM*	*RV*	*WDR*
FMRL				–8 268.00				
Technical correction				–8 375.00				
Base year[b]	246.05				22 274.22	1 162.78	NA	345.15
2013		–994.23	1 407.98	–18 474.10	17 411.71	1 900.74	NA	284.29
2014		–1 332.96	1 422.75	–18 110.24	17 219.91	1 907.86	NA	284.09
2015		–1 644.70	2 017.35	–17 619.59	17 126.05	1 896.18	NA	284.09
2016		–1 986.58	1 803.17	–17 272.86	17 010.91	1 890.88	NA	282.91
2017		–2 312.44	1 465.09	–16 797.63	16 943.92	1 883.32	NA	282.73
2018		–2 565.05	1 904.58	–16 036.88	16 811.75	1 869.00	NA	271.02
2019		–2 836.43	2 224.20	–15 454.60	16 793.24	1 857.98	NA	270.68
Percentage change base year–2019					**–24.6**	**59.8**	**NA**	**–21.6**

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

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

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

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

Table I.5
Key relevant data for the United Kingdom of Great Britain and Northern Ireland under Article 3, paragraphs 3–4, of the Kyoto Protocol from its 2021 annual submission

Parameter	*Data values*
Periodicity of accounting	(a) AR: commitment period accounting (b) Deforestation: commitment period accounting (c) FM: commitment period accounting (d) CM: commitment period accounting (e) GM: commitment period accounting (f) RV: not elected (g) WDR: commitment period accounting
Elected activities under Article 3, paragraph 4, of the Kyoto Protocol	CM, GM and WDR
Election of application of provisions for natural disturbances	Yes, for AR and FM
3.5% of total base-year GHG emissions, excluding LULUCF	28 103.084 kt CO_2 eq (224 824.677 kt CO_2 eq for the duration of the commitment period)
Cancellation of AAUs, CERs and ERUs and/or issuance of RMUs in the national registry for:	
1. AR	NA
2. Deforestation	NA
3. FM	NA
4. CM	NA
5. GM	NA
6. RV	NA
7. WDR	NA

Annex II

Information to be included in the compilation and accounting database

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

Table II.1
Information to be included in the compilation and accounting database for 2019, including on the commitment period reserve, for the United Kingdom of Great Britain and Northern Ireland
(t CO_2 eq)

	Original submission	*Revised submission*	*Adjustment*	*Final value*
CPR	**2 470 443 559**	–	–	**2 470 443 559**
Annex A emissions				
CO_2	369 009 693	–	–	369 009 693
CH_4	49 466 087	–	–	49 466 087
N_2O	20 318 966	–	–	20 318 966
HFCs	12 592 304	–	–	12 592 304
PFCs	344 686	–	–	344 686
Unspecified mix of HFCs and PFCs	NO	–	–	NO
SF_6	589 389	–	–	589 389
NF_3	642	–	–	642
Total Annex A sources	**452 321 765**	–	–	**452 321 765**
Activities under Article 3, paragraph 3, of the Kyoto Protocol				
AR	–2 836 426	–	–	–2 836 426
Deforestation	2 224 195	–	–	2 224 195
FM and elected activities under Article 3, paragraph 4, of the Kyoto Protocol				
FM	–15 454 596	–	–	–15 454 596
CM	16 793 238	–	–	16 793 238
CM for the base year	22 274 224	–	–	22 274 224
GM	1 857 975	–	–	1 857 975
GM for the base year	1 162 779	–	–	1 162 779
WDR	270 683	–	–	270 683
WDR for the base year	345 148	–	–	345 148

Table II.2
Information to be included in the compilation and accounting database for 2018 for the United Kingdom of Great Britain and Northern Ireland
(t CO_2 eq)

	Original submission	*Revised submission*	*Adjustment*	*Final value*
Annex A emissions				
CO_2	381 889 659	–	–	381 889 659
CH_4	49 769 801	–	–	49 769 801
N_2O	20 140 293	–	–	20 140 293
HFCs	13 220 679	–	–	13 220 679
PFCs	256 839	–	–	256 839
Unspecified mix of HFCs and PFCs	NO	–	–	NO
SF_6	615 423	–	–	615 423
NF_3	584	–	–	584

	Original submission	*Revised submission*	*Adjustment*	*Final value*
Total Annex A sources	**465 893 277**	–	–	**465 893 277**
Activities under Article 3, paragraph 3, of the Kyoto Protocol				
AR	–2 565 053	–	–	–2 565 053
Deforestation	1 904 577	–	–	1 904 577
FM and elected activities under Article 3, paragraph 4, of the Kyoto Protocol				
FM	–16 036 877	–	–	–16 036 877
CM	16 811 746	–	–	16 811 746
CM for the base year	22 274 224	–	–	22 274 224
GM	1 868 998	–	–	1 868 998
GM for the base year	1 162 779	–	–	1 162 779
WDR	271 020	–	–	271 020
WDR for the base year	345 148	–	–	345 148

Table II.3
Information to be included in the compilation and accounting database for 2017 for the United Kingdom of Great Britain and Northern Ireland
(t CO_2 eq)

