Annex

Data quality principles from major GHG accounting protocols, standards, and guidelines

The text that is contained within this annex is taken from the major GHG accounting documents referenced in the GHGMI blog post, "The overlooked mystery of the missing GHG accounting principles." They are aggregated herein, from versions accessed online in December of 2021, to ease cross-referencing for the reader.

2006 IPCC Guidelines for National Greenhouse Gas Inventories: Volume 1 General Guidance and Reporting, Chapter 1

These guidelines provide guidance on ensuring quality on all steps of the inventory compilation – from data collection to reporting. They also provide tools to focus resources on the areas where they will most benefit the overall inventory and encourage continuous improvement. Experience has demonstrated that using a good practice approach is a pragmatic means of building inventories that are consistent, comparable, complete, accurate and transparent – and maintaining them in a manner that improves inventory quality over time. Indicators of inventory quality are:

Transparency: There is sufficient and clear documentation such that individuals or groups other than the inventory compilers can understand how the inventory was compiled and can assure themselves it meets the good practice requirements for national greenhouse gas emissions inventories. Documentation and reporting guidance is provided in Chapter 8, Reporting Guidance and Tables, of Volume 1 and in the respective chapters of Volume 2-6 (see also Volume 1, Chapter 6, QA/QC and Verification).

Completeness: Estimates are reported for all relevant categories of sources and sinks, and gases. Geographic areas within the scope of the national greenhouse gas inventory are recommended in these Guidelines. Where elements are missing their absence should be clearly documented together with a justification for exclusion (see Volumes 2-5).

Consistency: Estimates for different inventory years, gases and categories are made in such a way that differences in the results between years and categories reflect real differences in emissions. Inventory annual trends, as far as possible, should be calculated using the same method and data sources in all years and should aim to reflect the real annual fluctuations in emissions or removals and not be subject to changes resulting from methodological differences. (See Chapter 2: Approaches to Data Collection, Chapter 4: Methodological Choice and Identification of Key Categories, and Chapter5: Time Series Consistency in Volume 1.)

Comparability: The national greenhouse gas inventory is reported in a way that allows it to be compared with national greenhouse gas inventories for other countries. This comparability should be reflected in appropriate choice of key categories (see Volume 1, Chapter 4), and in the use of the reporting guidance and tables and use of the classification and definition of categories of emissions and removals presented in Table 8.2 of Chapter 8, and Volumes 2-5.

Accuracy: The national greenhouse gas inventory contains neither over- nor under-estimates so far as can be judged. This means making all endeavours to remove bias from the inventory estimates (see especially Chapter 2, Approaches to Data Collection, and Chapter 3, Uncertainties, in Volume 1 and Volumes 2-5).

GHG Protocol Corporate Accounting and Reporting Standard

***Relevance**:* Ensure the GHG inventory appropriately reflects the GHG emissions of the company and serves the decision-making needs of users – both internal and external to the company.

***Completeness**:* Account for and report on all GHG emission sources and activities within the chosen inventory boundary. Disclose and justify any specific exclusions.

***Consistency**:* Use consistent methodologies to allow for meaningful comparisons of emissions over time. Transparently document any changes to the data, inventory boundary, methods, or any other relevant factors in the time series.

***Transparency**:* Address all relevant issues in a factual and coherent manner, based on a clear audit trail. Disclose any relevant assumptions and make appropriate references to the accounting and calculation methodologies and data sources used.

***Accuracy**:* Ensure that the quantification of GHG emissions is systematically neither over nor under actual emissions, as far as can be judged, and that uncertainties are reduced as far as practicable. Achieve sufficient accuracy to enable users to make decisions with reasonable assurance as to the integrity of the reported information.

***Relevance**:* Use data, methods, criteria, and assumptions that are appropriate for the intended use of reported information The quantification and reporting of GHG reductions should include only information that users—both internal and external to the GHG project—need for their decision-making. This information should thus fit the intended purpose of the GHG project and meet the expectations or requirements of its users. Data, methods, criteria, and assumptions that are misleading or that do not conform to Project Protocol requirements are not relevant and should not be included.

