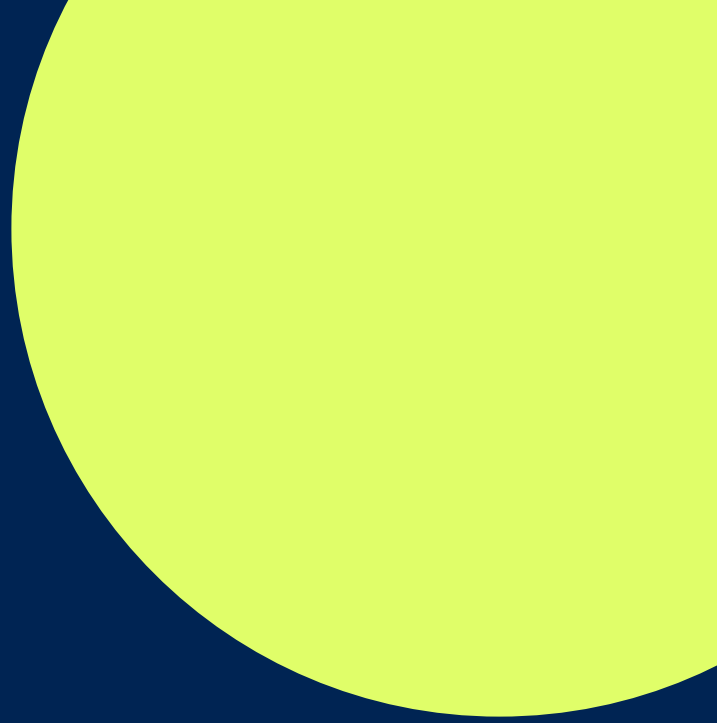




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# **Greenhouse Gas (GHG) Measurement and Reporting Guide**

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# Introduction

Whether voluntarily or due to regulatory requirements, organizations across the globe are recognizing the need to measure, manage, and report their carbon emissions accurately. While the focus has been on carbon as it is the most significant greenhouse gas (GHG) contributing to climate change, the need to reduce other GHGs such as methane, is growing.

That's why CPA Ontario is proud to present the Greenhouse Gas Measurement and Reporting Guide (Guide). This Guide is designed to provide comprehensive, non-authoritative guidance to organizations and CPAs involved in GHG accounting. It offers insights and practical steps to help navigate the complexities of GHG measurement and reporting.

This Guide outlines six essential steps for effective GHG accounting and reporting based on the Greenhouse Gas Protocol. It begins with identifying the relevant regulatory and reporting frameworks, followed by thorough planning and preparation to establish a solid foundation. The Guide then covers best practices for data collection and management, accurate emissions calculations, and comprehensive GHG inventory reporting. Finally, it emphasizes the importance of robust documentation and record-keeping to ensure transparency and readiness for external assurance. As a reminder, the GHG landscape is continuously evolving. It is essential to regularly monitor changes in applicable regulations, reporting frameworks, and emission calculation methodologies.

# 1. Regulatory and Reporting Framework Identification

## 1.1 Identify applicable regulations and reporting requirements

- Research and identify relevant international, national, state/provincial and local (e.g. municipal) greenhouse gas emission regulations/reporting obligations.
- Document which regulations apply and the associated reporting obligations (if any).
- Identify if there are any sector-specific voluntary reporting initiatives, e.g. peer voluntary reporting.

## 1.2 Select appropriate reporting framework

- Assess if applicable regulations require reporting within a specific framework.
- Consider industry reporting norms and peer reporting practices.
- Document rationale for selection of reporting framework(s).
- Document rationale for selection of emission measurement methodology.

The [Greenhouse Gas \(GHG\) Protocol](#) is a universally accepted measurement and reporting framework for greenhouse gas emissions. This guide utilizes the GHG Protocol.

## 1.3 Determine reporting frequency and deadlines

- Inventory all applicable reporting/regulatory deadlines.
- Align internal processes with external deadlines.
- Set internal milestones for data collection, calculation, review and reporting.
- Establish an internal communication plan for deadline reminders.
- Create a reporting calendar (a workback plan).

## 2. Planning and Preparation

### 2.1 Define organizational boundaries (GHG Protocol, Chapter 3)

- Review legal structure of the organization.
- Identify all entities and facilities, owned or controlled.
- Select consolidation approach (equity share, financial control, or operational control).
  - In selecting consolidation approach, it is best practice to collaborate with the financial reporting team to understand where the company has control and to ensure the list of entities owned and controlled is complete.
- Document rationale for consolidation approach selected.
- Create an organizational chart showing included entities based on consolidation approach selected.

