

# **Conducting a Baseline GHG Inventory: Methodologies and Lessons Learned**

**Extended Abstract # 1031**

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## **ABSTRACT**

This paper provides an outline of the plan that Corning Incorporated (Corning) took in setting a greenhouse gas (GHG) strategy, establishing a baseline GHG inventory, and seeking third party certification of the corporate inventory. The paper focuses on mechanisms, such as data quality management procedures, that were implemented after conducting the baseline inventory in order to facilitate future third party verification and improve the GHG data gathering and calculation process. Specifically, the paper outlines the following items:

- Developing a GHG Management Plan
- Conducting a Baseline GHG Inventory
- Pursuing Third Party Certification
- Lessons Learned through the Baseline GHG Inventory and Certification
- Developing a GHG Data Quality Management Procedure (using ISO 14064 Part 1 as Guidance)

## **INTRODUCTION**

As a global company, Corning recognized the need to demonstrate the potential impact of climate change on its businesses. In 2005, Corning embarked on an effort to conduct a corporate baseline GHG emissions inventory. The decision to conduct a baseline GHG emissions inventory was made in the context of the company's corporate environmental strategy, which was to understand and manage its GHG emissions and minimize GHG risks to the global business. In addition, creation of the GHG strategy and a verifiable baseline inventory was essential in order to respond to both current and future external inquiries regarding the company GHG policy through mechanisms such as the Carbon Disclosure Project (CDP) and other emerging shareholder requests. Corning's initial strategy was to:

- Measure, track and report direct and indirect GHGs following "The Greenhouse Gas Protocol" published by the World Business Council for Sustainable Development (WBCSD) and World Resource Institute (WRI)<sup>1</sup>

- Register GHGs with an external GHG registry in order to obtain baseline protection and preserve data associated with early reductions
- Track and monitor international, national, regional and state climate legislation
- Publish its company-wide goals, targets, and emissions data in its 2007 Environmental, Health, & Safety Progress Report and third party certify (or verify) this emissions data.

In 2006, Corning Incorporated joined the California Climate Action Registry and completed third party certification of the organization's 2005 baseline inventory for public reporting.

## **Developing a GHG Management Plan**

The first step in developing a strategy for Corning was to prepare a GHG management plan document, which included a detailed review of voluntary and mandatory programs that would potentially impact Corning. Specifically, Corning included the following in the GHG management plan:

- Greenhouse Gas Inventory Background and Emissions Analysis
- Regulatory Analysis – International Programs (European Union Emissions Trading Scheme, Kyoto Protocol)
- Regulatory Analysis – Domestic U.S. Programs (Pending Legislation, Regional and State Program Reviews)
- Review of Voluntary Programs and Emissions Trading Opportunities
- Benchmarking Analysis and Metrics

The GHG management plan allowed Corning to have a greater initial understanding of the company's options with respect to GHG management, where there were potential carbon risks in terms of legislation that would impact Corning operational locations, and voluntary programs in which Corning could participate in the United States.

Through the GHG management plan and subsequent evaluation of options, Corning decided to quantify and report 2005 GHG emissions and selected the CCAR as the appropriate program in which to participate. Considerations for selecting the CCAR included:

- Requirement for third-party certification and public disclosure of emissions, which provides credibility and transparency to Corning's GHG programs
- Ability to register international emissions with the CCAR (since Corning is an international company)
- Alignment with the WRI/WBCSD GHG Protocol
- CCAR's memorandum of understanding with the World Economic Forum (WEF) GHG Register
- Future linking to a Multi-State Registry
- Engagement of CCAR staff with international programs such as the European Union (EU) Emissions Trading Scheme (ETS)

## Conducting a Baseline GHG Inventory

After preparing the GHG management plan, Corning proceeded with conducting a comprehensive GHG inventory, which included the following key steps:

- Step 1: Establishing organizational and operational boundaries
- Step 2: Gathering the GHG activity data
- Step 3: Conducting the emissions calculations and entering data into CARROT

### *Establishing Organizational and Operational Boundaries*

Corning conducted the corporate GHG inventory in accordance with the CCAR's General Reporting Protocol.<sup>2</sup> When conducting a corporate GHG inventory, it is important to define the boundaries of the organization in order to set the scope of the inventory. The organization boundary standards set by the CCAR protocol include reporting under management control or under equity share. Management control can be defined in either operational or financial terms. Corning decided to report their GHG emissions based on management control using operational control terms (rather than financial control terms). Operational control is the authority to develop and carry out the operating or health, safety and environmental (HSE) policies of an operation or at a facility.