***Completeness**:* Consider all relevant information that may affect the accounting and quantification of GHG reductions, and complete all requirements All relevant information should be included in the quantification of GHG reductions. Among other things, this means that all the GHG effects of a GHG project should be considered and assessed (Chapter 5), all relevant technologies or practices should be considered as baseline candidates (Chapter 7), and all relevant baseline candidates should be considered when estimating baseline emissions (Chapters 8 and 9). The GHG project's monitoring plan should also specify how all data relevant to quantifying GHG reductions will be collected (Chapter 10). Finally, notwithstanding areas where there is flexibility and discretion, all requirements within relevant chapters should be completed to quantify and report GHG reductions.

***Consistency**:* Use data, methods, criteria, and assumptions that allow meaningful and valid comparisons The credible quantification of GHG reductions requires that methods and procedures are always applied to a GHG project and its components in the same manner, that the same criteria and assumptions are used to evaluate significance and relevance, and that any data collected and reported will be compatible enough to allow meaningful comparisons over time.

***Transparency**:* Provide clear and sufficient information for reviewers to assess the credibility and reliability of GHG reduction claims Transparency is critical for quantifying and reporting GHG reductions, particularly given the flexibility and policy-relevance of many GHG accounting decisions (see Chapter 3). GHG project information should be compiled, analysed, and documented clearly and coherently so that reviewers may evaluate its credibility. Specific exclusions or inclusions should be clearly identified, assumptions should be explained, and appropriate references should be provided for both data and assumptions. Information relating to the GHG assessment boundary, the identification of baseline candidates, and the estimation of baseline emissions should be sufficient to enable reviewers to understand how all conclusions were reached. A transparent report will provide a clear understanding of all assessments supporting GHG reduction accounting and quantification. This should be supported by comprehensive documentation of any underlying evidence to confirm and substantiate the data, methods, criteria, and assumptions used.

***Accuracy**:* Reduce uncertainties as much as is practical Uncertainties with respect to GHG measurements, estimates, or calculations should be reduced as much as is practical, and measurement and estimation methods should avoid bias. Acceptable levels of uncertainty will depend on the objectives for implementing a GHG project and the intended use of quantified GHG reductions. Greater

accuracy will generally ensure greater credibility for any GHG reduction claim. Where accuracy is sacrificed, data and estimates used to quantify GHG reductions should be conservative.

***Conservativeness**:* Use conservative assumptions, values, and procedures when uncertainty is high GHG reductions should not be overestimated. Where data and assumptions are uncertain and where the cost of measures to reduce uncertainty is not worth the increase in accuracy, conservative values and assumptions should be used. Conservative values and assumptions are those that are more likely to underestimate than overestimate GHG reductions.

ISO 14064-1 Greenhouse gases — Part 1: Specification with guidance at the organization level for quantification and reporting of greenhouse gas emissions and removals

General

The application of principles is fundamental to ensure that GHG-related information is a true and fair account. The principles are the basis for, and will guide the application of, the requirements in this document.

Relevance*:* Select the GHG sources, GHG sinks, GHG reservoirs, data and methodologies appropriate to the needs of the intended user.

Completeness*:* Include all relevant GHG emissions and removals.

Consistency*: Enable meaningful comparisons in GHG-related information.*

Accuracy*:* Reduce bias and uncertainties as far as is practical.

Transparency*:* Disclose sufficient and appropriate GHG-related information to allow intended users to make decisions with reasonable confidence.

ISO 14064-2 Greenhouse gases — Part 2: Specification with guidance at the project level for quantification, monitoring and reporting of greenhouse gas emission reductions or removal enhancements

General
The application of principles is fundamental to ensure that GHG-related information is a true and fair account. The principles are the basis for, and will guide the application of, the requirements in this document.

