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Abbreviations

IPCC = Intergovernmental Panel on Climate Change

UNFCCC = United Nations Framework Convention on Climate Change

GHG = greenhouse gas

GWP = Global Warming Potential

SAR = Second Assessment Report (IPCC, 1995)

TAR = Third Assessment Report (IPCC, 2001)

AR4 = Fourth Assessment Report (IPCC, 2007)

Revised 1996 Guidelines = Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories (IPCC, 1996)

GPG2000 = Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories (IPCC, 2000)

GPG-LULUCF = Good Practice Guidance for Land Use, Land-Use Change and Forestry (IPCC, 2003)

2006 Guidelines = 2006 IPCC Guidelines for National Greenhouse Gas Inventories (IPCC, 2006)

LUCF = Land-Use Change and Forestry

LULUCF = Land Use, Land-Use Change and Forestry

IPPU = Industrial Processes and Product Use

AFOLU = Agriculture, Forestry and Other Land Use

Questions about IPCC (National Greenhouse Gas Inventories Programme)

Q1. What is the role of the IPCC in Greenhouse Gas Inventories and reporting to the UNFCCC?

A: The IPCC has generated a number of methodology reports on national greenhouse gas inventories with a view to providing internationally acceptable inventory methodologies. The IPCC accepts the responsibility to provide scientific and technical advice on specific questions related to those inventory methods and practices that are contained in these reports, or at the request of the UNFCCC in accordance with established IPCC procedures. The IPCC has set up the Task Force on Inventories (TFI) to run the National Greenhouse Gas Inventory Programme (NGGIP) to produce this methodological advice. Parties to the UNFCCC have agreed to use the *IPCC Guidelines* in reporting to the convention. Annex I Parties are required to use the *Revised 1996 Guidelines for National Greenhouse Gas Inventories (Revised 1996 Guidelines)*, the *Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories (GPG2000)* and the *Good Practice Guidance for Land Use, Land-Use Change and Forestry (GPG-LULUCF)*. Non-Annex I Parties should use the *Revised 1996 Guidelines* and are “encouraged” to use the *GPG2000* and the *GPG-LULUCF*. See <http://www.ipcc-nggip.iges.or.jp/> for full details.

Q2. How does the IPCC produce its Inventory Guidelines?

A: Utilising IPCC procedures, nominated experts from around the world draft the reports that are then extensively reviewed twice before approval by the IPCC. This process ensures that the widest possible range of views are incorporated into the documents. See <http://www.ipcc-nggip.iges.or.jp/> for full details.

Q3. What are the required steps to be taken to have an inventory methodology accepted by the IPCC?

A: The IPCC NGGIP follows IPCC procedures and inventory methodology reports are prepared in accordance with the decision of the IPCC. When preparing inventory methodological reports, authors review the latest science and technological knowledge for the best methodologies. These are then described in the methodology report which is reviewed once by experts and the second time by governments and experts before adoption/acceptance by the IPCC.

It should be noted that the IPCC does not limit specific methodologies to be used, but rather where a better national method is available for a specific sector the IPCC recommends it be used. The only requirement is that these national methods should be transparent and documented.

Q4. How can new data and information be taken up by the IPCC NGGIP?

A: The IPCC NGGIP can only include in its reports the new inventory information that are approved by the IPCC process. The IPCC NGGIP follows IPCC procedures and inventory methodology reports are prepared in accordance with the decision of the IPCC. However the IPCC has created the Emission Factor Database (EFDB). This aims to be a constantly updated library of emission factors and other parameters that can be used by inventory compilers under their responsibility. New data and parameters can be proposed to the EFDB for dissemination on a wider basis. The Editorial

Board of the EFDB examines such proposals in terms of their scientific robustness. See <http://www.ipcc-nggip.iges.or.jp/EFDB/> for full details.

Questions about General Greenhouse Gas Issues

Q5. How do greenhouse gases affect the atmosphere?

A: Scientific aspects of greenhouse gases are dealt with by Working Group 1 of the IPCC. See <http://www.ipcc.ch/>.

Q6. What are the major greenhouse gases?

A: Scientific aspects of greenhouse gases are dealt with by Working Group 1 of the IPCC. See <http://www.ipcc.ch/>. The NGGIP deals with the following anthropogenic emissions by sources and removals by sinks of greenhouse gases (GHG).

