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ADOPTION AND ACCEPTANCE OF THE "2019 REFINEMENT TO THE 2006 IPCC GUIDELINES FOR NATIONAL GREENHOUSE GAS INVENTORIES"

Collated comments from Governments on the Final Draft Report and Authors' responses

(Submitted by the Co-Chairs of the Task Force Bureau)

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2019 Refinement - Collated Comments on Final Draft from Governments with Authors' Responses

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
71	1	1	77		For all types of forests	Iran	Accepted	Corrected.
135	1	1	130	138	As far as Facility-Reported Data (e.g. EU-ETS) relates to "geographically resolved data" (cf. also new vol1 chap2 section 2.3), for cross-consistency, that could be also reflected here. The title "Subnational GHG inventory compilation (e.g. cities, states, provinces, territories)" could be extended as : "Subnational GHG inventory compilation and facility-reported data (e.g. cities, states, provinces, territories, facility emission registers)". And also the bracket "(including waste disposal and recycling/treatment sites)" might be completed with "(facility-reported data including waste disposal and recycling/treatment sites)".	France	Accepted with modification	Text reworded to clarify that geographic resolution is not only about facility level for this paragraph, but it is one example.
143	1	1	119	153	We welcome the new box 1.0A "LINKAGES OF GHG INVENTORY ACTIVITIES WITH OTHER DATA COLLECTION AND REPORTING". We appreciate the promotion of integrated and streamlined system for : a good cooperation with the national statistical system; a better coordinational / harmonisation between emission works at national level and compilations at local / territorial / facility levels; integrated national inventory system for both GHG and air pollutants.	France	Noted	No action needed.
145	1	1	103	360	Very good description of "National GHG inventory arrangements" : that will be useful for countries that will expect to shift or improve the management of their national GHG inventory, for the coming Paris agreement period.	France	Noted	The commenter is thanked for his encouragement.
359	1	1	187	188	Table 1.2, Column "Sectors & Categories": Propose to replace "FOLU" with "LULUCF" and add "KP LULUCF", if the relevant reporting is provided by the Party.	Russian Federation	Accepted with modification	AFOLU is suggested as this would be coherent with table 1.1
361	1	1	187	188	Table 1.2, Column "Timeseries span": Propose to replace "…latest year -2" with "one but last calendar year" as outlined in the UNFCCC Guidelines.	Russian Federation	Accepted with modification	Revised text as: "Yearly values from 1990 until two years prior to current calendar year"
363	1	1	187	188	Table 1.2, Column "Reporting formats": Propose to add "NIR" to the rows, where the "CRF" has been referred.	Russian Federation	Accepted with modification	The term "CRF" is more coherent for the 2006 IPCC Guidelines. NIR has been added as this is part of the reporting as well.
613	1	1	89	89	Delete "a" before "fossil" at the end of the line.	New Zealand	Accepted	Deleted.
615	1	1	103	360	The IPCC is commended for including this essential guidance on national greenhouse gas inventory arrangements as part of the refinement exercise.	New Zealand	Noted	The commenter is thanked for his encouragement.
617	1	1	187	193	Footnote (f) is not elaborated below the table	New Zealand	Accepted	Text for (f) added.
619	1	1	198	198	Suggest replace "an isolated" with "a stand-alone"	New Zealand	Accepted with modification	Revised text to also clarify what "this" referred to instead of vague language of "functioning system".
621	1	1	201	202	In the box concerning Management/coordination, "expert" should be "experts"	New Zealand	Accepted	Graph updated.
623	1	1	207	207	Replace "well functional" with "well-functioning"	New Zealand	Accepted	Replaced.
625	1	1	209	210	Suggest delete "needed to function" from the heading in the table	New Zealand	Accepted	Deleted.

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
627	1	1	216	216	Suggest the following additions and changes to the sentence "The process of engaging actors and stakeholders is likely to be different in different countries" such that it will read: "The process of engaging actors and stakeholders is likely to vary between different countries and between sectors within countries."	New Zealand	Accepted	Sentence changed as suggested.
629	1	1	217	217	At the end of the line change "are" to "is"	New Zealand	Rejected	are' is correct in the sentence.
631	1	1	240	240	Suggest "This can be the Inventory Agency" is changed to read "This could be an Inventory Agency"	New Zealand	Accepted with modification	Clarified what "this" refers to.
633	1	1	269	269	Given that reporting under the Paris Agreement is to be every two years, and that not all countries will be producing annual inventories, it may be advisable for any contractual arrangements to be longer than 3 years as this may cover only one reporting cycle. Suggest "(e.g. 3 to 5 years)" is changed to "(e.g. 4 to 6 years)"	New Zealand	Accepted	Changed.
635	1	1	345	345	Insert "to" before "provide" in "the receiving party provide feedback" thus: "the receiving party to provide feedback"	New Zealand	Accepted	Inserted.
637	1	1	454	457	Stongly support this point - important to retain	New Zealand	Noted	No action to be taken.
937	1	1	56	95	Chapter 1 needs to update the concept of "anthropogenic emissions and removals" as required in the outline adopted at the 44th plenary session. However, there is no relevant text in the present report. It is suggested that the author team explain this.	China	Accepted	Updated.
939	1	1	373	379	The report gives a regular inventory worksheet with a 52-week (one-year) cycle. However, considering that emission inventories differ from country to country in cycling (e.g., two- or four-year cycles), it is suggested to clarify in the report that the timetable is extended accordingly when an inventory cycle exceeds 52 weeks.	China	Accepted with modification	The following sentence has been added "Table 1.6 is only illustrative. It may require adjustment to the specific national circumstances including the timeframes and time period of the GHG inventory cycle which may be more than 1 year (e.g., 2 or 4 years)."
1339	1	1	155	156	Concering "There is a wide diversity in approaches used by countries to monitor, report, and respond to review of its GHG estimates on a regular basis. ", we would like to include "verify" after "report" , so the statement reads "...to monitor, report, verify and respond to review..." We believe that verification and QA/QC processes are very relevant to include in the institutional arrangements.	Sweden	Accepted	Included.
1421	1	1	155	156	"There is a wide diversity in approaches used by countries to monitor, report, and respond to review of its GHG estimates on a regular basis. "We would like to include "verify" after report so it will read to monitor, report, verify and respond to review..... We believe that verification and QA/QC processes are very relevant to include in the institutional arrangements.	Sweden	Accepted	Included.

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
1435	1	1	60	64	The ToR for the Refinement called for a clarification of the concept of "anthropogenic emissions and removals" in Volume 1, Chapter 1. Any such clarification should be evidence-based and need not be limited to "natural disturbances". Major disturbances causing significant inter-annual variability can be non-anthropogenic, but can also be human-induced. For example, the ignition of most forest fires, regardless of the scale or location (managed or unmanaged land) is due to human activities. Land management (including fire suppression regimes) can have a major influence on the frequency and magnitude of extreme events and peat fires are most often facilitated by human activities such as drainage and land-use change. There Appears to be insufficient evidence base for linking the estimation of anthropogenic (versus non-anthropogenic) emissions on managed land solely to "inter-annual variability".	EU	Accepted	Updated.
1437	1	1	61	61	The term "LULUCF" is not used in Chapter 2, Volume 4.	EU	Accepted	Changed accordingly.
1439	1	1			We think that flexibility regarding the setting up and/or implementation of institutional arrangements is essential and we do not see the need for a common definition of 'good practice' as there can be many different good practices in different countries. Having said this, the only reference to 'good practice' in the chapter is in line 107 'It is considered good practice that countries maintain and where possible improve the quality (transparency, accuracy, completeness, comparability and consistency) of national GHG inventories'. We think that improving GHG inventories should be 'good practice' even if this cannot happen in specific years due to a number of possible and justified reasons. We know that inventories cannot be perfect. However, we think that institutional arrangements should support continuous inventory improvements. We would therefore suggest to rephrase line 107 as follows: 'it is considered good practice that countries aim at improving the quality (TACCC) of national GHG inventories on a continuous basis'.	EU	Accepted with modification	Agreed on change, with modification that improvement not simply be an "aim", which implies only intention, but something that is actively worked for and it should happen on a continuous basis.
1813	1	1	187	187	UK + Over seas Territories' should be changed to 'UK + Overseas Territories'	United Kingdom (of Great Britain and Northern Ireland)	Accepted	Changed.
1815	1	1	187	187	The EU Monitoring Mechanism Regulation should have Geographical resolution for the geographical resolution, not 'Mainland UK'	United Kingdom (of Great Britain and Northern Ireland)	Accepted with modification	Text revised to clarify resolution is "Regulated installations within mainland UK".

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
1915	1	1	89	95	This section needs to be more complete, to be definitive. The last sentence currently infers that if you burn biogenic waste without energy recovery, that you don't report the CO2 at all. Why would that be correct, to take a different reporting approach to the CO2 emitted from waste burned (i) with energy recovery, or (ii) without energy recovery? It would make no sense to do so, but the text here reads as such. Therefore please specify again for combustion of biogenic waste without energy recovery that the CO2 is reported as a memo item, and not within the national inventory total. Further, it would be clearer - more definitive - to also simply state here that all GHG emissions from the burning of the fossil-component of mixed wastes are to be reported in the national inventory total - in Energy for EfW and in Waste for incineration without energy recovery. I realise this chapter 1 section is dealing with "burning of biomass", but to make this clear point is worthwhile.	United Kingdom (of Great Britain and Northern Ireland)	Noted	It would not be helpful to go into any detail in this volume. The details have to be discribed in AFOLU and/or energy sector volume.
1917	1	1	270	272	Last sentence here is duplicated in the next paragraph, so can delete this sentence.	United Kingdom (of Great Britain and Northern Ireland)	Accepted	Deleted.
1919	1	1	288	290	Given the effort put in for other stakeholders to establish core responsibilities (e.g. for SNE, compilation experts), this section on data providers is very light-weight. It warrants some guidance adding here. There is an opportunity here to set out some example expectations of e.g. engaging with the inventory compilation (steering committee etc), providing data for users (including inventory compilers) that support inventory data quality objectives (notably time-series consistent, i.e. collect data on a consistent basis, and complete across all national sources, all regions etc). You could even talk about data quality systems (ISO...) that stats organisations should seek to achieve. You could go further and talk about data reporting formats, units, annual checks on data, data templates - or that may be covered in later chapters.	United Kingdom (of Great Britain and Northern Ireland)	Noted	The whole of Chapter 2 of Volume 1 is addressing data collection. It was the intention of the writing team to avoid any duplication but include references in the text - which have been included.
1921	1	1	315	328	Useful to add that where data are accessed from a regular source (e.g. website, annual statistical release), that it is good practice to also log the date on which the data were accessed for the use in the national inventory, as there are many data used in inventories where a more recently published dataset becomes available during the inventory compilation and reporting cycle, but is not used. Therefore good to state explictly the origin data date.	United Kingdom (of Great Britain and Northern Ireland)	Accepted with modification	This chapter 1 has a focus on the organisational aspects of the national inventory system. The technical details of implementation are addressed in other chapters of volume 1. However, the note in table 1.5 was revised to indicate that the dataset description should include the version numer or date.

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
1923	1	1	345	346	The sentence as it stands is poorly drafted and confusing. Suggest "A mechanism for the data users (e.g. SNE, inventory agency) to provide feedback to the data provider on any priorities for future improvement of the dataset, e.g. perhaps data would be more directly useful in different units."	United Kingdom (of Great Britain and Northern Ireland)	Accepted with modification	Reworded "procedures that enable the receiving party (the data user, e.g., SNE or inventory agency) to provide feedback to the data supplier on priorities for future improvement of the data set".
1925	1	1	331	360	This section misses the opportunity to elaborate on the benefits of a DSA. Suggest that you add sentences along the lines of; "The purpose of establishing a Data Supply Agreement is that it can be beneficial for both parties - the SNE/inventory compiler and the data provider; the DSA will help to establish a secure data provision into the future, such that inventories can be compiled in a timely, efficient and consistent manner, with a clear understanding on both sides of the expected data to be delivered, the deadlines for delivery and the data quality requirements for use in the inventory. Also a DSA can assist the data provider organisation, as it formally documents the data requirements and can help to secure resources within the data provider organisation to deliver the data on time, to quality etc."	United Kingdom (of Great Britain and Northern Ireland)	Accepted	Sentence added "Ideally, a DSA is arranged between the GHG inventory SNE and the data supplier stakeholder. A DSA can be beneficial for both an SNE/inventory compiler and data provider. A DSA can help secure data provision in the future. Also, a DSA can assist a data supplying organisations by establishing a formally recognized acknowledgement that can promote the allocation resources within a data supplying organisation to deliver high quality data on time. DSAs can be useful for managing a regularly updated GHG inventory."
1927	1	1	389	389	Change to either "Calculating GHG Estimates" or "Calculation of GHG Estimates"	United Kingdom (of Great Britain and Northern Ireland)	Accepted	Changed in 'Calculating GHG estimates'.
1929	1	1	381	383	This paragraph is muddled english. Suggest you consider something like: "The process of preparing a national inventory will involve the use of numerous datasets, the application of a range of assumptions, expert judgements, data conversions and manipulations (e.g. aggregation/integration of data from multiple data sources). Inventory compilation and the documentation of the data inputs, assumptions and other details may be performed in a range of models, and the model outputs from across all source categories will need to be aggregated and reported in a consistent national dataset. (See Volume 1, Chapter 2 for further details on models and tools typically used for inventory compilation.)"	United Kingdom (of Great Britain and Northern Ireland)	Accepted with modification	Simplified text and focused on reference to other chapters for guidance on documentation.

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
1931	1	1	384	388	This paragraph misses a key message in my view. I suggest that you add that: "In all cases, the choice of data management system for inventory compilation and reporting should consider factors such as: the available resources (human, financial, IT) for inventory compilation; the existing capacity and skill-set of the inventory compilation team, and provision of training where necessary, to ensure that the development of new models and data management systems will support and improve the inventory quality." Also useful to draw out that communication across all parties involved in the inventory compilation of inventory-wide protocols (e.g. colour-coding) is necessary.	United Kingdom (of Great Britain and Northern Ireland)	Noted	The factors listed in comment are mostly relevant for all aspects of inventory development (e.g., resources, capacity, etc.), so it seems odd to mention them specifically here. Plus, the list given is not comprehenisve of all factors so it seems improper to list some factors and not others. It is beyond the scope of this section to provide detailed guidance on the design of data mgmt systems.
2539	1	1	56	95	Concepts from Volume 1 of the 2006 IPCC Guidelines have been inexplicably removed from this section. These concepts relate to: anthropogenic emissions and removals, National territory, Inventory year and time series, Inventory reporting, Greenhouse gases, Other gases, Sectors and Categories. These are essential to the basis of the IPCC Guidelines; deleting this text would not respect the terms of reference for the 2019 MR. The 2006 IPCC GLs clearly define these concepts as applying to all sectors; in the current version the only sentence referring to anthropogenic emissions and removals relates to the LULUCF sector, which is misleading.	Canada	Accepted	Concepts' have been reinserted.
2541	1	1	66	95	Please include biomass fuels not sourced from harvested wood or forest products. For example, from agricultural products or landfill/waste management sources of biomass fuel (landfill gas or 'renewable natural gas') products.	Canada	Noted	It would not be helpful to go into any detail in this volume. The details have to be discribed in AFOLU and/or energy sector volume.
2543	1	1	68	68	The text should read '…emissions and removals…' and NOT '…emissions and sinks…'.	Canada	Accepted	Changed.
2545	1	1	77	77	There is a significant transparency issue when CO2 emissions from biomass - a major source of energy globally - is quantified implicitly; the IPCC should ensure its guidance ensures a transparent - as opposed to "implicit" – quantification of emissions from biomass energy.	Canada	Noted	There are good reasons for estimation of emissions from biomass combustion based on biomass carbon stock change in AFOLU sector.
2547	1	1	103	361	The text continues to mix scientific guidance on how to develop high-quality estimates with policy prescriptive text on reporting requirements or how countries could organize their inventory systems. This issue was raised during the first government review and we find it has not been sufficiently addressed. The introductory statement that "the details of this section should not be considered prescriptive" (line 113) is insufficient to address our concerns; specific changes are provided below for this section.	Canada	Accepted with modification	The comment has been taken into consideration and text revised where possible.

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
2549	1	1	113	113	Please change text: "They provide suggested possible approaches and examples…"	Canada	Accepted with modification	Sentence reworded to include the word possible, although it implies that it is necessary to clarfy that the reader needs to be told that approaches are not "impossible".
2551	1	1	116	116	Please change text: "The development of national GHG inventory systems could benefit from being should be developed in cooperation or integration with…"	Canada	Accepted with modification	Text revised with appropriate grammatical correction.
2553	1	1	178	179	Please change the title of Table 1.1: "AN ILLUSTRATIVE EXAMPLE OF A SUGGESTED STRUCTURE FOR CAPTURING AND…"	Canada	Accepted with modification	Wording changed for readibility.
2555	1	1	209	210	Please change headings in Table 1.3: "Common Actor and Stakeholder Type" "Typical Necessary Capabilities"	Canada	Rejected	The current heading reflects the text.
2557	1	1	218	218	Please change text: "Table 1.4 provides examples of suggested metadata for…"	Canada	Accepted with modification	Changed in "Table 1.4 provides examples of metadata for …".
2559	1	1	220	221	Please change the title of Table 1.4: "EXAMPLES OF SUGGESTED METADATA FOR TRACKING GHG INVENTORY STAKEHOLDERS"	Canada	Accepted with modification	Changed in "Examples of metadata for tracking GHG inventory stakeholders".
2561	1	1	258	258	Please change text: "Inventory management and coordination can be is delegated to…"	Canada	Accepted	Changed in "Inventory management and coordination can be delegated to…"
2563	1	1	264	272	Please change text: "A private company, university or other non-government organisation. The inventory management and coordination can be are contractually delegated to an organisation outside of government, such as a university, research institute, or a consultancy/private company. This organisation may be is selected for its technical competency and capacity to coordinate the activities and expertise for the compilation and reporting of the inventory. Contracts can be are typically set-up with well-defined deliverables and quality objectives and commitments to engage the organisation preferably over a suitable period (e.g. 3 to 5 years) to promote the sustained development and maintenance of the GHG inventory. Provisions could should be in place for the full transfer of data, documents, calculation and reporting tools and knowledge of the national GHG inventory from the contracted organisation to the SNE or new contracting organisation at the end of the contract period."	Canada	Accepted with modification	Changed to "A private company, university or other non-government organisation. The inventory management and coordination can be contractually delegated to an organisation outside of government, such as a university, research institute, or a consultancy/private company. This organisation may be selected for its technical competency and capacity to coordinate the activities and expertise for the compilation and reporting of the inventory. Contracts can be typically set-up with well-defined deliverables and quality objectives and commitments to engage the organisation preferably over a suitable period (e.g. 4 to 6 years) to promote the sustained development and maintenance of the GHG inventory. Provisions could be in place for the full transfer of data, documents, calculation and reporting tools and knowledge of the national GHG inventory from the contracted organisation to the SNE or new contracting organisation at the end of the contract period."
2565	1	1	273	274	Please change text: "…provisions could should be in place for the transfer of data…"	Canada	Accepted	Changed.
2567	1	1	275	276	Please change text: "These provisions can help will ensure national retention of…"	Canada	Accepted	Changed in "These provisions can help ensure national ..".
2569	1	1	279	279	Please change text: "A national GHG inventory system can benefit from needs a committed team of inventory compilation experts."	Canada	Accepted	Changed in "A national GHG inventory system can benefit from a ..".
2571	1	1	284	284	Please change text: "As an example, roles and responsibilities for core compilation functions of the GHG inventory team are also outlined in…"	Canada	Accepted	Text changed.

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
2573	1	1	289	289	Please change text: "Further examples suggestions for the formalization…"	Canada	Accepted with modification	Changed in "Further examples for the formalisation.."
2575	1	1	316	320	Please change text: "An important component of institutional arrangements is a systematic approach to data management and the collection of data. A first step could be is to create and maintain an archive and list of the datasets that are needed for the GHG inventory compilation. This archive and list, which can be established for each sector or as a centralised entity, can will help to build and maintain institutional memory and support efficient and transparent compilation of regular updates. An illustrative outline for a list of datasets is presented in Table 1.5."	Canada	Accepted	Changed in "An important component of institutional arrangements is a systematic approach to data management and the collection of data. A first step could be to create and maintain an archive and list of the datasets that are needed for the GHG inventory compilation. This archive and list, which can be established for each sector or as a centralised entity, can help to build and maintain institutional memory and support efficient and transparent compilation of regular updates. An illustrative outline for a list of datasets is presented in Table 1.5.
2577	1	1	337	337	Please change text: "Possible Suggested contents, taken from examples of…"	Canada	Accepted	Changed in : "Possible contents, taken from examples of…"
2579	1	1	448	449	The new proposed text related to GHG inventory training activities appears to impose requirements which are beyond the scope of IPCC guidance and additional clarity indicating the content is not prescriptive should be added. The introductory statement that "the tools in this section should not be considered prescriptive" (see line 369) is insufficient to address our concerns, however the following specific changes provided for this section will: "Suitably trained and/or experienced GHG inventory experts help should support the national GHG inventory system to efficiently produce high quality outputs." "Ready access to training and regular review participation can will help build national capacity…"	Canada	Accepted	Text revised taking into consideration the comment.
2965	1	1	65	95	This is a good addition to the 2019 refinements. It is a concise summary of how biomass is currently accounted for within national GHG inventories. However, recommend to put more emphasis on how this accounting practice only works when assessing/reporting emissions across all source categories, or at least both Energy and LULUCF sectors. Furthermore, when reviewing individual sectors (e.g., assessing Energy sector without also assessing AFOLU), the current IPCC accounting/reporting approach for the CO2 emissions from the combustion of biomass does not hold true because the carbon/CO2 reported to LULUCF is not accounted for.	United States of America	Noted	It would not be helpful to go into any detail in this volume. The details have to be discribed in AFOLU and/or energy sector volume.

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
2967	1	1	70	88	Though this text is an improvement toward clarifying the 'why' behind IPCC accounting for biogenic CO2 in the AFOLU sector, it still is a bit muddied and requires further clarification. Specifically, this paragraph should also include additional text that puts more emphasis on how this accounting practice (of assigning the biogenic emissions associated with biomass use for energy to AFOLU) ONLY works when assessing/inventorying emissions across all or at least both the AFOLU and energy sectors. It should also assert that when looking at individual sectors (e.g., assessing energy sector without also assessing AFOLU), this accounting method for assigning biogenic CO2 emissions to AFOLU does not hold because the biogenic CO2 contribution from AFOLU-based biomass combustion/conversion is not accounted for. It is imperative that these important disctinctions be made to eliminate further confusion on how the IPCC views biogenic CO2 emissions.	United States of America	Noted	It would not be helpful to go into any detail in this volume. The details have to be discribed in AFOLU and/or energy sector volume.
2969	1	1	76	82	Footnote pertaining to clarification on accounting for biogenic CO2 related to annual crops should be at the end of the sentence on that topic, which ends on line 79. Currently the footnote is at the end of line 82.	United States of America	Accepted	Corrected.
2971	1	1	157	157	It would be helpful to repeat here "The details of this section should not be considered prescriptive."	United States of America	Accepted	Repeated.
2973	1	1	179	179	Provide additional information on how to fill out and use the table, and clarify or provide some examples on why the table is helpful. As is, the table is confusing and inventory compilers would have no idea how to fill this out, or what to use it for.	United States of America	Rejected	Requested explanatory text has already been provided in lines 170-178.
2975	1	1	201	201	Consider removing "Steering group" from this figure. Consider also that there are many ways to bring outside input into the inventory process, e.g., through a public review period for the inventory. These other approaches should be noted in this chapter as well.	United States of America	Accepted with modification	It is suggested to keep the "Steering group" in the figure. However, a footnote has been added to highlight that this is a generic term used to represent any coordinated review and development of the GHG inventory.
2977	1	1	209	209	Given that inventories are meant to be policy neutral, recommend deleting the role of policy advisor.	United States of America	Accepted with modification	The role of the policy advisor should be to help make the inventory policy relevant, e.g. by being able to reflect mitigation actions being implemented. Revised to "policy analyst".
2979	1	1	209	209	It would be good to note here that a good inventory can be developed with far fewer actors/stakeholders than this table is implying. This table would be intimidating to a group trying to develop an inventory program for the first time.	United States of America	Accepted with modification	Sentence added to state that a single individual may serve in more than one actor role. Experience shows that usually smaller countries use linear structures whereas large countries need more complex and larger organisation.

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
2981	1	1	209	209	When discussing the idea of a steering group, specify that the group should be balanced and unbiased. Industry stakeholder groups will point to the "Steering Committee" as discussed in the IPCC guidance to try to have more influence on the national inventory process, perhaps introducing a bias to the process.	United States of America	Accepted with modification	Sentence added to state that a Steering committee is just one approach for the purpose of getting external input. It is up to countries how to structure input or governance over inventory. It is not an issue for this section to prescribe whether or not a Steering committee is establish or what advisory role it should have. The figure is already labeled as an example.
2983	1	1	209	209	Change "Typical Roles" to "Example Roles"	United States of America	Accepted with modification	Revised to say "examples of typical roles".
2985	1	1	209	209	For sector experts, add "Identification of potential improvements to estimates"	United States of America	Accepted	Added.
2987	1	1	288	290	Note here that a wide variety of data sets from a wide variety of data providers may be appropriate/necessary to compile the GHG inventory. Note also that a lot of (maybe most at this point?) data may be publicly available over the internet. In that case, the inventory compiler should review the QA/QC plan of the data set and ask any questions to clarify appropriate use of the data set, but no formal arrangement is likely to be necessary.	United States of America	Noted	The details of such information are included in Chapter 2 of Volume 1.
2989	1	1	378	379	Table 1.6: Consider moving the point on stakeholder consultation up in the process. There will not be much that can be done with that feedback with only a few weeks before submission of final inventory.	United States of America	Noted	Table 1.6 is only illustrative. It may require adjustment to the specific national circumstances.
2991	1	1	408	412	Some subsources require thousands of data inputs (usually pasted into spreadsheets in rows). The suggested table is not practical for many of these categories, this issue should be discussed in this paragraph	United States of America	Rejected	The focus of Chapter 1 is on the organisational structure and also the necessary skills have been addressed. The guidelines cannot describe any detail of the "how".
2993	1	1	455	455	Consider adding sector-specific training activities (e.g. conferences, site visits) to improve the source lead's understanding of emission sources and trends	United States of America	Noted	Training on IPCC Guidelines and methodologies is addressed already in section 1.6.4.
73	1	2	102		All types of forests	Iran	Accepted	Adds clarity.
365	1	2	219	220	Figure 2.0b: It is proposed to increase the size of the figure, because it is impossible to read the text in the boxes.	Russian Federation	Accepted	Figure has been formatted.
367	1	2	296	344	Box 2.0A: It is proposed to edit the text of Confidentiality Agreement, because "we", "you" and "your" seem irrelevant in the context of the formal agreement.	Russian Federation	Rejected	This is a quotation from a national agreement as an example. The words are correct.
369	1	2	1252	1252	It is proposed to include "emission and removal categories" in the text of the bullet to read: "Methods and emission and removal categories used are in line with IPCC methodologies"	Russian Federation	Accepted with modification	Incorporated suggested text with modification by placing 'categories of' before 'emissions and removals'. Also delected text after methodologies.
371	1	2	1288	1289	Figure 2.3: It is proposed to increase the size of the figure, because it is impossible to read the text in the boxes.	Russian Federation	Accepted	Figure has been formatted.
373	1	2	1288	1289	Figure 2.3: It is proposed to include in decision tree a requirement that methods and categories used by the FRD must be consistent with those in the IPCC Guidelines.	Russian Federation	Accepted with modification	Modified text corresponding to 'Conduct quality assessment of FRD' to 'At minimum, quality assessment should be based on country's FRP and IPCC quality requirements. See Section 2.3.2.1, Table 2.4 and Table 2.5, for quality criteria examples.' This section including tables note that methods must align with inventory or be of higher tier.

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
639	1	2	70	70	Suggest "required" be changed to "necessary" [it sounds less prescriptive]	New Zealand	Rejected	Authors consider the word "required" as not prescriptive.
641	1	2	82	83	The sentence "A network of data providers will need to provide information on an annual basis" needs to be modified to take into account national circumstances such as the country doesn't produce an annual ghg inventory, and even if it does, collection of annual data is not always necessary to enable a country to prepare a ghg inventory report annually.	New Zealand	Rejected	Data collection should be on an annual basis. And it is best to have an annual inventory process to mantain expertise, allow for improvements and track emissions. Nevertheless, in case data are missing for certain temporal periods there are methods that allow for the estimation of data gaps.
643	1	2	93	93	delete "emission" from the end of the line	New Zealand	Rejected	They are called emission inventories.
645	1	2	95	97	Suggest that the phrase "need to be estimated using higher Tier methods" be modified. The application of higher tier methods to key categories will always depend on national circumstances, and while it is highly desirable, using the phrase "need to be estimated using higher tier methods" is too strong, particlularly if read in conjunction with the first part of the sentence "When starting the inventory compilation for the first time...." . A possible redraft would be to delete "need to be estimated using higher Tier methods" from the first sentence, with the second sentence reading: "It is good practice to use Tier one methods for non-key categories and higher tier methods for key categories if national circumstances allow (see chapter 4)" . This language is consistent with that in footnote 1 which occurs in line 176 and is at the bottom of page 2.7	New Zealand	Accepted with modification	Sentence changed. "Need" changed to "Should" and added the same footnote here for consistency and so it is clear that this should be done but there is an allowance for a lack of resources.
647	1	2	194	195	Change "undertake new surveys targeting inventories relevant sectors" to "undertake new surveys targeting data from relevant inventory sectors"	New Zealand	Accepted with modification	Changed in "undertake new surveys targeting inventory relevant sectors".
649	1	2	211	211	Change "formalized in any agreement to data supply" to read "formalized in any data supply agreement"	New Zealand	Rejected	The proposed change may imply a specific type of agreement. This is more generic (e.g. MoU, LoA etc).
729	1	2	355	356	The sentence "Each inventory compiler will need to find suitable categories to aggregate confidential emissions suited to their national circumstances" should be removed from Example 2 and placed near the top Box 2.0B as a chapeau for Examples 1 and 2.	New Zealand	Accepted	Changes implemented.

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
731	1	2	684	686	The sentence "If there is insufficient information on emissions data, then it is necessary that these countries undertake measurement programs in an effective and robust manner" could be interpreted as rather prescriptive given that there may be extenuating circumstances that would prevent this, as well as, in some cases, undertaking such measurement programmes on a more regional basis (involving more than one country) could be a more efficient approach. In addition, as the paragraph goes on to say, there may be other ways of improving/developing country-specific factors. Consider modifying to say: "If there is insufficient information on emissions data, then it may be necessary for these countries to undertake measurement programs in a cost-effective and robust manner"	New Zealand	Accepted with modification	Text changed in "If there is insufficient information on emissions data, then it may be necessary that these countries undertake measurement programs in a cost-effective and robust manner".
733	1	2	960	960	Make "compiler" plural	New Zealand	Accepted with modification	Added missing article - changed to ", if available to the compiler, "
735	1	2	965	965	Suggest the phrase "integrating facility-reported data (FRD) into inventory is optional" be modified to read "integrating facility-reported data (FRD) into the national GHG inventory is optional"	New Zealand	Accepted	Modified.
737	1	2	973	973	Change "primarily" to "primary"	New Zealand	Accepted	Changed.
739	1	2	980	980	Change "proposes" to "purposes"	New Zealand	Accepted	Changed.
741	1	2	988	988	Make "definition" plural	New Zealand	Accepted	Changed.
743	1	2	1073	1073	The phrase "by providing at via single point common data requirements" needs some attention. A possible redraft would be: "by providing common data requirements"	New Zealand	Accepted	Sentence rephrased.
745	1	2	1088	1088	Change "each participating organisations" to "each participating organisation"	New Zealand	Accepted with modification	each' has been removed from the sentence in consideration of another comment (ID 1847).
747	1	2	1098	1098	Change "threshold" to "thresholds"	New Zealand	Accepted	Changed.
749	1	2	1109	1109	Change "estimate and method" to "estimates and methods"	New Zealand	Accepted	Changed.
751	1	2	1181	1181	Possibly not appropriate to say "it is stongly recommended" as this will be seen as being presecriptive. Look at rephrasing using something like "it would be practical and efficient that emissions reporting facilities …"	New Zealand	Accepted	Sentence rephrased using 'practical and efficient'.
753	1	2	1195	1195	As above, it may not be appropriate to say "it is strongly recommended". Look at rephrasing	New Zealand	Accepted	Rephrased 'it would be productive …'
755	1	2	1206	1206	Suggest "will account for completeness issues due to coverage" be changed to "will address completeness issues due to coverage i.e. avoid use of "account for"	New Zealand	Accepted	Changed as suggested.
757	1	2	1240	1241	Change "When such break occurs and it may be justifiable" to "When such a break occurs it may be justifiable"	New Zealand	Accepted	Changed.
759	1	2	1242	1242	Change "In these cases, explanatory documentation should be required" to "In these cases, explanatory documentation should be provided"	New Zealand	Accepted	Changed.
761	1	2	1248	1248	Change "process" to "processes"	New Zealand	Accepted	Changed.
763	1	2	1265	1265	Change "consumptions" to "consumption"	New Zealand	Accepted	Changed.

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
765	1	2	1275	1275	Change "compare with inventory's" to "compare with inventory" or "compare with the inventory's"	New Zealand	Accepted with modification	Text changed in 'compare with inventory's emission estimates'.
767	1	2	1288	1289	In the second to bottom row of the decision tree, change "Is coverage complete and activity data is in-line with national dataset?" to "Is coverage complete and is activity data in-line with national dataset?	New Zealand	Accepted	Changed.
769	1	2	1296	1299	Not obvious why the period "5 to 8 years" is specified (except in that these periods are the same as CP1 and CP2 under the Kyoto Protocol. These time periods are close to irrelevant for the purposes of the 2019 refinement. Suggest that the first use "only once every 5-8 years" is changed to "only once for a multi-year period"; and that the second use "e.g. for landfills, the collection of data on waste composition may occur every 5-8 years in this case, the composition of waste should be used to represent the composition within those years" is changed to "e.g. for landfills, where the collection of data on waste composition may not occur annually, the composition of waste should be used to represent the composition within those years" .	New Zealand	Accepted	Changes implemented.
771	1	2	1304	1304	Delete "the" before "it"	New Zealand	Accepted	Deleted.
773	1	2	1309	1309	Insert "of" before "Models"	New Zealand	Accepted	Inserted.
775	1	2	1310	1310	Change "IPCC, 2011" to "IPCC, 2011b"	New Zealand	Accepted	Changed.
777	1	2	1319	1319	Change "IPCC, 2011" to "IPCC, 2011b"	New Zealand	Accepted	Changed.
941	1	2	188	188	Considering the fact that countries differ in the cycle of preparing emission inventories on an annual, biennial or quadrennial basis, it is suggested that "where data is not collected annually" be replaced by "where data is not collected regularly".	China	Accepted with modification	Changed to: 3. Modify existing data sets to meet the inventory requirements (e.g. where data is not collected on a calendar year basis annually, convert from (e.g. financial year) convert to calendar year, adjust for different classifications of sources or fill gaps in territorial coverage).
943	1	2	680	814	As required in the outline adopted at the 44th plenary session, this chapter should develop emission factors for developing countries. So it is suggested to add recommendations, encouraging the development of emission factors suitable for one's own national conditions.	China	Noted	This section does encourage the development of emission factors of one's own national condiitons. It is not possible to provide methods specifically for developing countries - they are the same as for all countries. Providing actual emission factors for developing counties as a whole is an enormous task beyond the scope of this document.
991	1	2	96	97	Sentence "It is good practice to use Tier one methods for non-key categories" indicate that Tier 1 method should always be used for non-key categories. However, if Tier 2 or Tier 3 method is already in use or more suitable for a certain country it is also good practice to use these methods even for non-key categories and even though not mandatory according to decision trees. The sentence should be removed or modified as "Tier 1 methods can be used for non-key categories according to decision trees".	Finland	Accepted with modification	Sentence changed. "Need" changed to "Should" and added the same footnote here for consistency and so it is clear that this should be done but there is an allowance for a lack of resources.

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
993	1	2	173	174	On line 173 it is stated that "Following the 2019 Refinement, it is possible to provide a Tier 1 estimate for every category. The sectoral volumes contain default Tier 1 emission factors and parameters that can be used". Have the writers checked that this is certainly the case in every category?	Finland	Accepted	Changed in "Following the 2006 IPCC Guidelines and its 2019 Refinement..."
995	1	2	682	684	Please change the sentence "for key categories it is good practice to develop country specific emission factors" to "for key categories it is good practice to develop country specific emission factors if Tier 2 or Tier 3 method for that specific category requires it". Not all Tier 2 approaches, which can be used for key-categories, require country-specific EFs (e.g. 2F1, transport)	Finland	Accepted with modification	"Provided a Tier 2 or 3 method exists in the guidelines." added as a footnote as the authors think it unlikely that a key category will not have a tier 2 method.
1241	1	2	365	365	after 'provided;' add ' the most appropriate way to impose corrections to activity data based on other sources as well as expert knowledge;'	India	Rejected	Corrections to activity data are NOT part of chosing a proper methodology.
1243	1	2	435	435	Add the sentence at the end ' Screening process may involve theoretical excercises utilizing backup knowledge which identifies improper data.'	India	Rejected	This comment is related to original text from the 2006 IPCC Guidelines. Theoretical exercises and backup data are unclear. This was not intended to involve reseach type exercises but a review of existing data.
1245	1	2	450	450	After 'national coverage,' add 'extent of coverage and limitation,'.	India	Accepted with modification	Changed "national" to "extent of".
1423	1	2	1417	1419	"Another document published by UN is on definitions, units of measure and conversion factors relative relative to energy statistics (UN,1987), which contains detailed information on terminologies for energy commodities, units of measurement and conversion from one unit to another." Remove one relative.	Sweden	Accepted	Removed.
1441	1	2	127	127	insert 'data from' after 'use existing', add 's' to collection	EU	Accepted	Inserted.
1443	1	2	252	252	The sentence ends with '...national statistical offices (NSO)', but afterwards the abbreviation NSA is mostly used. NSA is defined earlier. Use either the term NSO or NSA consistently through the chapter, or explain the different usage.	EU	Accepted	Consistency in NSO usage has been ensured during final editing.
1445	1	2	1054	1054	Split the sentence into two or insert the missing word: '… and is why many inventories'. Replace inventories by inventory compilers.	EU	Accepted with modification	Added 'this'.
1447	1	2	1432	1432	Please use Eurostat instead of EUROSTAT	EU	Accepted	Changed.
1449	1	2	1435	1435	Footnote 32; a much more relevant link is: https://ec.europa.eu/eurostat/web/energy/overview	EU	Accepted	Link updated.

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
1451	1	2			'good practice', contrary to what line 821 suggests': 'It is good practice when producing suitable activity data to follow the stepwise approach shown in Figure 2.0b.' Some reasons are: a) the decision tree is too complex and difficult to implement in practice; b) we do not agree that countries should use 'expert judgement' or 'surrogate data' in all cases. We think that there should be a distinction between key categories, for which you would expect data collection activities when activity data is missing, and non-key categories, for which it may be justified using surrogate data; c) This decision tree should also be consistent with sector-specific decision trees, where lack of activity data for key categories generally leads to an expectation of data collection activities; d) The phrasing in boxes such as 'data is satisfactory' or 'assumptions are reasonable', is in our view too vague to be 'good practice'. Thus, even if the rationale for developing a decision tree for data collection is important, we would see this decision tree as an example of how countries could approach data collection. We do not think it qualifies as 'good practice' as it stands now. We do not think it should be removed as a whole either, as some countries may find it useful with the needed modifications. For instance, distinguishing between key sources and non-key sources is very relevant. Thus, we could suggest adding 'is it a KC? Yes/No' after the box 'can the data be collected…?' If Yes, then 'set up programme to collect data'; if No, then 'use surrogate data'. While expert judgement is relevant for the choice of methods and input data, we think that expert judgement by itself should be avoided as input to estimating GHG emissions. Expert judgement may be used in some cases as a last resort involving non-key categories or when the actual or surrogate data are missing.	EU	Accepted with modification	There is a circularity here - how can you identify key categories if you do not have any data? Do not agree this is too complex - it has to cover the available options. Data collection is a very important part of compiling an inventory and should not be over simplified. For countries with established inventories this should not impose additional activities. The comment would be true for developed countries but for those with few resources some allowances should be made, especially when an inventory is being compiled for the first time. Text on "data satisfactory" and "assumption adequate" has been replaced with "Ensure data is complete, has uncertainty information, is transparent, consistent over time and with the sectorial definitions, and is as accurate as practical". Boxes added on key categories.
1817	1	2	79	79	Change 'statistical' to 'statistical or administrative'	United Kingdom (of Great Britain and Northern Ireland)	Accepted	Changed.
1819	1	2	194	194	Change 'inventories' to 'inventory' (or 'sectors relevant to inventories')	United Kingdom (of Great Britain and Northern Ireland)	Accepted	Suggestion implemented as proposed.
1821	1	2	728	728	It's useful having the web links for the new data sources - if possible, could these be added for the other entries in this table?	United Kingdom (of Great Britain and Northern Ireland)	Rejected	Web addresses are avoided as they change.
1823	1	2	973	976	This sentence should be reworded to 'Although the primary focus of this section is to provide guidance on integrating industrial facility data of industries under the Energy and the Industrial Process and Product Use sectors of the IPCC's Guidelines, these integration concepts and guidance can be adapted to most other IPCC sectors and categories such as Waste (i.e. wastewater treatments or landfills)'	United Kingdom (of Great Britain and Northern Ireland)	Accepted	Sentence rephrased.

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
1825	1	2	986	986	Change 'approached' to 'approach'	United Kingdom (of Great Britain and Northern Ireland)	Accepted	Changed.
1827	1	2	987	987	Change 'multiply' to 'multiple'	United Kingdom (of Great Britain and Northern Ireland)	Accepted	Changed.
1829	1	2	988	988	Change 'definition' to 'definitions'	United Kingdom (of Great Britain and Northern Ireland)	Accepted	Changed.
1831	1	2	1042	1042	Remove 'of'	United Kingdom (of Great Britain and Northern Ireland)	Accepted	Removed.
1833	1	2	1043	1043	Replace 'facility's' with 'a facility'	United Kingdom (of Great Britain and Northern Ireland)	Accepted with modification	Deleted in paragraph revision in response to comment ID 1959.
1837	1	2	1044	1044	Remove 's'	United Kingdom (of Great Britain and Northern Ireland)	Accepted with modification	Deleted in paragraph revision in response to comment ID 1959.
1839	1	2	1051	1051	In last bullet, replace 'request for supporting documentation' with 'request supporting documentation'	United Kingdom (of Great Britain and Northern Ireland)	Accepted	Revised.
1841	1	2	1051	1051	In footnote 27, replace 'contributes' with 'contribute'	United Kingdom (of Great Britain and Northern Ireland)	Accepted	Replaced.
1843	1	2	1073	1073	Replace 'at via single point common data requirements' with 'common data requirements at a single point'	United Kingdom (of Great Britain and Northern Ireland)	Accepted	Replaced.
1845	1	2	1087	1087	Replace 'This' with 'These'	United Kingdom (of Great Britain and Northern Ireland)	Accepted	Replaced.
1847	1	2	1088	1088	Remove 'each'	United Kingdom (of Great Britain and Northern Ireland)	Accepted	Removed.
1849	1	2	1103	1103	Replace 'overtime' with 'over time'	United Kingdom (of Great Britain and Northern Ireland)	Accepted	Replaced.

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
1851	1	2	1140	1140	Replace 'established' with 'establish'	United Kingdom (of Great Britain and Northern Ireland)	Accepted	Replaced.
1853	1	2	1196	1196	Replace 'multiply' with 'multiple'	United Kingdom (of Great Britain and Northern Ireland)	Accepted	Replaced.
1855	1	2	1198	1198	The text on the diagram isn't very legible, particularly s=2 and s=3 due to the text being on top of a patterned background - these could maybe moved elsewhere on the diagram for clarity	United Kingdom (of Great Britain and Northern Ireland)	Accepted	Figure has been formatted.
1857	1	2	1203	1203	Replace 'allow' with 'allows'	United Kingdom (of Great Britain and Northern Ireland)	Accepted	Change implemented as proposed.
1859	1	2	1240	1241	Replace 'When such break occurs and it' with 'When such a break occurs it'	United Kingdom (of Great Britain and Northern Ireland)	Accepted	Replaced.
1861	1	2	1258	1258	Remove ','	United Kingdom (of Great Britain and Northern Ireland)	Accepted	Removed.
1863	1	2	1260	1260	Remove 'for'	United Kingdom (of Great Britain and Northern Ireland)	Accepted	Removed.
1865	1	2	1296	1296	Replace 'period' with 'periods'	United Kingdom (of Great Britain and Northern Ireland)	Accepted	Replaced.
1867	1	2	1304	1304	Replace 'how the it has' with 'how it has'	United Kingdom (of Great Britain and Northern Ireland)	Accepted	Replaced.
1869	1	2	1309	1309	Replace 'Use Models' with 'Use of Models'	United Kingdom (of Great Britain and Northern Ireland)	Accepted	Replaced.
1871	1	2	1397	1397	Replace 'published' with 'publishing'	United Kingdom (of Great Britain and Northern Ireland)	Accepted with modification	Changed with 'with published statistics…'

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
1933	1	2	80	82	Confusing sentence. Suggest you simplify and turn the second bit around: "During the data collection for the greenhouse gas inventory, interactions between the inventory compilers and stakeholders will take place. This consultation with data providers and other stakeholders may be the most time-consuming part of the emission inventory compilation process, even when many statistics useful for the inventory may be freely available via the internet." Even better if you explain here WHY this can be time-consuming, e.g. to ensure that the inventory compilers understand the scope and origin of the data; to enable discussions to identify potential improvements (in completeness, quality) of data gathering systems, such as new survey questions or parameters to be reported.	United Kingdom (of Great Britain and Northern Ireland)	Accepted with modification	Sentences have been revised to improve clarity.
1935	1	2	97	99	Several instances of cross-references to "chapter 4". Suggest that you are consistent with the approach generally in the GLs of also citing the Volume, in this case "Volume 1, Chapter 4".	United Kingdom (of Great Britain and Northern Ireland)	Accepted	Consistency in usage of cross-references has been ensured during the final editing.
1937	1	2	103	104	Not convinced that the sentence "Inventory compilers should aim for completeness and focus on further improvements of inventories in later years.." sits here in the Data Collection section - this appears to be a statement asserting the order of priority for TCCCA. If valid, then presumably that should sit in Vol 1 Chapter 1.5? Also - do we think this IS valid? Should a developing country for example focus on ensuring completeness for all sources before worrying about the accuracy of emissions from key categories? The similar text in lines 199-200 is pitched much better, so perhaps just delete the text in lines 103-104.	United Kingdom (of Great Britain and Northern Ireland)	Accepted	Deleted ". Inventory compilers should aim for completeness and focus on further improvements of inventories in later years" as this was not clear.
1939	1	2	119	121	VERY small text in the diagram here. Borderline illegible. Please can you amend the diagram so that the text in each box is readable, if printed on A4 paper?	United Kingdom (of Great Britain and Northern Ireland)	Accepted	Figure has been formatted.
1941	1	2	171	172	This sentence seems out of place here. If retained, then suggest that you write out in full "the European Union Emissions Trading System (EU ETS)" as this appears to be its first use.	United Kingdom (of Great Britain and Northern Ireland)	Accepted	EU ETS written out in full.
1943	1	2	222	229	Good section but would be useful to also stress the benefits to the data provider organisation. Suggest adding (to last sentence for example) "…and to clarify/document the inventory data requirements with data suppliers may help to secure the regular provision of resources within that organisation to provide the data to the required quality and on time in future inventory cycles."	United Kingdom (of Great Britain and Northern Ireland)	Accepted	Suggestion followed.

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
1945	1	2	245	357	This section presents information on how to manage the process of gathering confidential data. It would be useful (and help promote efficiency for the compiler) if the link can be made, regarding transparency, of the prevailing national inventory review process and that review teams are mandated to maintain data confidentiality, and hence that in the compilation and management of confidential data, that countries should consider how they will be able to report the data to a review team, for example for the UNFCCC process. If this is not appropriate in the "Data Collection" section, then can you add a link to where this information is covered in an "Inventory Data Reporting" section of Volume 1? You could even add examples within that Box 2.0B, such as adding text to the "Example 1" along the lines of: "Further, in the reporting of the national inventory it may not be possible to present details of the facility-level data, but for the purposes of the inventory review process the inventory agency may prepare a spreadsheet to be shared with the UN review team, presenting facility-level data, to ensure that the transparency of the inventory can be maintained without disclosing the information in public domain publications.	United Kingdom (of Great Britain and Northern Ireland)	Rejected	No action can be taken because comment is out of scope of 2019 Refinement. It is not up to the IPCC to decide on how the UNFCCC reviews should treat confidentiality.
1947	1	2	399	400	Can you provide examples, similar to in lines 397-8? E.g. perhaps you mean "leading academic researchers", "emission inventory sector experts from other countries with similar national circumstances"..?	United Kingdom (of Great Britain and Northern Ireland)	Accepted with modification	Academic researchers are covered already. Added to international experts.
1949	1	2	700	701	Sentence doesn't scan. Suggest: "For more detailed guidance on parameters influencing emission factors, see sector-specific guidance in Volumes 2-5."	United Kingdom (of Great Britain and Northern Ireland)	Accepted	Suggestion followed.
1951	1	2	702	703	In RH column suggest adding: (Energy-fuel comb-mobile) CH4 and N2O.. "Emission control technologies, including additives and equipment fitted to vehicles in the fleet."	United Kingdom (of Great Britain and Northern Ireland)	Rejected	This does not seem to be a significant source.
1953	1	2	958	959	Suggest adding some examples of improved data supply that can help to derive higher-tier methods, to help clarify to compilers what they may be able to use, e.g. add "..such as fuel NCVs, industrial production data.."	United Kingdom (of Great Britain and Northern Ireland)	Accepted	Implemented.
1955	1	2	994	997	This paragraph really belongs in the introduction to section 2.3, not here under the "design" section	United Kingdom (of Great Britain and Northern Ireland)	Accepted	Paragraph moved to section 2.3.1.

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
1957	1	2	1025	1026	Within this table, one key aspect of facility reporting that needs to be included as a quality criterion (I suggest under "transparency", but you may consider a different TACCC criterion as more appropriate, as there are related points made under both comparability and completeness) is thus: "Where a facility reports emissions from more than one emission source category, for example a cement kiln reporting emissions from combustion of fuels (Energy) and decarbonisation of minerals (IPPU), then the reporting of AD, EFs and emissions should enable resolution of the total GHG emissions between these different source categories." You may regard this as implicit due to the wording one of your other statements, but I think to specify this clearly will be important for some inventory compilers.	United Kingdom (of Great Britain and Northern Ireland)	Accepted with modification	Accepted but text shorten and made stronger: "• FRD should be reported at a sufficient level of disaggregation for assessment and use. For example, where a facility reports emissions from more than one emission source category, (e.g. a cement kiln reporting combustion emissions (Energy) and process emissions (IPPU)), then AD, EFs and emissions should be reported separately for these source categories."
1959	1	2	1037	1044	Two concerns with this paragraph. Firstly the provision of permits / reports for each facility and inference that the inventory agency should check each one (at least for method outliers or changes) does infer a very significant resource requirement - it certainly would do for many EU Member States for example, and I'm sure for the USA and many other countries too. Second, that last sentence basically says that it is up to the inventory agency to work directly with the facility to improve the methods. In most cases, there will be a specific regulatory or trading scheme requirement for the facility reporting, and this will be governed by a regulator for the reporting mechanism. This paragraph needs to better-reflect that the inventory agency needs to work with those regulators, and discount the facility data for use in the inventory if the data aren't good enough until the matter is resolved. At least add in reference to engagement with the regulators of the reporting mechanism in this paragraph.	United Kingdom (of Great Britain and Northern Ireland)	Accepted	Agreed the original paragraph does potentially put a burden on inventory compilers. Although in some scenario, via industry consultation it is possible for all parties such as the regulation and inventory compilers to work closely with facilities. Paragraph revised: "Where methods are used that do not meet recognised standards, a report describing facility specific methods (such as engineering approaches, site specific emission factor development etc.), measurement techniques (that deviate from standards) and assumptions should be provided to allow transparent understanding of the basis of the data. Where methods do not meet national regulatory requirements, or recognised standards, national inventory compilers should only use the data if they can be assured that that facility specific methods will result in quality data that would be equivalent to or better than those resulting from national regulatory requirements, or recognised standards. When facility specific method(s) is found to be deficient, national inventory compiler(s) is encourage to work with regulator and where possible reporting facility to better understand and resolve issues as to increase data quality".
2581	1	2	183	183	Figure 2.2: Second box on the left that says "Can the data be collected through measurements, surveys or census, considering existing resources?" should mention remote sensing and geospatial as possible method for data collection. Suggest to modify text as: "Can the data be collected through measurements, surveys, census, remote sensing or geospatial products, considering existing resources?"	Canada	Accepted with modification	Sentence rephrased (geospatial products not included).

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
2829	1	2			Problems relating to the preparation of national greenhouse gas inventory	Sri Lanka	Noted	This does not seem to be a comment for the authors. However, preparation of national greenhouse gas inventory, problems and solution are already described (e.g section 2.2)
2851	1	2	347	356	Aggregating data for preserving confidentiality is the contrary of transparency. If this is absolutely necessary, a high level quality should be implemented.	Belgium	Accepted with modification	This is true: aggregation reduces transparency (as indicated in line 273-4) but the box is solely about aggregation. Added text in line 277: ", noting the need to ensure the quality of the inventory".
2853	1	2	483	502	Surrogate data should have a validation process independenly of their source and production algorithm. This process should be indicated in the document.	Belgium	Rejected	This text is unchanged from the 2006 IPCC Guidelines except for the additon of reference to other parts of the guidelines. The comment seems to indicate a too extensive study.
2995	1	2	209	210	Another bullet point in addition to those found from lines 202 to 209: "Has the collected data already undergone specific QA/QC procedures? (important to document those procedures)"	United States of America	Accepted with modification	The following has been added: • Has the collected data already undergone specific QA/QC procedures? Are these procedures documented?
2997	1	2	551	562	It would be helpful here to expand on what "representative" means. E.g. in terms of any emissions controls, geographically, practices, operators, etc. and to emphasize that any measurement study should provide the critical background data used to assess representativeness and to determine how to appropriately apply the data for a natiaonl inventory.	United States of America	Rejected	This is a comment to unchanged 2006 IPCC Guidelines text. The text does indicate what representative means without listing some of the parameters in the comment. Not all the parameters in the comment are relevant to all source, e.g. geographical may not be suitable for process emissions. Therefore the original text is kept.
2999	1	2	566	567	For documentation, include documentation of the representativeness of the measurements.	United States of America	Accepted	Included.
3001	1	2	940	940	For clarity, recommend inserting "which is" between "facility data" and "increasingly collected"	United States of America	Accepted	Inserted.
3003	1	2	941	941	Facility-specific data is not "implemented." Recommend replacing "implemented" with "generated and collected"	United States of America	Accepted	Replaced.
3005	1	2	949	949	The meaning "other indirect activity data" is not clear. Other than what? Can you provide an example? May be easiest to delete.	United States of America	Accepted	Deleted.
3007	1	2	949	949	Recommend replacing "these parameters" with "the latter parameters"	United States of America	Accepted with modification	Changed to "emission factors" as comment ID 3005 has changed earlier text.
3009	1	2	953	953	Recommend ending sentence after "needs" and beginning the next new sentence with "Thus"	United States of America	Accepted	Implemented.
3011	1	2	956	956	Replace "Else" with "If this is not possible,"	United States of America	Accepted	Replaced.
3013	1	2	968	968	Recommend replacing "biases" with "errors," since the errors introduced by using poor-quality facility data could be random (imprecision) as well as systematic (inaccuracy or bias).	United States of America	Rejected	Bias is meant here. The issue of overall quality is included in the head of the paragraph. To clarify "accuracy" is included in line 965.
3015	1	2	968	969	Recommend replacing "fuel quantities" with the more general "activity data."	United States of America	Accepted	Replaced.
3017	1	2	970	971	Rephrase this sentence; its meaning is unclear "Bias is also present if measurement methods are similar across industry…"	United States of America	Accepted with modification	Changed to "Bias may also be present if measurement methods are similar across industry or and do not account for facility-specific operation and processes. "
3019	1	2	1025	1025	In Table 2.4, in "Comparability" row, recommend inserting a new bullet "Facilities in same industry use similar methods."	United States of America	Accepted	Bullet inserted.

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
3021	1	2	1025	1025	In Table 2.4, in "Consistency" row, after Time series demonstrates consistency," recommend adding "or if not, provision is made for achieving such consistency."	United States of America	Rejected	We assume this is consistency not comparability. This table contains goals - provision for achieving consistency is not a goal - is it the way of achieving the goal.
3023	1	2	1025	1025	In Table 2.4, in "Completeness" row, recommend replacing "facilities" with "emissions" in third line. It is the fraction of emissions, not facilities, covered that determines the completeness of the reported emissions. In many cases, a high percentage of emissions can be covered even if a relatively low percentage of facilities is covered (the "80/20 rule").	United States of America	Rejected	This completeness point is considered in the first bullet. The intent of the second bullet is for complete industry coverage.
3025	1	2	1034	1034	After "fuels and feedstock;" recommend adding "standardized methods of measuring emissions of GHGs from vents and correlating these with activity data measurements to establish emission factors." These types of measurements and correlations are essential for many industrial source categories, such as fluorochemical production and aluminum production.	United States of America	Accepted with modification	Replaced the word 'establish' in the suggested text with 'develop'.
3027	1	2	1050	1051	Rephrase the part on de minimis to say "If the reporting program requires a de minimis provision (for burden reduction, etc.), the deminimis should in no case be set larger than the absolute value of the uncertainty." From the GHG inventory perspective it's preferable to have no de minimus so unclear why this guidance would seem to promote it.	United States of America	Rejected	The purpose of a deminimis is to reduce reporting burden at a facility level and if allowed must be clearly stated. This is similar to the UNFCCC's NE allowance and is included in several reporting regimes. The deminimis is only applicable to faciity reporting and does NOT replace inventory reporting or IPCC's completeness criteria. An inventory compiler will need to estimate the outstanding deminimis portion, respecting IPCC and UNFCCC requirements. As presented in Figure 2.2, national inventory compiler (via activity data) should know the total for a specific source to address completeness and coverage issues araising from FRD when generating a national inventory estimates.
3029	1	2	1050	1051	Under activity data, also include "information on any emissions controls"	United States of America	Accepted	Included.
3585	1	2	960	970	Recommend replacing "bias is" with "errors are" for the reasons cited in the comment on line 968.	United States of America	Rejected	Bias is meant here. The issue of overall quality is included in the head of the paragraph. To clarify "accuracy" is included in line 965.
3587	1	2	967	973	Recommend simplifying and clarifying this paragraph to read, "The primary focus of this section is to provide guidance on integrating industrial facility data for the Energy and Industrial Processes and Product Use sectors into national GHG inventories. However, these integration concepts and guidance can be adapted to most other IPCC sectors and categories such as Waste (i.e., wastewater treatments or landfills)."	United States of America	Accepted with modification	Maybe this relates to line 973? Keeping one sentence as this is one concept, see also comment ID 1823. Change text to: "Although the primary focus of this section is to provide guidance on integrating industrial facility data for the Energy and IPPU sectors into national GHG inventories, these integration concepts and guidance can be adapted to most other IPCC sectors (e.g. Waste) and categories (e.g.., wastewater treatments or landfills)".
61	1	3			estimation of uncertainty includes some equations and formula which could be difficult to users with limited experience, it would be better if a friendly use tool maybe designed to help in estimating the uncertainty, otherwise to be taken into consideration in the update of the 2006 GL software (the 2019 Refinements Software)	Egypt	Noted	Tool is already provided as an Addendum to Chapter 3. No further action needed.

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
75	1	3	427		C stock of a certain type of forest to	Iran	Accepted with modification	Text has been revised to reflect that the estimator is for a stand in forest land or a stand in a specific forest type.
77	1	3	428		the average C stock of a portion of a certain type of forest to infer the C stock of the entire forest)	Iran	Accepted with modification	Text has been revised to reflect that the estimator is for a stand in forest land or a stand in a specific forest type.
79	1	3	548		of the forestland in a country. The biomass C for each type of forest is multiplied by a weight	Iran	Accepted with modification	Text changed to "The biomass C for each of the sampled forest stands is multiplied by a weight of 20..."
375	1	3	170	171	It is proposed to remove from the paragraph the last sentence starting with the words"The approach 2…", because it is not needed here.	Russian Federation	Accepted	Sentence has been deleted.
377	1	3	302	358	Box 3.0: It is proposed to edit the text in the box to include the description of how the Monte Carlo Analysis was applied and how the results of the analysis allowed for reducing uncertainty of inventory estimates.	Russian Federation	Accepted with modification	This information is provided in Volume 4. A reference has been added to the section with more information about the Monte Carlo analysis.
379	1	3	359	360	Box 3.0: It is proposed to edit the text in the box to include the reference to the figure in lines 359 to 360. It is further proposed to explain what the figure illustrates.	Russian Federation	Accepted with modification	The content of the figure is already explained in lines 344 to 346. A caption was added to provide more context for the figure.
381	1	3	958	958	To enhance usability of the Monte Carlo method, it is proposed to develop a worksheet for Monte Carlo Analysis similar with the worksheet for Approach 1 uncertainty calculations and include it in the 2019 Refinement.	Russian Federation	Rejected	It is not feasible to develop a worksheet for a Monte Carlo Analysis that could be used across categories and include all flexibility including correlations that a Monte Carlo package provides.
665	1	3	661	671	emissions expressed in percentage terms. as a module (absolute value) of sum of all emissions in denominator. Footnote 4 in line 662 suggests that the formula should be used "caution should be exercised in the interpretation of the results in cases where the point estimate is very small when compared with the size of the confidence interval (e.g. a sector or inventory where removals and emissions are of similar sizes). Moreover, in the unique case the sum of negative quantities is equal to the sum of positive ones, the denominator in the Equation 3.2 is equal to "0" and the formula has no sense." The problem with the denominator has been inherited from GPG2003, where in attempt to take into account that LULUCF sector emissions could have negative values (as they could represent removals of CO2 from the atmosphere), a module was introduced for the summation in the denominator. It was meant for individual components of the sum, not for the total - this most likely was a typo overlooked during the compilation and editing process. Previously, in GPG2000, the denominator did not have an absolute sign around the sum. Indeed, when most Annex I Parties are approaching the zero carbon net economies, the use of absolute sum in denominator will lead to extremely large uncertainties values (like millions) that will definitely not portray the uncertainty of a country's net emissions and ultimately will not make any sense. As the denominator should portray the range over which the absolute uncertainty of the sum expressed in the numerator is spread over, it would be more accurate to use the sum of absolute values in the denumenator instead of absulute value of the sum, i.e. $\|x1\| + \|x2\| + \|x3\| + ... + \|xi\|$ instead of $\|x1 + x2 + x3 + ... + xi\|$. This change will not make any difference for combining emissions	New Zealand	Accepted with modification	Footnote has been amended by the following sentence: "In that case, the uncertainty should be expressed just as half the 95% confidence interval (±1.96σ)". This case has been carefully considered and the conclusion is that equation 3.2 is mathematically correct. The proposal would change the meaning of the formula and would not be consistent with the technical background.
779	1	3	149	149	Change "biannually" to "biennially" [the former means twice a year, the latter means once every two years]	New Zealand	Accepted	"biannually" replaced by "biennially".

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
781	1	3	303	303	Could be useful to state somewhere that moving to a higher tier does not necessarily reduce uncertainty, and that in some cases, might increase it	New Zealand	Rejected	Line 287 states that "Moving to a higher tier method in these cases will likely increase accuracy. Applying a higher tier method may also improve the precision of estimates, as shown in Box 3.0". Moving to a higher Tier can sometimes give the impression that the uncertainty is increasing as there is a small probability that the true value for emission factors and possibly activity data falls outside of the confidence intervals used in a Tier 1 analysis because we are typically using normal distributions. However, it seems unnecessary to add any elaboration in Box 3.0 because this does not appear to be the case for the example in the box.
783	1	3	506	506	Suggest "double counting" is replaced with "over counting"	New Zealand	Accepted	"double counting" is replaced with "overcounting".
785	1	3	747	747	The subscript "s" is an error: should be VS. Also need to be consistent with the formula in line 745, where we see VS dairy [subscript dairy], but here in line 747 where the terminology in the formula is explained, VS rate [subscript rate] is included i.e. VS rate, dairy [subscript rate, dairy].	New Zealand	Accepted	Term corrected in line 747. In the equations in lines 745, 771 and 772 all subscripts "d" are replaced by subscripts "dairy" for consistency.
1341	1	3	172	172	This figure needs some text to clarify what it shows, otherwise it does not provide good information.	Sweden	Rejected	Figure is introduced and explained in lines 159 to 171. Further text will not be much helpful.
2583	1	3	302	358	Box 3.0 is very heavy text and does not provide a practical approach to doing uncertainty analysis with process based models. The main challenge in carrying out Monte Carlo analyses with Tier 3 models is that model runs are not fully independent, since many parameters are not randomized and remain the same for multiple runs. Guidance would be valuable on the handling of these constant parameters across multiple runs as dependent variables.	Canada	Accepted with modification	Box is intended to show the benefit of moving to higher tiers and not as a detailed guide for the application of Tier 3 models. However, there is more information provided in Volume 4 about the uncertainty methods. A reference has been included in the Box.
2585	1	3	342	346	The validation of the model results against independent research data would be an assessment of accuracy, not precision, please revise.	Canada	Rejected	The benefit covers both bias (accuracy) and precision.
2587	1	3	758	760	As mentioned in lines 163-166, improvement plan takes into account uncertainty assessment along with KC analysis, QA and resources available. This is not consistent with a tool directing priorities as stated in 759. Please revise	Canada	Accepted	The comment seems to refer to line 792 (?). Text "directing priorities of improving the inventory" replaced by "helping in prioritizing improvements to the inventory".
2589	1	3	793	793	It might be easier to understand if 2% is changed for 2 points of percentage	Canada	Rejected	The comment seems to refer to line 825 (?). If that is the case it is already mentioned in line 822 that the trend uncertainty is measured in percent points. The sentence in line 825 is an example that "2%" means different things for the level and trend uncertainty.
2909	1	3	664	671	Equation 3.2 is misleading while in case of subtraction the denominator should be the absolute value of the difference and not the sum of quantites. If the title of this equation is "Addition and subtraction" the denominator should follow this distinction and should be for example: |x1 ± ...±xi±.... ± xn|.	Hungary	Accepted with modification	In order to increase clarity the definition of xi has been changed to say that xi may be a positive or a negative number; and 'combined' has replaced the term 'added'.

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
3031	1	3	556	562	Suggest rewriting this example, as it is not fully clear and the approach to stratification beyond the determination of intitial production systems is not obvious. The text states that there are funds to sample 100 farms in each of 15 production systems. The next line states that 10 farms were sampled in each production system. Please explain the relationship between the 100 farms that might be sampled, and the 10 farms that were sampled. In this example, was each production system further divided into 10 strata?	United States of America	Accepted	Description has been corrected.
81	1	4	3B3a		Comment for all "grassland" repeated in text, which should be defined and used as "grassland and / or rangeland"	Iran	Rejected	The IPCC land use category name is "Grassland" and changes to the name is outside the scope of the Refinement. Is worth to recall that according to the definition: "This category includes rangelands and pasture land that are not considered Cropland".
95	1	4	55	56	suggested that the development of simplified procedures approved by countries(Islamic Republic of Iran).	Iran	Noted	The procedure developed to identify key categories is well developed and builds on country-specific emissions inventory data and information.
97	1	4	88	91	It is necessary to specify the methodology used to identify the key categories in order to find out that the methodology used corresponds to the decision tree of the sector.	Iran	Noted	The methodology provided already addresses this comment.
787	1	4	64	65	Given that it is the operation of the national inventory arrangements that will identify the priorities etc, suggest a re-ordering of "Key category analysis helps the National Inventory Arrangements (see Section 1.5 of Chapter 1) identify the priority categories for which methods, activity data, emission factors and.." to read: "Within the National Inventory Arrangements (see Section 1.5 of Chapter 1) application of a key category analysis will help identify the priority categories for which methods, activity data, emission factors and..."	New Zealand	Accepted with modification	Changed to "Within the National Inventory Arrangements (see Section 1.4a of Chapter 1) application of a key category analysis will help identifying ....."
789	1	4	119	119	Change "...countries...." to "....countries'..." i.e. insert an apostrophe	New Zealand	Accepted	Changed.
791	1	4	124	125	Suggest "This will be facilitated by an approach, which aggregated/disaggregated based on methodology and in particular uncertainties" is changed to"This will be facilitated by an approach which is aggregated/disaggregated based on methodology and in particular uncertainties"	New Zealand	Accepted	Changed.
793	1	4	126	126	Change "principals" to "principles"	New Zealand	Accepted	Changed.
795	1	4	131	131	Change "adequate" to "adequately"	New Zealand	Accepted	Changed.
797	1	4	386	386	See comment above on lines 64 and 65. Suggest "designed to inform the National Inventory Arrangements" is changed to "designed to inform the operation of the National Inventory Arrangements"	New Zealand	Accepted with modification	Changed to "designed to inform the functions of the National Inventory Arrangements".
799	1	4	396	396	More correct to say "Finland's greenhouse gas inventory" rather than "the Finnish greenhouse gas inventory"	New Zealand	Accepted	Done.
801	1	4	400	400	Make the change suggested for line 396 above to the title of Table 4.5	New Zealand	Accepted	Done.
803	1	4	402	402	Make the change suggested for lines 396 and 400 above to the title of Table 4.6	New Zealand	Accepted	Done.

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
805	1	4	403	403	Make the change suggested for lines 396, 400 and 402 above to the title of Table 4.9	New Zealand	Accepted	Done.
807	1	4	404	404	Make the change suggested for lines 396, 400, 402 and 403 above to the title of Table 4.10	New Zealand	Accepted	Done.
857	1	4	180	180	In category 2C1 'Metal industry - Iron and Steel Production' N2O gas emitted by flaring of BFG and LDG should be considered.	Republic of Korea	Accepted	It makes sense since Table 8.2 in Volume 1, Chapter 8 includes emissions of N2O.
945	1	4	259	402	The calculation with Equation 4.2 is inconsistent with the data in Table 4.6, according to which, it is assumed that Equation 4.2 should be . Please check. With regard to Table 4.3: Since the definition of Ti,t was not given earlier, it is suggested that Ti,t here be changed to Tx,t and y in line 292 to x accordingly. If Ti,t is retained, it is suggested that the definition of Ti,t be given in the earlier text, and y in line 292 to i and Tx,t in Table 4.6 to Ti,t accordingly. note: Formulas are in the supporting file 1	China	Accepted with modification	Equation 4.2 is correct. Agree that Table 4.6 is inconsistent with Equation 4.2. Example in Table 4.6 has been corrected. On the definition of Ti,t, and Ei,t, there is no need to define Ti,t in addition to Tx,t. It is the same definition referred to different categories. In line 207 there should be absolute value. In line 267 there is no absolute value.
997	1	4	259	261	Please correct mathematic formula of the equation 4.2, absolute value signs should be placed as follows T(x,t) = |E(x,t)-E(x,0)| / sum(|E(x,t)-E(x,0)|)	Finland	Rejected	Equation 4.2 compares the absolute value of the trend for the category with the absolute value of the trend of the inventory.
999	1	4	279	280	Please correct the column headings in the Table 4.3. Current column headings refer to the equation 4.2 (lines 259-261), which is not correctly written. In the example table later in the chapter (line 402) column headings are correct.	Finland	Rejected	Equation 4.2 is correct.
3697	1	4	150	150	The footnote 3 reads: "The methodology is also applicable for other weighting scheme, but for the derivation of threshold for Approach 1 and 2 and for the examples in Section 4.5 CO2-equivalent values were calculated using the global warming potentials (GWP) over a 100-year horizon of the different greenhouse gases, provided by the IPCC in its Second Assessment Report (SAR)". Please update the footnote with correct reference to which GWP values that should be used. We recommend that the reference to IPCC reports are done less spesific, as we envision that the IPCC/UNFCCC will update the GWP values more often than the GL will be updated. Moreover the calculations in the Refinement should be provided with reference to the most recent AR4 GWPs, hence the examples in Section 4.5 should be updated.	Norway	Accepted with modification	The comment was considered and the note updated to clarify the version of the IPCC AR used for the examples: "The methodology is also applicable for other weighting scheme, but for the derivation of threshold for Approach 1 and 2 CO2-equivalent values were calculated using the global warming potentials (GWP) over a 100-year horizon of the different greenhouse gases, provided by the IPCC in its Second Assessment Report (SAR). For the examples in Section 4.5, CO2-equivalent values were calculated using the GWPs provided by the IPCC in its Fourth Assessment Report".
3699	1	4	399	400	Table 4.5. Please specify what GWP values that are used in this table.	Norway	Accepted with modification	Note 3 has been updated to explain this.
83	1	5	186	189	Country-specific categories/and or forest ecosystem-specific categories: In cases where the 2006 IPCC Guidelines and its 2019 Refinement do not provide guidance on allocation and methodological guidance for a specific category and country or region deems the category to be significant (according to its national or regional definition) to its national or regional emissions total (e.g. CH4 emissions and removals from agricultural soils or forest ecosystem in low forest cover countries).	Iran	Accepted	Suggestion implemented as proposed.

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
809	1	5	279	280	Suggest "(E.G. DATA FROM EMISSIONS TRADING SCHEMES OR OTHER NATIONAL DATA REPORTING PROGRAMMES)"	New Zealand	Accepted	Suggestion implemented as proposed.
811	1	5	285	285	Delete "etc". As this is a list of examples, "etc" is not needed	New Zealand	Accepted	Suggestion implemented as proposed.
813	1	5	364	364	Delete "so that" i.e. "able to understand the differences so that to be sure that the new…" becomes "able to understand the differences to be sure that the new…"	New Zealand	Accepted	Suggestion implemented as proposed.
815	1	5	427	427	Suggest "the time series shows a linear time series" is changed to "the time series is linear"	New Zealand	Accepted	Suggestion implemented as proposed.
1309	1	5	237	238	Add 'These EFs should be applied from the year the changes took place. These EFs can not be applied prior to the year of change'.	India	Accepted	Suggestion implemented as proposed.
2855	1	5	493	493	In Table 5.1, regarding the Non-linear Trend Analysis, under the comment section "Should not be applied for long periods. Applicable in the case of large annual fluctuations." It should be more specific about what a "long period" or "large fluctuation" means to avoid ambiguity.	Belgium	Accepted with modification	The sentence making reference to long period has been removed as the application of the splicing techniques will apply based on the nature of the data presented. In some cases the non-linear trend analysis can well apply in datasets with longer time series. Example in Box 5.2B illustrates this very well. Sentence dealing with large fluctuations has been improved to address the use of standard deviation to interpret fluctuations in line with Chapter 3, Volume 1.
3033	1	5	242	251	This paragraph is inconsistent with the guidance on fugitives, where the lower emissions of CH4 due to flaring or other activities is already reflected in the EFs. One fix is to remove the sentence "These activities…for different years." Another option is to add at the end of the paragraph, "For example, methane emissions in the oil and gas sector are impacted by flaring and other activities/technologies. The fraction of oil or gas production with and without these activities/technologies can be determined and distinct emission factors can be applied to each population."	United States of America	Accepted	Second option implemented by authors as both scenarios ar true. The paragraph now covers both scenarios.
85	1	6	411		where agriculture, forestry and other land-use is dominant, which we need to enhance research to find inventory method with least uncertainties.	Iran	Noted	Comment is valid, but discussion of improving AFOLU inventory may belong to another chapter?
817	1	6	130	131	More accurate to say "the Kyoto Protocol Clean development Mechanism (CDM), not "the UNFCCC Clean development Mechanism"	New Zealand	Accepted	Suggestion implemented as proposed.
819	1	6	315	315	"NGHGI" is an unnecessary acronym	New Zealand	Accepted	Suggestion implemented as proposed.
821	1	6	483	483	"were detected" not "where detected"?	New Zealand	Accepted	Suggestion implemented as proposed.
823	1	6	550	550	"GHGI" is an unnecessary acronym	New Zealand	Accepted	Text has been revised.
825	1	6	553	554	Easier to understand if "a to the power of minus 1" were changed to "per year" such that it reads "25 Gg CO2 equivalent per year"	New Zealand	Accepted	Text has been revised accordingly.
827	1	6	590	590	Change "Greenhouse Gas Inventory" to "greenhouse gas inventories"	New Zealand	Accepted	Suggestion implemented as proposed.
829	1	6	603	621	The more common term is "fluorinated gases", not "halogenated gases". Suggest this change is made to the heading and in the rest of the paragraph and wherever else it might be relevant in the full document.	New Zealand	Accepted	Changed from halogenated to fluorinated, as it was in 2006 IPCC Guidelines.

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
831	1	6	703	703	Suggest "Recommended" is deleted. Could be replaced with "Key", making the language in the heading consistent with that in line 708	New Zealand	Accepted	Text revised accordingly.
833	1	6	716	716	Insert "a" before "UK"	New Zealand	Accepted	Suggestion implemented as proposed.
835	1	6	728	729	Suggest "On inventory side, following several steps are recommended to take" is changed to "On the inventory compiler side, the following step-wise approach is isuggested" . i.e. avoid the use of "recommended"	New Zealand	Accepted	Text revised accordingly.
837	1	6	848	848	Change "necessary" to "necessarily"	New Zealand	Accepted	Suggestion implemented as proposed.
839	1	6	865	865	Change "those" to "they"	New Zealand	Accepted	Suggestion implemented as proposed.
841	1	6	894	894	Change "Use of Models in Good Practice National Greenhouse Gas Inventories" to "Good Practice Use of Models in National Greenhouse Gas Inventories"	New Zealand	Accepted	Suggestion implemented as proposed.
843	1	6	927	927	Change "In order to set up, calibrate and parameterise the model real data ("calibration data") is needed" to "In order to set up, calibration and parameterisation of the model real data ("calibration data") is needed"	New Zealand	Accepted	Suggestion implemented as proposed.
845	1	6	938	938	Models are used for removals too. Suggest "emissions in a source category" is changed to "emissions or removals in an inventory category"	New Zealand	Accepted	Suggestion implemented as proposed.
847	1	6	978	978	Change "buy" to "by"	New Zealand	Accepted	Change implemented as proposed.
849	1	6	1002	1002	Change "In planning implementation of any model allowance should be made for….." to "In planning the implementation of any model, allowance should be made for…."	New Zealand	Accepted	Suggestion implemented as proposed.
1001	1	6	555	556	Something, possibly a verb, is missing from the sentence "Where possible, facility-level emissions ..". Please correct/complement.	Finland	Accepted	Text has been revised accordingly.
1003	1	6	393	395	Please check the term "national inventory estimates" here and throughout the text under "Comparison with atmospheric measurement". Should it not refer to estimates used in the national ghg inventories or used to verify estimates presented in the national inventory? It should not refer to country-level estimates made outside inventories, which may in some cases disagree with the ghg inventory requirements.	Finland	Noted	The text implies we work with national inventories. Throughout the section we don't discuss verification of other types of inventories.
1005	1	6	890	893	Please correct the indentation for (i)-(iii), they should be at the level of other bullet points? Otherwise, this part of the list is incomprehensible.	Finland	Accepted	Indentation corrected.
1007	1	6	920	924	The text is unclear and not pragmatic. Please rephrase that when choosing a model, differences in management, conditions etc should be carefully considered and please remove the good practice guidance on the need to report speculatively on suitability of the model. With no actual data, these remain highly speculative. List under 6.12.6 should suffice. Verification of inventory estimates or evaluation comparisons are more important to be documented carefully so adding the reporting burden with speculative interpretations of the impacts of differences is unnecessary.	Finland	Accepted with modification	New text added at the end of para 6.12.4 to give guidane to inventory compilers for handling of verification and validation for established and well-known models.

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
1009	1	6	923	923	Please clarify what does "outside parameter space" mean.	Finland	Accepted with modification	Outside parameter space means "outside the range of parameter " for which the model was developed. The sentence has been updated to reflect the use of the phrase "outside the range of parameter".
1011	1	6	929	932	The text says that it is good practice to evaluate model behaviour i.e. compare model ouputs with data used in calibration. This seems to be contradictory to what is written in Volume, Ch.2, lines 2109-2111 and 2169-2171 where it says that It is good practice to use measurements independent of those used for model calibration when evaluating model behaviour. Evaluation of model behaviour and verification of model outputs can be seen as different things (the latter needing data independent of calibration data for sure) but please correct for consistency between volumes the guidance on use of models between volumes.	Finland	Accepted with modification	Text has been changed as follows: "it is good practice to compare model outputs with data independent of the calibration data (e.g. evaluation of model behaviour)".
1013	1	6	832	1118	Chapter 6.12 is written with a point of view of models typical to natural sciences, such as process models used in the AFOLU sector. Thus, not all guidance, including documentation and reporting requirements, are appropriate for other kinds of models, such as some transportation models. Please modify the text and lists of requirements to reflect the variety of complex models used in the inventories.	Finland	Accepted with modification	I cannot see why the documentation required (section 6.12.6) cannot apply to a transport model. Indeed, most transport models will already be documented with reports giving most, or all, of the items listed. Even transport models need to be calibrated and validated. Data will be used during the construction of the model to ensure it is working correctly (calibration) and after it is complete outputs should be compared against the real world (validation). QA/QC is always needed. However, to clarify this some text has been added: after line 906 Established and well-known models (e.g. some transport models) are usually well documented, calibrated and validated already. For these inventory compilers can rely on published reports and peer-reviewed publications and simply reference this material. There is no need to duplicate the reports, calibration or validation work, or uncertainty analysis. after line 927 • Transport models should conserve vehicle number.
1311	1	6	127	129	Needs more clarification for the term 'verification' used in carbon market and IPCC	India	Accepted with modification	A sentence has been added at the end of the box to indicate that verification has a wide range of meanings depending where it is used.
2591	1	6	351	352	Not all approaches using atmospheric data are largely independent of activity data and emission factors. Suggestion to edit: "This approach is particularly valuable as it can be largely independent of…"	Canada	Accepted	Suggestion implemented as proposed.
2593	1	6	366	366	A reference should be given why these techniques are considered "cost- and labour intensive". Is this in comparison to creating an annual NIR update or relative to author QA/QC procedures>	Canada	Noted	Wording is kept from the 2006 IPCC Guidelines. The meaning is that the atmospheric observation and modeling costs are not at the scale of minor fraction of NIR preparation, but comparable to it.

