CSA Group
Corporate Greenhouse Gas Inventory for Global Operations

Fiscal Year 2007-2008
Version 13.0

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CSA Group
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Report Content

The following report outlines the procedures and results of CSA's Corporate Greenhouse Gas Inventory for the fiscal year 2007/2008. This inventory has been compiled to the best of our knowledge, using emission factors from highly reputable organizations.

The content of this report has been formulated as a result of collaboration with the following team members. For any questions or concerns, please contact the project lead.

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1.0 Introduction

This inventory has been conducted primarily for voluntary self-evaluation purposes, but will also be available to the public through the CSA website[1]. The purpose of this report is to summarize the procedure and results of the greenhouse gas (GHG) inventory performed by CSA for the fiscal year 2007/2008.

CSA Group is an independent, non-for-profit membership organization, dedicated to serving business, industry, government and consumers. It is comprised of three major divisions: the Canadian Standards Association, which develops standards and provides guidance on how to apply them; CSA International, which provides testing and certification services; and OnSpeX, which provides consumer product evaluation and consulting services for retailers and manufacturers. During the fiscal year 2007/2008, CSA group also consisted of a fourth division known as QMI, which provided management services for various standards, such as the ISO 9001 and ISO 14001 standards.

CSA Group has taken a voluntary initiative to maintain a carbon neutral status for its operations. The first CSA greenhouse gas inventory was compiled for the fiscal year of 2006/2007, and accounted for all North American operations. The new target for the fiscal year 2007/2008 was for CSA to maintain a carbon neutral status when accounting for its world-wide operations.

This report has been created in compliance with Section 7.3.1 of the CSA/ISO 14064-1 standard, titled as the *Specification with Guidance at the Organization Level for Quantification and Reporting of Greenhouse Gas Emissions and Removals.*

The information provided in this report will be verified by an independent third party, as outlined by the CSA/ISO 14064-3 standard, titled *Specification with Guidance for the Validation and Verification of Greenhouse Gas Assertion*, and will be registered on the CSA's GHG CleanStart™ Registry[2].

1 http://www.csa.ca/Default.asp?language=english

2 http://www.ghgregistries.ca/cleanstart/index_e.cfm

2.0 GHG Assertions

1. CSA Group's, North American Operations GHG Inventory for fiscal year 2007/2008 report was prepared in conformance with the CSA/ISO 14064-1 standard entitled *Specification with Guidance at the Organization Level for Quantification and Reporting of Greenhouse Gas Emissions and Removals*.

2. Emissions from CSA Group's GHG Inventory for International Operations covering the described subcategories for the fiscal year 2007/2008 were approximately 11,103.30 tonnes CO_2e.

3.0 Scope

3.1 Reporting Period

The inventory inclusively covers the 2007/2008 fiscal year from April 1st 2007 to March 31st 2008.

3.2 Assets

During the fiscal year 2007/2008, CSA group had the following assets:

- Twenty-one (21) company fleet vehicles
- Sixteen (16) North American facilities: 5 Owned, 11 Leased
- Seven (7) leased International facilities
- A head office in Rexdale, Toronto
- 1,176 employees

3.3 Greenhouse Gases

The three greenhouse gases quantified in this report include: carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O). This is because the US Environmental Protection Agency identifies these to be the gases present in the largest quantities, with the overall greenhouse gases comprised of 74% CO_2, 16% CH_4, and 9% N_2O[3].

3.4 Organizational Boundaries

A control approach was selected as the best method of consolidation for corporate GHG emissions. Therefore, any sectors where CSA Group exercised operational control have been quantified in this report. This method had been selected in order to maintain consistency when comparing the inventory to the base year.

The organizational boundaries were expanded to include operations on an international level in order to meet CSA's new target of carbon neutrality for global operations.

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3 "Global Greenhouse Gas Data." EPA. 18 Feb. 2009. US. Environmental Protection Agency. 2 Mar. 2009 <http://www.epa.gov/climatechange/emissions/globalghg.html>.

3.5 Operational Boundaries

Five greenhouse gas sources were considered to be relevant within the organizational boundaries:

- Air Travel of Employees
- CSA Group Vehicle Fleet
- Energy Indirect Emissions
- Direct Building Emissions
- Auditor and Inspector Vehicle Emissions

Using the ISO 14064-1 method of classification, as outlined within section 5.1 of the standard, the above identified sources of GHG were categorized into the appropriate subgroups, as shown in Table 1:

Table 1: GHG Emissions Classification from CSA/ISO 14064-1[4]

Emission Source	CSA/ISO 14064-1 Emissions Classification
Air Travel of Employees	Other Indirect Emissions
Electricity	Energy Indirect Emissions
Natural Gas	Direct Emissions/ Energy Indirect Emissions (see Methodology)
Direct Building Emissions	Direct Emissions
Auditor and Inspector Vehicle Emissions	Direct Emissions
CSA Group Vehicle Fleet	Direct Emissions

Other sources were primarily excluded due to the absence of methods by which data could be tracked, and as a result, accounting for other indirect emissions was not technically feasible. Later inventories are expected to include a broader range of sources as well as an expanded organizational boundary. In future GHG inventories, CSA plans to account for train travel, bus travel, taxi travel, and business use of personal vehicles by employees.

Although air travel had been initially classified as an "other indirect emission", it was proven to be a significant source of greenhouse gas activity, thus having a large impact on the magnitude of the carbon footprint.

Reservoirs: No reservoirs[5] were identified within the organizational or operational boundaries.

Sinks[6]**:** During the year 2006, CSA had installed a windmill at their head office in Rexdale in order to displace a portion of their emissions resulting from electricity consumption.

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4 'Defined Categories' from CSA/ISO 14064-1 Definitions; Section 5.1

5 Reservoir: Physical unit or component of the biosphere, geosphere, or hydrosphere with the capability to store or accumulate a GHG either removed from the atmosphere by a sink or captured from a source

6 Sink: Physical unit that removes a GHG from the atmosphere

In addition, there are no CO_2 emissions from the combustion of biomass, as all combustion-related emissions are from fossil fuels either used for space heating and air conditioning, certification and testing or transportation.

3.6 Base Year

It has been established that future inventories will use a rolling base year system, such that each inventory is compared, with the best of its ability, to the inventory of the previous year. This decision has been made due to the fact that CSA is an expanding organization, and therefore, acquires more facilities over years.