Those covered in the *Revised 1996 Guidelines*;

- Carbon dioxide (CO₂)
- Methane (CH₄)
- Nitrous oxide (N₂O)
- Hydrofluorocarbons (HFCs - this is really a family of gases, there are many individual gases)
- Perfluorocarbons (PFCs - this is also a family of gases)
- Sulphur hexafluoride (SF₆)

Other direct GHG covered in the *2006 IPCC Guidelines for National Greenhouse Gas Inventories (2006 Guidelines)*;

- Nitrogen trifluoride (NF₃)
- Trifluoromethyl sulphur pentafluoride (SF₅CF₃)
- Halogenated ethers
- Other halocarbons

The NGGIP inventory guidelines do not include GHGs covered by the Montreal Protocol, such as;

- Chlorofluorocarbons (CFCs - this is also a family of gases)
- Hydrochlorofluorocarbons (HCFCs - this is also a family of gases)

There are also the “indirect” GHGs that do not directly contribute to the greenhouse effect, but once they are released into the atmosphere they form substances (e.g. tropospheric ozone O₃, aerosols) which contribute to the greenhouse effect. Indirect anthropogenic greenhouse gases are, amongst others, carbon monoxide (CO), non-methane volatile organic compounds (NMVOC), nitrogen oxides (NO_x), ammonia (NH₃) and sulphur dioxide (SO₂). *2006 Guidelines* contain links to information on methods used under other agreements and conventions, for the estimation of emissions of tropospheric precursors which may be used to supplement the reporting of emissions and removals of greenhouse gases for which methods are provided.

Q7. Why is water vapour not covered by the *IPCC Guidelines*?

A: There is a natural greenhouse effect which is largely driven by water vapour (H₂O) and other greenhouse gases which occur to a certain extent naturally in the atmosphere. However anthropogenic emissions of water vapour do not contribute significantly to the change of atmospheric water vapour concentration. Thus, the *IPCC Guidelines* do not deal with water vapour as an anthropogenic GHG.

Q8. How can you compare emissions of different gases?

A: The radiative impact of a single GHG depends on the amount emitted and its specific properties. Currently, in reporting to the UNFCCC, Parties are asked to weigh their emissions by the “Global Warming Potential” (GWP). The GWP are calculated as the ratio of the radiative forcing of one kilogramme greenhouse gas emitted to the atmosphere to that from one kilogramme CO₂ over a period of time. The precise numbers to be used are laid down by the UNFCCC and at present they are for a 100 year time horizon. More recent estimates of GWP are given in the IPCC’s third and fourth assessment reports. (Also see Q22.) (See the Working Group 1 reports <<http://www.ipcc.ch/>>).

Q9. Is reporting of GHG limited to six gases?

A: Decisions on what gases to report are made by the Parties to UNFCCC or to the Kyoto Protocol, not the IPCC. (See detailed reporting requirements: <http://unfccc.int>.)

Q10. What are precursor gases? Do we need to estimate for these for inclusion in the GHG inventory of the AFOLU Sector?

A: Precursors are gases whose emissions lead to the formation of substances in the atmosphere with a climate change impact. Precursors include SO₂, NO_x, NMVOC and CO. Precursor gases are known as such because they are precursors to the formation of greenhouse gases in the atmosphere. For a complete estimation of emissions from the AFOLU Sector, emissions of gases which give rise to indirect N₂O (i.e. NO_x and NH₃) need to be estimated. Indirect N₂O emissions are dealt with in Section 4.8, Chapter 4, of *GPG2000* and Section 11.2.2, Chapter 11, Volume 4(2) of *2006 Guidelines*.

Questions about Inventory Issues

Q11. Where can we find rules for corporate GHG inventories? Does IPCC provide guidelines for corporate GHG inventories?

A: The IPCC provides guidelines and methodologies for national greenhouse gas inventories and not for corporate level accounting. These guidelines are used by all countries that have ratified the United

Nations Framework Convention on Climate Change. However, no internationally agreed methodologies or rules for estimating the greenhouse gas or CO₂ balances at a company level exist, in particular for the purpose of emission trading or improving corporate environmental performance. Please see e.g. the website of the World Business Council for Sustainable Development. <http://www.wbcsd.org/>.

Q12. Where can we find methodological guidance for compilation of GHG inventory at a municipality level? Can the *IPCC Guidelines* be used for municipality GHG inventory?