Regarding geographic boundaries, the CCAR protocol requires registry of California GHG emissions; however registering U.S. emissions is optional. Corning elected to report U.S. emissions to the CCAR. In addition, the CCAR also permits entities to use CARROT for calculating their organization's international emissions in accordance with CCAR protocols and reporting this information to the CCAR (however, emissions outside the U.S. are not certified under the program).

With regard to operational boundaries, Corning is required to report all direct emissions and indirect emissions associated with purchased heat, electricity or steam, to the CCAR. These are typically termed "Scope 1" and "Scope 2" emissions sources in the WRI/WBCSD GHG Protocol. "Scope 3" emissions sources or other indirect emissions, such as employee commuting, GHG emissions from the use of products, or other life cycle GHG impacts of manufacturing are not required to be reported to the CCAR. Table 1 provides a summary of the GHG emission categories and gases that were evaluated as part of the GHG inventory for Corning.

**Table 1. Corning GHG Emission Source Categories**

Source Category	GHGs	Description
Direct Stationary Combustion Emissions	CO <sub>2</sub> , CH <sub>4</sub> , N <sub>2</sub> O	Fuel burning from combustion of fuels (natural gas, propane, diesel fuel, etc.)
Direct Mobile Combustion Emissions	CO <sub>2</sub> , CH <sub>4</sub> , N <sub>2</sub> O	Fossil fuel burned from the operation of vehicles (and airplanes) owned or leased by Corning.
Direct Process Emissions	CO <sub>2</sub>	CO <sub>2</sub> emissions from use of carbonate materials in Corning manufacturing processes
Direct Fugitive Emissions	HFCs and SF <sub>6</sub>	Hydrofluorocarbon (HFC) usage in refrigeration/cooling systems and process-related sulfur hexafluoride (SF <sub>6</sub> ) usage
Indirect Purchased Electricity	CO <sub>2</sub> , CH <sub>4</sub> , N <sub>2</sub> O	Electricity purchased for use by Corning facilities (including both buildings owned and leased by Corning)

***Gathering the GHG Activity Data***

The data gathering phase is often the most time-consuming phase of a baseline GHG inventory project. Many companies closely track the information that is required to compile a GHG inventory; however, it can often be housed in various parts of the organization. In addition, during the data gathering phase, many organizations surprisingly find that there is conflicting data among the data sources.

For the baseline inventory, Corning gathered GHG activity data through a number of means. First, Corning requires facilities to report their annual usage of energy, including natural gas, fuel oil, propane, and other fuels. This fuel usage is reported annually to Corning Environmental Control (CEC) via an intranet based Microsoft Access database, screened by CEC for potential errors, and then accepted into a database that CEC maintains for the GHG inventory. Finally, Corning employs a third-party energy management company to track electricity and natural gas usage for selected domestic manufacturing facilities. Electricity and natural gas invoices are also maintained by the financial controllers. For the GHG inventory process, where there was any discrepancy in natural gas or electricity data, the order of priority (in decreasing level of anticipated accuracy) was assigned as:

- Third party energy management company electronic invoices
- Financial controller electronic invoices
- Information provided directly from the plant via spreadsheet

In order to quantify sources such as fleet vehicle emissions (for vehicles owned or leased for exclusive use by Corning employees) and electricity usage for other buildings (leased or owned by Corning), a spreadsheet listing was obtained from Corning’s corporate procurement division. Finally, information such as refrigerant usage (to calculate HFC emissions) was requested in an annual plant manager’s report.

## ***Conducting the Emissions Calculations and Entering Data into CARROT***

To calculate U.S. and international GHG emissions from direct stationary combustion emissions and indirect purchased electricity emissions, The Climate Action Registry Reporting Online Tool (CARROT) was used. Spreadsheets were used to calculate non-CARROT sources, such as process emissions from carbonate raw materials or sources that were expected to be *de minimis* such as direct mobile combustion emissions, direct fugitive emissions from refrigeration, and other indirect purchased electricity emissions. The most complex emissions calculations for Corning were the carbonate materials, which evolve CO<sub>2</sub> in the manufacturing process. Proprietary information was utilized to generate the stoichiometric relationships for each of these carbonate materials in order to calculate the amount of CO<sub>2</sub> evolved in the process.