### 2.2 Establish operational boundaries

- Inventory all operations and activities within the organizational boundary identified.
- Categorize which operations contribute to Scope 1, 2 and 3 emissions:
  - Scope 1: Direct emissions are emissions that come directly from owned or controlled sources.
  - Scope 2 Indirect emissions are emissions from the generation of purchased electricity, steam, heating and cooling consumed by the organization.
  - Scope 3 Other indirect emissions occur in the organization's value chain, both upstream and downstream. Scope 3 emissions include:
    - Purchased goods and services, capital goods, fuel and energy-related activities (not included in Scope 1 or 2), upstream transportation and distribution, waste generated in operations, business travel, employee commuting, upstream leased assets, downstream transportation and distribution, processing of sold products, use of sold products, end-of-life treatment of sold products, downstream leased assets, franchises and investments.
  - Document all operations and activities contributing to Scope 1, 2 and 3 emissions, including any exclusions with a rationale as to the exclusion.
  - Create a process map of included operations.

## 2.3 Ensure completeness of inventory of operations and activities that generate emissions

- Hold interviews with key stakeholders throughout the business and the organization's value chain to ensure that all operations/activities are identified and inventoried.
- If the organization does not have a mapping of its value chain, create a value chain map to ensure completeness of emissions.
- Tips for ensuring completeness across the emissions scope:
  - Scope 1: consider company facilities and assets (collaborate with the finance department for buildings owned, leases, vehicles, etc.)
  - Scope 2: Assemble a complete view of steam, heating, cooling and electricity purchased by the organization (collaborate with the departments responsible for vendor procurement/management).
  - Scope 3: Value chain considerations – identify all stakeholders involved for each category of Scope 3 emissions. For organizations with higher complexity in their organizational structure or value chain, consider engaging an expert to assist in compiling a complete inventory.

## 2.4 Select base year for measurement

When reporting GHG emissions, an organization requires a base year to measure against future changes.

- Choose a base year for GHG emission measurement, typically the earliest year with reliable data available.
- Ensure that the selected base year is representative of the organization's typical operations.
- Document rationale for base year selection.

## 2.5 Establish a criteria/policy for base year recalculation

- Define materiality threshold for significant changes (e.g. % of total emissions).
- Inventory potential triggers for recalculation:
  - Structural changes (mergers, acquisitions, divestments)
  - Methodology changes
  - Discovery of material errors
- Document the recalculation policy.



## 2.6 Establish a criteria/policy for change in the base year selection

It may be required to change the emission measurement base year for comparative purposes to ensure it continues to remain relevant and comparable.

- Document the considerations and policy for any assessment of a change in the base year measurement.
- If a change in base year measurement is made, document the rationale and compliance with policy.

## 2.7 Determine reporting period

- Align GHG emission reporting with financial reporting, if possible.
- Ensure consistency year-over-year.
- Document chosen reporting period and any deviations to financial reporting.

## 2.8 Identify and inventory key stakeholders

- Identify and inventory internal stakeholders, such as management, finance, operations, and those charged with governance.
- Identify and inventory external stakeholders, such as regulators, investors, customers, suppliers.
- Assign roles and responsibilities for GHG emission accounting processes and the associated controls.
- Create a RACI matrix (Responsible, Accountable, Consulted, Informed).

## 2.9 Perform a gap assessment

- Based on identified regulations and reporting obligations with identified frameworks, perform a gap assessment against reporting framework/reporting obligations to identify gaps in processes and controls.
- Develop, document and communicate remediation plans to update processes, implement/change controls.