A: Yes, we believe the *2006 IPCC Guidelines for National Greenhouse Gas Inventories* are useful for anyone who wishes to estimate GHG emissions/removals. You will need to be careful with differences between reporting requirements for countries and those for cities, but in most cases the estimation methods in the *2006 IPCC Guidelines* can be used to estimate GHG emissions at a city level. You may also need to consider boundary issues and availability of activity data at the municipality level.

Q13. What are the potential issues involved in using the *2006 Guidelines* for scales other than national scales?

A: The *IPCC Guidelines* can potentially be used for scales other than the national scales. However, *IPCC Guidelines* estimate emissions from within the national territories, while users of small scale inventories may be more interested in emissions resulting from activities in the area wherever they occur. Furthermore, data may not be available at all geographic scales.

Q14. Can national GHG national inventory guidelines be applied at sub-national scales? If so, would the sum of sub-national estimates equal the national estimate?

A: Yes, however it depends on the availability of data at the sub-national scales and consistent methodological choice at all levels.

Q15. Should inventory compilers perform and report the uncertainty analysis using the Tier 1 method, even if they have performed it using the Tier 2 method?

A: The Approach 1 method, being spreadsheet based, is very easy to apply and would represent hardly any additional effort for an inventory agency also undertaking Approach 2, therefore inventory compilers are encouraged to apply the Approach 1 method. For UNFCCC reporting guidelines, please see <http://unfccc.int>.

Q16. How can we calculate the change in emissions from burning biomass residues for energy instead of using fossil fuels?

A: The IPCC methodologies are intended to estimate national, anthropogenic emissions and removals rather than life cycle emissions and removals. However the *IPCC Guidelines* can be used, with care for different purposes. For calculating emissions from substitutions, all the changes in emissions and

removals must be accounted for.

Q17. Can we consider CO₂ produced by biomass burning for energy to be “CO₂ neutral” or “carbon neutral”?

A: Biomass burning for energy can not be automatically considered carbon neutral even if the biomass is harvested sustainably, there still may be significant emissions from processing and transportation etc. of the biomass. While CO₂ emissions from biomass burnt for energy are reported as zero in the Energy Sector, the net CO₂ emissions are covered in the AFOLU Sector.

Questions about Inventory Definitions

Q18. Are national methods, if available, considered to be better than those presented in the *IPCC Guidelines* (e.g., "default" methods)? If yes, where can we find in the *IPCC Guidelines* such statements?

A: YES, if it is well documented, better represents the national circumstances than the IPCC default methods and produces comparable and consistent results for each year in the time series.

See the *Revised 1996 Guidelines*, Vol.1 Reporting Instructions, Page Introd.2, Page Overview.4, and Page Overview.6.

Q19. Why do the sectoral definitions used by the IPCC for emission calculations differ from those used elsewhere e.g. used by NAMEA (national accounting matrix including environmental accounts) for emissions?

A: The *IPCC Guidelines for National Greenhouse Gas Inventories* aim to estimate total annual NATIONAL emissions. Hence the inventories aim to estimate all the emissions from the area under national jurisdiction for a specific year. The definitions follow this with a few pragmatic deviations and are designed to be globally applicable.

Inventories developed for different purposes may have different definitions, for example:

- They may consider extra-territorial emissions. For UNFCCC reporting, emissions from international bunker fuels are not included in national total emissions. The IPCC considers emissions under the jurisdiction of a country. For example, emissions from international bunker fuel use are not included in national total emissions.
- There may be a greater focus on economic considerations and the need for linkage to economic data.
- Differences may have developed historically. For example some local inventories have been developed to meet local needs.

Q20. In the *IPCC Guidelines*, is ‘NOx’ assumed to be NO₂ or NO, or some combination of NO and NO₂?

A: The convention in the *Revised 1996 IPCC Guidelines* and the *2006 Guidelines* is that NO_x (NO + NO₂) emissions are expressed on a full molecular basis assuming that all NO_x emissions are emitted as NO₂. (See the footnote on Page 1.37 of Vol.3 of the *Revised 1996 Guidelines*.)

Q21. Should I include emissions from sources not discussed in the *IPCC Guidelines*?

A: To be complete all significant sources of emission should be included. Where there is a source that is not included in the *IPCC Guidelines* it should still be reported where possible. Sources may not be included in the guidelines because there is not enough information to develop globally applicable methods or because they are specific to one or a few countries.

Questions about Global Warming Potentials

Q22. Differing GWP values are presented in the IPCC SAR, TAR and AR4. Which values should be used in calculation of GHG emissions in tonnes of CO₂-equivalent?