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
2595	1	6	368	368	Should be specified that current studies extend beyond the inventory cycle, but the community is working towards faster turn arounds. Suggested edit: "Currently, the required analysis time …"	Canada	Accepted	Suggestion implemented as proposed.
2597	1	6	427	428	Fossil fuels are void (virtually free) of radiocarbon not "very low". Some fuels e.g. diesel/gasoline have a non-fossil contribution nowadays, but this should not be confused here.	Canada	Accepted	Suggestion implemented as proposed.
2599	1	6	430	430	Suggest adding a reference here: e.g. Levin et al. 2003, GRL, Vol. 30, NO. 23, 2194, doi:10.1029/2003GL01847	Canada	Accepted	Suggestion implemented as proposed.
2601	1	6	474	476	Suggest adding more up to date references e.g.: CH4: Saunois et al. 2016, ESSD, 8, 697-751; SF6: Levin et al. 2010, ACP, 10, 2655-2662	Canada	Accepted	Suggestion implemented as proposed.
2603	1	6	499	509	This sections neglects to mention ground-based total column observations. They are similar in technique to satellite measurements, but measure at fixed locations (e.g. the TCCON and COCCON networks). This data can be used to validate satellite retrievals or atmospheric models and help integrate in-situ and satellite observations.	Canada	Accepted with modification	Revised, added mention of TCCON use for satellite validation. Unfortunately a number of related papers on direct use of TCCON data for emission estimates came out after literature cut-off date.
2605	1	6	538	538	In Volume 1, the comment was made to expand the discussion of challenges of reconciling top-down and bottom-up emissions posed by natural emission sources. This was not addressed and is an important issue questioning the validity and applicability of top-down approaches in validating emissions. The proposed article clearly documents these challenges.	Canada	Noted	The proposed paper was cited in same context earlier in the section.
2607	1	6	642	644	Significant progress has been made since 2005 (as stated in the previous sections) - these references should be updated	Canada	Accepted with modification	Text revised accordingly.
2609	1	6	808	809	The examples provided of inventory validation with inverse model estimates suggest that anywhere from one to four sites have been used for this purpose. Stating that the number of observation sites will vary with the geography and situation does not provide concrete and useful guidance. Comments to this effect on the SOD were not addressed. Please elaborate on how an inventory compiler would assess whether the number of observation sites justifies a comparison with inventory estimates.	Canada	Accepted with modification	Revised, elaborated on ways to determine required number and locations of the observing networks. Note that clear guidance is difficult to formulate. Good practice examples of the current networks are constructed by taking into account all consideration: available funding, available infrastructure and minimising uncertanty of emission estimates. UK had only site at first, which was not enough for annual emission estimates, they could only do 3 years mean estimate.
2611	1	6	820	820	Figure 6.1 Correct third box to " Improve and validate the model"	Canada	Accepted	Text revised accordingly.
2613	1	6	977	978	Guidance on what should be reported goes beyond the mandate of the IPCC Therefore, change "It is good practice to report:" to "It is good practice to document"	Canada	Accepted	Change implemented as proposed.
2615	1	6	1024	1024	Guidance on what should be reported goes beyond the mandate of the IPCC Therefore, change "It is good practice to report:" to "It is good practice to document"	Canada	Accepted	Suggestion implemented as proposed.
2831	1	6			Problems relating to the preparation of national greenhouse gas inventory	Sri Lanka	Noted	Not possible to address the comment as we can not locate the line number the comment is referring to.

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
2887	1	6	839	849	It is not clear what this section tries to say. It needs to be made clearer to the reader. For example, it needs to say when there are no gains in using more complex methods and illustrate this by examples from the literature.	Estonia	Accepted	Text revised to read: Simple approaches to estimating greenhouse gas emissions and removals may be unsatisfactory for some specific categories in some countries because they fail to capture the complexity and diversity of systems and practices, in that sector. Therefore, some inventories rely on more sophisticated approaches, using models or direct measurements. In general, models may be used to estimate those emissions or removals that cannot be easily otherwise obtained, to extend limited information to cover national emissions and removals, both spatially and temporally, or to improve the accuracy of the estimates. Model development relies on data from direct measurements and uses measured data for calibration and evaluation. However, models should be used with care. Complex models are not necessarily improvements over simple ones (e.g. carbon dioxide emissions from road transport is best estimated from fuel sold and its carbon content: no transport model will provide a better estimate although they may allocate the emissions to specific vehicle types and estimate improved emission of methane and nitrous oxide). Models are limited by the underlying quality of the data. Use of models will require resources for additional QA/QC and documentation.
3035	1	6	114	115	Verification, as referred to in these lines, is not only done in carbon markets, but for a number of other other reasons (including results-based payments). Inserting carbon markets into a discussion of QA in this way may be confusing to some. It would be better to delete the reference in lines 114 and 115 and simply include the text at the end of the third paragraph include a line at the end of the box noting that "verification" has different meanings in different contexts, and in the case of carbon markets, results-based payments, etc has a meaning more similar to the QA definition above.	United States of America	Accepted with modification	A sentence has been added at the end of the box to indicate that verification has a wide range of meanings depending where it is used.
3037	1	6	345	379	As there have been particular sensitivities around external stakeholders "verifying" country-reported data using atmospheric measurements, it may be useful here to specify that the verification contemplated is done by/with inventory compilers and understood in the inventory sense (as explained in Box 6.1), as opposed to done by external stakeholders and understood in the carbon markets-related sense. (A different term, such as "validation," might also be considered.	United States of America	Accepted with modification	In this occasion changed from verifying to comparison. Use of verification term in this context is clarified in Box 6.1.
3039	1	6	407	416	In the text, F gases are considered good candidates because they are long-lived, but also in the text it is noted that there are additional challenges with N2O because it is long-lived. Is one a typo or is there a difference?	United States of America	Accepted	Revised, noting very long N2O lifetime (as opposed to several years for F-gases and methane).

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
3041	1	6	408	409	It's worth mentioning the influence of natural sources of CH4 here as well.	United States of America	Accepted	Suggestion implemented as proposed.
3043	1	6	471	489	Global dynamic monitoring does not have as much apparent relevance for national GHG inventories. Suggest either clarifying the relevance to estimates at a national level, or deleting.	United States of America	Accepted with modification	New text included to clarify relevance.
3045	1	6	537	539	Sentence does not make sense as currently written, possibly just a typo, but it needs editing.	United States of America	Accepted	Sentence revised for better reading.
3047	1	6	551	552	This is an inaccurate description of the gridded US GHGI. Livestock emissions estimates are available by state, but the emissions are mapped to livestock population locations in the gridded US GHGI. Petroleum estimates at the national level were used to develop emission factors (e.g. CH4 per well) to apply to wells at specific locations throughout the U.S.	United States of America	Accepted with modification	Revised, removed detail. Readers can find needed information in the paper.
3049	1	6	552	556	This is an inaccurate description of the use of the GHGRP data in the griddedUS GHGI. GHGRP data is used as an input to the gridded inventory to help allocation national emission totals across facilities for the gridding. It is suggested to confirm final language with the team that developed the gridded US CH4 inventory.	United States of America	Accepted with modification	Revised, simplified. Readers can find detailed information in the paper.
3051	1	6	568	568	It would be good to mention here the influence of natural sources and temporal aspects (e.g. a measurement in the summer, or when high-emitting events are occuring is not necessarily useful in evaluating average national emissions unless temporal aspects are taken into account)	United States of America	Accepted	Revised, sentence added.
3053	1	6	607	607	Earlier in the chapter "top-down" is used to describe use of national level activity data to estimate emissions. Use a different term here, or define its use here.	United States of America	Accepted	Text revised accordingly.
3055	1	6	819	819	It is unclear that this decision tree is necessary, or even helpful, but if it stays, we recommend changing the last box to "document the results of the comparison, take steps to assess difference (see box 6.5)." It's inconsistent with the rest of the chapter to say "use estimates in reporting."	United States of America	Accepted	Text revised accordingly.
3057	1	6	827	827	Under Remapping to make national total, the text should note that this step is unnecessary with a gridded inventory. It's also unclear why it is necessary to report differences to the inverse modellers. I'd recommend changing "report preparation" to "documentation"	United States of America	Accepted with modification	Text revised to "Documenting the results of the comparison".
87	1	7	120		We may need to refer to the REDD and REDD+ here (in addition to vol4).	Iran	Noted	No action can be taken because comment is out of scope of 2019 Refinement.

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
133	1	7	98	101	Concerning fuel combustion, in fact, except for coal and maybe HFO (heavy fuel oil), for most other fuels, the thermal-NOx / prompt-NOx is generally more important than the "fuel-NO" bound to the nitrogen in fuel. So the refinement sentence should reflect the general situation. Furthermore, for some countries, the consumptions of coal and HFO represent now minor contributions to the national energy balance. - Original sentence: "Most NOx emissions resulting from fuel combustion are typically 'fuel-NO' that is formed from the conversion of chemically bound nitrogen in the fuel. The content of nitrogen in different fuel varies. Depending on the combustion temperature, thermal-NOx and prompt-NOx can also be formed from nitrogen contained in the combustion intake air." - Possible new sentence : "Generally, NOx emissions may result from 'thermal-NOx', 'prompt-NOx' and/or 'fuel-NO' that is formed from the conversion of chemically bound nitrogen in the fuel. The content of nitrogen in different fuel varies. Depending on the combustion temperature, thermal-NOx and prompt-NOx are more or less formed from nitrogen contained in the combustion intake air."	France	Accepted with modification	This guidance on precursors and indirect emissions is not intended to consider the relevance of any of such emissions. It is up to the inventory compiler to make such assessment. The respective guidance on activity data for any source category is provided in Section 2.1 of Volume 1.
383	1	7	180	182	The methodology for estimation of CO2 added to the atmosphere from indirect emissions and precursor oxidation has not been provided. It is proposed to develop the relevant equation(s) and supporting parameters for estimation CO2 input to the atmosphere from indirect emissions and precursor oxidation. Otherwise this sections should be moved to the annex as an issue for further methodological development.	Russian Federation	Rejected	A method has been provided - see lines 171 to 221.
1015	1	7	51	52	Please delete the first sentence, it is unnecessary and incorrect. Volumes 2 to 5 of the 2006 IPCC Guidelines do not provide GWP-weighted GHG totals. They provide guidance by gas in mass units.	Finland	Accepted	Suggestion implemented as proposed.
1017	1	7	55	63	This text should provide also an introduction to precursors of CO2 (CO, CH4, NOVOCs), which are addressed in the guidance and reasoing for estimating these emissions which is to take to total warming impact of these emissions into account, when compared with emissions of other gases. Please complement - othewise the introduction makes no sense.	Finland	Accepted with modification	Subsection 7.2.1.5 includes the rationale and explanation for indirect CO2 emissions. A sentence was added to introduction stating that the majority of the carbon emitted in the form of non-CO2 species (i.e., CH4, CO, and NMVOCs) eventually oxidizes to CO2 in the atmosphere and this amount can be estimated from the emissions estimates of the non-CO2 gases.

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
1019	1	7	64	67	The text says "The guidance of this chapter is consistent with the use of any radiative forcing metric (e.g. Global Warming Potential or Global Temperature Potential) included in the asessment reports of the IPCC so far and follows the principle to avoid double counting". (see section 7.2.1.5). However, it does not provide guidance to estimate the overall radiative forcing resulting from emissions of greenhosue gases, precursors and indirect emissions". This guidance is missleading and should be improved. Therefore, please change it to read: "The guidance provided in Sections 7.2 to calculate emissions for presursors of CO2 (CH4, CO and NMVOCs) is only applicable when the metric (GWPs or GTPs or other) used to assess the warming impact of these gases do not take into account the impact of the atmospheric conversion of these gases into CO2 in the atmosphere (see section 7.2.1.5)."	Finland	Noted	This is just an introduction. The detailed guidance is provided in the subsections. It would not be a good logic to repeat such detailed guidance already in the introduction. In order to provide the clarity, reference to subsection 7.2.1.5 has been already included in the FD.
1021	1	7	167	170	Please clarify the text and change it to read: Two options are possible to address input of CO2 from CH4 to global warming. If countries use a metric for CH4 that includes the impact of atmospheric oxidation of CH4 to CO2 (such as the GWP and GTP values for "fossil methane" provided in the Appendix 8.A in IPCC 2013), they should not estimate separately the amount of CO2 resulting from atmosperic oxidation of CH4 to avoid double counting the warming impact. If countries use a metric which does not take into account the conversion of methane into CO2 atmospere, countries should apply the methods described below to calculate the amount CO2 from CH4. Countries should transparently document the option used.	Finland	Accepted with modification	The text has been modified building on the suggested text - with slight modifications without change of the story line of the text as suggested.
1237	1	7	101	101	after the phrase 'combustion intake air', add ',as this takes place in typical cases of pulverised coal combustion.'	India	Accepted with modification	At the end of the sentence reference has been included in brackets to the example of pulverized coal combustion.

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
1733	1	7	295	295	There is a description that "the carbon in NMVOC emissions from fueling stations would typically be captured in fossil fuel consumption activity data and therefore in emissions from 1.A." in the column of explanation for 1.B. Fugitive Emissions from Fuels in Table A7.1 (new), but the carbon in NMVOC emissions from fueling stations may not necessarily be captured by the emissions from 1.A. depending on the statistical survey method. If the amount of fuel actually refueled to cars is surveyed for the fuel consumption data, the carbon included in NMVOC emitted from fueling stations is not included in the fossil fuel consumption data used for 1.A. Therefore, we suggest that the description of the explanation in this table be revised by "the carbon in NMVOC emissions from fueling stations might be included in fossil fuel consumption activity data depending on the scope of the statistical survey, and such carbon should be included in emissions from 1.A for those cases".	Japan	Rejected	The common IPCC methodology for estimating CO2 emissions from the combustion of liquid transport fuels is based activity data on fuel sales. The fuel sales will capture all carbon contained. The fugitives are then based on the emission factors provided in the guidelines.
2617	1	7	51	54	The text in section 7.1 is unclear and will create confusion for inventory compilers and reviewers as to the core purpose of inventories, i.e. the direct release of GHGs as a result of human activities. Determining CO2 from the atmospheric oxidation of precursors is an option. This section needs to be clearer in that respect, by unambiguously stating that it is sufficient to estimate GHG emissions from Volume 2-5. Going beyond would exceed the terms of reference for this report.	Canada	Noted	The revision is clear on situations where it would be appropriate to calculate indirect emissions and when it would be inappropriate. The proposed general statement would create additional confusion, rather than reduce it.
2619	1	7	98	99	The main natural source of nitrogen is from air. Air contains 78 to 79% nitrogen. What is fuel NO (what fuel does this apply to)? If technically correct as written, then it should be referenced.	Canada	Accepted with modification	This comment addresses an editorial issue, text has been revised to NOx from NO.
2621	1	7	129	129	Indirect CO2 is not an 'input" to the atmosphere; instead it is formed in the atmosphere from precursors. The use of 'input' to the atmosphere is technically incorrect. Replace "CO2 input to" with "CO2 formation in".	Canada	Rejected	It is noted that the Glossary does not include a definition of indirect emissions. Given the unequal treatment of this term it would be difficult to provide such definition. As there has been no mandate to introduce a coherent concept of indirect emissions/precursors in the whole 2006 IPCC Guidelines, it seems premature to address that comment now. Every suggestion would very likely raise a lot of comments. Furthermore, the focus in 2006 IPCC Guidelines is clearly on the term "input" which has already been extensively used in the 2006 IPCC Guidelines, including in formulas as well as capture to tables. 'Formation' was only kept mainly in those part of the text where this term has already also been used in the 2006 IPCC Guidelines. It would create very likely a range of comments if we start to change terminology already introduced by 2006 IPCC Guidelines without having a specific mandate to do that.
2623	1	7	131	131	Replace 'inputs of CO2' with 'formation of CO2'.	Canada	Rejected	See comment ID 2621 response.

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
2625	1	7	156	156	Replace for both instances, "CO2 inputs to the atmosphere" with "formation of atmospheric CO2 from" to avoid confusion between direct and indirect CO2.	Canada	Rejected	See response to comment ID 2621.
2627	1	7	53	53	The meaning of "indirect" is inconsistent across the report (notably between this section and the chapter on agricultural soils); to avoid confusion use the term precursors rather than 'indirect CO2'.	Canada	Noted	No action can be taken because comment is out of scope of 2019 Refinement.
2629	1	7	165	165	Replace: 'CO2 resulting from emissions of…' with 'atmospheric CO2 formation resulting from the oxidation of ….' to be more specific and clear.	Canada	Rejected	See response to comment ID 2621.
2631	1	7	167	167	Replace 'inputs of CO2' with 'formation of CO2'.	Canada	Rejected	See response to comment ID 2621.
2633	1	7	180	190	Replace 'Inputs CO2' with 'input precursors'. The term 'Inputs CO2' is misleading since this discussion is focused on formation of CO2 in the atmosphere from releases of precursors.	Canada	Rejected	See response to comment ID 2621.
2635	1	7	188	188	Need references and justification to support the default values of 0.6 and 0.85 for NMVOC and which would be applicable for a specific condition since this will vary based on speciation profiles and local atmospheric conditions.	Canada	Accepted with modification	Peer reviewed literature reference added to text as source of default values.
2637	1	7	207	211	Justification (or details from a supporting reference) should be provided for the applicability of the default percentages of mass carbon content presented (i.e., 60%, 85%), considering it can range from 51% to 100% for CH4 (as an example).	Canada	Noted	A method has been provided - see lines 171 to 221. And with respect of justification see response to comment ID 2635.
2639	1	7	208	211	This text: "Boucher et al. (2009) assumes 95% of emitted CO2 is oxidized with a range of 51 to 100 percent", is not very informative, given the range provided and the lack of a time period. : What use is this for compiling inventories? Consider deleting.	Canada	Noted	This reference should be seen as a starting point. If this category is relevant or even key (e.g. after practical phase out fossil fuels) it might be appropriate to base the calculation on more specific and elaborated studies.
2641	1	7	211	214	Bottom line is that oxidation of NMVOC may take from 'minutes to months' and up to years while some species don't get oxidized. How necessary is this to inventory compilers?	Canada	Noted	See response to comment ID 2639.
2889	1	7	64	67	A discussion on radiative forcing. It is very technical and needs to be made clearer and more easier to understand to people who are not involved in climate science. Also please add the term 'radiative forcing' to the glossary.	Estonia	Noted	Noted. No action can be taken because comment is out of scope of 2019 Refinement.
2891	1	7	93	106	Shipping and aviation emissions need a specific mentioning here.	Estonia	Accepted with modification	Navigation has now been mentioned separately in the context of SO2 emissions.
2893	1	7	105	106	In shipping scrubbers are also one way of reducing SO2 in addition to low-sulfur fuels.	Estonia	Accepted with modification	In addition to stationary also mobile sources have been included with specific reference to 'marine'.
3059	1	7	55	56	Are precursors included in GTP-weighted totals? If not, this sentence might be revised to not only refer to GWP.	United States of America	Noted	This might depend - as with GWP. There is no standardized calculation.
3061	1	7	133	134	Add an i.e. to this sentence (i.e., source categories not requiring separate estimations)	United States of America	Rejected	The current wording is clear. Footnote 6 informs on specific cicumstances that would require additional calculation.
3063	1	7	295	296	Table 7.1 needs to be updated to be consistent with new structure of oil and gas fugitives. One option is to just delete the venting and flaring rows in the first column and add the information related to flaring in the last column to the row above it.	United States of America	Accepted	Suggestion implemented as proposed.
3701	1	7	214	214	Brackets around reference should be removed.	Norway	Accepted	Change implemented as proposed.

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
89	1	8	72		from road transportation by its sources depending on	Iran	Accepted	Changes implemented as proposed.
137	1	8	121	122	HFC-1234yf has been included in the examples of hydrofluorocarbons. We suggest to add a precision to explain that HFOs have to be considered in the HFC family. "hydrofluorocarbons (HFCs: e.g., HFC-23, HFC-134a, HFC-152a), including hydrofluoro-olefins (HFOs: e/g/, HFC-1234yf, HFC-1234ze)	France	Accepted	Suggestion implemented as proposed.
139	1	8	129	130	HFCO-1233zd could also be added in the list of examples. It is an HCFO (HCFC with a near-to-zero ODP) recently developed.	France	Accepted	Suggestion implemented as proposed.
141	1	8	108	158	What about possibly including hydrocarbons (e.g. HC-290, HC-600a), as they are progressively used as alternatives of HFCs in refrigeration and air-conditionning applications (and as far as they do have a non zero GWP)?.	France	Noted	No action can be taken because comment is out of scope of 2019 Refinement.
1239	1	8	2A4a	2A4a	Add the sentence 'This should include emission from calcination of clay, bauxite, dolomite, calcite, magnetite etc. in integrated unit'.	India	Accepted	Suggestion implemented as proposed.
1811	1	8	115	115	least one point pick wrongly from new information. In fact, the new footnote 2 in Vol. 1 Chapter 8, Page 8.5 is misleading as Table 8A.1 should not be used (does not include the effects of climate-carbon feedbacks). As a minimum change, it needs to be deleted or replaced by -- Begin Text -- See, e.g., the IPCC Fifth Assessment Report "Climate Change 2013: The Physical Science Basis" by Working Group I, Chapter 8, Table 8.7 and Table 8.SM.16. -- End Text It would be more helpful to inventory compilers if a proper explanation on the proper use of GWP values could be included, either here or by also cross referencing from this footnote -- Begin Text -- Details of the proper use of GWP are provided in xxxx -- End Text -- This text should then include -- Begin Text -- GWP values to compare the effects of other relevant GHG's with those of CO2 have been established by the IPCC. These values can be seen as factors to convert a mass of a given gas into "CO2-eq" mass. Although subject to uncertainty, GWP values are based on clear, traceable scientific methods as described in the WGI AR5; and they are currently the best available methodology to calculate the respective importance of different well mixed greenhouse gases. The use of the latest update of these values in the version "with climate-carbon feedback" (IPCC AR5 Working Group I, Table 8.7 and Table 8.SM.16: IPCC, 2013) is recommended. Note that other main tables in AR5 WGI Chapter 8 list GWP values, but these are not recommended for emissions reporting (e.g., Table 8A.1). Future IPCC Assessment Reports may supersede the values provided therein. Until then, recommended values are 36 for CH4 from fossil sources, 34 for CH4 from biogenic sources (for which subsequently formed CO2 needs not to be accounted for), 298 for N2O,	Austria	Accepted with modification	The footnote 2 has been deleted from Chapter 8. GWPs are defined in the Glossary.
2907	1	8	45	46	Use of CO2: the two examples (CO2 use in greenhouses and soft drinks) given are too specific and can be confusing. These are not discussed specifically elsewhere and can raise questions, for example, about calculating CO2 stored in fizzy drinks. It would be better to say 'for agricultural and industrial use' instead of giving too specific examples.	Estonia	Accepted with modification	The word "greenhouse" has been retained as it is not clear to authors what categories would be applicable in agriculture other than this application. Industry has been proposed in place of soft drinks and other processes.

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
3065	1	8	71	73	We assume lines 71-73 refers to road transport which crosses national borders? If it is accurate, the text should be clarified to read as such. Lines 71-73 currently could be understood to imply that a production, vs consumption, approach should be applied to road transport emissions.	United States of America	Accepted	Changes implemented as proposed.
3067	1	8	91	96	It would be helpful if the guidance were clearer on where removals are removed. For example, if biogenic carbon is captured from an ethanol plant, it is clear per the guidance that if the CO2 storage meets the requirements, it can be deducted from the inventory, but where?	United States of America	Accepted	Issue addressed by adding the folowing sentence "In the Energy Sector however, these emissions are reported as memo items. If CO2 emissions from biomass combustion or energy production are captured, Energy Sector inventory compilers should ensure that these captured emissions are subtracted from the amount of CO2 estimated in AFOLU as part of net carbon stock changes".
3069	1	8	97	99	Note that CO2 is reported as an information item in Energy, and that Non-CO2 from biomass combustion for energy and biomass energy fugitives are both reported under energy.	United States of America	Accepted	Text revised to highlight that CO2 combustion emissions are also reported in the energy sector as memo items. And also included the treatment of non-CO2 fugitive emissions from biofuel production.
3071	1	8	238	239	Table needs a row for post-meter emissions in 1.b.2.b	United States of America	Accepted	Row added as proposed.
3703	1	8	110	118	The Norwegian Environment Agency has recently performed a screening study on the potential occurrence of emerging substances to the Arctic environment. Many of the compounds have been selected for the study as they have been identified as chemicals of emerging concern in a recent report from the Arctic Monitoring and Assessment Programme (AMAP Assessment 2016: Chemicals of Emerging Arctic Concern, 2017). As one of the main findings of the study, five volatile fluoroorganic and related compounds (as listed under) were detected in Arctic air for the first time. Several of these compounds, which are by instance used as liquids in chemical industry and medical applications, have not been found in environmental samples before. The detection of these compounds in Arctic air samples is a potential indication of long-range transport and persistency. In addition, these compounds have no sink in the lower atmosphere and they have a strong IR-absorbance, which together make it very likely that they can act as long?lived greenhouse gases. Please take those information into account and consider to include those compounds in the assessment. A report summarizing the findings of the study will be published in a couple of weeks. The substances in question are: PFPHP - Perfluoroperhydrophenanthrene (Vitreon, Flutec PP 11) - CAS 306-91-2, PFTBA - Tris(perfluorobutyl)-amine (FC-43) - CAS 311-89-7, TCHFB - 1,2,3,4?Tetrachlorohexafluorobutane - CAS 375-45-1, DCTFP - 3,5-Dichloro-2,4,6-trifluoropyridine - CAS 1737-93-5, DCTCB - 1,2-Dichloro-3-(trichloromethyl)benzene - CAS 84613-97-8	Norway	Accepted	The authors thank the reviewer for highlighting these new F-gas observations. The electronics authors recognize PFTBA as a popular heat transfer fluid used in electronics manufacturing. Although the compound's GWP and atmospheric lifetime have not been published in the peer-reviewed scientific literature, research by the manufacturer, as well as the compound's perfluorinated structure, indicate that it has a very long atmospheric lifetime and a 100-year GWP near 10,000. Guidance on estimating emissions of this and other fluorinated liquids is provided in Chapter 6 of the Refinement. Research into the other compounds indicates that they are used in a variety of applications, some of which are addressed in the 2006 IPCC Guidelines. For example, PFPHP is used in cosmetics and medical applications, whose emissions of perfluorinated compounds are addressed in Volume 3, Section 8.3 of the 2006 IPCC Guidelines (Use of SF6 and PFCs in Other Products). The authors will note the other substances as potentially of interest for future IPCC research.
573	1	Annex 1	51	51	Either "updated by adding a paragraph" or "updated by adding paragraphs" [not "updated by adding paragraph"]	New Zealand	Accepted	Corrected.

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
575	1	Annex 1	72	72	Suggest "of" is replaced by "to" in the phrase "approaches of data collection" becoming "approaches to data collection"	New Zealand	Accepted	Corrected.
577	1	Annex 1	95	95	"Refinements undertaken for chapter 3 involves a series of updates" should be "Refinements undertaken for chapter 3 involve a series of updates" ("involve" is singular)	New Zealand	Accepted	Corrected.
579	1	Annex 1	127	128	First row in the box, question the inclusion of "source" before "category" as there are sink categories as well. Suggest delete "source":"Example of reducing uncertainty in a category by adopting higher tier methods"	New Zealand	Accepted	Source' deleted.
581	1	Annex 1	156	157	In the last four rows of the table it would be more correct to say "Finland's GHG inventory" rather than "the Finnish GHG inventory"	New Zealand	Accepted	Finland's used instead of Finnish.
583	1	Annex 1	159	159	Same as comment for line 95: "involve" not "involves"	New Zealand	Accepted	Corrected.
585	1	Annex 1	161	161	Suggest "provision of "guidance" rather than "provision of text"	New Zealand	Accepted	Corrected.
587	1	Annex 1	162	162	"become" not "becomes"	New Zealand	Accepted	Corrected.
589	1	Annex 1	187	188	Insert "for" before "methane" in the third line of the table: "overlap method for methane", and before "direct" in the last line of the table: " for direct soil N2O emissions"	New Zealand	Accepted	Corrected.
591	1	Annex 1	221	221	Word missing in the phrase: "background science precursors and indirect emissions". Suggest "background science on precursors and indirect emissions" and then the language will match that in the overview Chapter, line 249	New Zealand	Accepted	Corrected.
851	1	Annex 8A.2			A consistent approach should be taken for the header on Table A Summary Table (1 of 6) through to Table A Summary Table(6 of 6) (pages T4 to T9) in that NF3 should be in the header regardless of whether the sectors/categories listed are sources of NF3. If the sector/category isn't a source of NF3, then it is shaded out. We see Table A Summary Table as being one table that is split into 6 parts, not as 6 separate tables.	New Zealand	Accepted	Changes implemented as proposed.
853	1	Annex 8A.2			Similar to the above comment, a consistent approach should be taken for the header on Table B Short Summary Table (1 of 2) and Table B Short Summary Table (2 of 2) (pages T11 and T12) in that NF3 should be included in the header regardless of whether the sectors/categories listed are sources of NF3. If the sector/category isn't a source of NF3, then it is shaded out. We see Table B Short Summary Table as being one table that is split into 2 parts, not as 2 separate tables.	New Zealand	Accepted	Changes implemented as proposed.

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
1023	1				General comment on Vol. 1: The guidance in Vol.1 is related general and crosscutting issues, sectoral guidance is given in Volumes 2 to 5. General and crosscutting guidance should include "good practice" sparsely as detailed guidance is given in the sectoral volumes which can better reflect the specificities involved with the estimation and documentation of emissions/removals, and also for ensuring consistency of the guidance. We note that this is the case for most chapters and sections in Vol. 1. However, the sections 6.12.4 to 6.12.7 on how to choose, apply and document the use models in inventory preparation include many good practice sentences, many relevant only in special circumstances. Please evaluate the general applicability the good practice guidance given, and revise accordingly .	Finland	Noted	Section 6.12 has been included to provide specific guidance on reporting use of models in certain cases.
1557	1		193	253	Would inverse models correct uncertainty issues? Inverse models seems to suffer from cross contamination.	Saint Lucia	Noted	All elements of comparison with atmospheric concentrations have inherent uncertainty associated with them. Therefore, these uncertainties should be quantified and reported for transparency.
2885	1				It is good to see an increased number alternative approches to collecting/measuring/estimating GHG data that is likely to lead to more precise outcome.	Estonia	Noted	Chapter 2 documents approaches to collection, estimation of activity data.
91	2	2	58		counting. Emission reduction or changes following of forest management (REDD and REDD+) needs to be mentioned here.	Iran	Rejected	REDD projects are outside of the scope of the IPCC national GHG Inventory guidelines, and their mention in the energy volume would likely confuse Energy compilers. The current text has the right level of detail. Additional detail on AFOLU methods can of course be found in the AFOLU volume.
93	2	4	2563		to charcoal (FAO, 2016) natural forest and forest plantation as wood for energy may differ in its productions, and most of the remainder was	Iran	Accepted	
149	2	4	1829	1829	The tier 1 EF for 1B2aiv from table 4.2.4c for non-combustion CO2 from oil refining is : 5.85 t CO2 / 1000m3 refined oil (within the confidence interval [2.9 ; 13.5]. According to reported IEF from Parties in 2018 CRF table submissions for 1B2aiv, we can see that among e.g. 5 Parties (4 member states and one other developped country) the IEF are bewteen 2 and 67 t/1000m3 refined oil (2; 13; 35 (FR); 41; 67). This present dispersion is widely over the maximum value of the confidence interval of the IPCC tier 1 proposed EF. The explanation of such situation is certainly due to the issue of the reporting of catalyst regeneration. For France, we currently report it in 1B2aiv (that may not be the case currently for all Parties). We can see that for the new 2019 IPCC refinements, it is recommended to report catalyst regeneration emissions in 1A1b. So the IPCC 2019 refinements should bring more reporting harmonisation. Can you confirm the analysis of this issue? Furthermore with the 2019 refinements, flaring and venting will be gathered within 1B2aiv which will make reporting more simple and harmonised.	France	Noted	Yes, box 4.2.2 explains, that catalyst regeneration is a thermal process and heat is used within the refinery. Therefore such emissions should be reported under 1.A.1.b. It can also be confirmed that flaring and venting are now included in 1.B.2.a.iv. Comparing CRF tables - especially in this segment - may lead to misinterpretations. To stick with your example: France reports fugitive CO2 emissions in the same range as Spain and the USA (all 2000-4500 kilotons) while Canada and Denmark reports a thousandth or even hundred thousandth part (5 to 1000 tons). This cannot only be explained with refinery capacity or used technology. As all countries passed the UNFCCC reviews several times, it seems to me that some countries included certain emissions here whereas others reported them under 1.A.1.b, 1.B.2.c or 1.B.2.d or even anywhere else. A comparison is not quite appropriate.

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
151	2	4	2577	2579	The 2019 IPCC refinements recommend : "The fugitive CH4 and N2O emissions from production of biochar to be used for energy purposes would be reported in the Energy volume, while those emitted during the biochar produced that is applied in agriculture sector would be estimated and reported following the methodologies set out in the AFOLU volume". This choice is quite unusual compared to the general principle of emission inventory to estimate and report emissions relating to the source (emitting activity) and not relating to the end user of the product (except for actual emissions from the activities of the user). It is also unusual compared to the other principle of reporting the related emissions during the year when it is emetted. These two main principles would be no longer followed in the case of biochar applied in agriculture soils. So it would be more simple and more consistent with the usual "source oriented" approach to consider instead : "The fugitive CH4 and N2O emissions during the production of biochar are to be considered and reported in the Energy volume whatever the final uses of biochar (energy purposes or agriculture soil uses). Consistently, the AFOLU volume would need to be reviewed concerning the calculation of carbon capture relating to biochar uses for agriculture soils. Maybe flexibility could be introduced, and the 2 possible options could be considered?	France	Accepted with modification	Clarifying text on reporting added.
385	2	1	62	63	Figure 1.1: It is proposed to increase the size of the figure, because it is almost impossible to read it.	Russian Federation	Accepted	Figure size increased.
387	2	4	401	401	Equation 4.1.2: It is recommended to provide the default fraction of CO2 in the recovery gas, otherwise it is impossible to estimate emissions from underground coal mines as recommended by the Equation 4.1.2.	Russian Federation	Accepted with modification	the amount of CO2 contained in the recovered gas shoud be determined in a similar way as how the volume of methane recovery and utilization in Equation 4.1.2 is obtained, and there may be 3 approach options for the potential users to choose based on whatever sources they could get.
389	2	4	471	472	It is proposed to clarify description of Tier 1 approach to indicate that it provides global average method for calculation of methane emissions from underground mines before correction for methane utulization and flaring. The present text of Tier 1 description is misleading.	Russian Federation	Rejected	No action can be taken because comment is out of scope of 2019 Refinement.

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
391	2	4	990	996	The use of augmentation of coal reserves as activity data for estimation of methane emission from exploration boreholes has a fundamental problem, because it may result in underestimation otherwise overestimation of the emissions. The underestimation may occur, if there is no proved increase (augmentation) in coal reserves despite of the number of boreholes constructed. The overestimation may be a case when significant increase in coal reserves will be associated with a few boreholes constructed, because it is unlikely that these boreholes will be sources of significant methane emissions, given the fact that the methane is mainly adsorbed in coal deposit, and only minor part of it will release through the borehole. It is recommended that the authors reconcile methodological approach for exploratory emission estimation in a view to collect the information on specific methane emissions per exploratory borehole and provide these as default emission factor for Tier 1.	Russian Federation	Accepted with modification	This section has been moved to the appendix for future methodological development.
393	2	4	1843	1870	Sub-section 1 B 2 a vii Abandoned Oil Wells provides methodology and default emission factors for greenhouse gas emission estimation from both abandoned oil and gas wells. With this, the section title (Abandoned Oil Wells) and caption of Table 4.2.4E are inconsistent with textual content. It is proposed to change the title of sub-section 1 B 2 a vii and the caption of table 4.2.4E to include the refrence to gas wells otherwise remove reference to gas from the sub-section and develope a separate sub-section with the guidance on estimation of greenhouse gas emissions from abandoned gas wells.	Russian Federation	Accepted with modification	From one hand, changing of name of the sub-section would lead to categories structure inconsistency. From another hand, developing of a separate sub-section on abandoned gas wells would duplicate the current sub-section. For that reasons, accent has given to oil wells in the text.
395	2	4	1975	1975	The reference to oil production is irrelevant to natural gas production and gathering as described in section 1 B 2 b ii. It is proposed to remove it from line 1975.	Russian Federation	Accepted	
397	2	4	1999	2005	The text in paragraph in lines from 1999 to 2005 refers to oil wells and it is irrelevant to natural gas production and gathering as described in section 1 B 2 b ii. It is proposed to remove this paragraph from this sub-section.	Russian Federation	Accepted with modification	The text refers to both oil and gas wells and is relevant here as it discusses how to determine which wells are included in which category (oil versus gas). Some edits were made to try to make the text clearer.
399	2	4	2013	2013	Equation 4.2.14: The equation includes methodology for estimation emissions from onshore coalbed production that has not been described in sub-section 1 B 2 b ii. It is recommended that the authors provide the description of methodology for estimation GHG emissions from onshore coal bed production in sub-section 1 B 2 b ii. Otherwise the estimation approach should be removed from the Equation 4.2.14.	Russian Federation	Accepted	While noting that rows 2004 to 2007 already describe approach for estimation of emissions for onshore coal bed methane production, have also added text in row 1985 noting that factors for onshore coal bed methane are also available in Table 4.2.4G. Also clarified in Row 2036 that the term is "Volume of onshore coal bed methane produced, and likewise in Row 2037 "Emission factor for onshore coal bed methane production"

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
401	2	4	2027	2028	Table 4.2.4G: The table includes default emission factors that differ notably from the parameters provided in the 2006 IPCC Guidelines, making it impossible to compare the estimates made with the use of them. Besides, new emission factors combine several activities that have been previously considered separately, which provides for another comparability problem. It is recommended that the authors address inconsistency between the emission parameters in the 2006 IPCC Guidelines and in the 2019 Refinement and justify the rationale for the use of the new factors provided.	Russian Federation	Rejected	In terms of the categories included in the 2019 Refinements, the text is very clear on which activities are included, and the categories are consistent to the extent possible with the 2006 categories. To do a detailed comparison with the 2006 guidelines, one could review the appendix, which gives the approximate split between venting, leaks, and flaring emissions for each subsegment. It is also possible to sum the leak, venting, and flaring information from the 2006 IPCC guidelines to compare with the updated values in the 2019 guidelines. In the text where the Tier 1 factors are first discussed, the following text provides information on use of the new factors: "The factors in Tables 4.2.4 to 4.2.4k are derived using detailed emission inventory results from the United States, Canada, Australia, Germany, and other countries, and, where possible, have been updated from the values previously presented in the IPCC Guidelines for National Greenhouse Gas Inventories (2006) document to reflect the results of more current and refined emissions inventories. In many cases, technology- and practice-specific emission factors are presented, so that an inventory compiler may select factors that best represent industry practices in the country. While the emission factor options are meant to cover technologies and practices that are common in the oil and gas industries, technologies and practices can vary significantly. In addition, the accuracy of factors is dependent on the uncertainty of underlying data. A country should periodically assess changes in technologies and practices, and changes in available emissions data, and
403	2	4	2119	2131	Equation 4.2.16: Obviously, the authors make an assumption that annual gas storage is equal to annual gas consumption, which may not be the case for many countries. It is proposed that the authors reconcile the assumption on the basis natural gas consumption data otherwise provide more clear rationale for the assumption made.	Russian Federation	Accepted	Text added clarifying why consumption is used for the activity basis, and what to do if better data are available.
405	2	4	2172	2177	Equation 4.2.17: The legend for the equation is not included. It is recommended that the authors include the legend for the Equation 4.2.17.	Russian Federation	Accepted	
407	2	4	2205	2205	The identification of the parameter is misleading. It is recommended that the authors identify the parameter as the volume of gas consumption at industrial plants and power stations.	Russian Federation	Accepted	Rechecked parameters in the legend and equation and made corrections.
409	2	4	2290	2291	Table 4.2.7: Table caption is inconsistent with its content. It is proposed that the authors replace the caption with the list of activity data that seems more appropriate than the guidance on activity data obtaining.	Russian Federation	Accepted	
411	2	4	2642	2643	Table 4.3.3: Table 4.3.3 is inconsistent with Table 4.3.2, because different uncertainties are provided for the same emission factors. It is recommended that the authors merge uncertainties in tables 4.3.2 and 4.3.3 and remove table 4.3.3 from the text of the refinement.	Russian Federation	Accepted	Table 4.3.3 is removed.

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
413	2	4	3217	3217	It is recommended that the authors edit text in line 3217 to avoid repetition.	Russian Federation	Accepted	
415	2	4	3181	3189	The harmonization of the units is very important, and it is commendable that the authors address it in the Refinement. However, Annex 4A.1 does not include the values of correction factors referred to in Equations 4A.1.1 (K15), 4A.1.2 (K60/60) and 4A.1.3 (KAPI). The absense of the correction factors makes it impossible to harmonise the units and the entire Annex 4A.1 looses the importance. It is recommended that the authors provide values of correction factors referred to in Equations 4A.1.1 (K15), 4A.1.2 (K60/60) and 4A.1.3 (KAPI).	Russian Federation	Rejected	There are around 30 pages of values of parameters used in Equations 4A.1-4A.4. Including these pages in the GLs is not reasonable. The references on documents, from which the parameters may be taken, are provided.
859	2	4	1776	1780	When hydrogen is produced as a by-product in refineries, Box 4.2.1 explains that it is good practice to report the GHGs in the Energy sector and its methodololy can be adopted from Ch.3.11 Vol.3(IPPU). - However, no appropriate methodology is provided in Ch.3.11 Vol.3. It is necessary to explain a detailed estimation methodology including the selection of activity data, default EFs, etc. in a proper volume. - Also in the chapter3.33 Vol3(line 1254, Table 3.29, Notes2 and Box 3.16) it is described that the emissions are typically already accounted for the respective sectors. Therefore it should make clear whether the emissions from producing hydrogen in refineries are needed to estimate additionally using IPPU methodology and report to energy sector or already accounted for the energy(fugitive)	Republic of Korea	Accepted	Clarifying language provided.
861	2	4	2208	2208	The table 4.2.5 is omitted(table 4.2.5 is quoted in Ch.4, Vol2, Line2888, 2909)	Republic of Korea	Rejected	Flaring-specific uncertainty values are from the 2006 GL. They are not available in the 2019 Refinement.
863	2	4	2703	2703	It is impossible to recognize letters in Figure 4.3.2. Please revise the figure.	Republic of Korea	Accepted	
865	2	4	2720	2721	In the table 4.3.4 because flaring of COG in coking stage is separated in comparison with the second draft, " from any flaring of the COG produced" should be deleted in source and significance of fugitive emissions	Republic of Korea	Accepted with modification	The text "(COG flaring is covered in a separate line below)" was added for clarification.
867	2	4	2720	2721	In the table 4.3.4 carbonisation process emissions in coking stage should be reported in1.A.1.c(energy) instead of 2.C.1(IPPU).	Republic of Korea	Accepted	
869	2	4	2720	2721	In the table 4.3.4. in 'flaring of COG' and 'coking' stage, reporting non-flaring fugitive needs to be changed from 1.b.1.c to NO, and flaring from NO to 1.b.1.c.	Republic of Korea	Accepted	
871	2	4	2722	2722	It is very difficult to recognize letters in Figure 4.3.3. Please revise the figure.	Republic of Korea	Accepted	
873	2	4	2721	2817	The usage of different expressions such as BOFG, LDG, and converter gas for the same gas is very confusing. A consistent expression will make readers more easily understand the guideline. Furthermore, it is necessary to write together their full names (i.e. Basic Oxygen Furnace Gas, Linz-Donawitz Gas).	Republic of Korea	Accepted	
875	2	4	2812	2812	Please revise a typo "upto" to "up to".	Republic of Korea	Accepted	

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
877	2	4	2832	2832	Please revise an error "Table 4.3.6" to "Table 4.3.7".	Republic of Korea	Accepted	
879	2	4	2919	2919	Please revise a typo "double counting are" to "double counting is".	Republic of Korea	Accepted	
881	2	4	2949	2949	It is written that "Current production levels … 120 million tons of CO2 equivalent.", however, it is unclear on what year and reference the current data is based. Please state clearly in the guideline on its reference doument and year.	Republic of Korea	Accepted with modification	The reference has been moved from the footnote into the text)
883	2	4	2999	2999	Please revise a typo "Do country-specific EFs exists?" to "Do country-specific EFs exist?".	Republic of Korea	Accepted	
885	2	4	3127	3127	Please delete a repeated phrase "it is good practice charcoal and biochar production:".	Republic of Korea	Accepted	
887	2	4	3849	3876	The references for Appendix 4a.2 are provided at lines 3849-3876, however, all but World Bioenergy Association (2018) are already included in the References for wood pellet production at lines 4150-4176. Please delete repeated references and merge World Bioenergy Association (2018) into the References for wood pellet production.	Republic of Korea	Accepted	
889	2	4	3886	3886	Please revise an error "please see Section 4.2.2.3 of Volume 2, Chapter 1" because there is no such phrase in Vol.2, Ch.1.	Republic of Korea	Accepted	
891	2	4	3921	3921	Please revise errors "Figure 4.3.5" and "Subsection 4.3.2.1.1" to "Figure 4.3.7" and "Subsection 4.3.2.2", respectively.	Republic of Korea	Accepted	
947	2	Annexes	14	14	Annex1: It is suggested that “Surface Mines” be replaced by “Exploration”.	China	Accepted	
949	2	Annexes	43	49	Annex1:It is noted that the "worksheets" for oil and natural gas systems have substantially changed in terms of the classification of emission sources as compared with the 2006 edition, which (including the CRF tables in the current national inventories of Annex I Parties to the Convention) requires that the three sources of flaring, venting and leakage emissions be calculated separately for oil and natural gas systems, among which leakage emissions is further subdivided into different segments, while the "2019 Refinement" makes a consolidated calculation with the aggregated emission factors directly under the segments of oil and natural gas systems, that is, flaring, venting, leakage emissions are no longer reported separately. This is not only a change in accounting methodology, but also a change in the requirements for or contents of future inventory information reporting. So it is suggested that the author briefly explain the reasons for this change where appropriate in "4.2 FUGITIVE EMISSIONS FROM OIL and NATURAL GAS SYSTEMS" for the sake of users' understanding and acceptance.	China	Accepted	Explanation included in 4.2.4. The mandate of the refinement was the develop technology-specific tier 1 emission factors. To do so, the best data available does not have a clear distinction between leaks, venting, and flaring (though the authors do make a best estimate of this split in the annex). To maintain consistent reporting between the tiers, the table has been revised. It is the view of the author’s that this new formulation allows for clearer and more accurate reporting.

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
951	2	Annexes	32	33	Annex2:This passage does not fully reflect "Fugitive emissions from mining, processing, storage and transportation of coal". So it is suggested that "and on carbon dioxide (CO2) emissions from underground mines." be replaced by "and on carbon dioxide (CO2) emissions from underground and surface coal mines." In addition, please modify Lines 255-257 in the Overview by referring to the above.	China	Accepted	
953	2	4	938	1131	"4.1.6 Coal Exploration" does not offer enough literature support or data availability to come up with a scientific, reliable and operable methodology. There are three main problems as follows: First, there is a lack of literature support: 1) The relationship between the annual augmentation of coal resources and the fugitive emissions from coal exploration. It is true that the annual augmentation of coal resources is easier to obtain than the exploration borehole data (see 964-965 for details). However, section 4.1.6 does not provide any valid literature to prove that there is a positive or linear relationship between the annual augmentation of coal resources and the fugitive emissions from coal exploration. So it is not scientific enough to use the annual augmentation as activity data to calculate the emissions. The Tier 2 and Tier 3 approaches have the similar defects. 2) The default emission factors of Tier 1 Approach are not supported by any literature. It is merely said that they are based on expert judgment (see 1036-1037 for details), without producing any valid documentation. The relevant information about the experts involved and their professional background, logical basis for judgment, whether the results of expert judgment are peer-reviewed or externally recognized is not clear or transparent. Second, the Tier 1 Approach has weakness in methodology: Tier 1 Approach counts up the annual augmentation of 'proved resources, indicated resources and inferred resources' as activity data, and applies them with the same emission factor without any distinction. However, according to line 1095-1099, there are significant differences in spacing of exploration boreholes between the three categories of resources and their	China	Accepted	Text has been moved to an appendix. Additionally the decision tree has been corrected.
955	2	4	1032	2724	Figures 4.1.4, 4.3.2 and 4.3.3, which are not clear due to low resolution, are suggested to be modified and improved.	China	Accepted	
957	2	4	1351	1352	This version updates the "decision tree" in Figure 4.2.1. In the old version, the decision tree was given to natural gas and oil systems respectively, while in the new one, the decision trees are merged. However, the decision trees in 4.1 and 4.3 of the report are given separately by the emission source type. So it is suggested to keep 4.2 structurally consistent with 4.1 and 4.3.	China	Rejected	The current version of the "decision tree" is compiled for better representation of oil and gas industry taking into account updated Annex 4A.3 (Definition of terminologies used in Section 4.2). Unification of two separated for oil and gas "decision trees" aimed to avoid duplication similar procedures of decision making, and hence to avoid extra volume of the Guidelines.
959	2	4	2053	2054	It is mentioned here that the fugitive emissions from gas production process will be considered in Section 4.3, which (P100, lines 2553-2555), however, states that no gas methodology is specifically provided. Please give it a check and explanation.	China	Accepted	

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
961	2	4	2602	2603	The unit of emission factors, which is not clearly expressed, is suggested to be modified as: Emission factor GHG = emission factor GHG (g GHG/kg charcoal(or biochar) produced)	China	Accepted	
963	2	4	2885	2889	It is noted here that the N2O emission factor is cited from Table 4.2.5 of Volume 2 of the 2006 Emission Inventory, which, however, has been updated as Table 4.2.4G (P74, Chapter 4, Volume 2 in the 2019 Refinement. So it is suggested to make a revision as such.	China	Accepted	
965	2	4	2891	2892	Table 4.3.7: 1) The multiplier (x sign) in the equation containing the N2O emission factor should be a divisor (÷ sign). So a check is requested. 2) The equation for calculating the CH4 emission factor lacks the calorific value and density parameter of COG and the method for K calculation. Such an addition is requested.	China	Accepted	Numbers and formulas has been corrected
1025	2	4			General and crosscutting with IPPU, also Waste: Some fuel transformation processes use the same processes (gasification) and feedstock which are addressed in the IPPU sector (hydrogen production). Some guidance how to avoid double counting of emissions would be useful. Also reference between the sector in places where double counting could be an issue would be useful. The guidance should clarify the basic principles of reporting emissions, energy use in Energy sector, non-energy use in the IPPU sector. This is especially important as sometimes it is not that clear how and where the related emissions should be reported.	Finland	Accepted	Clearer guidance has been provided on hydrogen, refineries, and coke production to clarify reporting and double counting issues.
1027	2	4	2178	2178	Table 4.2.4J: Please add emission factors per gas distributed for town gas distribution (as alternative choice for EFs per km of pipeline) as this would make calculations easier.	Finland	Rejected	No sound data is available to generate a good emission factor.
1029	2	4	2614	2614	Please check if is this correct, seems a little bit surprising: "Kilns with lower efficiency tend to have lower emission factor and vice versa."	Finland	Accepted	
1031	2	4	2891	2891	In Table 4.3.7. calculated N2OEF (9.76 E-06) does not correspond to the formula shown; probably numerator and denumerator have changed places. Please check and correct if necessary.	Finland	Accepted	Numbers and formulas has been corrected
1033	2	4	3044	3044	In Table 4.3.10. the emission factors for different CtL gas types show very different magnitudes: please check.	Finland	Accepted	The EFs were reviewed and fixed for Syngas/H2 and SNG, as well as for GTL in Table 4.3.11
1035	2	4	3232	3232	In Table 4A.2.5 percentages of the second subcategory do not add up to 100%; please correct.	Finland	Accepted	Added a footnote
1037	2	4	3818	3818	In Figure 4a.2.2 Burner startup emissions are shown as potential emission sources for a typical pellet plant. These emission should not be allocated under sector 1B, but under 1A (emission from fuels used by the dryer burners). Please correct.	Finland	Accepted	
1231	2	Annexes	40	40	For Annex 1, under table 1.B.1.c in the row of 'Code', the title of 4th Column should be 'Activity Data', instead of 'Activity'.	India	Accepted	
1233	2	Annexes	45	45	For Annex 1, under table 1.B.2 in the row of 'Code', the title of 4th Column should be 'Activity Data', instead of 'Activity'.	India	Accepted	
1235	2	Annexes	48	48	For Annex 1, the title of the 4th Column should be 'Activity Data', instead of 'Activity'.	India	Accepted	
1247	2	4	54	54	Add 'and' between 'Overview' and 'description'.	India	Accepted	

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
1249	2	4	101	101	Add ':' after 'Tier 2'.	India	Rejected	This comment is rejected as the wording in equation 4.1.11 refers to the "approach", i.e.., "tier 2 approach"
1251	2	4	103	103	Replace '-' with ':'.	India	Noted	This is out of scope of the 2019 Refinement
1253	2	4	257	257	Add 'left over coals in' before 'abandoned coal mines..'.	India	Accepted	
1255	2	4	326	326	Coalbed' is one word. Remove any space between 'coal' and 'bed'.	India	Rejected	Based on an internet search, both spellings are acceptable.
1257	2	4	328	328	Replace 'understanding strata geophysics' with 'obtaining core samples for resource estimation and, investigation of various chemical and geo-mechanical parameters essential for designing the resource recovery (may be coal by mining or CBM through production wells)'	India	Accepted with modification	Have inserted text with minor modification in order to maintain original purpose of the sentence.
1259	2	4	329	329	Coalbed' is one word. Remove any space between 'coal' and 'bed'.	India	Rejected	Based on an internet search, both spellings are acceptable.
1261	2	4	356	356	macropores' is a single word. No space needed between 'macro' and 'pores'.	India	Accepted	
1263	2	4	358	358	Add a '-' between 'hydro' and 'fracturing'.	India	Accepted with modification	Changed to hydraulic fracturing
1265	2	4	387	387	in situ' should be in italics.	India	Accepted	
1267	2	4	414	414	Correct 'subtraction' to 'substraction'.	India	Rejected	"Subtraction" is correct. "Substraction" is not a word in the English dictionary.
1269	2	4	794	794	Correct 'exept' to 'except'.	India	Accepted	
1271	2	4	804	804	Correct 'referrs' to 'refers'.	India	Noted	This is out of scope of 2019 Refinement, however this will be modified as typo after IPCC-49.
1273	2	4	896	896	Delete the phrase 'and inventory year'.	India	Noted	This is out of scope of the 2019 Refinement
1275	2	4	1077	1077	Remove '-' between in and situ	India	Accepted	
1277	2	4	1079	1079	Remove extra dot after etc.	India	Accepted	
1279	2	4	1178	1178	Coalbed' is one word. Remove any space between 'coal' and 'bed'.	India	Rejected	Based on an internet search, both spellings are acceptable.
1281	2	4	1229	1229	Replace 'capstone' with 'caprock'.	India	Accepted with modification	Both definitions are correct.
1381	2	4	2632	2642	The title of Table 4.3.3 reads "DEFAULT UNCERTAINTY ASSESSMENT FOR EMISSION FACTORS FROM CHARCOAL PRODUCTION". However, the uncertainty values differ significantly from the uncertainty ranges provided in table 4.3.2. Also, while the text above table 4.3.3. talks about activity data uncertainty, Line 2641 reads: Table 4.3.3 provides the uncertainties associated with charcoal production. Thus, there seems to be a mismatch between the informatio and especially concerning what table 4.3.3 displays.	Sweden	Accepted	Table 4.3.3 has been removed. Suggestion taken and sentence on double counting added.

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
1453	2	2	46	79	It would be most useful to include in this section "new guidance" in a box, for information purposes only, similar to that in Box 2.0A of Chapter 2, Volume 4 (AFOLU). This is because IPCC guidelines on biomass are often applied or referred to outside of the NGHGI context, for example life cycle analyses or biomass projects. Many of those applications would be usefully informed by guidance similar to that in Box 2.0A mentioned above. It could point out the potential implications arising from differences in system boundaries, sectoral boundaries, timeframes and the like. Such guidance would recognise the important role the IPCC guidance already plays beyond its immediate purpose, and could help practitioners adapt it to other contexts, avoiding the inadvertant misapplication of methodologies.	EU	Rejected	The revised text elaborates on (but does not change the meaning of) the information previously presented in the bullet points, in this section of the 2006 IPCC guidelines. There is no need to highlight this information in a box, which was already accepted to be presented in bullet format. The additional information requested by the commenter is outside of the scope of this section which deals specifically with the treatment of biomass. Any more general information on the use of IPCC guidelines can be found in Volume 1.
1835	2	4	449	450	"Low temperature oxidation of coal..." would read better than "Coal low temperature oxidation..."	United Kingdom (of Great Britain and Northern Ireland)	Accepted	
1873	2	4	3127	3127	Delete one instance of "Charcoal and biochar production: it is good practice". It is said twice	United Kingdom (of Great Britain and Northern Ireland)	Accepted	
2643	2	4	2063	2065	Section states: "If none of the proposals works, a value of 32% sour gas can be applied". As stated in the footnote, the 32% value is taken as the average of the Germany (40%) and Austria (25%) sour gas shares. Given that the two countries combined produce about 0.3% of total world gas production, the suggested value of 32% is not representative of world conditions. This is also overly prescriptive for the guidelines. Suggest removing this sentence and the accompanying footnote.	Canada	Rejected	I totally agree that using this split factor should not be the very first option and the value is not representative to the whole world. However, the two sentences above explain, that compiler should attempt to determine the fraction of the gas using nationally available statistics or industry information. If no data is available, the fraction should be assumed by comparing with adjacent countries or taken from the study provided. The split factor in the footnote should be used if all other attempts fail.
2645	2	4	2290	2291	Table 4.2.7 is titled "Guidance on obtaining the activity data values required …" but it doesn't offer any guidance. It simply lists the activity data values previously discussed for each industry segment. Suggest deleting "Guidance on Obtaining the" from the table title.	Canada	Accepted	
3073	2	4	843	845	Column one, row four of updated Table 4.1.7 refers to an Equation 4.1.10. However, there is no such numbered equation in the draft. The equation numbering skips from Equation 4.1.8 directly to Equation 4.1.11, omitting numbers 4.1.9 and 4.1.10.	United States of America	Rejected	Numbering of equations and tables corresponds to the IPCC 2006 Guidelines

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
3075	2	4	937	1131	The draft method for coal exploration (4.1.6) is unsupported and should be moved to an appendix for further development. The draft Tier 1 method does not provide any technical support for the activity data to be used. In particular, no technical support is provided for the assertion that there is a positive correlation between the augmentation of national coal resource in a reporting year (i.e., the discovered coal reserves during the reporting year) and the number of exploration boreholes drilled during the reporting year. The draft narrative itself acknowledges that "the spacing of boreholes depends on the geological structure, deposit character, nature of data required for mine planners etc." (lines 978-979). The draft Tier 1 method also presents no technical support for the default emission factors used in the method, ascribing their basis to "expert judgement". No explanation is provided for the technical basis underpinning the "expert judgement" used in establishing these emission factors. In contrast, the narrative of the draft acknowledges that the release of gas from a coal seam is highly dependent on gas desorption parameters (lines 1022-1031). Overall, no technical support is provided for either the validity of the activity data (coal resource augmentation as a proxy for number of exploration boreholes) or the validity of the emission factors (m3 of CH4 per tonne of augmented coal resource) used in the draft Tier 1 method.	United States of America	Accepted	This section has been moved to the appendix for future methodological development.
3077	2	4	984	996	The Tier 1 approach relies on coal resource data by depth of coal seam. The U.S. does not collect coal resource information by depth of coal seam (Form EIA-7A, Annual Survey of Coal Production and Preparation). Provide another method or move this to an appendix.	United States of America	Accepted with modification	This section has been moved to an appendix
3079	2	4	996	1002	The Tier 1 approach does not specify the definition of "augmented resource". Values for coal resources can vary widely depending on definition, such as "resource base", "recoverable resource", "measured reserves", "proved reserves", "indicated reserves", and "inferred reserves". As an example of these widely varying values, see the U.S. EIA report, U.S. Coal Reserves: 1997 Update (DOE/EIA-0529(97)) (p. 2; Figure 2, p. 5) . These values, depending on the coal resource definition, can vary by an order of magnitude. The draft method states that "[a]ll different categories of coal resources such as measured (or proved), indicated and inferred etc. (UNFC 2009), should be taken into account for determining activity data of augmented resource." It is not clear what is meant by this statement and how it should be applied when using the method. Applying the method using data based on different definitions of coal resource would result in widely different estimated emissions results.	United States of America	Accepted with modification	This section has been moved to the appendix for future methodological development.

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
3081	2	4	2544	2545	It might be useful to add something in here before the discussion of transformation processes on the different types of feedstocks that could be used, in particular biomass vs. fossil feedstock and the implications for reporting CO2 emissions in particular.	United States of America	Accepted	Text added: Table 4.3.1 provides cross references to the locations in the guidelines for the methods for estimating fugitive emissions from the transformation, and, shows the categories where emissions should be reported. Compilers should note carefully the differences in reporting of CO2 from biomass and fossil feedstock
3083	2	4	2556	2557	Table 4.3.1, should coke production row include CO2 (flaring COG), BtL and BtG rows should it read Appendix 4a3 and why are emissions reported in 1.B.3 instead of 1.B.1.c?	United States of America	Accepted	Table was corrected and table 4.3.1 was added for further clarification.
3085	2	4	2564	2564	add "and" after (industrial),	United States of America	Accepted	
3087	2	4	2565	2566	It is unclear what Emissions is referring to in start of sentence, recommend adding Emissions "from harvested wood energy use" are …	United States of America	Accepted	
3089	2	4	2566	2567	add "only" after process, so reads: the solid to solid transformation process only	United States of America	Accepted	
3091	2	4	2575	2575	Not sure what Section 4.2.2.3.1 is referencing, 4.2.2.3 is choice of activity data on dead organic matter.	United States of America	Accepted with modification	Deleted reference to 4.2.2.3.1
3093	2	4	2590	2590	Figure 4.3.1, Second decision box that reads are kiln level efficiencies or emission factors available, this is after indication that kiln level activity data is not available so should change box to read: Are country specific efficiency or emission factors available	United States of America	Accepted with modification	In examining the comment carefully, we had reached the conclusion that to address the comment, this decision tree needs to be revised totally, thus the figure was replaced.
3095	2	4	2602	2603	add "of a given" between factor and GHG delete the (kg GHG/unit of charcoal (or biochar) produced) first set of parenthesis as units are covered by second set, add "produced" to end of second set	United States of America	Accepted	
3097	2	4	2608	2608	Change "this source" to "lignite briquette production"	United States of America	Accepted	
3099	2	4	2614	2614	confirm lower efficiency leads to lower emission factors, seems like it would be opposite	United States of America	Accepted	
3101	2	4	2623	2623	Not sure export of charcoal matters since country would still account for production emissions here	United States of America	Accepted	
3103	2	4	2629	2629	Include something in this paragraph about double counting, for example, confirm CO2 from charcoal is not accounted for under fuel combustion or harvested wood production emissions/accounting. In the US we include wood combustion emissions based on activity data that includes : Wood and products derived from wood that are used as fuel, including round wood (cord wood), limb wood, wood chips, bark, sawdust, forest residues, charcoal, paper pellets, railroad ties, utility poles, black liquor, red liquor, sludge wood, spent sulfite liquor, densified biomass (including wood pellets), and other wood-based solids and liquids.	United States of America	Accepted	
3105	2	4	2647	2648	If possible can this also reference Fig 4.3.2 for where emissions are accounted for	United States of America	Accepted	

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
3107	2	4	2703	2704	Figure 4.3.2, If possible can this figure show where the different emission sources would be accounted for, e.g., this category vs 4.2, vs energy combustion	United States of America	Accepted	
3109	2	4	2720	2721	Table 4.3.4, coke pushing line should flaring column be NO? Flaring COG line should no-flaring fugitives column be NO and reporting moved to flaring column? Also should flaring of COG be in a separate discussion since there is a separate section on it?	United States of America	Accepted	"Coke pushing line should flaring column be NO?" Yes, it should. I have changed it. "Flaring COG line should no[n]-flaring fugitives column be NO and reporting moved to flaring column?" I have added a reporting category to the 'flaring' column. There might be non-flaring fugitives released during flaring, so I propose leaving the reporting for non-flaring fugitives as it is. Also should flaring of COG be in a separate discussion since there is a separate section on it?" For completeness, it is included here as well.
3111	2	4	2763	2764	add "or process" after combustion, should read the combustion "or process" emissions are not included …	United States of America	Accepted	
3113	2	4	2790	2790	Should reference to box be Box 4.3.1	United States of America	Accepted	
3115	2	4	2797	2797	delete "which" after 5%	United States of America	Accepted	
3117	2	4	2802	2802	Specify the location for COG flaring emissions reporting. Is it in section 1.B.1.c.ii??	United States of America	Accepted with modification	Correct category is 1.B.1c.
3119	2	4	2848	2848	Review Box 4.3.1 and edit for clarity	United States of America	Accepted	Box 4.1 has been changed by Box 4.3.1 in the text
3121	2	4	2849	2849	Add "as shown in Table 4.3.7" to end of sentence	United States of America	Accepted	
3123	2	4	2847	2849	Recommend making formula based on COG produced and add into the calculations % of COG flared that way it is something the country can adjust as needed and to make more consistent with non-CO2 calculations	United States of America	Accepted with modification	Equation 4.3.3 has been changed, and the text modified accordingly
3125	2	4	2858	2858	should this reference equation 4.3.3?	United States of America	Accepted with modification	The number of the Equation has been changed
3127	2	4	2871	2871	Add language from CO2 calcs here "The Tier 1 approach assumes that 2% (by volume) of the coke oven gas produced is removed from the production stream and then flared"	United States of America	Rejected	The approach has now changed to let compilers enter their own value for flaring, but 2% can be used as a default.
3129	2	4	2866	2870	Recommend adding in % of COG flared to the equation directly instead of building into Efs, that way country can adjust if needed.	United States of America	Accepted with modification	The equation and the EFs has been change accordingly
3131	2	4	2881	2881	Add "The" to beginning of sentence, so reads "The" Ch4 emission factor …	United States of America	Accepted	
3133	2	4	2891	2892	Table 4.3.7, recommend pulling % flared out of EF calc and make part of equation, in N2O calculation EFN2O should be divided by EF CO2 for oil and gas production, not the other way around	United States of America	Accepted	Numbers and formulas has been corrected
3135	2	4	2921	2921	Also include something about how care should be taken with any adjustments or emissions from COG used in the energy fuel combustion calculations	United States of America	Accepted	
3137	2	4	2924	2924	change "composed by" to "composed of"	United States of America	Accepted	
3139	2	4	2927	2927	change "obtained at" to "obtained through"	United States of America	Accepted	

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
3141	2	4	2946	2946	Should CO2 be CO?	United States of America	Accepted	
3143	2	4	2959	2962	Indicate which of these sources are included here	United States of America	Accepted	Sentence added to clarify the sources of CO2 considered.
3145	2	4	2981	2982	Here and throughout this section CtL emissions are based on syngas produced but actually think coal used would be a better factor and there might be better activity data on that at the country level, syngas produced would have to be obtained from each facility and might be confidential business information (CBI)	United States of America	Rejected	Yes we agree but the literature presents emission factors as a function of syngas produced which makes sense because it is not the coal but the amount of syngas that determines production of liquid fuels downstream. No change to the text is done
3147	2	4	2989	2989	change "feedstock combusted" to "feedstock used"	United States of America	Accepted	
3149	2	4	3096	3097	Add something about potnetial double counting in the energy fuel combustion activity, in US we adjust energy use to account for syngas production used as fuel so we would already account for CO2 emissions	United States of America	Accepted	A sentence has been added to deal with this issue and also the quality control aspect of coal use as feedstock in syngas production is already addressed in lines 3144-3147 below
3593	2	4	1	3215	Fugitive CO2 emissions from coal mining have been included for the first time in 2019 IPCC refinement report. These emissions constitute a reasonable amount of GHG emission from coal mining activities. The methodology, activity data and emission factors, should be included in the refinement guidelines to provide guidance to national inventory compilation.	India	Noted	The methodology and default emission factors have already been included in the refinement guidelines. Activity data, which are country-specific and dependent on inventory year, should not be pre-assigned by the refinement.
3705	2	4	1166	1168	Unsure that the definition of what Oil and Natural Gas System comprise all we want to include. What about abandoned wells/fields?	Norway	Accepted	
3707	2	4	1256	1256	The term waste gas is used much throughout the document - is it the sum of gas being flared, vented or leaked? Please clarify and consider to include waste gas in the glossary.	Norway	Accepted	Glossary definition added, "Waste gas: gas stream containing hydrocarbons and/or other gases that are vented or flared and not used for other purposes (e.g. production of useful energy)"
3709	2	4	1257	1257	Already stated above	Norway	Rejected	It is critical here to highlight the that fugitives here include venting, flaring, and leaks since there is sometimes confusion around the definition of "fugitive"
3711	2	4	1276	1287	We are not sure how this summary of practices(which may vary greatly by countries and facilities) can be useful. There is little of direct reference to reporting under specific categories	Norway	Rejected	1) the major part of the commented paragraph is unchanged text from 2006 GLs, which is not open for revision; 2) in 2019 refinements, flaring emission factor for difference segments are provided aggregately in each relevant segment and disaggregation could be found in Annex 4A.2.
3713	2	4	1308	1309	Here there term used is Oil System and Natural Gas System in capital letters , often not elsewhere in the document. Should be consistent and perhaps as: Oil and Natural Gas Systems. They are in the real world often very integrated and is also get a bit lost throughout the Guidelines, inclduding in the otherwise useful figure 4.2.0	Norway	Accepted with modification	Text was added to clarify the intent of this sentence
3715	2	4	1436	1436	How useful is this table given the coverage of empirical data and the relative importance of the emission sources in question? Please consider if it is possible to improve the coverage e.g by including data from more countries/regions.	Norway	Noted	Out of scope of the refinement

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
3717	2	4	1763	1764	Table 4.2.4B (New): The CH4 emission factors for offshore oil loading in Table 4.2.4B are given with reference to data submitted by Norway. However, they do not correspond to the current knowledge of emissions in Norway. - The suggested factor without recovery is based on implied emission factors for data reported for 1990-2000. These data do reflect conditions without recovery in those years. However, current emission factors for loading without recovery is lower, as shown below. - The suggested factor with recovery is based on implied emission factors for data reported for 2001-2016. However, emissions in these years were partly from loading with recovery, and partly for loading without recovery. Thus, the suggested factor will overestimate emissions from loading with recovery in this period. As an alternative, we have prepared new and updated emission factors, developed from emission data reported to the Norwegian Environment Agency by operators of the oil field on the Norwegian Continental Shelf for the years 2015-2017. Emission data are generated by a comprehensive monitoring programme including measurements of gas flow, temperature, pressure and gas composition and also modelling. The VRUs used are mainly condensation plants. Her is our proposal for new and updated emission factors in Table 4.2.4B - offshore loading of crude oil. We include suggestions for NMVOC factors: Sub-segment: Loading of offshore production on tanker ships without	Norway	Accepted	Used factors provided in comments and revised text to reflect information about the new factors.
3719	2	4	3290	3291	Annex 4A.3 Definition of terminologies used in Section 4.2: Please observe that the definition of CCS is very different from the definision normally used by IPPC (see the glossary in AR5, WGIII). Normally also transport is included in the definision. Is there a particular reason for this change in definition? If not consider to use the definision in AR5, WGIII: Carbon dioxide capture and storage (CCS) A process in which a relatively pure stream of CO2 from industrial and energy-related sources is separated (captured) from industrial or energy-related processes, conditioned, compressed and transported to a storage location for long-term isolation from the atmosphere.	Norway	Accepted	
3721	2	4	3252	3723	Annex 4A.3 Definition of terminologies used in Section 4.2. Please consider if some of these definitions should also be in the Glossary, e.g. ETS, CCS. Please also check if the teminology used here is consistent with the termiology in other IPCC reports.	Norway	Accepted	ETS and CCS are added and agree with AR5 WG III Glossary in the case of CCS

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
503	General				According to the Minsk_Scoping_Meeting_Report Table 2 New guidance for Category 1.A.1.c (issue #1 Table1) was proposed to be treated in new section 4.3 on fuel transformation of V.2 Ch. 4. However, in the Final Draft of the 2019 Refinements section 4.3 provides methodology only for "Fugitive Emissions from Fuel Transformation". While methodology for estimation of stack emissions from fuel combustion and the carbonisation (fuel transformation) of coal is provided in the IPPU V.3 ch.4 section 4.2.2. It is noted in the V.3 ch.4 section 4.2.2 that stack emissions estimated by the suggested methodology should be reported in category 1.A.1.c Manufacture of solid fuels of Energy sector. The Energy volume (v.2) does not provide any references for new guidance developed for the category 1.A.1.c as well as any explanations in which case and for which fuels this new guidance should be used. This situation is unacceptable, because it will lead to misunderstanding of the Refinements quidelines and possible double-counting or underestimation of emissions. Please, consider providing in V.2 - Energy a reference for new guidance developed for the category 1.A.1.c and explanations in which case this new guidance should be used.	Russian Federation	Rejected	This comment belongs to Volume 2. This comment is out of scope of TOR (IPCC-XLIV/L.3) and the Draft TOC elaborated at the scoping meeting in Minsk. In fact, what the reviewer points was included in item #1 of table 1 (not table 2) of the Minsk report, which is the list of issues considered but this issue was not finally included for refinement as indicated in p.17 of the Scoping report and in the draft TOC of that report.
2943	5	6	1	3215	Fugitive CO2 emissions from coal mining have been reported for the first time in 2019 IPCC refinement report. These emissions constitute a reasonable amount of GHG emission from coal mining activities. The methodology, activity data and emission factors, although not very definitive, should be retained in the refinement guidelines to provide guidance to national inventory compilation.	India	Noted	This comment belongs to volume 2. The methodology and default emission factors have already been included in the refinement guidelines. Activity data, which are country-specific and dependent on inventory year, should not be pre-assigned by the refinement.
3853	General	Glossary	65	67	Please clarify if the terms "biofuel" and "bioenergy" are interchangebale and consider including the defintion of bioenergy in the glossary.	Norway	Accepted with modification	A definition of bioenergy has been added to the glossary.
895	3	3	1245	1245	In the Table 3.29, note2, the Box number might be wrong "See Box 4.26 for the definition of main product," : Box 4.26 -> Box 3.15, "by-product and intermediate product and Box4.26" : Box 4.26 -> Box 3.16	Republic of Korea	Accepted	
897	3	3	1245	1245	Please explain which sector compilers should report when it is difficult to separate Activity Data into 'main product' and 'by-product'.	Republic of Korea	Accepted	The response is made by adding a new bullet point to Box 3.16, which is referred to in line 1245.
899	3	3	1431	1562	Typically, Tier b methodology uses more specific data with less uncertainty than Tier a (eg, Ch 6. electronics industry). Thus, changing the order (a -> b-> c higher tier) would reduce confusion.	Republic of Korea	Accepted	The response includes amending a sentence to line 1435, saying that: "There is no Tier method labelled 2a or 3a on this section."

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
967	3	3	562	572	The sentence "for new operations located in developing countries that operate without significant abatement, the emission factor is 0.04 kg HFC-23/kg HCFC-22 produced" states that the emission factor is 0.04, but that for "Plants of recent design, not specifically optimised" in Table 3.28 is 0.03. So a check and revision is requested.	China	Accepted	We agree with the commenter that the draft emission factor revisions need additional review and clarification. The draft 2019 Refinements document included review of an additional 2007 reference by A. McCulloch. In retrospect, following the commenter's note, we recognise that the change in description and characterisation of the 0.04 emission factor on lines 562 to 564 was not correct. We have deleted the draft text that discussed "new operations located in developing countries." The 0.04 emission factor is correctly characterised in Table 3.28 as "Old, unoptimised plants." In addition, the discussion of the 0.019 emission factor, also from the McCulloch 2007 reference, should appropriately refer to use of abatement. This sentence has also been deleted, as it refers to use of abatement and should not be included for a Tier 1 default emission factor. We have confirmed that the characterisations of the emission factors appropriately reflect their intended use.
1039	3	3			General and crosscutting with IPPU, also Waste: Some fuel transformation processes use the same processes (gasification) and feedstock which are addressed in the IPPU sector (hydrogen production). Some guidance how to avoid double counting of emissions would be useful. Also reference between the sector in places where double counting could be an issue would be useful. The guidance should clarify the basic principles of reporting emissions, energy use in Energy sector, non-energy use in the IPPU sector. This is especially important as sometimes it is not that clear how and where the related emissions should be reported.	Finland	Noted	The authors note that the basic principles of reporting of emissions (e.g. Energy use in the Energy sector, NEU in IPPU) is already well-established within the 2006 GLs. Specific to the Refinement, the authors have made very significant efforts to ensure that there is sufficient text to alert compilers to the risk of gaps and double-counts, including within the new Energy-Fugitives chapter, several IPPU chapters (including: Introduction, Hydrogen, Iron and Steel). Within that text the authors have noted specific issues, such as the ability to access activity data that are disaggregated to a sufficient level to enable reporting in accordance with good practice, and also to clarify where the use of specific methodologies may be limited, in light of the methods used in other parts of the inventory (e.g. where the use of carbon balance methods in Iron and Steel production impacts upon the method options for fugitive emissions from coke production, in the Energy sector). The authors therefore consider that the guidance text will help to minimise the risk of reporting gaps and double-counts.

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
1041	3	3	1158	1680	In earlier guidelines, there were no mention, that CO2 emissions from biological feedstocks in IPPU sector have to be reported as a memo item. This need to report the CO2 emissions from use of biomass as feedstocks in the IPPU sector as a memo item does not appear to be included in the original draft Table of Contents /Chapter Outline as attached to the Terms of Reference for the 2019 Refinement either. Please delete the guidance to report the CO2 emissions from use of biomass as feedstocks in the IPPU sector as a memo item.	Finland	Rejected	The ToR was established to generate emission estimation and reporting guidance for Hydrogen production,and one component of this industry is the generation of biogenic CO2 from certain technologies. The proposed approach to reporting of biogenic CO2 emissions from Hydrogen production is entirely consistent with the principles established elsewhere in the IPCC GLs.
1287	3	3	770	770	Process vents are typically configured for batch/intermittent or continuous measurement(s) of the concentration.	India	Accepted	We agree that processes and therefore process vents may be batch or continuous, and the approach for concentration measurements would need to reflect this. We have revised the sentence to reflect that, as the commenter suggested, process vents may be batch or continuous in nature and therefore intermittent or continuous measurements could be made.
2647	3	3	1456	1474	CO2 emission estimation for H2 production and for ammonia production should be similar because both production processes use steam methane reforming. The carbon oxidation default factor for a Tier 1 Ammonia production estimation is set to 1.0, and could be specified for Tier 2 or 3. Suggest adding this factor and methodology to the H2 Production Tier 1 evaluation with the option to specify a different factor for Tier 2 or higher.	Canada	Rejected	The estimation method provided in the Hydrogen chapter apply only when the feedstock is completely oxidized. This is considered to be the case for all production processes yielding hydrogen as the main product. The guidance in Ch. 3.2 Ammonia production specifically covers partial oxidation reactions, and should not be used as a reference for the Hydrogen chapter in this context.
3151	3	3	1	9999	Chapter 1 (Introduction) of Volume 3 needs to be updated to reflect the new source categories in the Refinement (e.g., Hydrogen Production, Rare Earth Metals, Waterproofing of Electronic Circuits, etc.) This will affect both the text and the tables.	United States of America	Accepted	Chapter has been updated to include the new source categories.
3153	3	3	221	221	"In addition," should read as "If available,".	United States of America	Rejected	This comment refers to a tier 3 method in which measurements have to been undertaken and inventory compilers should have them documented so they need information on the technologies employed (at least for internal documentation).

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
3155	3	3	973	974	NF3 should probably be removed from the table of typically emitted compounds (3.28b) because there is already a specific Tier 1 default EF for production of NF3, and NF3 is not commonly generated as a by-product during production of other fluorochemicals.	United States of America	Accepted	We agree with the commenter that the majority of NF_3 emissions occur from the intended production of NF_3, and outside of intended production of NF_3, NF_3 emissions are significantly less. We conducted additional analysis to review the actual contribution of NF_3 emissions from other non-NF3 fluorochemical processes based on the available data in the U.S. EPA GHGRP. For example, in RY2016, NF_3 emissions reported under the GHGRP were 219,000 $mtCO_2e$, approximately 218,000 $mtCO_2e$ (99 percent) of the emissions were from the intended production of NF_3, and approximately 1,150 $mtCO_2e$ (1 percent) were from other types of fluorochemical processes (i.e., non-NF_3 processes). Over the six years of reporting data, the NF_3 emissions from intended production is 92 percent, and the NF_3 from other fluorochemical processes is 8 percent. With the additional review, we revised Table 3.28b to replace the NF_3 component with the next most commonly emitted fluorinated GHG.
3157	3	3	1169	1169	Insert item d. Ethylene production (Volume 3, section 3.9)	United States of America	Accepted with modification	Included in item c, as methods are the same as for methanol. Line 1178 is amended accordingly.
3159	3	3	1227	1227	change spelling of "oxidise" to "oxidize" for consistency w/rest of chapter	United States of America	Accepted	
3161	3	3	1244	1245	Table 3.29, Footnote 2, last sentence, revise first instance of "Box 4.26" to "Box 3.15" and second instance of "Box 4.26" to "Box 3.16"	United States of America	Accepted	
153	3	4	807	808	- The values for Scrap Iron and Steel in Table 4.3 make reference to Table 4 of the ISO 14404-1 and -2 standards. However, Table 4 of these standards does not mention neither Scrap Iron, nor Steel. Table 4 only suggests a value for Cold Iron i.e. 0.172 tCO2/t (0.047 tC/t) which corresponds to the value suggested for Purchased Pig Iron in Table 4.3. - Material-specific carbon contents have to be given for Scrap Iron and Steel, and also for Steel Scrap which are consistent with practice. We suggest to use the value given in Annex C of standard EN 19694-2 for post-consumer scrap i.e. 0,0066 tCO2/t (0.0018 tC/t) which is based on the average of the carbon content of all the steel put on the market by EU producers in the years 2007/2008. Hence, this 0.0018 tCO2/t value should be used for both Steel Scrap and Steel (which should be renamed Carbon Steel Scrap and Carbon Steel). It is much more consistent with the actual values observed in practice than the 0.01 tC/t used for steel in the current Table 4.3.	France	Accepted	The text of FD has been changed accordingly as commenter proposed: in the table 4.3 Steel will be replaced with Steel Scrap and Steel.

