



Verification Report

City of Cambridge – 2008 & 2012 GHG Emissions Inventories

Prepared for:

City of Cambridge

November 13, 2015

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1.0 Introduction

Ruby Canyon Engineering (RCE) was contracted by the City of Cambridge (City) to perform the third-party greenhouse gas (GHG) emissions inventories verifications for the City's facilities reporting under operational control to the ISO 14064 standard and the requirements of The Climate Registry's (TCR) reporting program for the baseline year, 2008, and 2012. The City is not reporting to TCR for 2008 or 2012, except as historic inventories; however, the inventories are being verified against TCR's program requirements.

1.1 Inventory Description

The City of Cambridge's 2008 and 2012 emissions inventories include emissions from all City facilities and include emissions from stationary combustion, emissions from mobile combustion, fugitive emissions, and emissions from purchased electricity. Emissions of all six Kyoto Protocol gases plus nitrogen trifluoride (NF₃) are included; however, the entity has no PFC, SF₆ or NF₃ emissions.

1.2 Responsible Parties

City of Cambridge
344 Broadway
Cambridge, MA 02144

1.3 Verification Team

The RCE verification team consisted of the following individuals who were selected based upon verification experience and knowledge of general reporting of GHG emissions sources and local government operations.

Lead Verifier: Nina Pinette
Team Member/Subcontractor: Lynne Santos, AQA
Team Member: Jessica Stavole
Independent Peer Reviewer: Michael Coté

1.4 Objectives

The objective of the verification activities was to ensure that the reported GHG emissions are complete, transparent, verifiable, and estimated and reported according to TCR's reporting protocols. Furthermore, the verification activities ensure that the data provided to RCE is well documented and free of any material errors or omissions.

1.5 Scope

The scope of the verification consisted of the following independent and objective activities:

- Review the 2008 and 2012 GHG emission sources;
- Review the 2008 and 2012 inventory support documents;
- Review the organizational and operational boundaries;
- Conduct a site visit to selected City facilities;
- Review the inventory data acquisition and quality control procedures;
- Review the GHG emissions calculations;
- Review the documents and data against the Verification Criteria listed in Table 1;
- Issue requests for corrective actions, additional documentation, and clarifications as necessary; and
- Issue a Verification Report and List of Findings to the City of Cambridge.

1.6 Verification Criteria

Table 1. Verification Criteria

Criteria	Details
Standards and Protocols for Verification	<ul style="list-style-type: none"> The Climate Registry's General Reporting Protocol (GRP) Version 2.0 (March 2013) The Climate Registry's General Verification (GVP) Protocol Version 2.1 (June 2014) ISO 14064-3 Specification with guidance for the validation and verification of greenhouse gas assertions
Reporting Years	2008 & 2012
Reporting Basis	Full – North America
Level of Assurance	Reasonable assurance
Materiality	A +/-5 percent materiality threshold assessed separately for Scope 1 and Scope 2 emissions

2.0 Verification Activities Summary

As the first step in verification activities, RCE developed a verification plan to follow throughout the verification process. The verification plan included the following activities:

- RCE completed an internal Conflict of Interest Assessment Form to identify any potential conflicts of interest with the City. The COI assessment revealed no conflicts of interest.
- RCE held a verification kickoff meeting with the City on May 15, 2015. During the kickoff meeting, RCE reviewed the verification objectives, verification process, and the verification schedule.
- RCE performed a strategic review and risk assessment of the received data and support documents in order to understand the scope and areas of potential risk in the GHG emissions inventories.
- RCE developed risk-based sampling plans based upon the strategic review and risk assessment. The verification team used the verification plan and sampling plan throughout the verification, and they were revised as needed based upon additional risk assessments.
- RCE conducted a site visit on June 4, 2015. During the site visit RCE performed key personnel interviews; inspected GHG emission sources; observed the onsite data management systems; and reviewed data gathering, monitoring, and handling procedures.
- RCE performed a risk-based desktop review of the submitted verification documents. The review included an assessment of the GHG emissions calculation methods and inputs, source data completeness, GHG data management and monitoring systems, and company record retention practices.
- RCE submitted requests for corrective actions, additional documentation, and clarifications as necessary throughout the verification.
- RCE's independent peer reviewer conducted a review of the verification sampling and verification report.
- RCE issued a final Verification Report and List of Findings.
- RCE held an exit meeting with the City on November 9, 2015.