In order to account for this rapid growth, this 2007/2008 Inventory will be used as the new base year for the next inventory because it serves as a reasonable representation of the organization's overall emissions.

As it is not technically feasible to calculate the international emissions for the 2006/2007 fiscal year, the North American section of each of the two reports have been used to draw a comparative analysis of emissions.

4.0 Quantification Methodologies

This section of the report provides an overview of the methodologies used to calculate the carbon footprint of the organization.

Though slight differences in calculations existed between the various subsections, the basic principle of calculation was constant. The primary method used for calculation was to multiply the activity data by the appropriate GHG emission factors.

A considerable level of certainty was feasible while performing the calculations as both, the activity data and emission factors were from reliable sources. All facilities were asked to scan and send all valid documents that could be used to verify the data that was provided. The standard emission factors were collected from reputable organizations, as listed under the References section of this report.

Several of the previous quantification methods have been revised in this inventory; changes and the reasoning behind these alterations have been provided in each subsection. The 2006/2007 Inventory has been updated to incorporate the new methods where possible.

Each subsection will provide the quantification methods and a qualification of the uncertainty associated with them, and will also summarize the results of the calculation.

Note: It is important to note that as of 2008, QMI does not fall under the ownership of CSA Group. As a result, future inventories will not be including QMI data in their quantification. As they are now under the ownership of a different company, QMI was unable to provide energy consumption data for any of their four facilities. Data for QMI Toronto and Edmonton has been estimated based on their square footage and Building Emission Intensity values determined during the 2006/2007 inventory.

Note: Verification documentation stating the square footage of the QMI Mexico office is unavailable.

4.1 Employee Air Travel

4.1.1 Methodology

The data collection process was based on the following four steps:

1. Compilation of an air travel list
2. Flight categorization
3. Sub-categorization of long-haul air travel
4. Total CO_2 emissions

Compilation of air travel list

International offices were contacted for their air travel records; this information was tracked directly by employees at each facility.

To maintain consistency, all North American employees at CSA are asked to use the Carlson Wagonlit Travel Agency to book all flights. Leo Vankeulen contacted Carlson Wagonlit, requesting them to extract all relevant CSA employee travel record from their database. The database uses an analysis system such that the data is automatically processed as reservations are made from CSA employees. This automated process reduces the potential errors that arise from manual input.

Employees in the Cleveland, Irvine, and Mexico offices booked their flights regularly through the Carlson Wagonlit Travel Agency using their Diner's Club card; however, they did not access the database as CSA employees. As a result, these fights were not displayed on the records provided by the Carlson Wagonlit database, and were manually extracted from expense reports in order to maintain completeness.

Employees in the China offices book flights from a specific travel agency called Swire. Facilities in India used a travel agency known as JV Travels to account for their travel records.

OnSpeX facilities in Shanghai and Shenzhen, China, extracted air travel data for the two inspectors with the most travel. Based on a list of inspectors received from contacts in China, it was assumed that all inspectors travelled the same amount of air miles as the two inspectors with the most travel. The fact that the 15 inspectors in Shanghai and 11 inspectors in Shenzhen travel by air approximately ten times per month was used to estimate their air travel.

Table 2 displays the methodology used to calculate inspector air travel:

Table 2: Calculations for OnSpex Inspectors Air Travel

Shanghai
The employee with the most travel, travels approximately 696 kilometres for each trip.

On average, inspectors travel about 10 times each month, and there are 15 inspectors in Shanghai. Therefore:

$$\frac{696 \text{ km}}{\text{Time} * \text{inspector}} \times \frac{10 \text{ times}}{\text{month}} \times \frac{12 \text{ months}}{\text{year}} \times 15 \text{ inspectors} = 1{,}252{,}800 \text{ km/year}$$

Shenzhen

The employee with the most travel, travels about 450 kilometres during each trip. On average, inspectors travel about 10 times each month, and there are 11 inspectors in Shenzhen. Therefore:

$$\frac{450 \text{ km}}{\text{Time} * \text{inspector}} \times \frac{10 \text{ times}}{\text{month}} \times \frac{12 \text{ months}}{\text{year}} \times 11 \text{ inspectors} = 594{,}000 \text{ km/year}$$

Facilities in Korea indicated only two instances where air travel was required, neither of which were scheduled during the 2007/2008 period covered in this report; they have not been included.

The raw data extracted from each database was organized into an Excel spreadsheet containing the following sets of data for each flight:

- Passenger Name
- Total Cost
- Employer
- International, Domestic, or Continental
- City of Departure
- Airport of Arrival
- Miles flown

Flight Categorization

The distance travelled for each flight was provided in miles, and was converted into kilometres using the appropriate conversion factor (1 mile = 1.609 km). Guidelines from *The Greenhouse Gas Protocol Initiative, World Resources Institute* [7] were used to organize the data as one of three main categories. Table 3 shows the classification criteria for each category:

Table 3: Flight Classification [8]

Category (Haul)	Distance Travelled (km)
Short	Flights less than 500 km
Medium	Flights between 500 and 1,600 km
Long	Flights greater than 1,600 km

Long-haul Flight Sub-categorization

A second air travel list was obtained from Carlson Wagonlit, including traveler name, date of departure, airport of origin, destination airport, flight duration, flown airline code, service class, ticket number, and sub trip miles. Despite all efforts to ensure that the data set included only final bookings, the CWT data

7 http://www.ghgprotocol.org/calculation-tools/all-tools

8 'F*or Air, Rail, Bus and Car Travel, Business Travel, Service Sector, Version 2.0, GHG Protocol Initiative, August 2005*< http://www.ghgprotocol.org/calculation-tools/all-tools>

system was unable to completely remove all intermediate and duplicate bookings. To ensure accuracy of the data set, duplicates, intermediate bookings, and other discrepancies within the air travel data set were manually removed. The procedure to remove any duplicate and/or extraneous bookings is as follows:

1. Sort the data set by Traveler name, then Departure date.
2. Manually inspect the data set to determine any discrepancies, duplicates, and extraneous entries. These were all highlighted yellow.
3. Determine which of the above entries are valid and therefore to be kept. The following methodology was used for this:
    a. The ticket number which comprised the most complete and logical trip was selected as correct.
    b. In cases where a. did not produce a clear solution, the trip with the highest ticket number was considered to be correct.
    c. In cases where neither a. nor b. produced a clear solution, the trip which both began and ended in the employee's home location and any intermediate trip legs which matched up with these flights was considered to be correct.