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
417	3	4	274	275	This statement is not correct: "The emission estimation methodology from the carbonisation of coal is presented here as there is a significant overlap with the activity data used for iron and steel production" because at least Tiers 1a and 1b calculates not only "carbonisation emissions" but also "combustion emission". This should be clearly explained to avoid double-counting	Russian Federation	Accepted	Text has been changed accordingly
419	3	4	297	298	Table 4.1A. Note (1) - is not correct, because methodology described in this chapter (at least Tiers 1a and 1b) calculates not only "carbonisation emissions" but also "combustion emission"	Russian Federation	Rejected	Table 4.1A. Indicates the place where the emissions estimates has to be allocated, not where the methodology is described
421	3	4	358	359	Table 4.1B. It is necessarily should be indicated that "if Tier 1a or Tier1b method is applied, do not also calculate emissions from coke oven gas combustion using methodology described in v.2 ch 2 to avoid double counting".	Russian Federation	Accepted with modification	The comment 421 is correct, but not only for Tier 1a and Tier1b, but for all the tiers. To address this issue, at the begining of the item 4.2.2.1, we added: "In all cases, the methods encompass emissions from carbonisation and fuel combustion"
423	3	4	358	358	Table 4.1B - Title of the table "TIERS TO ESTIMATE CO2 EMISSIONS FROM METALLURGICAL COKE PRODUCTION – CARBONISATION PROCESS" is not appropriate - because at least Tier1a and Tier 1b include emissions not only from "carbonization process" but also from coke oven gas combustion	Russian Federation	Accepted	Text has been changed accordingly in this Table, but also in the Title of the Item 4.2.2.1
425	3	4	515	516	Figure 4.8a: on the right arrow from diamond-shaped cell at the bottom of decision tree (with inscription "Is this a key category?") to Tier1 box should be written "no" instead of "yes"	Russian Federation	Accepted	Text has been changed accordingly
427	3	4	520	521	Figure 4.8b: on the right arrow from diamond-shaped cell at the bottom of decision tree (with inscription "Is this a key category?") to Tier1 box should be written "no" instead of "yes"	Russian Federation	Accepted	Text has been changed accordingly
429	3	4	590	594	Authors should check on the possible underestimation of CO2 emissions from iron and steel production in the equation 4.9. The amounts of steel and pig iron scrap containing carbon are not included in equation 4.9. Carbon mass balance is not full.	Russian Federation	Accepted	Text has been changed accordingly
431	3	4	590	626	Authors should check on the possible double counting of CO2 emissions from use of blast furnace gas in iron and steel production (eq. 4.9) and in sinter production (eq. 4.10) or include comment to clarify this issue. If sinter plant is included into an integrated iron and steel production facility then blast furnace gas combustion has already been accounted for by the equation 4.9. Only blust furnace gas transferred off site (line 614) is subtracted in the equation 4.9, so all emissions from blast furnace gas combustion within an integrated iron and steel production facility has accounted for by the equation 4.9.	Russian Federation	Accepted	Text has been changed accordingly
433	3	4	614	614	Blast furnace gas is BG in the equation 4.9 and it is BFG in the list of parameters for this equation. Please, harmonize.	Russian Federation	Accepted	Text has been changed accordingly
435	3	4	622	622	Blast furnace gas is BG in the equation 4.10 and it is BFG in the list of parameters for this equation. Please, harmonize.	Russian Federation	Accepted	Text has been changed accordingly

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
437	3	4	628	632	The CO2 emissions from the combustion of blast furnace gas and converter gas for different needs within an integrated iron and steel production facility have been accounted for automatically by the equation 4.9 because only blast furnace gas transferred off site is subtracted. Applying of additional methodology described in Chapter 2 Volume 2 will result in double counting.	Russian Federation	Accepted	This paragraph corresponds to Tier 1, and has been moved up.
439	3	4	721	721	CH4 should be changed to N2O	Russian Federation	Accepted	Text has been changed accordingly
441	3	4	2083	2084	To make more clear it may be reformulated as follows: "SBS = mass fraction of alumina produced by sintering process. The parameter can be varied from 0 to 1, where 1 is related to 100% of alumina produced by sintering process." Also, the default SBS value should be provided for Tier 1 methodology.	Russian Federation	Accepted with modification	The text has been changed as follow "mass fraction of alumina produced by sintering process (BSP and BSS). The parameter can be varied from 0 to 1, where 1 is related to 100% of alumina produced by sintering process." Default Sbs added.
443	3	4	2085	2086	There is a contradiction between statement "The parameter can be varied from 0 to 1, where 1 is related to 100% of alumina produced by sintering process" and line 2098-2099 indicating that "In case of alumina production from the nepheline ore, 100% of alumina is produced with the sintering process". It may be reformulated as follows: "SNP = mass fraction of alumina produced by sintering process. The parameter equals 1, because 100% of alumina in this process produced by sintering process."	Russian Federation	Accepted with modification	Text has been changed as per GOV reviewer comments, with minor clarifications added
445	3	4	2154	2158	Equation 4.27h CO2 emissions from carbon-bearing non-fuel materials are subtracted from the total CO2 emissions. It is contradictory to the statement that this materials may contribute to the emissions (lines 2137-2144).	Russian Federation	Accepted	Changes made to text - agree "+" used instead of "-", Corrected another incorrect symbol in the equation.
447	3	4	2161	2166	It seems that it is better to use "bauxite/limestone raw mix" and "nepheline/limestone raw mix" instead of "bauxite and nepheline ore". Otherwise, it is not clear why bauxites and nephelines contain remarkable amounts of carbonates .	Russian Federation	Rejected	Bauxite and Nepheline ores have carbonates and it is not because of mix ore and limestone. Limestone separatelly considered in as ELC. So to avoid confusion suggested do not consider this comment. Some clarifications have been made to the text on 'ores'
449	3	4	2192	2194	It seems that it is better to use term "potential emissions" instead of "emissions" because emissons do not actually occur in the process.	Russian Federation	Accepted with modification	Changes made to text as recommended + added notification: ", that is not emitted because some carbon absorbed by residue and stored at bauxite or nepheline residue areas",
451	3	4	2198	2208	Authors should check on the possible double counting of CO2 emissions from soda ash use in alumina production (Equation 4.27h). In equation 4.27i only mass of soda ash produced for using out of plant is accounted for (Line 2208), while in equation 4.27h the total amount of soda ash used in the sintering process is accounted for (not only soda ash purchased from other producers).	Russian Federation	Rejected	Soda ash produced for using out of plant is used out of plant. If it used at other alumina refinary it will be considered at particular alumina refinary as an input material in equation 4.27h. So There is no possible double-counting possibe.

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
453	3	4	2223	2232	1. It seems that it is better to use "bauxite/limestone raw mix" and "nepheline/limestone raw mix" instead of "bauxite" and "nepheline". 2. There is a contradiction between lines 2227-2228 and line 2232. The authors propose to calculate the weighted average content of CO2, assuming 100% calcination of the carbonate, while in the equation 4.27k there is a factor (Fj) taking into account that calcination is not 100%. 3. The authors propose to calculate the weighted average content of CO2 for carbonates consumed in the kiln. Soda ash is a carbonate too, but it is accounted for separately in the equation 4.27h. It seems that it is better to indicate clearly which carbonates are meant.	Russian Federation	Accepted with modification	
455	3	4	2249	2250	It should be reformulated as "EFk = emission factor for kerogen or other carbon-bearing nonfuel raw material k, tonnes CO2/tonne carbon-bearing nonfuel raw material".	Russian Federation	Accepted	Changes made as recommended.
457	3	4	2307	2314	Needs language editing.	Russian Federation	Accepted	Changes made to text for clarity
893	3	4	375	375	"CF4" should be changed into CH4	Republic of Korea	Accepted	Text has been changed accordingly
901	3	4	430	431	In tier 2 methodology using mass balance, CH4 emissions are not necessary to be estimated since all carbon emissions are already counted as CO2.	Republic of Korea	Rejected	IPCC methodology has to cover the emissions of all GHGs, including CH4.
903	3	4	614	622	"BFG" need to be changed into "BG" followed by equations 4.9, 4.10	Republic of Korea	Accepted	Text has been changed accordingly
969	3	4	369	380	The units in Equation 4.1 and Equation 4.1A are not identical. According to the formula, the unit on the left side is in kg, and the right side is in tones. It is suggested that the unit of emissions be changed to tones in line 378.	China	Accepted	Text has been changed accordingly
1043	3	4	2669	2670	Default Tier 1 emission factor for emissions from rare earth metals production in Table 4.26 is based on information only from 4 industrial production lines. There is a risk that this emission factor is not representative and applicable as a default emission factor for all process lines. Tier 3 method presented in the guidelines requires facility specific emission factors and the use of this method is not feasible if this emission source is minor in certain countries. Proposition: move description of these two methods and emission factors to an appendix.	Finland	Rejected	While it is acknowledged that the default emission factor (EF) was based on anode carbon consumption data from 4 industrial potlines in China, these potlines are considered representative of current technology in China (ref. Cai et al 2018), and China currently represents >90% of global production. This default EF is also consistent with what is expected from first principles / mass balance calculation approach with stoichiometric ratios of carbon consumed (and hence CO2 formed) vs. RE metal formed; this was described in footnote 1, page 4.83, and has now been moved to note 'b' under Table 4.26 for clarity. The method of estimating CO2 emission factors from net anode carbon consumption is consistent with CO2 accounting approach for aluminium production. Further clarification has been made to note 'a' in Table 4.26. While a level of uncertainty is expected in estimating CO2 emissions outside China (or for other technologies), it is not expected to be greater than the uncertainty levels indicated in Table 4.26. Therefore, we believe the risk that the default EF is not representative to all process lines is manageable.

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
1289	3	4	375	375	"CF4" should be "CH4" EQUATION 4.1A (NEW): CH4 EMISSIONS FROM COKE PRODUCTION (TIER 1A)	India	Accepted	Text has been changed accordingly
1291	3	4	1930	1930	Replace "NO2" with "N2O"	India	Accepted	Changes made to text as recommended
1385	3	4	765	766	The presented default CH4 EF for coke production is equal to the reference "Japan NIR 2018", but outside of the range of the other reference "EU IPPC BREF 2013". The Japan NIR is not a sufficient reference, as the basis for the EF the original source is not referenced. The authors have neither provided any reasoning for choosing a value outside of the BREF ranges.	Sweden	Rejected	The availability of this data is scarce, but surely the variability is high. The data from EU corresponds to measurements made in a single plant, while the data from Japan is the average value of measurements made in some plants of the country, but we have not the corresponding range. For the default EF we consider that: (1) the data reported by both are highly consistent (same order of magnitude) and (2) The values from Japan surely includes higher values, as 0.089 is the average. In this context we chosen the higher value found in literature.
1735	3	4	872	872	As stated in paragraph 849 – 850, we also recognize that it is difficult to calculate CO2 emissions for the Energy Sector and the Industrial Processes Sector separately without any ambiguities because of complex iron and steel production processes. The most prioritized point for the estimation of emissions from this category is to calculate all GHG emissions from iron and steel production completely and accurately and to report them without any double counting and omission of emissions, even if national circumstances of a reporting country such as data availability make it difficult to allocate emissions from iron and steel production into the Energy and IPPU sector in strict accordance with the concept provided in the IPCC guidelines. There is also a description that "it is good practice to check the completeness of all fuels and sources discussed here and to document where and how they are reported in the inventory" in Vol.3.1.4 QC OF COMPLETENESS AND ALLOCATION OF CO2 FROM NON-ENERGY USES of the 2006 IPCC guidelines. Therefore, we suggest that the following sentence be added at the end of the "RELATIONSHIP TO THE ENERGY SECTOR" section of "4.2.2.5 COMPLETENESS" in order to request a country which does not report emissions from iron and steel production in accordance with the allocation rule provided in the IPCC guidelines to provide clear explanation on which emissions are reported under which category of the Energy or IPPU sector to make sure that there is neither double counting nor omission of emissions in the inventory. "Due to national circumstances of a reporting country such as data availability related to the difficulty of allocation of emissions resulting from complexities of iron and steel production, the emissions from iron and steel production are not allocated between the Energy and IPPU sector in accordance with the IPCC guidelines In such a case, a clear	Japan	Accepted with modification	A new paragraph has been added: " To avoid double counting and to ensure completeness it is a Good Practice to cross-checked the proper allocation of the emissions between the Energy and IPPU sectors, and to document where and how they are reported in the inventory"

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
1961	3	4	207	252	Whilst this section may be greyed out and considered "out of mandate" for any revisions, nevertheless it requires a small change to reflect that the new Energy-Fugitives chapter now presents the emission sources and methods for fugitive releases from transformation process, including coke production. It doesn't make sense that this greyed out section includes reference (lines 241 to 247) to the reporting of emissions from fuel use in coke production in the Energy Volume, but doesn't also mention the methods and reporting of fugitive emissions in the Energy Volume too. Please make it clear to compilers and amend those cross-references.	United Kingdom (of Great Britain and Northern Ireland)	Accepted	The authors agree with the reviewer about the need to modify this paragraph in grey.
1963	3	4	256	454	This entire section needs to be reviewed (and much of it removed) in light of the decision to now include fugitive emissions from coke production under the new Energy Volume chapter. The IPCC approach is that coke production is an energy transformation process. Combustion is reported in Energy; fugitives are now to be reported in energy. Therefore, all of the relevant information - the description of the coke production technologies, the combustion and fugitive emission sources - should only be included in the energy volume of the inventory guidance - duplication of inventory guidance across Energy and IPPU will cause confusion for compilers. Guidance should be in one place only for a given emission source. There is still a need to retain some residual information in IPPU and to cross-reference properly, especially where methodological choices / decisions are inter-twined (e.g. some methods in Energy-fugitives will have to be discounted if a carbon balance approach is used in I&S including the coke works in IPPU).. but the vast majority of this section should be deleted, and the Energy-Fugitives chapter clearly cross-referenced.	United Kingdom (of Great Britain and Northern Ireland)	Accepted with modification	The comment is right, in the sense that the methodologies to estimate and report GHG emissions from combustion and fugitives are included in the Energy chapter, but is incomplete because combustion and fugitives do not comprise non-fugitive carbonization emissions that occurs in coke oven batteries. To clarify this issue the consistency between combustion and fugitives (described in Energy reported under Energy) and non-fugitives from carbonization (described in IPPU, reported under Energy), has been improved with modifications in the text
3163	3	4	1	1000	If necessary, update the guidance on IPPU/Energy relationships in Chapter 1 (Introduction) of Volume 3 to reflect the updated or new guidance in the Iron and Steel and Hydrogen sections.	United States of America	Accepted	Chapter 1 has been updated to reflect the updated and new guidance in the iron and steel and hydrogen sections.
3165	3	4	260	260	Recommend inserting "emissions" after "GHGs" and deleting the "s" from "GHGs."	United States of America	Accepted	Text has been changed accordingly
3167	3	4	335	336	The variability of processes and their GHG emissions should be considered while determining the appropriate frequency and duration of testing to establish site-specific emission factors. With this in mind, recommend adding "the variability of the process and its GHG emissions," after "information on the frequency and duration of the measurements."	United States of America	Accepted	Text has been changed accordingly
3169	3	4	358	359	Table 4.1B is very helpful.	United States of America	Noted	
3171	3	4	460	460	The meaning of "to generate the reported production outputs" is not clear. Does this refer to the iron and steel produced or the emissions estimates reported? If it refers to the iron and steel produced, recommend either deleting or revising to "to produce the sinter, iron, and/or steel."	United States of America	Accepted	Text has been changed accordingly

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
3173	3	4	463	464	For completeness and consistency, a brief description of the Tier 2 method for Iron and Steel Production would be helpful here.	United States of America	Accepted	Text has been changed accordingly
3175	3	4	465	468	The variability of processes and their GHG emissions should be considered while determining the appropriate frequency and duration of testing to establish site-specific emission factors. With this in mind, recommend adding "the variability of the process and its GHG emissions," after "information on the frequency and duration of the measurements."	United States of America	Accepted	Text has been changed accordingly
3177	3	4	560	563	Equation 4.8a: Recommend including "BFG and LDG" between "From" and "Flaring" in the equation title, to clarify that emissions from flaring of COG are not included in IPPU.	United States of America	Accepted	Text has been changed accordingly
3179	3	4	575	576	Equation 4.8a includes formulas to calculate EFCO2BFG flaring and EFCO2LDG flaring, but does not include the results of those calculations (i.e., numerical values for the EFs) based on default carbon-content values. Instead, those numerical values are presented under Equation 4.14b, at ll. 780-781. Unless inventory compilers are expected to apply the formulas in Equation 4.8a based on country-specific carbon-content values, recommend replacing the EFCO2 formulas in Equation 4.8a with the calculated numerical values from ll 780-681, documenting their derivation in a footnote.	United States of America	Rejected	Eq 4.8.a is for CO2 emissions from flaring, while eq 4.14 b is for N2O emissions from flaring.
3181	3	4	597	614	The variable name for blast furnace gas changes between "BG" and "BFG" in this equation and its definitions and throughout the document. One name should be used consistently; recommend "BFG" as more intuitive and consistent with use of "COG" for coke oven gas.	United States of America	Accepted	Text has been changed accordingly
3183	3	4	768	786	Recommend presenting Table 4.2b at the top of this section, unless inventory compilers are expected to apply Equation 4.14b based on country-specific values for EFCO2BFG flaring, EFCO2LDG flaring, and/or the ratios of the EFs for CO2 and N2O for oil and gas, which does not appear to be the case. Moving up Table 4.2b will clarify to the compiler that they are not expected to perform the calculation in Equation 4.14b. Instead of showing equation 4.14b in the main text, it can be moved into a footnote or supporting documentation.	United States of America	Accepted	Text has been changed accordingly, and also including the consistency with Table 4.3.7 of the Volume 4 of Energy Chapter (Fugitive emissions). An error in the CO2 EF for LDG has been identified and corrected.
3185	3	4	772	777	In both of the equations titled "Equation 4.14B (NEW)," the forumla does not appear to result in the correct estimate/units. It appears that the terms (EFCO2/EFN2O) in both equations should be inverted to (EFN2O/EFCO2) to yield emission factors for N2O.	United States of America	Accepted	The formula has been changed
3187	3	4	780	781	These CO2 EF definitions incorrectly reference equation 4.14a, which is for N2O emissions. They should reference equation 4.8a, which includes terms for these CO2 EFs.	United States of America	Accepted	Text has been changed accordingly
3189	3	4	799	799	Recommend replacing "indicative" with "representative" for clarity.	United States of America	Accepted	Text has been changed accordingly
3191	3	4	846	846	Recommend replacing "among each other" with "to each other" for clarity.	United States of America	Accepted	Text has been changed accordingly

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
3193	3	4	857	857	Recommend deleting "with the following peculiarities," which is an odd phrasing, from the end of the sentence. Instead, include a new sentence, "Note in particular:"	United States of America	Accepted	Text has been changed accordingly
3195	3	4	866	867	Sentence is jumbled. Recommend deleting "then if the gas is delivered to" and moving closing parenthesis from after the word "example" to after the word "producer," and following the parenthesis with a comma.	United States of America	Accepted	Text has been changed accordingly
3197	3	4	874	876	Figure 4.8d is potentially quite useful but needs to be clarified further. It is difficult to follow the flow of emissions through the process and whether they are under IPPU or Energy. For example, it is difficult to see the flow of metallurgical coke into the steelwork boundary and how it connects to Energy.The three arrows extending straight down from the COG, BFG, and BOG pipes in the middle of the figure do not connect to anything, so their meaning is unclear. Are they supposed to touch the IPPU "Electricity and/or heat production" box to their left? What is the significance of the dotted green line around the blue boxes titled "blast furnace" and "steel making?" Should this line be extended around the "Sinter plant" and IPPU "Electricity and/or heat production" boxes as well, since their emissions are also supposed to be reported under IPPU? In addition to clarifying these points, recommend expanding Figure 4.8d to take up an entire page, similar to Figure 4.1 between lines 249 and 252 (page 4.10), which would allow more space to see the flow of emissions to be allocated.	United States of America	Accepted	Fig. 4.8 has been improved- To include in a separate sheet, the Item RELATION TO OTHER METHODOLOGICAL APPROACHES has been moved up.
3199	3	4	899	902	Currently, this sentence could be interpreted as an IPCC opinion regarding whether the ISO 14404 method can be used for emissions trading schemes, which the IPCC should not be judging. Suggest revising to read "Although the World Steel Association [or other relevant organization] does not recommend using these calculations to determine the benchmark for free allocation under emissions trading schemes (because different regions have different energy sources and raw materials available), the calculations can be used to compare the performance of steel plants globally and to help plant staff determine their own position in energy and CO2 efficiency."	United States of America	Accepted with modification	The paragraph has been deleted
3201	3	4	1092	1104	This paragraph focuses on methodological choice and therefore would be better placed under "Choice of Method" and merged with the paragraph that appears at lines 1154-1162. (It is currently somewhat redundant with that paragraph.) Because this section is long and relatively complex, it is particularly important to focus and streamline it by systematically providing information first on industry background and then on methodological choice.	United States of America	Accepted	Changes made to text as recommended - merged two paragraphs and removed redundant information

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
3203	3	4	1117	1150	These paragraphs focus on sources and mechanisms for emissions rather than methdological choice. They would therefore be better placed under "Introduction to Primary Aluminum." (A partial exception is the transition paragraph at lines 1146-50, some part of which could be repeated in both the "Introduction" and "Choice of Method" sections.) Because this section is long and relatively complex, it is particularly important to focus and streamline it by systematically providing information first on industry background and then on methodological choice.	United States of America	Rejected	While acknowledged this would improve clarity, the changes recommended have not been made since doing so would also require moving background on CO2 emisisons (currently in sections 4.4.2.1, which are outside the scope of 2019 Refinments) to the Introduction also. Therefore, we have kept the background information on PFCs in this section as previous
3205	3	4	1151	1153	Recommend starting the "Choice of Method" section with this paragraph and adding the following sentence to the beginning of the paragraph to provide an overview: "This section includes guidance for estimating emissions from HVAE and LVAE using a range of methods."	United States of America	Accepted with modification	Changes made to text as recommended, with adjustments, since industry background material was not moved to the Introduction
3207	3	4	1154	1155	This sentence provides a helpful summary of the Tier 2 and 3 methods, but it should include a similar summary of the Tier 1 method. Recommend inserting "the Tier 1 method is based on aluminum production, while" between "For HVAE emissions, and "the Tier 2" on line 1154.	United States of America	Accepted	Changes made to text as recommended
3209	3	4	1157	1157	"generally" or a similar qualifier should be inserted before "good practice" in recognition of the exception to this statement described in the following sentence.	United States of America	Accepted	Changes made to text as recommended
3211	3	4	1173	1173	This sentence provides a helpful summary of one Tier 3 method for LVAE, but for completeness and consistency, it should be preceded by a similar summary of the Tier 1 method for LVAE. Recommend adding the following to the beginning of the paragraph: "For LVAE emissions, a Tier 1 method and two Tier 3 methods are provided. The Tier 1 method calculates PFC emissions by multiplying technology-specific default emission factors by aluminum production. The first Tier 3 method calculates PFCs by multiplying a facility-specific factor. . . [continue with current text on ll. 1173-74]."	United States of America	Accepted	Changes made to text as recommended
3213	3	4	1175	1175	Recommend changing "The alternative is to use" to "The second Tier 3 method for LVAE uses." "The alternative" implies that there is only one alternative to the first Tier 3 method, when the Tier 1 method is another alternative.	United States of America	Accepted	Changes made to text as recommended
3215	3	4	1221	1222	Insert "neither to omit nor" between "Care should be taken" and "to double count." Delete the "not." Avoiding omissions is at least as important as avoiding double-counting.	United States of America	Accepted	Changes made to text as recommended
3217	3	4	1224	1233	Figure 4.12 (Decision Tree) works reasonably well for HVAE emissions but does not appear to address LVAE emissions at all. Recommend either integrating LVAE emissions into Figure 4.12 or creating a separate decision tree for LVAE emissions.	United States of America	Accepted	Added a new decision tree for LVAE emissions. Existing HVAE decision tree has been updated with labels for "HVAE" and with some diamonds updated for consistency with LVAE decision tree.

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
3219	3	4	1224	1233	Figure 4.12 (Decision Tree) clearly indicates that the Tier 1 method should be used to estimate HVAE emissions from smelters without automatic HVAE termination strategies. This is very useful to the user. The figure would be even more helpful if it included detail on which technologies can use the Tier 2b method.	United States of America	Rejected	To avoid overcrowding the decision tree with information. It was decided to limit the decision box to main Tiers. The numerous details regarding the requirements and limitations for sub-tiers are well described in the text of the chapters, and in the updated Table 4.14a.
3221	3	4	1224	1234	The decision tree refers to calculating PFC emissions using the various tiers but it is really focused on calculating PFC emissions from HVAEs. Authors should consider revising tree to refer to HVAE emissions calculations (not total as stated in title). There is no guidance in the tree about the method for LVAEs. Or the authors could provide a modified decision tree. If keeping decision tree as-is, it would be useful to provide guidance about whether it is acceptable e.g. to combine a Tier 3 HVAE method with Tier 1 LVAE estiamtes if facility specific LVAE measurements are not available earlier than the time-series consistancy section (where it does talk about it)	United States of America	Accepted	Added a new decision tree for LVAE emissions. Renamed caption in Decision Tree Fig 4.12 to refer to "HVAE related" emissions only, raher than 'total' emissions previously. In the HVAE decision tree (Fig 4.12), question in diamond "Is there an automatic HVAE termination strategy?" replaced with "Is the technology class PFPB_MW", to be consistent with the equivalent quesion diamond in the new LVAE decision tree (Fig 4.12a).
3223	3	4	1234	1235	Table 4.14a is very helpful. It would be even more helpful if it included a summary of the smelting technologies to which each method is applicable. Such a column would fit before or after the final two columns, which relate to each method's applicability to normal operations and start-up. If this would make the table too wide, other options include: (1) replacing one or both of the final two columns with the column including the smelting technologies to which the method is applicable, or (2) creating a second table that focuses on the applicability of each method and that includes the first three columns (repeating them from the first table), the final two columns (moving them from the first table) and a new column with the smelting technologies to which the method is applicable. Option (1) may be simplest and least disruptive. The fact that all but one of the cells in the current final two columns say "Yes" indicates that these columns are not conveying much information. Although information on the applicability of each method to each technology appears in the footnotes to the table, it is considerably more difficult to extract the information from the footnotes than it would be to extract the information from a table.	United States of America	Accepted	Table 4.14a has been updated, taking suggestion (1), i.e. replacing the final 2 columns in the original table (which did not contain much extra useful information) with 1 column summarising which methods are applicable to which technologies. Footnotes have been updated accordingly
3225	3	4	1234	1235	Consider removing the "Applicable for" columns. With almost all values listed as "Yes", the columns do not really enhance the table but instead make it more confusing, especially as all of the methods can be used to estimate start-up emissions, but sometimes it's already included, sometime it's not, sometimes you use different slope coefficient, etc. Althernatively, if the authors keep the columns, consider being more descriptive than "yes", "Included in HVAE default", "Start-up speciific coefficients required"	United States of America	Accepted	Table 4.14a has been updated, taking suggestion (1), i.e. replacing the final 2 columns in the original table (which did not contain much extra useful information) with 1 column summarising which methods are applicable to which technologies. Footnotes have been updated accordingly

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
3227	3	4	1235	1235	Footnote "i" of Table 4.14a mentions emission factors in connection with the Tier 3dm approach, but the Tier 3dm approach does not include the development of emission factors. Instead, it appears to require measurement of all emissions at all times during the year, either through the time-integrated or continuous measurements. Therefore recommend replacing "emission factors" with "emissions measurements" in footnote "i" of Table 4.14a .	United States of America	Accepted	Wording "emission factors" has been replaced by "emissions measurements" in Table 4.14a, footnote 'h' (updated footnote numbering).
3229	3	4	1265	1267	First sentence is unclear. Is "have" meant to be "HVAE"? This section also lacks an introduction to what the section is about. Suggest replacing beginning with "The Tier 2a and Tier 3a methods estimate HVAE CF4 emissions based on the relationship between anode effect emissions and performance. In both methods, the slope coefficient in Equation 4.26 is based on direct measurements of PFCs."	United States of America	Accepted with modification	Changes made to text as recommended except second sentence on direct measurements as Tier 2a is not based on direct measurements.
3231	3	4	1350	1360	Authors may want to consider summarizing the method options in a table by technology class. E.g. If using SWPB and have AEDs greater than 150s, which method(s) are recommended?	United States of America	Rejected	In order to correctly recommend a method for different scenarios, additionnal data would have been required. The purpose was to present the available newer and more accurate methodologies along with their limitations and an overview of their uncertainty range. The final choice of a method is up to inventory compilers based on the availability of the data, the distribution of the data and the limitations of the different methods.
3233	3	4	1350	1355	Shouldn't the division be PFPB(L) and SWPB are recommended to use Marks and Nunez and PFPB(M) use the Dion approach? Table 4.16B (line 1603), which has the uncertainties for the Tier 2b methods, groups SWPB and PFPB(L) together. If you are basing the suggestion on the relative uncertainties, the recommendation for PFPB(L) and SWPB should be the same.	United States of America	Accepted	Re-edited the table for clarity
3235	3	4	1486	1487	The final sentence of Box 4.3 states that "This detection threshold is specific to each facility (based on historical data) and should be used for calculating HAVE performance at the facility when estimating cell start-up emissions." This sentence needs to be clarified. Is it applicable to each of the three methods described in ll. 1493-1507? If not, to which of these methods is it applicable?	United States of America	Accepted with modification	Added a sentence at the end of the box to specify that it is applicable to all methods.
3237	3	4	1494	1495	"as it is based" should be replaced by "as they are based"	United States of America	Accepted	Edited accordingly
3239	3	4	1497	1497	To clarify that this is the first of the three options discussed in the preceding three sentences, replace "First" with "The first option is to"	United States of America	Accepted	Edited accordingly
3241	3	4	1502	1504	To clarify that LVAE emissions must always be included in CSU emissions estimates, add the following sentences to the end of the paragraph: "Again, LVAE emissions during start up can be estimated using Tier 1 or Tier 3."	United States of America	Accepted	Edited accordingly

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
3243	3	4	1537	1538	Recommend adding a sentence to emphasize that both measurement approaches provide continuous coverage of total emissions, e.g., "Both approaches provide continuous coverage of total emissions."	United States of America	Accepted with modification	Adjusted previous sentence (removed "common" since both direct measurement methods are not being used routinely at present by the industry) and added sentence similar to what was recommended: "While neither are routinely carried out by the industry at present, both have the potential to provide continuous coverage of total emissions." There should be flexibility in the IPCC GLs to allow for the possibility of non-continuous coverage. For example, one approach used for other atmopsheric pollutants from the industry (e.g. fluoride emissions) is by direct measurement, on a representative but non-continuous sampling frequency, depending on regulatory requirements. The question of whether continuous coverage or not is should be a conversation between governments/ regulators and the industry, and should not be specified here. Line 1558-1560 already recommend continuous coverage for time-integrated measurements as 'good practice'.
3245	3	4	1601	1604	Lines 1601-1603 mention only PFPB(m) and PFPB(L) but the table also lists SWPB.	United States of America	Accepted	Re-edited the table for clarity
3247	3	4	1601	1604	It's consfusing to have lines 1350-1355 say that Marks & Nunez is not appplicable to SWPB (by omission) but have an uncertainty in Table 4.16 (due to the grouping of SWPB and PFPBm). If the uncertainty in Table 4.16 is accurate for SWPB for Marks & Nunez, it would be helpful if the authors note why the Marks & Nunez method is not applicable for SWPB.	United States of America	Accepted with modification	Re-edited the table for clarity
3249	3	4	1655	1655	Recommend adding a summary sentence to the beginning of the "Completeness" section that is similar to the summary sentences in other chapters: "Completeness for the aluminium production source category requires reporting of emissions of all GHGs (CO_2, CF_4, and C_2F_6) from all sources (see Table 4.14) for all aluminium production in all smelters in a country."	United States of America	Accepted	Changes made to the text as recommended
3251	3	4	1665	1665	Recommend inserting "(imprecision)" after "higher level of uncertainty" to reflect the fact that including the LVAE emissions will make estimates more accurate (i.e., no longer biased low due to omission of some emissions) even if they are also less precise.	United States of America	Accepted	Changes made to the text as recommended

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
3253	3	4	1677	1748	The recommendation to wait until 2020 to begin applying the 2019 Refinement for HVAE emissions is not appropriate, given that the technological changes described in Introduction were occurring in the late 2000s (i.e., starting before 2010), and that the measurements supporting the 2019 Refinement default EFs and other factors must have occurred before July 2018 to have been included in the Refinement. Under the recommended approach, countries that have produced aluminum using the PFPBM and PFPBMW technologies since the early 2010s would not have appropriate technology-specific EFs to apply for the years before 2020. One potential solution to this problem would be to require application of technology-specific EFs to each technology regardless of when that technology was used, as is done in Chapter 6 (Electronics) for the 200-mm and 300-mm wafer sizes. If this approach would not work for all smelting technologies (e.g., because changes were occurring within the technologies as well as across them), another approach would be to recommend use of the Refinement beginning with an earlier year, e.g., 2010 or 2015 (at the latest), for some or all of the technologies.	United States of America	Accepted with modification	Lead Authors have adjusted guidance. The transition moment is no longer uniform for all technologies. Instead, the refinements refers to the time-span over which measurement data (on which default Tier 1 EFs and Tier 2a default slope coefficients are based) was collected for each technologyand recommends the Median Year of measurements as the moment to change or transition the EFs from the 2006 GL values to the 2019 Refinement values. This can be through interpolation / backcasting of Tier 1 default EFs or Tier 2a default slope coefficients from 2006 to the Median Year. The exception is PFPB_MW technologies, where the 2019 Refinement default Tier 1 EFs would apply across the entire time span, as it is considered more accurate than reverting to CWPB emission factor values from 2006 GLs. For PFPB_M and PFPB_L tecnhnologies, compilers can backcast back to CWPB values.
3255	3	4	1728	1733	The guidance not to report LVAE emissions before 2006 is not well supported. The footnote includes the observation that the factors that make LVAE emissions more prevalent "in today's current smelting technologies" were absent in earlier technologies, but that technological difference is already accounted for in the differentiation between the Modern PFPB technology and the other technologies. Indeed, Table 4.15 includes much lower default EFs for Legacy PFPB, SWPB, VSS, and HSS than for Modern PFPB. Thus, unless it is definitely the case that currently used Legacy PFPB, SWPB, VSS, and HSS all have higher anode current densities, lower anode-cathode distances, and/or larger anode dimensions than the versions of these technologies that were used before 2006, the guidance should recommend accounting for LVAE emissions using technology-specific EFs back to 1990. If there have been changes WITHIN each of the technologies, that fact should be clarified in the guidance (e.g., the footnote).	United States of America	Rejected	Authors have decided to reject the comments about "backcasting" LVAE prior to 2006 because we are convinced that these emissions are the results of new and recent dynamics in the electrolysis cells. Firstly, there is no literature to support the "existence" of this type of emissions prior to 2006 and all the measurement data indicate that the level of PFC remained within the noise of the HVAE PFC emissions. Secondly, any small contribution of LVAE emissions would have been insignificant in comparison to HVAE emissions, due to the very high HVAE frequencies pre-2006. Finally, top-down and bottom-up measurement were in good agreement prior to 2006, in agreement with the statement that LVAE were negligible or non-existent during this period of time. Nonetheless, there was some important changes to the text in order to include these justifications and explain why the period prior to 2006 should be neglected from considering LVAE emissions.
3257	3	4	2514	2514	For clarity and consistency with the following bullet points, recommend substituting "involves" for "consists of" at the end of this sentence.	United States of America	Accepted	Changes made to the text as recommended
3259	3	4	2521	2523	Recommend splitting this bullet into one that simply says "High temperatures (1050-1100 C)" and one that begins, "Depending on the technology, the process may be periodically interrupted or disturbed. . ."	United States of America	Accepted	Changes made to the text as recommended
3261	3	4	2540	2540	Recommend adding "to increase production efficiency" before "to reduce perfluorocarbon GHG emissions"	United States of America	Accepted	Changes made to the text as recommended

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
3263	3	4	2584	2588	"it is assumed that industrial rare earth facilities currently do not manufacture or pre-bake their own graphite anodes." Is this assumption based on the fact that such pre-baking has not been observed at rare earth facilities whose emissions have been measured? If so, please clarify this.	United States of America	Accepted	The following sentence is added: "For example, it is assumed that industrial rare earth facilities currently do not manufacture or 'pre-bake' their own carbon anodes, but rather they purchase graphite anodes. This is the case in the Chinese rare earth metal industry in 2018 (expert opinion), given the much lower process volumes and smaller anode sizes compared to the primary aluminium industry". This is based on observation that no rare earth facilities in China manufacture or bake their own carbon anodes, rather they purchase graphite anodes from third party providers. This is based on expert opinion from IPCC Contributing Authors: Prof. Youming Yang who is an industry expert in Chinese Rare Earth Metal production and Dr Xiping Chen, who was one of the senior Chinese researchers who has worked with the local rare earth industry and measured PFCs in the two reported industrial campaigns.
3265	3	4	2594	2594	In the last box on the left in Figure 4.17, recommend replacing "process data" with more precise "anode data"	United States of America	Accepted	Changes made to ext in Figure 4.17 box as identified
3267	3	4	2608	2610	Recommend replacing "uses a lower order estimate based only on" with "multiplies a default emission factor by." The method generates an estimate rather than using it, and "lower order" estimate could be interpreted to mean underestimate.	United States of America	Accepted with modification	Changes made to text, with some slight adjustments. "The Tier 1 method for calculating CO2 emissions is through multiplying a default emission factor by rare earth metal production. "
3269	3	4	2642	2643	Recommend including guidance for situations where anode composition is different for different REs, such as "where the anode composition differs, replace Impa with Impi, the impurity content of the anodes used to produce each type of RE."	United States of America	Accepted	Changes made to the text as recommended
3271	3	4	2781	2782	It is unclear why RE-iron is assigned a unique emission factor. Authors should consider adding a note on how it was determined that RE-iron alloys should have a unique EF from other REs, e.g. is there a scientific reason for a different EF or is the separation just based on measurement differences? If the latter, consider whether there is enough data to support a unique EF.	United States of America	Accepted with modification	An explanation as to why RE-Fe (e.g. Dy-Fe) alloys are expected to have greater PFC generation - and therefore justify having separate emission factors (EFs) - was provided in footnote 1 of page 4.85; this footnote 1 has been further updated to provide extra clarity of the following. Due to the high melting point of these elements, they require alloying with Fe to produce a liquid metal product, which requires high temperature and high cell voltage - since PFC generation occurs at higher electrochemical potentials, these two conditions theoretically increase the risk of PFC emissions for production of RE-Fe alloys vs. other RE metals. This theory is supported by industrial measurements in Cai et al. 2018 and Zhang et al. 2018. Furthermore, the following sentence has been added after Line 2782, "RE-Fe alloys were reported to have greater PFC emissions than other RE metals (Cai et al. 2018; Zhang et al. 2018), consistent with the greater risk of PFC generation expected with the higher temperature and cell voltage operation required. "

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
3273	3	4	2824	2824	The EF(CF4) for Re-iron alloys is shown as 146.1 g/t. However, for the two papers cited, the value reported were 106 and 109.4. Is there a citation missing or an error? Also, the EF (CF4) is shown as 35.8 but the average of the 4 values cited (26.9, 26.66, 36.16 and 33.96) is 30.9. If a method other than a straight average of the measured EFs was used, the authors should specify it.	United States of America	Accepted	Footnotes a in Table 4.28 have been updated, noting that the (Zhang et al 2018) value of 106 g-CF4/t-metal for Dy-Fe production was divided by 57.97% gas collection efficiency (% process gases sampled vs. lost, from Cai et al. 2018 study). This is a straight average. Similarly Footnotes b in Table 4.28 have been elaborated, noting that the 26.9 g-CF4/t-metal for Nd metal (Zhang et al. 2018) was correctetd by dividing by the same 57.97% gas collection effiency from Cai et al. 2018 study.This was a straight average.
3275	3	4	2824	2824	Footnote a: Are the two industrial measurements from a single plant? Or two different plants? Both cited papers characterize the data as from a single cell from Qiangdong. Consider revising footnote to specify number of locations and not just number of measurements.	United States of America	Accepted	Footnote a in Table 4.28 has been updated, clarifying that this is 2 industrial measurements from the same facility for the default EF for Dy-Fe production.
63	3	6			The GL needs to give more concentration on the ghg emissions from electronic industries because of its high dangerous toxicity compared to other anthropogenic emissions.	Egypt	Rejected	IPCC Guidance on GHG Inventories is intended to focus on national GHG emissions, not other types of emissions or impacts (in-door or toxic concentrations).
1045	3	6	678	892	Emission estimation methods for semiconductor, LCD and photovoltaics manufacturing given in the guidelines are complex and not always straightforward for Tiers 2 and 3. It is for example indicated that in method 2a it is not necessary to know substrate sizes (e.g. lines 141-142, 680-684). However in order to calculate eq. 6.10 with the default values in Table 6.4, the wafer sizes have to be known. The guidelines for Tier 2a should clearly point out that it is also good practice to calculate emissions without taken into account the emission control systems if those are not in place or would require too heavy reporting burden for facilities (e.g. eq. 6.12 requires too detailed (min/year) information on operating times).	Finland	Accepted	Adding Tier 2a values for gamma. We will note that it is good practice to account for abatement but it is acceptable to report unabated emissions.
1047	3	6	1160	1162	Please replace phrase "good practice" with word “advisable” in this sentence. This requirement is too strict for example for small research institutes in which production capacity is low and new gases or process types are just tested. It is not feasible to collect data on Tier 3 level from these facilities supposing that the data is even available if the emissions from this source are insignificant compared to country's total GHG emissions. Also please check other parts of this chapter referring to this "accounts for (less than) 1%".	Finland	Accepted with modification	The term "good practice" was maintained; however, authors agree that an additional threshold is needed and have modified text
1049	3	6	1168	1173	The statement that county-specific default emission factors are less desired is confusing. Country-specific emission factors can be used if their use is justified. On the other hand, default emission factors given in guidelines should not only be country-specific. Please edit sentences.	Finland	Accepted	Language revised.
1293	3	6	757	757	The units for "EABi,CF4" and "Ci" are not given (may be prescribed in "kg"). They should be provided.	India	Accepted	Added units (kg)
1295	3	6	994	994	The units for "EABi,CF4" and "Ci" are not given (may be prescribed in "kg"). They should be provided.	India	Accepted	Added units (kg)

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
1297	3	6	1013	1013	Usage of parameter "k" not reflected in Equation 6.15 in line no. 994.	India	Accepted	Deleted k
3277	3	6	1	2107	The electronics and RAC chapters include several fluorinated compounds that are not currently addressed in Chapter 1 (Introduction) of Volume 3. Chapter 1 should be updated to remain consistent with Chapters 6 and 8 and especially with Volume 1, Chapter 8, section 8.2.2 ("Gases Included"), ll. 108-145, and with the updated Reporting Tables.	United States of America	Accepted	Chapter 1 has been updated to include additional GHGs.
3279	3	6	119	2404	The electronics chapter is relatively long and complex. Therefore, the guidance needs to be focused and streamlined to make it more usable by removing repetition (particularly within and between the Introduction and Choice of Methods sections), by reorganizing some discussions, and by adding tables to summarize information that is currently sprinkled throughout the text.	United States of America	Accepted	Chapter was clarified and streamlined.
3281	3	6	133	158	This list should be edited to remove redundancey and clarify which sub-sectors have had EFs updated (SC, LCD), which have not (PV), and which are entirely new (MEMS). Because a similar list of changes appears later in the Introduction, it probably makes sense to move this bulleted list (with the edits suggested) to the Mapping Tables.	United States of America	Accepted	This list was edited and moved to the mapping tables.
3283	3	6	138	138	Clarify that apportioning may also be required between wafer sizes.	United States of America	Accepted	Clarified in list; entire list was moved to the mapping tables
3285	3	6	154	154	Provide additional detail regarding updates to guidance regarding fluorinated liquids (e.g., mention new EFS for packaging, testing, and soldering).	United States of America	Accepted	Additional detail was added to the list under "Tier 1 method".
3287	3	6	163	163	To increase readability, strongly recommend breaking the Introduction into two smaller sections called something like "Overview of Emissions and Their Sources" and "Summary of Refinements," and reorganizing as necessary to remain consistent with these titles.	United States of America	Accepted	Subheadings were added as suggested
3289	3	6	174	174	Should note that fluorinated liquids are sometimes used to clean substrate surfaces, e.g., for MEMS.	United States of America	Accepted	Added substrate surface cleaning for MEMs to list of fluorinated liquid uses.
3291	3	6	175	175	Correct to indicate that fluorinated liquids are no longer believed to be used to clean TFT display panels during manufacturing. (They were used before 2010)	United States of America	Accepted	Added "before 2010" and clarification that they are no longer used
3293	3	6	175	176	Delete "Inventory compilers should also account for" since this section is intended as background rather than guidance. Similar language should also be deleted at 182.	United States of America	Accepted	Removed "inventory compiles should aslo account for" from setences
3295	3	6	177	177	Note that "dry removal of photoresist" is an additional "other" N2O using process.	United States of America	Accepted	"Other" N2O using processes examples were expanded to included dry removal of photoresist
3297	3	6	183	183	"light emitting devices" should be "light emitting diodes"	United States of America	Accepted	Changed
3299	3	6	193	211	This is a rather long paragraph and currently, the sentences regarding the sources of emissions run together. It should be revised to more clearly call out the different emissions sources.	United States of America	Accepted	Paragraph edited for clarity
3301	3	6	207	210	Delete sentence beginning "However, if the emissions control system's OEM." This level of detail is too high for an introduction.	United States of America	Accepted	Deleted sentence

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
3303	3	6	211	212	To increase usability, strongly recommend adding a new table that provides an overview of the sources of and types of GHGs emitted during electronics manufacturing, and where in the guidance each is discussed.	United States of America	Accepted	Table added.
3305	3	6	215	226	This text addresses methodological choice and therefore should be merged with the discussion in the "Choice of Method" section.	United States of America	Accepted	The refinements portion of this paragraph were moved the subheading "Summary of Refinements". The remainder was merged with the "Choice of Methods" section
3307	3	6	220	226	Here and elsewhere, please clarify the guidance regarding MEMS. Can the guidance recommend that inventory compilers use semiconductor Tier 2 EFs for MEMS that are manufactured using semiconductor tools and/or processes? Are MEMS manufactured on the same wafer sizes as semiconductors?	United States of America	Accepted	Added language to clarify that where semiconductor "Tool and processes" are used, Tier 2 Efs can be used for MEMs (Choice of Methods Section). Added discussion of via process and related high SF6 EF (Section 6.2.2.1).
3309	3	6	232	232	Move the sentence regarding the Tier 2b and 2c methods further down. This paragraph focuses on Tier 2a method.	United States of America	Accepted	Tier discussions separated. Moved to summary of refinements subsection per another comment
3311	3	6	239	246	Recommend deleting much of this discussion as it is redundant with ll 342-46.	United States of America	Accepted	Most of this section was deleted, as suggested by commenter
3313	3	6	247	247	Apportioning is also relevant to the Tier 3a method.	United States of America	Accepted	Changed to "using the Tier 2 and Tier 3a methods"
3315	3	6	248	252	This discussion on apportioning should be merged with the Choice of Method section.	United States of America	Accepted	Most of this discussion is now in the Choice of method section
3317	3	6	258	258	Note that the Tier 3b approach is applicable to all subsectors.	United States of America	Accepted	Note on applicability to all sub-sectors added.
3319	3	6	259	263	This discussion would fit better in the QA/QC section.	United States of America	Accepted	Moved from "summary of refinements" section to "QA/QC"
3321	3	6	268	268	Strongly recommend adding a new table to provide an overview of which Tiers have been updated for which sub-sectors.	United States of America	Accepted	New Table 6.2
3323	3	6	268	268	It appears that the emission factors and guidance for the photovoltaic subsector, which appeared in the 2006 Guidelines, have been dropped. Strongly recommend including EFs and guidance for PV for the following reasons: (1) even if current PV manufacturing only rarely uses FCs, countries still need to estimate emissions from historical PV manufacturing that did use FCs, and (2) at least one PV manufacturer in the US has recently reported emissions under the Greenhouse Gas Reporting Program.	United States of America	Accepted	Tier 2b Efs for PV from 2006 guidelines were added to the document as the current Tier 2c. Tier 2a and Tier 2b methods cannot be used if emissions control technology is used because Gamma data is not available.
3325	3	6	277	277	For simplicity, and to parallel the title for the Fluorinated Liquids discussion, recommend renaming this section something like "Gaseous Fluorinated Compounds and Nitrous Oxide."	United States of America	Accepted	Section renamed as suggested
3327	3	6	277	386	Strongly recommend reorganizing this text to move systematically from Tier 1 to Tier 3b, emphasizing the increasing precision and accuracy of the methods, as well as the increasing detail of the required data, as one moves from the lower to the higher Tiers.	United States of America	Accepted	Section is now organized to move systematically from Tier 1 to Tier 3b and emphasizing the increased precision and accuracy, as well as the increased detail of the required data
3329	3	6	279	279	Note that emissions also vary with the quantities of the gases used (which vary roughly with substrate processed), the identities of the gases used, and the wafer size (for semiconductors.	United States of America	Accepted	Sentence edited to note that emissions can vary with the quantities of the gases used (which vary roughly with substrate processed), the identities of the gases used, and the wafer size (for semiconductors.

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
3331	3	6	280	281	Note that the choice of method also depends on whether the category is key.	United States of America	Accepted	Reference to using Tier 1 only when electronics category is not key aded to section
3333	3	6	284	292	Would be helpful to reorganize this paragraph to move systematically from lower to higher Tiers.	United States of America	Accepted	Whole section was re-organized to move systematically from Tier 1 to Tier 3b
3335	3	6	293	304	This discussion belongs further down, in the discussion of why it is worthwhile to move from Tier 2 to Tier 3.	United States of America	Accepted	Whole section was re-organized to move systematically from Tier 1 to Tier 3b
3337	3	6	293	325	This paragraph includes valuable insights but should be broken up into multiple paragraphs (e.g., at line 316) providing an overview and then brief discussions of Tier 1 and Tier 2a. The first of the resulting paragraphs should be reorganized to increase readability, noting at the beginning the the precision of the emissions estimates improves as one moves from lower to higher Tiers and building on that generalization.	United States of America	Accepted	Whole section was re-organized to move systematically from Tier 1 to Tier 3b
3339	3	6	304	306	Delete; redundant with ll. 280-83.	United States of America	Accepted	Reference to Figure 6.1 deleted
3341	3	6	311	311	The current discussion of errors in gas apportioning could lead to the conclusion that apportioning always leads to increased error, but this is not the case at the Tier 2 level (i.e., in moving from Tier 2a to Tier 2c). Recommend revising discussion to clarify this.	United States of America	Accepted	Discussion on potential error due to errors in apportioning revised
3343	3	6	312	315	This discussion would fit better in the Uncertainty section.	United States of America	Accepted	Uncertainty discussion removed from this section
3345	3	6	316	316	Note that the choice of method also depends on whether the category is key.	United States of America	Accepted	Added to discussion of Tier 1
3347	3	6	316	320	In the discussion of the Tier 1 approach, note also that the Tier 1 method does not account for the quantities of the gases consumed (which are only loosely correlated with production), the identities of the gases consumed, the process type, and the wafer size (for semiconductors).	United States of America	Accepted	Added suggested note
3349	3	6	349	349	Recommend adding a paragraph discussing why apportioning increases the precision and accuracy of the Tier 2c method compared to the Tier 2a and 2b methods, considering both the distinctions among process types and the per-tool emissions of each gas from each process type for the abatement calculations.	United States of America	Accepted	Added paragraph on the why Tier 2c is more accurate than Tier 2a and 2b
3351	3	6	351	369	Consider moving Box 6.1 to the Tier 2a discussion or possibly to the Introduction.	United States of America	Accepted	Now box 6.2 and is in section on Tier 2a
3353	3	6	387	388	Move lines 300-304 to follow this sentence. They fit here more logically.	United States of America	Accepted	Moved to later in the disucssion, as suggested
3355	3	6	404	417	Figure 6.1 should be revised to eliminate the reference to 6 generation for Display in the fourth diamond down on the right, and to replace "substrate size" with "wafer size (for semiconductors)" in the third diamond down on the right. Only semiconductor manufacturing includes different EFs for different substrate sizes or technology vintages.	United States of America	Accepted with modification	Reference to 6 gen for Display was removed from Figure 6a. Authors prefer "substrate size" but added "(for semiconductors)"
3357	3	6	404	418	Figure 6.1 references tracking gas usage by generation (less than 6th vs. 6th or greater) for display to decide whether to use Tier 2a or Tier 2b; however, there is no Tier 2a or Tier 2b for display or a differentiation by generation.	United States of America	Accepted	Reference to 6 gen for Display was removed from Figure 6a.

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
3359	3	6	428	442	Consider whether Table 6.1 is still necessary or useful. If so, break up and/or simplify this table. Recommend breaking up by emissions source, e.g., gaseous FCs vs. liquid FCs. Could also (1) merge similar data elements (e.g., Ui and Ui,p), noting that for higher Tiers, more disaggregated data is required, and (2) re-order to "follow" gas flows (consumption, EFs, DREs, etc. as in 2006 GL). Authors may want to present this in landscape format to allow small amounts of detail in each cell (e.g., for Ci by process type for Tier 2c, "Ci,p (by process type)"	United States of America	Accepted	Table was revised.
3361	3	6	443	443	Recommend adding "EFs based on Production" to the title to clarify difference between Tier 1 and other Tiers, which are based on gas consumption	United States of America	Accepted	Title modified as suggested
3363	3	6	479	480	Recommend noting that Tier 1 does not account for actual gas consumption or for differences in EFs among process types.	United States of America	Accepted	Added to Tier 1 discussion
3365	3	6	487	487	Recommend adding "for Tiers 2 and 3" to the title to clarify applicability of the section	United States of America	Accepted	Title modified as suggested
3367	3	6	488	490	Recommend adding language to clarify that apportioning can also be performed to manufacturing of specific wafer sizes if more than one wafer size is produced in the same facility. Apportioning would be performed first by wafer size and then by process type.	United States of America	Accepted	Added reference to clarify that apportioning must also be done by wafer size
3369	3	6	520	520	"l" is a confusing variable name because it looks like the numeral "1".	United States of America	Accepted	Changed "l" to "c"
3371	3	6	541	544	This language is very similar to the language at 582-589. Should choose one or the other.	United States of America	Accepted	Removed from 582-589
3373	3	6	547	548	Recommend replacing "inventory compilers should" with "it is good practice to" in this sentence.	United States of America	Accepted	Changed to "it is good practice"
3375	3	6	557	581	This section should be rewritten to be clear, but less prescriptive. It is currently written more like a regulation than guidance.	United States of America	Accepted	Edited for clarity and revised to be less prescriptive
3377	3	6	565	567	This requirement appears to apply to stack testing rather than apportioning and should be deleted from the text here.	United States of America	Accepted	Sentence removed
3379	3	6	599	676	Recomend combining, streamlining, and moving this discussion above Equation 6.10, which is the first to use the weighting factor gamma. Recommend discussing the benefits of the gamma factor as well as its drawbacks. Applying the weighting factor gamma to tool counts to calculate the fraction of emissions abated is a vast improvement over using unweighted tool counts even if gamma is also uncertain. The example in the second paragraph of the Box should probably be replaced; it appears to be confusing total emissions for each process type with per-tool emissions for each process type.	United States of America	Accepted	Box and discussion moved as suggested. Example in box was replaced.
3381	3	6	619	620	Should be "ratio of of emissions of input gases or by-products k per tool between process types"	United States of America	Accepted	Gamma was clarified as based on per-tool emissions ratios

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
3383	3	6	633	676	Gamma should be an emissions per tool based ratio. Since gamma should be emissions per tool, it shouldn't matter if a facility has mostly IPC or mostly RPC. Instead a higher gamma could be reflective of differences in the number of chambers for each process type or a change in the gas ratios used in etching (e.g. an old facility might use more C2F6 per tool for etch than a new facility, resulting in a lower gamma)	United States of America	Accepted	Gamma was clarified as based on per-tool emissions ratios. Example was changed.
3385	3	6	638	642	Should be "when the percentage of tool equipped with emission control technologies is not the same for different process types using the same input gas…"	United States of America	Accepted	Changed to "fraction of process tools" from "number of process tools"
3387	3	6	650	652	Should be "uncontrolled emissions…per in-situ plasma cleaning tool…"	United States of America	Accepted	Fixed throughout document
3389	3	6	678	678	Recommend adding "Default EFs based on gas consumption" to the title to clarify difference with Tier 1 method.	United States of America	Accepted	Modified heading as suggested
3391	3	6	690	698	This discussion is redundant with the introduction to the Choice of Method section and can be deleted.	United States of America	Accepted	Discussion removed
3393	3	6	707	708	Here and elsewhere in the document, clarify that the inventory compiler's responsibility is to verify that the emission reductions are real, not to require use of abatement devices.	United States of America	Accepted	Modified sentence to clarify compiler's responsibility
3395	3	6	747	747	Recommend including a sub-heading just above this line similar to "Emissions and emission reductions from emission control devices"	United States of America	Accepted	sub-heading added
3397	3	6	760	762	Unclear what "when direct reaction with hydrocarbon fuel and fluorinated species is not certified" means. I assume the equipment in question needs to certified (in line with lines 750-752), not that the reaction is certified	United States of America	Accepted	"when direct reaction with hydrocarbon fuel and fluorinated species is not certified not to occur by the emissions control equipment OEM or electronics manufacturer"
3399	3	6	773	777	Lines 773-777 are similar to lines 1017-1021. It may be worth combining and discussing earlier in the Tier 2 section. Also, the wording in 1017 is clearer than in 773. 1017 uses "Inventory compilers should calculate" and 773 uses "Inventory compilers should note that"	United States of America	Accepted with modification	Authors decided to keep each calculation method section as stand-alone sections. Thus, the repetition is needed. Wording change accepted.
3401	3	6	804	804	Recommend including a sub-heading just above this line similar to "Calculation of ai and ak using the default weighting factors gamma I and gamma k"	United States of America	Accepted	Heading added as suggested
3403	3	6	808	808	Need to add guidance to this section on how to calculate destruction terms for gas and process-type combinations whose consumption is apportioned under Tier 2a and 2b (e.g., NF3 and C3F8 used in remote plasma clean processes and N2O used in either CVD or "other" processes.) In these cases, recommend referring users of the guidance to Equations 6.18 and 6.19.	United States of America	Accepted	Guidance added to use 6.18 and 6.19 for apportioned gases
3405	3	6	808	824	This discussion is somewhat confused because it implies that Equation 6.10 should be used for gas and process-type combinations whose consumption is apportioned. This includes, e.g., NF3 and C3F8 used in remote plasma clean processes and N2O used in either CVD or "other" processes. The discussion can be simplified by removing these gas and process type combinations. This will also enable direct reference to "etching" and "chamber cleaning" rather than "process type 1" and "process type 2."	United States of America	Accepted	Guidance was added to use 6.18 and 6.19 for apportioned gases. Also now directly references "etching" and "chamber cleaning" rather than "process type 1" and "process type 2."

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
3407	3	6	808	809	If Tier 2a is used (due to a mix of wafer sizes), which set of Gammas should be used from table 6.4? Table 6.4 requires choosing a wafer size	United States of America	Accepted	Gammas were developed for Tier 2a. Table 6.4 now has Tier 2a gammas and Tier 2b gammas
3409	3	6	813	813	Instead of "number of tools…is not the same" it should be "percentage of tools…is not the same"	United States of America	Accepted	Changed to "fraction of tools" from "number of tools"
3411	3	6	817	819	Gamma should be a ratio of emissions/tool for each process type	United States of America	Accepted	Fixed throughout document
3413	3	6	822	824	It is unclear why in the case of 300mm facilities that gamma is the sum of IPC and ITC but that this wouldn't occur for 200.	United States of America	Accepted	Changed to general guidance about counting all tools running ITC or IPC processes
3415	3	6	826	864	Here and in the introductions to the other Tiers, recommend starting with the applicability and general principles of the Tier, then moving to the default emission factors and equations. There is no need to reiterate the full discussion that appears in the introduction to the Choice of Method section.	United States of America	Accepted	Changes made.
3417	3	6	828	863	For na(i) and ma(i), perhaps "a" should be a subscript? Currently it looks like n is mulitplied by a (subscript i) instead of nai being one variable that is dependent on both a and i. On line 903, these are listed as n subscript (a,i)	United States of America	Rejected	Authors think current variables are already clearly defined.
3419	3	6	841	861	Gamma should be emisions/tool	United States of America	Accepted	Revised.
3421	3	6	845	845	In Equation 6.11, would it reasonable to estimate m(k) as the the total number of process type 2 tools (assuming process type 2 is EWC) as all EWC gases, except CF4, produce CF4 as a by-product? This would be simple and avoid double counting of tools that use multiple input gases. Was gamma(k) calculated this way? This may also be a reasonable approximation for C2F6 m(k)	United States of America	Accepted	Footnote added regarding tendancy to double count.
3423	3	6	857	857	Should say "process type 1" instead of "process type 2"	United States of America	Accepted	Error corrected
3425	3	6	878	880	This statement states that it is "good practice" to use interlock process tools or backup emissions control systems, but specifying use of abatement is beyond the purview of the Refinement. Recommend replacing with "Thus, using interlock process tools or backup emissions control systems reduces uncertainty by eliminating the need to estimate UT for the reporting facility."	United States of America	Accepted	Changed here and in other similar sentences
3427	3	6	901	901	Default gammas should be different for Tier 2b than Tier 2a. The gamma factors in table 6.4 are substrate size specific	United States of America	Accepted	Sentence revised to indicate that gamma is substrate size dependent for Tier 2b
3429	3	6	914	914	Consider whether you can merge at least some of the Tier 2a and Tier 2c equations, e.g., by simply noting that in most Tier 2a calculations (except for those for N2O and for NF3 and C3F8 used in RPC), the "p" subscript can be ignored.	United States of America	Rejected	For ease of inventory compilers, the equations were not merged
3431	3	6	915	916	Suggest rewording setence to the following: "The Tier 2c method is applicable to the semiconductor and display sub-sectors and is based on a set of equations and default emission factors that account for the difference in emissions between distinct process types.	United States of America	Accepted with modification	Sentence reworded for clarity

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
3433	3	6	943	944	In the clause " that reactions between …to form CF4 is not occuring…" the subject and verb are not in agreeement. Suggest changing to " that reactions between …to form CF4 are not occuring…"	United States of America	Accepted	Changed as suggested
3435	3	6	944	945	"but such emissions are calculated using…" should be a new sentence (and not include "but"). Suggest "...are not occurring within their emissions control systems). Tier 2c emissions are calculated using..."	United States of America	Accepted	Changed as suggested
3437	3	6	974	990	This language appears to be identical to ll 736-752 (under Tier 2a). This is one of many such repeats throughout the document. Recommend referencing the earlier discussion here and deleting at least some of the repeated text. One approach would be to include sections that are applicable to all Tiers (or e.g. all Tier 2 methods) at the front end and then to focus on the differences under each Tier description. Another would be to repeat the basic guidance regarding how to handle the calculation of byproducts, but to include the background information only once. Either aproach will simplify and reduce the length of the document.	United States of America	Accepted	Discussion was shortened and refers to previous discussion
3439	3	6	1106	1122	This language appears to be identical to ll 864-880 (under Tier 2a). Consider referencing the earlier discussion here and deleting some of the repeated text.	United States of America	Rejected	Keeping for ease of compilers.
3441	3	6	1155	1157	Was there a quantitative basis for the default EFs of 0.8, 0.15, and 0.05 ? This should be explained.	United States of America	Accepted	Footnote added to explain how authors decided on these defaults
3443	3	6	1167	1169	Recommend eliminating "country-specific default emission factors are less desired" because it is a vague statement and country-specific factors may in fact have some value. Explain instead that countries are likely to find it challenging to develop representative coumtry-specific factors, and that it is often preferable to refine factors at the global level.	United States of America	Accepted	Revised to explain that developing robust country-specific defaults may be challenging
3445	3	6	1195	1195	In the title, recommend inserting "process-specific" between "measured" and "parameters" to more clearly distinguish between the Tier 3a method and the Tier 3b method (which also relies on measured parameters).	United States of America	accepted	sub-heading modified as suggested
3447	3	6	1246	1246	Recommend adding "Stack testing" after the title to more clearly distinguish between the Tier 3a and 3b methods.	United States of America	Accepted	Title modified as suggested

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
3449	3	6	1268	1349	The preliminary estimate and subsequent methods used to estimate emissions from untested stacks raise a number of challenging issues. First, the preliminary estimate permits the use of unweighted tool counts to apportion gas usage to various stack systems (ll. 1282-84). No distinction is made between etching and TFD equipment. Since the preliminary estimate is the source of the factor (theta) used to scale up the EFs to account for untested stacks, errors here are a significant issue. Second, the equations for the gas-specific emission factors (6.26 and 6.27) assume that (1) the uptime of abatement equipment for the facility is the same as the uptime of abatement equipment for the tested stacks, and (2) the fraction of gas abated (ai,f) for the facility is the same as the fraction of gas abated for the tested stacks. Both assumptions appear questionable. Consider whether it may actually be simpler to require testing of all stacks initially, and then to permit less frequent testing of stacks that are identified as low-emitting through the initial test. This would eliminate the theta factor from Equations 6.26 and 6.27.	United States of America	Accepted	Changes made.
3451	3	6	1358	1362	This language is somewhat confusing and should be clarified. Presumably, the goal is to recommend retesting when the fraction of annual consumption of FC gases (expressed in CO2e) accounted for by any one FC gas changes by more than 10 percentage points compared to the year of the most recent emissions test. A distinction should be made between percentage and percentage points.	United States of America	Accepted	Revised for clarity
3453	3	6	1358	1362	Recommend removing N2O from this criterion and, if necessary, establishing a separate criterion for it. N2O is used for different purposes than the F-GHGs; thus, one wouldn't expect changes in N2O consumption to cause changes to FC EFs.	United States of America	accepted	N2O removed
3455	3	6	1363	1364	This does not specify what "change in consumption" means for an FC not used during the emissions test. Recommend that retesting be required when the FC accounts for 5% or more of facility consumption in mtCO2e.	United States of America	accepted	Modified as suggested
3457	3	6	1377	1400	Recommend shortening many bullets by eliminating "should be conducted."	United States of America	accepted	"should be conducted" removed
3459	3	6	1387	1391	The guidance does not distinguish between possible and expected byproducts here, but it does distinguish between them at ll. 1453-8. It probably makes sense to distinguish between them everywhere, but in any event, the guidance needs to be internally consistent.	United States of America	Accepted	Guidance revised for consistency
3461	3	6	1394	1397	Recommend emphasizing the importance of accurate gas consumption measurements during the stack test. Can add a sentence something like: "Because stack testing is conducted over a relatively brief period, measurements and calculations of gas consumption during that period must be precise to ensure that the resulting emission factors are accurate."	United States of America	accepted	Modified as suggested
3463	3	6	1464	1468	Equation 6.26 is missing a parenthesis	United States of America	Accepted	Added parenthesis

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
3465	3	6	1609	1630	Recommend clarifying the subsectors for which default Tier 1 fluorinated liquid emission factors are (and are not) available. It is worth noting that although Tier 1 EFs are not available for cleaning of MEMS, emissions from this process can be quite high.	United States of America	Accepted with modification	Availability of Tier 1 HTF Efs added. Emissions from cleaning of MEMs is not discussed here as there are no Tier 1 Efs available.
3467	3	6	1609	1630	Need to expand this equation (or the definitions of its terms) to include guidance on how to calculate emissions from testing, packaging and soldering, the emission factor for which is expressed in thousands of packaged devices.	United States of America	Accepted	Definition expanded and guidance added to text
3469	3	6	1633	1663	Recommend including a list of the common fluorinated liquid compounds and their trade names, as well as some discussion of their GWPs (if applicable).	United States of America	Accepted	Added table of commonly used HTFs with GWPs
3471	3	6	1703	1704	Authors should add information on how the Tier 1 Efs were calculated, including regions associated with the data, wafer sizes, whether wafer sizes were equally weighted, etc.	United States of America	Accepted	Information on Tier 1 calculations was added [does not discuss wafer sizes]
3473	3	6	1703	1734	Tables 6.2, 6.3, 6.4, 6.5, 6.6, 6.7, and 6.8 do not cite sources of data	United States of America	Accepted	[Still need reference to either sources]
3475	3	6	1706	1706	Need to restore default EFs for photovoltaics	United States of America	Accepted	Tier 2b Efs for PV from 2006 guidelines were added to the document as the current Tier 2c.
3477	3	6	1714	1728	What weighting factors were used to develop Tier 2a and Tier 2b? No sources are cited. Can the authors provide guidance on what facilities may be accurately described by using a Tier 2a or Tier 2b?	United States of America	Accepted	Authors will provide explanatory paper. The explanatory paper will contain information on the "average" fab that would be accurately described by the default Efs
3479	3	6	1725	1726	This table includes default gamma weighting factors for gas and process-type combinations whose gas consumption is apportioned and that therefore should not require gamma weighting factors. The table should be streamlined and clarified.	United States of America	Accepted	Errors in Table were identified and fixed
3481	3	6	1725	1725	It seems highly unlikely that Gamma(i) and Gamma(k) are the same for CF4 from IPC/EWC. Likewise it seems unlikley that Gamma(i) and Gamma(k) are the same for C2F6 from IPC/EWC. Were there transcription errors in this table?	United States of America	Accepted	Errors in Table were identified and fixed
3483	3	6	1725	1725	Since a gamma(i) exists for NF3 (IPC+ITC)/EWC for 300mm, then a gamma(k) for CF4 (IPC+ITC) should also exist since there is a CF4 by-product listed for both clean process types and CF4 is produced as a by-product in EWC. Also, since a gamma(i) exists for NF3 (IPC+ITC)/EWC for 300mm, than it should also exist for NF3 (IPC) and NF3 (ITC), unless both processes always exist simultaneously. The corresponding gamma(k) for CF4 should also exist.	United States of America	Accepted	Gammas are provided for different process combos for all substrate sizes. Other errors were identified and fixed
3485	3	6	1725	1725	What should faciliites do for instances were no default gamma exists? E.g. if they use NF3 in in situ thermal clean in a 200 mm facility. Can they use an analagous gamma?	United States of America	Accepted	Defaults provided by analogy gammas were we do not have data. Footnote added to gamma table to direct facilities to use a gamma of 10 where no gamma exists
3487	3	6	1725	1725	C3F8 is not listed as a by-product for RPC. Thus there should be no Gamma(k). Was this value intended to be a gamma(i)?	United States of America	Accepted	Errors in Table were identified and fixed
3489	3	6	1725	1725	How were the default gamma(i) and gamma(k)s calculated? No sources are listed. For gamma(k) for CF4, was the total number of EWC tools used (since all gases produce CF4 as a by-product, to avoid double counting of tools)?	United States of America	Accepted	Authors will provide explanatory paper. Potential issue of double counting is noted in text

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
3491	3	6	1729	1730	There are no in situ thermal clean emission factors in Table 6.6 or any indication that situ thermal clean is used for 200 mm. However, there are reported emissions from in situ thermal clean from 200mm facilities in the US. It would be good to clearly indicate that the process is used (either by having a data row and "NM" for gases used or otherwise in the text) but that no data exists	United States of America	Accepted	Footnote added to Tier 2c for <=200 that ITC is known to occur
3493	3	6	1768	1772	Run-on sentence. Suggest changing to: "These processes can lead to the formation of significant amounts of molecular fluorine (F2) originating from the conversion of NF3 into F2 or the limited ultiization efficiency of F2 (when the latter uis used as a cleaning precursor). When the exhaust gas contains large amounts of F2 AND when hydrocarbon -fuel-based combustions emissions control technology is used, direct reaction of the hydrocarbon fuel with F2 to form CF4 can occur.	United States of America	Accepted	Changed as suggested
3495	3	6	1809	1809	Source contains one quotation mark. Typo?	United States of America	Accepted	quotation mark removed
3497	3	6	1813	1814	Please check whether Xs should appear for C3F8 and COF2 for the Hot-wet technology in TABLE 6.11 (NEW)	United States of America	Accepted with modification	Adding an X for C3F8 greater than 850. No X is assigned to COF2 as COF2 is not in the table
3499	3	6	1816	1818	In figure 6.4, clarify that if an OEM-measured DRE is to be used, then it needs to be backed-up by supporting data. In addition, to avoid confusing abatement devices with semiconductor devices, recommend replacing "abatement device" with "abatement equipment" (or possibly "abatement system") here and throughout the document. For [4], recommend adding "to the levels shown in Table 6.12."	United States of America	Accepted	Changed
3501	3	6	1816	1818	You may want to consider adding the following two references here or in the text related to abatement. The references concern the formation of CF4 from organic process chamber residues during CVD chamber cleans using NF3, and similarly by direct reaction with hydrocarbon fuel if there is sufficient mixing in the emission control equipment. Gray, Fraser, and Afroza Banu, "Influence of CH4-F2 mixing on CF4 by-product formation in the combustive abatement of F2," Research Disclosure. Czerniak, Mike, "Mechanisms for PFC Formation in CVD Applications," presented at SESHA 2018.	United States of America	Accepted	Added as footnotes to discussion above figure
3503	3	6	1821	1822	The values in Table 6.12 should be expressed as decimal fractions rather than percentages.	United States of America	Accepted	changed to fractions
3505	3	6	1821	1822	the 2 in N2O should be a subscript, not a superscript; The 8 in C3F8 should be a subscript.	United States of America	Accepted	Error corrected
3507	3	6	1824	1825	The titles in Table 6.13 should be clarified to distinguish between heat transfer fluid applicatons and testing, packaging, and soldering (currently referred to as "burn in") applications.	United States of America	Accepted	Titles clarified
3509	3	6	1855	1857	This statement seems doubtful given that at least one PV manufacturer reported emissions through the US Greenhouse Gas Reporting Program. Consider revising or deleting.	United States of America	Accepted	Sentence removed

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
3511	3	6	1859	1859	Recommend adding the following overview sentence at the beginning of this section: "Completeness for electronics manufacturing requires accounting for all fluorinated GHGs and N2O (see section 6.1.1) and fluorinated liquids (see Table X) emitted from all emissions sources (see Table 6.1) at all facilities in all electronics manufacturing subsectors (see Table 6.2) in a country."	United States of America	Accepted	Added as suggested
3513	3	6	1859	1907	There is some redundancy among the bullets that can probably be eliminated.	United States of America	Accepted	Section streamlined
3515	3	6	1860	1861	Recommend making the bullet points more parallel to the issues in the overview sentence suggested for line 1859.	United States of America	Accepted	Bullets now more in-line with introduction to section
3517	3	6	1862	1867	Recommend deleting this bullet on the imprecision of the Tier 1 estimate. This is not what is meant by completeness. Tier 1 is less than ideal, but it is provided in case countries don't have data to support anything better. This is more of a precision issue.	United States of America	Accepted	Removed as suggested
3519	3	6	1920	1922	Considering that in 2006 very little 300mm technology existed, is the change in the Tier 1 emission factors largely due to the introduction of 300mm technology or the improvement of processes? If the former, would it be more accurate for 200 mm facilities to use the 2006 Tier 1 emission factors, regardless of year? Countries using Tier 1 may be more likely to be manufacturing on 200-mm and smaller wafers.	United States of America	Accepted	Authors revised guidance to say that if wafer size is known and 200mm or smaller, it use good practice to continue to use the 2006 Tier 1 factors even after 2010. Text added to both Tier 1 method discussion and time series consistency
3521	3	6	1923	1923	The meaning of "comparison or benchmark" should be clarified.	United States of America	Accepted	Removed "or benchmark".
3523	3	6	1939	2015	This discussion should not focus on the inability of the authors to estimate the uncertainty of the Tier 1 factors, but should note that Tier 1 EFs are highly uncertain and discuss why. The quantitative uncertainties calculated for Tier 2a, 2b, and 2c should be verified.	United States of America	Accepted	Disucssion of Tier 1 modified as suggested. Uncertainties were reviewed and accepted as calculated.
3525	3	6	1941	1942	"Accuracy" is generally interpreted to be included in the term "uncertainty."	United States of America	Accepted	Sentence removed per another comment; no longer relevant
3527	3	6	1972	1977	This discussion relates more to activity data uncertainties.	United States of America	Accepted	Moved to uncertainty of activity data section
3529	3	6	2058	2058	The discussion of gamma at 2045 through 2051 should be moved here, since gamma is used to calculate ai and ak.	United States of America	Accepted	moved as suggested
3531	3	6	2109	2335	Many of the sources listed in the "References newly cited in the 2019 Refinement" are not actually cited anywhere in the document, e.g. Trudinger (2016) is not cited anywhere	United States of America	Noted	Many of the references in the document are listed in the reference section as they are good resources for inventory compilers, but are not directly cited in the document are they are not specifically discussed. Where resources were used directly to e.g. develop emission factors, those references are cited.
1425	3	7	322	323	Spelling error; "partiesa" should be "parties"	Sweden	Accepted	
1653	3	7	413	413	7.5.1: We suggest to add blends such as R-448A, R-449A, R-452A, R-454A, R-455A, R-513A, which became common replacements for R-404A, R-410A, etc. during the last 5 years. Please check the supporting document. In turn, we suggest to delete blends that contain CFCs such as R-400.	Germany	Accepted with modification	A reference to the list of blends provided in the reporting guidelines of the UNEP secretariat is provided in the text

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
1655	3	7	682	682	Please revise the following incomplete sentence: "The spreadsheet "Calculation example for 2F1 (Tier 2) of the 2019 Refinement" and add SHOULD BE USED.	Germany	Accepted with modification	"Can be used" is added in stead of the suggested "should be used" because the use of the spreadsheet is optional
1657	3	7	713	713	Box 7.2: The case removal through export of equipment is not considered in the figure. Please add the word "Exported" in the "Retired Equipment" portion of the pie chart.	Germany	Accepted with modification	The fact that retired equipment can be exported, and not only scrapped, is now pointed out in the explanatory text in box 7.2B. It is also included in the worksheet (as an extra column for data entry) and the illustration in the worksheet. It is however not added in the pie chart as suggested, because we believe it is important to keep the chart as simple as possible to make it easier to understand.
1659	3	7	832	834	Please revise the sentence: "Information on the year each relevant kind of ODS-substitute was first used in each relevant type of equipment (sub-application) in your country (for instance, the year HFC-134a was first used in mobile air conditioning in your country)" and NEED TO BE COLLECTED.	Germany	Accepted	
1661	3	7	907	907	Due to the supporting material (NIR Germany, table 198), the lifetimes for MAC in maritime and railway can be longer than 16 years. Please adjust the value accordingly. Also, we suggest to use the following values for column "at time of charge": $0.2 \leq k \leq 1.0$	Germany	Rejected	Suggested statements and values were not found in the supporting materials or references therein
1663	3	7	907	907	Due to the supporting material (NIR Germany, table 198), the emission factor of operation emissions for MAC in maritime can be smaller than 20%. Please adjust the value accordingly. Also, we suggest to use the following values for column "annual loss, operating lifetime": $0.2 \leq k \leq 1.0$	Germany	Rejected	Suggested statements and values were not found in the supporting materials or references therein
1665	3	7	907	907	Due to the supporting material (NIR Germany, table 198), the emission factor of operation emissions for other MAC, namely agriculture machines, can be bigger than 20%. Please adjust the value accordingly. Also, we suggest to use the following values for column "annual loss, operating lifetime": $10 \leq x \leq 25$ (other MAC)	Germany	Rejected	Suggested statements and values were not found in the supporting materials or references therein
1895	3	7	657	658	The web link included here does not work and needs updating	United Kingdom (of Great Britain and Northern Ireland)	Rejected	The web link is correct
1897	3	7	1019	1032	It might be worth including a note that European Member States must report to the European Commission annually on production and imports of (bulk gas) HFCs in line with the EU F Gas Regulation.	United Kingdom (of Great Britain and Northern Ireland)	Accepted	

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
1051	3	8	361	362	Default Tier 1 emission factors for waterproofing of electronic circuits are based on measurement in one facility (Table 8.11). There is a risk that this emission factor is not representative and applicable as a default emission factor for all facilities. Proposition: move description of the calculation method and emission factors to an appendix.	Finland	Rejected	The current default emission factors are believed to be representative for the following reasons: - The measurement data represents significantly more than one data point, though admittedly from a single product application. The results were from several days of FTIR testing to eliminate run-to-run variability. - The process equipment that the testing was conducted on represents at least 30% of the global installed population of such equipment, and is therefore expected to be representative of the entire market. - The process is not altered for different circuit boards; the equipment contains "pockets" which hold the circuit boards so that the same equipment and process can be used for a wide variety of product applications. - LAs compared the data used to estimate the EFs with data from Stockholm University on Sony-Erikson phone circuit-board waterproofing, and the results were consistent.
1053	3	8	399	410	Please remove from this paragraph the phrase "authors propose" and edit text accordingly. Please add a clear statement to the chapter that countries are not obligated to report emissions from this potential new source since the proposed emission estimation methodologies are presented in an appendix.	Finland	Accepted	The Phrase "author propose" was remove and the text edited accordingly. The explanation about a role of Appendices will be added to the Overview Chapter of 2019 Refinement. A note about he Overview Chapter was added to the text.
1055	3	8	393	395	Please remove the word "significant" from the sentence since no actual indication of the level of emissions is presented in the chapter.	Finland	Rejected	See Comment ID#1057

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
1057	3	8	391	393	Please remove the text ", but, by analogy with plasma-based processes used in the electronics industry, FC emissions resulting from the use of input gases such as CF4, C2F6, CHF3, SF6, and other fluorine-containing molecules in plasma processes may be significant." There is no actual indication of the potential significance of the emissions level from this source and therefore no speculation on the possible significance should be presented in the guidelines.	Finland	Rejected	It is true that there are no available data about the textile fluorocarbons coating emissions in the atmosphere, however, treatment of both textiles and electronics with different kinds of plasma gas is a well-studied subject. There is no doubt from the scientific point of view that these process can have an incomplete use of the input gases or low emission of residual fluorocarbon monomers. The problem is the lack of information about the extent of this emissions and their relevance as GHG gases. However, considering that the world market of textile finishing repellent agents has been estimated to be 24.5 million tons in 2015, there is no doubt that even very small FC emissions released from these process could represent a significant new source, due to the large volume of substrates treated. The authors recognise the need for clarification in order to avoid misunderstandings by reediting the sentence as follows: "The extent to which plasma-based textile treatment processes have penetrated volume production is unclear, but, by analogy with plasma-based processes used in the electronics industry, and considering that many FC molecules are particularly stable and difficult to disassociate, the utilization efficiency of the input gas is likely to be limited, and FC emissions resulting from the incomplete use of input gases such as CF4, C2F6, CHF3, SF6, and other fluorine-containing molecules in plasma processes may be significant"
1299	3	Annex 1	28	28	In Column D (CO2 emissions); Equation should be divided by 1000 to arrive at Gigagrams from tonnes. Or otherwise, the unit of column D should be changed to "tonnes"	India	Accepted	
1301	3	Annex 1	30	30	Similar comment as above for column E	India	Accepted	
1303	3	Annex 1	32	32	Similar comment as above for column D	India	Accepted	
1305	3	Annex 1	86	86	Under Column E: it is unclear how kg value is being divided by 10^9 (instead of 10^6) to arrive at Gg value.	India	Accepted	Units for the emission coefficients C1 has been adjusted to "g CF4/s-tonne Al". This was an error in units. When divided by 10^9, this now correctly gives emissions in Gg CF4 units. The units have been corrected in both Annex 1, as well as in the Final Draft (variables for Equations 4.27b and 4.27f).
1307	3	Annex 1	89	89	Similar comment as above for column E	India	Accepted	Units for the emission coefficients C3 has been adjusted to "g C2F6/s-tonne Al". This was an error in units. When divided by 10^9, this now correctly gives emissions in Gg C2F6 units. The units have been corrected in both Annex 1, as well as in the Final Draft (variables for Equations 4.27b and 4.27f).
1383	3	Annex 5	17	17	Annex 5. The line reads: "CHAPTER 3". It would enhance the understanding if the line read: "CHAPTER 3 CHEMICAL INDUSTRY". This is relevant for all chapter headings in Annex 5.	Sweden	Noted	The format of the Mapping tables is standardised across all Volumes; the text in Annex 5 is consistent with the approach in other Volumes.