## 3. Data collection and management

### 3.1 Identify and inventory specific data sources for each emission category and its associated operations

- Identify and inventory potential data sources for Scope 1 emissions. There are two potential approaches for measuring Scope 1 emissions:
  - **Direct measurement**, which uses continuous emissions monitoring systems, typically in carbon-intensive industries.
  - **Indirect measurement** is used when continuous monitoring is not practical or available. Indirect measurement requires the use of activity data (e.g. fuel purchase invoices, fuel usage logs, boiler and furnace logs, refrigerant purchase records, vehicle fleet records, leak detection surveys), emission factors and Global Warming Potential (GWP) factors.
- Identify and inventory potential data sources for Scope 2 emissions.
  - **Indirect measurement** is the only approach for measurement of Scope 2 emissions, because the emission sources are not controlled by the company. Indirect measurement requires the use of activity data, including electricity bills, energy management systems, steam purchase invoices, renewable energy certificates, utility provider reports, and metering data.
- Identify and inventory potential data sources for relevant Scope 3 emission categories:
  - Purchased goods and services, including supplier invoices, procurement records, supplier environmental data.
  - Capital goods, including purchase orders, asset registers, depreciation schedules.
  - Fuel and energy-related activities not included in Scope 1 or 2, including mining of coal, refining of gasoline and transmission and distribution of natural gas, fuel purchase records, energy consumption reports, energy supplier information.
  - Upstream transportation and distribution including shipping records, freight invoices, logistics data.
  - Waste generated in operations, including waste disposal records, recycling reports, waste management plans.
  - Business travel, including air, rail, bus and automobile, other than commuting: travel expense reports, flight itineraries, rental car receipts/logs.
  - Employee commuting, which includes vehicles other than those owned or operated by the company, employee surveys, public transport pass records, carpooling data.
  - Upstream leased assets, lease agreements, leased asset records, utility bills for leased properties.
    - [The GHG protocol provides guidance on leased assets](#)
  - Downstream transportation and distribution, including distribution invoices, transportation contracts, shipping reports, retailer reports.
  - Processing of sold products, including product usage reports, customer surveys, product performance reports.
  - Use of products sold, including end use of goods and services sold to the end consumer.
  - End-of-life treatment of sold products, including product disposal records, recycling and waste management data, end-of-life analysis reports.
  - Downstream leased assets, including lease agreements, asset use records, utility and maintenance records/invoices.

- Franchises, including franchise agreements, franchisee emissions reports, and operational data.
- Investments, including investment reports, portfolio data, investment sustainability information/reports.
  - Partnership for Carbon Accounting Financials (PCAF) provides [additional guidance on calculating financed emissions](#).
- Some data may not be readily available and may require proxy data or assumptions. When using proxy data or assumptions to estimate emissions the rationale should be documented, along with the methodology and reasoning behind the proxy or assumption for estimation.
- Proxy data will vary depending on industry and business operations, and experts may be required to assist in developing the proxy.

### 3.2 Document rationale for chosen data sources

- Develop a hierarchy of data outlining the various scenarios of data availability such as actual data, partial gap filling based on actual data, estimation based on similar sources where actual data is available, consulting with experts to determine appropriate proxies.
- Assess completeness of data from each data source identified.
- Evaluate reliability and accuracy of each data source identified.
- Compare and evaluate alternative data sources, where applicable.
- Document justification for selection of each data source, including rationale and supporting reasoning when proxy data is used, or assumptions are made to estimate the emission data.

### 3.3 Develop and record document data collection procedures and policies

- Create step-by-step data collection procedures for each emission data source.
- Establish data collection frequency such as monthly, quarterly, and annually.
- Define data formats and units for consistency.
- Document procedures/policy for handling of missing or incomplete data.
- Create templates for data collection, where appropriate.

### **3.4 Establish quality control measures**

- Select an appropriate data management software or tools, such as ERP systems.
- Set up data storage structures, such as databases and folders, where applicable.
- Establish procedures for data correction, including documentation of rationale for any data corrections made.
- Create a log for documenting data quality issues, action plans and resolutions.

### **3.5 Define roles and responsibilities for data collection and maintenance**

- Assign clear data collection responsibilities for each emission source.
- Designate data quality control personnel.
- Identify and assign supervisors and managers to review and approve collected emissions data.
- Create a responsibility matrix for the data management process.

### **3.6 Document data collection audit trail**

- Implement a system for tracking data from source to final reporting.
- Record and log all data manipulations and calculations, where applicable.
- Ensure any manipulation of data is reviewed and approved by appropriate supervisors/managers and an audit log of any manipulations is maintained.
- Maintain audit logs of who accessed and modified data, when the data was accessed and modified, and who approved.
- Ensure the traceability of all final reported emissions data back to raw data (source).

### **3.7 Data gaps and proxy data usage**

- Create a procedure for identifying and recording data gaps and incomplete data.
- Establish a methodology and policy for estimating or proxying missing data.
- Document all instances of estimated / proxy data usage and rationale, and who reviewed and approved.
- Assess and record the impact of data gaps on overall emissions calculations.
- Create a log for documenting incomplete data, and action plans to remediate and resolution.