An Excel spreadsheet is available which contains the original data set received from CWT; the data set for only the fiscal year 2007/2008, with duplicates, changes, intermediate bookings and other discrepancies highlighted; and the final data set.

The full CWT air travel list was filtered to show only long-haul flights, ie: flights longer than 1,600 km. The long-haul flight data set was then broken down by class (business, economy, first, unknown). The distance flown for all business class, first class, and any unknown class flights over 5 hours in duration (as per CSA travel policy) was summed to determine the total kilometres flown in business class. All economy class flights and any unknown class flights under 5 hours in duration were considered to be economy class, and the total km flown in this category was calculated. From these totals, the percentage of long-haul flights flown in business class and economy class were determined, and applied to the full data set.

The average speed of the plane for each flight in the Carlson Wagonlit data set was calculated by dividing the distance flown in km by the flight duration in hours. The average speed of all Carlson Wagonlit flights was calculated.
For each area for which travel was not booked through Carlson Wagonlit (ie: Hong Kong, OnSpeX China, India, Cleveland, and Irvine), the flight duration was calculated for each flight by dividing the distance in kilometres by the calculated average speed of 656.56 km/h. The full travel list for these areas was filtered to show only long-haul flights, which were then sorted by increasing flight duration. Again, the total kilometres and number of long-haul flights both under and over 5 hours were calculated. From this, the percentage of each long-haul flights under and over 5 hours was calculated.

The total long-haul flight distance was then multiplied by the percentage of long-haul flights taken in each of business and economy class (from the long-haul flight sub-categorization.) This resulted in two long-haul flight categories: long-haul flight in business, and long-haul flight in economy. In order to be

consistent, future inventories will use the same approach to determining the percentage of long-haul flights in business and economy.

Assumption: For flights booked outside of Carlson Wagonlit, flight duration was not available. Instead, an average speed of 656.56 km/h was assumed, based on the average speed of all long-haul flights in the Carlson Wagonlit data set..

Total CO_2 emissions

The total distance travelled was calculated separately for each haul group in order to account for varying emission factors shown in Table 4. The emission factors used are highlighted in gray.

Table 4: Emission factors used for air travel [9]

Flight Type	gCO_2/pkm
Domestic	
Weighted Average	175.3
Short-Haul	
Economy	93.7
Business	140.5
Weighted Average	98.3
Long-Haul	
Economy	80.7
Economy+	129.1
Business	234
First Class	322.8
Weighted Average	110.6

Assumption: CSA Group policies indicate that all flights under five hours in length must be taken in economy seats. If a direct flight is assumed, then the travel time would be less than five hours[10]. It is therefore assumed that all medium and short haul flights were taken in economy class.

Assumption: Since the emission factors are listed in tonnes of CO_2 per seat on the flight, it is assumed that all seats in the aircraft were full during each trip.

The total distance in each category was multiplied by the corresponding emission coefficients in order to quantify the emissions.

4.1.2 Estimation of Uncertainty

Activity data was obtained from valid sources such as expense reports and databases of various travel agencies such as Carlson Wagonlit and JV Travels, due to which the activity data has a considerable level of accuracy associated with it. This flight data is considered to be complete. The percentage of long-haul flights taken in each of business and economy class has a high degree of certainty associated with it as it is taken directly from Carlson Wagonlit data base entries, which are considered to be relevant and accurate. Emission factors were used

[9] Table 4, Page 10, http://www.defra.gov.uk/environment/business/envrp/pdf/passenger-transport.pdf

[10] The Carlson Wagonlit database indicates that the distance from Montreal to Atlanta, Georgia is 1599 km. The Air Canada website was used to determine that the travel time for a non-stop flight is approximately three hours; however for a connecting flight, the travel time may range from four to 6 hours.

from DEFRA, a reputable organization that publishes updates emission factors and greenhouse gas quantification guidelines annually. The emission factors are accurate and relevant. Though minimal errors would result from the assumption taken into account for the OnSpex inspectors; in the case where an error exists, the data obtained is an over-estimation of the true value. The overall uncertainty associated with the calculation of CSA Group's air travel emissions is low.

4.1.3 Results

Table **5** below displays the overall emissions due to air travel of North American and International employees:

Table 5: Summary of Air Travel Emissions

Location	Emissions (tCO_2e)
North America	3420.96
International	882.81
Total	4303.77

4.2 CSA Group Fleet Vehicles

4.2.1 Methodology

During the fiscal year 2007/2008, all company and executive vehicles were classified under "fleet vehicles", as CSA exercised either financial or operational control over them. They consisted of 21 vehicles: 12 in Toronto, one in Cleveland, and 8 in Vancouver.

The method used to quantify the emissions resulting from the fleet vehicles consisted of the following steps:

1. Compilation of activity data
2. Calculation of total CO_2 emissions

Compilation of activity data

Activity data for Cleveland and Vancouver fleet vehicles was provided based on odometer readings.

Rexdale vehicle data was provided based on the calendar year, as it is not yet technically feasible to quantify this data based on the fiscal year. For the purpose of this inventory, the vehicle usage data from the 2007 year has been used. This method will prove accurate as no changes will be made to future inventories regarding this method, thus following the completeness principle. Future inventories will also be completed based on a calendar year rather than a fiscal year, for which this method would provide further accuracy.

The calendar year for this inventory was chosen based on the fact that the fiscal year contains nine months in the 2007 calendar year, with only three

months in 2008. Hence, in order to maximize accuracy, data for the 2007 calendar year was chosen for this inventory.

The activity data for Rexdale fleet vehicles is tracked based on odometer readings taken every six months. This data is also used for taxable benefit calculations and can, therefore, be assumed to be accurate.

Though a ratio of the percent of the vehicle mileage that accounted for business or personal use was available, these fractions were based on employee estimates rather than material data and were, therefore, concluded to be inaccurate. It was assumed that 100% of the odometer readings resulted from business travel.