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
1427	3	Spreadsheet for 2F1(Tier2)_Ch7			The spreadsheet example calculation should include years up to 2050 to be able to estimate emission scenarios.	Sweden	Accepted	
1429	3	Spreadsheet for 2F1(Tier2)_Ch7			The calculation does not work if emission years up to 2050 is included. Some years show negative emissions and amounts.	Sweden	Accepted	
1431	3	Spreadsheet for 2F1(Tier2)_Ch7			For some emission estimates, years before 1988 may need to be included. A note about this should be added.	Sweden	Accepted	
65	3				The GL needs to provide more clarification and simplifying for reporting ghg emissions from refineries with integrated chemical industries and some processes, because the language used in the GL may leads to misinterpretation of the location where the mentioned emissions be reported	Egypt	Noted	The authors have reviewed the text within Energy and IPPU and acknowledge that there are complexities in the reporting of emissions from integrated (refinery-petchem) complexes. However, the GLs provide appropriate methodologies for all emission sources, indicate good practice for reporting allocations, but also provide flexibility for compilers in order that national circumstances (e.g. of resolution of activity or emissions data) can be accommodated, with the over-arching guidance to avoid gaps and double-counts in national GHG emissions estimates. Separate guidance is presented specific to refineries, and also specific to chemical and petrochemical production, within the Energy and IPPU volumes. The authors therefore consider that the risk of misinterpretation of the GLs is minimised.
161	4	1	365	369	"Compile national-level statistics for livestock, manure management systems, soil N management, biochar C, liming and urea application" this list is not exhaustive. Why compile only statistics on these kind of activities ? Other activities must be informed for cropland reporting. This is implicit from step 3 (« categorize by specific management ») but maybe a specific step should be added.	France	Accepted with Modification	Data on cropland management practices are compiled in Step 3. Text has been added to Step 3 for improved clarity.
655	4	1	39	143	Introduction section introduces new section on disaggregating natural causes of IAV but does not mention the introduction of new guidance for soil c estimation (including for biochar) in Chapter 2, flooded land in Chapter 7 or the complete re-write of the HWP guidance in Chapter 12. Suggest revise to remove the inconsistency of treatment of the scale of changes introduced in the chapters of this volume.	New Zealand	Noted	The context for the refinements associated with biochar and flooded land are discussed briefly later in the chapter. It does not seem necessary to explain all refinements in this Chapter because the overview chapter has already provided this context. In addition, the mapping tables provide considerable detail about the refinements. Chapter 12 was admended as necessary to address the consequential changes on the updates of the variables following the mandate.
667	4	1	180	181	Could this diagram also include N2O emissions from the deposition of urine and dung directly onto pasture?	New Zealand	Noted	It is beyond scope to refine this diagram.
669	4	1	180	181	Could this diagram have an expanded soil carbon component? At the moment it seems very basic	New Zealand	Noted	It is beyond scope to refine this diagram.
671	4	1	342	342	Start "Tier 3" on a new paragraph	New Zealand	Accepted	

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
673	4	1	366	369	specifically mention statistics for cropping activities (e.g. area and yield/tonnage)	New Zealand	Accepted with Modification	Data on cropland management practices are compiled in Step 3. Text has been added to Step 3 for improved clarity. Have also added crop yields in step 4.
1463	4	1	109	117	This introductory section should clarify the purpose of Ch2.6 by making explicit reference to the ToR and the outcome of the May 2009 expert meeting on the Managed Land Proxy. In particular, this meeting agreed that annual emission inventories should estimate the actual emissions in the inventory year and that the aim of emission inventories is not to try to remove or reduce the impact of inter-annual variations (see conclusion 5 in the expert meeting report).	EU	Rejected	To have a common approach among all Volumes, no specific references to the refinements listed in ToR were made.
1875	4	1	227	227	Consider changing 'long-term' to 'long' for clarity. In addition, please provide an example on what the long turnover time may refer to: centuries, millenia or more.	United Kingdom (of Great Britain and Northern Ireland)	Accepted	
1877	4	1	265	265	Remove 'occur', and add 'of' after 'by-product'	United Kingdom (of Great Britain and Northern Ireland)	Accepted	
3533	4	1	95	96	It would be good practice not only to quantify and track area of unmanaged land over time, but also REPORT on it as well? Recommend making that explicit in this sentence.	United States of America	Rejected	Text is from the current 2006 GL and was not subject to refinement
3535	4	1	112	116	The distinction made between the two types of events may not be so clear. "Extreme events" such as hurricanes kill trees and result in immediate emissions; severe and prolonged drought and pests can also kill trees. These may also be considered natural disturbances. Suggest making this gradiation more clear.	United States of America	Accepted	Text revised.
3537	4	1	118	122	Dissaggregating MLP estimates and removals into those of human and natural effects provides "refined estimates" still does not take into account that those emissions/removals are happening on managed lands. So regardless of if they are human or natural, if they are happening on managed lands they should be quantified and reported as such in the GHG inventory.	United States of America	Accepted	The text in Section 2.6 states that countries that chose to disaggregate the components of the MLP are to report both the totals and the compnents as requested here. We have revised Chapter 1 text accordingly
3539	4	1	130	132	The "Optional guidance" for disaggregating the MLP should be an appendix to Volume 4. Phrasing as a new guidance and method for estimating emissions/removals for AFOLU is confusing since countries do not have to use this approach. Additional comments on chapter 2.6 "Inter-Annual Variability" are provided as well.	United States of America	Rejected	The section provides good practice guidance for inventory compilers who choose to use the guidance. The 2019 Refinement includes many other examples of choices that can be made by inventory compilers, including the choice of Tier 3 methods, and the GL contain guidance for those cases as well.
3723	4	1	87	87	Please consider to include explanations of direct and in particular indirect emissions and removals.	Norway	Noted	This text is out of scope for revision because the use of direct and indirect did not change from the 2006 GL.

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
3725	4	1	90	96	Managed land is defined as land where human interventions and practices have been applied to perform production, ecological or social functions and "Emissions/removals of greenhouse gases do not need to be reported for unmanaged land". Is previously degraded land by human intervention where now human intervention is no longer allowed due to natural restoration without human interventions /management classified as managed or unmanaged land? Moreover, due to urbanization, croplands might be abandoned in some places. Please consider specifying how this abandoned cropland are to be classified. It would be beneficial if these potential sources and sinks could be evlauated to estimate the net GHG balance.	Norway	Rejected	Text is from the current 2006 GL and was not subject to refinement; in particular the land use categories
3727	4	1	97	108	Please consider to elaborate on howpolicy decisions also can directly influence emissions/removals from unmanaged land. E.g. if an area is protected from human activities. Examples could be concervation of in forest areas, national parks etc.	Norway	Rejected	To avoid introducing extensive description about "management and policy decisions" the last sentence of the paragraph was removed; and therefore there is no need to elaborate on policy decisions.
3729	4	1	107	108	The sentence is very unclear	Norway	Accepted	Sentence was deleted
3731	4	1	112	117	Please clarify the statement "The two largest causes of inter-annual variability (IAV) in GHG emissions and removals in the AFOLU sector are (1) natural disturbances and (2) climate variability". The anthropogenic is mentioned as third factor but not part of the largest causes of IAV. Does it mean the anthropogenic factor has less effect on IAV than the aforementioned causes? How is this related to the conceptual illustration in Figure 2.6A (line 2432-2436), which shows that managed land has a dominant effect on the GHG emissions and removals? Maybe the reason is that the anthropogenic emissions have lower IAV?	Norway	Accepted	We have revised the text to clarify that we are refering to the IAV in the emissions and removals due to human activities, not the absolute amounts.
3733	4	1	406	407	Please consider explaining what Managed Land Proxy (MLP) is referring to. How is this related to the statement of "the managed land proxy is imperfect (Ogle et al. 2018) because reported emissions from any area can include non-anthropogenic sources, such as natural disturbances"?	Norway	Accepted with Modification	Additional text was introduced to better explain the context of MLP within the proposed refinement. However, since the purpose of the section is only to briefly describe the organization of the Volume, is not appropriate to comment and/or respond to assessments about the "quality" of the MLP made in other publications. More details about the MLP and it's characteristics can be founded in Chapters 2 and 3.
3735	4	1	465	466	Table 1.2: Cropland (chapter 5). This section shows different classification of C pools and non-CO2 gases. However, croplands used to cultivate both crops and fruits might also have below ground biomass (BGB). Please consider if possible to include estimation of BGB as a potential carbon pool in the subcategories of Cropland Remaining Cropland (CC) and Land converted to Cropland (LC) .	Norway	Noted	Belowground biomass may be estimated and reported at Tier 2 or 3 as discussed in Chapters 2 and 5.
3737	4	1	467	468	Table 1.2: Grassland (chapter 6). Please consider is possible BGB as a potential carbon pool in the subcategories of both Grassland Remaining Cropland (GG) and Land converted to Grassland (LG) .	Norway	Noted	Belowground biomass may be estimated and reported at Tier 2 or 3 as discussed in Chapters 2 and 6. However, note that there was no refinements to the biomass C section of Chapter 6 in this report due to lack of sufficient data.

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
3739	4	1	467	468	Table 1.2: Wetland (chapter 7). In this section only emissions of CO2 and non-CO2 gases are expected to be estimated. However, flooded land remaining flooded land, such as hydroelectric reservoirs, can have a potential to fix signifcant amount of CO2. Does this mean net emissions including removals?	Norway	Noted	Removals of CO2 due to activty of biota (e.g. bacteria, macroinvertebrates, plants, fish, and other aquatic species), but these removals reflect short-term carbon cycling by the aquatic biota, and are not addressed in this guidance. There may also be storage of C in reservoirs that is transported from upland systems. This C is addressed as a loss in the upland systems, but estimating the amount of C that it is transferred to the reservoir is challenging as discussed in Box 7.1. Compiler may estimate these transfers, but this requires a higher tier method.
3741	4	1	467	468	Table 1.2: Settlements (chapter 9). Please consider if possible BGB as a potential carbon pool in the subcategories of both Settlements Remaining Settlements (SS) and Land converted to Settlements (LS) since urban green space can act as a carbon sink (Strohbach et al 2012).	Norway	Noted	Belowground biomass may be estimated and reported at Tier 2 or 3 as discussed in Chapters 2 and 8.
3743	4	1	467	468	Table 1.2: Other land (chapter 9). Below ground biomass might be a potential carbon pool in the subcategories of both Other land Remaining other (OO) and Land converted to other land (LO).	Norway	Noted	Changes in C stocks are only estimated for Land Converted to Other Land, but not for Other Land Remaining Other Land because these areas are typically exposed rock, glaciers or other similar areas without vegetation. Regardless, changed in belowground biomass may be estimated for Land Converted to Other Land using higher tier methods as discussed in the generic methods for Chapter 2 and additional guidance in Chapter 9.
3745	4	1	469	470	Table 1.2: Managed soils (Chapter 11). Manged soils, depending on the type of management and environmental conditions, can be both sources of emissions and potential greenhouse gas mitigation, e.g., no-tillage, application of biochar, animal manure and crop residues. Please consider both cases in the estimation of net carbon pools.	Norway	Noted	The removals are addessed in the soil C methods provided in Chapter 2 and further guidance in each of the land use specific chapters for forest land, cropland, grassland, wetlands, settlements and other lands.
69	4	2	495	542	The use of allometric models for biomass estimation is written in good details, meanwhile, it's still not easy to identify the best model to be applied to assure that the model accuracy is equal or higher than available default factors of Biomass Emission Factors (BEFs), selection of the best model may steel in need for more improvements	Egypt	Noted	As stated lines 495-501 "The accuracy of the models may be lower than e.g. available default factors or Biomass Emission Factors (BEFs), so it is good practice to choose the method with the higher accuracy". Guidance is then provided on how to select the best allometric model/s, in particular lines 513 - 531.
105	4	2	624	625	We think, and the text confirms it, that the use of biomass density maps from remote data can only be accurate to estimate aboveground biomass. Therefore, we ask for the inclusion of ABOVEGROUND in the title of section B. It would read "Using ABOVEGROUND biomass density maps constructed from remotely sensed data for biomass estimation"	Spain	Accepted	We added "aboveground" in the title

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107	4	2	626	627	in line with comment above, we ask for the inclusion of "ABOVEGROUND" as first word in line 626, so the sentence would read "Aboveground biomass density maps are wall to wall....", and inserting the following sentence after "trees.": " From these maps, other parameters can be derived". We need to make clear that the remote sensing technologies will also produce aboveground biomass maps, and that, combining this maps with other data sources, other estimations can be done.	Spain	Accepted with Modification	Now is specified in the title of the section
109	4	2	685	685	The text clearly says that aboveground biomass is the variable predicted from remotely sensed data, therefore, for estimating any other values, root to shoot ratio SHALL be used, and not MAY be used. We urge to change "may" by "have to", so the sentence would read "additional information such as country specific data for root to shoot rations have to be used to estimate carbon stocks in other pools"	Spain	Accepted with Modification	We changed the text to "are needed" to reflect this point
111	4	2	983	984	Table 2.2.: this table refers only to forests, therefore, it shall be moved to chapter 4, where it belongs. Keeping it here is not consistent with the outline of the document or the structure of the chapters.	Spain	Rejected	The table is a refined version of the original table from the 2006 GL that refered only to forest.
113	4	2	1066	1066	The stock change method, as Tier 1 method, continues being the default method for estimating emissions and removals in SOC, therefore, we suggest to add "(Default method)" at the end of the line 1066	Spain	Accepted	We agree that this change is needed because the heading is for both the mineral and organic soils.
115	4	2	1071	1071	Delete the reference to "native lands" in the definition of reference conditions. As they are defined it is impossible that there will be any values for carbon stock in reference conditions, at least in Europe. Most of the studies for determining carbon stocks in soils in the last decades have been developed in areas that have had some kind of human intervention in the last centuries. Even SOCref referred in table 2.3. are mostly comming from studies on "non-native" lands. Therefore, we ask for the deletion of "native lands" and its replacement by "before a change in management"	Spain	Accepted	The sentence is altered to the following: "The reference condition for the Tier 1 method is defined as that present in non-degraded, unimproved lands under native vegetation."
117	4	2	2410	2411	add "direct" before "human activities and those that are..." in line 2410. This would be consistent with ine 2437, where clearly indicates that those direct human induced effects are the ones being discrimined.	Spain	Rejected	The guidance does not aim to only disaggregate 'direct human effects' it aims to disaggregate natural disturbances from human activities to reduce IAV contributed by non-anthropogenic Natural Disturbances.
119	4	2	2431	2431	Delete "and other scientific estimates of GHG balances". It is true that these data will be available and useful for other analysis different from national GHG inventories as such, but other scientific estimates are not the aim of this refinement.	Spain	Accepted with Modification	Text has been revised to state that this will make NIR estiamtes more comparable with "other estimates of land-related GHG balances in the scientific literature"
121	4	2	2455	2455	add an "s" after wildfire. "natural disturbances, in particular wildfireS".	Spain	Accepted	Text revised as suggested

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
123	4	2	2511	2512	Stock difference with periodic measurements can often be used for the quantification of IAV emissions and removals and the drivers, and stock difference with annual measurements can't always be used for this purpose. We believe that this table is useles and missleading, and we suggest its deletion, together with the explicative text below, that we also find misleading and confusing.	Spain	Accepted with Modification	Text has been revised to further enhance the purpose of Table 2.6C. It is well documented that stock difference with periodic measurements at best provides a dampened measure of IAV because each year only 1/n panels are measured (Röhling et al. 2016)
125	4	2	2564	2568	In this paragraph there is a clear difference between salvage logging and other management activites after natural disturbances, the difference being that salvage logging can be considered harvested wood products later, therefore, accounted twice if it is not explicitly identifiec in natural disturbances reporting. Deforestation after NDs also needs a different treatment, as emissions will need to be considered in the land conversion lines in reporting tables. But for the other management activities (soil protection, pests protection, seeding, etc.) there is no need to disaggregate emissions and removals. We propose to replace the paragraph by "if a country choses to disaggregate ND emissions and removals, the it is good practice to disaggregate as anthrpogenic emissions in NDs those resulting from salvage logging and defforestation, if applicable. "	Spain	Rejected	The fact that emissions from human activities are considered anthropogenic is the foundation of the IPCC GL. We therefore reject the notion that some activities, e.g. those following a natural disturbance, could be considered non-anthropogenic. Note also that if a country chose to declare such emissions to be natural (e.g. emissions from site rehabilitation after wildfire) then the subsequent removals would also have to be considered natural, as already outlined in the text.
127	4	2	2616	2620	CH4 and N2O can be subject to subsequent removals in terms of CO2 equivalent, so the balance can be achieved to the total emissions excluded on a CO2eq. basis. This should be reflected in the text. We suggest replacing from "non-CO2 emissions are not taken up by vegetation" to the end of the paragraph by "non-CO2 emissions will take longer to be taken up by vegetation in terms of CO2eq, therefore, there is expectatins that these emissions are to be balanced, but conversion factors to CO2eq (i.e., GWPs) need to be taken into account. " This is how European countries calculate their balance for natural disturbances. Not only CO2 is taken into account, but also the N2O and CH4 emissions in CO2eq.	Spain	Accepted with Modification	The CH4 and N2O emisisons decay to zero in atmosphere because of bio-chemico-physical process that are not included in the NGHGI. Consequently, their balancing to zero cannot and need not to be tracked within the NGHGI. Although the original text has been revised with the following change to make it more clear: "… there is no expectation that these emissions will be balanced by removals because the biological, chemical and physical processes that result in the complete decay of CH4 and N2O in the atmosphere are not captured
163	4	2	1086	1087	Second diamond box after start : Needs to distinguish between Land use and management because a country may have reference C-stocks for different land use but not for management (which is more disaggregated). In fact, it is unlikely that many country will have representative reference stocks for different managements at national level, hence Box 2 would not be used.	France	Noted	Reference stock refers to stock present non-degraded, unimproved lands under native vegetation (in essence under no management). The practices applied to managed soils have no impact on the reference stock.
165	4	2	1086	1087	Third diamond box after start : Needs data on animal manure too	France	Accepted with Modification	Given the decision to move the Tier 2 Steady State Modelling approach to the Croplands chapter, it should no longer appear in the generic discussion pertaining to soils. The third diamond has beeen removed from the figure.

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
167	4	2	1086	1087	Third diamond box after start : "if yes then use the steady state approach" (and for croplands use the Century based approach). This contradicts l1334-1339 where it is writing that it is possible (and not mandatory as I understand from the decision tree) to use a steady state approach, but that a prerequisite is that the model is evaluated country-wise.	France	Accepted	Action: Remove the third diamond related to the Tier 2 Steady State Modelling method from Figure 2.4
169	4	2	1086	1087	Third diamond box after start : another option if you have disaggregated data sufficient to run steady state approach is to use evaluated models to estimate disaggregated stock change factors for use in a stock change factor Tier2 approach (as described lines 1361-1366)	France	Accepted	Action: Remove the third diamond related to the Tier 2 Steady State Modelling method from Figure 2.4
171	4	2	1153	1154	Batjes (2010) and Batjes (2011) references are missing in the references list.	France	Rejected	The indicated references are not missing. They are present in the list of references for soil organic carbon.
173	4	2	1725	1745	Proposing to account for biochar priming in the Tier 3 is not reasonable nor feasible : (i) per se priming is not included in any of the IPCC guidelines concerning biomass inputs, and this is correct as there is no evidence of long term major effect of priming on SOC stocks (while priming is very important in the short term). So it is not coherent/ homogenous to introduce priming about biochar and (ii) There is no consensus in the litterature on the priming induced by biochar as can be found in these published papers (Abbruzzini, T. F., et al. (2017), Azeem, M., et al. (2019). Bruckman, V. J., et al. (2015). Budai, A., et al. (2016). Cely, P., et al. (2014). Cotrufo, M. F., et al. (2011). Cross, A. and S. P. Sohi (2011). Cui, J., et al. (2017). DeCiucies, S., et al. (2018). Ding, F., et al. (2018). Fang, Y. Y., et al. (2015). Fang, Y. Y., et al. (2017). Fischer, D., et al. (2018). Gibson, C., et al. (2018). Jiang, X. Y., et al. (2019). Keith, A., et al. (2015). Keith, A., et al. (2011). Kerre, B., et al. (2016). Liu, Y. X., et al. (2018). Lu, W. W., et al. (2014). Lu, W. W. and H. L. Zhang (2015). Luo, Y., et al. (2011). Luo, Y., et al. (2017). Luo, Y., et al. (2018).Luo, Y., et al. (2017). Maestrini, B., et al. (2015). McClean, G. J., et al. (2016). Mendez, A., et al. (2013). Naisse, C., et al. (2015). Purakayastha, T. J., et al. (2016). Rittl, T. F., et al. (2015). Senbayram, M., et al. (2019). Su, P., et al. (2017). Thangarajan, R., et al. (2014). Tilston, E. L., et al. (2016). Ventura, M., et al. (2019). Ventura, M., et al. (2015). Wang, J. Y., et al. (2016). Wang, J. Y., et al. (2016). Wang, J. Y., et al. (2016). Watanabe, S. and S. Sato (2015). Weng, Z., et al. (2015) Weng, Z., et al. (2018). Whitman, T., et al. (2014), Woolf, D. and J. Lehmann (2012), Yu, Z., et al. (2018). Zheng, H., et al. (2018). Zimmerman, A. R., et al. (2011). Zimmerman, A. R. and L. Ouyang (2019). Mention of biochar priming in Tier 3 should be deleted.	France	Noted	The method stated that "Tier 3 models may address the long-term impacts of biochar on priming", but did not specify that these fluxes must be included. It is accepted that priming is currently hard to predict. However, the intention was that the guidelines should be forward looking in thate sense that if improved methods for predicting priming become available, then inventory compilers should have the option to include such calculations in a tier 3 assessment, provided that the method used is explained, data-driven, and scientifically defended.

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
175	4	2	2109	2111	In practice, data for model calibration (and for calibration of any relevant process represented in the model) is often scarce and it is unlikely that data for both calibration and evaluation will be available. An alternative is to use the data only for quantifying and modeling the bias and precision of the model (see Box 2.2H) and include this statistical modeling in the Tier 3 approach (more details in the Step 6, l.2257, and 7, l.2338, of the Tier 3 approach).	France	Accepted with Modification	Even in the case where an empirical model is developed to quantify uncertainty in the model, these data must be independent from the data that are used to develop and parameterize the model. Otherwise, the uncertainties are based on how well the model is calibated to the sites used in the parameterization, and not how well the model predicts emissions across the the spatio-temporal domain of the inventory. Nonetheless, based on other comments the *good practice* text has been modified to be less specific.
177	4	2	2111	2111	"Calibration data should, where possible, match the quality and scale of data sets used in the GHG inventory." the term "scale" is unclear. Does it mean here "spatial resolution" or "spatial perimeter"? Please consider rephrasing this term.	France	Accepted with Modification	It is good practice for the calibration data to be representative of the environmental conditions occurring within the country. In practice, this does not mean that all environmental conditions are covered, but that the original calibration data includes a range of the conditions existing in the country that is representative of national circumstances.
179	4	2	2332	2332	Please detail the method (as it is done for the other steps of the variance estimation)	France	Accepted with Modification	A sentence has been added that the variance is estimated based on the two stage sample of the NRI and a reference is given more information. It is beyond scope of this guidance to provide the full derivation of the two-stage sample variance estimation.
283	4	2	1020	1024	This introductory paragraph in grey should introduce the term used in equation 2.24 for biochar amendments added to mineral soils	France	Accepted with Modification	Action: The ΔBCmineral equations from Equation 2.24 were moved to Equation 2.25 to make it more clear that biochar has been included just in the mineral soil section. A sentence for ΔBCmineral has been included in the introductory paragraph for Mineral soils.
285	4	2	1074	1075	Assuming that soil organic C stock change during the transition to a new equilibrium SOC occurs in a linear fashion over a period of 20 years is an approximation. Numerous data point to non linear (e.g. exponential) changes with SOC being lost more rapidly in initial years after a change in management leading to reduced SOC stock after 20 years. E.g. Soussana et al., 2004. Carbon cycling and sequestration opportunities in temperate grasslands. Soil use and management.	France	Noted	This would add too much complexity for a Tier 1 method. This issue was already identified in the text and the fact that the linear approach is an approximation was pointed out. The non linear dynamics can be addressed at higher tiers.
287	4	2	1098	1102	By contrast to the specific case of biochar addition to mineral soils, this update does not provide improved guidance on stock change factors for inputs of organic matter to mineral soils. Improved guidance on organic amendments, their organic carbon contents and the long-term fate of the added carbon, depending on the nature of the organic amendment (e.g. manures, slurries, composts, etc) would however be useful.	France	Noted	A literature review was conducted but there was not sufficient data to update the input factors for other organic amendments.

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
291	4	2	454	454	Most allometric equations (especially in Globallometry) are used to calculate wood volumes. To switch to biomass, it is necessary to use wood densities (Réjou-Méchain et al. 2017, https://doi.org/10.1111/2041-210X.12753), a step to which particular attention must be paid, particularly to reduce uncertainties (Picard et al. 2015, https://doi.org/10.1007/s10310-015-0510-5). Global databases exist on this subject, including Zanne et al. 2009's Global Wood Density Database (https://doi.org/10.5061/dryad.234/1) - see also Flores and Coomes 2010 (https://doi.org/10.1111/j.2041-210X.2010.00068.x). This is a different issue from biomass density maps (section 2.3.1.1.3.B) so we suggest that additional explanations be provided on aspects related to the use of wood densities in the section dedicated to allometric models (section 2.3.1.3.A).	France	Noted	The importance of wood density is included in the guidance in Chapter 2.3.1.1. Refer also to section "The use of allometric models" lines 495 -542, where different properties (volume, mass, C stocks) are referred to as possible results of the application of allometric equations.
293	4	2	1209	1269	We are doubtful about the treatment given to biochar in Chapter 2 of Volume 4. Biochar is the subject of much scientific debate, which should be assessed by the Special Report on Climate Change and Land (SRCCL). Indeed research is still undertaken to know if there are not negative impacts when used on agricultural soils, including in terms of GHG emissions and removals. In view of these scientific uncertainties, we ask that a careful review be carried out on all developments specific to biochar. In particular, we consider that several points suffer from a lack of information and should be improved, in particular the lack of coherence between the assumed 1000 year time frame for measuring the fraction of carbon remaining unmineralized, and the non-consideration of interactions between the fate of carbon and soil types or land management. Also, the equations proposed do not include some limitations of biochar, in particular the consequences on above-ground and below-ground biomass (via the plant growth) of the imbalance in the ratios between carbon and other soil elements caused by the addition of biochar. On this topic, please consider the following article: Kavitha, B., Reddy, P. V. L., Kim, B., Lee, S. S., Pandey, S. K., & Kim, K. H. (2018). Benefits and limitations of biochar amendment in agricultural soils: A review. Journal of environmental management, 227, 146-154.(https://doi.org/10.1016/j.jenvman.2018.08.082).	France	Noted	We are not endorsing biochar amendments as a best management practice. The Special Report and other related documents are the proper place to discuss merits and problems with biochar amendments. However, it is an anthropogenic activity that impacts soil C stocks, and accordingly addressed in this report to estimate anthropogenic greenhouse gas emissions and removals. Incorporation of impacts of biochar type and chemical attributes, soil type, climate and interactions on persistence would move the method to Tier 2 or 3.

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
295	4	2	1418	1436	We are doubtful about the treatment given to biochar in Chapter 2 of Volume 4. Biochar is the subject of much scientific debate, which should be assessed by the Special Report on Climate Change and Land (SRCCL). Indeed research is still undertaken to know if there are not negative impacts when used on agricultural soils, including in terms of GHG emissions and removals. In view of these scientific uncertainties, we ask that a careful review be carried out on all developments specific to biochar. In particular, we consider that several points suffer from a lack of information and should be improved, in particular the lack of coherence between the assumed 1000 year time frame for measuring the fraction of carbon remaining unmineralized, and the non-consideration of interactions between the fate of carbon and soil types or land management. Also, the equations proposed do not include some limitations of biochar, in particular the consequences on above-ground and below-ground biomass (via the plant growth) of the imbalance in the ratios between carbon and other soil elements caused by the addition of biochar. On this topic, please consider the following article: Kavitha, B., Reddy, P. V. L., Kim, B., Lee, S. S., Pandey, S. K., & Kim, K. H. (2018). Benefits and limitations of biochar amendment in agricultural soils: A review. Journal of environmental management, 227, 146-154.(https://doi.org/10.1016/j.jenvman.2018.08.082).	France	Noted	We are not endorsing biochar amendments as a best management practice. The Special Report and other related documents are the proper place to discuss merits and problems with biochar amendments. However, it is an anthropogenic activity that impacts soil C stocks, and accordingly addressed in this report to estimate anthropogenic greenhouse gas emissions and removals. Incorporation of impacts of biochar type and chemical attributes, soil type, climate and interactions on persistence would move the method to Tier 2 or 3.
297	4	2	1725	1745	We are doubtful about the treatment given to biochar in Chapter 2 of Volume 4. Biochar is the subject of much scientific debate, which should be assessed by the Special Report on Climate Change and Land (SRCCL). Indeed research is still undertaken to know if there are not negative impacts when used on agricultural soils, including in terms of GHG emissions and removals. In view of these scientific uncertainties, we ask that a careful review be carried out on all developments specific to biochar. In particular, we consider that several points suffer from a lack of information and should be improved, in particular the lack of coherence between the assumed 1000 year time frame for measuring the fraction of carbon remaining unmineralized, and the non-consideration of interactions between the fate of carbon and soil types or land management. Also, the equations proposed do not include some limitations of biochar, in particular the consequences on above-ground and below-ground biomass (via the plant growth) of the imbalance in the ratios between carbon and other soil elements caused by the addition of biochar. On this topic, please consider the following article: Kavitha, B., Reddy, P. V. L., Kim, B., Lee, S. S., Pandey, S. K., & Kim, K. H. (2018). Benefits and limitations of biochar amendment in agricultural soils: A review. Journal of environmental management, 227, 146-154.(https://doi.org/10.1016/j.jenvman.2018.08.082).	France	Noted	We are not endorsing biochar amendments as a best management practice. The Special Report and other related documents are the proper place to discuss merits and problems with biochar amendments. However, it is an anthropogenic activity that impacts soil C stocks, and accordingly addressed in this report to estimate anthropogenic greenhouse gas emissions and removals. Incorporation of impacts of biochar type and chemical attributes, soil type, climate and interactions on persistence would move the method to Tier 2 or 3.

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
299	4	2	2564	2568	but also many other activities, such as site rehabilitation, water erosion prevention, removal of dead shrubs and dead non-commercial trees, replanting or seeding, etc. (as highlighed in Lines 2830-2832). This paragraph suggests that all management is to be considered anthropogenic, but salvaging and deforestation are different from other types of management and should not be treated equally (that was the consensus in KP accounting rules). The paragraph seems to suggest that the best course of action is to "do nothing" on burnt areas. This may well be the case in some remote areas, but it is certainly not in densely populated areas and/or with actively managed forests and landscapes. The difference mostly lies in the fact the salvaging will avoid emissions in other forestlands. Treating salvaging as non-anthropogenic emissions would lead to an imbalance in emissions reporting in forest land, i.e. the "extra" removals in non-affected lands would count, but the "extra" emissions in burnt areas wouldn't. Deforestation does not guarantee any future removals and is by nature a human induced decision and so it is consensual that it should be treated as anthropogenic. On the other hand, other types of management aim at speeding up post-fire recovery and the quality of the future forest. We suggest these nuances should be inserted into the text, as per following editorial suggestion: "If a country chooses to disaggregate ND emissions and removals, then it is good practice to disaggregate as anthropogenic the emissions and subsequent removals. As discussed above, the non-anthropogenic nature of the emissions can be determined by either non-anthropogenic events and/or non-anthropogenic circumstances beyond the control and not materially influenced by a country. However, it is good practice to include	France	Rejected	The fact that emissions from human activities are considered anthropogenic is the foundation of the IPCC GL. We therefore reject the notion that some activities, e.g. those following a natural disturbance, could be considered non-anthropogenic. Note also that if a country chose to declare such emissions to be natural (e.g. emissions from site rehabilitation after wildfire) then the subsequent removals would also have to be considered natural, as already outlined in the text. This guidance is designed to estimate and report emissions and removals and does not suggest any "course of action". The purpose of the GL is not to incentivise or discourage specific actions but to estimate the emissions resulting from actions.

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
301	4	2	2830	2832	Land management after natural disturbances includes forest salvaging, but also many other activities, such as site rehabilitation, water erosion prevention, removal of dead shrubs and dead non-commercial trees, replanting or seeding, etc. This paragraph suggests that all management is to be considered anthropogenic, but salvaging and deforestation are different from other types of management and should not be treated equally (that was the consensus in KP accounting rules). The paragraph seems to suggest that the best course of action is to "do nothing" on burnt areas. This may well be the case in some remote areas, but it is certainly not in densely populated areas and/or with actively managed forests and landscapes. The difference mostly lies in the fact the salvaging will avoid emissions in other forestlands. Treating salvaging as non-anthropogenic emissions would lead to an imbalance in emissions reporting in forest land, i.e. the "extra" removals in non-affected lands would count, but the "extra" emissions in burnt areas wouldn't. Deforestation does not guarantee any future removals and is by nature a human induced decision and so it is consensual that it should be treated as anthropogenic. On the other hand, other types of management aim at speeding up post-fire recovery and the quality of the future forest. We suggest these nuances should be inserted into the text.	France	Rejected	This paragraph only calls for documentation (and thus transparency) of the methods and assumptions made by a country. This text makes none of the assupmtions specified by the reviewer. In particular, there is no suggestion in the text in lines 2830 to 2832 about the course of action to take, or that salvage should be treated as non-anthropogenic emission. Earlier in the text it was stated that management activities such as salvage logging or site rehabilitation of areas affected by natural disturbances that cause emissions that are anthropogenic and that subsequent removals on ND lands can be used to balance these emissions.
303	4	2	2616	2620	The balance of non-CO2 gases emitted through natural disturbances on managed lands cannot be reached on a gas-by-gas basis but can be considered on a CO2eq basis and/or a lower anthropogenicity in the subsequent removals. According to the first option, GHG emissions, including CH4 and N2O emissions, could be balanced by future CO2 removals, leading to an higher stock than the pre disturbed levels. According to the 2nd option, using the of distinction between anthropogenic and non-anthropogenic, the additional CO2 balance needed to offset non-CO2 emissions can be made by reducing the anthropogenicity of subsequent removals. We suggest the following editorial suggestions: "In addition to CO2 emissions, natural disturbances may cause non-CO2 emissions, e.g. wildfires cause N2O and CH4 emissions. While CO2 emissions are assumed to average out across time because of vegetation regrowth after disturbance, non-CO2 emissions are not taken up by vegetation and therefore balancing these emissions by removals can only be made if there is a reasonable possibility for future forest C Stocks to exceed the pre-disturbance levels by an amount equivalent to the non-CO2 gas emissions and/or by reducing the share of removals considered anthropogenic by a level equivalent to the non-CO2 gas emissions."	France	Accepted with Modification	The CH4 and N2O emisisons decay to zero in atmosphere because of bio-chemico-physical process that are not included in the NGHGI. Consequently, their balancing to zero cannot and need not to be tracked within the NGHGI. Although the original text has been revised with the following change to make it more clear: "… there is no expectation that these emissions will be balanced by removals because the biological, chemical and physical processes that result in the complete decay of CH4 and N2O in the atmosphere are not captured

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
351	4	2	1216	1216	The equation to take into account biochar effect is strange because it also includes emissions relative to its production. It seems contrary to usual methodologies which estimate actual emissions/removals when and where they occur. It seems much more logical to take into account CH4 and N2O emissions from biochar production in energy sector and carbon storage in AFOLU. This equation looks like a life cycle analysis which is quite unusual in IPCC guidelines for emission/removal calculation.	France	Accepted	It has now been decided that emissions of non-CO2 GHGs (e.g. CH4 and N2O) during the heating process used to produce biochar will be recorded in the Energy sector of national inventories (see Volume 2, Chapter 4, Table 4.3.2.1 for values associated with charcoal production).
353	4	2	1027	1027	This equation ΔCsoil = ΔCmineral - Lorganic + ΔBC + ΔCinorganic is not very balanced. As mentionned in the text, biochar could be included in Δcmineral, there are other products which may lead to very stable carbon in soil (it is likely that the IPCC won't change but it is proposed to name it ΔCbiochar). Lorganic could also be ΔCorganic even if especially losses are expected.	France	Accepted with Modification	Such changes to Equation 2.24 were discussed by the author group. It was decided not to change the subscripts because they are well known to inventory compilers and changing them could cause uncertainty. However, it is accepted that the biochar term creates an imbalance, and in fact, this practice is part ofh the mineral soil C method. We therefore have moved the biochar C term to the mineral soil C calculation in Equation 2.25.
459	4	2	298	298	Please, delete sentence "Losses are always marked with a negative (-) sign." - as with negative sign usually are marked not losses, but removals. Additionally, saying that losses have negative sign bring a confusion for eq.2.4 - as losses are subtracted from gains and it is not clear if it is meant like: gains - (-losses)= gain+losses	Russian Federation	Rejected	Changes in grey text not under refinement
461	4	2	1236	1237	The sentence seems unclear: The quantity of sequestered carbon will be greater than for times less than 1000 years, and very slowly decline below FPERMP thereafter, with FPERMP .	Russian Federation	Accepted	The sentence was removed as it did not add anything substantial to the text or interpretation.
463	4	2	2479	2483	The justification for usage of natural disturbances provisions only for some land categories and not for another needs to be more robust. "Large carbon stocks" are to be defined with numbers or a such limitation in usage of provisions should be deleted at all.	Russian Federation	Accepted	Deleted reference to "large carbon stocks".
465	4	2	2479	2492	As the proposed methodology includes disaggregation of natural and anthropogenic disturbances on managed land and if country would like to apply a such refined approach -- in that case it should be stated that disturbances of unmanaged lands to be disaggregated as well as. And the effects of all considered anthropogenic caused disturbances to be reported in the GHG inventory.	Russian Federation	Rejected	By definintion anthropogenic emissions and removals do not occur on unmanaged lands. If they do the land should be classified as managed. Moreover, there is no reporting requirement for E/R on unmanaged lands.
467	4	2	2494	2498	Not clear if emissions from ND will never balanced by removals on particular unit of land -- should country report the difference once? Or should document what activities have been implemeneted to ensure the establishment of the same C stocks on that land as prior to ND? Though these are natural disturbances, but the land is still MANAGED.	Russian Federation	Rejected	The current text clearly explain that in the absence of land use change (deforestation) the expectation of balance is always in place. If regeneration after disturbance fails, then there are no removals to report. Countires should report emissions and subsequent removals as they occur, even if in some cases the removals can occur over a long period.

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
469	4	2	2495	2496	It should be clarified here about non-CO2 emissions from natural disturbances: following to the suggested logic these emissions should be fully reported.	Russian Federation	Rejected	Non-CO2 emissions from natural disturbances are disaggregated (if chosen by the country) and reported in the ND component of the MLP emissions and remvoals. Their balance over time is achieved through atmospheric processes, not through removals in the ecosystem and these are not included in the NGHGI
471	4	2	2556	2592	Both natural and anthropogenic effects contribute to the annual disturbances (see rows 2455 and 2456). However current methodology only suggests fully excluding emissions and removals from disturbances without reporting of the anthropogenic part of the effect. There is no guidance on how always disaggregate such anthropogenic component of emissions and removals caused by any disturbances. Please add the corresponding guidance on estimation of anthropogenic component in emissions and removals when any disturbances occur.	Russian Federation	Rejected	**WIP -** Authors appreciate the request of the reviewer. The approach outlined on the separation of disturbance emissions and removals into "anthropogenic and natural" is based on the disturbance type and disturbance severity. Emissions from disturbances that are associated with managenent (e.g. slash and burn or fires on drained peatlands) are considered anthropogenic emissions, while those due to wildfires (e.g. caused by lightning stike or beyond the control of humans) are considered natural emissions. Thus for any individual disturbance event, the guidance request to "place" all emissions into either the anthropogenic or ND component. It is recognised that emissions from some disturbance events that are considered natural, may contain an anthropogenic component and conversely, some emissions from an anthropogenic component may be affected by natural effects. This is why the guidance refer to the resulting estimates of anthropogenic E/R as a second order approximation. A perfect separation (i.e. guidance on estimation of anthropogenic component in emissions and removals when any disturbances occur) is not possible at the moment but it assume that the mutual overlap cancels out, to some extent.
723	4	2	478	488	Suggest to also elaborate or describe the role of parameter "a" in the allometric equation. Based on the equation, it seems that both parameters "a" and "b" influence the proportionality between the relative increases of "x" and "y".	Philippines	Accepted with Modification	Text is revised and the parameters clarified
725	4	2	521	525	It seems the list of conditions is not complete, with missing bullets or a paragraph is missing.	Philippines	Noted	The list provided is indicative it does not intend to be complete
727	4	2	726	727	In Box 2.0E, the figure indicates a unit of "AGB Mg/ha". For consistency, it is suggested that the unit be replaced by "AGB Mg C/ha"	Philippines	Rejected	This section is about biomass maps and a unit in biomass units is fine.
905	4	2	798	798	Format of the reference in the text should follow the same form to ensure the consistency of the format.	Republic of Korea	Accepted	Formatting of references will be standardised (i.e. either "et al.," or "et al.") across all the docuement
907	4	2	655	660	Minimum spatial resolution needs to be further presented to ensure the accuracy of the data.	Republic of Korea	Accepted with Modification	We noted some inconsistency in the text and revised it to provide clarity on optical sensors and their resolution in the second paragrpah of the box
909	4	2	818	819	A bracket omission of ")" should be added after Haron et al., 2013)")".	Republic of Korea	Accepted	Editorial fixing

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
911	4	2	983	984	The format of table 2.2 should be revised. The variation of the default value shown in the table is too large to represent the data ability.	Republic of Korea	Rejected	The format of table 2.2 was kept from the 2006 GL, but the content was revised, based on an substantial literature review. The variation reflects the literature considered.
913	4	2	1516	1517	As the soil carbon maps presented as an activity data for this section are made in a global scale, it may be appropriate to use Tier 1 level rather than Tier 3.	Republic of Korea	Accepted	References removed
971	4	2	453	560	An Allometric Model, which is of great limitation in application, is only suitable for small-scale projects or stand level, but not for large scale and national-level greenhouse gas inventories. Due to the complexity of its application, this can not be regarded as a "good practice". Moreover, this section, which gives only a conceptual description of "Allometric Models ", does not indicate how to use it in inventory preparation. So it is suggested to give instructions in this connection. If they are not available, it is suggested to delete the mention of this model directly.	China	Rejected	The concerns are all addressed in the guidance. Allometric models are often used at national scales. Guidance is provided at the level required for inventory compilers to undestand in which context they can be used and not given concrete models or instructions how to construct them. There is already a considerable body of work available in the literature on the application of allometric models that can be consulted. As allometric models are in common use in inventories in particular when tier 2 is used, some general guidance for inventory compilers was considered necessary.
973	4	2	818	819	Considering the decomposition of dead wood, it is not appropriate to set its Carbon Fraction (CF) at 0.5. So it is suggested that its CF be revised to 0.37 the same as Litter.	China	Rejected	Thank you for the comment, we have clarified that this value is for temperate tree species. Unfortunately there is very little data on this topic so the values given here are default values, to be used if no more detailed information is available. The transition from wood to litter is gradual, as is the change in CF, and setting the CF of dead wood equal to that of litter would be incorrect.
1073	4	2	1216	1234	The equation 2.26A (New guidance) for estimation of annual soil C stock changes associated with biochar amendments include terms "global warming potential of methane and nitrous oxide produced during pyrolysis in unit of CO2 eq". The meaning of these terms in equation is not properly explained but indicate that CH4 and N2O emissions formed during the pyrolysis process to produce biochar would be subtracted from the C stock changes when biochar is used as a soil amendment. This does not seem consistent with general prinicples applied in IPCC Gls to estimated emissions of CO2, CH4 and N2O separately, and also to report emissions where they occur. It could also lead to double counting of emissions when these emissions would be reported in the energy sector (see Vol. 2, chapter 4). Please clarify the meaning and revise the equation, as appropriate.	Finland	Accepted	It has now been decided that emissions of non-CO2 GHGs (e.g. CH4 and N2O) during the heating process used to produce biochar will be recorded in the Energy sector of national inventories (see Volume 2, Chapter 4, Table 4.3.2.1 for values associated with charcoal production).
1075	4	2	2348	2349	Comparison of model-derived inventory estimates with the estimates of the previous submissions is not verification with independent data (as caption says) but normal QA/QC, please remove - unless different model was used in the previous submission but that would need more guidance to be clear to inventory compilers.	Finland	Rejected	The text does not suggest comparisons with previous inventory estimates as a verification process. Rather we note that is it possible to use other data sources, such as harvest statistics, to help verify the mdoel results, while noting the potential issues when doing so.

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
1077	4	2	2382	2832	Is the section on interannual variability in line with the Terms of Reference? The focus is on ND that are not mentioned in the TOR but very little guidance is given for ND (best suitable for an appendix) and practically no methodological guidance for interannual variability per se.	Finland	Accepted with Modification	Text in Chapter 1 has been revised to further clarify the purpose of Chapter 2.6 in line with the 2019 Refinement ToR. Nevertheles, authors disagree with the reviewer's suggestion that is "best suitable for an appendix" and the assessment that "practically no methodological guidance for interannual variability" was given. IPCC guidelines sets a strong precedent for enabling countries to apply their own definitions and methods within the framework of good practice and this section continues this approach. This section provides inventory compilers with the framework for developing country specific estimates following IPCC guidance, rather than dictating to countries how they must implement their inventory.
1079	4	2	2454	2832	Please place the draft guidance on ND to an appendix as there are not enough guidance given, no scientific method i.e. no mention what would Tier 1 be (or assumptions of it to be zero) and in addition, the current guidance appears to be a mixture of no guidance and some rules that can be interpreted to be more accounting rules than IPCC guidance (examples: proportion with which the subsequent removals should be allocated between ND and anthropogenic activity, taking into account current removals occuring on sites of the past natural disturbances (pre-1990) to balance out current ND losses). There is no guidance for taking into account the carbon storage in soil as well as in DOM pools in case of natural disturbances which would be needed if this ND guidance were to remain in Chapter text and not placed in an appendix.	Finland	Rejected	The method proposed is not an additional methodological tier, to be applied. It is just a refinement that countries that wish to do so can apply to refine the managed land proxy. Its application does not impact any of the methodological guidance provided by IPCC on how to estimate GHG emissions and removals from carbon pools (including soils) in land use categories.
1081	4	2	2454	2832	Please remove frequent references to countries in the text, i.e. the guidance should not be based on approaches or conditions of individual countries but should consist of more generic guidance approved by the experts and supported by literature.	Finland	Rejected	The term countries has beed used consistently throughout all 2019 Refinement to refer to countries collectively (generically) rather than individually. Country examples are given in boxes with the caveat that boxes are "for information only and neither adds guidance nor overrules guidance provided". In addition, according to "instruction to Authors" within the 2019 Refinement ToR "Lead authors must consider all recent scientific developments and national methods used by countries in their inventories".
1083	4	2	2407	2408	IPCC Expert Meeting Report would be the correct title, as it is not a question of reviewed report compiled by experts but a meeting report as stated in the list of references as well and given as a citing recommendation in the report in question. Please correct.	Finland	Accepted	Text revised as suggested

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
1085	4	2	2461	2462	Please remove the example referring to savannahs. The example is presented under natural disturbances but there is a strong component of human activity in frequent burning of savannahs thus this example should not included under heading of natural disturbances, especially because of the definitions of natural disturbances that follow. Please see for instance Laris et al. (2015). The Human Ecology and Geography of Burning in an Unstable Savanna Environment. Journal of Ethnobiology. 35. 111-139. 10.2993/0278-0771-35.1.111.for a reference on the anthropogenic origin of frequently burning savannahs.	Finland	Accepted	Reference to savannah has been deleted.
1087	4	2	2566	2576	Please check the use of "proportionally" which is not supported by the example following "proportionally". Subsequent removals that exceed original losses allocated to ND and are thus allocated to anthropogenic activity may exceed the original losses salvaged in salvage logging. The example appears to be an accounting rule, not a emissions/removals calculation guidance. Please reconsider the guidance.	Finland	Accepted with Modification	Text has been revised to enhance clarity. The user is correct that the removals are allocated "proprotionally" only until the ND emissoins are balance by ND removals and we have added text to indicated this. Thereafter all removals are allocated to the anthropogenic component. However, authors do not consider this to be an accounting rule but a specification required to ensure balanced allocation of removals to ND and anthropogenic components.
1089	4	2	2595	2596	In text and in Box 2.2L: The term of "Refined MLP" contradicts the concept of the Managed Land Proxy. Please rename as the guidelines clearly indicates that the approach of the MLP is maintained in the 2019 Refinement.	Finland	Accepted	We revised the text to replace the term "refined MLP flux" with "second order approximation of anthropogenic emissions and removals".
1091	4	2	2820	2820	Box 2.2L and elsewhere: Please reject the term "total fluxes" and its abbreviation CO2-e as use of fluxes is not consistent with the rest of the 2006/2019 GL.	Finland	Accepted	Text has been revised to replace "fluxes" emissions
1093	4	2	2820	2820	Box 2.2L: what does start year refer to? To ND events in the past (pre-1990) or what?	Finland	Accepted	Start year refers to the first year in the inventory time series, e.g. 1990. We have added a footnote to clarify.
1095	4	2	2777	2777	Box 2.2K: footnotes 27-32 are missing from the pdf.	Finland	Accepted	Footnotes added
1153	4	2	1053	1053	Recommend changing to 100 years. 1000 years is overly conservative and inconsistent with the permanence requirements for other sequestration measures.	Australia	Accepted	The permanence period has been changed to 100 years to be consistent with the permanence requirements for other sequestration measures.

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
1155	4	2	1215		Comment: We welcome the inclusion of guidance on calculation of biochar C, and largely agree with the approach. Ideally pyrolysis temperature should not be the distinguishing factor for biochar persistence but rather the elemental ratio H:Corg (at least to some extent long residence time can substitute for lower temperature, in terms of degree of carbonisation). We acknowledge the need for the Tier 1 method to be simple to apply, but are not convinced that it is easier to obtain data on kiln temperature than chemical analysis of biochar. Also, the considerably higher stability assumed for higher temperature char does not have strong basis, and may encourage gasification instead of slow pyrolysis, with net reduction in biochar produced, and biochar with lower agronomic value. Also, as noted at line 1053, 1000 years is overly conservative as a "permanence period". 100 years would be consistent with permanence requirements for other sequestration measures.	Australia	Accepted with Modification	The calculation of Fperm has been changed from a linear regression to heating temperature categories to account for the known non-linearity between pyrolysis temperature and biochar C persistence. Justification for this change has been added to Annex 2A.2. The Tier 1 methodology was based in temperature rather than biochar properties (such as the mentioned H/Corg or O/C ratios) to facilite accounting in the framework of a Tier 1 method. H, O, and C analyses using Dumas combustion requires specialized equipment that is not available in many countries. In addition, costs for analyses will also constrain the applicability of the method. Mandating the use of elemental ratios will reduce the ability to account for biochar additon to mineral soils. Countries with the ability to measure biochar properties are encouraged to use the recommended Tier 2 and 3 methods; appropriate reference was added to the method and appendix. The text in Annex 2A.2 defining how Fperm was calculated was revised. The revised values of Fperm have been added to Table 2.3B. Text has also been added to Annex 2A.2 defining the potential use of O/C and H/C ratios in higher Tier methods.
1157	4	2	1333		Recommend noting the possibility of measuring SOC stock change by equivalent mass rather than depth, as this requires consideration of C stock below 30cm depth.	Australia	Accepted	The following sentence has been added: For developing a Tier 2 method it would also be possible to define reference SOC stocks and SOC stock change factors using an equivalent mass approach (see Box 2.2B) rather than an approach based on a fixed depth.
1159	4	2	1579	1585	Recommend clarification: Three fractions are mentioned in line 1554: particulate, humus and resistant. It is not clear whether "decomposable and resistant plant materials" are included in one of these fractions. Derivation of decomposition rates of resistant and humus fractions is mentioned, but not for particulate fraction. Line 1585 introduces the term inert fraction which is not mentioned previously - is it different from resistant?	Australia	Accepted with Modification	In point 2) the relationship between the measureable fractions of SOC (particulate, humus and resistant) to the respective model pools (resistant plant material, humus and inert) is identified. The inert fraction is clearly identified. References are provided that go into detail about this relationship and what the fractions and pools represent. In point 5) the calibration of the model pools is discussed using the terms applied to the model pools. However, in referring to the resistant plant material pool, it was only labelled as resistant which could cause some confusion.
1161	4	2	2499		Recommend describing an example of regeneration failure: e.g. wildfire that leads to loss of veg cover on steep slope; subsequent heavy rainfall removes soil - no capacity for regeneration in human timeframe.	Australia	Accepted	Examples were added for clarification.

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
1163	4	2	2522	2523	Recommend clarification: presumably this applies just to CH4 - i.e. we need auxiliary data to know whether the C loss detected by stock difference was emitted as CO2 or CH4.	Australia	Accepted	Text has been revised to indicate that non-CO2 GHG here refers to both CH4 and N2O emissions from fires.
1165	4	2	2625		Recommend clarificaiton: Is this disclaimer relevant to all the other boxes describing examples? If so, explain this up front - e.g. in Chapter 1, and use a short-hand form in the relevant Boxes - e.g. "Informative"	Australia	Accepted with Modification	The disclaimer is relevant to all boxes describing examples that are given for information purpose and do not represent guidance. In addition, is worth to clarify that the term "New Guidance" has been used across headings of all proposed new boxes in the 2019 Refinement to indicate that the boxes contain new text (compared to the current text of the 2006 GL) introduced as a proposed refinement. Text has been revised to remove the word "Guidance" from the boxes as these are examples of national methods, not "Guidance". Clarification are also included in the Mapping Tables to clearly indicate if the boxes is for information purpose only.
1167	4	2	General comment		Comment: The examples and guidance on Tier 3 methods is welcomed, as is the inclusion of guidance and methods for estimating biochar carbon.	Australia	Noted	
1169	4	2	3664	3669	Recommend including the recent meta-analyses showing reduction in N2O eg Borchard et al found overall N2O reduction of 38%. These additonal papers shodul be cited to support the case that it is highly conservative to assume no effect of bicoahr on N2O.	Australia	Accepted with Modification	References to the Borchard et al and Liu et al papers have been added to the "Nitrous oxide emissions from soil after biochar amendment" section of Annex 2A.2. The Nguyen et al paper did not report on nitrous oxide.
1225	4	2	2385	2684	Comment: Section 2.6 provides much needed guidance on inter-annual variability due to natural disturbance events such as wildfires, insect infestation, extreme weather events, etc. It provides methodological approaches to disaggregate natural and anthropogenic components with country examples. The gudiance is well balanced in the treatment of natural effects with due consideration of managed land proxy principles.	Australia	Noted	We appreciate the positive feedback.
1433	4	2	2381	2381	Volym 4 chp 2 Rad 2381 2.6 INTER-ANNUAL VARIABILITY - The issue of interannual variation is important and guidance would be useful. However, the division of what is anthropogenic and what is not is still not very resolved. If guidance is to be included this part, it should be voluntary to follow.	Sweden	Accepted with Modification	Section 2.6 states in a number of places that the guidance in the section is "voluntary" as suggested by the reviewer. The section as a whole adequately addresses the disaggregation of antrhopogenic and interannual variability due to natural disturbances, even if the division is not fully resolved (due to the fact that it will not be possible to completely disaggregate all natural effects), it is an improvement over the MLP without this additional disaggregation

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
1455	4	2	2381	2832	The chapter should only focus on transparency elements for reporting on Natural Disturbances (ND). Parties interested in using this voluntary provision should be encouraged to report disaggregated emissions and removals in addition to the total emissions and removals. **Yet, it is of paramount importance that disaggregation does not affect the total reported GHG emissions and that the sum of disaggregated elements is equal to the total GHG emissions and removals**. Any quantification provided for calculating ND must not be added to or subtracted from the total GHG emissions and removals.	EU	Accepted	The chapter does exactly what is requested by the reviewer. The box on reporting outlines that countries that chose to disaggregate are to report the total as well as the disaggregated components.
1457	4	2	2381	2832	Use of the Managed Land Proxy Chapter 2.6 needs to state more clearly that use of the Managed Land Proxy (which is recommended as good practice in the chapter) involves a country reporting total emissions from managed land. In several places, the chapter creates confusion by referring to the concepts of 'natural', 'human-induced' and 'anthropogenic' emissions in an inconsistent manner. The addition of new terminology such as "refined MLP fluxes" further adds to this confusion.	EU	Accepted	Further clarification text added to reiterate 'all emissions and removals on managed land'. However, we do suggest that the approach outlined here is a second order approximation of the anthropogenic E/R in the managed land.
1459	4	2	2381	2832	Natural vs anthropogenic phenomena. Chapter 2.6 contains several unscientific statements regarding whether specific phenomena are to be considered natural or anthropogenic. For example, line 2392 mistakenly refers to "fire" as a natural disturbance.	EU	Accepted with Modification	The term to fire was replaced by "wildfire" to distinguish if from fire associated with management actions. Withoug further specification of what the reviewer considers to be "unscientific statements" authors are not able to respond. Moreover, the example given in line 2392 states "such as fire…" it does not state that all fires are natural disturbances. And throughout the boreal forest (and other forests of the world) the primary cause of area burned is ignition from lightning strikes.

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
1461	4	2	2381	2418	This introductory section should clarify the purpose of Ch2.6 by making explicit reference to the ToR and the outcome of the May 2009 expert meeting on the Managed Land Proxy. In particular, this meeting agreed that annual emission inventories should estimate the actual emissions in the inventory year and that the aim of emission inventories is not to try to remove or reduce the impact of inter-annual variations (see conclusion 5 in the expert meeting report).	EU	Accepted with Modification	Text in Chapter 1 has been revised to further clarify the purpose of Chapter 2.6 in line with the 2019 Refinement ToR and the outcomes of the May 2009 expert meeting on the MLP. Nevertheles, authors disagree with the reviewer's interpretation of the Expert Meeting outcome based on two quotes from the report: 1) "While the meeting agreed that annual emission inventories should estimate the actual emissions in the inventory year, it was also noted that there is a need to be able to identify the impact of mitigation and management efforts even where these are obscured by inter-annual variations in greenhouse gas fluxes for example by the impacts of natural processes (e.g. wildfire) or indirect human-induced processes (e.g. climate change impacts)"; and 2) "The meeting hoped that further work by the scientific community will result in more mature approaches which can be assessed at a later date."
1465	4	2	2408	2409	Examples of the existing methods for separation of natural and anthropogenic effects in inventories should not be included in this guidance. Section 2.6 provides new material as far as inventory guidance is concerned. Therefore, it is impossible by definition that existing inventories are following this guidance. The last sentence of the paragraph should therefore be deleted.	EU	Accepted with Modification	Text has been revised to delete the last sentence of the paragraph in line with the assessment that "... it is impossible by definition that existing inventories are following this guidance". Nevertheless, authors disagree with the assessment of the reviewer that "Examples of the existing methods for separation of natural and anthropogenic effects in inventories should not be included in this guidance". Examples are given in boxes with the caveat that boxes are "for information only and neither adds guidance nor overrules guidance provided". In addition, according to "instruction to Authors" within the 2019 Refinement ToR "Lead authors must consider all recent scientific developments and national methods used by countries in their inventories".
1467	4	2	2446	2453	The terminology here is different from that of the chapter introduction. This is confusing and needs to the corrected. While the chapter introduction (lines 2398-2418) refers to disaggregation of MLP emissions, these lines refer to refined approximation of the anthropogenic component of emission & removals. We recommend that the terminology such as refining approximation and second order approximation be removed and the paragraph re-phrased using the term disaggregation, which should be consistent throughout the chapter.	EU	Accepted with Modification	Text has been revised to removal references to "refined estimates" but the terminology "second order approximation" (which is achieved through disaggregation) is maintained.

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
1469	4	2	2454	2502	This subsection describes a mixture of natural and anthropogenic phenomena, and discusses the relationship between them. Several of the references to Natural disturbances (including the title) are therefore inaccurate and should be changed. We therefore recommend the following: • This paragraph should make clear that effects can have a range of natural and anthropogenic influences. Anthropogenic factors can contribute to effects of natural origin and vice versa. • In lines 2468-2492 (on definition of natural disturbances) it should be made clear that the purpose of greenhouse gas inventories is to estimate and report the actual emissions in the inventory year, without removing the impact of interannual variations. The methodology supplied in this chapter for disaggregation of emissions and removlas into components on the basis of variability of disturbances is made available to countries who wish to use it for other reporting purposes (such as transparency of commitments).	EU	Rejected	The text referred to by the reviewer focusses on natural disturbances as one of the factors that contributes to the IAV of estimated and reported emissions. Thus the focus on natural disturbances is appropriate. Contrary to the statement by the reviewer, the purpose of the GHG inventory is to estimate and report the anthropogenic emissions and removals within the managed lands. It is recognised by the IPCC that not all emissions and removals within the managed land are of anthropogenic origin, and the IPCC has therefore called on the scientific community to advance the science of estimating anthropogenic E/R within the MLP Proxy. The methods outlined here and the numerical examples provided in this report can increase the transparency of reported GHG E/R.
1471	4	2	2536	2541	This paragraph should clarify that applying the Managed Land Proxy (which is described as Good Practice) involves including all estimated emissions and removals occurring on managed land during the inventory period in the reported total emissions and removals. The second sentence should either specify that the methodology for 'further disaggregation' provided in this subsection may be used for purposes other than reporting of greenhouse gas inventories , or the words "from the total emissions and removals using MLP should be deleted.	EU	Accepted with Modification	Text has been revised to further clarify that "It is good practice for countries to apply the Managed Land Proxy (MLP) and estimate and report all emissions and removals that occur on managed lands"
1473	4	2	2577	2583	This paragraph is a description of accounting which should be removed.	EU	Rejected	The paragraph is just an example of estimation and not a "description of accounting". The text clearly states that the disaggregation of removals to the anthropogenic and natural components is in proportion to the disaggregation of emissions to these two components. This is the guidance required to ensure that the disaggregation of emissions is balanced by the disaggregation of removals to the anthropogenic and natural components. If the goal is to disaggregate emissions then removals also have to be disaggregated.

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
1475	4	2	2594	2599	This is the key paragraph but unfortunately it is contradicting in itself: "The natural disturbance component is subtracted from the total estimate of MLP emissions and removals, yielding a refined estimate of the anthropogenic emissions and removals from managed lands." is clearly an accounting step. The following sentence makes clear that this information is provided in addition to reporting total GHG emissions and removals: "This is the "refined MLP flux", i.e. the second order approximation of the anthropogenic component of E/R from managed land and is reported in addition to the total MLP emissions and removals." The idea of 'subtracting' natural disturbances from the MLP estimate of emissions and removals is not consistent with this methodology's stated aim of 'disaggregation'. We recommend that: • the term "refined MLP flux" be renamed. Since this flux is not consistent with the MLP concept, it should have another name to avoid confusion. • The paragraph should state more clearly that the all emissions and removals are to be reported in MLP totals in all circumstances, and the natural disturbance component may be reported in addition.	EU	Accepted with Modification	Text has been revised to enhance clarity; including replacing the term "refined MLP flux" with "second order approximation of anthropogenic emissions and removals". In addition is important to recall that the paragraph (and the table example provided Box 2.2L) clearly indicated that "all emissions and removals are to be reported" in addition to the other components. Finally, the decision what is to be reported in the CRF tables is to be made by the UNFCCC. The guidance provided here outlines how the components estimates can be derived and that the total and the two components are to be reported.
1477	4	2	2624	2777	convergent and are provided as guidance. They either intend to justify that ND can be removed during reporting (example AUS) or they are not clear that the ND provision is applied during accounting (EU-case), which is outside the scope of this chapter. The labelling of the boxes as both "new guidance" and "for information only" is also extremely confusing. There appears to be a discrepancy between the methodologies used and the interpretation of the results. E.g., the approach presented in Box 2.2I, "natural disturbances" are defined as those "occurring in a year which is an outlier". Therefore, the disaggregation seems to be done on a purely statistical basis (which is a reasonable approach to "inter-annual variability"). However, the resulting two components seem to be attributed to purely natural and purely human-induced causes, despite causality hot having been part of the disaggregation. **It is unclear what evidence supports the attribution made.** Moreover, even if this attribution is supported by more detailed evidence for the country concerned (not presented in the box), it remains unclear whether, or to what extent, such evidence would be valid or relevant in other countries wishing to apply this approach. **The approaches presented in the other two boxes have similar limitations.** The conflation of frequency with causality ignores the possibility that human management could result in irregular phenomena, **although evidence for that exists from certain regions (e.g., that fire suppression practices can change the fire regime of fire-adapted ecosystems from more regular small fires to less frequent, but bigger fire events).** Furthermore, we do not believe it is appropriate to present some	EU	Accepted with Modification	Text has been revised to remove the word "Guidance" from the boxes as these are examples of national methods, not "Guidance". In presenting the examples of countries we have clearly indicated that such examples are "for information only and neither adds guidance nor overrules guidance provided". As to the inapproriateness to present national examples - the instructions to the IPCC stated clearly that "Lead authors must consider all recent scientific developments and national methods used by countries in their inventories." LA have followed this request.

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
1479	4	2	2643	2645	""'Natural disturbance' emissions and removals are modelled on a spatial basis and, consistent with the MLP, included in reporting after averaging out initial carbon stock losses and subsequent recovery." This could show that total GHG for managed land is not reported "as seen by the atmosphere". A justification to this decision is made with previous IPCC guidance in a footnote and also Line 2441: "The natural effects "tend to average out over time and space" (Vol. 4, Ch. 1)…""	EU	Rejected	IPCC GL are meant to estimate anthropogenic GHG emissions and removals, which is not necessarily what the "atmosphere sees", otherwise it would be necessary to estimate E/R from all lands and oceans (managed and unmanaged). As agreed by IPCC, countries shall apply the MLP as a proxy to estimate anthropogenic E/R. The example of Australia (and others) are given to illustrate how countries have applied the MLP together with country-specific procedures to disaggregate the ND and anthropogenic component within the MLP. Is worth to note that such procedure has been reported to and reviewed by UNFCCC.
1481	4	2	2782	2820	This section should confirm that, irrespective of whether countries choose to apply the natural disturbance methodology described in this subsection, it is good practice for countries to apply the managed land proxy, meaning that an estimate of total emissions and removals from managed land during the inventory year should be reported in national total emissions.	EU	Accepted with Modification	Text has been revised to enhance clarity. This section (including Box 2.2L) clearly shows that the reporting should consist of the total and each of the two disaggregated components. The MLP seeks to quantify the anthropogenic E/R on managed land, and this guidance offers countries the option to estimate and report the total E/R and the disaggregated components.
1483	4	2	2822	2823	This sentence contains no verb and is therefore difficult to understand. It is probably a continuation of the bullet list.	EU	Accepted	As noted, this was the continuation of and to provide a verb we added: It is *good practice* to provide ...
1485	4	2	342	410	This guidance, intended for users of the Guidelines outside the context of the NGHGI, is most useful. It recognises the important role and contribution of the IPCC guidance beyond its immediate purpose, and helps practitioners adapt it to other contexts, to avoid the inadvertant misapplication of methodologies. It would be most useful to include similar new guidance also for other parts of the Guidelines that are frequently used or referred to outside of the NGHGI context, for example life cycle analyses or evaluation of bioenergy projects. For example, inventory guidelines are often referred to in the context of assessing the GHG benefits of bioenergy. Many of those applications would be usefully informed by a similar guidance pointing out the implications of differences in system boundaries, sectoral boundaries, timeframes and the like. Such guidance could be well placed in Volume 2, Section 2.3.3.4.	EU	Rejected	Authors can only propose refinments in accordance with the ToR agreed for the 2019 Refinment.
1487	4	2	352	352	Insert "system" before "boundaries" to read "system boundaries.	EU	Accepted	Text has benn revised as suggested

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
1489	4	2	989	991	Reference to the FAO classification is outdated. Please refer to the latest version of WRB 2015. Definition of organic soils (Histosols) is reported on page 85 of WRB 2015: Soils having organic material: 1. starting at the soil surface and having a thickness of ≥ 10 cm and directly overlying: a. ice, or b. continuous rock or technic hard material, or c. coarse fragments, the interstices of which are filled with organic material; or 2. starting ≤ 40 cm from the soil surface and having within ≤ 100 cm of the soil surface a combined thickness of either: a. ≥ 60 cm, if ≥ 75% (by volume) of the material consists of moss fibres; or b. ≥ 40 cm in other materials. IUSS Working Group WRB. 2015. World Reference Base for Soil Resources 2014, update 2015 International soil classification system for naming soils and creating legends for soil maps. World Soil Resources Reports No. 106. FAO, Rome. http://www.fao.org/3/i3794en/I3794en.pdf	EU	Noted	The definition used was taken from the IPCC2006 scheme for grouping soils and climate. In this scheme an organic soil is defined as provided in Volume 4 Chapter 3, Annex 3A.5. The statement that these soils have to have a minimum of 12% OC is correct, but further constraints are applied in the definition provided in Annex 3A.5). Previously this statement said that an organic soil had to have a "minimum of 12 to 20% organic matter" which was not correct given the IPCC definition. The values should have been expressed in terms of %orgnaic carbon rather than %organic matter. Although it may be desireable to update to the new IUSS classification, the values for the soil organic carbon reference stock were taken from Batjes (2011) who used the IPCC2006 soil classes. Updating would result in inconsistencies. The following text resides in the Batjes (2011) paper from which the reference stocks were obtained: "The default IPCC2006 scheme for grouping climate and soil classes was maintained for this study – proposing new criteria for this would require the derivation of new reference carbon stocks and stock change factors (IPCC, 2006), which is beyond the scope of this study." Action: No change
1491	4	2	1045	1056	The definition of biochar provided here is equivalent to charcoal and similar products. For the sake of consistency, it may be preferable to refer to them with the same term ("charcoal amendments"). Charcoal amendments should be originating from biomass, not from any general organic material. http://publications.jrc.ec.europa.eu/repository/bitstream/JRC55799/jrc_biochar_soils.pdf	EU	Accepted	Action: the following footnote has been added: "As defined biochar is equivalent to charcoal, but is differentiated and recorded separately on the basis of its use and how it is accounted for in the inventory process."

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
1493	4	2	1153	1154	Please update table 2.3 using the most recent WRB 2015 classification system and avoiding making reference to single National soil classification systems, like US Soil Taxonomy (http://www.fao.org/3/i3794en/I3794en.pdf) IUSS Working Group WRB. 2015. World Reference Base for Soil Resources 2014, update 2015 International soil classification system for naming soils and creating legends for soil maps. World Soil Resources Reports No. 106. FAO, Rome. http://www.fao.org/3/i3794en/I3794en.pdf	EU	Noted	The IPCC soil classes have been used and this is noted in the subtext to the table as well as the derivation of the classes. The reference soil organic carbon stocks have been calculated using this classification. For consistency the provided classification must remain as presented. Although it may be desireable to update to the new IUSS classification, the values for the soil organic carbon reference stock were taken from Batjes (2011) who used the IPCC2006 soil classes. Updating would result in inconsistencies. The following text resides in the Batjes (2011) paper from which the reference stocks were obtained: "The default IPCC2006 scheme for grouping climate and soil classes was maintained for this study – proposing new criteria for this would require the derivation of new reference carbon stocks and stock change factors (IPCC, 2006), which is beyond the scope of this study."
1495	4	2	1209	1269	Charcoal amendments to soil present large areas of uncertainty on its long term environmental impact (including climate impacts not coonsidered in the methodology, like albedo and black carbon) and implications for human health. It should not be not endorsed as standard good practice. Please remove this section or convert it to a box as optional guidance for information purposes only. http://publications.jrc.ec.europa.eu/repository/bitstream/JRC55799/jrc_biochar_soils.pdf	EU	Noted	We are not endorsing biochar amendments as a best management practice. However, it is an anthropogenic activity that impacts C stocks of mineral soils, and accordingly it has been addressed in this refinement.
1497	4	2	1418	1436	Charcoal amendments to soil present large areas of uncertainty on its long term environmental impact (including climate impacts not coonsidered in the methodology, like albedo and black carbon) and implications for human health. It should not be not endorsed as standard good practice. Please remove this section or convert it to a box as optional guidance for information purposes only.	EU	Noted	We are not endorsing biochar amendments as a best management practice. However, it is an anthropogenic activity that impacts soil C stocks, and accordingly addressed in this report to estimate anthropogenic greenhouse gas emissions and removals.
1499	4	2	1515	1517	Please remove GlobalSoilMap.net, since no global soil database exists from this project (project never completed) and also Soil Grid, since the product is not validated by National soil data centres. Please keep only 3) FAO Global Soil Organic Carbon Map, as the only validated global soil carbon stock data. The official FAO Global Soil Carbon Map is a fully validated product endorsed by all FAO Members.	EU	Accepted	References removed

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
1501	4	2	1725	1745	Charcoal amendments to soil present large areas of uncertainty on its long term environmental impact (including climate impacts not coonsidered in the methodology, like albedo and black carbon) and implications for human health. It should not be not endorsed as standard good practice. Please remove this section or convert it to a box as optional guidance for information purposes only.	EU	Noted	We are not endorsing biochar amendments as a best management practice. However, it is an anthropogenic activity that impacts soil C stocks, and accordingly addressed in this report to estimate anthropogenic greenhouse gas emissions and removals.
1503	4	2	3635	3722	The attention to charcoal application to soil ("biochar") in this chapter is absolultly unbalanced given the current relevance of the technology. In addition there is no single mentioning of the potential negative effects of "biochar" to the environment and human health. Pyrolisis of inappropriate feedstocks can generate severe health effects on humens and other species. Inappropriate application technologies can have ecffects on soil health and water quality. There are still large areas of uncertainty on the systematic application of charcoal on soils that do not allow for an endosrement of the technolgy as an IPCC methodology. The precautionary principle should apply in this case.	EU	Noted	We are not endorsing this technology, but are providing a method for an anthropogenic practice that impacts C stocks of mineral soils to which biochar has been applied.
1505	4	2	3694	3706	The evidence base for the fraction of charcoal amendment that will remain after 1000 years may be partly inconsistent with the definition of "biochar" provided in lines 1045-1056. According to Figure 2A.2-1, a number of sources relate to long-term experiments (decadal to millenial time scales). In the case of long-term experiments, it cannot be established that the source of charcoal amendment excluded pyrolytic organic materials that result from wild fires or open fires, which would not constitute "biochar". In the case of terra preta, it is likely that such sources were used (Cattle et al, 2014). Replacing the term "biochar" with "charcoal amendment" could facilitate consistency. Cattle, J., Singh, B., Kookana, R. S., Boersma, M., Macdonald, L. M., Butler, G., … Kimber, S. (2014). Opportunities and constraints for biochar technology in Australian agriculture: looking beyond carbon sequestration. Soil Research, 52(8), 739. https://doi.org/10.1071/sr14112]	EU	Accepted with Modification	The Fperm values in this methodology were calculated using values from only those experiments that utilized isotopically labeled biochars allowing unambiguous attribution of evolved CO2, as shown in (a) of Figure 2A.2-1. The values in (b) are added to provide decadal to millenial observational data; however, due to the fact that these were not isotopically labelled (therefore, not allowing definitive attribution of stock chages to different sources), they were not used to derive Fperm values. For this reason the data shown in (b) cannot be used to calculate actual Fperm values. We note, however, that the value calculated here (0.56) is below the values obtained for studies that met the criteria for inclusion in the derivation of Fpermp values. The term 'char' was added to the description of (b) in text and caption to indicate that these can be naturally accumulating pyrogenic organic matter in addition to purposefully added biochar.

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
1561	4	2	2381	2834	The whole section on IAV and natural disturbances is concerning as it presents generic, voluntary guidelines that may be interpreted by each country differently. This is not the purpose of the IPCC guidelines, which should provide the best scientific methodologies for estimating emissions / removals, rather than leaving countries to develop their own definitions. Where is the mandate for this development of a generic approach for disaggregating emissions and removals from natural disturbances? This new set of guidelines is a step backwards from previous guidelines and guidance developed by the IPCC for estimating emissions / removals from natural disturbances. Adoption of this section at this stage would appear very questionable.	Saint Lucia	Accepted with Modification	Text in Chapter 1 has been revised to further clarify the purpose of Chapter 2.6 in line with the mandate given by the 2019 Refinement ToR. Nevertheless, the authors disagree with the assessment that "this new set of guidelines is a step backwards from previous guidelines and guidance developed by the IPCC for estimating emissions / removals from natural disturbances". The IPCC guidelines sets a strong precedent for enabling countries to apply their own definitions and methods within the framework of good practice and this section continues this approach. This section provides inventory compilers with the framework for developing country specific estimates following IPCC guidance, rather than dictating to countries how they must implement their inventory.
1563	4	2	2482	2483	Previously natural disturbances have been confined to only forest land. Could we have some explanation of what natural disturbances are anticipated on these other types of land, and why their inclusion is justified? Is it easy to distinguish natural, non-anthropogenic events on other types of land?	Saint Lucia	Accepted with Modification	Text has been revised to enhance clarity. This chapter specifically refers to General Methodology applicable to Multiple Land Categories. Disturbances listed in the ND definition are not category-specific, they may occur in any of the land categories listed. Further, their occurrence can be identified so far as the land category is not a man made category as e.g. cropland or drained peatlands since in this case it would not be possible to consider any impact not materially influenced by human activities.
1565	4	2	2550	2555	The move to a country-specific defintion of natural disturbances is a shift away from the provisioning of good practice guidelines by the IPCC, towards more generic guidance that different countries can interpret differently. This risks jeopardising the scientific integrity of the IPCC's guidelines. We are concerned that allowing countries to develop their own definitions of natural disturbances will make it very difficult to track what countries are and are not counting as anthropogenic vs. natural, and creates the opportunity for Parties to choose a definition that benefits their accounting balances. This is a serious concern for the integrity of NGHGIs and our ability to collectively track progress in achieving the goals of the Paris Agreement.	Saint Lucia	Accepted with Modification	Text has been revised by stating that definitions of ND need to be "Consistent with the generic definition". This removes flexibility and by making it good practice to document the assumptions, it also increase transparency.
1567	4	2	2800	2800	These transparency requirements are very vague and generic. For the new guidance to be a useful addition to previous guidance, much more precise requirements should be listed here.	Saint Lucia	Rejected	Other comments have suggested that such requirements are not necessary. In order to find a "compromise solution" the text represents, in the authors' opinion, an appropriate balance between transparency and not being perscriptive.

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
1569	4	2	1045	1745	Biochar: biochar was not mentioned in the report outline, so we are surprised to see it here. We are concerned to see a tier 1 method for biochar as we are not sure that there is sufficient robust scientific evidence to support this methodology. Furthermore, these guidelines do not adequately address the risk of impermanence? According to Fuss et al. 2018, the residence time of biochar varies with temperature and soil type, and may be only a few decades. Additionally, we are concerned that the total lifecycle emissions of biochar would not be adequately captured. It should not be possible to report only the sequestration effect of biochar without also reporting the emissions associated with producing and deploying biochar.	Saint Lucia	Rejected	Chapters 5 and 6 of Volume 4 include updates to the stock change factors for mineral soils. The refinement was asked to address mineral soil stock change factors. Addition of Biochar C to mineral soil is anthropogenic activity that impacts soil C stocks, and as such the stock change factors needed to be updated to address this impact. The development of these factors required a new calculation to address the influence of biochar on the C stocks of mineral soils given its very different nature and stability against mineralisation in soil. To make it more clear that the inclusion of biochar was to allow a more accurate assessment of C stock changes in mineral soils, biochar has been removed from the general soil equation (Equation 2.24) and the biochar term and its derivation have been added to Equation 2.25 which is specific to mineral soils. Inclusion of a method in Tiers 1 and 2 make less errors than having no method at all. Excluding biochar from the methodology would reduce the accuracy of the method rather than increase it. If a country produces biochar, then the accuracy of its emissions inventory will always be improved by including the best possible estimate of the associated GHG fluxes rather than ignoring them altogether. The reviewer is correct that the mean residence time of biochar varies with the temperature and soil type it is exposed to in the environment. The data in this methodology uses all published data that met the stringent criteria for the period of time and data density mentioned, including the study by Fang et al. (2014) which the cited Fuss et al (2018) article bases its
1667	4	2	0	0	The addition of biochar to the 2019 Methodological Supplement is outside the ToR and the Chapter Outline agreed at the Scoping Meeting and as part of the mandate adopted by the IPCC plenary for the 2019 Methodological Supplement. Related to changes in carbon stocks in soils the mandate included only the following three issues 1. Update reference carbon stocks. 2. Develop new Tier 2 method for mineral soils that requires less AD and 3. Elaborate Tier 3 Methodologies with case study examples for soils. Therefore we request to delete the related sections on biochar amendments and the terms in the related equations in chapter 2 referring to biochar amendments to mineral soils.	Germany	Accepted with Modification	Chapters 5 and 6 of Volume 4 include updates to the stock change factors for mineral soils. The refinement was asked to address mineral soil stock change factors. Addition of Biochar C to mineral soil is anthropogenic activity that impacts soil C stocks, and as such the stock change factors needed to be updated to address this impact. The development of these factors required a new calculation to address the influence of biochar on the C stocks of mineral soils given its very different nature and stability against mineralisation in soil. To make it more clear that the inclusion of biochar was to allow a more accurate assessment of C stock changes in mineral soils, biochar has been removed from the general soil equation (Equation 2.24) and the biochar term and its derivation have been added to Equation 2.25 which is specific to mineral soils. Action: Moved the $\Delta B_{Cmineral}$ equations from Equation 2.24 to Equation 2.25 and moved all explanitory text pertaining to biochar C to the text following this equation.