A: The IPCC Working Group 1 presents GWP values based on the up-to-date science, but does not recommend any rules on application of those values.

As science develops over time, the IPCC has conducted periodic assessments on human induced climate change, and the latest assessment resulted in the "Fourth Assessment Report (AR4)" which was published in 2007. (See IPCC Working Group 1 reports (<http://www.ipcc.ch/>.)

It is not the role of the IPCC NGGIP to make any recommendation on which CO₂ equivalent factors such as GWP values should be applied. For the purpose of official submissions of national GHG inventories under the UNFCCC, Annex I Parties are required to use the GWP values provided by the IPCC in its SAR based on the effects of GHGs over a 100-year time horizon, because it was so decided by the Conference of the Parties at its 5th session. (See the UNFCCC document FCCC/CP/1999/7 for details.)

Please note that also for the 1st commitment period under the Kyoto Protocol, SAR GWP (100 year horizon) should be used by the Parties in accordance with the decision by the COP3. (Decision 2/CP.3)

Questions about the Energy Sector

Q23. Do the *Revised 1996 Guidelines* allow for dealing with storage of GHG? If yes, how could we treat the stored quantities of CO₂ according to the *Revised 1996 Guidelines*?

A: Yes, the *Revised 1996 Guidelines* allow for dealing with storage of GHG although it is not mentioned explicitly. If reporting emissions under the *Revised 1996 Guidelines*, the emissions from the plant where the gas is captured will need to be estimated along with estimates of emissions from the collection, processing, transport and injection of the GHG along with any leaks from the final storage.

It is covered in the *2006 Guidelines* more explicitly in a way that is consistent with the *Revised 1996 Guidelines*.

Q24. How is the demarcation between “international transport” and “domestic transport” defined in the IPCC methodology?

A: Essentially each leg of a journey is treated separately. A leg starting in one country and ending in another is international, while a leg starting in one country and ending in the same country is national.

The *2006 Guidelines* have slightly simplified the data needs for the domestic versus international split as compared to the *GPG2000*. It is very unlikely that this change would make a significant change to the emission estimates (see section 3.6.1.3 in the Energy Volume of the *2006 Guidelines* and section 2.5.1.3 in the *GPG2000* for further details).

Q25. Where can we find GHG emission factors for electricity use?

A: GHG emissions from electricity use occur in the generation of the electricity. The emissions, per GWh produced depend on the fuels used and the efficiency of generation and transmission. The *IPCC Guidelines* enable one to estimate emissions from the fuels used to generate the electricity. Efficiency and mix of fuels varies dramatically from country to country so no general factors can be given, but given knowledge of the fuels used and the amount of electricity produced, suitable factors can be estimated. Note however that there may be additional local issues to be considered (e.g. imports/ exports of electricity or impact of load on fuel mix).

Q26. Where can we find GHG emission factors for electricity generation?

A: These are present under stationary combustion in the *IPCC Guidelines* (see Chapter 2 of Volume 2 Energy in the *2006 Guidelines*).

Q27. Where can we find GHG emission factors for combined cycle gas turbine (CCGT)?

A: The *IPCC Guidelines* use the fuel combusted (in GJ) as the activity data in all the Energy Sector source categories.

The *2006 Guidelines* have default carbon dioxide emission factors (kg CO₂/TJ) for different fuels including natural gas, the fuel mostly used in CCGT technology in Table 1.4 of chapter 1 of Volume 2. The emission depends on the carbon content and amount of fuel used.

Q28. Where can we find GHG emission factors for hydropower?

A: There are no globally applicable methods for estimating GHG emission from hydropower in terms of their operation.

The IPCC methods give an approach for the flooding of the dam area – essentially the biomass flooded is emitted over time.

There is on-going scientific research on this issue as described in the Appendices of Volume 4 in the *2006 Guidelines* as further inventory development, and you are encouraged to refer to the latest scientific literature.

Q29. Is peat classified as fossil fuel or as biofuel in the *IPCC Guidelines*? What is the scientific basis for the classification the IPCC has chosen?

A: In terms of the *Revised 1996 Guidelines*, peat or peatland appear in the Energy and the Land-Use Change and Forestry (LUCF) chapters. Peat is classified as "Solid Fossil" in the Energy Sector.