The raw data was organized into an Excel spreadsheet, containing the following sets of data for each vehicle:

- Make
- Model
- Year
- VIN Number
- Location (City)
- Fuelled by diesel or gas
- Total distance travelled
- Size of vehicle engine

Calculation of total CO_2 emissions

The total distance travelled was used in collaboration with the individual fuel economy for each vehicle, to calculate the quantity of fuel used. The fuel economy of each car was determined using the *Fuel Economy Database*[11], created on values provided by the US Environmental Protection Agency; these values are available in the Management Handbook.

The appropriate emission factors were multiplied by the quantity of each fuel (diesel and gasoline), which was then added to calculate the overall CO_2 emissions from the fleet vehicles.

Table 6 displays the conversion factors used to calculate the emissions:

Table 6: Emission Factors for Fleet Vehicles[12]

Fuel Type	Emission Factor
Gasoline	
CO_2	2.36000 kgCO_2/L
CH_4	0.00012 kgCH_4/L
N_2O	0.00026 kgN_2O/L
Diesel	

[11] http://fueleconomydb.com

[12] National Inventory Report 1990-2004 Greenhouse Gas Sources and Sinks in Canada. http://www.ec.gc.ca/pdb/ghg/inventory_report/2004_report/ann13_e.cfm#sa13_5

CO_2	2.73000 kgCO_2/L
CH_4	0.00007 kgCH_4/L
N_2O	0.00020 kN_2O/L

Note: One fleet vehicle of the Cleveland facility was removed from use as of May 2007, and as a result, no data can be found to estimate the miles travelled by this vehicle. As this accounts for only one month of the reporting period, it was decided that based on the time and resources needed to account for this vehicle, the calculated emissions would be a minimal when compared to CSA's total emissions.

4.2.2 Estimation of Uncertainty

The values provided have a high degree of certainty associated with them, as both the activity data, and the emission factors have been obtained from valid sources. The activity data has been obtained from odometer readings, which is the most accurate and relevant method to track this data with the resources available. The emission coefficients for fleet vehicles have been obtained from Canada's National Inventory Report, providing a high level of accuracy. The one month of missing data for the sold Cleveland vehicle would not have a significant impact on the overall inventory results. The overall uncertainty associated with the calculation of the emissions due to CSA's fleet vehicles is low.

4.2.3 Results

The results obtained from the calculations for fleet vehicles have been summarized in Table **7** below:

Table 7: Summary of Fleet Vehicles Emissions

Fuel Type	CO_2 (t)	CH_4 (tCO_2e)	N_2O (tCO_2e)
Gasoline	85.57	0.091	2.92
Diesel	34.64	0.019	0.79
Total	120.21	0.11	3.71

4.3 Building Emissions – Energy

4.3.1 Methodology

The two sources of emissions resulting from energy were electricity usage, and natural gas used for space heating purposes. For the purpose of this inventory, electricity consumption was considered to be an energy indirect source. Natural gas usage for space heating was considered to be a direct source if CSA was the owner or occupied 100% of the building; space heating was considered an energy indirect source for leased buildings which had multiple tenants.

Table 8: Categorization of Space Heating Emissions

Facility	Owned/Leased	Direct or Energy Indirect

Montreal	Owned	Direct
Rexdale	Owned	Direct
Richmond	Owned	Direct
Edmonton	Owned	Direct
Atlanta	Leased	Direct
Irvine	Leased	Direct
Cleveland	Owned	Direct
Ottawa	Leased	Energy Indirect
Mississauga	Leased	Energy Indirect
QMI Edmonton	Leased	Energy Indirect
QMI Toronto	Leased	Energy Indirect
Nashville	Leased	Energy Indirect
Charlotte	Leased	Energy Indirect
Dallas	Leased	Energy Indirect
Chicago	Leased	Energy Indirect

The quantification method consisted of the following steps:

1. Compilation of building list
2. Compilation of activity data
3. Determination of appropriate emission factors
4. Revision of previous methodology
5. Calculation of total emissions

Compilation of building List

The building list was compiled based on information from the 2007/2008 annual report and the CSA website[1]. Electronic copies of all leases were received from the legal department, and were used to update the building list as needed. All facilities for which leases were not available from the legal department, were asked to provide us with required documentation.

The buildings list consisted of all leased and owned facilities used by any of: CSA, QMI, OnSpeX and/or CSA International. This list is available electronically.

Any facilities for which rent was not paid have been excluded from this report. This is because these facilities contained only one or two of the organization's employees, and as a result, CSA exercised no operational or financial control over them. These facilities were not within the organizational boundaries, and including them would have resulted in potential double counting.

Compilation of activity data

A blank template Excel file was created, asking each facility for a monthly breakdown of their electricity and natural gas consumption.

A high level of accuracy was associated with these calculations, as both the emission factors and activity data were obtained from verifiable sources. Each

facility was required to provide documentation verifying the electricity and natural gas consumption claimed by that facility; invoices are available electronically.

Many international facilities were located in climates that did not require heating, and therefore did not have any natural gas usage to be quantified. While some international facilities that did not require heating did require the usage of air conditioning, this has already been quantified. These facilities' energy usage due to air conditioning was reflected in their electricity invoices, and thereby this energy usage has been quantified in the electricity quantification.

Based on the information provided, a cumulative excel sheet was generated, consisting of the following information for each, electricity and natural gas:

- Facility Name
- Province/Country
- Leased/Owned
- Total Building Square Footage
- CSA Square Footage
- Percent of total area occupied by CSA
- Total electricity or natural gas consumption

Determination of appropriate emission factors

The emissions resulting from electricity usage in North American facilities were quantified based on emission factors for each province or state. Emission factors for each electricity grid were not available for the international facilities, and therefore, had to be calculated based on the national emission factors. For Canadian facilities, emission factors were not broken down for each specific gas, and had to be reasonably estimated.

Electricity emission factors from the US Environmental Protection Agency were used for US and Foreign emission calculations; while the Canadian National Inventory Report[13] was consulted for Canadian emission factors. All emission factors used for natural gas calculations were obtained from the US Environmental Protection Agency.

Revision of previous methodology

The quantification methods for the energy consumption of leased buildings were changed from those used in the 2006/2007 inventory. During the previous inventory, emission intensities were calculated for each leased building, based on the weather patterns. This method was deemed imprecise, and has been reviewed. This statement could be justified as the previous method required heavy estimates of the weather patterns when compared to the base. Such large assumptions would either significantly over-estimate or under-estimate the emissions.