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
1669	4	2	0	0	The biochar term is added to the calculation of C stocks in mineral soils without appropriate justification and without taking into account the large amount of literature questioning the positive and long-term sequestration effects of biochar addition. The section lacks a balanced scientific discussion of knowledge gaps and different scientific views related to the effects of long-term biochar application. Recent review e.g. summarized "Some fundamental mechanisms and the utilization of biochar in agro-ecosystems are poorly understood. These knowledge gaps mainly include the following aspects: it is significant to understand the interactions between biochar and soil microbial communities which may critically affect the release of CH4 and N2O. The exact service life of biochar is still rarely understood and (3) the maximum adsorption and desorption capacity of biochar are needed to be determined in further research." From this perspective it may be useful to add as a separate term in tier 3 approaches, but it is highly questionable whether it is good practice to add biochar amendments as a separate term as a tier 1 method given the existing knowledge gaps, lack of long-term measurements and uncertainties. We propose to delete at least the tier 1 approach for biochar addition. The method should request considerably more justification through long-term field measurements when biochar is included in GHG inventories in form of a separate biochar term.	Germany	Accepted with Modification	Chapters 5 and 6 of Volume 4 include updates to the stock change factors for mineral soils. The refinement was asked to address mineral soil stock change factors. Addition of Biochar C to mineral soil is anthropogenic activity that impacts soil C stocks, and as such the stock change factors needed to be updated to address this impact. The development of these factors required a new calculation to address the influence of biochar on the C stocks of mineral soils given its very different nature and stability against mineralisation in soil. To make it more clear that the inclusion of biochar was to allow a more accurate assessment of C stock changes in mineral soils, biochar has been removed from the general soil equation (Equation 2.24) and the biochar term and its derivation have been added to Equation 2.25 which is specific to mineral soils. The available literature was carefully reviewed and all studies that provided quantitiative experimental data pertaining to the retention of biochar C in soil were included in the analyses completed. Qualitative studies or opinions were not included Only experimental data that met the stringent quality criteria presented in Appendix 2A.2 were included. The references provided by the reviewer relate to the impact of biochar on soil fertility or crop yield. Recommendations about the agronomic impact of different biochars in different situations is outside the scope of the refinement. The refinement does not endorse biochar amendment as a best management practice. However, addition of biochar C is an anthropogenic activity that
1671	4	2	1005	1006	Table 2.3B gives for low and undefined temperature biochars an Fperm value of 0.13. A symmetric confidence interval of 0.04 - 0.23 is given. However, the Fperm value is a fraction and confidence intervals of fractions are generally not symmetric. It seems very likely that proper statistical analysis would indicate this value not to be significant, which would support exclusion of low and undefined temperature biochars. Inclusion of low and undefined temperature biochars should require material- and process-specific Tier 2 values for Fperm.	Germany	Accepted with Modification	The values were revised to asymmetric intervals, calculated as 95% bootstrap confidence intervals on the mean. This did not change the conclusions, and even the bootstrap estimates were close to symmetric. Action: No direct action was taken with respect to this comment. However, rather than using the regression line to predict Fpermp, all values within the temperature ranges (e.g. 350-450, 450-600 and >600 °C) were pooled to produce a revised set of Fperm values that have been entered into Table 2.3B. The uncertainties in these estimates were calcualted as 95% bootstrap confidence intervals and were close to symemetric. Thus the approach of expressing uncertainty in terms of ± a percentage deviation from the mean was retained.

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
1673	4	2	1241	1261	Box 2.2A explains GHG emission sources related to biochar production, but only addresses where such guidance may be generically found. However, a statement is missing that good practice requires the estimation of the emissions resulting from biochar production when biochar amendments are considered as part of sequestration in the estimation of C stocks in mineral soils. Please add in line 1241 after the first sentence: "It is good practice that all GHG sources associated with biochar production are carefully analysed, and that related GHG emissions are estimated and reported in the GHG inventory when countries decide to estimate the effects of biochar C amendments to mineral soils. "	Germany	Accepted	Suggested sentence was added.
1675	4	2	1261	1262	All default values in table 2.3A are sourced from ECN 2018. This is however not a peer reviewed source, but a database with a disclaimer saying that ECN and TNO cannot be held responsible for any errors or inaccuracies. It is not transparent how the default values for Fcp have been compiled. E.g. for biochar from wood, the database provides values much higher than 0.77 for all wood types apart from oak. In the database users can directly access the exact feedstock material, e.g. the wood types. From this perspective it introduces considerable additional inaccuracy and uncertainty to compile a value for wood or rice husks instead of searching for the detailed values in the database that has been used for this table. The database also does not clearly separate between gasification and pyrolysis and it is unclear how this separation was done for table 2.3.A. This is in particular an issue when the establishment of the values in table 2.3A cannot be tracked or understood when comparing with the entries in the ECN database. It does not seem to be useful from the point of data available to derive parameters for a tier 1 method for biochar amendments.	Germany	Accepted with Modification	The description of how Fcp was calculated was oversimplified and not transparent. This non-transparency gave the wrong impression that values had simply been taken from the database. The calculation method in the revised text, both in the note for Table 2.3A and in Annex 2A.2 has been revised by insertion of the addional text. Table 2.3A note: "FCp was calculated from the organic carbon content of biochar from regressions by Neves et al. (2011), corrected for ash content using biochar yield from Woolf et al. (2014). Data on ash, lignin, and carbon content of biomass feedstocks, which are parameters in these regression equations, were taken from ECN (2018)." Annex 2A.2 text: "The organic carbon content of biochar on a dry ash-free (daf) basis was calculated according to equation 14 from Neves et al. (2011), which was based on a regression (n=128) of data from 26 papers. This daf organic carbon content was corrected for ash content of the biochar to provide carbon content per unit mass of biochar using the regression equation (n=146 from 18 articles) of biochar yield from Woolf et al. (2014). Data on ash, lignin, and carbon content of biomass feedstocks, which are parameters in these regression equations, were taken from ECN (2018), which provides the most comprehensive collation currenly available of published values for biomass composition."

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
1677	4	2	1268	1269	The definition of biochar requires heating above 300 °C through gasification or pyrolysis (see lines 1049-1050). The definition of a default value for Fpermp for conditions of low (<450°!C) or uncontrolled or unspecified pyrolysis temperature in table 2.3B is inconsistent with the definition of biochar in the beginning of the section. The default for low temperatures should be defined as < 450 °C , but at the same time as necessarily above 300 °C. Uncontrolled and unspecified pyrolysis temperature should be deleted from the description of default factors as in such situations it cannot be guaranteed that biochar is produced as it is explained at the beginning of the section that temperatures > 300°C are essential.	Germany	Accepted	The lower limit of heating temperature to produce a biochar has been redefined as 350°C throughout the chapter and in Table 2.3B the lowest temperature class has been relabelled 350-450°C.
1679	4	2	1815	1816	Please clarify the header of Table 2.4. To us, it is neither clear what is meant by "Mean" nor by "SE".	Germany	Noted	Table 2.4 was not subjected to the refinement. "Mean" is the arithmetric mean, "SE" refers to the "standard error".
1681	4	2	2381	2832	The text on natural disturbances does not include any detailed description of methods, nor methods in line with a tier structure of methods in other areas and is therefore inconsistent with the remaining methodologies. This is not user-friendly for inventory compilers as it is not explained how the approach works with the different tiers provided in the other sections. Only examples of possible methods are provided. It does not seem to be compatible with the generic approach of IPCC Guidelines that a quantitatively very important part of the emission estimation neither provides for clearly described methods nor methodological tiers, but defines good practice guidance in an extremely limited way. The section mainly invites Parties to apply undefined country-specific methods. Without further improvement of effective guidance, it would be preferable to delete the chapter. Effective guidance means clearly described methods in a tier structure, clear definitions and the definition of good practice guidance.	Germany	Accepted with Modification	Text has been revised to enhance clarity on the guidance proposed. Nevertheles, authors disagree with the reviewer's assessment that "is not user-friendly for inventory compilers as it is not explained how the approach works with the different tiers provided in the other sections... It does not seem to be compatible with the generic approach of IPCC Guidelines that a quantitatively very important part of the emission estimation neither provides for clearly described methods nor methodological tiers, but defines good practice guidance in an extremely limited way". IPCC guidelines sets a strong precedent for enabling countries to apply their own definitions and methods within the framework of good practice and this section continues this approach. This section provides inventory compilers with the framework for developing country specific estimates following IPCC guidance, rather than dictating to countries how they must implement their inventory.
1683	4	2	2469	2473	The footnote indicates that the definition for natural disturbances is from 2014 wetlands supplement. However we could not find such definition in this IPCC report. The definition is from IPCC KP Supplement, but this definition refers to "emissions in forests" and not only "emissions". Please correct the reference and include 'emissions in forests".	Germany	Accepted with Modification	Footnote 15 refer to the KP supplement and not Wetland supplement. The footnote has been revised to indicate as additional information rather than the place from which the definition was derived (as it is slightly different). The proposed voluntary guidance is applicable to multiple land categories and is not limited to forests.

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
1685	4	2	2481	2483	The text extends the definition of natural disturbances from forests to other land uses such as woody grassland, undrained wetlands or undrained peatland without providing any justification or explanation what type of natural disturbances may occur on these land areas that are non-human induced and which cause non-anthropogenic emissions being beyond the control of and not materially influenced by a country. Please provide at least detailed examples and discuss what kind of justification is necessary to demonstrate that the impacts are non-human induced, non-anthropogenic , non materially influences and beyond human control for all the other land uses introduced in the method.	Germany	Rejected	This chapter specifically refers to General Methodology applicable to Multiple Land Categories. Disturbances listed in the ND definition are not land category-specific, they may occur in any of the land categories listed and they can contribute to IAV that is not due to anthropogenic actions. And the text already requires that countries that chose to disagregate the MLP E/R document their methods and assumtions as requested by the reviewer.
1687	4	2	2550	2555	There should be a clear definition of natural disturbances in the 2019 methodological supplement and element 2 of the generic methodological approach contradicts such clarity by allowing any country-specific definition of natural disturbances. Due to these shortcomings, we cannot accept an approach with a country-specific definition of natural disturbances. Certain parameters in the application of the natural disturbances definition may be determined by countries. But this is not the same as using a country-specific definition. Please clarify the relationship between the generic definition and any potential country-specific elements of such definition but delete the general reference related to a country-specific definition. Please also include the good practice requirements that have been used in previous IPCC guidelines related to the definition of natural disturbances, e.g. it is good practice that a Party demonstrates occurrences being beyond the control of, and not materially influenced by the Party by demonstrating practicable efforts to prevent, manage or control the occurrences which led to the application of the provisions.	Germany	Accepted with Modification	Text has been revised by stating that definitions of ND need to be "Consistent with the generic definition". This removes flexibility and by making it good practice to document the assumptions, it also increase transparency.
1689	4	2	2556	2592	The description of the generic methodological approach lacks precision, detail and the definition of good practice. In each step it should be inserted what good practice is related to the steps provided. The text should refer to "estimating the area affected by the disturbance" instead of "identification of lands" which is not precise language appropriate for IPCC Guidance. Inventory compilers should assess for each disturbance type that either the proportion of affected area is assessed accurately, if a approach is used at landscape level, or that each affected area is identified as being disturbed with georeferenced location, year and types of disturbances, when individual disturbed areas are assessed. Please also add that Parties should demonstrate that methods and algorithms used for detecting disturbances and disturbance type are suitable for the identification of areas affected by disturbances in a manner consistent with the Party's definition of forests and with the method how respective area or areas of land be identified in subsequent years.	Germany	Accepted with Modification	Most of the information provided in this section describes steps required to arrive at estimates of E/R which are explained in more detail, including the good practice requirements, in later chapters of the volume. Many of the requirements requested by the reviewer are provided in the more detailed chapters (e.g. how to estimate emissions from ND). The text states already that the land areas are to be identified (which clearly implies that an area estimate can be derived and this is required to estimate emissions, as described in later chapters). Nevertheless, text has been revised to include a footnote to indicate that "Methodological guidance on quantification of associated emissions and removals are given in the chapters with general guidance (chapter 2 and 3) as well in the category-specific chapters (chapter 4 and 6)".

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
1737	4	2	656	660	We would like to suggest adding "ALOS-2" as an example of satellite which can provide "fine resolution data with a pixel size smaller than 10 m". ALOS-2 was launched in 2014 and L-band Synthetic Aperture Radar (PALSAR-2) is onboard. The PALSAR-2 is capable of observing day and night, and in all weather conditions with 3m resolution. Please note that as the Global PALSAR-2 dataset is also listed in the Chapter3 Annex 3A.1 "Examples of International land cover datasets", the addition would likely enhance consistency between chapters.	Japan	Accepted with Modification	We added references to ALOS and Sentinel 1 and also to upcoming space missions to be more specific here and also added a reference to reflect that.
1739	4	2	1219	1219	Regarding the values of 0.0110 (for CH4) and 0.000022 (for N2O) in Equation 2.26A, it might be worth to indicating in footnote how these factors are derived from the respective default CH4 and N2O emission factors presented in Table 4.3.2 for charcoal production (Volume 2, Chapter 4).	Japan	Accepted	It has now been decided that emissions of non-CO2 GHGs (e.g. CH4 and N2O) during the heating process used to produce biochar will be recorded in the Energy sector of national inventories (see Volume 2, Chapter 4, Table 4.3.2.1 for values associated with charcoal production).
1741	4	2	1237	1237	To make it more comprehensive, other GHGs, such as CO, NOx should be added in Equation 2.26A. If they are not available, some explanations on why they are not on should be provided in foot note.	Japan	Accepted with Modification	It has now been decided that emissions of non-CO2 GHGs (e.g. CH4 and N2O) during the heating process used to produce biochar will be recorded in the Energy sector of national inventories (see Volume 2, Chapter 4, Table 4.3.2.1 for values associated with charcoal production).
1743	4	2	1237	1237	The subscripts with 'F' might be small letters, 'perm' and smaller 'p' (not 'PERM' and smaller 'p'). (typo)	Japan	Accepted	
1745	4	2	1245	1245	Table 4.3.2 is on the different volume. So it would be kind to indicate it, like 'in Volume 2, Chapter 4,' after 'Table 4.3.2' in the footnote 8.	Japan	Accepted with Modification	It has now been decided that emissions of non-CO2 GHGs (e.g. CH4 and N2O) during the heating process used to produce biochar will be recorded in the Energy sector of national inventories (see Volume 2, Chapter 4, Table 4.3.2.1 for values associated with charcoal production).

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
1747	4	2	1261	1262	In Table 2.3A, it makes it clearer if it is added what analysis method is used for this calculating biochar's organic carbon value of FCp should be added because there are more than one major methods for it. This will give a very useful information for countries determine country-specific values for Tier 2 method.	Japan	Accepted with Modification	The description of how Fcp was calculated was oversimplified and not transparent. This non-transparency gave the wrong impression that values had simply been taken from the database. The calculation method in the revised text, both in the note for Table 2.3A and in Annex 2A.2 has been revised by insertion of the addional text. Table 2.3A note: "FCp was calculated from the organic carbon content of biochar from regressions by Neves et al. (2011), corrected for ash content using biochar yield from Woolf et al. (2014). Data on ash, lignin, and carbon content of biomass feedstocks, which are parameters in these regression equations, were taken from ECN (2018)." Annex 2A.2 text: "The organic carbon content of biochar on a dry ash-free (daf) basis was calculated according to equation 14 from Neves et al. (2011), which was based on a regression (n=128) of data from 26 papers. This daf organic carbon content was corrected for ash content of the biochar to provide carbon content per unit mass of biochar using the regression equation (n=146 from 18 articles) of biochar yield from Woolf et al. (2014). Data on ash, lignin, and carbon content of biomass feedstocks, which are parameters in these regression equations, were taken from ECN (2018), which provides the most comprehensive collation currenly available of published values for biomass composition."
1749	4	2	1269	1269	Herath et al. 2014', this reference seems to be not correct. It should be "Herath et al. 2015".	Japan	Accepted	
1751	4	2	3103	3104	This paper is on "191: 158-167". Volume and should be corrected.	Japan	Accepted	
1753	4	2	3117	3122	The reference Herath et al. (2015) listed twice.	Japan	Accepted	Deleted second instance
1755	4	2	3213	3214	E' seems to be dropped from "Environmental Science and Technology".	Japan	Accepted	Added "E"

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
1793	4	2	2503	2832	separately identify/assess the anthropogenic and non-anthropogenic component of natural disturbance emissions. The proposed methods are clearly indicated as not-binding since the assumption of the management land proxy for all LULUCF emissions/removals shall be further used. The question is therefore, for which purpose and on basis of which mandate are these methods introduced in the GL refinement? Table 2.6.C lists monitoring approaches and their potential to distinguish between direct human and indirect human effects - this table is not based on scientific evidence (and related citations) but on judgement and it is not general applicable for this question since several direct human and indirect human effects exist which overlap in their effects. In addition, the methodological examples from the three selected countries differ in approach and outcome and consequently are not able to represent a general method to be applied by the countries with the aim to get "comparable" results (one of the main IPCC reporting principles). In addition, the methods seem not to be a sound approach regarding the possible real recognition of anthropogenic and non-anthropogenic natural disturbance emissions. For instance, the proposed approaches are based on statistical parameters, e.g. that outliers above a certain "baseline" or "confidence interval" or "mortality levels" would automatically represent non-anthropogenic effects, while those below/within would represent anthropogenic effects. There are serious doubts that such an approach based on statistical parameters only is suited to distinguish between anthropogenic and non-anthorpogenic effects in natural disturbance emissions. In fact, the magnitude of natural disturbance events depends on various parameters and circumstances like weather conditions, access to the area, conditions for spreading/extinction (e.g. anthropogenic mono	Austria	Rejected	**WIP - see word file "Comment_1793_san"**
1797	4	2	983		Table 2.2 includes dead wood and litter default values from various regions. There are some doubts on the appropriateness of these values for the selected regions. For instance, according to this table litter C stocks in temperate continental forests would be higher/similar to boreal forests, those in temperate mountain forest systems much lower to temperate continental forests - both results are unlikely. The default dead wood C stocks are partly very high, e.g. for temperate mountain forests. It is recommended to revisit the literature on this issue, particularly look for values from systematic surveys like forest and soil inventories for the listed regions. In addition, presented means should be calculated without statistical outliers originating from local studies.	Austria	Accepted with Modification	Vlues from the tables are revised and are developed out of the literature review (reference indicated), values are proposed as default values in case the countries do not have their own values with should be more approiated than the default values for their estimations. The access to systematic surveys data and not peer review literature (such as soil surverys) was limited to its open accesibility.
1879	4	2	1208	1208	Box 2.2 (Updated): Paragraph below third table: Edit the sentence 'However, estimates of annual changes of carbon stocks would generally not be very different, as shown in this example', and change to 'However, estimates of annual changes of carbon stocks would not differ greatly, as shown in this example.'	United Kingdom (of Great Britain and Northern Ireland)	Accepted	

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
1881	4	2	1249	1250	Box 2.2A (New Guidance): remove the 'associated with' after 'use' and replace with 'of' if it's applicable. The sentence is confusing as it stands now, and it is unclear what it is trying to say. Please consider redrafting to remove the use of 'associated with' twice in the same sentence.	United Kingdom (of Great Britain and Northern Ireland)	Accepted	Sentence was changed as suggested.
1883	4	2	1425	1425	Add 'years' after '1000'	United Kingdom (of Great Britain and Northern Ireland)	Accepted	Action: "years" added after 1000. Note that 1000 was changed to 100 years as well.
1885	4	2	1970	1970	Add 'to' after 'lead'	United Kingdom (of Great Britain and Northern Ireland)	Accepted	Editorial
1887	4	2	1980	1980	Change 'measures' to 'measurements'	United Kingdom (of Great Britain and Northern Ireland)	Accepted	Changed all instances of 'measures design' to 'measurement design'.
1889	4	2	1981	1981	Add 'be' after 'should not'	United Kingdom (of Great Britain and Northern Ireland)	Accepted	Editorial
1891	4	2	1989	1989	Change 'measures' to 'measurements'	United Kingdom (of Great Britain and Northern Ireland)	Accepted	Changed all instances of 'measures design' to 'measurement design'.
1893	4	2	2622	2622	Change 'for a European country' to 'for an EU country' if the aim is to include a general example that follows EU legislation/rules, or to 'Italy' if the aim is to be more specific (as this underlying data is from Italy)	United Kingdom (of Great Britain and Northern Ireland)	Accepted	Text revised as suggested (i.e. an EU country)
1911	4	2	2419	2834	Is the proposed approach to addressing interannual variability more relevant for accounting than reporting?	United Kingdom (of Great Britain and Northern Ireland)	Accepted with Modification	Text has been revised to enhance clarity IPCC GL are limited to provide guidance on estimation methods and reporting; therefore "accouting" is out of the scope of the proposed refinement. The approach aims to enhance transparency of national greenhouse gas inventories by providing a voluntary guidance to disagregate E/R within managed land and clearly state that all three components (i.e. total, ND and anthropogenic E/R) are to be reported.
2649	4	2	General comment		General comment: In spite of comments made on the SOD the guidance on models and modelling in Volume 4 continues to be inconsistent with the discussions of models and modelling in Volume 1. The most important issues are related to the question of how to validate models, and the use and need for validation against independent datasets. New comments have been made on this subject.	Canada	Noted	Please refer to specific comments responses

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
2651	4	2	General comment		General comment: the whole chapter 2 is difficult to read and, hence, to apply. It also confuses guidance with examples of what some countries have done, which is NOT guidance. Re-write by clearly separating concrete and practical guidance on quantifying emissions and removals, from examples and information boxes. Examples - which again should not be confused with guidance - should be provided together in an Annex.	Canada	Accepted with Modification	The word guidance was removed from the boxes examples; however the boxes are maintained within the main text to facilitate reading
2653	4	2	46	46	Section 2.6 on Inter-annual variability is part of the "additional guidance for Tier 3 methods" (following from the "Additional generic guidance for Tier 3 methods in Section 2.5), so would suggest for clarity that the Section title for 2.6 be revised as "Additional Guidance for Tier 3 Methods: Inter-annual variability". This would help to avoid any confusion as to whether this guidance applies to non-Tier 3 approaches.	Canada	Rejected	The guidance proposed is not limited to Tier 3 approaches.
2655	4	2	773	773	Reference is only made to drained organic soils. Organic soils may also be excavated, impacted through compaction, changes in vegetation cover resulting from various different land use changes. Since this is general guidance, the guidelines should clarify whether or not the generic guidance is applicable to these situations related to organic soil impacts that are not "drainage" per se.	Canada	Noted	There is guidance on these issues in the 2013 IPCC Wetlands Supplement, and it was beyond scope in the TOR to provide further guidance on organic soils in this refinement.
2657	4	2	800	807	This long list impacts readability and is not comprehensive in any case, please simplify and revise.	Canada	Accepted with Modification	The list is not intended to include all factors, but to show the complexity of the factors influencing decomposition processes. Text was added to clarify this aspect.
2659	4	2	1681	1698	Appears to be somewhat repetitive from Chapter 3, Volume 1, please assure that there is no repetition.	Canada	Noted	This box provides examples of the approaches taken by different countries to apply a Tier 3 approach to quantifying soil carbon stock change so the context is not the same as Chapter 3 in Volume, and so this box provides additional details about the methods that were not discussed in the uncertainty chapter.
2661	4	2	2023	2024	Revised as: "In all cases models used in Tier 3 methods ensure higher accuracy only when they have been effectively validated against an independent data set, are correctly applied and capable of representing the population of interest." As is, the statement confuses precision of output with accuracy. Models can provide very detailed and precise output that is completely inaccurate.	Canada	Accepted with Modification	We can agree (with the reviewer) and as per the initial text that higher accuracy of Tier 3 methods requires that ".... correctly applied and capable of representing the population of interest."However, that is the only requirement for higher accuracy. Validating against another data set does not influence the accuracy, but validation is of course useful as part of the process to develop a method that is more accurate. The act of validation itself has nothing to do with the accuracy of the method. The steps for correct implementation of models are outlined in the text following. Validation is included as a step. the text has been slightly modified to highlight that correct implementation is required and to achieve this the steps following should be worked through.

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
2663	4	2	2080	2082	Higher accuracy can only be assured when models are "validated" Modify sentence: only when they are correctly applied and validated, and are capable of representing the population of interest."	Canada	Accepted with Modification	We can agree (with the reviewer) and as per the initial text that higher accuracy of Tier 3 methods requires that ".... correctly applied and capable of representing the population of interest."However, that is the only requirement for higher accuracy. Validating against another data set does not influence the accuracy, but validation is of course useful as part of the process to develop a method that is more accurate. The act of validation itself has nothing to do with the accuracy of the method. The steps for correct implementation of models are outlined in the text following. Validation is included as a step. the text has been slightly modified to highlight that correct implementation is required and to achieve this the steps following should be worked through.
2665	4	2	2087	2087	It is not clear how "provide estimates of uncertainty for the estimated stock changes" could be considered a criteria of selection for a model. Remove and begin with: "uncertainty is reduced relative to…	Canada	Accepted with Modification	restated that the model needs to be capable of quantifying uncertainty
2667	4	2	2109	2109	Data that is independent from what? When talking about validation (or evaluation data sets according to the authors wording) it is clear that the data has to be independent from the data that is used in calibration. But what should the calibration data set be independent of? Please clarify.	Canada	Accepted with Modification	There is bracketed text at the end of the sentence that clarifies what the calibration data should be independent of. Additionally the *good practice* text has been modified as a result of this and other comments to say "Calibration data should represent the population. In practice, this does not mean that all environmental conditions are covered, but that the original calibration data includes a range of the conditions existing the country that is representative of national circumstances."
2669	4	2	2126	2126	Please revise to say simply "countries should document calibration results".	Canada	Accepted with Modification	Text have been edited to simply and concisly say; In all cases it is good practice to document the calibration procedure and results.
2671	4	2	2160	2164	This paragraph is more about interpretation of research results than guidance, please revise or remove	Canada	Accepted	Text removed

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
2673	4	2	2388	2388	The guidance in the introductory paras of Section 2.6 notes that "some" of the E/Rs from managed land are characterized by high IAV (line 2388), and as a result, this can make it "difficult to gain a quantitative understanding of the role of human activities compared to the impacts of natural effects" (Line 2398-2399). In response, the IPCC guidance presented in this section is aimed at reducing "high" IAV. However, evidence clearly shows that natural disturbances - whether these result in high IAV of emissions and removals or not - still affects the reported estimates. See for example Kurz et al, 2018 - Quantifying the impacts of human activities on reported GHG emissions and removals in Canada's managed forest. As currently written, however, the IPCC guidance does not address circumstances where natural disturbances occur and are non-anthropogenic in nature, but which are not characterized by high IAV of emissions and removals. For example, when aggregating the impacts of various types of natural disturbances at the national level for reporting in GHG inventories, the process of aggregation may mask high IAV occuring at the regional level. Therefore, any IPCC guidance aimed at clarifying the impact of human actions on the reporteed estimates needs to not only address high IAV related to natural disturbances, but all IAV related to natural disturbances, provided that countries can show how human impacts are distinguished from natural impacts. Specific text modifications have therefore been included below for lines 2388, 2398, 2413, 2455, 2464, and 2480 to clarify that there is evidence that IAV (i.e. not "large IAV") results in distortions in the reported estimates and that this can be effectively addressed by separating anthro from non-anthro impacts.	Canada	Rejected	According to the proposed guidance it is up to countries to define the ND and consequently what IAV they consider high.
2675	4	2	2388	2388	Replace "high interannual variability" with "interannual variability", as there is evidence that it is not just high IAV that affects the reported estimates and the ability to discern human from non-anthro effects. See for example Kurz et al, 2018 - Quantifying the impacts of human activities on reported GHG emissions and removals in Canada's managed forest.	Canada	Rejected	According to the proposed guidance it is up to countries to define the ND and consequently what IAV they consider high.
2677	4	2	2398	2398	Replace "high interannual variability" with "interannual variability", as there is evidence that it is not just high IAV that affects the reported estimates and the ability to discern human from non-anthro effects. See for example Kurz et al, 2018 - Quantifying the impacts of human activities on reported GHG emissions and removals in Canada's managed forest.	Canada	Rejected	According to the proposed guidance it is up to countries to define the ND and consequently what IAV they consider high.
2679	4	2	2413	2413	Replace "high IAV" with "interannual variability", as there is evidence that it is not just high IAV that affects the reported estimates and the ability to discern human from non-anthro effects. See for example Kurz et al, 2018 - Quantifying the impacts of human activities on reported GHG emissions and removals in Canada's managed forest.	Canada	Rejected	According to the proposed guidance it is up to countries to define the ND and consequently what IAV they consider high.

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
2681	4	2	2455	2455	Replace "large IAV" with "interannual variability", as there is evidence that it is not just high IAV that affects the reported estimates and the ability to discern human from non-anthro effects. See for example Kurz et al, 2018 - Quantifying the impacts of human activities on reported GHG emissions and removals in Canada's managed forest.	Canada	Rejected	According to the proposed guidance it is up to countries to define the ND and consequently what IAV they consider high.
2683	4	2	2464	2464	Replace "large IAV" with "interannual variability", as there is evidence that it is not just high IAV that affects the reported estimates and the ability to discern human from non-anthro effects. See for example Kurz et al, 2018 - Quantifying the impacts of human activities on reported GHG emissions and removals in Canada's managed forest.	Canada	Rejected	According to the proposed guidance it is up to countries to define the ND and consequently what IAV they consider high.
2685	4	2	2480	2480	Replace "large interannual variability" with "interannual variability", as there is evidence that it is not just high IAV that affects the reported estimates and the ability to discern human from non-anthro effects. See for example Kurz et al, 2018 - Quantifying the impacts of human activities on reported GHG emissions and removals in Canada's managed forest.	Canada	Rejected	According to the proposed guidance it is up to countries to define the ND and consequently what IAV they consider high.
2687	4	2	2435	2436	Graphic - if printed in black and white, opposed to colour, it is not clear what is meant with the labels "managed" and "unmanaged" land which appear below the illustration. Suggest reformatting so that this is clear in black and white/grayscale as well.	Canada	Accepted	Figure have been resived to avoid problems with printing
2689	4	2	2453	2453	It could be helpful to include an example here of where the 2nd order approximation method may still result in the inclusion of some effects of IAV and natural disturbances.	Canada	Accepted with Modification	For examples, please refer to boxes

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
2691	4	2	2469	2473	To avoid using language associated with accounting-related decisions from the Kyoto Protocol, which is inappropriate to reflect directly in IPCC guidance, the language in this para should be modified to draw on the important concepts and definitions established through the KP, but in a more general way. Line 2469 should state that "natural disturbances are non-anthropogenic events or non-anthropogenic circumstances." A second sentence could then recall important concepts, e.g. that natural disturbances result in emissions and removals that are beyond the control of and not materially influenced by Parties. Consistent with proposed changes to lines 2388, 2398, 2413, 2455, 2464, 2480 about the need to address all IAV associated with natural disturbances, and not only "high IAV", suggest removing the reference to "significant" emissions from line 2470. Footnote 15 should be also revised as follows: "Further information on natural disturbance definitions and approaches can be found in IPCC (2014), ..." Moreover, unlike the KP definition which was designed as accounting guidance for forest-related natural disturbances, the IPCC guidance should not restrict application to only forest lands, as evidence supports the application of this approach to non-forest lands as well. Removal of "defined" and keeping the reference to "in the context of AFOLU" in line 2469 help to clarify this.	Canada	Accepted with Modification	Text has been revised to "avoid language" that could be perceived as "associated with accounting-related decisions form the Kyoto Protocol"; including the revision to the footnote as additional information rather than the place from which the definition was derived (as it is slightly different). About significant, since the method is about disaggregating GHG emissions/removals with high certainty, such clause to be significant is needed since insignifcant fluxes cannot be identified/quantified with high certainty.
2693	4	2	2493	2502	This section does not provide any guidance for addressing the balance of emissions and subsequent removals in the instance where sequential natural disturbances occur on the same lands over time.	Canada	Accepted	Added "In the case of repeated disturbances on the same land, the time to reach balance is expected to increase." Note also that Kurz et al. 2018 does provide further information on the approach.
2695	4	2	2509	2509	Not clear how the 3 methods (annual to periodic, averaged or disaggregated by drivers) relate to following paragraphs	Canada	Accepted	The following paragraphs and table seek to document how methodological choices affect the IAV in estimates of E/R. Text was revised to improve clarity.
2697	4	2	2573	2583	By using actual fractions (one third) the concept could be easily confused. When suggesting mathematical constructs, authors should use mathematical equations. In general, however, this section seems overly prescriptive and it would be preferable if the authors were capable of developing some rules of thumb, as opposed to mathematical constructs.	Canada	Rejected	The text clearly states that the allocation of removals to the anthropogenic and natural components is in proportion to the allocation of emissions to these two components. This is the guidance. What follows is merely an example.

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
2699	4	2	2600	2608	The "carbon balance" rule introduces a methodological bias and is not practical. 1. The approach is not quantitatively sound: assume 2 stands with the same biomass, one in the anthropogenic component, the other still in the disturbed component (because it has not reached its pre-disturbed biomass yet). Harvesting those two stands in exactly the same way will be reflected differently in the inventory, because the loss of the growing sink will be reflected in the first instance but not in the second one. In addition, the significance of this discrepancy will vary depending on stands' pre-disturbed biomass, which is arbitrary. This will not occur If stands are considered as "anthropogenic" as soon as they are eligible for harvest. 2. The approach is not practical: Foresters know when a tree is ready to go to the mill, they do not know when carbon equivalency occurs (i.e. decades after a disturbance). Let's try to keep the guidelines practical and applicable. Line 2494: Modify the sentence to: A fundamental assumption of the MLP is that the Forest Land remaining Forest Land is not being degraded or declining in productivity due to natural disturbances. Therefore natural carbon stocks, if management was not occurring would not change overtime. Line 2600 Modify the sentence to: Given the expectation of the sustainability of the natural forest ecosystem (Section 2.6.1.2), it is good practice to assure that methodologies are based on principles that will capture practices that result in reductions in landscape scale standing volumes and ecosystem productivity and the subsequent impact that these practices would have on carbon stocks and/or emissions and removals. Lines 2603-2608: delete.	Canada	Rejected	As stated in rows 2564-2566 any C stock loss associated with an activity that occur after the disturbance is anthropogenic; so the example given at 1 is not correct. Regarding 2, forester may harvest trees at any time, this is just on how estimating associated emisisons and removals, this is not a guidance on forest management. Regarding line 2494, the text proposed is not consistent with the managed land proxy as described, so we cannot agree the proposed change. Regarding line 2600/2603-2608, this section deals with IAV, not with methods to estimates GHG emissions and removals, those methods are provided in other sections and chapters and remains unchanged as well as the principles on which they are based. This section deals with disaggregation of ND E/R only.
2701	4	2	2613	2615	Meaning of the sentence is not completely clear: as written is it always true?	Canada	Accepted with Modification	Paragraph have been moved to Box 2.2J (Canada example)
2703	4	2	2672	2673	Reformulate "background level of natural disturbances" which is a legacy concept associated with rules under the Kyoto Protocol. Suggestion: natural small-scale forest mortality	Canada	Accepted	Text revised as suggested
2705	4	2	2681	2681	Explain or specify the "re-entry age"	Canada	Accepted	Text has been revised to improve clarity
2707	4	2	2720	2725	Figure 2.6D in Box 2.2K seems to be confusing and inconsistent among the legends and it might be mislabeled. The legend below the figure talks about the left Y-axis representing "annual total net GHG emission (Gg CO2e) from managed forest land" and the dashed red line (right Y-axis) representing the "annual area burned (kha)". However, the two labels in the chart refer to "anthropogenic GHG net emissions" associated to the blue bars and "GHG removals from ND" associated to the dashed red line. Suggest to review it and correct the legends as appropriate.	Canada	Accepted	Figure have been revised
2709	4	2	2746	2768	Footnotes 27, 28, 29, 30, 31 and 32 referred to in Box 2.2K are missing	Canada	Accepted	Footnotes added
2711	4	2	2770	2771	Right axis is missing from the graph. No legends either. Also, ''anthropogenic GHG net emission'' should be renamed ''anthropogenic GHG net flux''	Canada	Accepted	Figure have been revised

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
2713	4	2	2776	2776	The legend below Figure 2.6E mentions a right Y-axis representing the disaggregated emissions and removals from natural disturbances; this right Y-axis does not appear in the figure. Suggest to revise this figure as appropriate.	Canada	Accepted	Figure have been revised
2715	4	2	2792	2792	Delete "Depending on the methodological Tier applied", as this section requires use of Tier 3 methods. Replace with "Depending on the approach used"…	Canada	Rejected	It is not correct that Tier 3 methods are required for this. Section 2.5 is specific to Tier 3 methods. Section 2.6 is about IAV and this is not limited to Tier 3 methods.
2717	4	2	2800	2819	The authors provide a series of good practice information requirements. In keeping with the mandate of the IPCC please re-state as: …" it is good practice to document the following: …"	Canada	Accepted	Text revised as suggested
2719	4	2	2802	2802	It is important to monitor the disaggregated carbon stock changes and emissions on managed land from anthropogenic and natural disturbances. Suggest to modify this sentences as: "… it is good practice to document disaggregated emissions and removals in the MLP, the approaches, assumptions and methods used"	Canada	Accepted	Text revised as suggested
2827	4	2	2381	2418	Brazil is in favor of the version presented in the final draft, that inform that the guidance is provided as an option that may be used by countries, not mandatory one.	Brazil	Noted	We appreciate the positive feedback.
2895	4	2	818	819	Are these two values of C per tonne d.m. the only ones available? The dead wood value is only fore temperate species? Table 2.2. gives C values per ha for different climates. It could have another column with C per d.m. for each of climate. If this data is available somewhere in the report and we missed it then please add a reference. Alternatively please add an explanation that no other studies for other climates are available or reference a study showing that these numbers remain the same for all climates. The current presentation is rather confusing. The same variable 'CF' is also used in other equations, so it is important to be clear here.	Estonia	Accepted with Modification	Thank you for the comment, we have clarified that this value is for temperate tree species. Unfortunately there is very little data on this topic so the values given here are default values, to be used if no more detailed information is available.
2897	4	2	1214	1215	How would it be possible verify which temperatures where used? The C content of charcoal does differ significantly depending on processing temperatures (table 2.3B).	Estonia	Noted	If biochar C applied to soil is to be included in the inventory, then it would be a requirement of biochar producers to record both the mass of biochar produced and the temperature used in its production in a manner consistent with the categories provided in Table 2.3B.
2899	4	2	2590	2592	It is not clear what this sentence tries to say; please rewrite so that everyone can understand what is meant here.	Estonia	Accepted	Text has been revised to improve clarity

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
2901	4	2	2420	2832	Natural disturbances - there should be more focus on IAV here and less on other timescales and accounting. Estimation of emssions from natural disturbances is also not clear. Perhaps it´s worth to wait until the science develops here and clearer guidance could be given. Uncertainties related to changes due to natural disturbances should be clearly highlighted here and elsewhere. Also, ways of distinguishing between managed and unmanaged land seems to be rather not straightforward.	Estonia	Accepted with Modification	Text in Chapter 1 has been revised to further clarify the purpose of Chapter 2.6 is not to provide "guidance on accounting". Nevertheless, the authors disagree with the assessments made by the reviewer; in particular because the estimation of emissions from natural disturbances is covered in earlier sections of the guidelines, and no changes are suggested in this section to the basic methods for estimating emissions. Estimation of uncertainties in E/R is also covered elsewhere in the guidenace and not altered here. This section does not address the distinction between managed and unmanaged lands (see Ogle et al. 2018) for a recent publication on this issue.
3541	4	2	653	672	Box 2.0D appears to focus on satellite-mounted LIDAR and SAR, but not airborne (i.e. plane-mounted) applications. Suggest either adding airborne applications to the box, or making the box's focus on satellite applications clear.	United States of America	Accepted	We added text to say that it can be both airborne and spaceborne instruments
3543	4	2	2381	2832	factoring out the inter-annual variability of emissions/removals resulting from natural disturbances on managed land. It may be that the intent of the new guidance is only to assist countries in disaggregating emissions/removals associated with natural disturbances on managed land so that they can better understand the impacts of their management activity. This seems fine and could be a useful exercise for some countries. However, some parts of the chapter appear to suggest that the comprehensive emissions/removals from managed lands associated with natural disturbances need not be reported as part of inventory totals (e.g., lines 2490-2492, 2594-2599, 2782-2783, 2801-2802, and others), thus leading to underreporting. This is not acceptable and the authors should carefully review the entire section to ensure use of this guidance will not be construed in this manner. Factoring out the emissions/removals is an accounting approach and is not consistent with inventory reporting in which the managed land proxy is used as the basis to separate natural and anthropogenic emissions/removals. Additionally, the new guidance does not make it sufficiently clear that addressing/factoring out emissions and removals from natural disturbances through accounting in the UNFCCC is already a well-accepted approach. While IPCC should not provide guidance on accounting, the omission of this information makes it appear as if the only way to address natural disturbances is through the GHG inventory. In our view it is inappropriate to include guidance on separating emissions/removals from natural disturbances from anthropogenic emissions/removals. This is an accounting practice, and not something that should be included in the IPCC inventory guidelines. Additionally, as acknowledged in the current text of this section, human activities are one of the drivers strongly controlling natural disturbances	United States of America	Accepted with Modification	Authors agree with the Reviewer's interpretation of the intent of the disagregation methods. Text of section 2.6.4 (and Box 2.2L) has been revised to make clear that is good practice to report both the total MLP E/R and the disagregated components. However, the authors do not agree that it is appropriate to move the guidance to an annex. For more details - see word document

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
3545	4	2	2384	2385	insert words in CAPITALs to the sentence: "...this APPRAOCH is currently recognised BY THE IPCC as..." This is necessary as other accounting and reporting entities/programs may use a different approach, so making this a unversially applicable statement is not appropriate.	United States of America	Accepted with Modification	Wording added to the sentence as suggested without using "capital" letters since is not according to IPCC editorial rules
3547	4	2	2391	2397	We disagree that the first two causes are necessarily larger than the third cause mentioned in this section.	United States of America	Accepted	We have revised the text to clarify that there are "three main causes" without ranking them. In addition, we are refering to the IAV in the emissions and removals due to human activities, not the absolute amounts.
3549	4	2	2392	2393	The distinction made between the two types of events may not be so clear. "Extreme events" such as hurricanes kill trees and result in immediate emissions; severe and prolonged drought and pests can also kill trees. These may also be considered natural disturbances. Suggest making this gradiation more clear.	United States of America	Accepted with Modification	Text has been revised to clarify that it's refering to the IAV in the emissions and removals due to human activities, not the absolute amounts.
3551	4	2	2405	2406	delete “long” and “major”	United States of America	Accepted	Text revised as suggested
3553	4	2	2412	2412	Insert “these supplemental approaches” after "These"	United States of America	Accepted	Text revised as suggested
3555	4	2	2483	2492	The points made here and related country-specific examples seem out of place here. Would be better suited to include these in intro parts of this section as part of explaining why this approach is deemed imporant to some countries/circumstances.	United States of America	Accepted	The text has been moved to the introduction.
3557	4	2	2499	2502	The stand level discussion seems to make an argument supporting the idea that "The natural effects “tend to average out over time and space” (Vol. 4, Ch. 1)." As national GHGIs are indeed national, looking across the different stands and different environmental conditions that either slow down/speed up the time needed to achieve balance again would likely come out in the wash - especially over this larger/national scale and over time. It seems this further weakens the scientific basic for including this new guidance on factoring out IAV.	United States of America	Rejected	The scientific data provided in the three country boxes clearly demonstrate that the IAV due to ND does not average out over the national scale and does not "come out in the wash". This strenthens the scientific basis for attempting to disaggregate the IAV due to NDs.
3559	4	2	2600	2608	Why is it good practice that removals on managed lands should be excluded when emissions from natural disturbance are disaggregated? This is an accounting question, not a reporting issue. What if management actions are taken to enhance removals? What if a country wants to get credit for the actions it takes to keep forest land as forest following a natural disturbance?	United States of America	Rejected	This paragraph has nothing to do with credits or debits. It states that if a country choses to disaggregate emissions and removals using the approaches outline in the 2019 GL, then removals on lands affected by natural disturbances PRIOR to the start year of the reported time series should also be estimated and attributed to the ND component (even if the associated emissions occured prior to the start year of the time series). Failure to do so violoates the assumption of balance over time and space that is central to the MLP. Please also see reponse to comment #229 for the question of incentivising management actions.
3561	4	2	2710	2744	Box 2.2K. The dashed line in the 1st graphic appears to be mislabelled in the key; the text says this is area burned, rather than GHG removals	United States of America	Accepted	Figure have been revised
3595	4	2	2391	2397	The incipt refers to "two largest causes are" although then three causes are listed. Therefore, it is suggested to redraft as "three main causes"	Italy	Accepted	Text revised as suggested

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
3597	4	2	2393	2393	The word "direct emissions" here is misleading since in figure 2.6A this is associated to anthropogenic effect/emisisons. I suggest to use the word "abrupt" or "immediate" to explain that such emissions occur at time when the disturbance occurs"	Italy	Accepted	Text revised as suggested (i.e. immediate)
3599	4	2	2412	2413	In many places of the IPCC Guidelines it is written that methods applied must not impact the trends. Therefore the reference here to trends is extremely confusing. My suggestion is to replace the sentence as follows: "These approaches may be of interest to countries with large AFOLU sector emissions due to natural effects"	Italy	Accepted with Modification	Text has been revised as follow: These supplementary approaches may be of interest to countries with AFOLU sector emissions where IAV due to natural effects is greater than that due to human activities".
3601	4	2	2453	2453	the anthropogenic component always include some natural effects, so it would be more clear here to replace the word "disturbances" with "effects"	Italy	Accepted with Modification	Text has been revised to insert the words "and other natural effects" after disturbances.
3603	4	2	2466	2467	As already noted, correction of trends is a very sensitive issue. It is therefore suggested to rephrase it as follows: "However, like interannual variability, the inter-decadal variability can also make it difficult to identify trends in emissions and removals that result from human activities"	Italy	Accepted	Text revised as suggested
3605	4	2	2473	2473	The natural disturbances definition referred here was created for forest land in developed countries under the Kyoto Protocol only. In that land use in those countires, the only use within management practices of fires is prescribed forest fires. However, this new definition of natural disturbances is now applicable to other land uses and all countries. Therefore the definiiton has to be improved as suggested: "...prescribed fires as well as any other fires associated with planned and unplanned management practices e.g. slash and burn".	Italy	Accepted with Modification	Text has been revised to include "slash and burn"
3607	4	2	2483	2492	This text is misplaced. This element is discussed in rows 2398-2404. It is therefore suggested to move this text just after row 2404	Italy	Accepted	The text has been moved to the introduction.
3609	4	2	2508	2509	This sentence is quite unclear. Possible rephrase: "…with different temporal resolution and disaggregation of variables."	Italy	Accepted	Text revised as suggested
3611	4	2	2555	2555	As noted for row 2473, here the text could be revised as "…prescribed burning, planned and unplanned including slash and burn,.."	Italy	Accepted with Modification	Text has been revised to include "slash and burn"
3613	4	2	2560	2561	Identification of the land means something, while identification of the areas something else. For instance, the KP method identify the land i.e. forest land but doesn't require to identify the areas or each specific area since the identification of ND is done statistically at level of total emissions; so that a fraction of the emissions caused by disturbances is qualified as subject to natural disturbances, not a fraction of areas. So, this sentence implies that the KP method cannot be implemented as it is. It is therefore suggested to redraft as follow: "Identification of the lands affected by disturbances, as well as a description of the methods and criteria applied"	Italy	Accepted with Modification	Text has been revised as follow: Identification of the lands and area of land affected by each disturbance, as well as a description of the methods and criteria applied

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
3615	4	2	2562	2563	Also for GHG fluxes information on criteria and approaches is important. So we'd suggest: "For those lands, estimation of the emissions and subsequent removals associated with natural disturbances only, e.g. salvage logging emissions and associated subsequent removals are not included, as as well as a description of the methods and criteria applied"	Italy	Accepted	We have added the proposed text. We also point out that Sectio. 2.6.4 provides additional information on documentation and transparency requirements.
3617	4	2	2582	2582	The "%" sign after the value "0.025" is an error. It should be either 0.025 (this is a proportion) or 2.5% (this is a percentage).	Italy	Accepted with Modification	Text has been revised to replace “fraction” with “percentage”.
3619	4	2	2581	2581	To enhance the understandability, it is suggested to add the word "entire" in front of "forest land".	Italy	Accepted	Text revised as suggested
3621	4	2	2609	2615	The 1990 base year is an UNFCCC element of reporting guidelines. IPCC guidelines have not such a time frame. We'd suggests to delete this para. Guidance in the previous para are clear enough.	Italy	Accepted with Modification	Paragraph have been moved to Box 2.2J (Canada example)
3623	4	2	2732	2732	replace "forests" with "any forest land"	Italy	Accepted	Text revised as suggested
3625	4	2	2756	2756	recalling comment on row 2393, it is suggetsed to replace "direct" with "abrupt"	Italy	Accepted with Modification	Text has been revised and word "direc" was replaced with "immediate"
3627	4	2	2791	2791	delete the word "direct", since also lagged emissions seem to be included according to the subsequent para	Italy	Accepted	Text revised as suggested
3629	4	2	2818	2818	the words "and/or magnitude" should be added to just after "likelihood", since "preventative measures or modifying factors " refers also to the "propagation"	Italy	Accepted	Text revised as suggested
3747	4	2	365	366	should be point v) of the list	Norway	Accepted	Text has benn revised as suggested

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
3749	4	2	375	375	In the report, the terms "Tier 1, 2 and 3" and "Approach 1, 2 and 3" seem interchangeable. The first term is clearly defined in the glossary (Glossary 711-714). Please consdier explaining the term approach in the glossary as well.	Norway	Accepted with Modification	represent areas of land-use according to IPCC categories; and Tier 2 and 3 refer to the level of methodological complexity used to estimate emissions and/or revmovals; therefore there are not "interchageable". Nevertheless, authors have agree to introduce the following definitions in the glossary: **Approach 1** Represents land-use area totals within a defined spatial unit, which is often defined by political boundaries, such as a country, province or municipality. **Approach 2** The essential feature of Approach 2 is that it provides an assessment of both the net losses or gains in the area of specific land-use categories and what these conversions represent (i.e., changes both from and to a category). Thus, Approach 2 differs from Approach 1 in that it includes information on conversions between categories, but is still only tracking those changes without spatially-explicit location data, often based on political boundaries (i.e., locations of specific land-use and land-use conversions are not known). **Approach 3** The key defining characteristic of Approach 3 is that it is both spatially and temporally consistent and explicit. Sample-based, survey-based and wall-to-wall methods can be considered Approach 3 depending on the design of the sampling/mapping
3751	4	2	457	457	change to: "…country-specific…"	Norway	Accepted	Text fixed
3753	4	2	460	460	Footnote 6: change to: "… "allometric equation" is also used...". i.e. reverse the word order of "…used also…"	Norway	Accepted	Text fixed
3755	4	2	480	480	The power function is incorrectly described in that "c" is not an estimated parameter, but is instead the random error for the model. Power Function (Allometric Function) has the form Y = aX^b + e. Where Y is biomass, a and b are parameters to be estimated, and e is the random error.	Norway	Noted	Text is revised and the parameters clarified
3757	4	2	482	482	"c" is not an estimated parameter, it is the random error of the model.	Norway	Noted	Text is revised and the parameters clarified
3759	4	2	486	487	The natural-logarithm linearized form of the Power Function is ln(Y) = ln(a) + b*ln(X) + ln(e). Please consider to correct	Norway	Noted	Text is revised and the parameters clarified
3761	4	2	489	490	Should read: "…tree height as a second predictor variable…'	Norway	Accepted	Text fixed

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
3763	4	2	617	622	The message of this part of the box is not according to field inventory practise. This box correctly describes the possibilities of using terrestrial laser scanning (TLS) as a means to develop or validate allometric biomass functions. However, the indicated lines suggest that TLS could be used for inventory purposes ("biomass predictions from TLS") and that the accuracy of such inventories would be independent of complex canopy structures. To our knowledge, this is not the case as occlusion effects do not allow the use of TLS for example in dense understory. Also issues due to weather (scan are of lower quality in strong winds or under rainy conditions), currently restrict the use of TLS to specific studies such as the development of biomass models. We suggest that you consider to delete the indicated lines.	Norway	Accepted with Modification	Part of the sentence is deleted
3765	4	2	648	648	"variables" (as opposed to parameters) are usually said to be predicted (not "estimated").	Norway	Accepted with Modification	In principle the reviewer is right on terminology. On the other hand, I think we do estimate (and not predict) some quantities in field. We predict biomass of individual trees, but we estimate when we produce the plot value by aggregating across tree predictions. So we used variables and parameters to be more general.
3767	4	2	665	665	Should read: "…strength of the signal of the reflected…"	Norway	Accepted	OK change accepted
3769	4	2	726	727	This box describes a method for generating a biomass map which does not seem to be published in a scientific journal. Please provide references.	Norway	Accepted with Modification	The following reference was added: Ometto, Jean Pierre; Assis, Mauro Lúcio; Cantinho, Roberta; Pereira, Francisca; Gorgens, Eric; Satto, Luciane; Siqueira, Emily; Tejada, Graciela (2018): Biomass map of Amazon with a 250m pixel size, link to GeoTIFF. PANGAEA, https://doi.pangaea.de/10.1594/PANGAEA.891345
3771	4	2	773	775	Figure 2.3: should Box 3 be named Tier 3 or Tier 2 & 3 since both Tiers are proposed.	Norway	Accepted	Text fixed, applies also to Box 2.
3773	4	2	799	807	Please consider associating this statement with the assumption of "the year of event": "the carbon in biomass killed during a disturbance or management event (less removal of harvested wood products) is assumed to be released entirely to the atmosphere in the year of the event". (see line 732-734).	Norway	Noted	This association is made beginning on line 777, text in grey beyond scope of revision.
3775	4	2	818	819	The default carbon fraction 0.5 might sometimes underestimate carbon stock (Beets and Garrett 2018). Moreover, carbon fraction might depend on stand age. Thus, please consider including a flexible carbon fraction (CF) of dry matter for both temperate and non-temperate species.	Norway	Accepted with Modification	Thank you for the comment, we have clarified that this value is for temperate tree species. Unfortunately there is very little data on this topic so the values given here are default values, to be used if no more detailed information is available.
3777	4	2	989	991	How is this sentence related to the fundamental assumption that the conventional factor that carbon comprises 58% of organic matter and the conventional conversion factor of 1.724?	Norway	Rejected	The value of 12% C provided is that used in Volume 4, Chapter 3, Annex 3A.5 to define an oragnic soil. An organic soil does not have to composed entirely of organic material, it can contain mineral material as well, but it must meet the minimum organic carbon concentration requirements as provided in Volume 4, Chapter 3, Annex 3A.5. Action: No change

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
3779	4	2	1054	1056	Consider to rephrase the sentence "Since the impact of biochar amendments is included …" to "Since the impact of persistent biochar amendments is included in Equation 2.24, it is essential that biochar with a persistence of 1000 years or more is not included as an organic amentment in the estimates of ΔCmineral". Reasoning: Only biochar that will remain after 1000 years is accounted for in the term ΔBCMineral. Biochar that will not remain after 1000 years should be treated like other organic amendments and should be included in the estimates of ΔCmineral.	Norway	Noted	Given the movement of the biochar component from Equation 2.24 to Equation 2.25 and the new use of a 100 year permanence period, a portion of this comment no longer applies. A statement already existed within the text to ensure that biochar is not included as an organic ammendement elsewhere in the inventory.
3781	4	2	1054	1056	It might be difficult to differentiate between biochar amendment and other organic amendments as there is no reliable measurement method that is able to differentiate between biochar and other organic amendments. It could be clarified how this can be done.	Norway	Accepted with Modification	All that is required is for biochar production faciliites to record the amount of biochar that ends up being applied to soil. The value used for ΔBCmineral can be the total amount of biochar applied to soil in an inventory. It does not need to be spatially tracked. Such an approach should allow separation of biochar from other organic amendments. The following sentence has been added. " The ΔBCmineral term in Equation 2.25 can be derived by determining the total mass of biochar carbon with a permanence >100 years that was applied to mineral soils. There is no requirement to track the spatial allocation of the biochar carbon applied to these mineral soils. "
3783	4	2	1086	1087	Figure 2.4: Editorial: Please check the term in the third box: It should be plant "production".	Norway	Accepted	Removed the third diamond related to the Tier 2 Steady State Modelling method from Figure 2.4
3785	4	2	1211	1211	Footnote 7 indicate that a Tier 2 or 3 method is needed for application of biochar in other land-use categories (than cropland and grassland). There is, however, no description of methodology in e.g. Ch. 4 Forest. How this is to be interpret is unclear. What is required to implement application of biochar in these land-use categories? Please add more information.	Norway	Accepted	The revision has been made in the footnote and the following text has been added as a note at the base of Table 2.3B. "The studies used in the derivation of Fperm values included only cropland and grassland mineral soils. Thus the Fperm values provided in Table 2.3B are only applicable to mineral soils under those land uses. If biochar is added to mineral soils associated with forest land, settlements, other lands or wetlands, then country specific values would have to be derived using a Tier 2 or 3 method."

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
3787	4	2	1214	1215	The temperature thresholds allocating 1.5 times more stability to biochars produced at above 600 °C are inappropriate. Please consider adjustments to the text. Some studies show that a temperature threshold of 370 °C is sufficient for producing stable biochar (Budai et al., 2016), and several studies show an increase in biochar stability with pyrolysis temperature (comparing pyrolysis temperatures of 450 and 550 °C for example) (Fang et al., 2014). However, greater stability of biochars produced above 600 °C compared to biochars produced in the range of 450 to 600 °C has not been documented and the source of data used here (Figure 2A.2-1) is not convincing of this trend either. There should not be a large increase in the FPERMp factors for biochars that have undergone more intensive carbonization. The categories (currently based on temperature ranges of 450 – 600 °C and >600 °C) should be eliminated or reduced: the FPERMp factors for all biochars meeting a minimum threshold (O/Corg < 0.25 and/or H/Corg < 0.7) should be a single value (0.43). Most change in biochar stability and reduction in biochar yield during production occurs at low temperature gradients, not in the range of 600 °C. Results from laboratory studies on biochars produced under highly controlled conditions indicate that an increase in persistence above a fairly low temperature threshold (450 °C) is not very strong with individual studies showing no difference (see Budai et al. 2016) or small differences in the range of 20%. The consequence of the current large difference is that producers will favor higher pyrolysis conditions, while at this time the environmental benefits of high- and low-temperature biochars is still being investigated.	Norway	Accepted with Modification	The calculation of Fperm has been changed from a linear regression to heating temperature categories to account for the known non-linearity between pyrolysis temperature and biochar C persistence. Justification for this change has been added to Annex 2A.2. The Tier 1 methodology was based in temperature rather than biochar properties (such as the mentioned H/Corg or O/C ratios) to facilite accounting in the framework of a Tier 1 method. H, O, and C analyses using Dumas combustion requires specialized equipment that is not available in many countries. In addition, costs for analyses will also constrain the applicability of the method. Mandating the use of elemental ratios will reduce the ability to account for biochar additon to mineral soils. Countries with the ability to measure biochar properties are encouraged to use the recommended Tier 2 and 3 methods; appropriate reference was added to the method and appendix. The text in Annex 2A.2 defining how Fperm was calculated was revised. The revised values of Fperm have been added to Table 2.3B. Text has also been added to Annex 2A.2 defining the potential use of O/C and H/C ratios in higher Tier methods.
3789	4	2	1217	1219	In equation 2.26A the term accounting for methane and nitrous oxide emissions (BCTOTp·GWP-CH4·0.011)+ (BCTOTp·GWP-N2O·0.011) during pyrolysis should be omitted. Reasoning: 1. In industrial pyrolysis plants syn gas (pyrolysis gas) is flared or used for energy/fuel production. Emissions of methane and nitrous oxide of these plants are neglectable. Values of 0.011 and 0.000022 in the equation are based on small, low technological kilns studied by Cornelissen et al. (2016) where syn gass is emitted without any treatment. 2. Emissions from pyrolysis plants should be taken into account in inventories for industry. Biochar, biooil and syn gass are the main products from pyrolysis. Pyrolysis is an industrial process for energy and fuel production equal to waste incineration, and emissions should be assigned to the industrial sector and not accounted for when biochar is used for carbon sequestration in soils.	Norway	Accepted	It has now been decided that emissions of non-CO2 GHGs (e.g. CH4 and N2O) during the heating process used to produce biochar will be recorded in the Energy sector of national inventories (see Volume 2, Chapter 4, Table 4.3.2.1 for values associated with charcoal production).

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
3791	4	2	1218	1218	Footnote 8: Please add that the Table 4.3.2 is in Volume 2, Energy, chapter 4.3.2.1 SOLID TO SOLID TRANSFORMATION PROCESSES	Norway	Accepted	It has now been decided that emissions of non-CO2 GHGs (e.g. CH4 and N2O) during the heating process used to produce biochar will be recorded in the Energy sector of national inventories (see Volume 2, Chapter 4, Table 4.3.2.1 for values associated with charcoal production).
3793	4	2	1219	1220	Please add "Corrections for GWP of CH4 and N2O do not apply if syngas is used for bioenergy purposes".	Norway	Accepted	It has now been decided that emissions of non-CO2 GHGs (e.g. CH4 and N2O) during the heating process used to produce biochar will be recorded in the Energy sector of national inventories (see Volume 2, Chapter 4, Table 4.3.2.1 for values associated with charcoal production).
3795	4	2	1227	1227	To be consistent with previous definition of permanent storage, why not take 100 years for permanent storage (instead of 1000). Alternatively please explain the choice of time horizon.	Norway	Accepted	The permanence period has been changed to 100 years to be consistent with the permanence requirements for other sequestration measures. All permanence values were recalculated to 100 years and used to replace values previously entered for a permanence period of 1000 years. All references to 1000 years in the text have been changed to 100 years.
3797	4	2	1230	1230	The word "produced" needs to be changed to "released to the atmosphere": The release of CH4 TO THE ATMOSPHERE during pyrolysis is a problem, but not its capture and use as bionergy (there it is beneficial and only concerns the energy sector). With well engineered biochar-pyrolysis systems, no CH4 is released to the atmosphere, but CH4 is produced by the process, use in the bioenergy sector (where it is relased to teh atm as CO2). This is why it is crucial to replace "produced" by "released to the atmosphere.	Norway	Accepted	It has now been decided that emissions of non-CO2 GHGs (e.g. CH4 and N2O) during the heating process used to produce biochar will be recorded in the Energy sector of national inventories (see Volume 2, Chapter 4, Table 4.3.2.1 for values associated with charcoal production).
3799	4	2	1232	1232	Need to add to explanation to N2O discounting: "if not used in a bioenergy context": If pyrolysis is effciently used (as it should) for both biochar and bioenergy/syngas production, the emisison associated with the bioenergy production need to be accounted in the energy sector, and not in the Land / C sequestration.	Norway	Accepted	It has now been decided that emissions of non-CO2 GHGs (e.g. CH4 and N2O) during the heating process used to produce biochar will be recorded in the Energy sector of national inventories (see Volume 2, Chapter 4, Table 4.3.2.1 for values associated with charcoal production).

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
3801	4	2	1261	1262	It should be highlighted that C content factor for the different feedstocks varies with pyrolysis temperature. Biochar produced at higher temperatures contains higher C levels.	Norway	Rejected	No temperature response is included in Table 2.3A (FCp). The reason temperature was not included is as follows: Although there is a modest increase with temperature in the carbon content of biochar on an ash-free basis, this is mediated by the fact that ash content of biochar (as a fraction of total weight) also increases with temperature. These two effects approximately cancel out, leading to only a negligible (much smaller than the uncertainty and not significant) change in carbon content as a fraction of total weight. Accordingly, no temperature response of FCp was used, because FCp is expressed per unit total weight of biochar (including ash).
3803	4	2	1268	1269	Elemental ratios should be the default measure of biochar quality, not pyrolysis temperature: Pyrolysis temperature is the most important determinant of biomass conversion, but it is unreliable as a quality index due to the difficulty of controlling and measuring it. This is especially true at lower pyrolysis temperatures of 400 °C and below where exothermic reactions are predominant (Budai et al., 2014). Heat transfer limitations often result in uneven pyrolysis of the biomass, with exothermic reactions remaining localized and measurements of the reactor temperature not necessarily representing the actual temperature experienced by the material. Therefore, elemental ratios of H/C reflect much better than temperature, the degree of carbonization (degree of biomass conversion) of the biochar and hence its quality. The suggestion is that measured biochar properties (atomic ratios of O/Corg and/or H/Corg) be used to define the FPERMp factors in Tier 1, not production temperature, as production temperature is difficult to monitor. Temperature measurements taken often do not reflect the actual temperature experienced by biomass in a reactor. Elemental analysis is a standard measurement that can easily be included in biochar quality assessment that would need to be performed anyway to ensure product quality (heavy metal content for example).	Norway	Noted	The calculation of Fperm has been changed from a linear regression to temperature categories to account for the known non-linearity between pyrolysis temperature and biochar C persistence. Justification for this change has been added to Annex 2A.2. The tier one methodology was based on heating temperature rather than biochar properties (such as the mentioned H/Corg or O/C ratios) to facilite accounting in the framework of a Tier 1 method. H, O, and C analyses using Dumas combustion requires specialized equipment that is not available in many countries. In addition, costs for analyses will also constrain the applicability of the method. Mandating the use of elemental ratios will reduce the ability to account for biochar use. Countries with the ability to measure biochar properties are encouraged to use the recommended Tier 2 and 3 methods; appropriate reference was added to the method and appendix.
3805	4	2	1418	1436	If the term in equation 2.26A accounting for methane and nitrous oxide emissions is not omitted (as suggested for Eq. 2.26A), it should at least be emphasized in tier 2 and 3 that methane and nitrous emissions can be estimated based on measurements.	Norway	Accepted with Modification	It has now been decided that emissions of non-CO2 GHGs (e.g. CH4 and N2O) during the heating process used to produce biochar will be recorded in the Energy sector of national inventories (see Volume 2, Chapter 4, Table 4.3.2.1 for values associated with charcoal production).

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
3807	4	2	1425	1436	There is not given any reasoning why biochar with a persistence of more than 1000 years should be assessed separately. Why not biochar with a persistence of more than 100 years? We think 100 years has been assessed as a reasonable period for soil carbon sequestration in earlier IPCC-reports. Persistence models based on the ratio of hydrogen or oxygen to organic carbon are highly uncertain.	Norway	Accepted	The permanence period has been changed to 100 years to be consistent with the permanence requirements for other sequestration measures.
3809	4	2	1478	1497	The carbon stock change is sometimes associated with the rate of soil loss rate and/or rate of soil formation (ton/ha/yr). Soil carbon loss /gain varies with the type of land uses (see Lal 2008; SOC depletion of 10–20 Mg C ha–1 for arable land, 5–10 Mg C ha–1 for pasture, 2–5 Mg C ha–1 for permanent crops, and 5–10 Mg C ha–1 for forest and woodland). Please consider this default range of SOC information to address the issue of carbon loss due to soil erosion.	Norway	Noted	Average erosion rates are likely already included in the land management factors. It is not possible to exclude them from these factors. As a result, to include eroision would require movement to a higher tier, derivation of new land managmenet factors that exclude erosion and derivation of C loss/gain factors in response to erosoion/deposition
3811	4	2	1598	1626	Box 2.2D refers to Finnish and Swedish studies but not to Nowegian. Tupek is cited (he documents an underestimation of stocks) but it is not mentioned that this is the conclusions of the paper. It could be good to add something like: "Yasso07 was found to be challenged in moist environments when estimating soil C stocks (Dalsgaard et al. 2016)". Fx. line 1624 page 2.49 after sentence ending with "(2001)".	Norway	Accepted with Modification	The proposed reference (Dalsgaard et al. 2016) has been added into the list of other references as follows: "Model has been extensively tested against independent data on forest land (Dalsgaard et al. 2016; Lehtonen et al. 2016; Rantakari et al. 2012; Tupek et al. 2016)"
3813	4	2	2258	2261	Uncertainty analysis should not be confused with sensitivity analysis. In order to avoid this please consider to add sensitivity analysis to the glossary.	Norway	Rejected	The paragraph clearly describes the difference between uncertainty analysis and sensitivity analysis. No further definition / explanation is required.
3877	4	2	2419	2502	It would be nice to include information on if /how phenomens like e.g. El Nino is to be included and considered. How is the principle that the emissions are "not materially influenced by, and beyond the control of, a country" to be understood in the context of e.g. a year with El Nino? How is this connected to the principles related to IAV and multi-year periods, Furthermore natural disturbances might also influence the removal by sinks. Please consider if this needs to be elaborated in section 2.6 e.g by including removals in line 2470.	Norway	Rejected	The text deliberately focuses on natural disturbances . The impact of drought (eg related to El Nino) was not included because of the difficulty in dissaggregating emissions (or reduced) removals. In line 2470 we are not adding removals because the actual disturbances (at the time) do not cause removals. However, elsewhere in the chapter we clearly state that removals following natural disturbances must be treated consistent with the treatment of natural disturbances.
3879	4	2	2481	2483	Line 2481-2483 lists categories where the methodolgoical guidance is applicable. It mentions undrained wetlands and undrained peatlands. Does this imply that the method is not applicable to drained wetlands and drained peatlands? This is important to clarify as eg Indonesia has years with large emissions from drained peatlands, and large interannual variability in such emissions (the emissions are caused by fires).	Norway	Accepted	Human-caused drainage of peatlands increases fire risks and increases emissions in the case of fires. These systems are therefore materially influenced by humans. Text has been revised to further clarify the application of the method

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3881	4	2	2479	2481	The text is a little unclear as to wether there must be subsequent removals to equal the emissions, if the emissions can be considered caused by natural disturbances. Such an approach is easy to understand for living biomass, but more difficult for soils. The text would benefit from being clearer on how to include or exclude emissions from soils in the context of natural disturbances.	Norway	Accepted with Modification	Text has been revised to further clarify that refers to all pools. Further details are in the paragraph below, and therefore the authors did not consider it appropriate to duplicate the text here. The methods build on estimates of emissions from all pools (including soils) derived using those methods outlined in the IPCC GL and they need not be repeated in this section.
3883	4	2	2624	2778	Boxes 2.2i, j and k: The text includes examples from three developed countries. It would be instructive to include examples also from a developing (tropical) country, and also include an example to highlight how to adress emissions and removals in the soil carbon pool in the context of natural distrubances.	Norway	Rejected	At this time we are not aware of any method that has been implemented in a developing country - but the methods listed as examples in the boxes could be applied. The emission and removals estimates presented here already include E/R from soil C pools because they are based on the general estimation methods outlined in the GL.
129	4	3	264	265	Box 3,1,A. in the line for "forest land" "reporting FL areas that in a specific inventory year or years fall below the country definition of FL", ad, at the end of the last paragraph ", legal instruments". There are countries where legal instruments define if a land is forest land even if it is not forested for a period of time.	Spain	Accepted	Added 'tenure' at the end of paragraph which captures the suggested intent without being precriptive as this can be achieved with or without a legal instrument.
131	4	3	591	591	replace, at the end of the line "unlikely" by "a challenge". We know that is difficult to use data mentioned in an approach 3 context, but it is not unlikely, it is challenging. It can be done.	Spain	Accepted	This sentence has been revised as suggested.
347	4	3	1	1699	The additions of explanations and examples in this chapter are welcome. Insights on approaches and good practices when using different types of data (wall to wall, sample-based methods…) and in particular the section "combining multiple data sources" will be very useful.	France	Noted	Thank you for the positive feedback.
473	4	3	194	195	This is a policy relevant question, potentially causing conflicts between reporting Parties. Meanwhile, political issues are not covered by the IPCC mandate and shall not be the subject of any IPCC Guidelines. It should be discussed and solved by the UNFCCC. By this reason we suggest to delete the recommendation on "excluding lands lost due to changes in political boundaries from the entire time-series; and including lands gained from changes in political boundaries for the entire time-series".	Russian Federation	Accepted	See response to comment 3563.
475	4	3	203	205	Please, note that transfer of managed land to unmanaged may occur in the reporting. Please, modify as following: If managed land become unmanaged the legacy effects of past management can continue for extended periods, and associated anthropogenic emissions and removals should be reported during chosen transition period.	Russian Federation	Rejected	The discussion in this para refers to a situation where legacy emissions from past management practice continue to occur for extended period during which time it is not possible to transfer managed lands to unmanaged if anthropogenic emissions continue to be reported.
477	4	3	530	531	It is not clear "….to lift the Approach to a higher level…" if it was stated that Approaches are not in a hierarchical system (line 277).	Russian Federation	Accepted	Sentence re-drafted as: These examples assume that only one type of data and process is used. In many cases the data inputs and processes can be combined resulting in a different Approach than can be achieved with any one single data source

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1071	4	3	617	619	In Table 3.6A and its footnote, non-permanent sample units (e.g. temporary inventory between two points in time) are defined as adequate for Approach 2 under sample-based methods whereas the text on lines 617-619 says that with only temporary sample units, it is not possible to apply Approach 2 or 3 methods but in combination with other data it would be possible. Please clarify. In our opinion, non-permanent sample units are in line with Approach 2.	Finland	Accepted	Table and the relevant text has redrafted to clarify use of temporary samples units for Approach 2 and 3 methods.
1507	4	3	1595	1614	Reference to the FAO classification is outdated. Please refer to the latest version of WRB 2015. Definition of organic soils (Histosols) is reported on page 85 of WRB 2015: Soils having organic material: 1. starting at the soil surface and having a thickness of ≥ 10 cm and directly overlying: a. ice, or b. continuous rock or technic hard material, or c. coarse fragments, the interstices of which are filled with organic material; or 2. starting ≤ 40 cm from the soil surface and having within ≤ 100 cm of the soil surface a combined thickness of either: a. ≥ 60 cm, if ≥ 75% (by volume) of the material consists of moss fibres; or b. ≥ 40 cm in other materials. IUSS Working Group WRB. 2015. World Reference Base for Soil Resources 2014, update 2015 International soil classification system for naming soils and creating legends for soil maps. World Soil Resources Reports No. 106. FAO, Rome. http://www.fao.org/3/i3794en/I3794en.pdf	EU	Accepted	The authors appreciate the suggestion of a more recent reference and have included the suggested text.
1509	4	3	1626	1640	Why proposing a National soil classification system (US Soil Taxonomy) and a international standard (WRB) as possible alternatives (Fig. 3A.5 3 and 3A.5 4)?	EU	Noted	These two figures are from the existing 2006 guidelines and not subject to review.
1757	4	3	185	195	The area data of national statistics is sometimes updated due to the improvement of accuracy of the low data reflecting the recent situation that better quality of remote sensing information become available than before. Such a change is caused by technical reasons and does not means real area change have happened, however, inventory compilers need to use this type of time series data. It is desirable to provide good practice on how to address this type of change in guidance (for instance, provide information on how this artificial data change is addressed in the inventory).	Japan	Accepted	Text has been modified based on the feedback to include only general guidance to account and report if there are changes in country area due to biophysicial or technical reasons.

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1759	4	3	861	875	Regarding the guidance of up-scaling, It is hard to understand how the calculation of highlighting mitigation potential (example in lines 861-862) can be used for up-scaling and to obtain national average stratified land-use data. More concrete guidance or procedure is necessary. Additional information on how to do to the part of lines 867 to 875 is also considered useful for compilers.	Japan	Accepted	Text revised to clarify the intent and purpose of up scaling and down scaling. Detailed guidance on up / down scaling methods is beyond the scope of current revision.
1761	4	3	969	969	"lag emissions/removals" is better to be replaced as "lagged emissions and removals" for editorial consistency.	Japan	Accepted	Text edited as suggested.
1763	4	3	985	990	The same sentences are seen in the previous paragraph. It would be better to remove this part to avoid duplication.	Japan	Accepted	Duplicate paragraph has been deteled. Thank you for pointing out this.
1765	4	3	1476	1476	"his refers to..." is to be changed to "This refers to..." (typo)	Japan	Accepted	Text edits made as requested.
1767	4	3	1504	1505	In terms of "guidance" prospect, it is more useful to provide the summary of methods on how change can be confirmed from time-series information by the research by NIS-LCCP than just explaining the fact that NIS-LCCP gives the example of this.	Japan	Noted	This text is part of the Annex. Here we provided references to publications to obtain additional info on this topic. We have cut down further discussion on remote sensing methods based on comments from earlier rounds of review.
1795	4	3	206	209	Consistent with the comment to chapters 2.6.2 to 2.6.4 above it is also recommended to delete these lines adressing good practice for reporting lands related to natural disturbances.	Austria	Rejected	It is importnat that land subject to natural disturabces are identified since otherwise emissions and subsequent removals could not be estimated! The intent here is to point to the existence of IAV gudance in Chapter 2, Volume 4, therefore it is not possible to delete these lines unless IAV sections are removed entirely.
3563	4	3	186	195	The level of detail here is not necessary, and likely to lead to the type of political discussions that are not apropriate in an IPCC context. Delete text starting on line 186 with "In some cases…" up through line 195 ending with "…entire time-series." and replace with the following: "When national land areas change it is good practice to document the cause of the change, and report the total country area throughout the reporting period as the area for the last year of the inventory report by using appropriate categories and sub-categories to report lands that are newly excluded/included in country reporting."	United States of America	Accepted	Level of detail has been reduced as suggested. The authors consider it relevant to povide general guidance as it is possible to have change in the area of a country due to biophsysical processes or technical reasons. Reference to good practice has been re-drafted as suggested: "When national land areas change it is good practice to document the cause of the change, and report the total country area throughout the reporting period as the area for the last year of the inventory report by using appropriate categories and sub-categories to report lands that are newly excluded/included in country reporting."
3565	4	3	200	201	Clarity would be improved by inserting the phrase "categorized as" here: "...and to ensure that anthropogenic activities in unmanaged land result in unmanaged land becoming CATEGORIZED AS managed."	United States of America	Accepted	Text edits made as requested.
3815	4	3	172	172	add line break between "...available. If...", as this info does not pertain to Other Land but to all categories.	Norway	Accepted	line break added as suggested.
3817	4	3	267	268	Considering acidic soil as a soil strata for Tier 1 might be relevant, especially in high rainfall areas, where leaching is a common incidence.	Norway	Noted	No action required.

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355	4	4	676	676	The table 4.5 on BCEF values were not refined, but the use of these BCEF are very complex for countries. For exemple in many cases, by using the default BCEF the carbon stock changes are very diffferent according to the method used (stock variation versus gains - losses) which is not easy to understand. The values for the growing stock levels <20 m3 are very high and may lead to very strange results. Moreover it is not so clear to undestand how to use these BCEF, because they are provided by growing stock levels and in many cases these growing stock level are not known (is it necessary to subdivide forest area ? is it possible to take into account carbon stock changes ?). It won't be possible to further develop this part but it is just to mention that it is one of the main concern of countries when they develop their GHG forest inventory.	France	Noted	Table 4.5 was not refined due to the lack of disgregated and comparable information, the table is the same that is being included in the 2003 GPG and the 2006 GL.
915	4	4	684	685	Due to the website accessing error to the 'Reference 80', there's no way to confirm the data for the Table 4.7.	Republic of Korea	Accepted	The URL revised.
917	4	4	684	685	In regard to the default values based on the 'Reference 80', the uncertainty is relatively large. Hence the possibility and feasibility of the default values should be reconsidered (ex. Temperate - Mountain - North and South America).	Republic of Korea	Accepted	The uncertaninty is corrected, it was a typo error. Now is 153.8.
919	4	4	688	689	Please make the description of the name of species consistent, as the text here use both the scientific name and English name of the species and it's rather confusing. I would suggest using scientific names. (ex. black locust)	Republic of Korea	Accepted	Scientific names provides for genus and species
921	4	4	696	697	The 'range' in Table 4.10 seems to be incorrect (ex. Temperate domain - mountain - North and south america "7" and "86") which requires re-consideration and do some error corrections if any. If not so, more clear statements on the range should be provided.(ex. Temperate domain - mountain - North and south america "7" and "86")	Republic of Korea	Accepted with Modification	Single values are uncertainties, a footenote is added to clarify.
923	4	4	700	702	Use of terminology: The term used in the title and unit of Table 4.11 is not clear whether it means "growth rate" or "growth".	Republic of Korea	Rejected	The term "rate" is correct, as the growth is given as mean annual increment" in m^3 ha-1 y-1.
975	4	4	664	705	In the Tables, it is suggested to add the defaulted Allometric Models. If the default value can not be given, it is suggested to delete all the words relevant to this model.	China	Rejected	The variability and availabilty of allometric models is far to large to give any default models that can be used in stead of the defult emission factors. Allometric models are considered as models to be country specific and therefore general guidance is provided as Tier 2.
1909	4	4	672	672	In table 4.4 the parameter R for some temperate forests assumes a very high value (e.g. 1.4) for 'Quercus'. Does this refer to cork oak and other Mediterranean type forests? If so, this should be made explicit, as it should not be applied for all Quercus species.	United Kingdom (of Great Britain and Northern Ireland)	Noted	It is not necessary to maked explicit, it is claer that the cited literature Cotillas et al 2016 refers to oak coppice, this explains the high value of "R".
2721	4	4	132	132	The term forest management "regime" should be explained (e.g., such as …). For example, line 132 mentions "management actions or regimes" and in line 223 "management intensity or regime".	Canada	Accepted with Modification	The word "management regime" has been removed when unnecessary and replaced with "management practices" when necessary.