***Relevance**:* Select the GHG SSRs, data and methodologies appropriate to the needs of the intended user.

***Completeness**:* Include all relevant GHG emissions and removals. Include all relevant information to support criteria and procedures.

***Consistency**:* Enable meaningful comparisons in GHG-related information.

***Accuracy**: Reduce bias and uncertainties as far as is practical.*

***Transparency**:* Disclose sufficient and appropriate GHG-related information to allow intended users to make decisions with reasonable confidence.

***Conservativeness**:* Use conservative assumptions, values and procedures to ensure that GHG emission reductions or removal enhancements are not over-estimated.

Used by Verified Carbon Standard (VCS) with this addition:
Note – Accuracy should be pursued as far as possible, but the hypothetical nature of baselines, the high cost of monitoring of some types of GHG emissions and removals, and other limitations make accuracy difficult to attain in many cases. In these cases, conservativeness may serve as a moderator to accuracy in order to maintain the credibility of project and program GHG quantification.

Global Protocol for Community-Scale Greenhouse Gas Inventories

Accounting and reporting for city-wide GHG emissions is based on the following principles adapted from the GHG Protocol Corporate Standard in order to represent a fair and true account of emissions.

***Relevance**:* The reported GHG emissions shall appropriately reflect emissions occurring as a result of activities and consumption patterns of the city. The inventory will also serve the decision-making needs of the city, taking into consideration relevant local, subnational, and national regulations. The principle of relevance applies when selecting data sources, and determining and prioritizing data collection improvements.

***Completeness**:* Cities shall account for all required emissions sources within the inventory boundary. Any exclusion of emission sources shall be justified and clearly explained. Notation keys shall be used when an emission source is excluded, and/or not occurring (see Section 2.2).

***Consistency**:* Emissions calculations shall be consistent in approach, boundary, and methodology. Using consistent methodologies for calculating GHG emissions enables meaningful documentation of emission changes over time, trend analysis, and comparisons between cities. Calculating emissions should follow the methodological approaches provided by the GPC. Any deviation from the preferred methodologies shall be disclosed and justified.

***Transparency**:* Activity data, emission sources, emission factors, and accounting methodologies require adequate documentation and disclosure to enable verification. The information should be sufficient to allow individuals outside of the inventory process to use the same source data and derive the same results. All exclusions shall be clearly identified, disclosed and justified.

***Accuracy**:* The calculation of GHG emissions shall not systematically overstate or understate actual GHG emissions. Accuracy should be sufficient enough to give decision makers and the public reasonable assurance of the integrity of the reported information. Uncertainties in the quantification process shall be reduced to the extent that it is possible and practical.

GHG Protocol Policy and Action Standard

Relevance: Ensure the GHG assessment appropriately reflects the GHG effects of the policy or action and serves the decision-making needs of users and stakeholders—both internal and external to the reporting entity. Users should apply the principle of relevance when selecting the desired level of accuracy and completeness among a range of methodological options. Applying the principle of relevance depends on the objectives of the assessment (Chapter 2).

Completeness: Include all significant GHG effects, sources, and sinks in the GHG assessment boundary. Disclose and justify any specific exclusions.

Consistency: Use consistent accounting approaches, data collection methods, and calculation methods to allow for meaningful performance tracking over time. Transparently document any changes to the data, GHG assessment boundary, methods, or any other relevant factors in the time series.

Transparency: Provide clear and complete information for internal and external reviewers to assess the credibility and reliability of the results. Disclose all relevant methods, data sources, calculations, assumptions, and uncertainties. Disclose the processes, procedures, and limitations of the GHG assessment in a clear, factual, neutral, and understandable manner through an audit trail with clear documentation. The information should be sufficient to enable a party external to the GHG assessment process to derive the same results if provided with the same source data.