[13] Canadian Electricity GHG Intensities, National Inventory Report, 1990-2005.

Assumption: For the purpose of this inventory, it is assumed that the percent of the total building electricity used by leased offices was equal to the percent of the square footage occupied by CSA. This approach is the best method, as it had been recommended by the GHG Protocol [7]. This assumption was used for only four of the leased facilities, while the remaining locations provided invoices that specifically indicated the energy consumed by CSA offices.

Assumption: Since both QMI Beijing and the Shenzhen office consisted of only office operations, and because no data for the QMI Beijing office was available, it was assumed that the amount of electricity consumed per area by the Shenzhen office was equal to the consumption of the QMI Beijing office per area. Similarly, QMI Mexico was estimated based on values obtained from the Dallas office.

Note: Electricity consumption for the Charlotte facility is included as part of the rent and was, therefore, unavailable. Instead, the landlord for this office provided for this report, the total electricity expenses for the year, and a document stating the method by which cost is calculated. These two documents were used to estimate the amount of electricity used by CSA's Charlotte office during the reporting period.

Calculation of overall emissions

Appropriate emission factors were multiplied by the building activity data to determine the corresponding emissions. The amount of each specific gas was then multiplied by the appropriate Global Warming Potential, to determine the total amount of emissions in CO_2e. The building emissions were then consolidated up to the corporate level, to produce the total emissions.

Note: Emission factors for carbon dioxide for North American facilities were based on the electricity grid of each province, while emissions for International facilities were based on the national emission factors.

Note: Emission factors for nitrous oxide and methane for Canadian facilities were not available based on individual electricity grids. Therefore, national emission factors were used to quantify these emissions.

4.3.2 Estimation of Uncertainty

The results have been obtained based on the readings summarized on invoices provided by the energy suppliers. These values are taken based on meter readings indicating the energy consumption for natural gas and electricity. The estimation performed for the QMI buildings is based on the thorough research performed by an independent contractor during the fiscal year 2006/2007, and is therefore, assumed to be accurate. Emission factors have been obtained from a combination of values provided by the US Environmental Protection Agency and Canada's current National Inventory Report. These values are therefore concluded to be accurate. As the emission values obtained are simply a product of these two values, a high degree of certainty is associated with these values.

4.3.3 Results

The overall emissions based on the natural gas and electricity consumption for the organization have been summarized in Table 9 below:

Table 9: Summary of Energy Emissions

Emission Type	CH_4 (tCO_2e)	NO_2 (tCO_2e)	CO_2 (t)	Total (tCO_2e)
Electricity	1.071	16.68	3,822.24	3,840.00
Space Heating	0.10	1.16	1,884.94	1,886.20

4.4 C&T Inspector and QMI Auditor Travel

4.4.1 Methodology

This category of emissions consisted of activity data for employee travel in the two separate categories of auditors and inspectors. Though the method by which the activity data was obtained differed, the quantification method for emissions resulting from both categories remained the same. The quantification method used, followed the following steps:

1. Obtained total distance travelled by QMI Auditors during the reporting period
2. Prepared a list of Field Service Representatives (Inspectors) across CSA
3. Collected complete activity data for each Field Service Representatives from corresponding sources
4. Calculation of emissions
5. Computation by gas type

QMI Auditor Data

As discussed in the 2006/2007 quantification report, QMI uses a data management system known as QTools to track the travel records of their employees. The system allows employees to view the distance travelled by their auditors during a specified time period. This information was provided by John Fraser through an email.

The data provided by QMI also included the cost of fuel for rental vehicles; however, this data has been excluded from the scope of this report as it is not technically feasible to collect similar data for C&T Inspectors. Future inventories basing their results on the data obtained from CSA's new data management system are expected to include this data.

Preparing a List of Field Service Representatives

A list of all CSA Field Service Representatives was extracted from the System Applications Processes database (SAP). SAP is the most frequently updated, and thus the most accurate, resource to extract employees profiles. A query on SAP was run in order to provide a report that consisted of the following data:

a. Last Name, First Name
b. Date of Hire
c. Location
d. Job Title

Any employees that had been hired after the reporting period were removed from the list. This list was then printed and used as a checklist to track the employees for which data had been collected.

Collection of Activity Data for Field Service Representatives

A template Excel Spreadsheet was created, consisting of the following data for each location:

a. Last Name, First Name
b. Date of Travel
c. Distance travelled in original units
d. Distance travelled in kilometres

Required data was manually obtained from the expense reports of each employee. In comparison to other options, this method was determined to be the most accurate source of data, as employees were reimbursed based on the distance travelled. This data is verified through financial audits and by CSA's accounting department; the weekly expense reports submitted by the employees also contain their supervisor's signature in order to verify that the costs claimed are accurate.

Research indicated that the required data was grouped by the following six categories:

a. Rexdale
b. Cleveland
c. Mexico
d. California and Colorado
e. Montreal and New Brunswick
f. India

Data for the inspectors in California and Colorado, and Mexico are maintained electronically in an Excel Spreadsheet. Similar data for Cleveland, Rexdale, Montreal and New Brunswick, and India required manual retrieval of data.

Exclusion: Travel for the OnSpeX inspectors in Shanghai and Shenzhen, China have not been included for this category. This is because the most common form of transportation in the two locations is either by bicycle, producing no emissions, or by buses and trains. All three modes of transportation are not included in the scope of this inventory.

Calculation of Emissions

The total distance travelled by all inspectors of CSA was multiplied with the corresponding emission factor to obtain the emissions.

Assumption: Since it is not feasible to track the type of car used by each inspector or auditor, it was assumed that all vehicles used were fuelled by gasoline. Furthermore, in order to maintain accuracy, it was also assumed that all vehicles had medium-sized engines, as most inspectors prefer to use medium vehicles over larger ones.

Methodological Change: During the fiscal year 2006/2007, it was assumed that the distance travelled by one C&T Inspector was equal to the distance travelled by one QMI Auditor. Due to improvements in data collection and the realization that C&T Inspectors often travel longer distances than auditors, it has been determined that the 2006/2007 inventory underestimated the emissions due to auditor and inspector travel. It is not technically feasible to recalculate the 2006/2007 data using this change, however, the change has been incorporated into this greenhouse gas inventory

Computation of Each Gas Type

The results of calculations performed during the 2006/2007 Inventory indicate that for each gram of gasoline emission, 96.6% is carbon dioxide, 0.1% is methane, and 3.3% is nitrous oxide.