In the *2006 Guidelines* peat is not described as a fossil fuel or as biomass but as peat because "Although peat is not strictly speaking a fossil fuel, its greenhouse gas emission characteristics have been shown in life cycle studies to be comparable to that of fossil fuels (Nilsson and Nilsson, 2004; Uppenberg et al., 2001; Savolainen et al., 1994). Therefore, the CO₂ emissions from combustion of peat are included in the national emissions as for fossil fuels." (See the footnote 5 on page 1.15 in Chapter 1, Volume 2 in the *2006 Guidelines*.)

Q30. How can we calculate GHG emissions from charcoal production and in what category should we report them?

A: Emissions from charcoal production should be calculated using the guidance provided under source category 1.A.1.c "Manufacture of Solid Fuels and Other Energy Industries" of the *2006 Guidelines* and reported in this source category.

The *Revised 1996 Guidelines* however require non-CO₂ emissions from the production of charcoal should to be reported in 1B1 (Fugitive Emissions from Solid Fuels).

However, the use of charcoal (which is a fuel combustion activity) should be reported in 1A (in the subsection that will depend on where the fuel was used e.g. if in agriculture or fishing, it has to be reported under 1A4) both under the *Revised 1996 Guidelines* and the *2006 Guidelines*.

Q31. Should we include fugitive emissions of CH₄ from a natural gas pipeline which crosses multiple countries in the national total GHG emissions, or should we treat those emissions in the same way as those from "international bunker fuels"?

A: By definition, the international pipeline fugitive emissions cannot be regarded as "international bunker fuels", and hence these emissions ought to be included in national totals. Consequently, emissions from pipelines within national territories are to be included in the national inventories. According to the *IPCC Guidelines* countries should report, and include in their national total amounts, the fugitive CH₄ emissions from this kind of natural gas pipeline with a clear description of underlying logic or assumptions that prompted this action.

Questions about the Industrial Processes and Product Use Sector

Q32. How should we differentiate industrial process emissions and fuel combustion emissions?

A: Allocating emissions from the use of fossil fuel between the Energy and the Industrial Processes or the IPPU Sectors can be complex. The feedstock and reductant uses of fuels frequently produce gases that may be combusted to provide energy for the process. Equally part of the feedstock may be combusted directly for heat. This can lead to uncertainty and ambiguity in reporting. To help to overcome this problem, the *2006 Guidelines* introduce practical guidance on when to allocate CO₂ emissions released from combustion of fuel to the subcategory fuel combustion within the energy source category or to the industrial process source category. This rule is given in Box 1.1 in Chapter 1, Volume 3 of the *2006 Guidelines*. The guidance on this issue is less clear in the *Revised 1996 Guidelines* and the *GPG2000*. The rule given in the *2006 Guidelines* may be by and large consistently used in the context of the *Revised 1996 Guidelines* and the *GPG2000*.

Q33. Can we use “potential emissions” approach for estimation of emissions related to consumption of HFCs, PFCs and SF₆ to prepare national GHG inventories?

A: “Potential emissions” approach is presented as a Tier 1 method for estimation of emissions related to consumption of HFCs, PFCs and SF₆ in the *Revised 1996 Guidelines* and the *GPG2000*. Therefore, this approach can be used in the context of the *Revised 1996 Guidelines* and the *GPG2000*.

However, those emissions have been the subject of considerable study since the *Revised 1996 Guidelines* were written and the understanding of them has been greatly improved. Therefore, in the *2006 Guidelines*, the potential emissions approach is no longer considered appropriate, and the actual emissions approaches are presented as Tier 1 methods. The potential emissions approach is still described in the *2006 Guidelines* as a verification tool for completeness of sources and as a QC check of the sum of activity data per compound, which should be equal to the sum of apparent domestic consumption as calculated in the potential emissions approach. For more details, refer to Chapter 7 and Annex 2 in Volume 3 of the *2006 Guidelines*.

Q34. Should we deduct quantities of CO₂ for later use and short-term storage (e.g., CO₂ used for urea production, CO₂ used for production of carbonated drinks) from CO₂ emissions?

A: The approach to this issue differs between the *Revised 1996 Guidelines* and the *2006 Guidelines*. According to the *2006 Guidelines*, quantities of CO₂ for later use and short-term storage should not be deducted from CO₂ emissions except when the CO₂ emissions are accounted for elsewhere in the inventory. Examples of the exceptions include the use of CO₂ in urea production and in methanol production.