3.0 Verification Findings

3.1 Assessment of the GHG Emission Sources

Prior to the site visit, the verification team reviewed the City’s inventory calculation spreadsheets. Based on the information in the spreadsheets, the verification team developed a sampling plan for the site visit. The sampling plan was based on the relative magnitude of emissions from each category as well as the relative magnitude of emissions from individual sources. The relative magnitude of emissions from each City department is shown in Table 2 below.

RCE conducted the site visit on June 4, 2015. The verification team visited the Department of Public Works Ryan Garage, the Walter J. Sullivan water treatment plant, and the Cambridge Rindge Latin School. The Department of Public works maintains and manages City vehicles at the Ryan Garage. Here, RCE viewed a vehicle fueling station and reviewed the Fuel Master program. RCE also viewed a sample of vehicles owned by the City including rubbish trucks, police vehicles, pickup trucks, and snow equipment. The water treatment plant is a large electric consumer—accounting for 22 percent of Scope 2 emissions in 2008 and 18 percent in 2012; here, RCE viewed electric pumps and natural gas boilers. RCE also selected the Cambridge Rindge and Latin School for a site visit because it is the largest school; schools represented 46 percent of Scope 1 emissions in 2008 and 36 percent in 2012. At the school, RCE viewed boilers, hot water heaters, a diesel emergency generator, and a chiller.

During the visit, the team met with and interviewed City personnel responsible for the development of the GHG assertion which was provided to the verification team prior to the visit. RCE also met with the City’s Energy and Sustainability Analyst who manages MEI (discussed in more detail below). The team discussed source data used in the development of the GHG emissions inventories which consists of database extracts and fuel invoices.

3.2 Assessment of the GHG Emissions Data Management System

During the site visit, RCE performed interviews with the key personnel who developed the GHG inventories. RCE reviewed the City’s procedures for data collection, data handling, and data QA/QC as well as record retention and backup procedures. RCE confirmed that these procedures were rigorous, that there are redundant procedures in place to ensure that data will be backed up in multiple locations, and that in the event that any data used as an input to calculate emissions is lost, it can be recovered.

The City uses Mass Energy Insight (MEI) to track all municipal fuel use data, including electricity. MEI is a state-level online software which tracks utility data. Utilities upload data into the system. RCE also compared invoices to MEI data for some accounts as discussed below.

Table 2. Scope 1 Emissions from City of Cambridge Departments

Facility	2008 Emissions (tCO ₂ e)	2008 % of Scope 1	2012 Emissions (tCO ₂ e)	2012 % of Scope 1
Buildings and Other Facilities	7,700.70	62.57%	5,774.08	63.76%
Vehicle Fleet	3,032.74	24.64%	2,706.70	29.89%
Fugitive	1,058.00	8.60%	209.00	2.31%
Water Delivery	512.80	4.17%	365.68	4.04%
Street Lights/Traffic Signals	2.28	0.02%	0.31	0.00%
Wastewater	0.11	0.00%	-	-
Scope 1 Total	12,306.63		9,055.78	

Individual sources may not sum to total; table is for summary purposes only

3.3 Assessment of the GHG Emissions Calculations

RCE's emissions calculations assessment included a review of the data inputs into the City's inventory calculation spreadsheets, calculation of the input values, and accuracy of the emission factors and calculation methodologies selected for each emissions source. RCE evaluated the completeness and validity of the original data and how the data was transferred to the inventory calculation spreadsheets.

During the desktop review, RCE conducted cross checks of spreadsheet functionality and compared calculation methodologies in the spreadsheets to the methods described by key personnel onsite during the site visit and to TCR's General Reporting Protocol methodologies. RCE found that the GHG calculations were accurate and consistent with TCR's methodologies.