4.4.2 Estimation of Uncertainty

The activity data obtained has been determined to be the most accurate method possible using the resources currently available. The list of Field Service Representatives acted as a checklist, helping ensure that no employees were excluded from the report. Any errors associated with the collection of activity data may have resulted from the manual entering of data. As well, relevant emission factors have been collected from the annual guidelines provided by a reputable organization known as DEFRA.

All assumptions have been performed to the best of our knowledge, and ensure that the principles of transparency, relevance and accuracy have been taken into account. The values resulting from these assumptions are believed to be an accurate representation of the true emissions of this subcategory. The overall uncertainty associated with the calculation of the emissions due to auditor and inspector travel is low.

4.4.3 Results

A breakdown of the emissions calculated using the methodology describes has been summarized in Table 10: **Summary of Auditor and Inspector Vehicle Emissions** below:

Table 10: Summary of Auditor and Inspector Vehicle Emissions

Area	CO_2(t)	N_2O (tCO_2e)	CH_4(tCO_2e)	Total Emission (tCO_2e)
QMI Auditors	183.78	0.00	0.00	190.25
Edmonton	58.87	0.00	0.01	60.94
Rexdale	146.74	0.01	0.02	151.91
Montreal	81.59	0.00	0.01	84.46
Denver & Irvine	39.62	0.00	0.00	41.01
India	1.47	0.00	0.00	1.53
Mexico	11.30	0.00	0.00	11.70
Cleveland	341.95	0.02	0.04	353.98
Total	865.32	0.04	0.10	895.77

4.5 Direct Building Emissions

4.5.1 Methodology

This category of emissions consisted of activity data for gases used for testing, such as methane, ethylene, acetylene, butane, propane, and natural gas. The quantification method used was based on the following steps:

1. Categorization of facilities
2. Collection of Activity Data
3. Calculation of emissions

Note: The quantity of fuel used for this calculation was based on the amount of fuel purchased during the reporting period. Due to the nature of our operations, it is not technically feasible at this point to track fuel used for testing purposes. The possibility of tracking inventory levels of fuels has been considered, and although not feasible at the current time, will be considered for future inventories.

Categorization of Facilities

Each building was first classified as either a testing site and/or office building. Those buildings listed as testing sites were then categorized as "Fuel-testing" and "Non-fuel testing" facilities.

Buildings listed as testing sites included:

a. Irvine, California
b. Cleveland, Ohio
c. Rexdale, Ontario
d. Montreal, Quebec
e. Shanghai, China
f. Edmonton, Alberta
g. Richmond, British Columbia
h. Atlanta, Georgia
i. Dallas, Texas

Of these testing buildings, only the following claimed to have fuel testing within their labs: Shanghai, Irvine, Cleveland, and Rexdale. The remainder of the buildings listed focus on electrical testing of products, thus no direct emissions result from these facilities.

Note: Though Rexdale performed several tests involving fuels, such as butane and propane, these have not been included in this inventory as no fuel was purchased during the reporting period.

Note: It was deemed necessary to identify that the Rexdale facility has a 300 kW bi-fuel generator, operational on both, natural gas and diesel. Since the bi-fuel generator has not been used for energy generation as of yet, it is only functional during maintenance checks when required. Since no problems were suspected with the generator during the reporting period, no fuel was purchased or used; therefore, no emissions resulted from the generator.

Collection of Activity Data

Buildings using fuels for testing were asked to send all invoices, which were then used to calculate the total amount of fuel purchased during the reporting period.

Note: All invoices are available for review in a Verification Documents binder.

Table 11 summarizes the fuel types consumed by each facility:

Table 11: Type of Gas Used For Testing in each Facility

Facility	Gas Type
Irvine	Propane, Butane
Cleveland	Propane, Butane, Gasoline
Edmonton	Hydrogen, Nitrogen, Oxygen, Argon, Ethylene, Acetylene, Methane
Shanghai	Propane, Natural Gas

Calculation of Emissions

For the Edmonton facility, emissions resulting from the use of oxygen, hydrogen, nitrogen, and argon were not accounted for. This is because oxygen is not a greenhouse gas; argon is an inert gas, thus producing no emissions; and hydrogen would react with the oxygen in the air to produce water vapour, which is not harmful to the environment. As well, Nitrogen can not be assumed to react with oxygen to produce nitrous oxide, as this is not a spontaneous reaction, and requires vast amount of energy in order for it to occur. Since no energy is supplied to the reaction, nitrogen must also be ignored for potential emissions.

Combustion reactions were assumed for ethylene and acetylene, thus allowing quantification of the carbon dioxide using stoichiometric calculations. Since methane is directly released into the atmosphere and is a greenhouse gas, no calculation was required, and it was assumed that all of the methane purchased had been released into the atmosphere.

Emission factors from Canada's annual National Inventory Report were used for the quantification of emissions resulting from butane, propane, and gasoline. Since the emission factor was provided in units per litre gas, the approximate densities of each of these gases, coupled with standard conversion factors, were used to convert the quantity of each gas into litres.

Methodological Change: The 2006/2007 Inventory based the quantity of fuel used on an estimated percent breakdown of gases provided by the Edmonton facility, whereas the 2007/2008 Inventory based the same values on the submitted invoices. This change was made because extracting data from invoices is more accurate than the estimate used during the previous inventory.

4.5.2 Estimation of Uncertainty

The activity data obtained is assumed to have a high degree of certainty associated with it as it is directly based on quantities listed on invoices rather than estimates. A slight degree of uncertainty may be present due to the assumption that all of the methane used had been released into the atmosphere, and that all of the ethylene and acetylene underwent pure and complete combustion; however, this assumption would provide an overestimation, and will consistently be used. All conversion and emission factors used have been obtained from verifiable sources and are, therefore, assumed to be accurate. The overall uncertainty in the quantification of the emissions due to testing is low.