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
3567	4	4	134	135	It's unclear why there is a line stating that it is not necessary to include SOC changes on mineral soils if Approach 2 or 3 data is used? Under the Tier 1 method you already state that soil C stocks do not change. It would be helpful to clarify this.	United States of America	Noted	The paragraph following the commented sentence provides further explanation on the question raised.
3819	4	4	81	90	Please consider revising the association of SOC and soil depth. To same extent, the existence of soil carbon can be extended to a depth of 1- 2 m (Kirschbaum 2000). Thus, restricting of SOC to the plowing depth (30 cm) may be applicable for cropland, but it might "underestimate" the amount of soil carbon pool in forest land and grassland. Depending on soil type and its property, moisture, temperature, rate of mineralization, etc, SOC decline with soil depth. The IPCC might consider developing emissions factor (EF) for each interval along the soil profil to certain depth, for example, 0-30, 30-50, 50-100 cm+. It's likely to increase SOC in the subsurface soil horizone due to deep placement and it classified as previously "unaccounted C" in the global budget (Lal 2008).	Norway	Rejected	We agree in principle that it would be an improvement to estimate impacts deeper in the profile, but there are insufficient data at this time to derive C stock change factors at deeper depths. In fact, it is not even feasible to estimate default C stock change factors to a 30cm depth for forest land.
3821	4	4	378	380	Please consider specifying how conversion from cropland will tend to decrease emissions. Does this assumption consider also rice farming as well, paddy field? This is related to drainage status. Besides, it depends on farming system, fallowing period/ no-till farming, bio-physical and chemical properties of the land drainage status, etc. Conversation from frequently plowed cropland use to grassland use are most likely to improve the status of SOC after some years.	Norway	Rejected	The statement is that C stocks tend to increase, but not that they will always increase. The text here is consistent with the results from meta-analysis that was conducted for the land use factor for cropland. See Chapter 5.
181	4	5	228	229	in the table, it is indicated "“*** calculated” : please explain how the values have been calculated using the other field of the table, for transparency and clarity purposes.	France	Accepted	Edited table footnote: "*** calculated (Lmax = G * Maturity cycle; Lmean = Lmax/2)". Also corrected an error in one table value.
183	4	5	395	401	Disagreement : in particular for estimating carbon inputs, detailed data on crop types, fertilization is required in the steady state approach.	France	Noted	We agree that data on crop types is needed but many countries collect such data routinely. However, there is no need to have any specific data on fertilizer to apply the method.
185	4	5	448	448	Ref. Paustian 1997b Not available	France	Accepted	This has been corrected to Paustian et al. 1997.
187	4	5	1015	1046	Excessive importance is given to biochar, compared to organic amendments for which only manure is considered (nothing on composts, digestates). This section on biochars should be shortened and a section on organic manure should be added, showing the importance of these inputs to soil carbon storage, and exhibiting the range of organic imput, from digestates to solid manures and composts (and thus the need to have a good characterization of these organic inputs).	France	Accepted with Modification	We did not realize that biochar C was given this level of prominence, but after reflecting on your comment, we agree that the methods should not be the focus of entire sections as currently presented. Therefore, we incorporated these methods into the mineral soil C sections. Biochar C is part of the mineral soil C stock calculation and therefore should be found with this section. Organic manures are addressed in this section as well, although manure is directly incorporated in the original C stock calculations from the 2006 GL given the short time frame over which the changes occur. This is where biochar C differs, and needs an additional calculation to be included in the method.
189	4	5	1222	1223	Which data was used for giving the 4.7 value?	France	Accepted	Note added for clarification of the source of the data: "10 t dry biomass (1996 Guidelines) and 0.47 carbon fraction (Table 5.8 value for herbaceous grassland) "

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191	4	5	1866	3365	the reference of Cardinael (agroforestry emission factors and biomass data) is missing : Cardinael, R., Umulisa, V., Toudert, A., Olivier, A., Bockel, L., Bernoux, M., 2018. Revisiting IPCC Tier 1 coefficients for soil organic and biomass carbon storage in agroforestry systems. Environmental Research Letters 13(12).	France	Accepted	Included
193	4	5	510	510	Indeed if D is different from 1 the method is not applicable (obviously, for large D values computed SOC values will be unrealistic). We suggest to remove it from the equation, which avoids l.518 and any misuse of the approach.	France	Accepted	We agree that it would be a problem to use for time steps of many years, so we replaced with 1 yr to maintain unit consistency within the equation. The V4_Ch5_Tier2_Steady_State_Method.xlsx spreadsheet was also changed to remove D.
195	4	5	536	536	Indeed if D is different from 1 the method is not applicable (obviously, for large D values computed SOC values will be unrealistic). We suggest to remove it from the equation, which avoids l.518 and any misuse of the approach.	France	Accepted	We agree that it would be a problem to use for time steps of many years, so we replaced with 1 yr to maintain unit consistency within the equation. The V4_Ch5_Tier2_Steady_State_Method.xlsx spreadsheet was also changed to remove D.
197	4	5	570	570	Indeed if D is different from 1 the method is not applicable (obviously, for large D values computed SOC values will be unrealistic). We suggest to remove it from the equation, which avoids l.518 and any misuse of the approach.	France	Accepted	We agree that it would be a problem to use for time steps of many years, so we replaced with 1 yr to maintain unit consistency within the equation. The V4_Ch5_Tier2_Steady_State_Method.xlsx spreadsheet was also changed to remove D.
925	4	5	815	815	For applying Tier 1 default stock change factor for input(Fi) between medium and highlevel, definition or range of supplemental organic matter in Medium level or medium C input in High-with manure level should be added in the description column.	Republic of Korea	Rejected	The factors were derived based on a yes/no classification in which the amount of amendment is not needed, just whether or not the soil is amended with organic matter. The classification was done in this way to simplify for the activity data requirements.
977	4	5	362	762	Considering the complexity of the "three sub-pool steady-state C model" and the absence of calculation parameters, Tier 2 is not applicable. So it is suggested to list Tier 3. Such a modification is requested.	China	Rejected	We agree that awkward wording of the differences between the steady-steady method and a Tier 3 model in box 5.1A could contribute to misunderstanding that the Tier 2 steady-state method is a process model. We reworded the sentences to be clear it is not a process model (L391-406) so that it is clearer now that it is not a complex model Tier 3 model. However, we reject the comment that the model shoudl be Tier 3 because calculation parameters are not provided because globally aplicable values for the parameters are provided in Table 5.5A.
979	4	5	1108	1108	The parametric values in this equation are not consistent with those given in TABLE 2.3B, Chapter 2, Volume 4. According to TABLE 2.3B, the equation should be changed from "(2000·0.38·0.24+50000·0.52·0.38+15000·0.49·0.09)=10,723.9 tonnes C" to "(2000·0.38·0.28+50000·0.52·0.43+15000·0.49·0.13)=12,348.3 tonnes C". Such a check and revision is requested.	China	Accepted with Modification	The fractions were revised based on comments in Chapter 2 to a 100 year time horizon for permanence, and have been updated as requested.
1097	4	5	1101	1101	Reference to Equation 2.25A should be corrected to Equation 2.26A.	Finland	Accepted with Modification	The equation number has been updated based on revisions to Chapter 2. The equation number is now 2.25

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1099	4	5	1108	1108	In example: Carbon contents appear to be the same than defaults in Table 2.3A but the other coefficients presented in the example are not the same as fractions remaining after 1000 yr in Table 2.3B. Please correct or please explain what the other set of coefficients represent.	Finland	Accepted with Modification	The fractions were revised based on comments in Chapter 2 to a 100 year time horizon for permanence, and have been updated as requested. There is a detailed explanation of these parameters in Chapter 2.
1171	4	5	854	855	The parameter Ws has a value of 1.331 in Table 5.5A as well as Table 5A.3-2 line 3741. In the example provided as a supplementary file, V4_Ch5_Tier2_Steady_State_Method.xlsx, the model parameter used in the calculations is 1.331 however in first sheet 'Equations and Calculation Steps', the text box containing the equation for wi in Equation 6: Soil Water factor shows a value of 0.9303 for Ws.	Australia	Accepted	We thank the reviewer for the careful checking. The correct value is 1.331, and the spreadsheet was corrected.
1173	4	5	612	616	The equation for Wfac shows a multiplication of 1.5 which is used in the calculations of the example provided as a supplementary file, V4_Ch5_Tier2_Steady_State_Method.xlsx, however in first sheet 'Equations and Calculation Steps', the text box containing the equation for Wfac in Equation 6: Soil Water factor shows a multiplication of 0.15	Australia	Accepted	We thank the reviewer for the careful checking. The value is 1.5, and the spreadsheet was corrected.
1175	4	5	629	635	The equation for Beta shows 0.85-0.018*(LC/NC) which is used in the calculations of the example provided as a supplementary file, V4_Ch5_Tier2_Steady_State_Method.xlsx, however in first sheet 'Equations and Calculation Steps', the text box containing the equation for Beta in Equation 7: Calculation of intermediate values shows 0.832*(LC/NC)	Australia	Accepted	We thank the reviewer for the careful checking. The equation in the text is correct, 0.85-0.018(LC/NC). The spreadsheet was corrected.
1177	4	5	868		Recommend clarification: Table 5.5 C The C/N ratio for sheep manure is surprisingly low - should be closer to beef cattle, not same as swine. The reference cited does not appear to contain this figure. Cite a more suitable source. Lignin content of manure of pasture-fed and lot-fed cattle will differ. That for sheep would be closer to grazed cattle than lot-fed.	Australia	Accepted with Modification	We thank the reviewer for noticing the inconsistency. We averaged the N content with that in 3 other articles, including the one suggested byt the reviewer, and derived an average N content of sheep manure of 3.26%. This very close to the 3.23% from the reviewer-suggested reference and closer to the value for beef cattle manure. We modified the table.
1179	4	5	1026	1035	Recommend inclusion: Tier 2 will also require chemical composition of the biochar so that the H/Corg method for estimating C stabilisation can be used.	Australia	Accepted	We have added a sentence about H/Corg method and also directed the compiler to Chapter 2 for more information. This text has been added here as well as the Tier 2 section in Land Converted to Cropland, Grassland Remaining Grassland and Land Converted to Grassland for consistency.

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
1691	4	5	362	362	Without any manipulation, we carried out a short, limited test of the steady-state model with data from two sites of the German Permanent Soil Observation program. The results showed both locations in equilibrium, i.e. no changes with respect to the temporal trend and carbon stocks calculated by the model deviated significantly from the level measured at the stations (ca. + 40%, respectively ca. - 70%). Only by intensively manipulating the input data of the model (C-Input) to reach the actual initial C-stock of the soil, we received results which correspond in trend and height approximately to the values of the measured values. A small, additional test showed that also the temperature sensitivity of the model does not seem very pronounced. Admittedly, this was only a superficial and not at all comprehensive check of the model. A comprehensive test would require to check significantly more locations and to evaluate the uncertainties of the model. Such additional validation should be conducted before this model is included in the guidelines. We also seek guidance, why specifically this model should be endorsed by the guidelines as other models are also available.	Germany	Noted	We appreciate the evaluation by the reviewers. As a non-obligatory Tier 2 method, it will be up to each country to determine if they want to adopt the method based on such country-specific assessments. The Tier 2 method provides general estimates of C stocks given more country specific data on C inputs, tillage, soil texture, and weather but does not include country-specific data on initial soil C stocks. Therefore, these C stock estimates are not expected to necessarily provide an accurate estimate of soil C stocks of particular location. If a country wishes to include the effect of measured initial soil C stocks on estimates of C stock changes, then it would be best to use a Tier 3 methodology. ANNEX 5A.3 provides the wide range of location whose obsevation were used to fit the method parameter values. We cannot provide a general method uncertainty since that depends on the uncertainties of the country-specific inputs of texture, C input, and weather. The uncertainties of the parameters are provided in Table 5.5A and the compiler can use these with the those of country-spefici inputs to estimate the uncertainty of method for their country. We added a sentence in 5.2.3.1 where the method is introduced (L365) that indicates the scope of use. It sufficiency for that scope is the rationale for the selection of the particular method. Also, the three pool steady state solution has been published in the literature. A country is not obligated to use it and can choose to base C stock change estimates on any veririfed model in a Tier 3 application.
1693	4	5	1401	1404	We understand that the possibility of using an asymmetric system with regard to the transitional period is introduced in order to avoid over- or underestimation of land-use change emissions from/ to cropland. This is commendable but currently under the existing rules not applicable. Most of the relevant literature refers to the "fast out - slow in" - principle (e.g. Poeplau et al. 2011), mostly based on paired site studies. However, other studies do not show this asymmetry in carbon stock changes. Apart from the fact that we ultimately do not know what is the truth, against the background of other basic rules of the guidelines, this method does not seem practicable. For example: According to Poeplau et al. 2011, in the case of land use change from, e.g., grassland to cropland, the carbon losses occur within 18 years, whereas in the opposite direction the transition period is in the range of 100-200 years. As land use is usually hard to trace back for the 20 default years, it seems impossible for 100-200 years. The compiler does not know, e.g., in the case of a LUC from grassland to other land, whether the area is in steady state or at what time in the 200 year transition period.	Germany	Accepted	Good point. We have a added a sentence to point out this issue out to complilers.
1695	4	5	1982	1984	Throughout chapter 5, no reference is made to this publication of Popken S., 2011. Please revise.	Germany	Accepted	Sent to Biomass C Subgroup

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
1697	4	5	240	241	Table 5.3: The citation "Canaveira, P. et al 2018" is missing in the reference list in the end of the chapter. Please add.	Germany	Accepted	Problems with missing references and refernced papers that are no longer cited to be fixed.
1769	4	5	1108	1109	Coefficient Fpermp in the Example seems to be different from the number on Table 2.3B. High temperature: 0.43, Medium temperature: 0.28, Low temperature: 0.13. If there is the reason why using other coefficient, it should be explicitly explained.	Japan	Accepted with Modification	The fractions were revised based on comments in Chapter 2 to a 100 year time horizon for permanence, and have been updated as requested.
1771	4	5	3081	3082	There seems to be one missing reference (Table 5.5., source 6). It is ': Shirato, Y. & Yokozawa, M. (2005) Applying the Rothamsted Carbon Model for long-term experiments on Japanese paddy soils and modifying it by simple mining of the decomposition rate. Soil Science and Plant Nutrition 51(3): 405-415.' and would be preferable to be add between Line 3081: 'Shirato, Y., Yagasaki, Y. & Nishida, M. (2011)' and Line 3082 'Shrestha, B. M., Singh, B. R., Forte, C. & Certini, G. (2015)'.	Japan	Accepted	We thank the reviewer for their careful checking. The missing reference added to reference list
1799	4	5	1166	1167	To be more precise it is suggested to change the term in the brackets into the following: (at maximum - afterwards C stock changes are accounted in the remaining subcategory)	Austria	Accepted with Modification	Text redrafted in line with the comment
2723	4	5	436	437	The figure legends are not explained in the immediate text. For example, C input, beta are not explained.	Canada	Accepted	We added description of the terms shown in the figure within the box
2725	4	5	606	606	Is this air temperature or soil temperature? Please specify.	Canada	Accepted	corrected so states it is air temperature
2727	4	5	821	821	"profile to below the tillage depth (refs)." Please insert references.	Canada	Accepted	These two references were added along with another (Gal et al. 2007) of depth-tillage effect interaction.
2729	4	5	821	821	"This may be consideration to chaise of depth." Ambiguous sentence, poorly worded. Please revise to clarify.	Canada	Accepted	Sentence was revised to be more specific that deeper depths can be warranted to estimate tillage system effect of soil C stock.
2731	4	5	828	829	"However, it is important to realize that all data used to derive stock change factors across all land uses must be on an equivalent mass basis if this method is applied". E18This seems incorrect. Equivalent mass calculations require only soil C concentration and bulk density. What do the authors mean by "all data"? Presumably, this sentence is intended merely to indicate that if an equivalent mass approach is adopted, it should be applied uniformly across all land uses. Please correct.	Canada	Accepted	Good point, replaced data with "soil C stocks" in sentence and so now clearer what is meant
2733	4	5	829	830	"This will be challenging…" This statement seems to discourage the use of the equivalent mass approach, implying grave difficulties. In fact, the equivalent mass approach is not unduly complicated and avoids some potentially serious errors in estimating soil C stocks.	Canada	Accepted	Good point, it is not challenging if a country has all the necessary data to do the calculations. Replaced "be challenging" with "require necessary soils data".
2735	4	5	863	864	Table 5.5B. Please specify the units for N content and lignin content. For example: g N (g residue)^-1? Also, presumably these concentrations are on a dry weight basis?	Canada	Accepted	Table was clarified
2737	4	5	1184	1184	"five carbon stocks" to "five carbon pools" ensures consistency with text and table 5.7	Canada	Accepted	Although the comment is on shaded text for consistency the suggested minor change is accepted

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
2739	4	5	1409	1410	"However, it is important to realize that all data used to derive stock change factors across all land uses must be on an equivalent mass basis if this method is applied" . This seems incorrect. Equivalent mass calculations require only soil C concentration and bulk density. What do the authors mean by "all data"? Presumably, this sentence is intended merely to indicate that if an equivalent mass approach is adopted, it should be applied uniformly across all land uses. Please correct.	Canada	Accepted	Good point, replaced "data" with "soil C stocks" in sentence and so now clearer what is meant
2741	4	5	1410	1411	"This will be challenging…" This statement seems to discourage the use of the equivalent mass approach, implying grave difficulties. In fact, the equivalent mass approach is not unduly complicated and avoids some potentially serious errors in estimating soil C stocks.	Canada	Accepted	Good point, it is not challenging if a country has all the necessary data to do the calculations. Replaced "be challenging" with "require necessary soils data".
2945	4	5	240	241	In Table 5.3, under tropical cropping system, coffee based agroforestry and cocoa based agroforestry can be added	India	Rejected	Table 5.3 is for monocultures. Coffee and cocoa-based agroforestry values can be found in Table 5.1 and Table 5.2 ("shaded perennial"). Insufficient data was found for pure (unshaded) coffee and cocoa crops.
2947	4	5	228	229	In Table 5.1, the agroforestry system in temperate and tropical conditions can be reclassified as i) Agrisiviculture, ii) Silvopastoral, iii) Boundary Planting, iv) Improved fallows, v) Shadow systems, vi) Home gardens and viii) Wood lots.	India	Rejected	The classification system used in the Table is the one used in the meta-analysis that provides the table data.
3823	4	5	442	442	Typo: the "2" in CO2 should be displayed as subscript	Norway	Accepted	Corrected
3825	4	5	678	678	Mentioning that Equation 5.0H could be used in abscence of country specific parameters could help here	Norway	Accepted	We added a reference to the equation that can be used in the absense of country-specific methods.
3827	4	5	782	782	We anticipate that you are referring to Equation 2.26A and not Equation 2.27 which is in Section 2.4 Non-CO2 emissions	Norway	Accepted	Corrected to equation 2.26A
199	4	6	111	111	We suggest to write " priming effect"	France	Accepted	Changed to the reviewer's suggestion
201	4	6	122	123	Table 6.2 : the new default number is quite low (0.9), in average 0.06 point lower, this mean also that even if we have intensive grazing none of the improvements (eg manure) can compensate this. A default value such as (0.92) would have allowed a small compensation	France	Accepted with Modification	The decision flow chart was revised so that intensive grazing is only relevant for grasslands that have don't have productivity above native conditions.

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
203	4	6	122	123	Table 6.2 : "Moderate degraded grassland" categorie for FMG was in 2006 splits in 3 climate zones in the new guideline this category is replaced by "intensity grazing" (without climate division) and overall decreased from 0.96 to 0.90. This change is little justified with reference in the text: lack of analysis.	France	Accepted with Modification	We added sentences to Annex 6A.1 that the categorization was revisited with the literature and concluded that the moderately degraded management factor had been determined from a non-rigorous and non-reproducible interpretation of scientific literature to categorize particular grazing regimes into "moderately degraded" and comparative "non-degraded" states. The original paper authors almost entirely did not refer to or define either the non-degraded or moderately degraded states, only the grazing intensity in terms of light, moderate, and heavy. This was different from the severely degraded state where there several papers that referred to severely degraded pasture and it was clear this referred to the state of both the vegetation and soil. In fact, outside of severely degraded, there was only few studies that reported a grassland vegetation state for each grazing regime to develop a relationship between grassland vegetation and soil C stocks. Therefore, we redid the analysis using the grazing intensities as defined by the original paper authors to derive a factor for high intensity grazing versus light to moderate grazing. The high grazing intensity factor is more scientifically defensible than the moderately degraded state factors in the 2006 GL. There was insufficient data to reliably derive the high -intensity grazing factor for different climates. Regarding activity data, for policy purposes, many countries collect data to know if they have too little or too much livestock for their grassland areas so may have activity data on grazing intensities relative desired grazing intensity and so can identity areas with high intensity grazing.
981	4	6	105	547	In order to keep the citations contextually consistent, Line 105: It is suggested that "Equation 2.27" be replaced with "Equation 2.26A" Line 250: It is suggested that Tables 2.4 and 2.5 be replaced with Tables 2.3A and 2.3B. Line 331: It is suggested that "Equation 2.25A" be replaced with "Equation 2.26A" Line 421: It is suggested that "Equation 2.27" be replaced with "Equation 2.26A" Line 547: It is suggested that Tables 2.4 and 2.5 be replaced with Tables 2.3A and 2.3B.	China	Accepted	Corrected as suggested
983	4	6	337	337	The parametric values in this equation are not consistent with those given in TABLE 2.3B, Chapter 2, Volume 4. According to TABLE 2.3B, the equation should be changed from "(30500·0.38·0.24) + (150000·0.52·0.38) = 32,421.6 tonnes C " to "(30500·0.38·0.28) + (150000·0.52·0.43) = 36,785.2 tonnes C ". Such a check is requested.	China	Accepted	Corrected as suggested. We thank the reviewer for the careful checking.

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
1181	4	6	190	194	Comment: (not just specific to the referenced lines) It is going to be difficult to distinguish high intensity grazing from Improved-High input grazing. If graziers have undertaken multiple improvements - fertiliser, species improvement - then there is high stocking capacity, so will usually have high grazing intensity. ie would not be decribed as "nominally or moderately grazed" But if well-managed, will not show signs of "change in species composition" - so is it "High intensity grazing" or "Improved grassland"? It is likely that such a system will have same SOC as a lower-input system (eg Young et al, 2016) ie will overestimate SOC if classed as Improved grassland but will underestimate if classed as High intensity grazing. There should be an additional class of "High intensity, not degraded", with a factor of 1.0. Otherwise, revise the description of high-intensity to remove all reference to degradation and change in species composition, to ensure that all high intensity grazing is allocated a factor of 0.9, to avoid overestimating SOC in improved pastures that are managed with high intensity.	Australia	Accepted with Modification	We agree that the way the decison tree is presented the compiler could be confused about having to make a grazing intensity decision for high productivity improved grasslands. We addressed this by changing the order of the flowchart so that decision on high intensity grazing is made after the grassland productivity decision so that high intensity grazing decision is only required for unimproved grassland. We also improving the definition as: "High intensity grazing is defined as grazing that deteriorates the condition and/or long-term recovery capacity of the vegetation compared with the vegetation state under nominal to moderate grazing intensity. High intensity grazing does not refer to stocking rate and duration only, but to the stocking rate and duration in relation to grassland productivity and resilience. This may be called a moderately degraded condition but high intensity grazing does not lead to the severe degradation such as is caused by relentless overgrazing. High intensity grazing also includes land where vegetation is frequently cut and removed equivalent to high intensity grazing and without application of any animal manure."
1699	4	6	465	468	We understand that the possibility of using an asymmetric system with regard to the transitional period is introduced in order to avoid over- or underestimation of land-use change emissions from/ to cropland. This is commendable but currently under the existing rules not applicable. Most of the relevant literature refers to the "fast out - slow in" - principle (e.g.. Poeplau et al. 2011), mostly based on paired site studies. However, other studies do not show this asymmetry in carbon stock changes. Apart from the fact that we ultimately do not know what is the truth, against the background of other basic rules of the guidelines, this method does not seem practicable. For example: According to Poeplau et al. 2011, in the case of land use change from, e.g., grassland to cropland, the carbon losses occur within 18 years, whereas in the opposite direction the transition period is in the range of 100-200 years. As land use is usually hard to trace back for the 20 default years, it seems impossible for 100-200 years. The compiler does not know, e.g., in the case of a LUC from grassland to other land, whether the area is in steady state or at what time in the 200 year transition period.	Germany	Accepted	Good point. We have a added a sentence to point out this issue out to compilers.
3829	4	6	201	201	Please update the current version of the link.	Norway	Accepted	Change to greyed text.

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
3831	4	6	394	396	The average change in soil carbon stock of a land use depends on the length of conversion and it's used as factor in estimation of average annual change in soil C stock. First, why is 20 years consider as a Default factor? How is irregular change handled in this case?	Norway	Noted	This suggestion is within the greyed text that is outside of the scope of the 2019 Refinements. Note the 20 year default is a consistent simplification within the Tier 1 method that balances between faster changes that occur in the tropics and slower changes in temperate regions.
205	4	7	207	207	Other flooded land do not exhibit necesseraly "low oxygene levels", it will depend on water column. But it is true that at interface water sediment, consumption of dissolved oxygen leads to low oxygen level surrounding sediment (few mm as explain in L1752)	France	Accepted	Inserted "may have low oxygen levels"
207	4	7	239	239	add "inflow water quality" after "hydrology"	France	Accepted with Modification	added "water quality"
209	4	7	282	283	Figure 7.2 is not readable in the version	France	Accepted	There was a problem when converting the Word (and illustrator embedded figure) into PDF format. We have corrected this problem.
211	4	7	289	294	Figure 7.4: The two back black arrows below "Factor out emissions …" are not clear.	France	Accepted	improved for clarity
213	4	7	319	319	"Unmanaged wetlands act as sinks for CO2" add "as well as some managed wetland" controlling by inflow water quality.	France	Accepted	Inserted the text as requested
215	4	7	510	555	Eq 7.17 proposes to include an "emission factor adjustment", but to be congruent, eq 7.18 should also include this "emission factor adjustment"	France	Rejected	Whilst an adjustment factor could in principle be developed, in practice none of the methods presented for different wetland categories in the Wetland Supplement included an adjustment factor based on trophic status, so we do not have a methodological basis for doing this here
217	4	7	934	934	Previously net CO2 emission was defined and applied. In the section 7.3.2.1, is it question of "total" or "net" co2 emission (CO2 consumption by aquatic biomass)? And in table 7.16, is "net" or "total"	France	Accepted	Text added on line 990-991. These Efs correspond to the total emissions attributable to the reservoir. See annex 7.1 for details.
479	4	7	1	2189	Please, see supporting document	Russian Federation	Noted	
481	4	7	156	156	Please explain "methanogenic production of CH4" (what it means)	Russian Federation	Accepted	We changed to the words "methane production". Methanogenesis is described in the appendix
483	4	7	167	170	This sentence may be understood as stating that nutrients loading is higher for small natural waterbodies than for constructed waterbodies. It is Likely that authors meant the opposite.	Russian Federation	Accepted	Rearranged the sentence to increase clarity
485	4	7	282	282	Figure 7.2 is not complete.	Russian Federation	Accepted	There was a problem when converting the Word (and illustrator embedded figure) into PDF format. We have corrected this problem.
487	4	7	1117	1117	Replace "Nb reservoir" with "Number of reservoir"	Russian Federation	Accepted	changed text as requested

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
489	4	7	1872	1873	Regarding at least carbon budget of unmanaged natural lakes this statement is not true, as more sophisticated models are available in the literature. They include 1D (vertically resolving) simulation of coupled physical and biogeochemical state of natural lakes (McCullough et al., 2018; Kiuru et al., 2018; Stepanenko et al., 2011; Stepanenko et al., 2016; Tan et al., 2015; Tan et al., 2017). Although, it is likely no attempt has been performed to apply same kind of models to artificial reservoirs, I suggest the authors of Guidelines to encourage the development of models of the same complexity and their application to artificially flooded land.	Russian Federation	Noted	Line 1873 removed. The models described by the reviewer require large amounts of data not generally available to compilers are not currently applicable to a large number of reservoirs.
491	4	7	1954	1954	The relevance of reference to Figure A1 is not clear	Russian Federation	Accepted	corrected the text - ..worldwide "as shown in the map in Figure A2."
493	4	7	2097	2097	Figure A4 → Figure A6?	Russian Federation	Accepted	Corrected text to A6
495	4	7	2114	2115	Should the "remineralization" be changed to "mineralization" here?	Russian Federation	Accepted	Corrected to mineralization
657	4	7	245		"Factoring out" is an accounting term that has been used specifically under the KP, therefore suggest rewording to apply the same language as used in IAV section of Chapter 2 "disaggregating" emissions that would have occurred if land was unmanaged, and reporting separately.	New Zealand	Rejected	We have followed the terminology given in the TOR from the IPCC Panel.
659	4	7	245		"Factoring out emissions (removals) that would otherwise occur from Unmanaged Land without conversion to Managed Flooded Lands". Once land is managed, the emissions that would have occurred anyway are not factored out for any other land use. It is inconsistent to apply this practice to the Wetland category only. Suggest this is disaggregated and reported separately as comment above to ensure consistency across the chapters of this Volume	New Zealand	Rejected	We agree that the general issue of emissions associated with conversion of unmanaged land to managed land is not unique to flooded lands. However, have provided a clearer justification for this approach for flooded lands in the Introductory section. We were mandated by the IPCC Panel in the TOR to develop "consistent methodologies that take into account factoring out of emissions that would otherwise occur in the absence of the flooded area for estimating CO2 and CH4 emissions from flooded lands". There was no guidance to do this for other land uses.
661	4	7	282		Comment on Decision tree diamond "is there a significant increase in surface area?". "Significant" requires definition e.g. increase is greater than x% of original and with a minimum size threshold (at least x ha in size). As an example Chapter 12 provides the following: "Furthermore, countries are encouraged to make the country-specific HWP commodity classes broad enough to capture significant carbon volumes contributing to the HWP pool. As a guide, the volumes of these commodity classes may be deemed significant if they represent at least 5% of the total HWP volumes as described by the particular approach selected by the country. "	New Zealand	Accepted	We have indicated that >10% change is considered "significant" . At L265 we have added (where there has been a significant change in surface area and/or residence time, for example by > 10%)
927	4	7	282	283	Figure 7.2 should be double checked as it is omitted.	Republic of Korea	Accepted	There was a problem when converting the Word (and illustrator embedded figure) into PDF format. We have corrected this problem.
929	4	7	330	340	Please ensure the consistency with the description of Equation and Variations as it is difficult to identify the Equation.	Republic of Korea	Noted	We have checked equations accordingly

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
1101	4	7	198	202	Consider adding: Country-specific conversion periods may be applied under Tier 2 and Tier3 methodology.	Finland	Accepted	Suggestion already noted in line 391-392
1103	4	7	222	225	It is mentioned that seasonally flooded agricultural land can be considered Flooded Land. Accoring to 2006 GLs, a land area can be classified only in one of the six land use categories in a year. Please, clarify the guidance how to prioritize land use categories, e.g., should the land mentioned in the text be classified as cropland/grassland or flooded land under wetlands category.	Finland	Noted	We agree that the land can only be classified as one land use and the decision will depend on national circumstances. Even if the land is classified as cropland or grassland the emissions should still be addressed by the compiler.
1105	4	7	245	281	2019 Refinement introduces a new concept in the GHG inventory to factor out emissions (removals). It is not clear, if this method is intended to be optional or mandatory for a country which is going to included emissions from flooded land in its inventory (in lines 276-277: ... with practical consideration for application of the methods by compilers). If it is optional to factor out emissions that would otherwise occur from unmanaged land without conversion to managed flooded land, this guidance shall be preferably placed in appendix to this Chapter. Whether it is optional or not to apply this method, more justification for it is needed, because it is not in line with GHG inventory principle to report actual emissions/removals. Factoring out emissions/removals means that a methodology to estimate emissions/removals from unmanaged lands would have to be developed - thus the 2019 Refinement should provide the appropriate guidance at the same time with guidance on flooded land factoring out. Also, the method is not consistent with the managed land proxy. Factoring out is not used for other land use categories or emissions/removals from other sources. Thus, the emissions from flooded lands would be counted differently even under wetlands category.	Finland	Accepted	We agree that the general issue of emissions associated with conversion of unmanaged land to managed land is not unique to flooded lands. However, there was a mandate in the TOR to develop these methods, we have provided a clearer justification for this approach for flooded lands in the Introductory section. The following sentence has been added: "Inventory compilers may choose to report total emissions from Flooded Land, in accordance with the Managed Land Proxy, or to factor out emissions and removals associated with Unmanaged Lands that occurred before conversion to Flooded Land. "
1107	4	7	267	275	It is mentioned that factoring out is not applied to flooded land which has been managed land before the conversion as they are included in the inventory from the baseline year. What does 'baseline' year mean? Base year? The base year can differ between countries, so how this should be taking into account? For many Annex I countries the base year is 1990. If a managed land is converted to flooded land e.g. in 2020, it is possible that the same land was unmanaged land in 1990. Please, clarify this section.	Finland	Accepted	Text modified in line 295. No reference is now made to base year.
1109	4	7	463	463	Please revise "> 20 years prior to inventory" to "> 20 years prior to reporting year"	Finland	Accepted	Revised as suggested
1111	4	7	679	712	Under Tier 2 CH4 emissions due to wastewater inflow can be estimated and factored out. Box 7.2 states that at Tier 3 level it is good pratice to factor out these emissions. That is not mentioned in the text for Tier 3 level. As the wording 'good practice' obligates a inventory compiler, all that kind of guidance should be in the actual text. Please clarify the text. Note the title of Box 7.2 Additional information...	Finland	Accepted	We have improved the Tier 2 and Tier 3 text and the text in the Box to provide more information as requested.

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
1113	4	7	768	770	It is left to inventory compiler to choose whether to report emissions from drainage ditches within flooded land (wetlands category), or under other managed land categories. If the ditches are an essential part of the land area, like it is in the case of drained forest land/cropland, the emissions from ditches should be reported in forest land/cropland category and not under wetlands. Please, reconsider the text.	Finland	Noted	This decision depends on national circumstances and therefore needs to be remain flexible.
1115	4	7	899	901	It is discussed about how to estimate the area of ditches in agricultural lands. Is it suggested to report the emissions from ditches in wetlands category? Some countries may have so wide ditches on croplands/grassland that it is practical to report separately the fields and the ditches. If this is the case, could it be clarified in the text. Normally the ditches are reported under cropland/grassland categories.	Finland	Accepted	The following text has been added: "For these areas, inventory compilers may choose to report these emissions within the appropriate land category, or separately in the Flooded Lands category. "
1117	4	7	975	976	Biomass removed from an area before impoundment shall be reported according to the guidance given in Chapter 2 (e.g. 2.3.1.2 estimating change in carbon stock in biomass), not according to the guidance given for HWP. To avoid missunderstanding, it would be useful if in the text it were mentioned that these emissions from removed carbon stocks shall be reported under flooded land category. Thus, the emissions in the year of conversion can be different from the emissions in the subsequent years.	Finland	Accepted	Accepted, the reference was corrected; the methodology for CO2 emissions and removals with LUC is indeed described in Vol. 4 Chp.2. It is important that C transfer and emissions prior to flooding be reported and not double counted. Carbon losses due to disturbances or transfered to another pool (e.g. HWP) are tracked with methodologies describe in Vol. 4 Chp.2. We believe that it is more efficient to track theses changes in the land use prior to flooding and that emissions due to flooding start at flooding than to modify the accounting of flooded land to consider these pre-flooding changes.
1119	4	7	1077	1080	Default emission factors for CO2 emissions are given in Table 7.16. It is unclear what emissions these EFs covers. It would be useful for inventory compilers, if a more detailed description would be given in the text on what emissions are included in these EFs (biomass, DW, SOM?). Do data behind model (that has been used to derive EF's) include situations when woody biomass for instance has been removed before flooding and situations when woody biomass has been left as it is? Do data behind EF's make a distinction between different soils (mineral, peat) and ground vegetation covers? Please give guidance to inventory compilers in line with 'the EF's in Table 7.16 represent following cases: woody biomass left/removed, soil is mineral/peat, dead organic matter stock..."	Finland	Rejected	The methodology and its rationale are explained in more detail the Annex. More specifically A7.1.2.2 (l.2085-2126). At tier 1 level, there is no distinction between soil types, however, climatic zones contraint somewhat the values. While different organic matter pool contribute to the surge of CO2 following flooding, their contribution is not individually modelled. the abudnant amount of reservoir emission measurements for reservoirs has made possible to develop estimates of net post-flooding CO2-C emissions taht are scaled to yearly values. The anoxic conditions felow a few mm and the lack of knowledge on the degradation dynamics of individual OM pools in the reservoir have prevented the development of a more specific appraoch at Tier 1.
1121	4	7	1150	1151	Please revise "flooded <= 20 years prior to inventory" to "flooded <= 20 years prior to reporting year"	Finland	Accepted	changes text as requested
1123	4	7	1153	1156	Equation 7.22: Please revise "reservoirs < 20 years" to "reservoirs <= 20 years"	Finland	Accepted	changes text as requested

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
1125	4	7	890	904	The guidance for AD collection needs improvement, especially in relations to agricultural ponds which can be very small in area (according to the guidance 40% of the emissions come from ponds < 0.1 ha) and not covered by national data bases. The use of satellite data or rather unclear methods in the many references provided are not pragmatic for all countries, especially developing countries. Please provide pragmatic guidance applicable to all.	Finland	Accepted	We have expanded the text to refer to Sentinel 2 data as a potential freely-available high-resolution data source.
1183	4	7	221		Recommend clarification on guidance on factoring out CH4 emissions, which also captures CH4 removals. It is not clear whether this should be also capture CO2 removals to account for the loss of carbon sequestration potential with the loss of pre-inundated habitat.	Australia	Accepted	Clarified by inserting CO2 emissions and removals - 'Seasonally flooded agricultural land may be coastal or inland, on mineral or organic soils, and relevant guidance for CO2 emissions and removals from these categories is provided in the 2013 Wetlands Supplement (Chapters 3-5, see Table 7.8 for details)."
1185	4	7	651		Recommend checking Table 7.10. The Table has the same average values for EFCH4 age>20,j , but a significantly lower 95% CI range than reported in the previous version of the SOD.	Australia	Accepted	For consistency with rest of chapter, uncertainty is reported as 95% confidence limits on the mean (standard error of the mean). In SOD, the 95% confidence interval was on the individual observations.
1187	4	7	762	763	Recommend clarification of whether this refers to Chapter 2, drained inland organic soils, specifically Section 2.2.2 and Annex 2A.2 Table 2A.1.	Australia	Accepted	Clarification has been added as suggested
1189	4	7	857		Recommend clarification of Table 7.15. The EF CH4 value for saline ponds is 30 kg CH4/ha/yr. Please provide a salinity range over which this applies, or else it will be in conflict with the 2013 Wetlands supplement in which Tier 1 default CH4 emissions are zero for water with salinity greater than 18ppt.	Australia	Accepted	Added the following text: Emissions from ponds are separated into Freshwater Ponds with water column salinity < 18 ppt and Saline Ponds with salinity of > 18 ppt, consistent with the *2013 Wetlands Supplement* (Chapter 4, Annex 4A.1 salinity based definitions).
1191	4	7	906	907	Comment: The issue of materiality regarding methane emission estimates under Other Flooded Land (constructed ponds etc, including farm dams) exists as the estimates may not be accurate for many Parties, and all values have high levels of uncertainty associated with them. See related comments #1 - #4, below:	Australia	Noted	Authors have developed default factors based on the best available data, consistent with other sources. Parties are encourged to use higher tier methods to improve the accuracy of their estimates, particularly key categories. This is guiding principle for all sources including flooded land.
1193	4	7	906	907	#1: Table 7.15 provides EF values with broad 95% CI's that are based on a restricted number of studies across a subset of possible environmental and climatic conditions. Therefore estimates of methane emissions from Other Flooded Land using Tier 1 models and EF values may not reasonably represent (in accuracy and/or level of uncertainty) their contribution to a Party's account, under normal circumstances.	Australia	Noted	Authors have developed default factors based on the best available data, consistent with other sources. Parties are encourged to use higher tier methods to improve the accuracy of their estimates, particularly key categories. This is guiding principle for all sources including flooded land.

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
1195	4	7	906	907	#2: Additionally, Tier 1 emission estimates for Other Flooded Land appear to be based on system capacity, that is the assumption that all structures under Other Flooded Land are filled to capacity throughout the year, and emission estimates are then based on that. This approach may result in an over-estimated methane emission value. Could additional guidance be provided on the application and range of values for a Tier 1 "correction factor" to account for system utilisation? System utilisation accomodates temporal changes in pond/ditch water level and area (and therefore methane emissions) associated with weather/climate variablity, usage and seepage losses.	Australia	Accepted	The following text has been added to the activity data section we have also added "If waterbodies vary substantially in their spatial extent through the year, the annual average (rather than annual maximum) inundated area will provide the most appropriate basis for flooded land area estimation"
1197	4	7	906	907	#3: could the references to Tier 2 and 3 models identify system utilisationas an important factor to account for temporal variability of emissions due to observed and/or modelled changes in pond level associated with weather/climate variability, usage and seepage losses.	Australia	Accepted	The following text has been added under Tier 2: "Additional management-related factors may be considered if these affect emissions, for example if waterbodies are subject to large seasonal or short-term changes in water level and area, this may produce different CH4 emissions that a waterbody with the same average surface area but more constant water levels."
1283	4	7	136	139	A clear definition of what a wetland is - needs to be provided. The current definition states land that is "Flooded Land is comprised of ------land area flooded…." But it is not clear for how much period if inundated, it can be considered as a wetland	India	Accepted	A more comprehensive definition of the types of Flooded Land considered in the chapter has been provided, with reference to the definition given in the 2006 Guidelines. We have clarified the distinction between flooded lands and other wetlands, and referred to the 2013 Wetland Supplement for guidance on the latter.
1511	4	7	135	1269	Guidance for estimating total flooded land emissions and removals should be consistent with the managed land proxy. Therefore, the total emissions reported should reflect the actual GHG fluxes that occur in lands classified as “managed”. Additional methodologies for estimating emissions and removals that would occur if the flooded land remained unmanged ("factoring out") should be provided as an option that may be used by countries that choose to consistently and transparently report such counterfactual emissions and removals. Such methodologies should be provided for information only, and it should not add guidance, nor overrule guidance provided.	EU	Rejected	We have provided methods for estimating the total emissions from flooded lands that are consistent with the Managed Land Proxy. To increase transparency we have modified the text and reporting tables to include both total and net emissions.

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
1523	4	7	128	2189	The chapter describes a factoring out methodology. It mainly focuses on including unmanaged land into the GHGI. Even though factoring out was requested in the mandate for drafting this chapter it seems the wrong guidance for reporting. If considered at all, it will be part of an accounting guidance, but this is not within the scope of this Refinement. The section seems to touch upon a general issue when unmanaged land becomes managed land, but this is not specific for flooded land. The justification for high carbon loss/gain is also not a specific criterion for flooded land, only. What about previously unmanaged forest land becoming included into managed land? GHG removals in unmanaged forests are enormous. Strict adherence to the Managed Land Proxy should be maintained for estimating emissions and removals for the inventory for flooded land reported in greenhouse gas inventories. Therefore, if the report retains methodologies for factoring out of emissions and removals that would occur on unmanaged land in the absence of flooding, it must be clarified that such methodologies are provided only for reporting purposes other than the reporting of national greenhouse gas inventories.	EU	Rejected	We agree that the general issue of emissions associated with conversion of unmanaged land to managed land is not unique to flooded lands. However, have provided a clearer justification for this approach for flooded lands in the Introductory section. We disagree with the comment that we have not followed the mandate given in the TOR. We have provided methods consistent with the guidance provided in the TOR. To increase transparency we have modified the text and reporting tables to include both total and net emissions.
1525	4	7	332	334	Equation 7.10 for CO2 (same as 7.14 for CH4) is the essence of factoring out. First, the message is wrong as reporting should not look at the net, expressed as a difference, but as the total, hence the sum of different components. If this equation is kept if should say F(CO2-tot) = F(CO2-net+F(CO2-otherwise). Equation 7.14 should be adjusted accordingly. This equation (7.10) also reveals a different aspect. Assuming F(CO2-tot) to be 0 due to the steady state of flooded land the emissions from F(CO2-otherwise) become the inverse for F(CO2-net), hence turning a reported sink into a reported source or vice versa just because the allocation of that land changed from unmanaged land to managed land. The report should also state clearly that each of the elements of Equation 7.10 & 7.14 (net, total and 'otherwise' annual emissions) should be reported separately when reporting using this methodology.	EU	Accepted with Modification	The reviewers suggested approach does not comply with commonly accepted mathematical conventions. These equations specifically show how to compute the net emissions. There are no defining equations for F_CO2_net or F_CH4_net; we derive the net flux from the defined total flux and defined other flux. F_CO2_tot and F_CH4_tot are defined in conventional Tier 1 EF formats as explicit equations (7.20 and 7.14, respectively). Additionally we have added text to say that reporting Net and Total emissions is appropriate and modified the reporting tables accordingly.

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
1527	4	7	247	255	Total emissions should be reported solely on the basis of the managed land proxy. Factoring out of emissions that would otherwise have occurred had the flooded land remained unmanaged is not consistent with the principles of the managed land proxy. The guidance should not therefore promote the use of such factoring out as good practice for inventory reporting. These methodologies should only be retained in the report if it is clearly stated that it is there to provide information in case Parties wish to use it for purposes other than reporting of greenhouse gas inventories.	EU	Accepted with Modification	We accept that it is good practice to report emissions using the managed land proxy, and have inserted text stating this guidance. We have also added text that addresses reporting of both Net and Total emissions as well as modifying the reporting tables. The following sentence has been added: "If a factoring out approach is applied, it is good practice to provide transparency by reporting both total and net emissions; otherwise the country should report the total emissions if net emissions are not estimated. Furthermore, if inventory compilers choose to factor out natural CH4 emissions from wetlands, it is also good practice to simultaneous factor out the loss of any natural CO2 sink in the that would otherwise have occurred if the land remained unmanaged.. " How this information is used for reporting by parties to the UNFCCC is a decision that will need to be made in the negotiations of the convention. We are only providing estimation methods and a framework for reporting in this guidance.
1529	4	7	277	279	"For transparency, the methods are applied so that the total emissions (removals) from flooded lands are estimated based on the managed land proxy, and then the net emissions are determined based on emissions (removals) that would occur if the flooded land remained unmanaged." This is a clear description for accounting as it looks at the net emissions and not the total emissions. Total emissions should be reported solely on the basis of the managed land proxy. Factoring out of emissions that would otherwise have occurred had the flooded land remained unmanaged is not consistent with the principles of the managed land proxy. The guidance should not therefore promote the use of such factoring out as good practice for inventory reporting. These methodologies should only be retained in the report if it is clearly stated that it is there to provide information in case Parties wish to use it for purposes other than reporting of greenhouse gas inventories.	EU	Accepted with Modification	We have added text that addresses reporting of both Net and Total emissions as well as modifying the reporting tables to increase transparency. TThe following sentence has been added: "If a factoring out approach is applied, it is good practice to provide transparency by reporting both total and net emissions; otherwise the country should report the total emissions if net emissions are not estimated. Furthermore, if inventory compilers choose to factor out natural CH4 emissions from wetlands, it is also good practice to simultaneous factor out the loss of any natural CO2 sink in the that would otherwise have occurred if the land remained unmanaged.. "
1531	4	7	285	287	Figure 7.3 lower left box: It should say Estimate emissions using country-specific emission factors (tier 2), or tier 3 methods.	EU	Accepted	added this box as requested

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
1533	4	7	245	281	This section on factoring out should clearly state that total emissions/removals from flooded lands based on the managed land proxy should be reported as part of national greenhouse gas inventories, regardless of whether Parties also choose to report emissions/removals that would occur if the flooded land remained unmanaged.	EU	Accepted	We have added text that addresses reporting of both Net and Total emissions as well as modifying the reporting tables. The following sentence has been added: "If a factoring out approach is applied, it is good practice to provide transparency by reporting both total and net emissions; otherwise the country should report the total emissions if net emissions are not estimated. Furthermore, if inventory compilers choose to factor out natural CH4 emissions from wetlands, it is also good practice to simultaneous factor out the loss of any natural CO2 sink in the that would otherwise have occurred if the land remained unmanaged.. "
1535	4	7	296	930	Factoring out of emissions that would otherwise have occurred had the flooded land remained unmanaged is not consistent with the principles of the managed land proxy. The guidance should not therefore promote the use of such factoring out as good practice for inventory reporting. These methodologies should only be retained in the report if it is clearly stated that it is there to provide information in case Parties wish to use it for purposes other than reporting of greenhouse gas inventories.	EU	Accepted	The following text has been added before Figure 7.2: "If a factoring out approach is applied, it is good practice to provide transparency by reporting both total and net emissions; otherwise the country should report the total emissions if net emissions are not estimated. Furthermore, if inventory compilers choose to factor out natural CH4 emissions from wetlands, it is also good practice to simultaneous factor out the loss of any natural CO2 sink in the that would otherwise have occurred if the land remained unmanaged.."
1537	4	7	1840	1858	This box should be labelled as for information only. As described above, guidance for inventories should be based on the managed land proxy. The methodology described in this box could be used for other purposes such as accounting but reporting in greenhouse gas inventories should be based on strict adherence to the Managed Land Proxy.	EU	Rejected	We were mandated by the IPCC Panel to develop "consistent methodologies that take into account factoring out of emissions that would otherwise occur in the absence of the flooded area for estimating CO2 and CH4 emissions from flooded lands". We consider that the issues raised here are a matter for the IPCC plenary, and do not relate to the robustness of the science.
1571	4	7	245	281	We are concerned that the new guidance on how to factor out emissions (removals) that would otherwise occur from unmanaged land is not in keeping with the IPCC's guidelines for other sub-sectors, and is more relevant for accounting than for reporting. The IPCC should not be providing guidance on such accounting methods, and we are not convinced that the methods provided are sufficiently scientifically robust, especially given that the definition of managed land can be interpreted in different ways by different countries. If this guidance remains in the refinement we fear that the integrity of NGHGIs will be compromised.	Saint Lucia	Rejected	We were mandated by the IPCC Panel in the TOR to develop "consistent methodologies that take into account factoring out of emissions that would otherwise occur in the absence of the flooded area for estimating CO2 and CH4 emissions from flooded lands". We consideedr that the issues raised here are a matter for the IPCC plenary, and do not relate to the robustness of the science.

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
1701	4	7	245	281	The inclusion of emissions (removals) from uncultivated land to calculate net emissions from land use change to "flooded land" respectively "flooded land remaining flooded land" is inconsistent with the rules for other land use categories in the guidelines. We feel the discussion of this case is not convincing and lacks substance. How are land use changes of organic and mineral soils (SOM rich) from unmanaged wetlands for example to grassland, cropland or managed wetlands dealt with? In this case, the justification given for flooded lands applies in exactly the same way. However, in the guidelines, it is neither a consideration nor a possibility, although the magnitude of emissions is much higher (10 Mg C ha-1 a-1). We strongly urge the authors to revise this approach, because it is not consequent and it results in a consistency issue.	Germany	Noted	We agree that the general issue of emissions associated with conversion of unmanaged land to managed land is not unique to flooded lands. We have provided further justificaiton for our approach (Introductory section). We were mandated by the IPCC Panel to develop "consistent methodologies that take into account factoring out of emissions that would otherwise occur in the absence of the flooded area for estimating CO2 and CH4 emissions from flooded lands". No mandate was given for the other land uses. We consider that the issues raised here are a matter for the IPCC plenary, and do not relate to the robustness of the science.
1773	4	7	220	221	Table 7.8 is inserted in the middle of sentence and make it a little hard to read the relevant sentence. It seems there is no reason of putting Table 7.8 in the current location. It is suggested that Table 7.8 be allocated at the bottom of the page.	Japan	Accepted	Reformatted and moved text to join with the paragraph before the table.
1775	4	7	225	225	"methane" can be stated as "CH4" for editorial consistency.	Japan	Accepted	Changed "methane" to CH4, except at the start of sentences or when hyphenated to other words, e.g. methane-rich.
1777	4	7	282	283	Figure 7.2 is not shown. The complete version needs to be provided.	Japan	Accepted	There was a problem when converting the Word (and illustrator embedded figure) into PDF format. We have corrected this problem.
1779	4	7	286	286	The first choice of the decision tree in Figure 7.3 is "Are water body is a key category" and then select Tier.1 when the answer to this question is NO. From the point of view of the inventory compiler's work flow, this type of consideration is possible only when at least tier 1 level of estimation is implemented first. Therefore, it is better to start one more box like "Estimate based on tier 1" in the beginning of the decision tree.	Japan	Accepted	added this box as requested
1781	4	7	369	369	Chapter 3 and 4 of the 2013 Wetlands supplement are referred here, but chapter 5 would be also necessary to refer here. This is because some methods of chapter 5 of the 2013 Wetlands supplement is relevant in this section, for example Table 7.9 includes EF of inland wetland mineral soil.	Japan	Accepted	We have added reference to Chapter 5.
1783	4	7	408	408	Chapter 3 and 4 of the 2013 Wetlands supplement are referred here, but chapter 5 would be also necessary to refer here. This is because some methods of chapter 5 of the 2013 Wetlands supplement is relevant in this section, for example Table 7.9 includes EF of inland wetland mineral soil.	Japan	Accepted	We have added reference to Chapter 5.
1785	4	7	1117	1117	Subscript "J" of "MJ" would be unnecessary in the title of Table 7.17 because "j" is used as parameter of climatic zone classification and the real parameter must be "M" here.	Japan	Accepted	
1801	4	7	256		"good practice" instead of "typical" is the appropriate expression of the approach	Austria	Accepted	Inserted "good practice"

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
1803	4	7	General con	General con	General comment: The wetland chapter introduces for the first time in the LULUCF sector methods of factoring out emissions which would naturally occur before an unmanaged land is converted to a managed wetland. It is recommended to strictly stay within the managed land proxy in the way that all emissions at managed lands are considered as human induced and counted (no factoring out of natural emissions) in order not to represent a precedent for other such cases. A decision of possible and principal factoring out of previous natural emissions would require a thorough analysis of the whole issue including unintended side-effects (also concerning other subcategories and -sectors) and a related general decision and mandate. Since this does not exist, it is recommended to leave out any ways of factoring out emissions in the IPCC GL refinement. It is recommended to redraft the whole chapter accordingly.	Austria	Rejected	In principle, we agree that it would be useful to consider the implications for all land uses, but in practice, the TOR did not give the authors this broad scope, requesting a factoring out method only for flooded land.
1805	4	7	282		Figure 7.2 is only partly visible and could not be checked	Austria	Accepted	There was a problem when converting the Word (and illustrator embedded figure) into PDF format. We have corrected this problem.
1807	4	7	285		Two comments to Figure 7.3: 1) The identification of a key category requires at least a Tier 1 estimate first. The decision tree immediately starts with the key category assessment before preparing an emission estimate for the category. It is suggested to redraft the decision tree accordingly. (The same problem exists for other such decision trees in the LULUCF chapters.) 2) Why is the general principle of applying higher tiers for key categories not applied for the estimate of emissions from water bodies? It is recommended to apply this general principle also for this category and to adjust the decision tree accordingly.	Austria	Accepted	added this box as requested
1809	4	7	1019		Explanation for SOC in Equation 7.21 refers to the use of default SOC values only. The approach should also allow the use of country specific SOC stocks, particularly since it represents a Tier 2 approach.	Austria	Accepted	Change was made in the description of parameter SOCjk, Eq. 7.21
1913	4	7	258	266	It would be better to apply this approach to all unmanaged land being converted to managed land categories, to ensure consistency and because if this is a valid approach for flooded land, it is valid for other land too. Alternative approaches are discussed in the scientific literature (e.g in Ciais et al. 2013).	United Kingdom (of Great Britain and Northern Ireland)	Noted	We agree that the general issue of emissions associated with conversion of unmanaged land to managed land is not unique to flooded lands. However, this was beyond the mandate in the TOR from the IPCC panel.
2743	4	7	138	139	Refer to glossary to ensure consistency regarding the definitions of the constructed water bodies mentioned in table 7.7.	Canada	Accepted	We have consolidated freshwater and Saline Ponds to single entry "Ponds" because this is the term in the Glossary
2745	4	7	193	196	Add citation to support the affirmation that GHG from drawdown zones are significant and similar per unit area to the emissions from the water surface.	Canada	Accepted	References added

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
2747	4	7	204	204	What's the difference between drainage channels and ditches?	Canada	Accepted	We have followed the Ramsar definition of linear human-made waterbodies here, which appears as either 'canals and drainage channels, ditches' or 'canals and drainage channels or ditches'. We consider the last two categories to be largely interchangeable and for simplicity have therefore (apart from referring to both categories in the definition) amended the guidance to refer to ditches only.
2749	4	7	906	907	General comment on chapter 7: The guidance in the Final Draft It is not consistent with the treatment of emissions and removals in the rest of the AFOLU guidance. The Factoring Out approach would lead to comparability issues if countries did implement it and as such can certainly not be provided as default methodology: see lines 2384-2385 of chapter 2, stating that "... the Managed Land Proxy... is the only universally applicable approach to estimating anthropogenic emissions and removals in the AFOLU sector". There are two options to maintain the integrity of the IPCC guidance in this 2019 MR, in spite of these inexplicable "Factoring Out" provisions. 1. Return to the approach used in the SOD and put the factoring out in a box as an example and not as guidance. 2. Group all factoring out in a new section "Basis for future methodological development" - allowing for such a time in the future when improved scientific understanding and quantification of "anthropogenic emissions and removals" will allow a scientifically credible implementation in inventories. As stated in chapters 1 and 2 of volume 4, the science currently does not support such "factoring out" approach as is proposed here.	Canada	Rejected	We agree that this method creates an inconsistency with other land uses, and also that there may be other relevant emissions that could be factored out with conversion to those categories. However, we were mandated by the IPCC Panel in the TOR to develop "consistent methodologies that take into account factoring out of emissions that would otherwise occur in the absence of the flooded area for estimating CO2 and CH4 emissions from flooded lands". We consider that the issues raised here are a matter for the IPCC plenary, and do not relate to the robustness of the science.
2751	4	7	0	0	General comment on chapter 7: if the goal is to better reflect the impact of activities on the atmospheric concentration of GHGs, then the "factoring out" of methane emissions from un-managed wetlands should be limited to one decade, that is the average time it takes for methane to oxidize in the atmosphere. Factoring out of methane emissions should certainly not be applied to "flooded land remaining flooded land".	Canada	Noted	While CH4 can oxidized in the atmosphere on the time scale of a decade, the emissions themselves can occur over a much longer period. The 20 year threshold is used for consistency and to reflect the different emission rates in these two time periods.
2753	4	7	256		Re-phrase so it is consistent with chapter 1 and 2 of volume 4: "However, it is typical good practice for the greenhouse gas emissions in the AFOLU sector…."	Canada	Accepted	Inserted "good practice"
2755	4	7	258	260	Delete the two sentences starting with "Special considerations…." : 1st sentence: there is absolutely no scientific basis supporting a blanket statement on higher pre-flooding emissions specifically on un-managed land. 2n sentence: the point of the entire IPCC guidelines is to provide guidance on quantifying emissions, not make gross and unverifiable assumptions on when land-use change have a large or small impact on emissions.	Canada	Accepted	The sentences referred to have been removed, and the paragraph has been revised to make it clearer which pre-flooding emissions and removals are relevant to the 'factoring out' issue.

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
2757	4	7	578	599	Box 7.1 does not provide sufficient guidance in to implement a methodology. Rather, provide a brief discussion of the challenges in quantifying the emissions and removals in sedimentation in the uncertainty section, not in the methodology portion.	Canada	Accepted with Modification	The intention of box 7.1 is not to provide the methodology to estimate carbon burial. The box reports the challenges to estimate the portion of the carbon burial that can be attributed to the reservoir construction. The box has been improved. For higher Tiers the box brings some information for the compilers: "For the development of higher Tier methodologies for carbon accumulation in reservoirs, an important guiding principle is that only the portion of the carbon permanently buried in reservoir sediments that would not have been stored elsewhere in the hydrological network (including the coastal ocean) could potentially be considered as an offset to reservoir greenhouse gas emissions."
2759	4	7	760	929	Assure that it is clear what equations or parameters apply to what "other constructed waterbodies" For example the title of Equation 7.19 is "annual emissions from other constructed waterbodies", but the parameter, "FCH4other" is labelled as the total annual flux of methane from ponds and channels.	Canada	Accepted	We have check and updated equations accordingly
2761	4	7	1040	1041	It's not clear how this is related to the presence of a river prior to inundation or if the reservoir is a small expansion of a natural lake.	Canada	Rejected	The comment indicates that the proportion of the area that is newly flooded can vary greatly among reservoirs. The EF is dependant on the soil C stock of the newly flooded land.
2825	4	7	136	296	Brazil is in favor of the version presented in the final draft. The proposed methodology fully meets the mandate set by the 44th plenary session of the IPCC in 2016, which prescribes that the refinement exercise should "update the CO2 emission factors for lands converted to wetlands and develop- based on a comprehensive review of the available literature and methodology- consistent methodologies that take into account the emission factor and removal that would occur in the absence of the flooded area to estimate CO2 and CH4 emissions from wetlands (both land converted to flooded land and flooded land remaining flooded). In order to reinforce this position, recent studies show that it would already be possible to discount the permanent burial of carbon in the sediment of the reservoirs using a lower Tier (2) than that proposed in this methodology.	Brazil	Noted	Box 7.1 has been improved.
2903	4	7	282	282	Figure 7.2 - present a clear figure please.	Estonia	Accepted	There was a problem when converting the Word (and illustrator embedded figure) into PDF format. We have corrected this problem.
2905	4	7	296		The guidance from this point onwards is very technical and not easily understandable and perhaps also not straightforward to apply, any simplification if possible (also in language) and further discussion on uncertainties would be appreciated.	Estonia	Noted	During the revision process we increased clarity where possible.

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
3569	4	7	135	1276	The guidance contained in Chapter 7 on factoring out emissions/removals that would otherwise occur in the absence of flooding has no scientific basis for its inclusion and is inconsistent with IPCC good practice and how the MLP is applied for all other land uses/conversions. By including this factoring out approach the IPCC is sending a message to countries that these additional methodological steps are necessary in order to be consistent with good practice, which they are not. This approach could also create incentives to flood unmanaged lands for reservoir construction by offsetting some of the GHG emissions that come from the new reservoir, which would be a perverse outcome. We therefore request that all the emission factors and/or guidance on "factoring out" be removed from the Wetlands chapter.	United States of America	Rejected	We agree that the methods are inconsistent with the other source categories, possibly with the exception of the IAV for natural disturbances. We have strengthened the justification for the factoring out in the Introductory sections. We disagree that the methods are not scientifically-based. We have evaluated the emissions sources that would contribute to emissions without flooding, and developed emissions to address those sources. Additional references are provided for the basis of our decisions. We are not sure why the method would create an incentive for flooding areas because the emissions are greater after the flooding, in addition to the fact that the contructing dams is an expensive endeavor, which is not likely to be implemented solely for the purpose of converting unmanaged land into managed land.
3571	4	7	282	284	Figure 7.2, part of the decision tree graphic appears to be missing.	United States of America	Accepted	There was a problem when converting the Word (and illustrator embedded figure) into PDF format. We have corrected this problem.
3573	4	7	969	972	It is not clear why the full estimated emissions over a 100-year lifetime of a reservoir would be reported over a 20-year period. It would make far more sense to assume the emissions factors will be high for the first ~10 years, slightly lower for the next ~10 years, and then (once reported as "flooded land remaining flooded land") maintain a steady low level of emissions over the remaining lifetime of the reservoir.	United States of America	Rejected	Most of the total emissions attributable to the reservoir are emitted in the first years. For consistency with other land conversion, the 20 year threshold was used but also include the residual emission occurring after years.
3631	4	7	235	244	Nevertheless, the proposed methodology within the managed land proxy fails in properly quantifying the anthropogenic component of the GHG net emission in flooded land. Indeed, in absence of the water reservoir, the carbon components dissolved within the river water would naturally follow a path to GHG emissions (CO2 and CH4) that is different from the path they are following because of the reservoirs (more CH4 less CO2). Therefore, a proper quantification of the impact of the activity of flooding land should factor out such GHG emissions from organic matter in the water under a "natural" condition from that one occurring as consequence of the reservoir construction. Such symmetry in the method is needed because the IPCC methods do not estimate the GHG emissions from the organic matter in the water flowing in the river while the new method for the flooded land will do. This factoring out has nothing to do with the previous use of the land, since the factoring out, as per IPCC plenary decision, must be applied to the organic matter within the river's water, not to the emissions from land C pools, and it has to be applied under both conditions: lands previously managed or unmanged. It is recommended to revise accordingly the methodology.	Italy	Rejected	Both the 'stock change' method for mineral soils (in this guidance), and the 'flux based' methods for organic soils (2013 WS) account for the conversion of riverine carbon to CO2. In the stock change method this is implicit (all C lost from the soil is emitted as CO2, regardless of whether this occurs directly from the land surface or indirectly via the river network). In the 'flux-based method', additional organic carbon transferred from managed organic soils to the atmosphere is estimated and resulting CO2 emission is calculated. Construction of a reservoir may change the location at which carbon transformation (emission as CO2, burial as sedimentary C) takes place, but there is insufficient evidence to show that the construction of a reservoir changes the overall amount of CO2 emitted from riverine carbon in a consistent or quantifiable way. Therefore we have not been able to include guidance to estimate the effects of reservoir construction on the fate of carbon from upstream sources.

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
3633	4	7	247	279	The factoring out approach proposed for flooded land on previous unmanaged land is inconsistent with the approach implemented for any other conversion of an unmanaged land to any other land use category. It is worth nothing that also other types of unamanged land are relevant sources of emissions and that their conversion is not factored out, e.g. conversion of natural peatlands to drained agricultural lands. If the proposed factoring out is accepted, it will require the redrafting of the managed land proxy approach, since reporting of conversion of unmanaged land to managed land will be based on a comparison of current emissions under management vs potential emissions under an unmanaged land scenario. As implemented in the current text, the factoring out approach seems designed for an accounting methodology of mitigation actions where the current GHG net emission is compared to a BAU GHG net emission, i.e. GHG net emission that would otherwise occur in a scenario where the current activity is not implemented, to account for its mitigation impact. However, such accounting is not within the scope of a national GHG inventory under the UNFCCC. Consequently, text in these rows must be deleted	Italy	Rejected	We agree that this method creates an inconsistency with other land uses, and also that there may be other relevant emissions that could be factored out with conversion to those categories. However, we have strengthened the justification for this approach in the Introductory section. Additionally, there was a mandate from the IPCC panel in TOR to include factoring out for this source, and only this source. Countries may ask for a redrafting of the managed land proxy if they decide this is needed. However, this method could be used in a restricted way or for accounting depending on decisions in the UNFCCC. We only dealing with estimation methods in this guidance. We complied with the scope in the TOR that the IPCC has made in this case, which did not include factoring out across all land uses and sources.
3635	4	7	308	408	according to comment on rows 247-279 delete this text	Italy	Rejected	We agree that this method creates an inconsistency with other land uses, and also that there may be other relevant emissions that could be factored out with conversion to those categories. However, we have strengthened the justification for this approach in the Introductory section. Additionally, there was a mandate from the IPCC panel in TOR to include factoring out for this source, and only this source. Countries may ask for a redrafting of the managed land proxy if they decide this is needed. However, this method could be used in a restricted way or for accounting depending on decisions in the UNFCCC. We only dealing with estimation methods in this guidance. We complied with the scope in the TOR that the IPCC has made in this case, which did not include factoring out across all land uses and sources.

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
3637	4	7	417	425	according to comment on rows 247-279 delete this text	Italy	Rejected	We agree that this method creates an inconsistency with other land uses, and also that there may be other relevant emissions that could be factored out with conversion to those categories. However, we have strengthened the justification for this approach in the Introductory section. Additionally, there was a mandate from the IPCC panel in TOR to include factoring out for this source, and only this source. Countries may ask for a redrafting of the managed land proxy if they decide this is needed. However, this method could be used in a restricted way or for accounting depending on decisions in the UNFCCC. We only dealing with estimation methods in this guidance. We complied with the scope in the TOR that the IPCC has made in this case, which did not include factoring out across all land uses and sources.
3639	4	7	462	555	according to comment on rows 247-279 delete this text	Italy	Rejected	We agree that this method creates an inconsistency with other land uses, and also that there may be other relevant emissions that could be factored out with conversion to those categories. However, we have strengthened the justification for this approach in the Introductory section. Additionally, there was a mandate from the IPCC panel in TOR to include factoring out for this source, and only this source. Countries may ask for a redrafting of the managed land proxy if they decide this is needed. However, this method could be used in a restricted way or for accounting depending on decisions in the UNFCCC. We only dealing with estimation methods in this guidance. We complied with the scope in the TOR that the IPCC has made in this case, which did not include factoring out across all land uses and sources.
3641	4	7	573	599	according to comment on rows 247-279 delete this text	Italy	Rejected	We agree that this method creates an inconsistency with other land uses, and also that there may be other relevant emissions that could be factored out with conversion to those categories. However, we have strengthened the justification for this approach in the Introductory section. Additionally, there was a mandate from the IPCC panel in TOR to include factoring out for this source, and only this source. Countries may ask for a redrafting of the managed land proxy if they decide this is needed. However, this method could be used in a restricted way or for accounting depending on decisions in the UNFCCC. We only dealing with estimation methods in this guidance. We complied with the scope in the TOR that the IPCC has made in this case, which did not include factoring out across all land uses and sources.

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
3643	4	7	627	635	according to comment on rows 247-279 delete this text	Italy	Rejected	We agree that this method creates an inconsistency with other land uses, and also that there may be other relevant emissions that could be factored out with conversion to those categories. However, we have strengthened the justification for this approach in the Introductory section. Additionally, there was a mandate from the IPCC panel in TOR to include factoring out for this source, and only this source. Countries may ask for a redrafting of the managed land proxy if they decide this is needed. However, this method could be used in a restricted way or for accounting depending on decisions in the UNFCCC. We only dealing with estimation methods in this guidance. We complied with the scope in the TOR that the IPCC has made in this case, which did not include factoring out across all land uses and sources.
3645	4	7	660	672	according to comment on rows 247-279 delete this text	Italy	Rejected	We accept that it is good practice to report emissions using the managed land proxy, and have inserted text stating this guidance. We have also added text that addresses reporting of both Net and Total emissions as well as modifying the reporting tables. The following sentence has been added: "If a factoring out approach is applied, it is good practice to provide transparency by reporting both total and net emissions; otherwise the country should report the total emissions if net emissions are not estimated. Furthermore, if inventory compilers choose to factor out natural CH4 emissions from wetlands, it is also good practice to simultaneous factor out the loss of any natural CO2 sink in the that would otherwise have occurred if the land remained unmanaged.. " How this information is used for reporting by parties to the UNFCCC is a decision that will need to be made in the negotiations of the convention. We are only providing estimation methods and a framework for reporting in this guidance.

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
3647	4	7	693	703	according to comment on rows 247-279 delete this text	Italy	Rejected	We agree that this method creates an inconsistency with other land uses, and also that there may be other relevant emissions that could be factored out with conversion to those categories. However, we have strengthened the justification for this approach in the Introductory section. Additionally, there was a mandate from the IPCC panel in TOR to include factoring out for this source, and only this source. Countries may ask for a redrafting of the managed land proxy if they decide this is needed. However, this method could be used in a restricted way or for accounting depending on decisions in the UNFCCC. We only dealing with estimation methods in this guidance. We complied with the scope in the TOR that the IPCC has made in this case, which did not include factoring out across all land uses and sources.
3649	4	7	713	720	according to comment on rows 247-279 delete this text	Italy	Rejected	We agree that this method creates an inconsistency with other land uses, and also that there may be other relevant emissions that could be factored out with conversion to those categories. However, we have strengthened the justification for this approach in the Introductory section. Additionally, there was a mandate from the IPCC panel in TOR to include factoring out for this source, and only this source. Countries may ask for a redrafting of the managed land proxy if they decide this is needed. However, this method could be used in a restricted way or for accounting depending on decisions in the UNFCCC. We only dealing with estimation methods in this guidance. We complied with the scope in the TOR that the IPCC has made in this case, which did not include factoring out across all land uses and sources.
3651	4	7	733	737	according to comment on rows 247-279 delete this text	Italy	Rejected	We agree that this method creates an inconsistency with other land uses, and also that there may be other relevant emissions that could be factored out with conversion to those categories. However, we have strengthened the justification for this approach in the Introductory section. Additionally, there was a mandate from the IPCC panel in TOR to include factoring out for this source, and only this source. Countries may ask for a redrafting of the managed land proxy if they decide this is needed. However, this method could be used in a restricted way or for accounting depending on decisions in the UNFCCC. We only dealing with estimation methods in this guidance. We complied with the scope in the TOR that the IPCC has made in this case, which did not include factoring out across all land uses and sources.

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
3653	4	7	751	758	according to comment on rows 247-279 delete this text	Italy	Rejected	We agree that this method creates an inconsistency with other land uses, and also that there may be other relevant emissions that could be factored out with conversion to those categories. However, we have strengthened the justification for this approach in the Introductory section. Additionally, there was a mandate from the IPCC panel in TOR to include factoring out for this source, and only this source. Countries may ask for a redrafting of the managed land proxy if they decide this is needed. However, this method could be used in a restricted way or for accounting depending on decisions in the UNFCCC. We only dealing with estimation methods in this guidance. We complied with the scope in the TOR that the IPCC has made in this case, which did not include factoring out across all land uses and sources.
3655	4	7	808	815	according to comment on rows 247-279 delete this text	Italy	Rejected	We agree that this method creates an inconsistency with other land uses, and also that there may be other relevant emissions that could be factored out with conversion to those categories. However, we have strengthened the justification for this approach in the Introductory section. Additionally, there was a mandate from the IPCC panel in TOR to include factoring out for this source, and only this source. Countries may ask for a redrafting of the managed land proxy if they decide this is needed. However, this method could be used in a restricted way or for accounting depending on decisions in the UNFCCC. We only dealing with estimation methods in this guidance. We complied with the scope in the TOR that the IPCC has made in this case, which did not include factoring out across all land uses and sources.
3657	4	7	827	829	according to comment on rows 247-279 delete this text	Italy	Rejected	We agree that this method creates an inconsistency with other land uses, and also that there may be other relevant emissions that could be factored out with conversion to those categories. However, we have strengthened the justification for this approach in the Introductory section. Additionally, there was a mandate from the IPCC panel in TOR to include factoring out for this source, and only this source. Countries may ask for a redrafting of the managed land proxy if they decide this is needed. However, this method could be used in a restricted way or for accounting depending on decisions in the UNFCCC. We only dealing with estimation methods in this guidance. We complied with the scope in the TOR that the IPCC has made in this case, which did not include factoring out across all land uses and sources.

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
3659	4	7	844	846	according to comment on rows 247-279 delete this text	Italy	Rejected	We agree that this method creates an inconsistency with other land uses, and also that there may be other relevant emissions that could be factored out with conversion to those categories. However, we have strengthened the justification for this approach in the Introductory section. Additionally, there was a mandate from the IPCC panel in TOR to include factoring out for this source, and only this source. Countries may ask for a redrafting of the managed land proxy if they decide this is needed. However, this method could be used in a restricted way or for accounting depending on decisions in the UNFCCC. We only dealing with estimation methods in this guidance. We complied with the scope in the TOR that the IPCC has made in this case, which did not include factoring out across all land uses and sources.
3661	4	7	857	858	according to comment on rows 247-279 delete this text	Italy	Rejected	We agree that this method creates an inconsistency with other land uses, and also that there may be other relevant emissions that could be factored out with conversion to those categories. However, we have strengthened the justification for this approach in the Introductory section. Additionally, there was a mandate from the IPCC panel in TOR to include factoring out for this source, and only this source. Countries may ask for a redrafting of the managed land proxy if they decide this is needed. However, this method could be used in a restricted way or for accounting depending on decisions in the UNFCCC. We only dealing with estimation methods in this guidance. We complied with the scope in the TOR that the IPCC has made in this case, which did not include factoring out across all land uses and sources.
3663	4	7	865	866	according to comment on rows 247-279 delete this text	Italy	Rejected	We agree that this method creates an inconsistency with other land uses, and also that there may be other relevant emissions that could be factored out with conversion to those categories. However, we have strengthened the justification for this approach in the Introductory section. Additionally, there was a mandate from the IPCC panel in TOR to include factoring out for this source, and only this source. Countries may ask for a redrafting of the managed land proxy if they decide this is needed. However, this method could be used in a restricted way or for accounting depending on decisions in the UNFCCC. We only dealing with estimation methods in this guidance. We complied with the scope in the TOR that the IPCC has made in this case, which did not include factoring out across all land uses and sources.

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
3665	4	7	876	877	according to comment on rows 247-279 delete this text	Italy	Rejected	We agree that this method creates an inconsistency with other land uses, and also that there may be other relevant emissions that could be factored out with conversion to those categories. However, we have strengthened the justification for this approach in the Introductory section. Additionally, there was a mandate from the IPCC panel in TOR to include factoring out for this source, and only this source. Countries may ask for a redrafting of the managed land proxy if they decide this is needed. However, this method could be used in a restricted way or for accounting depending on decisions in the UNFCCC. We only dealing with estimation methods in this guidance. We complied with the scope in the TOR that the IPCC has made in this case, which did not include factoring out across all land uses and sources.
3667	4	7	905	906	according to comment on rows 247-279 delete this text	Italy	Rejected	We agree that this method creates an inconsistency with other land uses, and also that there may be other relevant emissions that could be factored out with conversion to those categories. However, we have strengthened the justification for this approach in the Introductory section. Additionally, there was a mandate from the IPCC panel in TOR to include factoring out for this source, and only this source. Countries may ask for a redrafting of the managed land proxy if they decide this is needed. However, this method could be used in a restricted way or for accounting depending on decisions in the UNFCCC. We only dealing with estimation methods in this guidance. We complied with the scope in the TOR that the IPCC has made in this case, which did not include factoring out across all land uses and sources.
3669	4	7	915	916	according to comment on rows 247-279 delete this text	Italy	Rejected	We were mandated by the IPCC Plenary to develop "consistent methodologies that take into account factoring out of emissions that would otherwise occur in the absence of the flooded area for estimating CO2 and CH4 emissions from flooded lands". We consider that the issues raised here are a matter for the IPCC plenary, and do not relate to the robustness of the science.

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
3671	4	7	928	929	according to comment on rows 247-279 delete this text	Italy	Rejected	We agree that this method creates an inconsistency with other land uses, and also that there may be other relevant emissions that could be factored out with conversion to those categories. However, we have strengthened the justification for this approach in the Introductory section. Additionally, there was a mandate from the IPCC panel in TOR to include factoring out for this source, and only this source. Countries may ask for a redrafting of the managed land proxy if they decide this is needed. However, this method could be used in a restricted way or for accounting depending on decisions in the UNFCCC. We only dealing with estimation methods in this guidance. We complied with the scope in the TOR that the IPCC has made in this case, which did not include factoring out across all land uses and sources.
3673	4	7	1007	1011	according to comment on rows 247-279 delete this text	Italy	Rejected	We agree that this method creates an inconsistency with other land uses, and also that there may be other relevant emissions that could be factored out with conversion to those categories. However, we have strengthened the justification for this approach in the Introductory section. Additionally, there was a mandate from the IPCC panel in TOR to include factoring out for this source, and only this source. Countries may ask for a redrafting of the managed land proxy if they decide this is needed. However, this method could be used in a restricted way or for accounting depending on decisions in the UNFCCC. We only dealing with estimation methods in this guidance. We complied with the scope in the TOR that the IPCC has made in this case, which did not include factoring out across all land uses and sources.
3675	4	7	1063	1064	according to comment on rows 247-279 delete this text	Italy	Rejected	We agree that this method creates an inconsistency with other land uses, and also that there may be other relevant emissions that could be factored out with conversion to those categories. However, we have strengthened the justification for this approach in the Introductory section. Additionally, there was a mandate from the IPCC panel in TOR to include factoring out for this source, and only this source. Countries may ask for a redrafting of the managed land proxy if they decide this is needed. However, this method could be used in a restricted way or for accounting depending on decisions in the UNFCCC. We only dealing with estimation methods in this guidance. We complied with the scope in the TOR that the IPCC has made in this case, which did not include factoring out across all land uses and sources.

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
3677	4	7	1072	1073	according to comment on rows 247-279 delete this text	Italy	Rejected	We agree that this method creates an inconsistency with other land uses, and also that there may be other relevant emissions that could be factored out with conversion to those categories. However, we have strengthened the justification for this approach in the Introductory section. Additionally, there was a mandate from the IPCC panel in TOR to include factoring out for this source, and only this source. Countries may ask for a redrafting of the managed land proxy if they decide this is needed. However, this method could be used in a restricted way or for accounting depending on decisions in the UNFCCC. We only dealing with estimation methods in this guidance. We complied with the scope in the TOR that the IPCC has made in this case, which did not include factoring out across all land uses and sources.
3679	4	7	1081	1082	according to comment on rows 247-279 delete this text	Italy	Rejected	We agree that this method creates an inconsistency with other land uses, and also that there may be other relevant emissions that could be factored out with conversion to those categories. However, we have strengthened the justification for this approach in the Introductory section. Additionally, there was a mandate from the IPCC panel in TOR to include factoring out for this source, and only this source. Countries may ask for a redrafting of the managed land proxy if they decide this is needed. However, this method could be used in a restricted way or for accounting depending on decisions in the UNFCCC. We only dealing with estimation methods in this guidance. We complied with the scope in the TOR that the IPCC has made in this case, which did not include factoring out across all land uses and sources.
3681	4	7	1097	1098	according to comment on rows 247-279 delete this text	Italy	Rejected	We agree that this method creates an inconsistency with other land uses, and also that there may be other relevant emissions that could be factored out with conversion to those categories. However, we have strengthened the justification for this approach in the Introductory section. Additionally, there was a mandate from the IPCC panel in TOR to include factoring out for this source, and only this source. Countries may ask for a redrafting of the managed land proxy if they decide this is needed. However, this method could be used in a restricted way or for accounting depending on decisions in the UNFCCC. We only dealing with estimation methods in this guidance. We complied with the scope in the TOR that the IPCC has made in this case, which did not include factoring out across all land uses and sources.

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
3683	4	7	1108	1109	according to comment on rows 247-279 delete this text	Italy	Rejected	We agree that this method creates an inconsistency with other land uses, and also that there may be other relevant emissions that could be factored out with conversion to those categories. However, we have strengthened the justification for this approach in the Introductory section. Additionally, there was a mandate from the IPCC panel in TOR to include factoring out for this source, and only this source. Countries may ask for a redrafting of the managed land proxy if they decide this is needed. However, this method could be used in a restricted way or for accounting depending on decisions in the UNFCCC. We only dealing with estimation methods in this guidance. We complied with the scope in the TOR that the IPCC has made in this case, which did not include factoring out across all land uses and sources.
3685	4	7	1127	1128	according to comment on rows 247-279 delete this text	Italy	Rejected	We agree that this method creates an inconsistency with other land uses, and also that there may be other relevant emissions that could be factored out with conversion to those categories. However, we have strengthened the justification for this approach in the Introductory section. Additionally, there was a mandate from the IPCC panel in TOR to include factoring out for this source, and only this source. Countries may ask for a redrafting of the managed land proxy if they decide this is needed. However, this method could be used in a restricted way or for accounting depending on decisions in the UNFCCC. We only dealing with estimation methods in this guidance. We complied with the scope in the TOR that the IPCC has made in this case, which did not include factoring out across all land uses and sources.
3687	4	7	1172	1175	according to comment on rows 247-279 delete this text	Italy	Rejected	We agree that this method creates an inconsistency with other land uses, and also that there may be other relevant emissions that could be factored out with conversion to those categories. However, we have strengthened the justification for this approach in the Introductory section. Additionally, there was a mandate from the IPCC panel in TOR to include factoring out for this source, and only this source. Countries may ask for a redrafting of the managed land proxy if they decide this is needed. However, this method could be used in a restricted way or for accounting depending on decisions in the UNFCCC. We only dealing with estimation methods in this guidance. We complied with the scope in the TOR that the IPCC has made in this case, which did not include factoring out across all land uses and sources.

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
3689	4	7	1191	1196	according to comment on rows 247-279 delete this text	Italy	Rejected	We agree that this method creates an inconsistency with other land uses, and also that there may be other relevant emissions that could be factored out with conversion to those categories. However, we have strengthened the justification for this approach in the Introductory section. Additionally, there was a mandate from the IPCC panel in TOR to include factoring out for this source, and only this source. Countries may ask for a redrafting of the managed land proxy if they decide this is needed. However, this method could be used in a restricted way or for accounting depending on decisions in the UNFCCC. We only dealing with estimation methods in this guidance. We complied with the scope in the TOR that the IPCC has made in this case, which did not include factoring out across all land uses and sources.
3691	4	7	1255	1268	according to comment on rows 247-279 delete this text	Italy	Rejected	We agree that this method creates an inconsistency with other land uses, and also that there may be other relevant emissions that could be factored out with conversion to those categories. However, we have strengthened the justification for this approach in the Introductory section. Additionally, there was a mandate from the IPCC panel in TOR to include factoring out for this source, and only this source. Countries may ask for a redrafting of the managed land proxy if they decide this is needed. However, this method could be used in a restricted way or for accounting depending on decisions in the UNFCCC. We only dealing with estimation methods in this guidance. We complied with the scope in the TOR that the IPCC has made in this case, which did not include factoring out across all land uses and sources.
3693	4	7	1830	1858	according to comment on rows 247-279 delete this text	Italy	Rejected	We agree that this method creates an inconsistency with other land uses, and also that there may be other relevant emissions that could be factored out with conversion to those categories. However, we have strengthened the justification for this approach in the Introductory section. Additionally, there was a mandate from the IPCC panel in TOR to include factoring out for this source, and only this source. Countries may ask for a redrafting of the managed land proxy if they decide this is needed. However, this method could be used in a restricted way or for accounting depending on decisions in the UNFCCC. We only dealing with estimation methods in this guidance. We complied with the scope in the TOR that the IPCC has made in this case, which did not include factoring out across all land uses and sources.