3.3.1 Scope 1

RCE reviewed the calculation of stationary combustion emissions from natural gas combustion at City facilities for 2008 and 2012 which represent 31 percent and 50 percent of total Scope 1 emissions respectively. Natural gas is combusted in boilers, heaters, hot water heaters, and cafeteria kitchens. Emissions from natural gas represent a higher percentage of Scope 1 emissions in 2012 because equipment was converted from oil to natural gas between 2008 and 2012. RCE also reviewed the calculation of stationary combustion emissions from oil which represent 38 percent and 17 percent of total Scope 1 emissions, respectively, also showing a complementary decrease in emissions from oil combustion in 2012 relative to the increase in natural gas emissions in 2012. RCE reviewed the sums of monthly fuel quantities by account in MEI and compared invoices for natural gas and oil for some accounts to the monthly quantities in MEI. RCE also confirmed that appropriate emission factors were applied to the fuel quantities to calculate emissions. RCE identified some small errors in the emissions calculations due to not prorating for the 365 days in CY2008 and CY2012 and/or instances where one monthly invoice was missing and thus one month of fuel consumption was excluded from the annual total. The largest discrepancy was due to the exclusion of natural gas consumption at the Walter J. Sullivan water treatment plant for December 2012 which resulted in approximately 0.9 percent underreporting of Scope 1 emissions for 2012. There were similar exclusions for smaller facilities. When combined, these discrepancies due to not prorating and exclusions of end-of-year invoices were non-material for both years.

Mobile emissions accounted for 26 percent of Scope 1 emissions in 2008 and 30 percent of Scope 1 emissions in 2012. Although the relative magnitude of mobile emissions of total Scope 1 emissions increased from 2008 to 2012, actual mobile emissions decreased by almost 11 percent. The relative magnitude increase is due to an even larger decrease in stationary combustion emissions from 2008 to 2012. Again, the City utilizes MEI to track gasoline and diesel fuel for mobile sources. The City also tracks fuel dispensed using its Fuel Master program. RCE used Fuel Master records for dispensed fuel as a check on fuel purchases tracked in MEI and the totals were similar (with the exclusion of fire department and cemetery fueling stations which are not tracked by Fuel Master). RCE also reviewed the selection and application of CO₂ emission factors for gasoline and diesel in the emissions calculations and reviewed the City's use of TCR's Simplified Estimation Method (SEM) to calculate CH₄ and N₂O emissions using the factors in Table 13.9 for metric tons of GHG per metric ton of CO₂.

RCE reviewed service records for refrigerant recharge in Department of Public Works chillers/AC units in 2012 which were used to calculate fugitive emissions from chillers/AC units. Service records were not available for 2008.

RCE reviewed the City's calculations of fugitive emissions using SEMs for chiller/AC unit refrigerant fugitive emissions for 2008 and vehicle refrigerant fugitive emissions for 2008 and 2012. The City used

the SEMs screening method for both chiller/AC unit refrigerants and vehicle refrigerants. The screening method uses the charge capacity for each piece of equipment or the upper bound capacity value from Table 16.2 along with the leakage rate of operation from Table 16.2. The City used its inventory of equipment and appropriately estimated fugitive emissions using the screening method. RCE confirmed that, combined, the fugitive emissions calculated using SEMs—fugitive emissions from vehicles and chillers/AC units and mobile combustion emissions of CH₄ and N₂O—account for approximately 4.1 percent of total Scope 1 emissions in 2008 and 0.9 percent of total emissions in 2012 which is below the 5 percent threshold for both years, as required by the GRP. The decrease fugitive emissions from 2008 and 2012 is due to a change in calculation methodology and is discussed in more detail in Section 3.3.3 below.

RCE confirmed that the City's reported Scope 1 emissions are materially correct.