### **3.8 Establish data protection and security measures**

- Implement data encryption for sensitive emissions data.
- Set up secure data transfer protocols.
- Establish data breach response procedures/policies.
- Conduct regular security audits of data management systems.

## 4. Emissions Calculations

### 4.1 Select and document appropriate emission calculation methodologies

- Review calculation methodologies recommended/required by the relevant regulation and reporting framework.
- Determine the approach and/or calculation methodology for the calculation of non-CO<sub>2</sub> greenhouse gases.
- Assess available emissions data and its compatibility with required calculation methodologies.
- Select calculation approaches for each emission category.
- Document the rationale for chosen calculation methodologies and approaches.
- Ensure consistency in methodology selection across similar emission sources/categories.

### 4.2 Identify unit conversion factors, emission factors, GWP factors and their sources

- Identify and document the source of conversion factors. Note that the source should be reputable.
  - For example, the [Government of Canada provides some resources for unit conversion](#).
- Units of measurement should be clearly defined, so that units requiring conversion are readily identifiable.
- Research appropriate emissions factors for each emissions source.
  - Commonly used sources for emission factors based on the locations of the organization's operations:
    - Canada: [National Inventory Report \(NIR\)](#)
    - U.S.: [Environmental Protection Agency and International Energy Agency \(IEA\)](#)
    - U.K.: [United Kingdom's Department for Energy Security & Net-Zero \(DESNZ\)](#)
- Identify Global Warming Potential (GWP) factors for non-CO<sub>2</sub> greenhouse gases.
  - The [Government of Canada provides guidance on GWP factors based on IPCC guidelines](#).
  - Note: some emission factors may contemplate and embed the impact of GWP values – in this case, a separate GWP factor would not need to be applied. Ensure that emission factors used clearly indicate whether a GWP factor is included or not and adjust the calculation accordingly.
- Determine which GWP time horizon to use, such as 20-year and 100-year.
- Ensure consistency in GWP factors across all emission calculations for non-CO<sub>2</sub> greenhouse gases.
- Prioritize the use of local or national emission factors, where available.
- Document the source and vintage of each emission factor and GWP factor selected.
- Assess the applicability of chosen factors to the organization's specific circumstances.

### 4.3 Document policies and procedures for unit conversion factors, emission factors and GWP selection

- Establish a hierarchy of preferred sources for emission factors and GWP factors.
- Document the sources of unit conversion factors.
- Create guidelines for updating emission factors and GWP factors.
- Define a process for approving the use of non-standard factors.
- Document procedures for handling factors in different units.
- Establish policy for consistency in use of GWP time horizons.

### 4.4 Perform calculations for each emission scope and category

- Set up calculation spreadsheets or systems/tools for each emissions category.
- Input activity data, emission factors and GWP factors.
- Perform emission calculations according to chosen methodologies.
- Implement automatic unit conversions where applicable.
- Convert non-CO<sub>2</sub> greenhouse gas emissions to CO<sub>2</sub> equivalent using appropriate GWP factors.
- Aggregate emissions data across scopes and categories for reporting purposes.

### 4.5 Select Scope 2 calculation approach

There are two calculation approaches for Scope 2 emission measurement:

- **Location-based approach:** which reflects the average emissions of the grid where the energy consumption occurs.
- **Market-based approach:** which reflects emissions based on the specific energy purchases by the company (e.g. Power Purchase Agreements “PPAs”), and also uses renewable energy credits (RECs), which reduce reported Scope 2 emissions.

### 4.6 Document calculations processes and controls

- Document each calculation step.
- Implement calculation consistency checks.
- Establish control procedures for version control if spreadsheets are used for calculation.
- Establish controls to ensure appropriate cut-off of emissions, including emissions relating to the defined measurement period.
- Establish controls to address double-count risk, including ensuring that emissions are not included in both Scope 2 and 3.
- Establish review and approval procedures for greenhouse gas emission calculations and data completeness and accuracy.

## **4.7 Document all assumptions and methodologies used**

- Document all assumptions made during the calculation process.
- Document rationale for any estimations or extrapolations used.
- Document any limitations in the calculation methodologies used, and impact on measurement of greenhouse emissions, if any.
- Create an assumption log, detailing the impact on final emission figures.

## **4.8 Implement and document internal review and approval processes for emissions calculations**

- Establish a multi-layer review and approval process for emissions calculations.
- Create a review checklist for each level of review.
- Document all review comments and how they were resolved.
- Implement a final approval/sign-off of the emissions calculations.