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
3695	4	7	220	221	according to comment on rows 247-279 remove any references to factoring out	Italy	Rejected	This was mandated in the TOR.
3833	4	7	135	135	What is the net effect of land converted to flooded land on carbon sinks? Please consider including the role of flooded land on carbon sequestration. Assuming the "blue carbon principle, out of all the biological carbon captured in the world, over half is captured by marine living organisms hence it is called blue carbon". Artificial water reservoirs might also have a significant contribution of carbon captured.	Norway	Noted	Box 7.1 addresses the role of reservoirs in trapping sediments and carbon burial providing information to develop a methodology at higher tiers "For the development of higher Tier methodologies for carbon accumulation in reservoirs, an important guiding principle is that only the portion of the carbon permanently buried in reservoir sediments that would not have been stored elsewhere in the hydrological network (including the coastal ocean) could potentially be considered as an offset to reservoir greenhouse gas emissions."
3835	4	7	174	183	Please consider if the double counting issues are related to all N2O emissions produced in wetlands and other water reservoirs. Moreover, it is likely that canals, ditches, freshwater ponds and saline pond produce CO2 (Bridget R. et al. 2016).	Norway	Accepted	Test added at Line 183. Compilers may address local sources of
3837	4	7	198	202	Please justify why 20 years age is considered as a boundary to classify flooded land remaining flooded land (FF) and Land Converted to Flooded Land (FO).	Norway	Accepted	Text added in line 301
3839	4	7	270	273	When the landscape of managed lands are intensively modified using advanced machines to construct flooded land, emissions might be emitted due to (1) excavation and loss of originally accumulated soil carbon (per-flooding emission), and (2) flooded land. Pre-flooded emissions are most likely to relate to the size of excavation (e.g., volume), etc.,Thus, please take into account "double emission accounting" by estimating the potential loss of carbon from the excavated area/volume (V) it'd be estimated and reported in a parallel to factor out.	Norway	Accepted	We have improved the text. Explanations are provided l. 942-948 and l.973-980; the emissions or transfer to another carbon pool due to distrubance prior to flooding are taken into consideration using IPCC methodologies (see Chapter 2 Generic Methodologies Applicable to Multiple land-use Categories.)
3841	4	7	322	323	What is the time limit to determine unmanaged land for factoring out of emissions/removals? The per-flooded land uses might be passed though different land use changes at different time interval, e. g., wetland --→ forest --→unmanaged grassland---→other land uses (e.g., cropland) during inventory. It's most likely to classify all per-flooded land uses as unmanaged, specially wetland and unmanaged grassland. The selected type of unmanaged land use can under/overestimate both factoring out and net emissions/removals. Moreover, please consider defining, in the glossary section, what factoring out is referring.	Norway	Accepted	Note inserted in text of Table 7.9 and 7.14." The selection of appropriate EFCH4_luc j,r should reflect the land at the time of flooding."
931	4	8	114	114	Research paper by (McPherson et al. 2013) should be added, as it is currently left out from the reference list (p8-12)	Republic of Korea	Accepted	McPherson et al. 2013 is added in the reference list
933	4	8	167	168	Regarding the Table 8.2, number of the tree species have been reduced compared to 2006 GL. Default values by tree species are neccessary to be presented as shown in 2006 GL .	Republic of Korea	Rejected	Unfortunately, good data was not found in recent research. In addition, it was clarified that the default numbers in Table 8.2 of 2006GL were prepared based on forest trees and the data has not summarized as a paper. Therefore, they are removed from the updated Table 8.2.

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
985	4	8	111	116	"t C ha-1 crown cover-1 yr-1" – the unit of value for CRW - in lines 111, 113 and 116 should be changed to " t C (ha crown cover) -1 yr-1".	China	Accepted	It is correct. The unit modified to "(ha crown cover)-1". Ones in lines 102, 103 111, 113 116 and 132 also should be changed in the final editorial process.
2763	4	8	83	89	Not clear how we are supposed to take into account urban conditions, such as local air quality, to assess tree growth. Maybe add a reference for guidance.	Canada	Accepted with Modification	The authors considered the current text is already providing references to several papers, informing on how urban conditions affect tree growth and mortality. But the text is slightly modified for clarity.
2765	4	8	129	131	Even if no significant difference is observed between the original study and the updated value, we should use 2.8. The study is more recent and double the sampling size.	Canada	Accepted	The authors agree with taking 2.8 as the default, becase this value is based on the sound science. Updated table 8.1 and the text under Tier.2 are modified.
219	4	10	28	28	MCF spreadsheet, Maybe give a header "Input data : Temperature " OR "Temperature "	France	Accepted	
221	4	10	66	66	MCF spreadsheet, Maybe give a header "Other Input data " OR "Specific inputs" OR "Constants and other input parameters "	France	Accepted	
223	4	10	116	116	MCF spreadsheet, suggest to precise "Monthly model inputs and outputs over a three year period".	France	Accepted	
225	4	10	120	121	MCF spreadsheet, suggest to precise a bit what can be seen in panels : "top panels Temperature in °C (column C) and K (column D), coeffient (column E), VS excreted (column F)and VS loaded (column G) …..; middle panels idem	France	Accepted	
227	4	10	123	123	MCF spreadsheet, suggest to precise "Example of monthly patterns in Year 3: manure temperature …"	France	Accepted	
229	4	10	136	139	MCF spreadsheet, suggest to reword to make the phrase simpler " The term "VS Consumed" does not represent a conceptual degradation of VS but a quantity VS going from the liquid/slurry storage into biomethane potential at 35°C (i.e. to produce the B 0)	France	Accepted with M	Rewrote as: The term "VS Consumed" does not represent the real VS degraded but a conceptual quantity of VS removed from the liquid/slurry storage and placed into the biomethane potential at 35°C (i.e. to produce the B0).
231	4	10	143	144	MCF spreadsheet, suggest to reword to make the phrase simpler :" Though this is convenient for modeling, and consistent with the B 0 , this does not is not represent the reality. " in a liquid/slurry storage.2	France	Accepted with M	Rewrote as: Though this is convenient for modeling, and is consistent with the B0, this does not represent the physical reality the liquid/slurry storage
233	4	10	474	475	Table 10.1 : Growing swine under free range is missing in the table for low productivity systems	France	Accepted	The category of 'swine under free range' was added into the list presented in Table 10.1
235	4	10	1191	1191	add the reference of Sauvant and Nozière, 2016 (Sauvant, D., Noziere, P. (2016). Quantification of the main digestive processes in ruminants: the equations involved in the renewed energy and protein feed evaluation systems. Animal, 10 (05), 755-770. , DOI : 10.1017/S1751731115002670)	France	Noted	The information presented in the reference source was not used in the elaboration of the information reported in Chapter 10. It is not clear what the reviewer is requesting.
237	4	10	1435	1435	Animal waste management system : corresponds to each step of the manure management (building, outdoor storage, grazing, treatment). Maybe it would have been less confusing if storage was replaced by manure management technique.	France	Accepted	
239	4	10	1511	1511	erase in manure management system S	France	Rejected	It is not clear why the reviewer wants to remove this text that is consistent with the text around other parameters in the equation. We did remove the repeated comma in this line.

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
241	4	10	1561	1561	TAM: is it Typical animal mass at the middle of the growing period or mean Typical animal mass ?	France	Accepted with Modification	The weight that is used is dependant on the production system - values in this table were derived from the information that is contained in the Annexes of the Chapter, Table 10A.1 to Table 10A.5. In the case of dairy cattle, live weights are used. In the case of other cattle, weighted live weights are used that are based on the relative proportion of different animal subcategories during annual production. As a general rule meat production systems, use the median weight of the animal during its growth to slaughter. Animals that are kept for the production of products (milk, eggs), draft or other uses of mature animals use live weight. The following line has been added: "The TAM should be consistent with median weight of the animal during its production stage. Typically, for animals used in meat production systems, this is the median weight of the animal during its growth period. Animals that are kept for the production of products (milk, eggs), draft or other uses would use the typical live weight of the animal herd."
243	4	10	1592	1592	Table 10.14 : For the different kind of storage (inside building or outdoor storage) duration should be clearly indicated, as level of emissions varies in function of storage duration. For cattle, it is necessary to consider also : liquid storage under animal confinment (<1 and > 1 months), deep bedding, manure scrapping . For swine, liquid /slurry (outdoor storage), deep bedding; For poultry, litter system, outdoor liquid slurry sorage, manure drying indoor and outdoor. For all species, pasture/graze/paddocks should be added,	France	Rejected	In the second order draft, emission factors were provided for all the possible combinations of manure management system and animal categories and there were multiple comments stating that the method was far too complicated and there was far too much information in the document. We have provided emission factors for the default information about manure management systems that is provided by the FAO. For countries that have country specific manure management system data, they can use the Tier 2 methodology to calculated their emission factors for systems that are not included here. The Tier 1 methodology cannot take into account all potential combinations of manure management system but take into account the information necessary to calculate directly for the defaulat information. It is noted in the Tier 1 emission factor how an emission factor for a specific system, assuming that the country has additional information for some management systems could be calculated (MCF*B0*0.67).

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
245	4	10	1610	1611	As Nitrogen from bedding and additional N entering the system (Line 2624, co-digestates) can be accounted for, Carbon from bedding should be accounted for in C manure (VS).	France	Rejected	As mentioned in the text, bedding materials are used in solid manure management systems, when as a general rule methane emissions are lower than in liquid systems. Line 2624 refers specifically to large biomass inputs into biodigesters intended to increase methane production through the addition of material rich in carbon, and in the case of energy crops that could also be relatively rich in nitrogen. Further measurements of methane emissions on which methane emission factors are based, typically don't differentiate bedding from volatile solids, therefore the differentiation of bedding based methane and volatile solid based methane is not possible. For this reason, the carbon inputs from bedding to the methane production system are not explicitely quantified in the methodology.
247	4	10	1627	1627	equation 10.23: to calculate annual emission factor for livestock category the number of days should be a parameter and specific of the manure managment system and not considered to 365. For instance : how taking into account in CH4 emissions calculations of dairy cattles that spend 6 months in building and 6 months in pasture ? or how to take into account of the periods of emptiness of buildings between the differents flocks for animal in confinments ?	France	Rejected	The distribution of VS among different manure management systems is done through the AWMS fraction and not through the number of days of VS production. Likewise, though a barn may be empty it is assumed that the animal is still producing VS, whether in the barn or outside. If there are situations in which the animal may not be producing VS throughout the year, this should be taken into account in Equation 10.1.
249	4	10	1780	1789	examples of calculations with the different cited examples would have been apreciated.	France	Accepted with Modification	We have not provided specific examples in this case, but we have expanded the information that would need to be considered in carrying out these calculations. These type of calculations would not be considered as the prescribed Tier 2, but would be considered a country-specific application of the Tier 2 and therefore we wish to avoid confusion about what the default guidance is by providing a full example of the calculation.
251	4	10	1791	1792	Table 10.17: duration of storage should be indicated for composting and systems with litter	France	Rejected	Composting systems are treated in the same way as manure heaps. The MCF applies to the full fraction of the annual VS that is tranferred to the composting system on an annual basis. The MCF is not differentiated based on the length of compost (retention time), as was done for the liquid systems because there is not evidence that methane emissions vary based on retention times in the same way liquid systems do. The deep bedding systems are differentiated based on their lenght of storage, but only for less than one month and greater than one month.

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
253	4	10	1843	1843	Table 10.18: this table should be presented differently to facilitate the use and the understanding. Definitions of systems should be regrouped in function of the manure management step (ie building, storage, grazing, treatment). Systems wtih frequent manure removal from building (several times per day) are not defined in the table. Same for deep bedding with additives. This table should also include new systems that allow mitigation to take into account of the mitigations in inventories.	France	Rejected	The IPCC guidelines have been based on grouped systems since their initial implementation. To implement manure stages would be a significant deviation from the guidelines and would be beyond the scope of this refinement, which was to update emission factors and parameters, align methodolgies, but not develop entirely new methodologies, unless significant issues were identified with those as they stand. Grouping of systems was reviewed in earlier versions of the refinement; the collation of manure management systems and review of emission factors has been completed and reviewed in earlier versions of the refinement; there is no default emission factor for "deep bedding with additives" as additives comprise a very wide variety and act very differently; We were not able to develop a default series of emission factors that are specific to frequency of manure removal based on the current available literature; Country-specific mitigation measures can be carried out as a part of a country-specific Tier 2 methodology when information on the impact of specific management proacices are known and parties are encouraged develop higher Tier inventories by using national data, systems and emission factors.
255	4	10	1947	1947	Equation 10.25: NbeddingMS should be accounted in this equation. EF3 for systems with bedding have been assessed by measurement on the whole biologic system (animal excretion and litter). The emitting processes and emissions level are not the same for slurry only and solid manure. The mass balance approach should be prefered to consider emissions at each manure managment step (building, sotrage, grazing, treatment) and be more accurate and relevant even with the tier 1 approach. For instance how caculating with this equation emissions for systems with deep bedding and solid outdoor storage and grazing ? (see all the published papers dealing with solid manure)	France	Rejected	It is correct that EF3 has been assessed for whole systems (i.e. manure excretion and beeding), but then the emission measured in these full systems were related to the original N excretion rates. This means that the Efs include the effect of the bedding material, but are given in relation of animal N excretion; bedding quantities are highly variable in experimental results and in practice and add to the uncertainty of the measurement, but based on our analysis of the data, should not be included in this equation. Further the IPCC Tier 1 does not distinguish between housing and storage and the refinement did not have the mandate to include major changes to the IPCC methodology; it is however noted that this methodological change would be desirable in future updates.
257	4	10	2161	2161	N intake kg Nanimal-1day-1 and not kg Nanimal-1y-1	France	Accepted	
259	4	10	2188	2188	Dmi kg of DM.animal-1Day-1	France	Accepted	Text was included to make the description easier to understantand
261	4	10	2261	2261	This sentence seems not correct. "For the calculation of the Nretention_frac(T), the daily N retention can be calculated by dividing the result of equation 10.33A by the number of days from parturition to parturition (as mentionned in equation 10.33A).	France	Accepted	see response to comment 1715
263	4	10	2317	2317	Ngain not Nper gain?	France	Accepted	

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
265	4	10	2903	2904	Figure 6 : MCF spreadsheet, what is the unit of the figure in the middle (???kg, m3??)	France	Accepted	
267	4	10	1950	1950	The Nitrogen from the bedding should be included in equation 10.25 as EF3 has been assessed for the whole system ie excretion+litter.	France	Rejected	It is correct that EF3 has been assessed for whole systems (i.e. manure excretion and bedding), but then the emission measured in these full systems were related to the original N excretion rates and it is rare that bedding N was included in the estimate of the emission factor. This means that the Efs include the effect of the bedding material, but are given in relation of animal N excretion; Bedding quantities are highly variable and difficult to assess. It was not possible to develop default values for bedding quantities due to the variability of bedding under different systems. Because default values could not be provided, it was judged that it was better not to include bedding in the calculations. It is however noted that this methodological change would be desirable in future updates.
269	4	10	1993	1993	equation 10.26 : NbeddingMS should be accounted in this equation : N*awms (Nex + NbeddingMS) +Ncdg (same in eq 10.25) as fracgasms has been assessed on litter+excretion.	France	Rejected	It is the opinion of the panel, that since mineralization of nitrogen compounds in beddings occurs more slowly compared to manure and the concentration of ammonia fraction in organic beddings is negligible, both volatilization and leaching losses during storage of bedding are assumed to be zero. N in bedding is relevant to estimate the amount available for application - see Eqn 10.34. Further, due to the variabiity in the use and source of bedding it was not possible to develop default values to include in the equation and as a result it was preferred to not include it in the Tier 1 methodology.
271	4	10	2265	2280	In equation 10.33C, calculation is as follow : (Bwfinal -Bwinitial)* Ngain(BWfinal), why not using Bwfinal*Ngain(Bwfinal)-Bwinitial*Ngain(Bwinitial) (solution 2). Moreover calculated N retention with Ngain provided in table 10.20B are very low for growing pigs compared to those calculated with more recent models like the model developed by Dourmad et al. and used in Dourmad et al. (2015) Underestimation of retention will lead to overstimation of excretion and emissions. Cf. : Dourmad J.Y. (coord.), Levasseur P.(coord.), Daumer M.,Hassouna M., Landrain B., Lemaire N., Loussouarn A., Salaün Y., Espagnol S., 2015.Évaluation des rejets d'azote, phosphore, potassium, cuivre et zinc des porcs. RMTElevages et Environnement, Paris, 26 pages.	France	Rejected	We have reviewed the Dourmad method and noted that it requires an additional parameter, muscle percentage, which has an influence on both the trend in N retention and the absolute amount. We feel this value could vary widely across the world and further could vary over the growth period. We further verified if the use of the Dourmad equation resulted in significant changes in total N excretion for a production cycle and noted that the values were within 5%. Therefore it is the panel's decision to maintain the values in the Table as is. The suggested equation also ignores the use of the subscript "i" which indicates the growth stage for which the Ngain values should be applied, therefore modifications to the equation are not required.

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
273	4	10	2382	2382	Table 10.21: systems should be classified by manure magement step : building, storage, treatment. Durage of storage should be indicated and different EF should be proposed in function of the storage duration. This factor have an influence on the measured emissions level. In annex 10B, it is mentionned line 4032, given EF are expressed as kf of N2O-N kg of initial N-1. Initial N is not N excreted. Initial N is N coming to storage after building that means (Nexcreted -N emissions in buiding). These EF values have been reported in table 10.21 but not with the same unit (kg N2O-N.kg nitrogen excreted). This should be corrected as it can lead to a huge overestimation of emissions. All the values in table 10.21 should be checked considering that that kind of mistakes could have happened in other cells.	France	Rejected	The IPCC Tier 1 methodology does not distingush in the steps "housing" and "storage"; so initial N is N excreted, see the response to comment 253. The proposed change involves a modification that is beyond the scope of this refinement. Further, it is the panel's position that while this may be a desireable future improvement, with the current level of knowledge about emissions from steps and national information about manure management, this would be difficult to implement globally and would not necessarily result in an improvement of emission estimation accuracy.
275	4	10	2436	2436	equation 10.34 : NbeddingMS should be reformulated regarding modifications suggested for equation 10.26 and 10.25	France	Rejected	N in bedding is relevant to estimate the amount available for application. Eqn 10.34 is correct. N in bedding material will flow directly to NMMS_avb (see comment 269). The approach is based on the assumption that the organic N in bedding will make its most significant contribution to emissions after field application.
277	4	10	2521	2521	Table 10.22 : to avoid confusion in calculation % should be removed from the table. Fracgas-MS, Fracleach are divided /100 in equations 10.27 and 10.26. For storage and treatment Fracgas_MS should be corrected because they are not consistent with literature and not to Pardo el al 2015 because of a unit error. Emissions will be calculated regarding equations 10. 26 and in this equation FracgasMS corresponds to the fraction of Nexc that volatises as NH3 and NOx. The value given in table 10.22 correspond to the fraction of incoming N (for storage) as given by pardo et al. 2015. The incoming N for storage is (Nexcreted -N losses in building). All the values in table 10.22 should be checked and corrected regarding this information to avoid huge overestimation and inconsistancy with NH3 inventories. To avoid this kind of mistake a mass balance approach even for tier 1 should be preferred. Applying the volatilisation coefficient directly to N exc for storage and treatment is not relevant because it means that we do not consider what occured in the building before the outdoor storage. Usually EF assessment is not express in function of Nexc, that means the conversion of the EF /kg of Nexc required some data thant are not directly available in the paper.	France	Accepted	Table 10.22. "%" have been removed from the table and equations have been ammeded accordingly. FracGas_MS considered in IPCC (2019) includes N losses from housing and storage all together. Values have been taken from current EMEP/CORINAIR (2016) for categories present in EMEP/CORINAIR (2016). EMEP EF values, which are expressed per TAN excreted have been re-calculated to be expressed as a funtion of total N considering the mass balance flow between the different manure management phases prior to manure application (housing, yards, storage). For other categories not present in EMEP we used Pardo et al. (2015) relative EF´s differences between conventional solidwaste against composting, etc. as the basis (for the storage phase) to estimate EFs for the manure management phases prior to manure application (Includes housing). We assumed no N2O or N2 losses prior to storage. Some text has been added in the solid manure Annex to clarify this.
279	4	10	2661	2661	Figure 10.5: Nbedding has to be moved at the same level than N ex N codigestate with an arrow from Nbedding to Nmanure stored and managed; the number of the equations that are indicated should be checked. Some are wrong.	France	Accepted with Modification	The equations were checked and corrected, but Nbedding was maintained in the same position based on the response to comment 269, i.e. that N bedding is considered specifically in transfers to the field, but considered indirectly in manure storage emission estimates.
281	4	10	3229	3229	Equation 10.A.27 : NbeddingMS is the kg of litter/animal. Nex should be removed from equation	France	Accepted	

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
305	4	10	365	371	Chickens produced in intensive systems need no more than 35 d to grow until final slaughter weight of 2 kg. In 'SIQO' production system including organic systems, minimal period to grow chicken is around 80 d. Increasing part of organic system has to be acounted for. Cf. http://www.klimatmarkningen.se/wp-content/uploads/2009/12/2009-6-chicken.pdf	France	Noted	The comment refers to unmodified text used as an example in the 2006 GLs that is intended to illustrate how to calculate annual average population. It is unclear what the reviewer wants changed in this text.
307	4	10	429	430	Sheep prodution fr meat has to be separated into 'low productivity systems' (grass-fed) and 'high productivity systems' (concentrate-fed). As a onsequence, a Tier-2 approah could be considered as suggested in line 469-469, but not described in table 10.1. Cf. https://www.viandesetproduitscarnes.fr/index.php/fr/processtechnologies/468-la-production-dovins-viande-en-france-1ere-partie	France	Accepted	Table 10.1 was modified
309	4	10	501	502	Percentage of concentrate in the diet can be more easily estimated than NDF and is as accurate as NDF	France	Noted	While the proportion of concentrates in a diet is strongly correlated to the NDF, depending on the definition and type of "concentrates" the value of NDF will vary among different dietary regimes and therefore we feel more confident using the directly measured parameter rather than the surrogate.
311	4	10	601	603	Recently revised INRA system for ruminant have included ruminal protein balance into a more precise prediction of feed digestibility. Cf. INRA,2018. INRA feeding system for ruminants. Wageningen Academic Publishers, Waeningen, the Netherlands,640pp	France	Rejected	A full refinement of the GE model was not part of the scope of this refinement. Further, the cited document is from 2018 which would not have provided the author team with time to integrate such major changes into the refinement. The model parameters were verified against the most recent NRC publication and no important changes were noted to be required in the methodology.
313	4	10	658	698	In Equation 10.3 and 10.4 and 10.5 (and others..) as well as in table 10.4 , Cf and Ca must be expressed MJ day-1 (kg metabolic weight) -1) and not kg -1 (consistency of the units)	France	Accepted with Modification	We have put the units in where they are missing., however for clarity the units were maintained as MJ day-1 kg-1 to avoid confusion for compilers as equations refer to live weight.
315	4	10	696	698	In table 10.1, maintenance requirements may be defined accordingly to days in milk (dairy females) because of changes in BW due to lipid stores mobilization. Cf. INRA,2018. INRA feeding system for ruminants. Wageningen Academic Publishers, Waeningen, the Netherlands,640pp	France	Noted	A full refinement of the GE model was not part of the scope of this refinement. Further, the cited document is 2018 which would not have provided the author team with time to integrate such major changes into the refinement.
317	4	10	709	746	Predition of NE fo gain has been recently reviewed either by INRA (2018) or by Norfor sytem with a greater acuracy than NRC 1989. Cf. http://www.norfor.info/; INRA 2018 cf above	France	Rejected	A full refinement of the GE model was not part of the scope of this refinement. Further, the cited document is from 2018 which would not have provided the author team with time to integrate such major changes into the refinement.
319	4	10	788	790	Estimation of milk fat content for goats is overestimated for most of european breeds	France	Accepted with Modification	Rewrote as: Milk fat vary largely among breeds. Compilers are encouraged to use country-specific milk fat content to derive EVmilk when available.

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
321	4	10	860	867	Revision of Feed Unit System for Ruminants include now the CP in the prediction of REM and REG	France	Rejected	A full refinement of the GE model was not part of the scope of this refinement. Further, the cited document is from 2018 which would not have provided the author team with time to integrate such major changes into the refinement.
323	4	10	1197	1198	Ym of dairy cows as well as cattleis recognized to be affected by additives. How is it accounted for? Only through a specific Tier-3 approach? Or partly through table 10.12 assuming than addidtives affects feed digestibility? Or through lines 1361-1369. Cf. Knapp et al. 2014. J. Dairy Sci. 97 :3231–3261	France	Noted	This point appears to be a request for clarification, so we have noted it and provide here clarification: The treatment of the use of additives that impact the methane conversion factor are treated in lines 1361 to 1369 in the text. According to this text countries must provide scientific evidence of their efficacity and evidence of the uptake of the technology. Table 10.12 does not account for methane reducing additives, but there is an acknowledgement that certain animal production systems may use additives that impact feed efficiency. These do not directly affect methane production.
325	4	10	2103	2280	N excretion rate prediction does not account for quality' of CP, i.E the amino -acid profile of diet in its ability to better match amino-acid requirement for growth in pig species. This may increase artificially N excretion. Moreover, in numerous developped countries, phase feeding according to spcific requirement for protein in th successive growth phase is not accounted for.	France	Noted	We acknowledge the validity of this comment. However, there is not sufficient information to model nitrogen excretion to this level of detail in different regions of the world, specially that from low productivity systems. Nonetheless, guidance is provided in several sections of these guidelines to encourage countries that are able to do so, to move to tier 2 or tier 3 approaches to more precisely estimate N excretion under their specific conditions.
327	4	10	2280	2317	N excretion rate prediction does not account for quality' of CP, i.E the amino -acid profile of diet in its ability to better match amino-acid requirement for growth in poultry species. This may increase artificially N excretion. Moreover, in numerous developped countries, phase feeding according to spcific requirement for protein in th successive growth phase is not accounted for.	France	Noted	We acknowledge the validity of this comment. However, there is not sufficient information to model nitrogen excretion in different regions of the world, especially in low productivity systems. Nonetheless, text is provided in several sections of these guidelines to encourage countries that are able to do so, to move to tier 2 or tier 3 approaches to more precisely estimate emissions for their country-specific conditions and the information that is available to their inventory compilers.
349	4	10	2231	2231	The equation 10.33A is not so clear because it is mentionned that Ngain is from parturition to parturition. Maybe it would be clearer to say from parturition to the end of gestation (but before next parturition), or to say just during gestation which is a bit different but corresponds to the calculation proposed.	France	Accepted with Modification	Appropriate text was added to clarify
357	4	10	2244	2244	The title of the equation 10.33B is similar to equation 10.33C. It would be more logical to have "N RETENTION RATES FOR PIGLETS (NEW EQUATION)"	France	Accepted	
675	4	10	347	347	typo, "this sourcs"	New Zealand	Accepted	
677	4	10	573	576	Could there be more information on the regions where making an adjustment for cold temperatures could be appropriate?	New Zealand	Accepted with Modification	Additional information is provided on the range of termperature when the correction is applied (sub-zero temperatures

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
679	4	10	1018	1018	replace full stop after the word "emission" with comma	New Zealand	Rejected	The comment refers to the text of the 2006 GLs, which was not updated.
681	4	10	1091	1122	Could an example be provided showing how tier 1 enteric fermentation emission factors should be calculated for animals where the actual estimated liveweight is significantly different to the liveweight in table 10.10? e.g. what would be the guidance for calculating emissions from ostriches with a liveweight of 200kg?	New Zealand	Accepted	A footnote was added referring compilers to Section 10.2.4 where it is explained how to derive EFs if weight is different from those reported in table 10.10
683	4	10	1091	1122	Could this text and/or table 10.10 have some explicit text saying that enteric fermentation emissions from rabbits should not be considered?	New Zealand	Rejected	It is not possible to develop a fully comprehensive list of all domesticated livestock globally as information is not always available. Section 10.2.4 of the GLs describes how to consider and adjust EFs for animal species not listed in table 10.10 if it is possble to compare a species to another known emission factor based on their digstive characteristics. If default emission factors are not listed for animals with comparative digestive systems, compilers should consult the scientific literature or carry out country specific research if it is judged that a species not listed here makes an important contribution to their agricultural emissions. Compilers should document assumptions made in making this determination.
685	4	10	1321	1327	could Ym also be affected by genetics/breeding of animals selected for low Ym characteristics?	New Zealand	Accepted with Modification	Breed or genotype variation was added in this list, further, reference to breeding for Ym reduction was added to the discussion of methane yield modifying factors (line 1197)
687	4	10	1581	1581	Could an example calculation be shown after this paragraph for how to estimate total VS for a particular animal with a particular weight?	New Zealand	Accepted with Modification	We have provided more explicit text in Section 10.4.1 to describe how the calculation is carried out, but not a specific numeric example, as the equation is quite straightforward.
689	4	10	1843	1844	Could this table be moved further up near the start of the chapter?	New Zealand	Rejected	To conform with the Table of Contents defined by the IPCC Pleanary, the Table will remain where it currently is placed.
691	4	10	2197	2198	Could an example calculation be shown for how to estimate total Nex for a particular animal with a particular weight?	New Zealand	Accepted	A brief example calculation was included in the document
693	4	10	2521	2522	Typo on footnote 4, "Uncertain"	New Zealand	Accepted	
695	4	10	2662	2663	good diagram, could it also show which emissions are direct and which are indirect?	New Zealand	Accepted	
697	4	10	2736	2737	the goat (eastern europe) numbers in table 10 A.8 don't add to 100%	New Zealand	Accepted	
699	4	10	2740	2771	do "mean annual temperature" and "mean annual precipitation" have a precise scientific/meterological definition? If so, could this be provided?	New Zealand	Accepted	It is noted in the text now that the data is the annual averages from the 30 year period in the cited data source
715	4	10	338	340	Should there be reference to consistency across the time series, or referall to time series consistency methodology where this is not possible?	New Zealand	Accepted	
717	4	10	1001	1003	This seems like a complex way to describe methanogenesis, perhaps reword to a simpler sentence?	New Zealand	Accepted	The desctiption presented in tbe 2006 GLs was put back.

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
719	4	10	1537	1537	add: based on … "measurements of" … dry matter intake	New Zealand	Accepted with Modification	As DMI may come from surveys or measurements that are applied at the national scale the panel feels it is best to use the word estimate
1059	4	10	2421	2422	Reference to EEA 2016. EMEP/EEA air pollutant inventory has changed its recommendations on bedding: in the inventory guidebook 2016, volatilization losses are no longer assumed to be zero. Please remove the reference to EEA 2016.	Finland	Accepted	
1061	4	10	1791	1792	Table 10.17, subscript 1: thick, dry crust. A description of conditions favourable for formation of thick, dry crust should be added to the text or footnote to assist inventory compilers to choose a correct factor in case of insufficient or partial activity data.	Finland	Accepted	
1063	4	10	1791	1792	Table 10.17. MCFs by climate zone is missing deep bedding for other than cattle and swine. Please add MCFs for deep bedding for sheep, goats, horses and poultry, for which deep bedding is also used.	Finland	Accepted with Modification	The articles that were cited were related to cattle and swine. We have added a suggestion for compilers to use these values as surrogates if other animals are using deep-bedding systems for their production. We further corrected some minor issues with footnotes and column labels, specificall, the climate zone for Tropical Montane that was improperly labelled and the repetition of footnote 5 that was missing from footnote 1.
1065	4	10	522	530	We suggest an addition: Slaughter weights can be utilized in live weight estimations if slaughter ages, dressing percentages and growth curves are also available	Finland	Accepted	
1067	4	10	557	576	Please specify the temperature range for the months ('cold months') for which the Equation 10.2. is applicable.	Finland	Accepted	
1069	4	10	711	726	Please clarify in the text whether different mature weight values should be used for females, castrates and bulls - in addition to the difference created by the coefficient differing from 1 for these cattle subgroups. This is an important issue because of the great difference in mature weights between sexes. Calculation examples for a bull and a heifer would make sure that inventory compilers understand the guidance as it is intended.	Finland	Accepted with Modification	The clarification was added. An example was not provided, because full examples are provided and are available to compilers in the supplemental material where all Tier 1 calculation spreadsheets are provided.
1199	4	10	General con	General com	Comment: it is good to see that the chapter has been updated based on comprehensive analysis of literature for cattle and some other livestock categories. However, the values for sheep, especially in relation to manure-related emissions, do not appear to have strong justification from literature. In many cases their derivation is unclear, especially when grouped with "other". At least, the basis and justification for the values must be provided, especially where they are substantially different from other ruminant livestock.	Australia	Accepted with Modification	The reviewer is correct to point out that less focus was placed on emissions from the Sheep category, mainly due to prioritization decisions of the IPCC Panel. Based on the reviewer's comment we have reviewed the 2006 values for VS, liveweight and N excretion. The revised sheep values have been modified according to information based on GLEAM model from FAO. N excretion and VS have been modified and values are much smaller and similar to new values for goats. An independant verification of the GLEAM values suggested that they were more accurate than the 2006 guideline defaults.
1201	4	10	1653	1653	Recommend clarifying: Table 10.13A Footnote 5 Annex 10B.3 only considers goats. There is no information on how figures for sheep (or turkeys, ducks, horses, donkeys or camels) are derived. Recommend providing a description and justification.	Australia	Accepted	A footnote was added specifying that values are taken from 2006 Guidelines

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
1203	4	10	2171		Recommend clarification: should this say cattle, sheep and goats? Otherwise, where is the equation for these livestock, and why does line 2185 refer to cattle, sheep and goats?	Australia	Accepted with Modification	The title of the equation was changed as calculations can be carried out based on this equation and the values in Table 10.20.
1205	4	10	2302	2302	Recommend clarification in Table 10.19: Why are the values for sheep so much higher than goats everywhere except North America? There is no information about how these figures are derived. The cited annex has no data for sheep.	Australia	Accepted with Modification	N excretion sheep values have been modified according to information based on GLEAM model from FAO. New values do not show such large differences amongst regions, see the response to comment 1199.
1207	4	10	2446		Recommend correction: it should refer to equation 10.34A	Australia	Accepted	
1323	4	10	1612	1613	It is confusing how to allocate the emissions from anaerobic digestion (both from storage and application). These emissions are generally small, but it complicates the inventory work if the emissions of different substances from the same source should be allocated to different sectors. According to the 2019 refinements the emissions from digested manure should be allocated to 3.B. Moreover, the following is stated (vol 4, ch10, row 1612), "CH4 emissions from co-digestion of organic resources (crop residues, food waste, energy crops) need to be reported under the source category '3.B(a).5 – Co-distestates'". I.e., not only emissions from digested manure, but also from food waste etc, should be reported in 3.B. On the other hand, in the waste chapter, biological treatment of solid waste (2006 GL, vol5, ch 4), it is suggested that the emissions from "anaerobic digestion of organic waste, such as food waste, garden (yard) and park waste and sludge" should be reported in the waste sector. Finally, in the chapter about estimating emissions from manure management systems, the EMEP/EEA Guidebook (2016 and the 2019 draft) says, "Emissions from biogas facilities i.e. from during the storage of slurry before anaerobic digestion and the storage of digestate after biogas generation, are calculated and reported in Chapter 5B2. Hence, any manures used as biogas feedstocks need to be subtracted before calculating emissions from storage and application to land". It would be very useful to clarify the allocation in the final version.	Sweden	Accepted	Text was included to better indicate where and how emissions are reported among the different sectors from manure and codigestates in the introduction to Section 10.4. all references to the reporting of waste emissions in the Chapter 10 were removed to avoid confusion and text was added to indicate emissions from the combusion of biogas should be included in the energy section.
1325	4	10	1844	1844	The footnote is missing.	Sweden	Accepted	
1327	4	10	2502	2503	It is not clear which values the GL refer to. It would also be useful to considere to include information on the exact table/paragraph	Sweden	Accepted	

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
1399	4	10	1612	1613	It is confusing how to allocate the emissions from anaerobic digestion (both from storage and application). These emissions are generally small, but it really complicates the inventory work if the emissions of different substances from the same source should be allocated to different sectors. According to the 2019 refinements the emissions from digested manure should be allocated to 3.B. Moreover, the following is stated (vol 4, ch10, row 1612), "CH4 emissions from co-digestion of organic resources (crop residues, food waste, energy crops) need to be reported under the source category '3.B(a).5 – Co-distestates'". I.e., not only emissions from digested manure, but also from food waste etc, should be reported in 3.B. On the other hand, in the waste chapter, biological treatment of solid waste (2006 GL, vol5, ch 4) it is suggested that the emissions from "anaerobic digestion of organic waste, such as food waste, garden (yard) and park waste and sludge" should be reported in the waste sector. Finally, in the chapted about estimating emissions from manure management systems, the EMEP/EEA Guidebook (2016 and the 2019 draft) says, "Emissions from biogas facilities i.e. from during the storage of slurry before anaerobic digestion and the storage of digestate after biogas generation, are calculated and reported in Chapter 5B2. Hence, any manures used as biogas feedstocks need to be subtracted before calculating emissions from storage and application to land". W would like to see the problem with allocation solved in the final version.	Sweden	Accepted	Text was included to better indicate where and how emissions are reported among the different sectors from manure and codigestates in the introduction to Section 10.4. all references to the reporting of waste emissions in the Chapter 10 were removed to avoid confusion and text was added to indicate emissions from the combusion of biogas should be included in the energy section.
1401	4	10	1693	1699	There is still an inconsistent use of how B0 is written. Sometimes B0 and sometimes BO (i.e with a zero or the letter O).	Sweden	Accepted	
1403	4	10	1844	1844	The footnote is missing	Sweden	Accepted	
1405	4	10	2502	2503	It is not clear to me which values the GL are referring to. Could be good to also include information on the exact table/paragraph	Sweden	Accepted	
1555	4	10	277	326	Emission factor for methane should also be based on the ration fed to animals. For nitrous oxide emission, some consideration should be given to the fixation of nitrogen when manure is deposited on soils.	Saint Lucia	Noted	It is not clear what the reviewer is requesting in terms of specific changes to the document, and we feel that these issues are covered adequately in the methods proposed.
1703	4	10	1291	1291	Since in table 10.12 there is no "MY" but "EF_DMI" with a different unit (gCH4 kg DMI-1), please change the term "MY = methane yield, kg CH4 kg DMI-1 (Table 10.12)" accordingly.	Germany	Accepted	

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
1705	4	10	1592	1593	Table 10.14. Since the EFs are given in g CH4 PER kg VS, we see the following logical problem. For example, we do not understand, why a slurry system that stores manure from "high productivity systems" should feature an EF that is nearly twice as high as the EF for the same slurry system storing manure from "low productivity systems"? Differences in VS excretion per animal might occur dependent on high or low productivity systems, but we feel that EFs of identical manure storage systems related to VS (in the same climate zone) should be identical.	Germany	Rejected	For the most part, these emission factors have been developed directly from the information in the 2006 guidelines, the B_0 values for developing countries were used for the low productivity systems and the developed countries for the high productivity systems. The B0 value drives these differences. In cases where we did not find information that could effectively confirm or reject the values published in the 2006 guidelines we maintained the existing values. It is the hope of the hope of the panel that the presentation of Tier 1 emission factors on a g CH4 per kg VS basis will encourage researchers will begin to publish comparative measurements based on VS that will lead to significant improvements when there is an opportunity to revise the values again.
1707	4	10	1742	1750	From our point of view, it would provide a more consistent approach to keep animal-specific default Bo values for all MM systems. The animal-independent value suggested for the management system "grazing" does not follow the current systematic approach (animal-specific Bo, manure management system specific MCF) in the guidelines and seems like a step backwards.	Germany	Rejected	The current manure management methodology is based on a model that was developed for anaerobic digestion. It is the position of the panel that the concept of using an anaerobic digestion model is probably not appropriate for grazing situations, where warm temperatures can dry dung pats and wet conditions can dilute the dung. Even so, we calculated MCF based on the animal-specific B0 values. The current results are based on a compilation of experimental results and the results showed no statistical difference between animal categories. A similar non-significant result was found for cattle and sheep EF values. On this basis, it was decided that a single value for EF and for B0 was appropriate.
1709	4	10	1791	1792	The citation referred to in Table 10.17, footnote 25 ("calculations based on Haenel et. al (2018)") is missing in the reference list in the end of the chapter. Please add.	Germany	Accepted	
1711	4	10	1988	1988	Please correct the numbering of "Equation 10.26A" to Equation 10.26.	Germany	Accepted	
1713	4	10	2014	2014	Please correct the numbering of "Equation 10.26" to Equation 10.27.	Germany	Accepted	

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
1715	4	10	2157	2163	Please correct Equation 10.31: If both terms Nex(t) and Nintake(t) are already normalised over one ("kgN animal-1 year-1"), the multiplication with 365 is wrong.	Germany	Accepted with Modification	The N intake is not in fact per year, it is per day and therefore the 365 is required to be consisten tiwh the application of N excretion in the emission factor equations. We have corrected the unit for intake. This comment has however identified an important inconsistency that was futher resolved in this revision. Equations 10.33 to 10.33E all calculated N retention in as a quantity and not a fraction (note that this issue existed already in the IPCC 2006 Guidelines). Therefore, further calculations were required in order to calculate an N retention fraction such as is presented in Table 10.20 and would be applicable in Equation 10.31. We have resolved this issue by including an additional equation, Equation 10.31A in which the N excretion is calculated based on the difference between intake and retention. Further, in the case of Swine, instructions are provided to calculate daily N retention to make these calculations consistent with equations 10.31, 10.31A and 10.32,10.32A
1717	4	10	2163	2163	Footnote 4: The citation Rösemann (2017) is missing in the reference list in the end of the chapter. Please add. Besides that, without any further clarification what approach is suggested by this reference, the footnote will not help the reader, because the publication Rösemann (2017) consists of roughly 400 pages. Instead this publication, we suggest to cite the current version of the methods description for the German agricultural emission inventory (= Haenel et al. (2018)) and add the respective chapter numbers. We think the chapters 3.1.2.2.1 to 3.1.2.2.3 contain helpful discussions.	Germany	Accepted	Changes were included in the footnote (current location of footnote page 10.84)
1719	4	10	2357	2358	Please clarify the following: "However, emissions factors and N transfers should be corrected based on the time spent in each system…" and add information for which time in the respective systems the default EFs in Table 10.21 have been designed. This will help inventory compilers to do the correction.	Germany	Accepted with Modification	It is beyond the scope of this refinement to develop guidance for all combinations of staged manure management, though countries are encouraged to develop country-specific management specific emissions. We have developed a brief text to state points that are important to consider in the development of these emission factors.
1899	4	10	398	398	Do cows have to be genetically improved to be ranked in the high-prod systems? I thought that Friesian-Holsteins cattle used in Europe/UK are not genetically improved, byut are definitely high producing. If the latter is true than cattle do not have to be genetically improved to be ranked in the high-prod systems. Please change accordingly. The same applies to line 412.	United Kingdom (of Great Britain and Northern Ireland)	Accepted with Modification	We have clarified that genetic improvement is occurring through selective breeeding in these cases

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
1901	4	10	412	412	Regarding the text "Animals are genetically improved…" - Do cows have to be genetically improved to be ranked in the high-prod systems? I thought that Friesian-Holsteins cattle used in Europe/UK are not genetically improved, byut are definitely high producing. If the latter is true than cattle do not have to be genetically improved to be ranked in the high-prod systems. Please change accordingly	United Kingdom (of Great Britain and Northern Ireland)	Accepted with Modification	We have clarified that genetic improvement is occurring through selective breeeding in these cases
1903	4	10	545	545	If you strive for international 'ease of understanding', please consider changing the phrase 'draft animals' into 'work animals'.	United Kingdom (of Great Britain and Northern Ireland)	Rejected	The term was implemented in the 1996 GLs and has been used already for more than 20 years.
1905	4	10	598	598	Please change 'range lands' into 'land used for grazing' for clarity.	United Kingdom (of Great Britain and Northern Ireland)	Accepted with Modification	A footnote was added specifying the notion of rangelands. The important differentiation here is that these are lands that are not being highly managed and improved for increased biomass production and feed quality.
1907	4	10	735	735	The g in 'NEg' should be in subscript	United Kingdom (of Great Britain and Northern Ireland)	Accepted	The term was corrected
1969	4	10	1267	1267	Equation 10.21 it is not updated	Uruguay	Accepted	The heading for the equation was corrected. 'Updated' was removed.
1971	4	10	1111	1122	Line 1111: "To select emission factors from Tables 10.10 and 10.11 identify the region most applicable to the country" but the information it is not presented by region in table 10.10	Uruguay	Accepted	Footnote 1 to table 10.10 specifies the regions that should be considered under the both systems (low and high). However, the footnote was replaced from Table heading directly low- and high productivity columns.
1973	4	10	2455	2456	Please check the title of equation 10.34A	Uruguay	Accepted	
2767	4	10	1653	1653	Table 10.13A: the VS for North America seems low, please verify the source.	Canada	Noted	It is not clear what values are being questioned, for what animal category. The sources of country specific values are either those derived from the feed analysis for cattle, from the 2006 Guidelines or from GLEAM. Note that values must be taken in context with the default values provided in Table 10A.5
2769	4	10	2257	2257	"In estimating N excretion by breeding sows (Equation 10.33B)…". Equation 10.33B relates to N retention in growing pigs. Suggest to re-word to reference N retention (Eqn.10.33A) as part of the estimation of N excretion (Eqn. 10.31)	Canada	Accepted	
2771	4	10	2277	2278	In Table 10.20B, the value for growers in the 40-80 kg weight class is not reproducible using the equation provided in the table. The equation returns a range from 0.023 to 0.021 from 40kg to 80kg, respectively, whereas 0.024 is listed in the table. The value for finishers seems high as well - the equation returns a range of 0.021 to 0.019 for animal weights of 80kg to 120kg, respectively, whereas 0.021 is listed in the table.	Canada	Accepted	A very valid comment. We also included data from other research, such as Poulsen & Kristensen (1998) and FAO (2017). That information has now been included in that Table.
2773	4	10	2404	2415	"Nitrogen in manure is present both as organic nitrogen (Norg) and mineral nitrogen, called 'Total Ammonia Cal Nitrogen' (TAN)...." Suggest to re-word to account for nitrate in mineral nitrogen.	Canada	Accepted with Modification	Changed the wording slightly to say, of which the majority is TAN
2821	4	10	347	347	typographical error "sourcs" corrected "sources"	Mexico	Accepted	

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
2823	4	10	4404	4404	Revised methane emissions factors and spatially distributed annual carbon fluxes for global livestock	Mexico	Noted	The article noted has been reviewed, but is not cited specifically in the document and therefore is not in the reference list. It is not clear what the reviewer is requesting as a modification.
701	4	11	189	190	What is the meaning of the cross-hatching is some of the boxes? (e.g. Biomass Burning, Fossil Fuel Combustion)	New Zealand	Noted	Acknowledged but this box was not revised. This is out of scope with approved table of contents by the IPCC plenary.
703	4	11	240	243	Could there be more information on what is a dry or wet climate? What countries or regions do these include?	New Zealand	Accepted	A footnote was added to provide the definition of climate
705	4	11	248	249	Could there be more information on what is a dry or wet climate? What countries or regions do these include?	New Zealand	Noted	Climate definition is provided in Table 11.1, section "Notes", and also in a footnote that has been added in the paragraph above the table discussion disggregation by climate type.
707	4	11	329	445	Could the text and tables in this section provide information on crop residue emissions from crops such as apples, avocados, and grapes? Or should these crops use the generic default values?	New Zealand	Noted	Unfortunately it is not possible to provide default values for every single annual or perennial crops. We recommend using the generic values or developing country-specific estimates for these crops.
709	4	11	658	659	Could there be more information on what is a dry or wet climate? What countries or regions do these include?	New Zealand	Accepted	A footnote was added to provide the definition of climate
711	4	11	206	225	Could this chapter provide guidance on estimating emissions using geographic information systems (GIS) methodologies and data?	New Zealand	Rejected	Acknowledged but this is out of scope with approved table of contents by the IPCC plenary.
713	4	11	501	501	Expert opinion in place of expert advice?	New Zealand	Accepted with Modification	We replaced "expert advice" by "expert judgement" to be consistent with terminology in Volume I of this guidance.
987	4	11	248	249	In Table 11.1, it is suggested to add a source of referenced parameters of wet and dry climate, namely, Figure 10A.1, Chapter 10, Volume 4.	China	Noted	The climate classification is based on Figure 3.A.5.1 in Chapter 3 of Vol. 4, and this reference has been added. Climate definitions are provided in Table 11.1, section "Notes", and in a footnote in the paragraph above the table in the discussion about disaggregating data by climate type.

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
989	4	11	349	381	1. According to the report, the summation sign in the first equation should be followed with a bracket to sum the latter two parentheses. That is 2. According to the unit of variables given in the present report, the units on the left and right sides of the three equations of Formula 11.6 are not identical: The left unit in the first equation is kgN yr-1, while the right unit is kgN ha-1. The left unit in the second and third equations of the formula is kg d.m. ha-1, while the right unit is kg d.m.yr-1. 3. The CropT and BGRT in the third equation are inconsistent with the BGR(T) in the first equation and the Crop(T) in the second equation in terms of presentation. These problems are suggested to be modified as appropriate. 1) It is suggested that the expression of the first equation be checked. 2) The unit of AGR (T) in Line 363 be changed to kg d.m.yr-1, while that of BGR(T) in Line 371 be changed to kg d.m.yr-1. 3) CropT and BGRT in Line 357 be changed to Crop(T) and BGR(T) respectively. In addition, in line 354, it is not necessary to multiply the combustion coefficient Cf when straw crops are used as fuel. Since Frac Remove（T）+Frac Burn（T）+Frac Returning =1, it is suggested to replace 1-Frac Remove（T）-（Frac Burn（T）•Cf	China	Accepted with Modification	The equations were checked and corrected as per sugestions: 1) Brackets were added in the first equation; 2) The unit of AGR (T) and BGR(T) were changed to kg d.m. yr-1 on lines 363 and 371, respectively; and 3) BGRT and CropT were changed to BGR(T) and Crop(T) in equation 3. 4) However, the combustion factor was maintained as it is needed because 100% of the residue does not necessarily combust in a fire. 5) Also, an equation was added to estimate aboveground residue dry matter, AGDM(T) on a kg per ha-1 basis, and then added to Crop(T) to estimate BGR(T).

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
1329	4	11	688	688	In Table 11.3, the EF for NH3-N + NOx-N from urea is 0.15. In the EMEP/EEA guidebook the corresponding EF for NH3-N only is 0.20 (when converted from NH3 to NH3-N). These two guidelines should preferebly be consistent, or differences motivated, or commented.	Sweden	Noted	EMEP guidelines do not guarantee constancy in time as the EMEP/EEA air pollutant emission inventory guidebook is a living document and, therefore it is subject to ongoing changes. The latest version dates back from Nov 2016. In table 3.2 of crops section of EMEP (2016) the NH3 EFs for different fertiliser types and soil pH and temperature conditions are indicated (range for urea: 15.5-21%). https://www.eea.europa.eu/publications/emep-eea-guidebook-2016?utm_medium=email&utm_campaign=EMEPEEA%20guidebook_CRM&utm_content=EMEPEEA%20guidebook_CRM+CID_dccb33f00685c6c9d615dcd46f004610&utm_source=EEA%20Newsletter&utm_term=Read%20more To support the updated methodology in the EMEP/EEA Air Pollutant Emission Inventory Guidebook we were in contact with some authors of this chapter, who indicated that they are currently reviewing these values through re-analysing the raw data from Bouwman et al (2002) and Pan et al. (2016). Unfortunately, the study has not yet been published nor released and could not be used in this IPCC report. Instead, we analyzed the same data from Bouwman et al. (2002) and Pan et al. (2016) (273 studies as indicated in Annex 11A.7) and opted to use median instead of the mean value due to skewed distribution to the right. Bouwman et al. (2002) obtained a mean of 0.210 and a median of 0.140. Similarly, for Pan et al. data median is also close to 0.14, which is lower than the range of values proposed by the latest EMEP guidelines (15.5-21%). Revised NH3 EF values in the EMEP/EEA Air Pollutant Emission

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
1407	4	11	688	688	In Table 11.3 the EF for NH3-N + NOx-N from urea is 0.15. In the EMEP/EEA guidebook the corresponding EF for NH3-N only is 0.20 (when converted from NH3 to NH3-N). The two guidelines should preferebly be consistent.	Sweden	Noted	EMEP guidelines do not guarantee constancy in time as the EMEP/EEA air pollutant emission inventory guidebook is a living document and, therefore it is subject to ongoing changes. The latest version dates back from Nov 2016. In table 3.2 of crops section of EMEP (2016) the NH3 EFs for different fertiliser types and soil pH and temperature conditions are indicated (range for urea: 15.5-21%). https://www.eea.europa.eu/publications/emep-eea-guidebook-2016?utm_medium=email&utm_campaign=EMEPEEA%20guidebook_CRM&utm_content=EMEPEEA%20guidebook_CRM+CID_dccb33f00685c6c9d615dcd46f004610&utm_source=EEA%20Newsletter&utm_term=Read%20more To support the updated methodology in the EMEP/EEA Air Pollutant Emission Inventory Guidebook we were in contact with some authors of this chapter, who indicated that they are currently reviewing these values through re-analysing the raw data from Bouwman et al (2002) and Pan et al. (2016). Unfortunately, the study has not yet been published nor released and could not be used in this IPCC report. Instead, we analyzed the same data from Bouwman et al. (2002) and Pan et al. (2016) (273 studies as indicated in Annex 11A.7) and opted to use median instead of the mean value due to skewed distribution to the right. Bouwman et al. (2002) obtained a mean of 0.210 and a median of 0.140. Similarly, for Pan et al. data median is also close to 0.14, which is lower than the range of values proposed by the latest EMEP guidelines (15.5-21%). Revised NH3 EF values in the EMEP/EEA Air Pollutant Emission
1513	4	11	General con	General con	The proposal from the previous version of distinguishing EFs from synthetic fertilizer and other inputs has been maintained. The requested clarification from the previous review comments on differentiating EFs from organic amendments has not been included. In reality much of the manures (including slurries and digested manures) that are used in intensive agriculture have high contents of mineral N. The proposed EFs for wet climates provided very large differences (0.006 for other N inputs and 0.016 for synthetic fertilizers). In reality there will for liquid based manures mostly be very little difference between EFs for these manures. This is a problem for using these EFs in wet climates with intensive agriculture.	EU	Accepted with Modification	Thank you for this important comment. The authors acknowledge the potential difference in EF between liquid and solid forms of organic fertilisers. However, there is insufficient data to disaggregate the EF1 into liquid manure and solid/slurry manure. This would therefore require development of country-specific Tier 2 values. The text was amended before Table 11.1.
1721	4	11	248	249	Table 11.1, second column: Could you please clarify the calculations that yield a value for EF1 aggregated of 0.010 (as found in Annex 11A.2). Our calculation of the weighted mean of the disaggregated values for EF1 results in 0.012.	Germany	Noted	The calculation of the aggregated EF1 was not based on a weighted mean. It was computed as the mean of 3000 values generated by bootstrapping, as indicated on lines 1143-1145 of Annex 11A.2
1723	4	11	377	377	Please correct Footnote 14 by including a "not": "This term is included in the equation to account for lower N release rates in grasslands that are NOT replanted annually…"	Germany	Accepted	This is correct and the text was amended.

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
1725	4	11	1168	1174	Table A2-2, last 3 columns: Our calculations applying weighted mean (weighted with sample size) result in: [(509 * 0.016) + (110 * 0.006) + (200* 0.005)] / (509 + 110 + 200) = 0.012. If another calculation method was applied resulting in EF1 aggregated = 0.010, we suggest to mention it. Otherwise we kindly ask to correct this value.	Germany	Noted	The calculation of the aggregated EF1 was not based on a weighted mean. It was computed as the mean of 3000 values generated by bootstrapping, as indicated on lines 1143-1145 of Annex 11A.2
1727	4	11	1234	1238	Table A4-1: Calculation of disaggregated EF3PRP for cattle (wet): The calculation method explained in lines 1236 and 1238 results in 0.0078 * 0.66 + 0.0013 * 034 = 0.00559 for EF3PRP, which does not correspond to the 0.005 for disaggregated EF3PRP for cattle (wet) displayed in Table 11.1 (page 11.11). Please correct EF3PRP for cattle (wet) or provide the description of the calculation method.	Germany	Accepted	The EF3PRP for cattle (wet) has been corrcted to 0.006
1729	4	11	1236	1238	Please add the methodology applied to calculate the EFPRP for cattle and sheep and clarify that there are not disaggregated EF3PRP values for sheep displayed in Table 11.1 anymore.	Germany	Accepted	Text has been added to Annex 11A.4 to clarify the methodology and that there are no disaggregated sheep excreta EF3PRP values.
1787	4	11	363	364	It seems that the unit of AGR (T) is not "kg d.m. ha-1" but "kg d.m.". In addition, the equation (AGR(T) = Crop(T)* Slope(T) + (Intercept(T)*1000)) in Table 11.2 needs to be revised by "AGR(T) = Crop(T)* Slope(T) + (Intercept(T)*1000)*Area(T)*Fracnew(T)" and the unit of AGR(T) needs to be "kg d.m.". We suggest the unit and equation be checked and revised, if necessary.	Japan	Accepted with Modification	The unit was corrected to kg d.m. y-1 . However, given changes to estimate aboveground residue dry matter in Equation 11.6 based comment 989, it was not necessary to change the calculation in Table 11.2 to estimate kg dm. The multiplier of 1000 in the equation given in Table 11.2 was removed following these checks because it was not needed.
1789	4	11	371	371	It seems that the unit of BGR (T) is not "kg d.m. ha-1" but "kg d.m.". The unit be checked and revised, as appropriate.	Japan	Accepted	The unit for BGR (T) was corrected as kg d.m. yr-1.
2775	4	11	242	243	The phrase suggests that the disaggregation can be performed when either climatic or fertilizer type information is available. Based on the Table 11.1 this could pose ambiguity when one part of the information is available. For example, if they know all of the N applied is organic without the climate information, disaggregated values may not be useful. Thus, the statement should say "activity data by climate and fertilizer type".	Canada	Accepted	Thank you for the suggestion, this is correct and the text was amended as suggested.
2777	4	11	1217	1219	The uncertain range is extremely small for this parameter. I believe that the use of bootstrapping for this is underestimating the uncertainty. Bootstrapping attempts to reproduce the standard error of the population. As note in Volume 1 Chapter 3 on uncertainty, there are circumstances when the standard error should be used and there are times when the standard deviation should be used to define the uncertain bounds. In this case, it should be the standard deviation as this is a simple sample of the emission factors. The use of bootstrapping and therefore the development of standard error estimate underestimates the uncertainty as it would apply to a country that is applying that emission factor in their inventory. For the other EFs, though the range is not nearly as small as EF3, it should be clarified how the uncertain range were derived and assure that the approach used is consistent with the guidance in Volume 1 Chapter 3.	Canada	Accepted	For consistency with guidance in Vol. 1 Chapter 3, the confidence interval of the aggregated EF1 was recomputed using the standard deviation of the mean. This led to a slighly larger confidence interval. Formerly the low and high uncertainty values had been assigned the 2.5th and 97.5th percentiles of the dataset generated by bootstrapping; they were not based on the standard error. The updated confidence interval of [0.001; 0.018] seems reasonable in comparison with the uncertainty of [0.003; 0.03] in the 2006 guidelines, given the much larger dataset used for producing the EF1. The uncertainty ranges for EF3 have been revised by adopting the method outlined in Vol1 Chapter 3. This has resulted in a larger range of EF3 values that are more representative of the potential range of mean values that could be determined by individual countries.

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
2779	4	11	1336	1337	Suggested to rephrase "Field measurement data with chemical N application as well as studies with a focus on mitigation technologies, such as nitrification inhibitors or urease inhibitors were excluded from this analysis"	Canada	Accepted	The text was rephrased as per suggestion.
3575	4	11	248	249	Table 11.1. The revised factors properly represent the accumulated evidence published since the 2006 guidelines were derived. In particular, the disaggregated factors make sense and are defensible based on results from field studies. The revised uncertainty ranges are also reasonable and consistent with observations. The only concern is the lower bound of the range being negative for EF1 in the disaggregation of 'All N inputs in dry climates'. This seems counter-intuitive because it implies that as N inputs increase N2O could decrease.	United States of America	Accepted	Thank you for noting this and we found that this was an error. The lower bound of the range is zero and not -0.001, its higher bound is 0.0011 and not 0.0012 and the sample size is 207 instead of 200; as indicated in TABLE A2-2 - Disaggregation by rainfall for Dry climates in the final order draft.
329	4	12	96	99	It would be useful to add some general elements to the introduction to define HWPs (see Lines 340 and 341: The term "harvested wood products" is based on a concept consisting of the two separate elements of "forest harvesting" and "wood products" (Brown et al. 1998; UNFCCC 2003).) and to clarify that carbon captured and stored in solid chemicals or gases is excluded (see Lines 1498-1499).	France	Rejected	We have not made the change suggested to include further discussion of the concept of HWP "up front". Although we agree that the points referred to are very important, they are only certain points amongst many that have such importance, and we feel it is inappropriate to give these specific points undue profile over others. For the sake of clarity, we feel we should stick to presenting all aspects following the carefully developed chapter structure, We note that the text has been clearly identified by the review where it currently in Section 12,4,1.1 and this gives us some reassurance that the points are clearly expressed. We have responded to the request to clarify where biomass-derived gases and chemicals are included but not in the way envisaged by the comment. We added text to Section 12.4.1.1 to specify that harvested wood biomass carbon captured and stored in the form of solid chemicals or gases is excluded is in fact excluded from HWP.
331	4	12	195	218	This section should also highlight that the different approaches used for HWPs have implications for the calculation and reporting of emissions and removals in the AFOLU sector and the Energy sector (see Lines 1546-1548) and that there are issues of double counting or omissions when countries are using different approaches (see Lines 265-269).	France	Accepted with Modification	On the subject of the reporting of emissions in the AFOLU and Energy sectors, we have added some text and a cross-reference to Section 12.5. On the subject of the possibilities for double-counting or non-counting of emissions depending on the selection of approaches by countries, relevant text is already included in in the penultimate paragraph of Section 12.3.2.
333	4	12	268	269	The sentence about double counting and/or non-counting when different countries are using different approaches should be kept: this is very relevant information that countries should keep in mind as they implement or improve their reporting system on HWPs.	France	Noted	Noted.

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
335	4	12	270	276	We welcome the use of the wording "assumption of steady-state HWP pool" which is a more appropriate and less confusing than the previous wording "instant oxidation assumption" used in previous IPCC guidance (see lines 513-515). We suggest that the differences between the two be briefly explained here (with a reference to section 12.4.1.2 lines 505-522.) and to write that the new wording should be preferred now.	France	Accepted with Modification	We have included a brief clarification in a footnote and have added to the discussion in Section 12.4.1.2.
337	4	12	662	663	We suggest improving the clarity of this sentence by explicitly giving the two components of Equation 12.5 to which reference is made.	France	Accepted	We have modified the text discussing Equation 12.5 in the light of the comment. This includes explaining what the two components are, immediately after mentioning them.
339	4	12	983	983	Please consider the opportunity to add some further developments on the consistency to be ensured between country-specific emission factors for HWPs and other parameters used in Tier 2 methods to estimate aboveground biomasses (see section 2.3.1.3 of Chapter 2, Volume 4). In particular, it could be expected to some extent that consistency should be ensured regarding the use of wood densities to estimate change in above-ground biomass carbon stock and HWPs carbon stock.	France	Rejected	Emission factors (i.e. half-life or service life) information on the duration of the use of wood in use in relevant markets is independent from any information relevant for estimating above ground biomass and vice versa. Wood density of processed wood (i.e. wood commodities as covered by statistics) on the other hand (relating to activity data not emission factors) do NOT relate to standing timber /above ground biomass in forests – especially not in the case of composites, such as wood-based panels (consisting of different feedstocks incl. glue and additives).
341	4	12	992	992	It may seem unappropriate to base IPCC guidelines on a private and fee-based access standard (ISO). Would it be possible to consider an open and free-access alternative, ideally from UN statistics or database?	France	Rejected	To our understanding, there are no widely-applicable alternative sources of relevant information, presented according to an internationally consistent defined standard. The international standards provided by ISO are an accepted source of information which has already been referred to in previous IPCC guidance (IPCC 2006 GL Vol 2 or KP Supplement). To our understanding, the development of alternative methods would also incur costs and the deployment of resources.
343	4	12	1230	1237	Table 12.5 is useful and should be kept. Would it be possible to specify the consequences in terms of double counting and omission resulting from the use of different approaches by different countries? (see Lines 265-269).	France	Rejected	It would be inappropriate for us to provide the requested information because this could be interpreted as the guidance "taking a view" on the relative merits of selecting amongst the various approaches, which is still under discussion by SBSTA, hence being prescriptive about the choice of approach. However, we would note that the information in Table 12.5 could be rearranged easily by a reader, to find out the requested information.

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
345	4	12	1552	1552	Specify that 44/12 is the fraction resulting from the molar masses of CO2 and C, and useful to switch from a measurement in tC to a measurement in teqCO2.	France	Accepted with Modification	A cross-reference has been added to "Vol. 4 Ch. 2 Section 2.2.3". The application of this conversion factor is not unique to HWP and relevant text is included in Chapter 2 of the Volume 4, IPCC 2006 GL: "The conversion to CO2 from C, is based on the ratio of molecular weights (44/12). The change of sign (-) is due to the convention that increases in C stocks, i.e. positive (+) stock changes, represent a removal (or 'negative' emission) from the atmosphere, while decreases in C stocks, i.e. negative (-) stock changes, represent a positive emission to the atmosphere."
497	4	12	1	1719	Chapter 12 considers only semi-finished wood products (sawnwood, wood-based panels and paper& paperboard) as Harvested Wood Products . However, Roundwood is often used in some countries for constriction of buildings, private houses and that is the best option for long-lived carbon storage in HWPs. Unfortunately a such option is not considered within the chapter 12 at all. Please, add some guidance of estimation of such HWPs, how to avoid double-counting etc.	Russian Federation	Accepted with Modification	The direct use of roundwood or logs in end-uses is covered by the commodity class "other industrial roundwood" as part of "industrial roundwood". The use of these datasets is covered by Tier 3 methods as explained in Section 12.4.1.1. Please note that the commodity class "industrial roundwood" excludes e.g. telephone poles; the use of such datasets representing end-uses requires country-specific information on end-uses and methods, i.e. not to be combined with default FOD-function). We have amended Section 12.4.1.1 by adding the definition of "other industrial roundwood" to the list of definitions provided. We have also referred to "roundwood used directly in the construction of buildings" in the preceding discussion of the difficulties in using data on other industrial roundwood in conjunction with Tier 1 and Tier 2 methods.
499	4	12	1	1719	Would be useful to develop excel calculation sheet for HWPs as well as it is done e.g. for Tier 2 Steady State Method	Russian Federation	Rejected	We agree that it would be useful to provide standard calculation worksheets. However, experience from developing the 2006 GL suggests that is a major undertaking and unfortunately there was insufficient capacity and time for this work as part of this refinement. Please note that the authors provide a calculation example on how to implement the FOD default method (i.e. Equations 12.2 and 12.4) in Box 12.1.
501	4	12	170	170	There is no possibilities for "non-counting of emissions and removals" with various Approaches. Only double-counting is possible. Please, delete "non-counting".	Russian Federation	Rejected	The text referred to in the comment is explaining a general principle about the important purpose behind the definition of approaches. It does not offer any view on whether the available defined approaches actually lead to double-counting or non-counting of emissions. The text simply explains that one of the purposes of defining approaches is to avoid these sorts of outcomes.

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
1209	4	12	1580	1583	Recommend removing the Rüter-sourced figures and rely on the box-and-arrow diagrams, and remove the qualifications around their accuracy in lines 1569 & 1604. Alternatively, it could be qualified that the element of concern in the Rüter-sourced figures represent carbon capture and storage technology which may be developed in the future, but it not yet in use. However, this could require a more extensive discussion of carbon capture and storage / negative emissions technologies in the context of HWP methods which we believe is outside the scope of this review	Australia	Accepted with Modification	A note has been added to each of the figures in question, to explain that the vertical -/+ arrows appearing at the top of each diagram show where additions, deductions or transfers of carbon are involved in a given approach. This clarifies that the diagrams do not represent carbon capture and storage technology. The authors decided to maintain the presentation of the figures, including the illustration of the functionality of presented default methods. The first set of figures illustrates how the approaches are meant to be implemented by means of the presented default method. The second set of figures (i.e. box-and-arrow diagrams) have been included to further clarify differences in the relevant system boundaries.
1211	4	12	1252	1252	Recommend including a qualifying statement on Good Practice and transparency related to emissions of any imported biomass for combustion which lie outside the scope of a country's national emissions: "Where a consuming country is directly combusting harvested wood biomass which has been imported from another country, it is still good practice to identify and report the emissions arising from this activity for which the producing country would be responsible"	Australia	Rejected	The proposed inclusion of this point would be considered prescriptive. The guidance cannot prescribe how countries decide to report CO2 emissions for information purposes.
1213	4	12	265	269	Comment: The statement here is commendable and represents feedback from a number of parties. It does a very good job at ensuring parties are under no illusion about the international comparability of estimates under differing system boundaries, but without prejudicing the decision-making processes in other fora.	Australia	Noted	Noted.
2781	4	12	139	143	The 2006 IPCC Guidelines actually provides two examples of approaches that, conceptually, involve tracking carbon or CO2 fluxes (atmospheric flow and simple decay), not just one as indicated here. To correctly refer to the 2006 IPCC Guidelines, the text should refer to "examples" rather than "example".	Canada	Accepted	The text has been amended as recommended in the comment.
2783	4	12	164	167	For clarity, suggest the following: "An "approach" includes a conceptual framework for the estimation of CO2 emissions and removals (see inter alia Brown et al. 1998; UNFCCC 2003; Cowie et al. 2006). An approach also defines the particular system boundary referred to when calculating quantities of carbon entering, retained in and lost from the HWP pool."	Canada	Accepted	The text has been amended as recommended in the comment.

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
2785	4	12	206	208	Line 100 states that this chapter maintains the existing approaches covered in the 2006 IPCC Guidelines: in doing so, this chapter should seek to build on the existing approved guidance in the 2006 IPCC Guidelines and should be careful to not ignore or misrepresent that guidance. The 2006 GL includes the simple decay approach, and this approach should be represented accurately. A more accurate text is "Approaches identified in the 2006 IPCC Guidelines are the 'stock-change', 'production', 'atmospheric-flow' and 'simple decay' approaches. As explained below, these approaches have differences in terms of their conceptual frameworks and the system boundaries employed for calculations (Section 12.2)."	Canada	Accepted with Modification	The text has been amended to read: "The 2006 IPCC Guidelines considered four approaches known as the 'stock-change', 'production' 'atmospheric-flow' and 'simple-decay' approaches".
2787	4	12	206	215	Even though the 'simple decay' approach is similar to the 'production' approach in term of the system boundary, there is a fundamental difference clearly noted in the 2006 IPCC Guidelines that should be noted as well in this 2019 refinement. This is the difference as noted in the 2006 guidelines: "The Simple Decay Approach differs from Production Approach in that HWP pool is considered to be related to activities in the forest and hence does not assume instant oxidation of wood in the year of harvest.". This text should be maintained in this refinement and should be added to the text in this paragraph.	Canada	Accepted with Modification	The text in the relevant section and also in Annex 12.A has been amended extensively following very careful review and reconsideration of this subject. The 'simple-decay' approach is discussed more fully, and the point (and spirit) requested to be addressed in this comment has been covered, although the wording is different, mainly for the sake of clarity.
2789	4	12	209	2015	This text misrepresents the 2006 IPCC Guidelines on the subject of the simple decay approach, and our previous comments on this point have not been adequately addressed. The 2006 GL clearly states that the simple decay approach does not have the same conceptual framework as the production approach, in the sense that "conceptual framework" is described in section 12.3.1 as either 1) changes in carbon stocks within defined HWP pools or 2) actual CO2 fluxes to and from the atmosphere. Specifically, the 2006 GL (volume 4, page 12.30) states: "The Simple Decay Approach differs from Production Approach in that HWP pool is considered to be related to activities in the forest and hence does not assume instant oxidation of wood in the year of harvest." The text should be changed to read: "In this guidance, the 'simple decay' approach is treated as having the same system boundary as the production approach but a conceptual framework that focusses on quantifying actual CO2 fluxes, applied in conjunction with a country-specific calculation method. Further discussion of country-specific methods is presented in Section 12.4.4 on Tier 3 methods. Detailed information about the 'stock-change', 'production' and 'atmospheric-flow' approaches are provided in Annex 12.A."	Canada	Accepted with Modification	The text in the relevant section and also in Annex 12.A has been amended extensively following very careful review and reconsideration of this subject. The 'simple-decay' approach is discussed more fully, and the point (and spirit) requested to be addressed in this comment has been covered, although the wording is different, mainly for the sake of clarity.

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
2791	4	12	212	215	While the simple-decay approach is a variant of the production approach, it is important to distinguish why it exists. As the simple-decay variant estimates a release of carbon to the environment after the useful life of the product it is more easily compatible with the gains-loss approach, rather than the stock change approach of forest reporting. I agree that the authors don't need go into a great deal of detail throughout the document to provide specific guidance about simple-decay, but clear indications of where it differs and when it is applicable should be included when the Production approach is being discussed.	Canada	Accepted with Modification	The text in the relevant section and also in Annex 12.A has been amended extensively following very careful review and reconsideration of this subject. The 'simple-decay' approach is discussed more fully, and the point (and spirit) requested to be addressed in this comment has been covered.
2793	4	12	227	229	According to the 2006 IPCC Guidelines, the simple decay approach has the same conceptual framework as the atmospheric flow approach (see volume 4, page 12.30).	Canada	Accepted with Modification	The text in the relevant section and also in Annex 12.A has been amended extensively. The 'simple-decay' approach is discussed more fully, and the point requested to be addressed in this comment has been addressed.
2795	4	12	240	240	Given that there is also a simple decay approach, remove the word "three".	Canada	Accepted	The word has been deleted as requested. Please also note that the discussion of the 'simple-decay' approach has been revised and extended.
2797	4	12	259	260	This guidance should seek to build on existing approved guidance in the 2006 IPCC Guidelines and should be careful to not ignore or misrepresent that guidance. The 2006 GL discuss the boundaries of the simple decay approach and explains how the boundaries of the approaches compare (see volume 4, page 12:30). Add the following paragraph after the paragraph on the atmospheric flow approach: "The 'simple decay' approach estimates fluxes of CO2 from and to the atmosphere from HWP from wood harvested in a country. In other words, when applying the 'simple decay' approach the producing country reports fluxes from HWP produced by that country, regardless of where the HWP are consumed and used." As well, clarity would provided by adding the previously agreed sentence in the 2006 GL that explains the relationship among the HWP approaches and their boundaries: "Just as the Production Approach differs from the Stock-Change Approach (for the production approach all stock changes are accounted for and reported by the producer and for the Stock-Change Approach all stock changes are reported by the country where they occur) the Simple Decay Approach (SDA) is similarly related to the Atmospheric Flow Approach (for the Simple Decay Approach all CO2 release is reported by the country where the HWP was harvested and for the Atmospheric Flow Approach all CO2 release is reported by the country where the release occurs)."	Canada	Accepted with Modification	The text has been amended as requested, but with some differences in wording, mainly for the sake of clarity.
2799	4	12	265	265	Given that there is also a simple decay approach, remove the word "three".	Canada	Accepted	The word "three" has been deleted as requested.

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
2801	4	12	474	482	The definition of the feedstock "Recovered Paper" should note the potential risk of double counting when using this feedstock and depending on the estimation approach, given that the material included in this commodity may have been already counted under wood pulp. A recommendation should be given to the inventory compiler to exercise caution when considering this type of post-processing material.	Canada	Rejected	"Recovered paper" is not "counted" under "Wood Pulp" as it is a different commodity class used as a feedstock. The estimation (i.e. presented default method) does not track and trace carbon molecules, but estimates the input volumes/masses of different feedstock categories into the manufacturing process of commodity classes, which enter the HWP carbon pool, such as "paper and paperboard" (i.e. at the level of paper mills). The amount of feedstock commodity in the commodity classes "Recovered paper" + "Wood pulp" never exceed 100% (see Equation 12.7). If country-specific methods (not "approaches") are used (i.e. other than Equation 12.7), the risk of double-counting is not exclusive to the commodity class of "Recovered paper".
2803	4	12	637	637	This line should refer to Equation 12.2 (where the k decay constant is actually used and explained) instead of Equation 12.3	Canada	Accepted	The cross-reference has been amended to refer to Equation 2.2.
2805	4	12	1242	1242	Depending on the method tier/approach used and on the AD available, emissions from biomass burnt on harvesting sites may be included in "Biomass burning", therefore we suggest to add the text "or as part of biomass burning emissions" after the text "harvesting sites"	Canada	Accepted with Modification	The paragraph has been rewritten in the light of the comment and now reads, "The CO2 emissions from burning 'unutilized wood harvest residues' without energy recovery, generated as part of harvesting, are included as a component of the CO2 emissions and removals estimated for forests and other wood producing land categories and are reported by the producing country".
2807	4	12	1295	1298	The statement given in these lines implies that if a country estimates CO2 emissions from burning woody biomass for information purposes in the Energy sector (consistently with the non-CO2 emissions estimated and reported by the consuming country in this sector) and also estimates and reports CO2 emissions from burning woody biomass in the AFOLU sector following a specific approach chosen by the country, these two estimates may not be consistent between themselves depending on the approach and estimation method used by the reporting country for AFOLU. Suggest to note this potential inconsistency in this paragraph.	Canada	Accepted	A statement along the lines suggested by the comment has been added.

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
2809	4	12	1509	1520	Line 100 states that this chapter maintains the existing approaches covered in the 2006 IPCC Guidelines: this chapter should seek to build on the existing approved guidance in the 2006 IPCC Guidelines and should be careful to not ignore or misrepresent that guidance. The 2006 GL includes the simple decay approach, and this approach should be represented accurately. It is incorrect to say that specific guidance on implementation of the simple decay approach was not given in the 2006 IPCC Guidelines. Guidance was provided on the approach in the 2006 GL: see volume 4, page 12.30 and page 12.24 which explain which HWP variable to use for the approach, with the calculation of the variable explained earlier in the chapter. Replace this paragraph with: "The 2006 IPCC Guidelines defined how to calculate emissions and removals of CO2 associated with HWP for the 'stock-change' approach, 'production' approach, 'atmospheric flow' approach and 'simple decay' approach. A detailed supporting description is provided in this annex for the first three. The 'simple-decay' approach is also maintained in this updated guidance by recognizing it as having a system boundary like that of the production approach but using a conceptual framework based on identifying and quantifying actual CO2 fluxes to the atmosphere, in combination with a specific (essentially Tier 3) calculation method. The general guidance on Tier 3 methods in the main chapter (Section 12.4.4) may be referred to."	Canada	Accepted with Modification	The text in Annex 12.A has been amended extensively following very careful review and reconsideration of this subject. The 'simple-decay' approach is discussed more fully, and the point (and spirit) requested to be addressed in this comment has been covered, although the wording is different, mainly for the sake of clarity.
2811	4	12	1528	1529	Include simple decay approach.	Canada	Accepted with Modification	The text in Annex 12.A has been amended extensively following very careful review and reconsideration of this subject. The 'simple-decay' approach is discussed more fully, and the point (and spirit) requested to be addressed in this comment has been covered.
2813	4	12	1539	1539	To reflect the simple decay approach, say "(i.e. atmospheric flow and simple decay approaches)"	Canada	Accepted with Modification	The text in Annex 12.A has been amended extensively following very careful review and reconsideration of this subject. The 'simple-decay' approach is discussed more fully, and the point (and spirit) requested to be addressed in this comment has been covered.
2815	4	12	1567	1570	The box-and-arrow diagram looks conceptually complete and accurate. If not, then it should be explained how it is not complete or entirely accurate, or the diagram should be modified to make it complete and accurate.	Canada	Accepted with Modification	The sentence that caused confusion about the 'box-and-arrow' diagram has been deleted.
2817	4	12	1602	1605	The box-and-arrow diagram looks conceptually complete and accurate. If not, then it should be explained how it is not complete or entirely accurate, or the diagram should be modified to make it complete and accurate. Figure 12.A.3 is not completely clear: the HWP C-pool in use should indicate it is from domestically harvested wood.	Canada	Accepted with Modification	The sentence that caused this confusion regarding the box and arrow diagram has been deleted. Figure 12.A.3 is retained. Having evaluated Figure 12.A.3, the authors confirm that it correctly reflects that the timber originates from forest within the reporting country borders.

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
2819	4	12	1528	1529	The box-and-arrow diagram looks conceptually complete and accurate. If not, then it should be explained how it is not complete or entirely accurate, or the diagram should be modified to make it complete and accurate. Figure 12.A.5 is quite confusing - why not simply show the approach based on its actual conceptual framework as opposed to trying to mix the conceptual framework with methods for estimation involving carbon stocks? Or at least start with a figure that shows the conceptual framework so that it is clearer what the approach is meant to do.	Canada	Accepted with Modification	The sentence that caused confusion about the 'box-and-arrow' diagram has been deleted. Figure 12.A.5 is retained. Having evaluated Figure 12.A.5, the authors decided to maintain the presentation of the figures, including the illustration of the functionality of presented default methods. The figure illustrates how the atmospheric-flow approach is meant to be implemented by means of the presented default method. The objective of the guidelines is to provide practical guidance on how to implement the approaches by means of method – not to only present concepts. The figures thus complement each other.
2911	4	12	640	646	Box 12.1 MS Excel equations for stock change values are wrong; for example, C9-C8 should be C8-C7 while carbon stock change = Ct+1 - Ct	Hungary	Accepted with Modification	We have added a footnote to Box 12.1 to explain that the calculation of the carbon stock change in year t does not require fore-knowledge of Ct+1, because of the formulation of Equation 12.2. However, the specifics of the comment appear to be based on a misunderstanding. The spreadsheet calculation example in Box 12.1 has been thoroughly checked and appears to comform exactly with Equation 12.2. The stock change year (i) is calculated as the carbon stock in year (i+1) minus the carbon stock in year (i), i.e. cell D8=cell C9-cell C8.
3577	4	12	103	103	The encouragement to use the refinement, as opposed to the 2006 GL, seems inconsistent with the approach taken in every other chapter, and appears to suggest that Chapter 12 be treated differently than other chapters. Suggest deleting this sentence	United States of America	Accepted	The sentence referred to has been deleted.
3579	4	12	105	106	Has a new HWP calculation worksheet been made available as part of the refinement? If not, the inability to use the 2006 worksheet may be a real challenge for some countries.	United States of America	Rejected	We agree that it would be useful to provide standard calculation worksheets. However, experience from developing the 2006 GL suggests that this is a major undertaking and unfortunately there was insufficient capacity and time for this work as part of this refinement. Please note that the authors provide a calculation example on how to implement the FOD default method (i.e. Equations 12.2 and 12.4) in Box 12.1.
3581	4	12	244	259	Lines 244-246 state that under all approaches changes in carbon stock are reported by the "producing country." Lines 247-249 state that under a stock-change approach carbon stock changes are reported by the "consuming country." Similarly, Lines 256-269 explain that emissions and removals from HWP are reported by the "consuming country." Please clarify these apparently contradictory statements.	United States of America	Accepted	We agree that the meaning of this sentence was unclear. The paragraph has been re-written to clarify the meaning.