3.3.2 Scope 2

RCE reviewed the calculation of emissions from purchased electricity for the City. Again, the City utilizes MEI to track purchased electricity. RCE reviewed the sums of monthly electricity consumption by account in MEI and compared electric invoices for some accounts to the monthly quantities in MEI. Like with natural gas, there were calculation errors for some accounts which did not include the full 365 calendar days and/or were not prorated for CY2008 or CY2012. These discrepancies were non-material for both years and are estimated to result in approximately 1 percent underreporting of Scope 2 emissions for each year.

RCE also confirmed that appropriate emission factors were applied to the quantities to calculate emissions. The City used ISO New England Inc. CO₂ emission rates for New England for 2008 and 2012. These factors are third-party developed geographic emission factors, are publicly documented, and have been through a review process. RCE confirmed that the use of these factors was reasonable and met TCR's requirements for third-party developed emission factors. The City used eGRID factors to calculate CH₄ and N₂O emissions from purchased electricity.

RCE confirmed that the City's reported Scope 2 emissions are materially correct.

3.3.3 2008 to 2012 Comparison

RCE compared 2008 emissions to 2012 emissions. Scope 1 emissions decreased 28 percent from 2008 to 2012. This is primarily due to the conversion of boilers in many city buildings, especially schools, from oil to natural gas. The former police station at 5 Western Avenue was occupied and within the City's operational control in 2008 but was under construction and was no longer under the City's operational control in 2012, which showed a decrease in emissions.

Additionally, the calculation methodology to calculate fugitive refrigerant emissions changed from 2008 to 2012. For 2008, SEMs were used to calculate all fugitive refrigerant emissions, as explained above. In 2012, records were available for fugitive refrigerant emissions from chiller/AC unit service and recharge, which provides a more accurate description of fugitive emissions. Thus the 80 percent decrease in fugitive emissions between 2008 and 2012 is a result of improved data rather than actual reductions.

Scope 2 emissions decreased 16 percent from 2008 to 2012. Some of this decrease is accounted for by the change in ISO New England electricity emission factors from 2008 (890 lb/MWh) to 2012 (719 lb/MWh), which reflects the grid being supplied by more renewable electricity sources. There were also electricity efficiency measures implemented at the water treatment plant between 2008 and 2012.

4.0 Verification Results

The City provided sufficient evidence and documentation of its emissions calculations, data collection procedures, and monitoring and quality control procedures for its facilities and emission sources. The verification process focused on verifying the emissions calculations and the source data used by the City to quantify its GHG emissions in accordance with TCR's General Reporting Protocol. The following is a summary of the verification results.

The City reported Scope 1 emissions of 12,306.63 metric tons of CO₂e in 2008 and 9,055.78 metric tons of CO₂e in 2012, Scope 2 emissions of 16,178.46 metric tons of CO₂e in 2008 and 13,705.94 metric tons of CO₂e in 2012 as per the information provided in the inventory calculation spreadsheets. Table 3 defines the GHG emissions verified for 2008 and 2012.

During the verification process, RCE made requests for corrective actions, additional documentation, and clarifications to complete the verification. The City sufficiently addressed all material corrective actions. The details of these requests are documented in RCE's List of Findings provided to the City.

5.0 Conclusion

RCE conducted a risk-based analysis of the City's GHG emissions inventories and a strategic review of the inventory data and calculations. Based upon the processes and procedures and the evidence collected, RCE concludes that the GHG assertions are a fair representation of the GHG emissions for 2008 and 2012 and can be considered:

- In conformance with The Climate Registry's General Reporting Protocol Version 2.0,
- Without material discrepancy in Scope 1 or Scope 2 emissions, and
- Verified to a reasonable level of assurance.

Table 3. Total Entity Emissions by Emission Type Under Operational Control

Emissions Verified	2008 CO ₂ e (metric tons)	2012 CO ₂ e (metric tons)
Stationary Combustion	8,215.89	6,140.08
Mobile Combustion	3,032.74	2,706.70
Fugitive	1,058.00	209.00
Scope 1 Total	12,306.63	9,055.78
Scope 2 Total	16,178.46	13,705.94

*Individual categories may not sum to total due to rounding

Lead Verifier Signature



Nina Pinette

Independent Peer Reviewer Signature



Michael Coté