## **4.9 Establish an Update Frequency for Emissions Factors and GWP Factors**

- Define a schedule for reviewing and updating emissions factors and GWP factors, periodically or at minimum in response to new scientific findings or regulatory updates and requirements.
- Document the sources and rationale for any updates made to emissions factors and GWP factors.
- Ensure that all relevant stakeholders are informed of changes to emissions and GWP factors.
- Implement a tracking system for documenting the vintage of each emissions factor and GWP factor used in calculations.



## 5. Prepare a greenhouse gas inventory report

### 5.1 Prepare a greenhouse gas inventory report

- Draft an executive summary.
- Include key findings and emissions totals by scope.
- Highlight significant changes from previous reporting periods.
- Describe organizational and operational boundaries.
- Explain the consolidation approach used.
- List included and excluded operations.
- Detail the reporting period and base year information.
- Justify the base year selection.
- Explain any recalculations of base year emissions.
- Present emissions data for all scopes.
- Break down emissions by scope and category.
- Provide comparative data from previous years, including the base measurement year.
- Explain methodologies and assumptions.
- Detail calculation methodologies for each emissions category.
- Describe data sources and quality.
- Outline data collection process.
- Discuss any significant data gaps or limitations.
- List emissions factors used.
- Provide sources for all emissions factors.
- Explain any changes in emissions factors from previous years.
- Conduct and report uncertainty assessment.
- Identify key sources of uncertainty.
- Quantify uncertainty ranges where possible.

## 5.2 Conduct internal review and approval process

- Identify subject matter experts for each section of the report.
- Assign roles and responsibilities for review of each section of the report.
- Establish review criteria and checklist for reviewer of each report section.
- Ensure all review comments and associated resolutions are documented.
- Assign responsibility for overall review of report (e.g. mid-management, C-suite, Board).
- Establish review criteria and checklist for overall review of the report.
- Ensure all review comments and associated resolutions are documented.
- Maintain version control of report during review and approval processes.
- Document final approvals (e.g. C-suite, Board).

## 6. Documentation and record keeping

### 6.1 Maintain a comprehensive audit trail throughout the emission calculation process

- Establish a centralized system for documenting all carbon accounting activities.
- Record all key decisions made during the accounting process.
- Document rationale for changes in methodologies, organizational structure, or operational boundaries.
- Maintain logs of data collection activities, including dates and personnel involved.
- Keep records of all calculations, including interim steps.
- Document rationale and support for all assumptions and estimations made.

### 6.2 Archive all relevant documents, data and calculations

- Identify all documents requiring archiving (e.g., raw data, calculation spreadsheets, final reports).
- Establish a logical folder structure for easy retrieval.
- Implement version control for all documents.
- Ensure all archived documents are clearly dated and labeled.
- Include context notes with archived documents explaining their significance.
- Cross-reference related documents within the archive system.

### 6.3 Establish and document data and information storage procedures

- Define the storage format for different types of data, including raw data, processed data, reports.
- Establish naming conventions for files and folders.
- Implement a system for tracking document versions.
- Create procedures for regular backups of all data and documents.
- Establish protocols for secure storage of sensitive information.
- Define access rights and permissions for different user roles.

## 6.4 Implement data protection measures

- Conduct a risk assessment of potential data security threats.
- Implement appropriate cybersecurity measures such as firewalls and encryption.
- Establish protocols for secure data transmission.
- Create procedures for handling and protecting confidential information.
- Regularly review and update data protection measures.
- Provide training to staff on data protection procedures.

## 6.5 Develop and enforce a documentation retention policy

- Determine appropriate retention periods for different types of documents.
- Ensure compliance with legal and regulatory requirements for record keeping.
- Create a schedule for regular review of retained documents.
- Establish procedures for secure document destruction at the end of their retention period.
- Assign responsibility for overseeing the implementation and maintenance of the retention policy.
- Conduct periodic audits to ensure compliance with the retention policy.

## 6.6 Ensure traceability of reported emissions information

- Maintain clear links between reported figures and source data.
- Document the flow of data from collection to final report.
- Create data lineage diagrams for complex calculations.
- Implement a system for easy retrieval of supporting documentation for any reported figure.

## 6.7 Prepare for external assurance, if applicable

- Compile a package of key documents that demonstrate the integrity of the carbon accounting process.
- Create a map or index of where all relevant information is stored.
- Prepare summaries of methodologies, assumptions, and key decisions.
- Ensure all team members are prepared to explain their role in the process.
- Conduct internal audits to identify and address potential issues.