For example, according to Section 3.2, Chapter 3, Volume 3 of the *2006 Guidelines*, CO₂ recovered from ammonia production process for downstream use in urea production should be deducted from CO₂ emissions from ammonia production. When this deduction is made, it is *good practice* to ensure that emissions from urea use are included elsewhere in the inventory (e.g., in sub-category 3C3 “Urea Application” under the AFOLU Sector).

In the *Revised 1996 Guidelines*, however, this is not the case. According to Chapter 2, page 16 of

Volume 3 of the *Revised 1996 Guidelines*: “The CO₂ from ammonia production may be used for producing urea or dry ice. This carbon will only be stored for a short time. Therefore, no account should consequently be taken for intermediate binding of CO₂ in downstream manufacturing processes and products.”

With this the *2006 Guidelines* improve the *Revised 1996 Guidelines*.

Q35. Do the *IPCC Guidelines* provide any methodological guidance on absorption of CO₂ through carbonation reaction associated with cement and lime?

A: No, the *IPCC Guidelines* do not provide methodological guidance on this issue. In Section 2.2 on cement production in Volume 3 of the *2006 Guidelines*, this is explained as follows.

“There is one additional issue that, while not included in the current methodology, may become relevant for consideration in the future. Free lime (CaO not part of the formulae of the clinker minerals mentioned above) released during the curing of concrete (i.e., from the hydration of the clinker minerals) can potentially re-absorb atmospheric CO₂ - a process called carbonation. However, the rate of carbonation is very slow (years to centuries)”. (Page 2.15)

Similar explanation is given also in Section 2.3 on lime production in the same volume of the *2006 Guidelines* (page 2.24).

Q36. Do the *IPCC Guidelines* provide any guidance on how to collect confidential data/information from companies or business associations?

A: Yes. It is described in Section 2.2 “Collecting Data” in Chapter 2, Volume 1 of the *2006 Guidelines*. In the *Revised 1996 Guidelines* or *Good Practice Guidance* reports (*GPG2000* and *GPG-LULUCF*), no specific guidance is given on how to collect confidential data/information although it is repeatedly mentioned that confidentiality should be protected by aggregating data/information in the inventory reporting.

The guidance given in the aforementioned section in the *2006 Guidelines* may be consistently used also in the context of the *Revised 1996 Guidelines* and the *Good Practice Guidance* reports.

Questions about the Agriculture, Forestry and Other Land Use Sector

Q37. What are managed lands?

A: Managed land has been defined as “land where human interventions and practices have been applied to perform production, ecological or social functions”.

Q38. Should the greenhouse gas emissions/removals in the AFOLU Sector include those occurring only on managed lands? What about those occurring over unmanaged lands?

A: The *2006 Guidelines* state that for the AFOLU Sector, “anthropogenic greenhouse gas emissions and

removals by sinks are defined as all those occurring on 'managed land'. The use of managed land as a proxy for anthropogenic effects was adopted in the *GPG-LULUCF*. The preponderance of anthropogenic effects occurs on managed lands and, from a practical standpoint, the information needed for inventory estimation is largely confined to managed lands. Although it is not necessary to report the GHG emissions occurring over unmanaged lands, it is *good practice* to quantify and track changes over unmanaged lands as well to maintain consistency in area accounting as land use change occurs. However where an event [e.g. fire] on unmanaged land leads to a transition to managed land then the emissions from the event should be reported.

Q39. What are the key greenhouse gases for the AFOLU Sector? What are the processes responsible for emissions/removals of greenhouse gases from the AFOLU Sector?

A: The key greenhouse gases for the AFOLU Sector are CO₂, CH₄ and N₂O.

The processes responsible for the release/absorption of these are: CO₂ uptake through photosynthesis and release through combustion and decomposition, release of N₂O through nitrification and de-nitrification and release of CH₄ through methanogenesis under anaerobic conditions in soil and manure storage, enteric fermentation and during incomplete combustion of organic matter.

Q40. What are indirect emissions?

A: In the AFOLU Sector, "indirect emissions" refers to the formation of greenhouse gases displaced in time and space from the activities that are their ultimate cause. The application of nitrogenous substances to fields as fertiliser leads to direct emissions of N₂O as some of the N is emitted directly and also, through volatilization, leaching or runoff of nitrogen compounds into soil, waterways and the sea, as indirect N₂O as some of this nitrogen is subsequently converted to N₂O through denitrification. Indirect N₂O emissions are dealt with in Section 4.8, Chapter 4, of *GPG2000* and Section 11.2.2, Chapter 11, Volume 4(2) of *2006 Guidelines*.