4.5.3 Results

A breakdown of the emissions for this subcategory has been summarized in Table 12 below:

Table 12: Summary of Testing Emissions by Gas Type

Fuel Type	Tonne CO_2	Tonne N_2O	Tonne CH_4	Total (tCO_2e)
Propane	7.84	5.6E-03	1.3E-03	8.013
Butane	0.44	2.7E-05	6.1E-06	0.447
Gasoline	1.87	4.0E-05	2.2E-02	1.931
Acetylene	0.77	0.00	0.00	0.768
Dry Ice	0.89	0.00	0.00	0.890
Ethylene	41.38	0.00	0.00	41.384
Methane	0.00	0.00	0.093	0.093
Total	53.19	5.7E-02	0.116	53.530

5.0 Carbon Sink - Windmill

During the calendar year 2006, CSA also installed a windmill, serving as an alternative energy system at the Rexdale head office. The overall electricity disrupted by this windmill has been incorporated into the electricity grid, and is thus automatically reflected through the invoices of this facility. The windmill contains a meter that tracks the cumulative electricity generated since its installation.

Note: Since the first reading of this meter was taken 25 April, 2008, the energy displaced by the windmill will be estimated based on the number of days in operation and the total energy produced during this period. The average daily energy produced will be multiplied by the number of days in the 2007/08 fiscal year, 365, to estimate the amount of energy displaced. To prevent this problem in future years, as of April 2008, these meter readings are taken each month, thus separating energy production for each fiscal year.

Note: Since the windmill was installed on 15 March, 2006, it has displaced a total of 53.42 kg of carbon dioxide. During the 2007/2008 fiscal year, the windmill displaced 25.26 kg of carbon dioxide. Only the 25.26 kg displaced during the 2007/2008 fiscal year will be counted towards CSA's carbon neutral report; however, the remainder of the 53.42 kg displaced from installation until 25 April, 2008 will not be utilized towards carbon neutrality.

As windmills are known to have no emissions associated with them, they act as carbon sinks by reducing the amount of electricity consumed from the electricity grid. Since this windmill was located in Ontario, provincial emission factors were used to quantify the amount of energy displaced from the electricity grid. Table 13 below summarizes this data:

Table 13: Emission Reduction by Windmill at the Rexdale facility

Total Energy Displaced	Energy Displaced 2007/08 FY	Total CO_2 Displaced	CO_2 Displaced 2007/08 FY
296.80 kWh	140.33 kWh	53.42 kg	25.26 kg

6.0 Data Management System

All raw data and information files have been saved and filed electronically in a protected folder. Hard copies of validation documents are available for review in a Verification Documents binder.

A new Management Handbook from the 2007/2008 year has been created, providing guidelines for future inventory purposes. The Handbook consists of contact information, lessons learnt, and suggestions for future inventories. The Handbook also lists all emission factors that were used, along with their sources for future inventories.

A new data management system for all facility leases and deeds is currently being implemented, and is expected to be fully functional by August 2009.

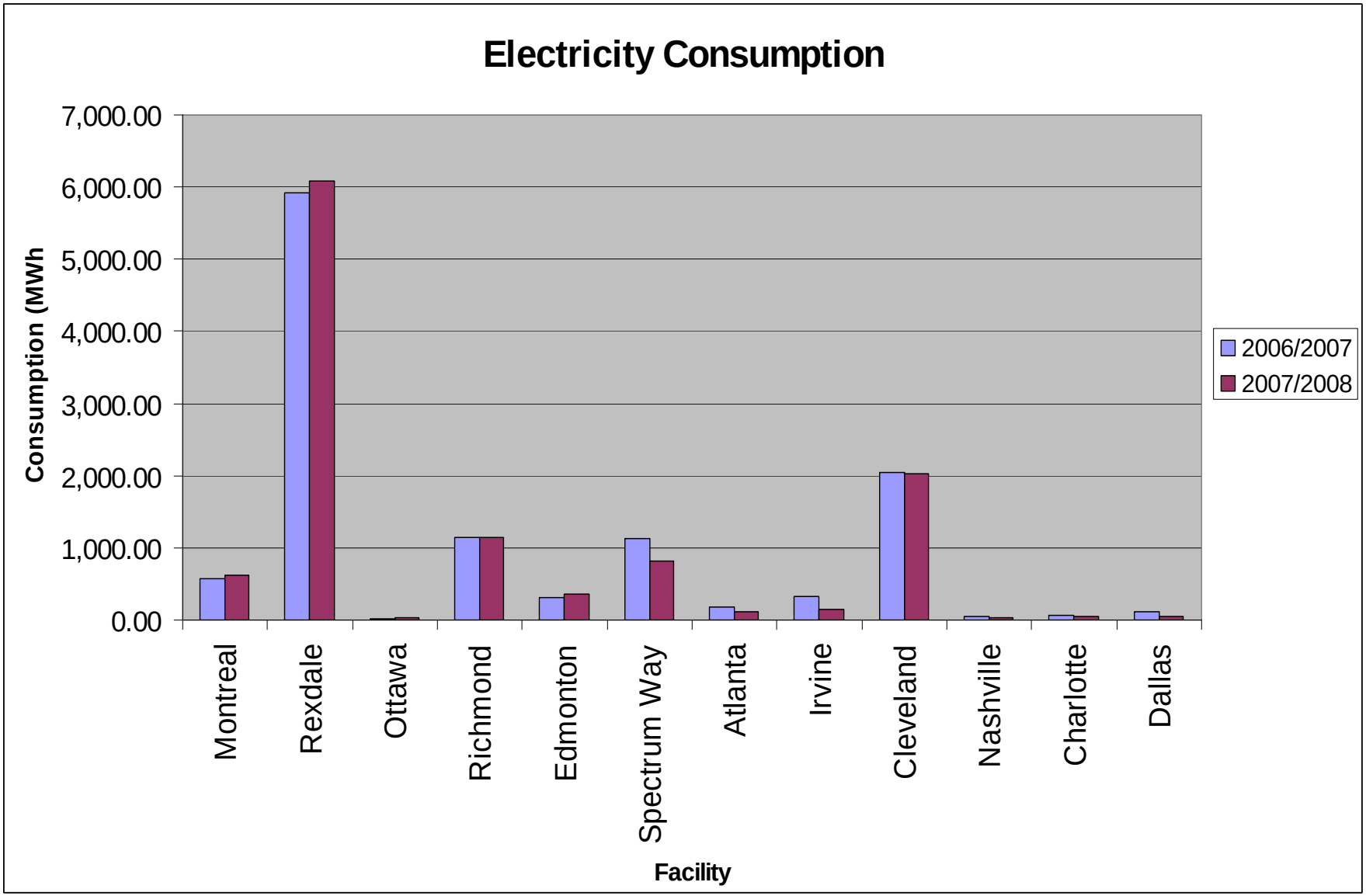
Facilities in China and India have been provided with travel templates to be used as their employee travel data management systems, and will automatically forward these documents to the inventory team each year. It has also been decided that fleet vehicle data will be automatically submitted to the inventory team annually.