	Original submission	*Revised submission*	*Adjustment*	*Final value*
Annex A emissions				
CO_2	387 565 181	–	–	387 565 181
CH_4	50 115 966	–	–	50 115 966
N_2O	20 361 777	–	–	20 361 777
HFCs	13 563 851	–	–	13 563 851
PFCs	493 196	–	–	493 196
Unspecified mix of HFCs and PFCs	NO	–	–	NO
SF_6	509 633	–	–	509 633
NF_3	531	–	–	531
Total Annex A sources	**472 610 133**	–	–	**472 610 133**
Activities under Article 3, paragraph 3, of the Kyoto Protocol				
AR	–2 312 436	–	–	–2 312 436
Deforestation	1 465 088	–	–	1 465 088
FM and elected activities under Article 3, paragraph 4, of the Kyoto Protocol				
FM	–16 797 632	–	–	–16 797 632
CM	16 943 918	–	–	16 943 918
CM for the base year	22 274 224	–	–	22 274 224
GM	1 883 318	–	–	1 883 318
GM for the base year	1 162 779	–	–	1 162 779
WDR	282 726	–	–	282 726
WDR for the base year	345 148	–	–	345 148

Table II.4
Information to be included in the compilation and accounting database for 2016 for the United Kingdom of Great Britain and Northern Ireland
(t CO_2 eq)

	Original submission	*Revised submission*	*Adjustment*	*Final value*
Annex A emissions				
CO_2	399 337 394	–	–	399 337 394
CH_4	49 622 505	–	–	49 622 505
N_2O	19 881 028	–	–	19 881 028
HFCs	13 671 766	–	–	13 671 766

	Original submission	*Revised submission*	*Adjustment*	*Final value*
PFCs	353 941	–	–	353 941
Unspecified mix of HFCs and PFCs	NO	–	–	NO
SF_6	499 564	–	–	499 564
NF_3	482	–	–	482
Total Annex A sources	**483 366 680**	–	–	**483 366 680**
Activities under Article 3, paragraph 3, of the Kyoto Protocol				
AR	–1 986 576	–	–	–1 986 576
Deforestation	1 803 167	–	–	1 803 167
FM and elected activities under Article 3, paragraph 4, of the Kyoto Protocol				
FM	–17 272 858	–	–	–17 272 858
CM	17 010 912	–	–	17 010 912
CM for the base year	22 274 224	–	–	22 274 224
GM	1 890 875	–	–	1 890 875
GM for the base year	1 162 779	–	–	1 162 779
WDR	282 912	–	–	282 912
WDR for the base year	345 148	–	–	345 148

Table II.5
Information to be included in the compilation and accounting database for 2015 for the United Kingdom of Great Britain and Northern Ireland
(t CO_2 eq)

	Original submission	*Revised submission*	*Adjustment*	*Final value*
Annex A emissions				
CO_2	422 340 107	–	–	422 340 107
CH_4	51 346 162	–	–	51 346 162
N_2O	20 097 777	–	–	20 097 777
HFCs	13 687 870	–	–	13 687 870
PFCs	327 229	–	–	327 229
Unspecified mix of HFCs and PFCs	NO	–	–	NO
SF_6	475 950	–	–	475 950
NF_3	438	–	–	438
Total Annex A sources	**508 275 534**	–	–	**508 275 534**
Activities under Article 3, paragraph 3, of the Kyoto Protocol				
AR	–1 644 701	–	–	–1 644 701
Deforestation	2 017 346	–	–	2 017 346
FM and elected activities under Article 3, paragraph 4, of the Kyoto Protocol				
FM	–17 619 591	–	–	–17 619 591
CM	17 126 049	–	–	17 126 049
CM for the base year	22 274 224	–	–	22 274 224
GM	1 896 180	–	–	1 896 180
GM for the base year	1 162 779	–	–	1 162 779
WDR	284 095	–	–	284 095
WDR for the base year	345 148	–	–	345 148

Table II.6
Information to be included in the compilation and accounting database for 2014 for the United Kingdom of Great Britain and Northern Ireland
(t CO_2 eq)

	Original submission	*Revised submission*	*Adjustment*	*Final value*
Annex A emissions				

	Original submission	*Revised submission*	*Adjustment*	*Final value*
CO_2	438 540 999	–	–	438 540 999
CH_4	52 263 812	–	–	52 263 812
N_2O	20 501 464	–	–	20 501 464
HFCs	13 698 510	–	–	13 698 510
PFCs	278 315	–	–	278 315
Unspecified mix of HFCs and PFCs	NO	–	–	NO
SF_6	500 292	–	–	500 292
NF_3	399	–	–	399
Total Annex A sources	**525 783 791**	–	–	**525 783 791**
Activities under Article 3, paragraph 3, of the Kyoto Protocol				
AR	–1 332 961	–	–	–1 332 961
Deforestation	1 422 753	–	–	1 422 753
FM and elected activities under Article 3, paragraph 4, of the Kyoto Protocol				
FM	–18 110 235	–	–	–18 110 235
CM	17 219 906	–	–	17 219 906
CM for the base year	22 274 224	–	–	22 274 224
GM	1 907 860	–	–	1 907 860
GM for the base year	1 162 779	–	–	1 162 779
WDR	284 095	–	–	284 095
WDR for the base year	345 148	–	–	345 148