Q41. What method should the countries use for estimating biomass carbon gain for land remaining in the same land use category if they do not have national carbon stock inventories?

A: Countries that do not have national carbon stock inventories system should use the gain-loss method for biomass carbon gain estimation using the default data provided in the *2006 Guidelines*. They can only use the stock difference method if they have carbon stock inventories at two points in time.

Q42. What is the default time period for which an area subject to land use change needs to be tracked for the estimation of carbon stock changes in the dead organic matter and soil carbon pools and why?

A: For estimating the carbon stock changes during transition periods, areas subject to land use change need to be tracked for a period required for the carbon pools to reach steady state levels of carbon. The default time period is 20 years for Tier 1 methods. However, under Tier 2 and 3 methods, this time period can be varied depending on the vegetation and other factors that determine the time required for the pools to reach steady state.

Q43. What is meant by the “equivalence” or “synchrony” of CO₂ emissions and removals? When is it reasonable to assume equivalence of CO₂ emissions and removals when considering CO₂ emissions due to fire?

A: “Equivalence” of CO₂ emissions and removals means that the CO₂ emissions would be counterbalanced by CO₂ removals from the subsequent re-growth of the vegetation within one year. This assumption is generally reasonable for land uses such as burning of grassland, annual crop and agricultural residues. However care must be taken to check whether woody vegetation is not lost in the process or if the grazing is the predominant use in the Forest land that is regularly burnt. In such cases net carbon stock change due to burning should be reported.

Q44. What are the three different Approaches to data collection and representation of land employed in the AFOLU Sector greenhouse gas estimation? When should they be used? Is there any correspondence between the approaches and the Tiers used for estimation of greenhouse gas emissions from the AFOLU Sector?

A: There are three Approaches to spatial data collection and representation as laid out in the *2006 Guidelines* viz. Approach 1, 2 & 3. These refer to the different ways in which area data could be collected and represented for greenhouse gas inventory purposes of the AFOLU Sector. The *2006 Guidelines* define these as: “Approach 1 identifies the total area for each individual land-use category within a country, but does not provide detailed information on the nature of conversions between land uses. Approach 2 introduces tracking of conversions between land-use categories. Approach 3 extends the information available in Approach 2 by allowing land-use conversions to be tracked on a spatially explicit basis. Countries may use a mix of Approaches for different regions over time.”

Tiers on the other hand represent the methodological complexity required to estimate the emissions and removals from a given category given its influence on a country’s total inventory, data availability and national circumstances. The use of particular Approach or a mix of Approaches for a Tier 1, 2 or 3 method will depend on the stratification schemes used for the inventory purposes. Further information on this topic is available in Chapter 3, Vol. 4 of the *2006 Guidelines*.

Q45. Are there any methodologies available for calculation of N₂O emissions from offsite decay of organic matter from horticultural peat?

A: Currently there are no methodologies available for estimation of N₂O emissions from the offsite decay of organic matter from horticultural peat, because generally nitrogenous fertilizers are added to the horticultural peat before use, and will likely dominate most of such emissions. In order to avoid double counting of the N₂O emissions from fertilizer use, the offsite emissions of N₂O from the decay of organic matter from horticultural peat are excluded from the N₂O emissions from lands managed for peat extraction.

Q46. What are the variables behind the IPCC default emission factors for enteric fermentation?

A: The variable for enteric fermentation CH₄ EF for dairy cows takes into account regions, weight, weight gain per day, feeding situation, milk per day, working hrs per day, % pregnant, digestibility of feed, and CH₄ conversion, and for non-dairy cattle, weight, weight gain per day, feeding situation, milk per day, working hrs per day, % pregnant, digestibility of feed, CH₄ conversion, and day weighted population mix.

Table 10A.3 in the *2006 Guidelines* presents the data for estimating Tier 1 enteric fermentation CH₄ EF for buffalo. The parameters considered are subcategory, weight, weight gain, feeding situation, milk per day, work hours per day, % pregnant, digestibility of feed, CH₄ conversion factor and day weighted population mix.

The relevant sections of Chapter 4 of the *Revised 1996 Guidelines*, and Chapter 10, Volume 4 of *2006 Guidelines*, dealing with emissions from livestock and manure management can be accessed at <http://www.ipcc-nggip.iges.or.jp/public/gl/invs6.htm>

and

<http://www.ipcc-nggip.iges.or.jp/public/2006gl/vol4.htm> respectively.