It is important to note that the CCAR allows a *de minimis* threshold of 5% of the emissions (in terms of either categories of emissions or gases). The certification process focuses on ensuring that the certifier can assure that there no material misstatements in the GHG data (that 95% of the emissions are being accurately reported and no more than 5% is outstanding in the reported emissions). However, in a baseline GHG inventory, one has to quantify what the 100% of the emissions (sometimes by making simplifying assumptions) in order to determine what falls into the 5% *de minimis* category.

Table 2 provides a summary of the 2005 GHG emissions from Corning, Incorporated.

**Table 2. Summary of 2005 GHG Emissions from Corning, Inc.**

<b>Greenhouse Gas</b>	<b>CO<sub>2</sub>e (metric tons)</b>
Direct Emissions	
Mobile Combustion	10,451
Stationary Combustion	254,868
Process Emissions	15,606
Total Direct	280,925
Indirect Emissions	721,532
Total (Direct + Indirect)	1,002,457
<i>De minimis Emissions</i>	<i>38,814</i>

## **Pursuing Third Party Certification**

After completing the GHG inventory, Corning then pursued third party certification (or verification) of the GHG inventory through the CCAR. The certification process occurred between October and December in 2006. The process involved the verifier gaining an understanding of Corning's businesses entities, gaining an overview of the GHG reporting processes/systems in the following areas:

- Reviewing the information flow for gathering and processing the GHG data
- Identifying the key reporting risks that may impact the GHG data quality

- Identifying the key controls in place to mitigate risks which might significantly impact data quality
- Conducting required site visits to confirm the GHG activity data

Corning reported its GHG emissions based on management control so the certification process first reviewed the organizational boundaries. The certification process was conducted against the CCAR General Reporting Protocol Version 2.1 (2006) for the 2005 reporting year. For Corning, the certification process took approximately two weeks to complete. In the first week, two days were spent reviewing the organizational structure, meeting with key internal personnel involved with the development of GHG inventory, and reviewing and understanding Corning's GHG data management system. The overall review of the management systems focused on:

- Source Identification
- Calculation Methods and Measurements
- Responsibilities and Competence
- Internal Management Review/Audits
- Document Control and Record Control
- Reporting and Recordkeeping

The third and fourth day focused on domestic site visits to manufacturing plants to understand their operations to ensure the quality of the data and to ensure process emissions were captured in the reporting data base. The fifth day focused on the certification close-out. The second week consisted of international travel to Europe to complete two more site visits in order to fulfill the registry requirement that the certifier visit 10% of the sites for operations with reporting facilities between 51 and 100 facilities.<sup>3</sup>

The pre- and post-greenhouse gas emissions were changed by only 0.1 percent during the verification process. The certification process ended in December 2006 when the verifier provided an opinion that Corning's GHG data had no material misstatements based on the registry protocols.

## **Lessons Learned through the Baseline GHG Inventory and Certification**

After conducting an initial baseline inventory and undergoing the third party certification process, Corning evaluated ways in which to internally improve the efficiency and documentation associated with the GHG inventory process. The following were items that Corning identified as lessons-learned through the baseline GHG inventory process that may be useful for other organizations as they embark on similar initiatives.

### ***GHG Management Plan***

A GHG management plan assisted Corning with confirmation of the organization's understanding of the current regulatory landscape and advantages and disadvantages of pursuing voluntary programs that were available for baseline protection. This step provides an opportunity to leverage external professionals who work with climate change issues on a daily basis.

### ***Internal Energy and Environmental Data Systems***

Corning had invested in a custom database developed internally that tracks energy and fuel usage for a majority of Corning's facilities. A data management system enabled Corning to more efficiently extract and utilize GHG data in the inventory process.

### ***De Minimis Source Quantification Report***

Corning prepared a *de minimis* source quantification report which outlined the calculation methodology and the assumptions that were made in calculating and declaring the *de minimis* emissions sources. This document was very valuable in the third party certification process, since the certifiers need to confirm the sources (and/or gases) that were claimed as *de minimis* in the inventory. A detailed *de minimis* emissions report can prove to be useful in facilitating this review.

### ***Reporting Units***

Organizations should ensure the facilities report in energy units and not in volume units such as cubic feet or cubic meters. This will eliminate an opportunity to introduce a reporting error through conversion factors. The natural gas in Europe has a heating value of approximately 1,080 BTU/ft<sup>3</sup> compared to 1,020 BTU/ft<sup>3</sup> in the USA. The application of US heating values units would introduce approximately a four percent error immediately.