Table II.7
Information to be included in the compilation and accounting database for 2013 for the United Kingdom of Great Britain and Northern Ireland
($t CO_2 eq$)

	Original submission	*Revised submission*	*Adjustment*	*Final value*
Annex A emissions				
CO_2	477 387 488	–	–	477 387 488
CH_4	54 216 568	–	–	54 216 568
N_2O	19 805 683	–	–	19 805 683
HFCs	13 519 283	–	–	13 519 283
PFCs	318 714	–	–	318 714
Unspecified mix of HFCs and PFCs	NO, NE	–	–	NO, NE
SF_6	522 074	–	–	522 074
NF_3	362	–	–	362
Total Annex A sources	**565 770 171**	–	–	**565 770 171**
Activities under Article 3, paragraph 3, of the Kyoto Protocol				
AR	–994 226	–	–	–994 226
Deforestation	1 407 985	–	–	1 407 985
FM and elected activities under Article 3, paragraph 4, of the Kyoto Protocol				
FM	–18 474 104	–	–	–18 474 104
CM	17 411 714	–	–	17 411 714
CM for the base year	22 274 224	–	–	22 274 224
GM	1 900 742	–	–	1 900 742
GM for the base year	1 162 779	–	–	1 162 779
WDR	284 291	–	–	284 291
WDR for the base year	345 148	–	–	345 148

Annex III

Additional information to support findings in table 2

Missing categories that may affect completeness

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

(a) 1.B.2.b natural gas (CO_2 and CH_4) (see ID# E.8 in table 3);

(b) 2.A.4 other process uses of carbonates (CO_2) (see ID# I.9 in table 3);

(c) 4.A forest land (CO_2) (see ID# L.12 in table 3);

(d) 4.D wetlands (CO_2, CH_4 and N_2O) (see ID# L.17 in table 3);

(e) GM (CO_2, CH_4 and N_2O) (see ID# KL.14 in table 3).

Annex IV

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

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

IPCC. 2019. *2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories*. E Calvo Buendia, K Tanabe, A Kranjc, et al. (eds.). Geneva: IPCC. Available at https://www.ipcc-nggip.iges.or.jp/public/2019rf/index.html.

B. UNFCCC documents

Annual review reports

Reports on the individual reviews of the 2013, 2014, 2015, 2016, 2017 and 2019 annual submissions of the United Kingdom, contained in documents FCCC/ARR/2013/GBR, FCCC/ARR/2014/GBR, FCCC/ARR/2015/GBR, FCCC/ARR/2016/GBR, FCCC/ARR/2017/GBR and FCCC/ARR/2019/GBR, 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%202020_final.pdf.

Annual status report for the United Kingdom of Great Britain and Northern Ireland for 2021. Available at https://unfccc.int/sites/default/files/resource/asr2021_GBR.pdf.

C. Other documents used during the review

Responses to questions during the review were received from Susie Wright (United Kingdom Department for Business, Energy and Industrial Strategy), including additional material on the methodology and assumptions used. The following references may not conform to UNFCCC editorial style as some have been reproduced as received:

Bide, T, et al. (2018), United Kingdom Minerals Yearbook 2018. Statistical data to 2017. British Geological Survey Minerals and Waste Programme Open Report OR/19/018. Available at: https://www.bgs.ac.uk/downloads/browse.cfm?sec=12&cat=132.

Bradley, R., Milne, R., Bell, J., Lilly, A., Jordan, C. and Higgins, A. (2005), A soil carbon and land use database for the United Kingdom. Soil Use and Management, 21: 363-369. https://doi.org/10.1079/SUM2005351.

Falloon, P., Smith, P., Bradley, R.I., Milne, R., Tomlinson, R., Viner, D., Livermore, M. and Brown, T. (2006), RothCUK – a dynamic modelling system for estimating changes in

soil C from mineral soils at 1-km resolution in the UK. Soil Use and Management, 22: 274-288. https://doi.org/10.1111/j.1475-2743.2006.00028.x.

Matthews, R., Malcolm, H., Buys, G., Henshall, P., Moxely, J., Morris, A., and Mackie, E. (2014) Changes to the representation of forest land and associated land-use changes in the 1990-2012 UK Greenhouse Gas Inventory. Report to Department of Energy and Climate Change, Contract GA0510, CEH: Edinburgh.

Matthews, R.W., Razauskaite, R., Hogan, G.P., Mackie, E.D., Sayce, M. and Randle, T.J. (2019) The CARBINE model: a technical description. Ver 1.1. Report prepared for BEIS. Forest Research: Farnham.

Proceedings: Comparison of the CFLOW and CARBINE carbon accounting models. 2003. K. Robertson, J. Ford-Robertson, R. Matthews.

Randle, T.J, Thomson, A., Vanguelova, E. and Matthews, R.W. (2017) SCOTIA forest soil carbon model: Interim progress report on comparison of model estimates and measurements of soil carbon stocks and fluxes. Report prepared for BEIS. Forest Research: Farnham.