Accuracy: Ensure that the estimated change in GHG emissions and removals is systematically neither over nor under actual values, as far as can be judged, and that uncertainties are reduced as far as practicable. Achieve sufficient accuracy to enable users and stakeholders to make appropriate and informed decisions with reasonable confidence as to the integrity of the reported information. Accuracy should be pursued as far as possible, but once uncertainty can no longer be practically reduced, conservative estimates should be used. Box 4.1 provides guidance on conservativeness. In addition, users should follow the principle of comparability if relevant to the assessment objectives.

Comparability *(optional)*: Ensure common methodologies, data sources, assumptions, and reporting formats such that the estimated change in GHG emissions and removals resulting from multiple policies or actions can be compared. The principle of comparability should be applied if the objective is for a single entity to assess and compare multiple policies or actions using the same methodology. If the objective is to compare the results of independent assessments of policies carried out by different entities, users should exercise caution in comparing the results of policy assessments based on this standard. Differences in reported emissions impacts may be a result of differences in methodology rather than real-world differences. Additional measures are necessary to enable valid comparisons, such as consistency in the timeframe of the assessments, the types of effects included in the GHG assessment boundary, baseline assumptions, calculation methodologies, methods for assessing policy interactions, and data sources. Additional consistency can be provided through GHG reporting programs or more

detailed sector-specific guidance. To understand whether comparisons are valid, all methodologies, assumptions, and data sources used must be transparently reported.

Product Life Cycle Accounting and Reporting Standard

Relevance*:* Ensure that the product GHG inventory accounting methodologies and report serves the decision-making needs of the intended user. Present information in the report in a way that is readily understandable by the intended users.

Completeness: Ensure that the inventory report covers all product life cycle GHG emissions and removals within the specified boundaries; disclose and justify any significant GHG emissions and removals that have been excluded.

Consistency: Choose methodologies, data, and assumptions that allow for meaningful comparisons of a GHG inventory over time.

Transparency: Address and document all relevant issues in a factual and coherent manner, based on a clear audit trail. Disclose any relevant assumptions and make appropriate references to the methodologies and data sources used in the inventory report. Clearly explain any estimates and avoid bias so that the report faithfully represents what it purports to represent.

Accuracy: Ensure that reported GHG emissions and removals are not systematically greater than or less than actual emissions and removals and that uncertainties are reduced as far as practicable. Achieve sufficient accuracy to enable intended users to make decisions with reasonable assurance as to the reliability of the reported information.

Global Protocol for Community-Scale Greenhouse Gas Emission Inventories

Relevance: The reported GHG emissions shall appropriately reflect emissions occurring as a result of activities and consumption patterns of the city. The inventory will also serve the decision-making needs of the city, taking into consideration relevant local, subnational, and national regulations. The principle of relevance applies when selecting data sources, and determining and prioritizing data collection improvements.

Completeness: Cities shall account for all required emissions sources within the inventory boundary. Any exclusion of emission sources shall be justified and clearly explained. Notation keys shall be used when an emission source is excluded, and/or not occurring (see Section 2.2).

Consistency: Emissions calculations shall be consistent in approach, boundary, and methodology. Using consistent methodologies for calculating GHG emissions enables meaningful documentation of emission changes over time, trend analysis, and comparisons between cities. Calculating emissions should follow the methodological approaches provided by the GPC. Any deviation from the preferred methodologies shall be disclosed and justified.

Transparency: Activity data, emission sources, emission factors, and accounting methodologies require adequate documentation and disclosure to enable verification. The information should be sufficient to allow individuals outside of the inventory process to use the same source data and derive the same results. All exclusions shall be clearly identified, disclosed and justified.

Accuracy: The calculation of GHG emissions shall not systematically overstate or understate actual GHG emissions. Accuracy should be sufficient enough to give decision makers and the public reasonable assurance of the integrity of the reported information. Uncertainties in the quantification process shall be reduced to the extent that it is possible and practical.