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SHORT-LIVED CLIMATE FORCERS

(Prepared by the Co-Chairs of Task Force on National Greenhouse Gas Inventories)

(Submitted by the Secretary of the IPCC)

SHORT-LIVED CLIMATE FORCERS

1. Introduction

The Intergovernmental Panel on Climate Change (IPCC) decided at its 46th Session in September 2017 in Montreal, Canada to hold an expert meeting on Short-Lived Climate Forcers (SLCFs) to discuss issues on estimation of emissions and climate effects jointly co-organized by the Task Force on National Greenhouse Gas Inventories (TFI) and Working Group I (WGI). In accordance with this decision, the meeting was held on 28-31 May 2018 at the headquarters of the World Meteorological Organization (WMO) in Geneva, Switzerland.

The report of this expert meeting is available on the TFI website at: <http://www.ipcc-nggip.iges.or.jp/>. The outcomes of this meeting are summarized in Annex I to this document. Based on the outcomes, a plan of future work by TFI was considered by the Bureau of TFI (TFB) and the scientific steering committee for this expert meeting. A proposed future TFI work plan (document IPCC-XLVIII/INF.4) was reported to the Panel at its 48th Session in October 2018 in Incheon, Republic of Korea.

During the ensuing discussion, several delegates supported the recommendations from the expert meeting. The TFI was requested to develop a thorough document with a full list of options for the implementation of recommendations from the meeting to be discussed at the 49th Session of the IPCC. It was further suggested that the development of methodologies and emission factors for SLCF emission estimation could commence during the current sixth assessment cycle. One delegate cautioned that the TFI could be overworked if additional tasks are assigned to them before the completion of the 2019 Refinement work.

2. Overall objectives and possible types of products

Overall objectives

In accordance with the conclusions of the expert meeting in May 2018, the overall objectives of the future work on SLCFs by TFI should be to fill gaps in existing methodologies and to develop and disseminate an internationally-agreed, globally applicable methodological guidance based on existing methodologies. Each option in Section 3 below aims to achieve these overall objectives.

Possible types of products

Two types of products can be considered from the TFI work to achieve the overall objectives, according to the Appendix A to the Principles Governing IPCC Work.

Table 1: Possible types of products

Class	Explanation	Examples
Methodology Report (IPCC Report)	One of the main IPCC materials. The IPCC Methodology Report must be produced through the writing and review process defined in Appendix A to the Principles Governing IPCC Work. It is composed of an Overview Chapter, individual chapters and technical annexes. The Overview Chapter must be adopted and the entire report must be accepted by a Session of the Panel.	2006 IPCC Guidelines for National Greenhouse Gas Inventories
Supporting Material	Consists of three categories: (1) Workshop proceedings and material from Expert Meetings which are either commissioned or supported by the IPCC, (2) software or databases to facilitate the use of the IPCC Methodology Reports, and (3) guidance material (guidance notes and guidance documents) to guide and assist in the preparation of comprehensive and scientifically sound IPCC Reports and Technical Papers. Supporting Material is not accepted, approved or adopted.	Use of Models and Facility-Level Data in Greenhouse Gas Inventories (2010); Uncertainty and Validation of Emission Inventories (2010)

3. Options for the future work by TFI

Taking into account the overall objectives, the possible types of products, and the time available during the AR6 cycle, two options can be considered as summarized in Table 2 below.

Table 2: Summary of options for the future work by TFI

	Option A	Option B
Approach	Stepwise technical assessments in AR6 cycle that will be followed by further methodological development in AR7 cycle	Early start of production of comprehensive guidelines with a view to its completion in AR6 cycle
Output and timeline	A series of Supporting Materials (reports of expert meetings) will be published in 2020, 2021 and 2022. They may be used by countries in conjunction with existing methodological guidance to produce their national SLCF inventories. They may also serve as a basis for further methodological development (e.g. comprehensive guidelines as a Methodology Report) during the AR7 cycle.	A comprehensive guidelines as a Methodology Report will be published in 2022 or 2023. Two sub-options with different timelines can be considered: ➤ Option B-1: May 2020 – Early 2023 ➤ Option B-2: Nov 2019 – May 2022
Required activities	➤ Technical analysis work by TFI TSU with other experts ➤ 3 - 4 Expert Meetings	➤ Scoping meeting ➤ Approval of outline by the Panel ➤ Author nomination/selection ➤ 4 Lead Author meetings ➤ 3 reviews by experts and/or governments ➤ Adoption/acceptance by the Panel
Estimated total budget	560,000 – 750,000 CHF	Option B1: 3,020,000 CHF Option B2: 2,260,000 CHF

Option A (Stepwise technical assessments in AR6 cycle that will be followed by further methodological development in AR7 cycle)