### ***Verification Process Cycle***

One item that Corning found valuable was to leverage a three year certification cycle with the chosen verifier since the first year takes more time for the verifier to understand the company's operations, organizational structure and data management systems. The second and third year can focus on a paper review because the verifier has additional knowledge of the systems and thus reduce overall certification costs. It is also important to note that the CCAR General Certification Protocol states that companies cannot engage a certifier for longer than a six consecutive year period, essentially to ensure that the certifier does not become "too" familiar with the organizations GHG systems, which may result in a loss of accuracy in the verification process.

### ***Data Quality Management Procedure***

For the baseline GHG inventory, Corning did not formally prepare data quality management procedure but rather relied on internal personnel's knowledge to explain how the data flow and data management processes worked during the certification process. However, for the next cycle of third party certification, Corning is developing a GHG data quality management plan using ISO 14064 Part 1 as a guidance document.<sup>4</sup> The plan will identify processes and systems used to collect and verify the data and document the process used to validate the data. The contents of this data quality management procedure are discussed in the next section of the paper.

### **Developing a GHG Data Quality Management Procedure**

In preparation for the first years' GHG certification, Corning validated approximately 70% of the emissions during the first year. The validation consisted of identifying and reviewing the energy usage records. In most cases, it meant reviewing the invoices from local utility supplier. Corning focused on the largest energy users in and outside the United States. By focusing on the invoices, Corning was able to leverage internal programs around the financial infrastructure and retrieve the invoices on a timely basis usually less than one week from the date requested. In addition, Corning conducted a 100% check on transcriptions errors for the entry of GHG activity data into the CARROT database. It is important to note that Corning used the default emission factors listed in the Registry database which eliminated the need to check the basis of the emission factors.

In 2007, Corning began to develop a GHG data quality management procedure. The objective of the procedure was to:

- To formalize the tasks and responsibilities associated with gathering, calculating and reporting the GHG emissions data;
- To require each department, division, unit/sector, and each site involved in providing data for the GHG calculations to conduct routine and consistent checks to ensure accuracy and completeness of the GHG inventory;
- To conduct routine and consistent checks to identify and address errors and omissions of data;
- To document and archive relevant GHG inventory records and information management activities; and
- To document and archive relevant GHG inventory records and information management activities as they relate to the CCAR.

As previously mentioned, ISO 14064 Part 1 was relied upon as a guidance document for developing this procedure. Specifically, Section 6.1.2 of ISO 14064 Part 1 was applied to the procedure, which recommends that the following items be addressed in a GHG data quality management procedure:

- Identification/review of the responsibility and authority of individuals responsible for GHG inventory development
- Training for members of the inventory development team
- Identification/review of organizational boundaries
- Identification/review of organizational GHG sources/sinks
- Selection/review of calculation methodologies, including GHG activity data, and GHG emission and removal factors that are consistent with the intended use of the GHG inventory
- Review of the application of quantification methodologies to ensure consistency across multiple facilities
- Use, maintenance, and calibration of measurement equipment, as applicable
- Development and maintenance of a robust data-collection system
- Regular accuracy checks
- Periodic internal audits and technical review
- Periodic review of opportunities to improve information management procedures

In conjunction with preparing the GHG data quality management procedure, Corning is conducting a gap analysis against the ISO 14064 Part 1 standard to determine where enhancements may need to occur in order to potentially verify the Corning GHG inventory to ISO 14064 Part 1.

## **SUMMARY**

In summary, this paper highlighted the steps taken to establish a corporate GHG inventory and provided lessons learned for consideration when conducting a baseline corporate GHG inventory. This paper also focused on the third party certification (or verification) process and how that process unfolded for Corning. Finally, this paper summarized suggested elements for a GHG data quality management procedure that was prepared using ISO 14064 Part 1 as a guideline.

## **REFERENCES**

- <sup>1</sup> The Greenhouse Gas Protocol - A corporate reporting and accounting standard (revised edition), See <http://www.ghgprotocol.org> (accessed April 2007).
- <sup>2</sup> California Climate Action Registry General Reporting Protocol, Version 2.2, See <http://climateregistry.org/docs/PROTOCOLS/> (accessed April 2007).
- <sup>3</sup> California Climate Action Registry General Certification Protocol, Version 2. See <http://climateregistry.org/docs/PROTOCOLS/> (accessed April 2007)
- <sup>4</sup> ISO 14064-1:2006, Greenhouse gases – Part 1: Specification with guidance at the organization level for the quantification and reporting of greenhouse gas emissions and removals.