Q47. Can we obtain removal units (RMUs) under the Kyoto Protocol from avoided emissions associated with peat mining operations in wetland/peatland area?

A: While the *IPCC Guidelines* provide estimation methods for managed wetlands and peat lands, but questions relating to all accounting issues under the Kyoto Protocol are beyond the scope of the IPCC-NGGIP. UNFCCC may be approached for some advice on this issue.

Q48. Are there any trans-boundary issues involved in estimation of indirect N₂O emissions from inputs to managed soil? If so is it reasonable to use country specific emission factors?

A: No. The method presented in Volume 1, Chapter 7, and Section 7.3 of the *2006 Guidelines* attributes all indirect N₂O emissions resulting from N inputs to managed soils to the country of origin of the atmospheric NO_x and NH₃, rather than the country to which the atmospheric N may have been transported.

Q49. Do the guidelines take into account the creation of black or inert carbon stock?

A: Post fire residues consist of a small amount of char apart from burnt and partially burnt residues. This char or black carbon is highly resistant to decomposition due to its chemical nature. The current knowledge of its formation and turnover rates being very limited, it has not been possible to develop reliable methodologies for inventory purposes. However the *2006 Guidelines* include the technical basis for further methodological development in Appendix 1 of Volume 4.

Q50. How is the long term storage of carbon in wood products treated?

A: This is covered by the Harvested Wood Products section. The default assumption is that the stocks are stable – which implies emissions are equal to harvest. In the guidelines there are a number of

approaches to dealing with this where this assumption is not true. The UNFCCC has not yet decided which approach to use.

Q51. How are emissions from wetlands treated?

A: CO₂ is assumed to be covered by upstream carbon stock changes and N₂O by the indirect N₂O emissions in the AFOLU Sector. Although there is insufficient information to produce a globally applicable method for CH₄ from wetlands, some information is contained in Appendix 3 of Volume 4 in the *2006 Guidelines*.

Q52. Should a country wish to report the CH₄ emissions from termites, do the *IPCC Guidelines* provide methodologies to estimate these?

A: The *2006 Guidelines* provide that "... some biomass losses can lead to emissions of C other than as CO₂, such as biomass consumption and emission as methane (CH₄) by termites and wild mammals. Default Tier 1 methods for these sources have not been developed, and countries wishing to estimate and report these emissions should develop and employ a Tier 3 approach".

Questions about the Waste Sector

Q53. Should we estimate and report CO₂ emissions from wastewater treatment?

A: No. CO₂ emissions from wastewater treatment are not included in the national total in the *IPCC Guidelines* since these are assumed to be of biogenic origin, because any net changes in carbon stock of biogenic origin is covered in the AFOLU Sector.

Q54. How should we treat CO₂ emissions from waste incineration, where the waste is of mixed biogenic and non-biogenic material?

A: Distinctions between carbon of biogenic and non-biogenic origins have to be made, because any net changes in carbon stock of biogenic origin is already covered in the AFOLU Sector. The method to estimate the non-biogenic carbon fraction is described in Sections 2.3 and 5.4.1.2. of the Waste Volume of the *2006 Guidelines*.

In the absence of energy recovery by the incineration of waste, CO₂ emissions from the incineration of non-biogenic carbon in the waste are considered as net emissions and reported under the Waste Sector while those of biogenic carbon in the waste should not be included in national total.

Where the incineration of waste is used for obtaining energy, CO₂ emissions from non-biogenic carbon need to be reported under the Energy Sector. Emissions from biogenic carbon should be reported as information items under the Energy Sector, hence, not included in the national total.

Q55. Can the mass-balance approach be used for waste disposal sites where historical data are not available?

A: The mass-balance method is included in the *Revised 1996 Guidelines* and *GPG2000* and so is consistent with the requirements for Annex 1 parties, where a higher tier method is not indicated by the decision tree (*GPG2000*, Fig 5.1).

However, the *Revised 1996 Guidelines* allow inventory compilers to choose any methods with which they believe would improve their inventories beyond the default methods and/or make them more complete. The authors of the *2006 Guidelines* believe that their first order decay (FOD) approach was an improvement over the mass-balance approach, even when there is only a single years worth of data. Therefore if Inventory compilers do not have historical data they should consider using the FOD method together with the guidance on data collection and ways of dealing with a lack of historic data.