(1) Soon after the adoption/acceptance of the *2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories (2019 Refinement)* at the 49th Session of the IPCC in May 2019, the TFI proposes to establish a small task team consisting of TFI Technical Support Unit (TSU) and some other experts, possibly those from the secretariat of the Task Force on Emission Inventories and Projections (TFEIP) under the United Nations Economic Commission for Europe (UNECE) Convention on Long-range Transboundary Air Pollution, to prepare a paper on the commonalities of the *2006 IPCC Guidelines* and the EMEP/EEA¹ air pollutant emission inventory guidebook² (by early 2020). This paper will be published as IPCC Supporting Material. The contents of this paper would focus on the following 2 items:

- Identify which major sources of SLCFs can be mapped to IPCC source/sink categories.
- Compare the methodologies in the IPCC inventory guidelines and those in the EMEP/EEA air pollutant emission inventory guidebook to identify what can be harmonized and what cannot.

¹ EMEP = European Monitoring and Evaluation Programme, EEA = European Environment Agency

² <https://www.eea.europa.eu/themes/air/emep-eea-air-pollutant-emission-inventory-guidebook/emep>

- (2) In mid 2020, an expert meeting will be held by TFI, possibly jointly with the UNECE/TFEIP, to comprehensively examine available methodological guidance for SLCFs to identify knowledge gaps, taking into account the outcomes of expert meeting on SLCF in May 2018 as well as the paper mentioned above (1). A report of this expert meeting will be published as IPCC Supporting Material.
- (3) The outcomes of the steps (1) and (2) will be reported to the Panel at the 53rd Session in October 2020. They will help assessing possible solutions to the identified gaps in the existing methodological guidance on SLCF inventory and will help countries who wish to start producing and reporting national SLCF inventories.
- (4) A further work plan will be decided by the Panel at the 53rd Session in October 2020 after consideration of the outcomes of the steps (1) to (3) above. This future work plan will take into account the discussion by the Panel at a future session(s) after the 49th Session of IPCC as well as the views of the UNFCCC.
- One possible approach may be to organize two expert meetings in 2021 focusing on specific sources/SLCF species to come up with detailed methodological guidance.
 - One more expert meeting may be held jointly by TFI and WGI again in late 2021 or early 2022, building on the WGI contribution to the AR6 which will be approved/accepted in April 2021 as well as the outcomes of TFI expert meetings mentioned above. This joint expert meeting may be useful to provide insights for the further TFI work during the AR7 cycle, benefiting from the latest WGI's assessment of climate effects of SLCFs including issues on metrics, among others.
 - Reports of these expert meetings will be published as IPCC Supporting Materials.
 - Production of a new Methodology Report which deals with SLCF inventory, if necessary, may be done in the AR7 cycle, building on the outcome of these steps.

Option B (Early start of production of comprehensive guidelines with a view to its completion in AR6 cycle)

This option is presented in response to the suggestion made during the discussion at the 48th Session of the IPCC to the effect that the development of methodologies and emission factors for SLCF emission estimation could commence during the current AR6 cycle. The product of TFI work according to this option will be comprehensive guidelines for national SLCF inventories as an IPCC Methodology Report.

It should be noted that production of an IPCC Report needs to be completed within the AR6 cycle if it commences during the AR6 cycle. Carry-over of the production of an IPCC Report from AR6 cycle to AR7 cycle is not possible because of the discontinuity of TFB and TFI TSU. Taking it into account, two different schedules may be considered for this option.

Table 3: Schedule for sub-options under Option B

Necessary Event in accordance with the IPCC Procedures	Option B-1	Option B-2
Scoping Meeting	May 2020	Nov 2019
Approval of Outline by the Panel	Oct 2020 (IPCC-53)	Feb 2020 (IPCC-52)
Author nomination	Nov-Dec 2020	Mar-Apr 2020
Author selection	Jan 2021	May 2020
1 st Lead Author Meeting (LAM1)	Apr 2021	Aug 2020
2 nd Lead Author Meeting (LAM2)	Jul 2021	Nov 2020
Expert Review of the 1 st order draft	Oct-Nov 2021	Feb-Mar 2021
3 rd Lead Author Meeting (LAM3)	Jan 2022	May 2021
Government/Expert Review of the 2 nd order draft	Apr-May 2022	Aug-Sep 2021

4 th Lead Author Meeting (LAM4)	Jul 2022	Nov 2021
Final Government Review of the final draft	Oct-Nov 2022	Feb-Mar 2022
Adoption/Acceptance by the Panel	Early 2023 (IPCC-58)	May 2022 (IPCC-57)

Note:

- The dates of the Plenary Sessions are provisional, based on the latest information.
- For the Option B-1, the Adoption/Acceptance Plenary Session in early 2023 may be IPCC-58 or IPCC-59.
- If the IPCC-53 takes place earlier (e.g. July 2020), the implementation of Option B-1 may be completed at IPCC-58 in late 2022.