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
3583	4	12	1205	1208	It is good that this section has this basic statement on the reporting of biomass used for energy. However, it is not detailed or strong enough to cover this crucial point which is very often misunderstood and/or misconstrued (e.g., when people use this construct as a basis to determine biomass emissions as neutral. Specifically, this paragraph should also include additional text that puts more emphasis on how this reporting practice (of assigning the biogenic emissions associated with biomass use for energy to AFOLU) ONLY works when assessing/inventorying emissions across all or at least both the AFOLU and energy sectors. It should also assert that when looking at individual sectors (e.g., assessing energy sector without also assessing AFOLU), this reporting method for assigning biogenic CO2 emissions to AFOLU does not hold because the biogenic CO2 contribution from AFOLU-based biomass combustion/conversion is not accounted for. It is imperative that these important disctinctions be made to eliminate further confusion on how the IPCC views biogenic CO2 emissions.	United States of America	Accepted with Modification	We have added an additional sentence which goes some way to addressing the spirit of this request. However, it should be noted that the primary purpose of GHG inventories is for national GHG reporting and not, for example, for the purposes of assessing the impacts of current or future policies (e.g. with regard to bioenergy). Other types of assessment and tools are more appropriate for this purpose.
3843	4	12	333	333	Figure 12.1: Minor: It would be helpful for the inexperienced user if the text in the step 3 box mirrored the text line 316 (emission factors vs. half-lives).	Norway	Accepted	Text has been added to the relevant box in the decision tree to give consistency.
3845	4	12	333	333	Figure 12.1, step 3 box: When a country has FAOSTAT activity data for the three HWP default categories Yes is the intuitive answer here. Please consider to revise/add one more choise (box) to reflect the data needed as mentioned in 12.4.3 (i.e. data on sub-categories is needed).	Norway	Rejected	FAOSTAT provides generic data for many countries, while a country specific data source will permit a country to make a more detailed or refined calculation. Therefore, availability of FAOSTAT activity data does not imply the availability of country-specific data. The supporting discussion of Step 3 in Section 12.4.1 refers the reader to Sections 12.4.1.1 and 12.4.3 where detailed guidance and explanation is given.
3847	4	12	975	982	The use of HS categories only provide the Tier 2 data on import and export. It would be very helpful with guidance on how Tier 2 activity data on national production could be collected for sub-classes of the three default HWP commodity classes since the data might be scattered and/or kept confidential. Please spesify if e.g. annual national surveys could be accepted.	Norway	Accepted with Modification	The text has been amended to explain that it is highly desirable for data sources to be publicly available and that confidential data sources are likely to be unsuitable for use unless they can be shared for the purposes of transparency and verification.
1731	4	Annexes	3077	3078	We suggest to replace the reference to "Rösemann et al. 2017" by "Haenel et al. 2018".	Germany	Accepted	Changes were included in the footnote (current location of footnote page 10.84)
3849	4	Annexes	1590	1590	Annex 3A.5: "2" in N2O needs to be put in subscript (two accounts).	Norway	Accepted	Text edits made as requested.
651	4	Cover page	1	1	General editorial comment on all chapters in Volume 4: Emissions and removals are referred to inconsistently across the chapters - e.g. Chapter 1 and Chapter 4 refer only to "emissions and removals", Chapter 2 refers to "emissions and removals" and "emissions/removals (E/R)", Chapter 3 and Chapter 12 refers to "emissions and removals" and "emissions/removals", Chapter 7 refers to "emissions and removals" and "emissions (removals)".	New Zealand	Noted	

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
653	4	Cover page	1	1	General editorial comment on all chapters in Volume 4: when "it is good practice" is stated sometimes it is italicised and sometimes not, so please check for consistency throughout volume. We do find it useful to italicise this material.	New Zealand	Noted	
103	4	General			Comment on Volume 4, AFOLU: We have expressed before our concerns with respect to the references to the 2013 supplement on wetlands in relation to organic soils. As Government department and as inventory compilers, we want this 2019 refinement to be adopted by the COP and/or CMA as mandatory basis for the elaboration of GHG inventories under the UNFCCC. 2013 supplement is only for voluntary use, governments didn't manage to adopt it as mandatory for the elaboration of GHG inventories under the Convention, and we fear that the references to the supplement in the refinement could jeopardize the adoption of the 2019 refinement under UNFCCC as methodological guidance to be used for inventories in the future. Therefore, we suggest to delete those references, or replace every reference with a neutral language: "2006 GLs on organic soils were complemented by 2013 supplement on Wetlands. This document does not preempt which of these guidance are to be used."	Spain	Rejected	Organic soils and wetlands in general were out of scope for refinement, with the exception of flooded lands. The 2013 Wetlands Supplement provides the latest guidance associated with wetlands, which has been reviewed and approved by the IPCC plenary. The decision about using this guidance for national inventory reporting is made in the UNFCCC. This refinement just points to the latest guidance on wetlands, which has been approved by the IPCC process and is available for reference.
67	4	General Comment			The IPCC guidance has to be developed in a simplified way to enable all countries to estimate their corresponding ghg emissions taking into account shortage of data and national capacities and expertise Meanwhile, the way the guidelines is developed is somehow written in difficult way to be understandable in some parts (particularly AFOLU), so it needs to be taken into account more simplifying the GL language in future refinements	Egypt	Noted	The acttion is outside the scope of the agreed refinements listed in the ToR. To be further considered by IPCC

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
1515	4	General Comment			No refinement was foreseen for Chapter 1, therefore no comments can be provided in the form. However, there are substantive and significant new texts that need revision. The sentence in lines 111-112, should make it clear that the mixing of anthropogenic and natural causes (which cannot be consistently separated) is the reason behind the use of the MLP. The following sentence: "In the AFOLU sector, the application of the Managed Land Proxy (MLP) means that IAV can be caused by both anthropogenic and natural causes." should be revised as: "In the AFOLU sector, the managed land proxy (MLP) is used because emissions and removals, including their IAV, are caused by both anthropogenic and natural causes, which cannot be consistently disaggregated." In line 112, "The two largest causes" should read "The three largest causes". In line 114, "and" should be deleted before (2) In line 116, "The third cause" should be a continuation of the previous list, as "respiration, and (3) the variation in the rate...".	EU	Accepted with Modification	Text has been revised to make reference to 3 main causes of IAV. The reason why MLP is used was already explained in previous paragraphs
1517	4	General Comment			No refinement was foreseen for Chapter 1, therefore no comments can be provided in the form. However, there are substantive and significant new texts that need revision. Lines 118-124 should be deleted or should address inter-annual variability only, without making assertions about the disaggregation of causes. "disaggregating MLP emissions and removals into human and natural effects" would be desirable, but it is currently not possible, and no guidance is provided for that. The guidance in Chapter 4 under IAV does not provide sufficient guidance to identify causes of variability.	EU	Accepted with Modification	Text has been revised to clarify that is referring to "interannual variability in emissions and removals due to natural disturbance". In addition, additional text was introduced in Section 1.4 to better explain the guidance provided, including its limitation: "The reason that the Guidelines have limited the disaggregation to E/R from ND is because scientific methods to quantify all-natural effects are currently not available"

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
1519	4	General Comment			No refinement was foreseen for Chapter 1, therefore no comments can be provided in the form. However, there are substantive and significant new texts that need revision. Lines 130-132 should be deleted or should be rewritten as follows: "Optional guidance that may be used by countries that choose to disaggregate AFOLU emissions and removals into those that are considered to be linked to irregular extreme events beyond the control of the country from other, more regular effects." This is because the term "natural disturbance" does not necessarily imply non-anthropogenic origins (e.g., most forest fires, both on managed and unmanaged land, are ignited by humans and many major disturbances on managed land are materially inlfuenced by management), and because the guidance does not disaggregate "natural disturbances" (from other emissions and removals on managed land), but major (exceptional) disturbances from smaller ones, irrespective of causality.	EU	Rejected	The guidance is not limited to " irregular extreme events beyond the control of the country from other, more regular effects."
1521	4	General Comment			No refinement was foreseen for Chapter 1, therefore no comments can be provided in the form. However, there are substantive and significant new texts that need revision. The sentence in lines 405-407 should be deleted or revised as follows: "In addition, Chapter 2 provides an optional guidance that may be used by countries that choose to disaggregate AFOLU emissions and removals into those that are considered to be linked to irregular extreme events beyond the control of the country from other, more regular effects." This is because the term "natural disturbance" does not necessarily imply non-anthropogenic origins (e.g., most forest fires, both on managed and unmanaged land, are ignited by humans and many major disturbances on managed land are materially inlfuenced by management), and because the guidance does not disaggregate "natural disturbances" (from other emissions and removals on managed land), but major (exceptional) disturbances from smaller ones, irrespective of causality.	EU	Accepted with Modification	The guidance is not limited to " irregular extreme events beyond the control of the country from other, more regular effects." Nevertheless, additional text was introduced in Section 1.4 to better explain the guidance provided.

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
99	5	2			Management Data, we propose to use Singapore's total waste generation data which includes industrial and commercial waste as MSW data. We suggest that the IPCC use the following data instead:- 1) Year 2000 Population, 4.03 million, according to Singstats. 2) Year 2000 Total waste generated, 4.64 million tonnes, from Data.gov.sg 3) Year 2000 Total waste landfilled, 0.36 million tonnes, from Data.gov.sg 4) MSW Generation Rate Values (tonnes/cap/year) for Year 2000: 1.15 (i.e., 4.64 divided by 4.03) 5) Fraction of MSW disposed to SWDS for Year 2000: 0.08 (i.e., 0.36 divided by 4.64) 6) Year 2010 Population, 5.08 million, according to Singstats 7) Year 2010, Annual Report of EPD, Page 63, Table 20, Amount of non-incinerable waste directly landfilled at Semakau Landfill. 8) Year 2010 Total waste generated, 6.52 million tonnes, from Data.gov.sg 9) Year 2010 Total waste recycled, 3.76 million tonnes, from Data.gov.sg 10) Year 2010 Total non-incinerable waste landfilled, 0.17 million tonnes, from Data.gov.sg 11) Year 2010 Total incinerable waste, 2.59 million tonnes, from Data.gov.sg 12) Composting = 0 13) MSW Generation Rate Values (tonnes/cap/year) for Year 2010: 1.28 (i.e., 6.52 divided by 5.08) 14) Fraction of MSW disposed to SWDS (Open dumped) for Year 2010: 0 15) Fraction of MSW disposed to SWDS (Disposed to landfills) for Year 2010: 0.03 (i.e., 0.17 divided by 6.52) 16) Fraction of MSW incinerated for Year 2010: 0.40 (i.e., 2.59 divided by	Singapore	Accepted with modification	We thank for data provision from Singapore. Waste generation rate, and fraction of MSW treated including disposal to open dumping, landfill, incineration and other have been updated for the year 2010. However, values in the year 2000 is the data from 2006 IPCC Guidelines, therefore there is no change. In addition, in case that country has their own specific value, country may consider to use as appropriate.

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
101	5	2			2016 waste composition which can be found in the 14th Annual Report of Environmental Protection Division (EPD) of the National Environment Agency (NEA) - Page 42, Table 7.1, "Types and Amounts of Waste Disposed of and Recycled in 2016" 1) Food waste: 0.10 (i.e., 791,000 divided by 7,814,200) - based on "Food waste" as stated in EPD-NEA Report 2) Garden (yard) and park waste: 0.04 (i.e., 320,500 divided by 7,814,200) - based on "Horticultural Waste" as stated in EPD-NEA Report 3) Paper and cardboard: 0.15 (i.e., 1,183,100 divided by 7,814,200) - based on "Paper/Cardboard" as stated in EPD-NEA Report 4) Wood: 0.07 (i.e., 530,700 divided by 7,814,200) - based on "Wood/Timber" as stated in EPD-NEA Report 5) Textiles: 0.02 (i.e., 150,700 divided by 7,814,200) - based on "Textile/Leather" as stated in EPD-NEA Report 6) Nappies (disposable diapers): - (Not available) 7) Rubber and leather: 0.004 (i.e., 32,700 divided by 7,814,200) - based on "Scrap Tyres" as stated in EPD-NEA Report 8) Plastics: 0.11 (i.e., 822,200 divided by 7,814,200) - based on "Plastics" as stated in EPD-NEA Report 9) Metal: 0.19 (i.e., (1,357,500 + 97,200) divided by 7,814,200) - based on "Ferrous Metal" and "Non-ferrous Metals" as stated in EPD-NEA Report 10) Glass (and pottery and china): 0.009 (i.e., 72,300 divided by 7,814,200) - based on "Glass" as stated in EPD-NEA Report 11) Other: 0.31 (the rest including "Construction and demolition waste", "Used slag", "Ash & Sludge", "Others (includes stones, ceramics & rubber" as stated in EPD-NEA Report)	Singapore	Accepted with modification	We thank Singapore for the updated information and we considered its reliability. Correction in Table 2A2 has been done to include the addition of reference. Changes are based on calculation of values in the provided reference.
159	5	2	1	525	The set of default data (generation rate, MSW composition, management data…) has been improved a lot : more recent data are provided (allowing an evolution along the time series), more detailed data (much more parties are documented). Moreover, open dumps are now considered in the default data (management data). On the basis of this new set of data concerning MSW, all parties should be able to identify data adapted to their national circumstances or to check the national data. More information is provided concerning sludge.	France	Noted	We thank reviewer for kind comment.
571	5	2	234	237	Tables 2.4 and 2.5 are missed in the new version.	Russian Federation	Noted	No action can be taken because comment is out of scope of 2019 Refinement.

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
1227	5	2		294	(All Tables) Recommend reviewing data relating to Australia, including zero waste composted and composition of MSW containing zero plastic and metals. Would suggest that both AU and NZ data is reviewed. The data presented for waste generation in Australia and New Zealand are not accurate. Better numbers, at least for Australia (which is 80% of Australia and New Zealand) are: MSW generation 0.57 t/person; fraction open dumped 0; fraction to landfill 0.58; fraction incinerated 0; fraction composted 0.21; fraction to other 0.21.	Australia	Rejected	We thank for your comments. Table 2A.1 showed the waste generation and management data in the year 2000 (from 2006 IPCC Guidelines) and in the year 2010. The values are in the same year for every countries with the aims to be consistent and comparable among countries and regions. We have checked the reference of Australia National Waste report 2016, table 12 (provided for comment 1229) and found that the value in 2010-2011 is 0.61 t/capita which is in line with our proposal in the refinement. In addition, National Greenhouse and Energy reporting (measurement) Determination was compiled on 1 July 2018 and registered on 25 July 2018 which is after the cut off date (25 June 2018).
1229	5	2		294	(All tables) Recommend considering data relating to Australia for inert waste fractions that can be derived from the national waste report workbook ('other national data'): metals 0.03; plastics 0.12; glass 0.04.	Australia	Accepted with modification	Referring to provided reference - National Waste Report workbook on 'other national data' - waste composition of Australia in Table ~~@2~~A.2 has been changed.
1967	5	2	288	290	MSW Generation and Management Data (Table 2A1) presented for Uruguay is not correct. The correct values are (SOURCE: MVOTMA): Generation rate 0,35 ton/cap.year; MSW disposed in SWDS 82 %; Open dump: 0% ; Other managment:18 % (includes compost, recycling and others)	Uruguay	Rejected	Reference provided is of April 2019 which is after the literature cut off date of 25 June 2018 for the 2019 Refinement
157	5	3	484	484	A new type of SWDS has been added in the 2019 Refinement: active-aeration. The practice of implementation of active aeration of solid waste disposal site (SWDS) is very limited (Appendix 3A.2, chapter 3, Volume 5). On the other hand, the case of "bioreactors" is still not considered although it may correspond to an important part of SWDS in some Parties, such as France.	France	Noted	No action can be taken because comment is out of scope of 2019 Refinement.
1215	5	3	348	377	Recommend incorporating two papers published since the second review of the Guidelines. The papers have suggested new DOCf factors for wood and wood products.	Australia	Rejected	We thank for the additional reference suggestion. However, this paper is published on 15 December 2018 which is after the literature cut off date of 25 June 2018 for the IPCC 2019 Refinement. Therefore, it is unfortunate that we can not combine this reference in the IPCC 2019 Refinement.
1217	5	3	355	356	Recommend including two additional references: Less decomposable wastes include tree branches and harvested wood products such as sawn and engineered wood materials.	Australia	Noted	Reference has already been in the FD.
1219	5	3	360	361	Recommend including one additional reference: The biodegradation yield of the waste component under anaerobic condition varies greatly depending on the material type, ranging from minimal yield for wood and wood products	Australia	Accepted	Reference has been added.
1221	5	3	362	363	Recommend including one additional reference: Meanwhile, biogenic carbon conversion of paper products varies greatly (21% to 96%) depending on the type of paper.	Australia	Rejected	We thank for the additional reference suggestion. However, this paper is published on 15 December 2018 which is after the literature cut off date of 25 June 2018 for the IPCC 2019 Refinement. Therefore, it is unfortunate that we can not combine this reference in the IPCC 2019 Refinement.

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
1223	5	3	366	367	Recommend including one additional reference and new text as follows to reflect more recent literature: "For the engineered wood products, the DOCf was low for key product types such as particle board, medium-density fiber board and plywood, ranging from 0.7-1.6% (Wang et al 2011; Ximenes et al 2018a). There is some evidence that bamboo products may decay to a greater extent in landfills than engineered wood products, with a suggested carbon conversion of 11.3 % (Ximenes et al 2018a)"	Australia	Rejected	We thank for the additional reference suggestion. However, this paper is published on 15 December 2018 which is after the literature cut off date of 25 June 2018 for the IPCC 2019 Refinement. Therefore, it is unfortunate that we can not combine this reference in the IPCC 2019 Refinement.
155	5	5	71	72	Waste categories are not defined and do not seem to match with those of the Basel Convention. Hence some questions: do industrial waste include partially or totally hazardous waste? Category "fossil liquid waste" appears in table 5.2, but is not mentionned in lignes 71-72.We suggest adding definitions of each waste categories refered to in the guidance.	France	Rejected	The 2006 IPCC Guidelines have defined waste goes into incineration include MSW, Industrial wate, harzadous waste and sewage sludge. Detail of each categories are explained in chapter 2 section 2.2.3 for industrial waste, section 2.2.4 for hazardous waste and clinical waste. The 2006 IPCC Guidelines focused on some hazardous wastes that are incinerated and can contribute to the fossil CO2 emissions from incineration which ~~is~~ do not match with Basel convention. Both contents in line 71-72 and table 5.2 on fossil liquid waste is originally in the 2006 IPCC Guidelines and is out of scope of the refinement.
505	5	6	177	178	The phrase "sludge produced in primary treatment is not accounted for in this category" is confusing - because it can be considered that such sludge is not contain BOD (according to the Table 6.6a(new) it is not true) so we don't need to include it into the calculations. Also there is no clear explanation where sludge produced in primary treatment should be accounted. For example, such sludge can be composted or incinerated on-site and then relevant emissions should be included in the wastewater treatment sector.	Russian Federation	Accepted	The text in quotes has been removed from the text. Primary treatment sludge was considered in the development of the emission factors, and the text has been clarfied to say that emissions from sludge, other than from the anaerobic digestion of sludge at WWT plants, is reported in other sections of Volume 4 and 5.
507	5	6	180	185	It should be better to move phrase "Some sludge is incinerated before land disposal." (line 185) after the words " and drying." (line 182). Also better to add "digestion" after words "Land disposal, composting, " (line 182) because this process also considered in the Chapter 4 together with the compostion.	Russian Federation	Accepted with modification	The sentence was moved to improve the text, but the word digestion was not added because emissions from anaerobic sludge digestion at wastewater treatment plants must be considered in Chapter 6.
509	5	6	189	200	It should be clear explained how to distinguish on-site and off-site sludge treatment or to write that the final decision is on experts.	Russian Federation	Accepted with modification	Additional text has been added to specify that only anaerobic digestion of sludge at wastewater treatment plants should be reported under this chapter. In addition, the terms onsite and offsite were reviewed and removed when unnecessary.
511	5	6	195	196	Arrows and lines for "Wastewater" and "Sludge" flows are not clearly distinguished from each other when printed.	Russian Federation	Accepted	Further differentiation of lines was incorporated.
513	5	6	195	196	It should be better to change words "reported" to "considered" in the boxes "Incineration", "Composting", "Landfilling", and "Land application" because emissions from these processes can be reported in the Chapter 6 or relevant chapters depending on offsite or onsite sludge treatment.	Russian Federation	Rejected	Emissions from incineration, composting, landfilling, and land application are not to be reported in Chapter 6; therefore, no change to the figure was made. Further text revisions were made to improve the clarity of this reporting, and confirm that only emissions from anaerobic digestion of sludge at wastewater treatment plants should be considered and reported in Chapter 6.

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
515	5	6	198	200	Probably worth adding explanation about biogenic CO2 emissions from sludge anaerobic treatment (from gas recovery) and incineration as such emissions should be included in the inventory (NIR) (as information items if they are in the Energy sector).	Russian Federation	Rejected	As explained in Volume 1, Section 1.1, CO_2 emissions of biogenic origin are not included in Waste sector since any net changes in carbon stock of biogenic origin is covered in the AFOLU sector. CO_2 emissions from biomass combustion sources are reported in the Energy sector as a memo item.
517	5	6	253	256	The 2006 IPCC Guidelines previously provided different emission factors for “well managed” and “not well managed” centralised aerobic treatment systems not only because the quantity of organic in the system but on the idea that in the "not well managed" system anaerobic conditions may be formed (in places). Please consider a possibility to maintain the disaggregation among “well managed” and “not well managed”.	Russian Federation	Rejected	It was commented in the previous expert review round in response to comment number 6218 that for MCF there is no need to distinguish factors between "well managed" and "not well managed" plants; indeed an explanation was provided for this refinement in the Final Draft on line 231-234 and again on line 520-524 (i.e. "If country-specific data are available to differentiate whether systems are overloaded or not well managed, these situations should be reflected in the calculation of TOW (for inflow overload) or Smass (for systems that are not well managed and therefore not achieving the expected removal of sludge"). We consider the literature data insufficient to be able to accurately distinguish the emissions profiles of "well managed" and "not well managed" plants.
519	5	6	303	324	Please add some explanation how to distinguish on-site and off-site sludge treatment or to write that the final decision is on experts.	Russian Federation	Accepted with modification	See response to comment 509.
521	5	6	326	339	Information in the Table 2.4A (new) for sludge DOC content in fraction can lead to mistakes, because despite DOC data in the Equation 3.7 (Volume 5 Chapter 3) is in fraction, similar information in the Tables 2.4 and 2.5 (Volume 5 Chapter 2) is given as percentages. Also other data in the Table 2.4A (new) are given as percentages. Please harmonize it if possible.	Russian Federation	Accepted	We agree with comment. Fraction of DOC in Table 2.4a are changed to percent as suggested.
523	5	6	334	335	Please add "compostion" after the words "incineration, landfills," (line 335).	Russian Federation	Accepted with modification	We have added the word "composting."
525	5	6	344	356	More clear explanation that component R in the Equation 6.1(updated) refers only to CH4 recovery from anaerobic processes, different from sludge digestion (methantanks), is needed. Also, more direct reference to methodology for estimation emissions from methane combustion for energy generation can be useful (Volume 2 Chapter 2 Sludge Gas).	Russian Federation	Accepted with modification	R refers to all CH_4 methane recovered from wastewaterWW treatment, such as methane captured on filters exhausted from covered (anaerobic) treatment ponds, as well as CH_4 recovered from or anaerobic sludge digestion. The approach to estimation of emissions from wastewater WW treatment in this chapter covers all emission sources and sinks (recovery) on-site ofat a wastewater treatment WWT plant. This includes the commonly used flaring or combustion of biogas generated from sludge stabilisation but also methane captured on filters exhausted from covered (anaerobic) treatment ponds.
527	5	6	385	386	Please consider adding calculating emissions from other onsite sludge treatment processes as another step.	Russian Federation	Rejected	Emissions from other sludge treatment processes are considered as negligible and were not changed during work on this refinement.

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
529	5	6	419	442	It should be noted, that despite correct, the Equation 6.1 (updated) can be confusing then calculating, because in proposed steps this equation is more suitable to estimate only emissions from treated wastewater, not from discharge pathways. It is especially evident as in the Equation 6.1A(new) there are two special components to calculate emissions from wastewater effluent discharged to environments. Additional explanations or text reorganization may be useful.).	Russian Federation	Accepted	The fact that CH_4 emissions from both discharge pathways and treatment systems have to be considered in the inventory has been emphasised in the document. In particular a list of treatment systems and discharge pathways has been added in the text before Equation 6.1 (UPDATE).
531	5	6	423	423	It can be useful to add explanation about checking in calculations that TOW input (both as a whole and at the every one considered wastewater treatment system) should be consistent across the wastewater pathways and at the end with TOW output to the environments taking into account organics removal including loss to sludge and biological decomposition.	Russian Federation	Rejected	TOW input and TOW output do not have to be equal, and in fact won't be equal due to conversion of TOW into CH_4 and into CO_2 and other NMVOC. The information on how to estimate TOW is provided in Section 6.2.2.3 - Choice of Activity Data, including an example of application.
533	5	6	440	444	Units for CH4 emissions in the Equation 6.1A(new) (and others equations) in kg can be a reason for mistakes, because the final emissions data for NIR should be in Gg (kilotons). Please, check these units again.	Russian Federation	Accepted	Equation 6.1A(New) has been modified to result in final emissions in Gg.
535	5	6	440	455	There are two special components to calculate emissions from wastewater effluent discharged to aquatic environments in the Equation 6.1A(new). It is noted, that wastewater effluent discharged to (wet) soil is excluded from the equation despite the same origin and produced methane emissions (see Table 6.3 (updated)). Please, add such emissions as additional coponent of the equation or explain why it is omitted.	Russian Federation	Accepted with modification	A simpler version of Equation 6.1A (NEW) is now proposed which is simply the sum of methane emissons from all discharge pathways and treatment systems. Some additional discussion has been added to the text before Equation 6.1 (updated) to note that this equation has to be applied to all types of discharge (discharge to reservoirs, lakes and estuaries; discharge other than to reservoirs, lakes and estuaries; and discharge to sewers) which includes discharge of treated and discharge of untreated wastewater.
537	5	6	440	455	If TOWEFFtreat is only for discharged treated wastewater effluent than untreated wastewater effluent is missed despite it also can be discard to different environment (as %Tiers 1 and 1A). Please consider the possibility to add untreated wastewater effluent or clearly explain how it is included.	Russian Federation	Accepted with modification	Untreated wastewater effluent should use TOW, since no removal of organics happens before discharge. We have added an explanation in Equation 6.3A to clarify this.
539	5	6	440	455	The components %Tier 1 and 1A in the Equation 6.1A(new) can be confused with the component FWTk from the Equation 6.3D(new). Also it is a source of mistakes if experts already have used FWTk for wastewater treatments systems, differentiated by discharged wasterwater effluents receiver types. Please add some explanations and quidance.	Russian Federation	Accepted with modification	In response to comments, the components of % Tier 1 and 1A have been removed.
541	5	6	440	455	Please consider reorganizing Equation 6.1A(new), for example, as a sum of emissions from water discharge to the environment, untreated system, and treated system (according to the Table 6.3(updated)) with additional equation especially for emissions from discharged wastewater effluents.	Russian Federation	Rejected	Please see response to comment 535. There is no reason to propose two separate equations for dischage pathways and for treatment systems as the equation 6.1 (updated) can be applied to both cases and, moreover, there is no need to report separately discharge and treatment emissions.

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
543	5	6	519	524	The 2006 IPCC Guidelines previously provided different emission factors for "well managed" and "not well managed" centralised aerobic treatment systems not only because the quantity of organic in the system but on the idea that in the "not well managed" system anaerobic conditions may be formed (in places). Please consider a possibility to maintain the disaggregation among "well managed" and "not well managed".	Russian Federation	Rejected	See response to comment 517.
545	5	6	543	544	In the Table 6.3(updated) type of pathway "Discharge other than to reservoirs, lakes, and estuaries" could be better to change to "Discharge to other aquatic environments than to reservoirs, lakes, and estuaries" (or make a according remark) because now it can be a reason for confusion with discharge to soil.	Russian Federation	Accepted	Changed to 'aquatic environments'.
547	5	6	543	544	In the Table 6.3(updated) type of pathway "Discharge to soil" (wet climate) wasn't marked as particular tier, as were marked pathways "Discharge other than to reservoirs, lakes, and estuaries" and "Discharge to reservoirs, lakes, and estuaries". It would be better marked as Tier 2 and added to the Equation 6.1A (new).	Russian Federation	Accepted with modification	We determined that wastewater discharge to soil was out of the scope of the Chapter 6 refinement and have removed the MCF from the table. Associated emissions from wastewater or sludge applied to soil should be considered under Volume 4.
549	5	6	543	546	There is some inconsistence between information about discharge to soil and septic tank with land dispersal field. According to the Table 6.3 discharge to soil is a source of CH4 in wet climate, whereas for septic tank indicated that negligible emissions come from land dispersal field. Also this situation arose same question for latrines, that often have land dispersal field. Please check for any inconsistencies.	Russian Federation	Accepted with modification	See response to comment 547.
551	5	6	590	594	It can be useful to add information, that these T data is referred only to the first stage of wastewater treatment or discharge (for example, discharge to the sea after aerobic plant do not take into account).	Russian Federation	Accepted	A footnote has been added to the example.
553	5	6	595	610	It should be noted, that despite additional guidance on how to estimate organic component removed as sludge, there is no correlation between BOD and DOC in sludge in the Chapter 6 and Chapter 2 (Volume 5), so it prevent from making consistent calculation for sludge emissions across the sector. Additional explanations on this issue may be useful.	Russian Federation	Accepted with modification	There is no correlation between BOD removed from waste water and DOC in sludge, as this varies depending on the wastewater treatment process and on the subsequent treatment of the sludge. Volume 5 Chapter 2 (Section 2.3.2 Sludge) provides guidance on estimating DOC of sludge.
555	5	6	664	665	It looks like TOWrem default data for secondary and tertiary treatments in the Table 6.6b are not for separate processes but for a chain of them (from primary to tertiary). Please make an additional verification or/add explanation, because they can be considered as different wastewater treatment types in calculations so separate data may be needed.	Russian Federation	Accepted	Yes, the TOW_{REM} data reflect the chain of treatment processes, and the table text was modified to reflect this.
557	5	6	608	610	According to the Equation 6.3b(new) and Table 6.6A (new) it would be better to change "per ton" to "per kilograms" (at the end of the line 609).	Russian Federation	Accepted	The text has been updated.

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
559	5	6	621	629	In the text and in the Table 6.6A(new) there are Krem factors that are more than 1 (more than 1 kg of BOD in one kg of sludge). It is not clear how it is possible. Please make an additional verification or/add explanation.	Russian Federation	Rejected	BOD, or biochemical oxygen demand, is not the mass of organic constituents in the sludge. Rather it is a value that describes the strength of the waste (literally by estimating the amount of oxygen microorganisms require to metabolise the organic material). Essentially it is a proxy indicator of the quality (or organic content) of the waste, but it is not a direct mass measurement of the organic content. Just as the mass of oxygen in carbon dioxide is greater than the mass of carbon, it is feasible for the BOD of a carbon-containing molecule to exceed 1 when the molecule is metabolised to carbon dioxide. The Krem values indicate how measured BOD changes for a tonne of sludge during different levels of treatment. So a value of 0.5 means that the value of the BOD measurement of the treated waste has reduced by 0.5 kg of oxygen consumed (which is a surrogate for organic content) compared to the untreated waste. Data usually available for inventory compilers concerning sludge removed is usually expressed in mass. Equation 6.3B (new) is provided in order to convert into kg of BOD removed as sludge at all stages of the process (Saerobic) as necessary for the application of Equation 6.1 (updated).
561	5	6	648	652	The titale of Equation 6.3D(new) is "Total organics in the treated domestic wastewater effluent" as the text above it indicated that it is "for discharges of wastewater from treated or untreated systems". In our view this equation should be better marked for both type of system and indicator TOWEFFtreat renamed.	Russian Federation	Accepted with modification	The authors agree with your remark concerning the inconsistency between the text line 648 and the title of the equation (i is a mistake). However, the equation does correspond to the estimation of TOW effluent from treated wastewater. Therefore the text above the equation should be "For discharge of treated wastewater, inventory compilers should […]" and will be corrected in the final version.
563	5	6	650	660	The component FWTk is referred to the Table 6.5, but it is for T (DEGREE OF UTILISATION OF TREATMENT, DISCHARGE PATHWAY OR METHOD FOR EACH INCOME GROUP, is depend on U), also used in the Equation 6.3A (new). The situation is the same for treatment types k and j. Are they different from each other? Additional explanation or correction is needed.	Russian Federation	Accepted	We have removed the use of FWTk and k throughout the chapter and have more directly tied these parameters to T and j.
565	5	6	650	665	It would be useful to add default TOW rem for discharges of wastewater from untreated systems. It can be 0 in most cases, but according to the Table 6.3 for stagnat sewers (they emit CH4, see table 6.3), this data can be different.	Russian Federation	Accepted	A line has been added to the table with a zero default.

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
567	5	6	661	663	There is no explanation in the text what is biological decomposition. Please, add some explanatory information.	Russian Federation	Rejected	The only reference to this term in the document is in definition of parameter TOW_REM in line 663. This is a straightforward term (i.e. "wastewater organics decomposition that occurs through biological means, either aerobically or anaerobically") and some basic background knowledge is assumed for those reading the document. It is impractical to define every such term used herein, especially those used only once.
569	5	6	664	665	Please make an additional verification for the TOWrem to the "Latrines-regular sediment removal for for fertilizer. In or view with regular removing of sludge TOWrem should be higher.	Russian Federation	Rejected	This row has been removed from Table 6.6B(New) and Table 6.3(Updated). Emissions from sludge applied to agricultural land is reported in Volume 4.
1127	5	6			General: the guidance on WWT is clearly improved with regards to more detailed and complete guidance, including more disaggregated parameters and EFs. The guidance also defines tiers for the estimation. However, guidance for methods, AD and parameters to use does not apply the tier structure and is therefore unclear. Please improve the structure, taking into account the tiers defined.	Finland	Accepted	Additional discussion and guidance has been added to clarify the tier structure.
1129	5	6	441	443	The equations 6.1 (updated) and 6.1 (new) are to be used to estimate the CH4 emissions from WWT. How these equations should be applied need more explanations, e.g. with regards to eq. 6.1 it would be good to summarize where the guidance for estimating emissions from sludge removed can be found. In relation to 6.1 (new) the link to eq. 6.1 (updated) should be clarified, e.g. to avoid double counting of emissions. Also how the default for parameter % Tier 1 and % Tier 1a have been derived should be explained.	Finland	Accepted with modification	Please see response to comment 535.
1131	5	6	371	481	It would be much better if the guidelines distinguished emissions from treatment and discharge clearly from each other and e.g. do not refer to treatment/discharge pathways.	Finland	Rejected	Please see response to comment 541.
1133	5	6	368	368	Please modify Figure 3. 6.2. (to resemble Fig. 6.4) so that even when methane emissions from domestic wastewater are a key category, steps to indicate the need to estimate the emissions from discharges to waterways are included in the decision tree.	Finland	Accepted	Additional modifications were made to Figures 6.2 and 6.3 to more closely align with the set up in Figure 6.4. Please note that the underlying rationales and tier structures for CH4 (morphological) and N2O (trophic condition) are different, so it does not make sense to make these figures match exactly.
1135	5	6	725	725	Please modify Figure 6.3 (to resemble Fig. 6.6) so that even when methane emissions from industrial wastewater are a key category, steps to indicate the need to estimate the emissions from discharges to waterways are included in the decision tree.	Finland	Accepted	Additional modifications were made to Figures 6.2 and 6.3 to more closely align with the set up in Figure 6.4. Please note that the underlying rationales and tier structures for CH4 (morphological) and N2O (trophic condition) are different, so it does not make sense to make these figures match exactly.
1137	5	6	424	439	Activity data for methane emissions should be the BOD load to plants without sludge removals. As major part of methane is formed in sewers the removed sludges have no effect on that. Please consider giving values for well and poorly operating treatment plants in Table 6.6B (for those countries without measured emission data on discharges loads).	Finland	Rejected	The activity data for methane emissions should not be the BOD load to the plant, as the MCFs and emission factors were developed using the activity data specified in the chapter. Regarding values for well and poorly operating treatment plants, see response to comment 517.

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
1139	5	6	289	289	Discharge emissions should not be limited to primary treated discharges. Evidently, discharge emissions should be calculated also from secondary or tertiary treated wastewaters (Equation 6.3D and Table 6.6B).	Finland	Accepted	The word "primary" has been deleted as suggested.
1141	5	6	720	720	Figure 6.1 should be Figure 6.3	Finland	Rejected	The reference to Figure 6.1 is correct, as this figure shows the potential discharge pathways and treatment systems that should be considered in the inventory.
1143	5	6	718	719	Chapter 6.2.3 Industrial wastewater is incomplete. Equation 6.6 does not exist. Also, there is no equations for wastewater discharge (Figure 6.3 and Table 6.8 indicate that there should be equations). The Worksheets for industrial wastewater are incomplete, also. Please correct.	Finland	Rejected	Equation 6.6 is located in Section 6.2.3.3 of the 2006 IPCC Guidelines and is not refined as part of this document. Inventory compilers should refer to the original 2006 GL for these unrefined sections of the chapter.
1145	5	6	298	298	Please add seas and oceans to the text (line 298) and to Tables 6.3 and 6.8.	Finland	Accepted	We replaced "most freshwaters are highly supersaturated" with "surface marine waters are typically supersaturated (Conrad and Seiler, 1988; Ward et al, 1987) and freshwaters highly supersaturated with CH4 (Stanley et al, 2016)".
1147	5	6	902	902	There is only one default EF for centralised, aerobic treatment plant. Is this valid for all those plants (in second-order draft there were two default values)? Please check and justify.	Finland	Rejected	We considered the development of two EFs for BNR and non-BNR processes, as proposed in the Second-Order Draft. However, following comments received from reviewers, we conducted additional statistical analysis of the data and found that there is no significant difference in EFs of BNR and non-BNR systems. Therefore, only one EF for all centralised, aerobic treatment plants has been proposed in the Final-Order Draft. Please see Annex 6A.5 for more details on the analysis.
1149	5	6	1013	1015	Please add a default EF for industrial wastewater plants or indicate what to use in case there is no default EF to give.	Finland	Accepted	A reference to Table 6.8A (New) has been added to the explanation of EF.
1151	5	6	1002	1002	domestic should be industrial.	Finland	Accepted	
1313	5	6	490	490	Dishcarged BOD values are even lower for "new" processes such as the MBR process. It usually generates discharged concentrations of BOD < 2 mg/L. This is also common in well managed conventional activated sludge processes. A comment stating that really low BOD values (<2 mg/L) are not that uncommon in well managed modern plants would seem to be needed here.	Sweden	Rejected	We used the word "typically" which is appropriate for a global guideline. Many plants do better, but it does not appear necessary to make the text more extensive.
1315	5	6	371	371	he numbering of the steps is confusing: should all steps 1, 1A AND 1B be conducted, or can 1A and/or 1B be skipped if step 1 is conducted? It is difficult to distinguish here the difference between a step with only a number (eg. Step 1) and a step with both a number and a letter (eg. 1A). This would be good to clarify.	Sweden	Accepted	To improve clarity, the steps have been renumbered to only be numbers with no letters.
1317	5	6	976	976	Please specify if NREM always be taken from Table 6.17, even if more country specific data is available?	Sweden	Rejected	See response to comment 1391.
1319	5	6	612	612	Some of the values in the table 6.5 are close to 20 years old. An update would seem to be called for, with more up-dated figures.	Sweden	Noted	No action can be taken because comment is out of scope of 2019 Refinement.

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
1321	5	6	198	198	In Table 6.1, it looks strange to only state "N2O is generated", for the "Non-aquatic environment (soils)" treatment type. Some explanation for where it is formed or similar, should be incuded.	Sweden	Rejected	This pathway (discharge to soil) is now excluded from Volume 5 Chapter 6 and instead is covered in Volume 4 Chapter 11.
1331	5	6	481	481	It is a little confusing that B0 is listed per both BOD and COD in Table 6.2, whereas in the eq. 6.2 and in the text below it is strictly in per BOD. It could be clarified in eq. 6.2 that it is to be per BOD, eg. with an extra suffix B0 (BOD).	Sweden	Rejected	It is clearly stated in the definition of the parameter: maximum CH_4 producing capacity, kg CH_4/kg BOD. A value based on COD is also provided in Table 6.2 for use with industrial wastewater discharges.
1333	5	6	550	550	Please specify in Eq. 6.3 that it is BOD5 that is to be used (as some countries apply BOD7, it is good to specify this here, see e.g. Table 6.4 which specifies BOD5).	Sweden	Accepted	The text has been updated.
1335	5	6	725	725	In Figure 6.3, in the first decision box "Identify major industrial sectors…", it might be good to refer to the bullet list in the beginning of the chapter for examples of major industrial sectors of CH4 emissions.	Sweden	Accepted	Text added.
1337	5	6	913	913	Please specify that N loss to the atmosphere can be both as N2 and as N2O, where N2 is the dominant and wanted fraction and N2o is less dominant and unwanted.	Sweden	Rejected	Basically, this is just an explanation for N loss during transport and tretment processes. The proportion of N2 and N2O does not matter. It is very common for everyone that N2O emission is not desirable.
1387	5	6	490	490	Dishcarged BOD values are even lower for "new" processes such as the MBR process. It usually generates discharged concentrations of BOD < 2 mg/L. This is also common in well managed conventional activated sludge processes.I think a comment stating that really low BOD values (<2 mg/L) is not that uncommon in well managed modern plants, would be suitable somewhere here.	Sweden	Rejected	See response to comment 1313.
1389	5	6	371	371	Sligthly confusing with the numbering of the steps; should all steps 1, 1A AND 1B be conducted or can 1A and/or 1B be skipped if step 1 is conducted? It is difficult to distinguish the difference between a step with only a number (eg. Step 1) and a step with both a number and a letter (eg. 1A). We would like to see this clarified.	Sweden	Accepted	See response to comment 1315.
1391	5	6	971	976	Should NREM always be taken from Table 6.17, even if more country specific data is available? Please specify.	Sweden	Rejected	It is always recommended to use country-specific data if it is available. This concept can be found in the decision tree (Figure 6.4 (New)).
1393	5	6	612	612	Some of the values in the table are close to 20 years old which would motivate an update. We would like to see the table 6.5 updated with more up-dated figures.	Sweden	Rejected	See response to comment 1319.
1395	5	6	198	198	In Table 6.1, it looks strange to only state "N2O i generated." for the "Non-aquatic environment (soils)" treatment type. No explanation to where it is formed or similar, as is given for other treatment types?	Sweden	Rejected	This pathway (discharge to soil) is now excluded from Volume 5 Chapter 6 and instead is covered in Volume 4 Chapter 11.
1397	5	6	198	198	In Table 6.1, a bullet point (.) is missing between words (system) and Frequent, for treatment type "Septic system".	Sweden	Accepted	
1409	5	6	481	481	It is a little confusing that B0 is listed per both BOD and COD in Table 6.2, but in the eq. 6.2 and in the text below it is strictly in per BOD. Could be clarified in eq. 6.2 that it is to be per BOD, eg. with an extra suffix B0 (BOD).	Sweden	Rejected	See response to comment 1331.

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
1411	5	6	550	550	Please specify in Eq. 6.3 that it is BOD5 that is to be used (since some countries apply BOD7 it is good to specify this here, see eg. Table 6.4 which specifies BOD5).	Sweden	Accepted	See response to comment 1333.
1413	5	6	595	595	An s is missing after component.	Sweden	Accepted	The text has been updated.
1415	5	6	601	601	An s is missing after component.	Sweden	Accepted	See response to comment 1413.
1417	5	6	725	725	In Figure 6.3, in the first decision box "Identify major industrial sectors…" it might be good to refer to the bullet list in the beginning of the chapter for examples of major industrial sectors of CH4 emissions.	Sweden	Accepted	See response to comment 1335.
1419	5	6	913	913	Please specify that N loss to the atmosphere can be both as N2 and as N20, where N2 is the dominant and wanted fraction and N20 is less dominant and unwanted.	Sweden	Rejected	See response to comment 1337.
1791	5	6	902	902	Since the definition of "Nutrient-impacted and/or hypoxic" in the new table 6.8A seems unclear, countries could be confused when they select an appropriate methodology. Therefore, it would be better to provide a quantitative criteria of "Nutrient-impacted and/or hypoxic" in the table 6.8A.	Japan	Accepted with modification	Two paragraphs of text are devoted to the fact that many different kinds of evidence can be used to identify the nutrient impacted or hypoxic conditions (all of 886 to 904 in the previous draft) consistent with the reviewer's point including several quantitative criteria. We added a cross reference back to the text to try and make the connection more obvious.
2913	5	6	145	146	The sentence should be "Treatment and discharge systems can sharply differ between countries and for rural and urban areas." remove the rest.	India	Accepted	
2915	5	6	147	148	The first sentence should be "Sewer systems may consist of networks of open channels or closed underground pipes." The following sentence should be " Occasional stagnant conditions and heat provide favourable anaerobic condition for methane generation in closed and open sewers."	India	Accepted	
2917	5	6	163	168	Shift the whole paragraph after line 155. The following sentence should be " The pits are used alternatively and the contents used as manure after few months usage."	India	Accepted	
2919	5	6	171	172	The sentence should read like " Secondary treatment consists of biological processes that degrades organic matter in the waste water through microorganisms. The next sentence should start with " The biodegradation is conducted across various bioreactors viz. aerobic stabilisation ponds....."	India	Accepted with modification	We have revised this text slightly to improve clarity.
2921	5	6	189	194	Shift the whole paragraph at the bottom of Figure 6.1	India	Rejected	The authors believe this text is an appropriate introduction to the Figure 6.1 and have not shifted its position.
2923	5	6	208	208	After 'processes.' insert the sentence " In some countries simple disinfection process concludes tertiary treatment." Remove the existing sentence " Treatment processes….nutrient removal."	India	Accepted with modification	We have revised this text and other associated text in this paragraph, for improved clarity and to reduce duplication.
2925	5	6	210	210	Start the line with the sentence "It can be achieved through biodegradation, volatalisation, adsorption, absorption and sedimentation process."	India	Accepted with modification	The suggested text has been included at the end of the final sentence in this paragraph.
2927	5	6	233	243	Remove the whole paragraph, since it is a repetition of para between the lines 201 to 212.	India	Rejected	This information was not a duplication of that provided in paragraph line 200-212, so it has been retained but also merged with another adjoining paragraph for improved readability.

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
2929	5	6	248	249	The sentence should read as " Hence refinements are requested to introduce new MCFs associated with centralised wastewater treatment systems."	India	Accepted with modification	We have revised the text to increase clarity.
2931	5	6	250	251	The sentence should read as " Occasionally wastewater treatment system could be hydraulically or organically overloaded, and results in lower performance of the plant."	India	Accepted with modification	We have included aspects of the suggested modification and edited this text for improved readability.
2933	5	6	272	276	The whole paragraph should be shifted after line 284	India	Accepted	
2937	5	6	397	400	Remove the paragraph as it is repeated between line 305 and 308.	India	Accepted	
2943	5	6	1	3215	Fugitive CO2 emissions from coal mining have been reported for the first time in 2019 IPCC refinement report. These emissions constitute a reasonable amount of GHG emission from coal mining activities. The methodology, activity data and emission factors, although not very definitive, should be retained in the refinement guidelines to provide guidance to national inventory compilation.	India		
3589	5	6	593	594	In table 6.6, other fresh waterbodies are not addressed under discharge system for urban high and low income into which is important for developing countries.	India	Rejected	This table is simply intended to be an example of the type of distribution of treatment system or discharge pathways that may be present, and is not intended to reflect all possible scenarios.
3591	5	6	294	298	Reference is needed for the statement. Otherwise may consider deleting.	India	Accepted	We replaced "most freshwaters are highly supersaturated" with "surface marine waters are typically supersaturated (Conrad and Seiler, 1988; Ward et al, 1987) and freshwaters highly supersaturated with CH4 (Stanley et al, 2016)".
57	General	General			The 2019 Refinements provides a well established guidelines for GHG emission estimation, and it includes more enhancements for the 2006 GL, so the Government of Egypt is accepting it as presented	Egypt	Noted	Noted with thanks.
59	General	General			The 2006 GL Software needs to be updated according to the 2019 refinements, and it's at most important for countries, particularly developing countries, to be provided with necessary capacity building to assure the correct and efficient use of the new refinements	Egypt	Noted	The software is out of scope of this refinement work, and no action can be taken at this moment in time to address this comment. However, this comment is well noted for future work by TFI; once the 2019 Refinement is adopted by IPCC plenary.
147	General	General			The 2019 IPCC refinements would bring in some cases, more precise guidance which may be useful for better harmonisation between Parties. E.g. emissions from oil refining, QAQC procedures (use of models, QC checklist forms…), many examples of good practice implementations.	France	Noted	Noted with thanks.

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
503	General				According to the Minsk_Scoping_Meeting_Report Table 2 New guidance for Category 1.A.1.c (issue #1 Table1) was proposed to be treated in new section 4.3 on fuel transformation of V.2 Ch. 4. However, in the Final Draft of the 2019 Refinements section 4.3 provides methodology only for "Fugitive Emissions from Fuel Transformation". While methodology for estimation of stack emissions from fuel combustion and the carbonisation (fuel transformation) of coal is provided in the IPPU V.3 ch.4 section 4.2.2. It is noted in the V.3 ch.4 section 4.2.2 that stack emissions estimated by the suggested methodology should be reported in category 1.A.1.c Manufacture of solid fuels of Energy sector. The Energy volume (v.2) does not provide any references for new guidance developed for the category 1.A.1.c as well as any explanations in which case and for which fuels this new guidance should be used. This situation is unacceptable, because it will lead to misunderstanding of the Refinements quidelines and possible double-counting or underestimation of emissions. Please, consider providing in V.2 - Energy a reference for new guidance developed for the category 1.A.1.c and explanations in which case this new guidance should be used.	Russian Federation	Rejected	This comment is out of scope of TOR (Decision IPCC/XLIV-5) and the Draft TOC elaborated at the scoping meeting in Minsk. In fact, what the reviewer points was included in item #1 of table 1 (not table 2) of the Minsk report, which is the list of issues considered but this issue was not finally included for refinement as indicated in p.17 of the Scoping report and in the draft TOC of that report.
663	General	General	1	1	General overall comment - provide a single set of guidelines that combines the unchanged 2006 text with the 2019 refined guideline text to assist inventory compilers intending to implement the 2019 Refinement.	New Zealand	Noted	IPCC decided to prepare a "2019 Refinement to the 2006 IPCC Guidelines for National GHG Inventories" (2019 Refinement), which will not replace the 2006 IPCC Guidelines; it will be used in conjunction with the 2006 IPCC Guidelines. Consolidating all methodological guidance into a single report would require a new IPCC decision, subject to be discussed in the IPCC plenary.

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
935	General				The Chinese government thanks the members of the Bureau, the lead authors and the Technical Support Unit (TSU) of the Intergovernmental Panel on Climate Change (IPCC) for 2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories (2019 Refinement) for their hard work in preparing this methodology report. In order to have a more science-based, comprehensive and balanced IPCC assessment report with fully reasonable and actionable findings when applied, Chinese government has made the following comments on this draft in the hope that they will be adopted in its revision process. 1. On accounting fugitive emissions from coal exploration. As a methodology report that will be widely used, the accounting method described therein should be rigorously science-based, sufficiently informed with reference and highly actionable. There being few studies on how to account for fugitive emissions from coal exploration, there is a clear lack of literature support in this connection, which leads to difficulties in data availability. Therefore, it is suggested to relocate the text on the accounting of fugitive emissions from coal exploration in Section 4.1.6, Chapter 4, Volume 2 to the annex of this Volume. 2. On the formulation and presentation of formulas in the report. As an important part of the accounting method, the accuracy of the formulas is particularly important. Some of the formulas in the report are inconsistent in quotation and incorrect in dimension as found, for example, in Lines 259-402, Chapter 4, Volume 1; lines 2891-2892, in Chapter 4, Volume 2; Lines 369-380, Chapter 4, Volume 3; Line 1108, Chapter 5, Volume 4; Lines 337, Chapter 6, Volume 4; Lines 349-381, Chapter 11, Volume 4. It is	China	Accepted with modification	For 1), the comment has been accepted. For 2), the comment has been accepted. Errors have been corrected where they were found. For 3), citation errors, typographical or grammatical errors will be corrected during the final copyedit before the publication of this report . Cosmetic improvements will be also made during the final copyedit, including improvement of presentation of figures/pictures. Substantial inconsistencies (not just editorial or typographical), where found, have been corrected. For 4), the comment has been noted. Consideration of different national conditions is already addressed by the tiered approach and decision trees. About provision of new/updated default emission factors, developing country data/EFs as well are already covered, for example, for coal, charcoal and biochar in Energy Sector (Vol.2).
1285	General	General			The methodology for rice cultivation and agricultural soil is very well written by the various experts. I wish some publications from India specific work was added to nitrous oxide from agricultural soils. There is no literature at all for emission coefficients from Indian conditions in the methodology chapters.	India	Noted	The authors did not find published studies specific to the Indian conditions in the literature review, and no specific articles were brought to their attention during the reviews. However, inventory compilers can use country-specific data when developing Tier 2 or 3 methods.
1379	General	General			We appreciate the hard work of the authors, and others who have contributed to the preparation of the report.	Sweden	Noted	Noted with thanks.
1965	General	General	all	all	The approach to generating a standalone document to be used in conjunction with the existing 2006 GLS is very confusing and will make the job of compilers, especially inexperienced compilers in countries that are not Annex 1 countries, extremely difficult and inefficient. It would be far preferable for the Refinement and 2006 GLs in future to be integrated into ONE set of inventory compilation documents. Compilers should not need to have two sets of complex technical materials to work with, and have to constantly cross-reference using mapping tables and hints throughout the Refinement text - it will lead to inconsistencies in application of the guidelines, reducing the quality of the dataset available to the UNFCCC and IPCC, and also be resource-intensive to work in that manner.	United Kingdom (of Great Britain and Northern Ireland)	Noted	IPCC decided to prepare a "2019 Refinement to the 2006 IPCC Guidelines for National GHG Inventories" (2019 Refinement), which will not replace the 2006 IPCC Guidelines; it will be used in conjunction with the 2006 IPCC Guidelines. Consolidating all methodological guidance into a single report would require a new IPCC decision, subject to be discussed in the IPCC plenary.

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
2833	General				It is difficult to understand the meaning of many sentences throughout the chapter because the English grammar and style still need to be fixed/refined (i.e. lines 206-207 should be "The material can be used both by countries establishing a data collection strategy for the first time and by countries..."; lines 209-211 should be "the progress of emission trading programmes or climate change policies have the potential..."). (Disregard this comment if it's planned to have another edit to fix the English).	Belgium	Accepted with modification	The text has been revised and English checked. Specifically, for the indicated lines 206-207, the text does not seem to have any problem and has been mantained the same. The text in lines 209-211 (which are to be read 940-941) has been slightly changed to increase readability.
2883	General	General			We thank the authors for their hard work on providing the refinements to the 2006 IPCC Guidelines for National GHG Inventories.	Estonia	Noted	Noted with thanks.
2949	General	General			The inclusion of text from the original 2006 Guidelines (in grey in the draft Refinement) appears to be inconsistent. Sometimes there are entire sections of grey text, with a minor phrase or one to two new paragraphs (in white) included. Sometimes there is no grey text; it is difficult to understand in these cases where the new text fits in. Volume 4 (especially chapter 2) contains entire sections of grey text. Consistency should be sought between all volumes and chapters to improve usability by inventory compilers	United States of America	Noted	As clarified in the explanatory note which accompanied the Final Draft circulated for the final government review, after the adoption/acceptance by the Panel, the 2019 Refinement will be published without grey highlight. The purpose of grey highlight in the draft is solely to facilitate the review and the differences accross different chapters/sections reflect the "amount" of refinements proposed. Therefore, is expected that "sometimes there are entire sections of grey text, with a minor phrase or one to two new paragraphs (in white) included. Sometimes there is no grey text".
2951	General	General			Maintaining the new text separate from the original 2006 Guidelines is not user friendly. It requires reading three documents at once: the relevant chapter in the 2006 Guidelines, the relevant chapter in the Refinement, and the annex mapping the relationship between sections. Far easier would be to incorporate the new text into the 2006 Guidelines in a new document, highlighting or underlining the new text. This would greatly assist not only review, but ultimately the likely uptake by inventory compilers.	United States of America	Noted	IPCC decided to prepare a "2019 Refinement to the 2006 IPCC Guidelines for National GHG Inventories" (2019 Refinement), which will not replace the 2006 IPCC Guidelines; it will be used in conjunction with the 2006 IPCC Guidelines. Consolidating all methodological guidance into a single report would require a new IPCC decision, subject to be discussed in the IPCC plenary.

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
2953	General	General			Most new examples presented in the Refinement seem to come from A1 Parties. Using examples from a broader variety of Parties may help make the Refinement more accessible to a wider range of countries.	United States of America	Noted	Efforts were made to include data and information from developing countries or non-Annex I counties under the UNFCCC, and a number of examples of such data/information were already included in the Final Draft. For example: - In Chapter 2 of Volume 4 (AFOLU), Box 2.0e (New Guidance) using a biomass map for GHG estimation: An Example from the Brazilian Amazon. - Volume 2 (Energy) has application for and draws emission factors from non-annex-1 countries at many places. For instance, the fugitive emissions from coal mining (section 4.1) where in data and emission factors include those from large developing countries; section 4.3.2.1 on charcoal and biochar production especially tables 4.3.2 and 4.3.3 (emission factors and uncertainty estimation), and Appendix 4a.2 (Fugitive Greenhouse Gas Emissions from Wood Pellet production). Such efforts will be continuously made in the future work by TFI.
3851	General	General			Different land uses, such as agricultural, grassland, forest, etc may be used to produce bio-energy/fuel. In this refinement, the approaches of Greenhouse Gas emissions accounting in relation to bio-energy should be explained. Please consider including how double accounting is avoided.	Norway	Noted	Treatment of CO2, CH4 and N2O emissions from combustion of biomass or biomass-based products is explained in detail in Chapter 1 of Volume 1. By this, and also by relevant guidance given in relevant chapters in sectoral volumes, the final draft of 2019 Refinement already provides guidance to avoid double counting of GHG emissions within a country's inventory.
289	Overview_Cl	Overview_Ch	277	277	We suggest that this paragraph briefly highlight some of the other specific developments in Chapter 2 of Volume 4 of the 2019 Refinement 2019, in particular on the consistency between AFOLU projects or activities and the IPCC inventory guidelines (Box 2.0A), on the use of allometric models for biomass estimation (Section 2.3.1.3.3.A) and on additional generic guidelines for Tier 3 methods (Section 2.5). These developments are particularly relevant for the implementation and improvement of reporting for all countries.	France	Accepted with m	The discussion about consistency in AFOLU projects and the inventory guidelines is provided for information purpose in a box and it is not guidance, so it is not appropriate to highlight it here. Highlight on allometric equations is already included in the bullet on "bimass estimates". A new bullet on Tier 3 model has been added.
593	Overview_Cl	Overview_Ch	78	78	Delete "Thailand" from the end of the line	New Zealand	Accepted	
595	Overview_Cl	Overview_Ch	163	166	Not clear if the table in Box 2 is supposed to be complete - it isn't; but this is OK if the intent is to only have part of the table for illustrative purposes	New Zealand	Noted	The intent is to only have part of the table for illustrative purposes, indeed. Therefore the title clearly says it is just an example, which shows readers what to find inside the the volumes of the 2019 refinement.
597	Overview_Cl	Overview_Ch	193	204	The IPCC is commended for including this essential guidance on national greenhouse gas inventory arrangements and management tools as part of the refinement exercise.	New Zealand	Noted	Noted with thanks.
599	Overview_Cl	Overview_Ch	335	335	"from active aeration landfill" should be "from active landfill aeration"	New Zealand	Rejected	Active aeration landfill is a type of landfill . This sentence refers to the type of landfill, not to the operation condition of the landfill.

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
601	Overview_Cl	Overview_Ch	366	367	Reporting of national greenhouse gas inventories is an essential component of reporting information that is used for compliance against commitments. The sentence could be modified as follows to reflect this: "While reported inventory estimates are an essential component of information used to assess compliance against commitments, the 2019 Refinement does not provide specific guidance on information necessary to assess compliance."	New Zealand	Accepted with m	The last setence of this bullet has been replaced by the following sentence. "The 2019 Refinement is relevant but not prescriptive with respect to the reporting of national inventories under international agreements, and the use of reported information under these agreements."
603	Overview_Cl	Overview_Ch	373	374	Suggest the last part of the sentence (for which any metrics can be used) is rephrased as not all metrics are designed to convert GHG emissions into CO2 equivalent.	New Zealand	Accepted	The sentence has been modified to read: "… for which inventory compilers may use any metrics that are designed to convert greenhouse gas emissions into CO2 equivalent."
721	Overview_Chapter		302	303	Between lines 302 and 303, suggest to add refinements made on the "methane rice section" of Volume 4 AFOLU, using the text from Volume 4 Annex1_FD (Mapping Table) in lines 278 to 283.	Philippines	Accepted	The text should be "Tier 1 factors have been updated for the baseline emission factors, scaling factors for water management regimes before and during cultivation periods, and conversion factors for organic amendments. Default cultivation periods have also been added for estimating annual emission factors."
855	Overview_Cl	Overview_Ch	328	330	This sentence needs to be revised for clarity.	Republic of Korea	Accepted with m	The sentences have been modified to read: - Waste generation, composition and management: The 2019 Refinement updates key parameters used in the first order decay (FOD) method including waste generation rate and waste composition by countries and region using UN classification. The 2019 Refinement also provides default values and uncertainty of carbon content, nitrogen content and degradable organic carbon (DOC) of domestic and industrial sludge. (Chapter 2)
1343	Overview_Cl	Overview_Chapter			The overview chapter contains some duplications and language that could be simplified to further advance its aim to provide concise introduction to the overal report. For example, specific examples may not always be needed, but left to the chapters and sections of the full report.	Sweden	Noted	Improvement has been made where it is deemed necessary as appropriate.
1345	Overview_Cl	Overview_Ch	66	66	Could remove "(e.g. …)" - it is not necessary and confuses more than provides key information.	Sweden	Accepted	
1347	Overview_Cl	Overview_Ch	71	81	Could omit the long titles of the decision, in order to improve readability.	Sweden	Accepted with m	The titles of the decisions have been moved into footnotes.
1349	Overview_Cl	Overview_Ch	77	77	Could omit "which was held…scoping meeting"	Sweden	Rejected	This information is necessary to clarify when and where the TFB28 was held.
1351	Overview_Cl	Overview_Ch	93	93	"may not" is unclear. Suggest: "	Sweden	Noted	This part could have been written as "… generally did not meet this criterion" which might be clearer than "… may not meet this criterion". However, the Box 1 shows the criteria that were actually used. It is factual information, and therefore cannot be changed.
1353	Overview_Cl	Overview_Ch	103	110	This text is probably very possile to omit. Much is said elsewhere, and it does not add much information.	Sweden	Rejected	This text is necessary to clarify how the outline was developed and why the table of contents of the final product is not exactly the same as the initially developed outline.
1355	Overview_Cl	Overview_Ch	113	114	Could remove "(e.g.… Report)"	Sweden	Accepted	

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
1357	Overview_Cl	Overview_Ch	131	132	The "The guidance.. are provided." is clear from the context, and could be omitted.	Sweden	Rejected	The fact explained here is not well known to new comers. Therefore it is better to keep this sentence.
1359	Overview_Cl	Overview_Ch	136	136	Could delete "As stated… above"	Sweden	Rejected	The sentences following these words are intentional repetition of those in Section 1. These words are necessary to clarify that.
1361	Overview_Cl	Overview_Ch	155	155	The sentences in ()s in the first two entries under "Explanation" in the table could be deleted. They are just duplicating the information above in the same cells.	Sweden	Accepted	
1363	Overview_Cl	Overview_Ch	169	170	Change "has been defined" to "is defined", and delete "since 2000… was introduced"-	Sweden	Accepted with m	In the context of refinement of Chapter 3 of Volume 1, it is necessary to refer to the history of development and use of the concept "good practice". To improve the clarity of the meaning of this paragraph, it has been modified.
1365	Overview_Cl	Overview_Ch	173	173	Suggest "… inventory development, as "a set…"	Sweden	Accepted with m	To improve clarity of the sentence, this part has been modified as "… inventory development. This definition can be also …"
1367	Overview_Cl	Overview_Ch	168	182	These two paragraphs largely carry in essence the same information. Could consider streamlining.	Sweden	Accepted with m	The first paragprah is to explain the definition of the concept "good practice", and the second paragraph is to explain why such concept is key. To improve the clarity of the meaning of the first paragraph, it has been modified.
1369	Overview_Cl	Overview_Ch	207	207	Replace "has also the advantage" with "is also"	Sweden	Accepted	The proposed change makes the sentence more readible.
1371	Overview_Cl	Overview_Ch	230	230	Delete "with an example"	Sweden	Accepted with m	The sentence has been changed to read: "A new methodology for non-linear interpolation analysis has been added in the 2019 Refinement, along with an example."
1373	Overview_Cl	Overview_Ch	253	253	Don't need units here, can delete "(percent carbin by mass)", "percent of" and "(by mass)".	Sweden	Accepted	Change implemented as proposed
1375	Overview_Cl	Overview_Ch	270	271	Suggest "… identified. Such greenhouse gases include, for example, …". The report names are already stated above.	Sweden	Rejected	It is important to specify which GHGs have been identified in the Fourth and Fifth Assessment reports vs. other references because GWPs and other weighting metrics are available for the GHGs in AR4 and AR5, but may not be available for GHGs that are known through other references.
1377	Overview_Cl	Overview_Ch	272	273	Could omit the "(a perfluoropolyether… manufacturing.)", as it does not seem to be needed here in the introduction.	Sweden	Rejected	The example is provided to show that some of the GHGs included in the Fourth and Fifth Assessment Reports, but not earlier Assessment Reports, are commercially important.
1559	Overview_Cl	Overview_Ch	89	101	Information from other sources such as FAO to meet data gaps.	Saint Lucia	Rejected	The Box 1 shows the criteria that were actually used. It is factual information, and therefore cannot be changed.
2835	Overview_Chapter		154	155	Is it necessary to use the term "inventory compilers" in Table 1? It makes the table more difficult to read. Suggest to change these sentences to the passive voice. Example: "The chapter/section/subsection in the 2019 Refinement should be used instead of the corresponding chapter/section/subsection in the 2006 IPCC Guidelines."	Belgium	Rejected	The authors believe that it is important to emphasize how "inventory compilers" as main targeted users should use this 2019 Refinement.

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
2837	Overview_Chapter		206	207	Suggest to fix the English: should be "The material can be used both by countries establishing a data collection strategy for the first time and by countries..."Disregard if it's planned to have another edit to fix the English).	Belgium	Accepted	
2839	Overview_Chapter		209	211	Suggest to fix the English: should be "the progress of emission trading programmes or climate change policies have the potential..."). Disregard if it's planned to have another edit to fix the English).	Belgium	Accepted	
2841	Overview_Chapter		185	187	"some boxes" (line 187): which boxes? Suggest to cite specific examples (e.g. by page number) or change the word "some" to be more descriptive.	Belgium	Accepted with m	The sentence has been deleted as it is not necessary.
2843	Overview_Chapter		202		Line 202 repeats the same information already stated in line 195. Suggest to modify this line. ("The tools presented in this new guidance should also not be considered prescriptive.)	Belgium	Accepted with m	Text " As it is the case for the provided guidance on national GHG inventory arrangements, the management tools presented in this new guidance …" has been added at the beginning of the sentence.
2845	Overview_Chapter		197	198	Suggest to change this line to "provides approaches and examples of good practices in national greenhouse gas inventory arrangements that are based on the best scientific information available."	Belgium	Noted	The current text recognises that the best available examples but there is no scientific methodology to develop to date that is used to distinguish between scientifically robust national systems. National systems tend to depend more on national circumstances.
2847	Overview_Chapter		233	240	Atmospheric observations and inversion models giving an estimate of sources are independent of government declarations and cover both a verification aspect as well as a possibility to to have data for non reporting countries. (Add at the end of line 240: "and modelling").	Belgium	Accepted with m	The text "and inverse modelling" has been added at the end.
2849	Overview_Chapter		258	260	This is important, as abandoned or unconventional extraction facilities have a large chance to be unreported. We support this text!	Belgium	Noted	Noted with thanks.
2957	Overview_Cl	Overview_Ch	154	154	The difference between "Update" and "New Guidance" is unclear. The instructions are basically the same. Provide clearer language that demonstrates the difference between them.	United States of America	Accepted with m	The explanation of "New Guidance" has been replaced with "Recognizing that there is no guidance in the 2006 IPCC Guidelines, inventory compilers should use the chapter/section/subsection in the 2019 Refinement."
2959	Overview_Cl	Overview_Ch	234	235	As there have been particular sensitivities around external stakeholders "verifying" country-reported data using atmospheric measurements, it would be useful here to specify that the verification contemplated is done by/with inventory compilers and understood in the inventory sense (as explained in Box 6.1 of Volume 1 Chapter 6), as opposed to done by external stakeholders and understood in the carbon markets-related sense. (A different term, such as "validation," might also be considered.)	United States of America	Accepted with m	The text "verifying national emissions" has been replaced by the text "improving national greenhouse gas inventories. These approaches can be used to provide additional scientific verification of inputs and results for particular categories and gases, and therefore help countries to target areas of uncertainty."
2961	Overview_Cl	Overview_Ch	278	288	This section suggests that the guidance on interannual variability is intended to help Parties disaggregate emissions/removals from natural disturbances in their inventories, but not to avoid reporting them in the inventories. We would support this. However, the actual guidance in Volume 4 does not make this clear, and appears to suggest these emissions/removals could not be reported. (See comments on Interannual variability in Volume 4, Chapter 2)	United States of America	Noted	This comment has also been made in Chapter 2 of Volume 4, and has been addressed by the LA in the respective chapter

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
2963	Overview_Cl	Overview_Ch	303	309	As reflected in our comments on Volume 4 Chapter 7, we have strong concerns about the proposals to factor out emissions and removals that would have otherwise occured in the absence of flooding (i.e., converting unmanaged land to managed by flooding). This approach contradicts the principles behind the managed land proxy. Based on the information provided, and the available literature, there is no scientific basis for factoring out emissions and removals on unmanaged lands that would otherwise occur in the absence of the flooded area. We request that the text reflect this (thereby "taking it into account"), and the sections on "factoring out" be removed from the Wetlands chapter.	United States of America	Rejected	managed land proxy in addition to a method for factoring out. In fact, we have included the factoring out method because it was specifically requested in the TOR from the IPCC panel to the authors for this report. Both total emissions using the MLP and net emissions from factoring out are reported based on the reporting tables that we have provided. We have revised the text to state that for transparency, it is good practice to report both the total emissions and net emissions if net emissions are estimated; otherwise the country should only report total emissions if net emissions are not estimated. The method is based on science and the methods provided in the IPCC guidance. It has been well-established in the scientific literature that non-saline water bodies and wetlands emit CH4 when they are unmanaged. Conversion of unmanaged wetlands or water bodies to flooded lands does increase the emissions, but a portion of these emissions would continue to occur if the land was not converted to flooded land, and this portion is factored out. In contrast, unmanaged forest land and grassland are typically a sink for CH4, and the net flux is considered non-anthropogenic even for managed forest land and grassland. Therefore there is no need for guidance to factor out this portion of the CH4 flux. For CO2 fluxes, there is a net uptake in unmanaged wetlands that would occur continue to occur if the land remained unmanaged. Therefore this portion is factored out. In contrast,
3863	Overview_Cl	Overview_Ch	91	93	Box 1: The authors should consider explaining what significance of sources/sinks is referring to and why it is global based not country based.	Norway	Rejected	The Box 1 shows the criteria that were actually used. It is factual information, and therefore cannot be changed.
3865	Overview_Cl	Overview_Ch	250	250	Please include an explanation of non-biogenic in the Glossary	Norway	Rejected	The word "biogenic" is just an ordinary word, and "non-biogenic" is self-explanatory, so it is not necessary to include it in the glossary.
3867	Overview_Cl	Overview_Ch	254	263	Please consider to include more detailes in the description of the updates. The information provided for Volume 2 and 3 seem to be much more aggregated than for Volume 1, 4 and 5.	Norway	Accepted	For Volume 2, more details in the description of the updates have been included.
3869	Overview_Cl	Overview_Ch	264	276	Please consider to include more detailes in the description of the updates. The information provided for Volume 2 and 3 seem to be much more aggregated than for Volume 1, 4 and 5.	Norway	Accepted	For Volume 3, more details in the description of the updates have been included.

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
3871	Overview_Cl	Overview_Ch	323	326	Please note that the Production approach is "mandatory" under the Paris agreement (if HWP is reported). You may therefor consider to change the text. Regarding footnote 10: Please consider to include the following about the ruels under the Paris agreement (the existing text only refers to the climate convention): "It should be noted that decision -/CMA.1 on the enhanced transparency framework under the Paris agreemnt states that in the case of a Party using an approach to reporting emissions and removals from harvested wood products in accordance with IPCC guidance other than the production approach, that Party shall also provide supplementary information on emissions and removals from harvested wood products estimated using the production approach".	Norway	Accepted with m	Footnote 10 has been deleted. There is no need to add the reference to Decision 4/CMA.1 since this relates to accounting and the 2019 Refinement provides guidance on how to estimate emissions and removals by any of the approaches.
3873	Overview_Cl	Overview_Ch	352	352	Please include an explanations of abiogenic in the glossary	Norway	Rejected	The term "abiogenic" has been replaced by "non-biogenic" in the text of 2019 Refinement. Therefore it is not relevant to the glossary any longer.
3875	Overview_Cl	Overview_Ch	360	378	Please consider to move the information in section 6 upfront after section 1.	Norway	Accepted with m	Section 1 is introduction, and Section 2 is background. It is not appropriate to put this Section 6 between these two sections. Instead, Section 6 has been moved to after Section 2, and the title has been changed to "CLARIFICATION ON KEY CONCEPTS IN THE 2019 REFINEMENT UNCHANED FROM 2006 IPCC GUIDELINES".
3885	Overview_Cl	Overview_Ch	217	223	We would suggest using the term "uncertainty assessment" in the lines 221 and 222 instead of "uncertainty analysis" as it is preferably used in the chapters (Volume 1 Chapter 3). For easier cross-reference with the 2006 Guidelines, the title in the line 217 may not be changed.	Madagascar	Accepted	The changes have been implemented as proposed.
3887	Overview_Cl	Overview_Ch	37	37	Introduce the following sentences: "The 2019 Refinement are intended for a broad range of users, including countries and inventory compilers setting out to prepare inventory estimates for the first time. It uses the overarching framework and the concepts of the 2006 IPCC Guidelines. It presents a step-by-step guidance on how to compiling a greenhouse gas inventory (See Volume 1 Chapter 1 2006 IPCC Guidelines). Inventories rely on a few key concepts for which there is a common understanding. This helps ensure that inventories are comparable between countries, do not contain double counting or omissions, and that the time series reflect actual changes in emissions. The 2019 Refinement do not contain any accounting element."	Switzerland	Accepted with modification	The following sentences have been added in Section 6 (which has become Section 3 in the amended Final Draft), instead of Section 1. "The 2019 Refinement is intended for all countries and national greenhouse gas inventory compilers, including those setting out to prepare inventory estimates for the first time. It uses the overarching framework and the concepts consistent with the 2006 IPCC Guidelines. National greenhouse gas inventories rely on a few key concepts for which there is a common understanding (see Chapter 1, Volume 1). This helps ensure that inventories are comparable between countries, do not contain double counting or omissions, and that the time series reflect actual changes in emissions.˝
3889	Overview_Cl	Overview_Ch	63	63	Write: "…and empirical knowledge related to GHG as well as to new technologies and production processes published since 2006 …"	Switzerland	Accepted with m	The sentence has been modified to read "…and empirical knowledge related to sources and sinks of greenhouse gases as well as inventory management published since 2006 …"
3891	Overview_Cl	Overview_Ch	122	122	At the end of the sentence, a reference on these matters to the appropriate chapter of the 2019 Refinement would be usefull.	Switzerland	Accepted	"(see Chapter 7, Volume 1)" has been added at the end.

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
3893	Overview_Cl	Overview_Ch	183	183	Write: " … of anthropogenic GHG emissions …"	Switzerland	Accepted with m	Instead of inserting "GHG" as suggested, "of greenhouse gases" have been added at the end of the sentence.
3895	Overview_Cl	Overview_Ch	198	198	Write: "… in particlar for reporting GHG emissions by sources and removals by sinks under international agreements."	Switzerland	Noted	Authors' view is that the proposed text goes beyond the scope of the 2019 Refinement in so far as reporting. The purpose of the guidance is to provide methodological guidance on emission estimates as well as more relevant in this case, examples of insitutional arrangements and tools necessary for emission estimations. To give clarity to the sentence, the follwoing words have been added at the end of the sentence. "in establishing greenhouse gas inventory arrangements".
3897	Overview_Cl	Overview_Ch	202	202	Write: " As it is the case for the provided guidance on national GHG inventory arrangements, the management tools presented in this new guidance …"	Switzerland	Accepted	Implemneted as proposed.
3899	Overview_Cl	Overview_Ch	233	244	The guidance provided on inverse models is an important progress that the 2019 Refinement contains	Switzerland	Noted	Noted with thanks.
3901	Overview_Cl	Overview_Ch	262	262	Write: "… from charcoal and biochar production, …"	Switzerland	Accepted with m	Text has been modified as "… charcoal production, biochar production …"
3903	Overview_Cl	Overview_Ch	278	288	For clarity and in order to avoid ambiguity, it would be better to use always the same expression when refering to e.g. fire, insects, windthrow, and ice storms, instead of two: "natural effects" and "natural disturbances". The one that will be retained should then included in the Glossary.	Switzerland	Accepted	Text has been revised to "use always the same expression" and terminologies consistent with section 2.6 of Chapter 2, volumen 4
3905	Overview_Cl	Overview_Ch	360	378	Section 6 "Clarification on kex concepts in the 2019 Refinement" should be moved after line 81 as it explains key concepts introduced and used in the following sections.	Switzerland	Accepted	
605	General	Glossary	189	190	Suggest the sentence be shortened to: "A barrier constructed to hold back water." The remainder of the sentence (in the context of national greenhouse gas inventories for the AFOLU sector) would seem to be irrelevant.	New Zealand	Accepted with modification	Accepted change but included in a reservoir for context. Changed to "An artificial structure that is barrier used to hold back water in a reservoir."
607	General	Glossary	287	287	"used to quantifying greenhouse gas emissions" should be either "used to quantify greenhouse gas emissions" or "used in quantifying greenhouse gas emissions"	New Zealand	Accepted	The sentence has been replaced with "… used to quantify …"
609	General	Glossary	431	433	Suggest the definition of "Manure" is revisited, as manure is produced regardless of whether or not it can be managed for agricultural purposes.	New Zealand	Accepted	The definition has been changed to read: "Waste materials produced by domestic livestock (vegetative material such as green manures are considered to be crop residues or compost). The term 'manure' is used here collectively to include both dung and urine (i.e., the solids and the liquids) produced by livestock."
611	General	Glossary	643	643	Change "downstream of the dam" to "downstream of a dam"	New Zealand	Accepted	

CommentID	Volume	Chapter	Fromline	Toline	Comments	Country	Responses	Authors' notes
2955	General	Glossary	103	111	The FD definition of "Carbon dioxide equivalent emission" needs to be revised. Currently, the definition goes too far in its statements that carbon dioxide equivalent emissions and carbon dioxide equivalent concentrations are unrelated. We recommend replacing the last two sentences with the following: "CO2-equivalent emission is a common scale for comparing emissions of different GHGs but implies only approximate equivalence of the corresponding climate change responses over the selected time horizon. Because GHGs have widely varying atmospheric lifetimes, CO2-equivalent concentrations cannot be calculated from CO2-equivalent emissions without knowing the identities and quantities of the GHGs emitted." In addition to making the definition more accurate, this change will make it more consistent with how the IPCC describes metrics in its Assessment Reports.	United States of America	Accepted with modification	The last two sentences have been deleted. The definition included in the Final Draft is identical to that included in the Glossary of Special Report on 1.5oC (SR15) which was already accepted by the IPCC. The suggested replacement of the last two sentences will lead to inconsistency between SR15 and 2019 Refinement. Instead, deletion of the last two sentences is more appropriate as the definition without them works well for inventory compilers' work.
3853	General	Glossary	65	67	Please clarify if the terms "biofuel" and "bioenergy" are interchangebale and consider including the defintion of bioenergy in the glossary.	Norway	Accepted	Added definition, "Energy derived from any form of biomass."
3855	General	Glossary	83	83	Should read: "…statistical method which…"	Norway	Accepted	
3857	General	Glossary			Please consider to include unmanaged forest and unmanaged land in the glossary.	Norway	Accepted with modification	A definition of managed land has been included in the glossary: "Managed land is land where human interventions and practices have been applied to perform production, ecological or social functions. All land definitions and classifications should be specified at the national level, described in a transparent 93 manner, and be applied consistently over time." (extracted from the current 2006 Guidelines text - Chapter 1 - Volume 4). Therefore, what is not defined as "managed land" by a country should be classified as unmanaged.
3859	General	Glossary			Please consider tp include å definition of Managed Land Proxy (MLP) in the glossary.	Norway	Accepted	A definition of the MLP has been included in the glossary: For the AFOLU Sector, anthropogenic greenhouse gas emissions and removals by sinks are defined as all those occurring on 'managed land'. This approach, i.e., the use of managed land as a proxy for anthropogenic effects, was adopted in the Good Practice Guidance for Land Use, Land-Use Change and Forestry (2003) and that use is maintained in the 2019 Refinement".
3861	General	Glossary			Please consider to include "below ground biomasse" in the glossary	Norway	Accepted with modification	It is clarified in the term "Biomass" that living biomass includes above and below ground biomass.
3865	Overview_Cl	Overview_Ch	250	250	Please include an explanation of non-biogenic in the Glossary	Norway	Rejected	The word "biogenic" is just an ordinary word, and "non-biogenic" is self-explanatory, so it is not necessary to include it in the glossary.
3873	Overview_Cl	Overview_Ch	352	352	Please include an explanations of abiogenic in the glossary	Norway	Rejected	The term "abiogenic" has been replaced by "non-biogenic" in the text of 2019 Refinement. Therefore it is not relevant to the glossary any longer.