4. Consideration

Impact of the products

In terms of impact of the products, a Methodology Report would have a greater impact than a series of Supporting Materials. If comprehensive guidelines for national SLCF inventories are successfully produced as an IPCC Methodology Report according to the Option B, production of SLCF emission inventories by countries may be accelerated than the Option A. However, it should be noted that a hastily-conceived report - in terms of scope, consistency and relevance of the guidance - may also bear significant negative impact, such as inconsistent or overlapping inventories. The production of such comprehensive guidelines requires not only a lot of human and financial resources but also sufficient time.

Technical feasibility

As compared to the Option A, the Option B is challenging in terms of technical feasibility. In order to produce high-quality comprehensive guidelines, the run-up to the Scoping Meeting is important. For example, four expert meetings were held during two years preceding the Scoping Meeting for the *2019 Refinement*. Although useful preliminary discussion was made at the expert meeting in May 2018, there is still some preparatory work which needs to be done before the Scoping Meeting for SLCF inventory guidelines, including coordination with other organizations (e.g. UNECE TFEIP) in line with the conclusions of the expert meeting in May 2018. In this context, the Option B-2 is particularly difficult. It should be also noted that both the Options B-1 and B-2 assume tighter schedules than that of production of the *2019 Refinement*, and that the work would be harder than that for the *2019 Refinement* in view of the different emission characteristics of SLCFs as compared to those of GHGs which the TFI has been dealing with for more than a decade.

Financial implications

The Option A will require three or four expert meetings with about 80 attendees from 2020 to 2022. Therefore the IPCC Trust Fund budget required for the Option A will be about 560,000 – 750,000 CHF in total. The Option B will require a scoping meeting with about 100 attendees and 4 lead author meetings with about 200 authors, and in the case of the Option B-1 one additional Plenary Session will be also required. Therefore the IPCC Trust Fund budget required for the Options B-1 and B-2 will be about 3,020,000 CHF and 2,260,000 CHF in total, respectively.

Other implications

The product of the proposed work, whether Supporting Material or a Methodology Report, would be used in improving the reporting of emissions of SLCFs in greenhouse gas inventory reporting and inventories of air pollutants. The scope of SLCFs for which methodologies would be developed is broader than presently in the greenhouse gas inventory reporting. Therefore, its scoping needs to be carefully done with views of stakeholders taken into account, including those of the UNFCCC.

In addition, there are some other implications to note with regard to the Option B.

According to the Option B-1, one additional Plenary Session will be necessary to adopt/accept the new Methodology Report early 2023 (or late 2022). It will be after the IPCC-57 in May 2022 to approve the Synthesis Report of AR6. This is not in line with the convention according to which the last event of an IPCC cycle is the approval of Synthesis Report.

According to the Option B-2, some events will likely collide with those for production of Synthesis Report of AR6. The Government and Expert Review of SOD will likely collide with the Government and Expert Review of FOD of AR6 Synthesis Report. The Final Government Review will likely collide with the Final Government Consideration of AR6 Synthesis Report. Furthermore, the adoption/acceptance of the new Methodology Report will have to take place at the same Plenary Session (IPCC-57 in May 2022) as the approval of AR6 Synthesis Report.

**Annex I:
Executive Summary of the Report of Expert Meeting on Short-Lived Climate Forcers (SLCF)
on 28-31 May 2018 in Geneva, Switzerland**

The IPCC Task Force on National Greenhouse Gas Inventories (TFI) and Working Group I (WGI) held an Expert Meeting on Short-Lived Climate Forcers (SLCF)³ on 28-31 May 2018 in Geneva, Switzerland, hosted by the World Meteorological Organization (WMO).

SLCF species are gases and particles that affect the climate. They have lifetimes in the atmosphere of a few days to a decade, and many of them are also air pollutants. Human activities contribute to SLCF emissions to the atmosphere. The impacts of SLCF species on climate are complex and depend on multiple factors, for example, where and when they are emitted. Methane is the longest lived SLCF, and is also included under the well mixed GHGs. There has been substantial improvement in scientific understanding of emissions and climate effects of SLCFs since the last Expert Meeting on Emission Estimation of Aerosols Relevant to Climate Change in 2005, and continued improvements since the AR5 WGI report (2013).

The following SLCF species were considered during the Expert Meeting: Black Carbon (BC), Organic Carbon (OC), PM_{2.5}, NO_x, CO, NMVOC (including BVOC), SO₂ and NH₃. Methane and halogenated compounds were not included, because inventory methodologies for them are already provided in the *2006 IPCC Guidelines for National Greenhouse Gas Inventories (2006 IPCC Guidelines)*.

Since AR5, progress has been made in improved definitions of OC and BC, increased understanding of non-combustion aerosol sources, more measurements on aerosol particle sizes, and better model parameterisations of aerosol processes. Some of the remaining uncertainties are expected to be reduced if more information on SLCF emissions from improved inventories is available. More robust emission estimates can manage some of the remaining uncertainties associated with recent and projected SLCF radiative forcing.

Much of the existing work on SLCF inventories is due to the role of these substances in affecting air quality and human health. Improved SLCF emission inventories and methodologies are also necessary to enhance scientific understanding and assessment of their role in climate change as well as to inform climate policy at the national and international levels, particularly through United Nations Framework Convention on Climate Change (UNFCCC). Internationally-agreed, globally applicable methodologies and emission factors for SLCF emission inventories are necessary. In several cases there are current data gaps that limit their application and require further developments. It is desirable to commence work for these inventories, based on existing methodologies such as those in the EMEP/EEA Emission Inventory Guidebook for Air Pollutants (EMEP/EEA Guidebook), recognizing that further discussion is needed on the timing, nature, format, and sequencing of such work. The IPCC can play an important role because of its unique position, and therefore it is considered to be the right organization to fill gaps in existing methodologies and to develop and disseminate an internationally-agreed, globally applicable methodological guidance based on existing methodologies. This could be achieved in close cooperation and collaboration with other relevant international bodies such as EMEP/EEA, CCAC, Arctic Council, ICAO, IMO.

³ Short-lived climate forcers (SLCF) are also referred to as short-lived climate pollutants (SLCP). They are referred to as near-term climate forcers (NTCF) in the AR5, which are a set of compounds whose impact on climate occurs primarily within the first decade after their emission. This set of compounds includes methane, which is also a well-mixed greenhouse gas, ozone and aerosols, or their precursors, and some halogenated species that are not well-mixed greenhouse gases (Annex 3 Glossary, WGI contribution to AR5).

Some SLCF species are of key importance globally and/or regionally for climate change (e.g. CH₄, NO_x, OC, BC and SO₂). Others may become a high-priority over time in terms of mitigation strategies (e.g. NH₃ and VOC). In order to take into account trends and developments, all SLCFs should be considered with more focus on species and sources that are not well covered in existing guidance. It is recognised that OC is not covered in existing guidance due to methodology and data gaps. The current approach to derive BC emissions might need assessment, improvement or new elaboration due to significant challenges in deriving BC from PM_{2.5} and variability in observations.

If the IPCC Plenary decides to engage into further work on SLCF inventories, careful consideration needs to be given to possible issues in consolidating existing inventory methodologies on GHGs and SLCFs, including those in harmonizing methods, aligning source categories, documenting emission factors, and linking to climate processes and climate change, and to establishing close cooperation and information exchange with other bodies working with these issues, for example, the UNECE Task Force on Emission Inventories and Projections (TFEIP), which develops the EMEP/EEA Guidebook.

Generally, much of the existing guidance on good practice methodologies/approaches on GHG inventory is applicable to, or can be a good basis for, SLCF inventories at a national level, if a more detailed air pollutant inventory does not exist. For example, the common activity data could be used for fossil fuel combustion, livestock enteric fermentation and manure management source categories, although additional information may be required for SLCF emission estimation. For some emission sources, however, existing inventory methodology does not provide a good basis for SLCF inventory (e.g., combustion of biofuels for cooking and heating, open burning of domestic waste).

Reporting of SLCF and GHG inventories should be in mass units for each individual emitted compound. Some SLCF species (e.g., VOC) comprise multiple different chemical compounds and thus mass-based emissions must be carefully defined. It should be noted that the existing inventory methodology on GHGs (*2006 IPCC Guidelines*) does not require inventory compilers to calculate and report national total emissions in CO₂ equivalent unit. The understanding of emission metrics and how they can be used, particularly in the context of SLCF emissions, has advanced but there is currently no agreed recommendation. The meeting participants concluded that SLCF emissions addressed in this meeting report should not be converted to CO₂ equivalent units in the same way as done based on GWP₁₀₀ in the inventory reporting under the UNFCCC. The meeting agreed that the issue of metrics and how they can be used may be further considered based on new scientific literature for coordination across Working Group reports, particularly those of Working Group I and Working Group III, towards the Synthesis Report (SYR) of the Sixth Assessment Report (AR6).

Key aspects of future work in this area, including the timing, scope, nature, format, and sequencing of such work on inventory methodology should be considered by the scientific steering committee for this expert meeting and the Bureau of IPCC Task Force on National Greenhouse Gas Inventories (TFB), and be decided by the IPCC Plenary.