A new data management system containing records of all North American inspector travel, is expected to be effective as of May 2009.All future inventories beyond and including that of the fiscal year 2009/2010 will use this system to extract their data for field service reps.

7.0 Comparison to Base Year

Note: All data used for comparison to base year is for North American facilities which were included in both 2006/07 and 2007/08 inventories. This is so that comparisons are as transparent and consistent as possible.

Electricity



Trends: There has been an overall decrease of 227.24 tCO2e in emissions. This is likely due to the fact that the methodology has been changed to incorporate as much real data and as few estimates as possible.

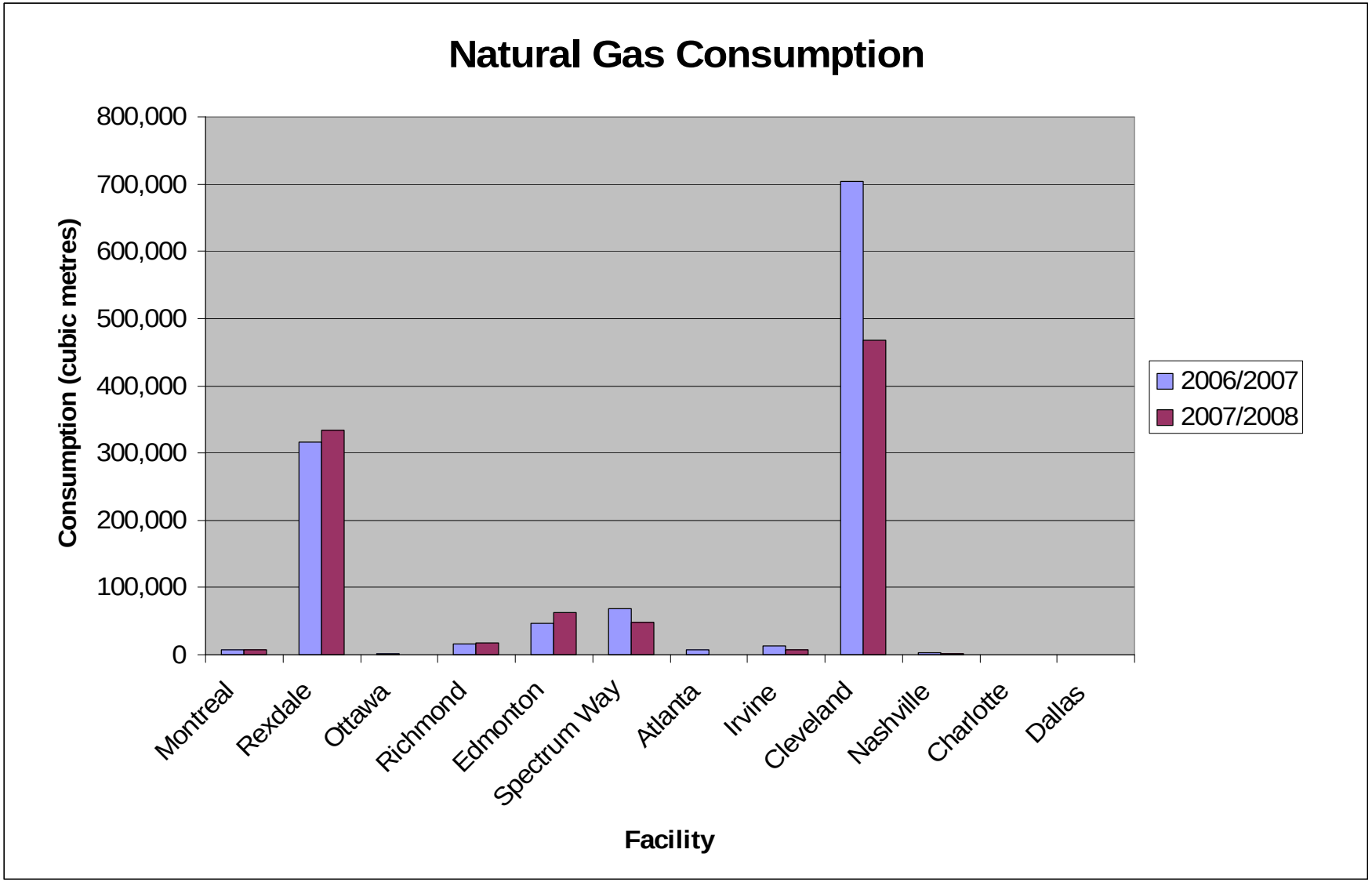
Note: The values for the electricity emissions for the fiscal year 2007/2008 shown in Table 14 do not represent the real emissions, and differ from those shown in Table 9. This is due to the fact that the emissions have been recalculated using the same methodology as what was used in the fiscal year 2006/2007. This has been done in order to maintain consistency and to provide meaningful comparisons between the two years.

Table 14 shows the recalculated electricity emissions for each of the two years.

Table 14: Electricity Emissions for Current and Base Year Inventories

Inventory Year	Emissions due to Electricity (tCO_2e)
2006/2007	4,082.82
2007/2008	3,855.58

Space Heating



Trends: After recalculation of the 2006/07 space heating emissions, due to the correction of Cleveland's consumption, there has been an overall decrease of 245,644.32 cubic metres of natural gas consumption; this corresponds to a 441.58 tCO_2e decrease in the overall emissions. This is likely due to the change in methodology, which now incorporates as much real data as possible, and avoids heavy assumptions based on weather patterns.

Table 15 below displays the emissions as a result of natural gas consumption for space heating for 2006/07 and 2007/08.

Table 15: Space Heating Emissions for Current and Base Year Inventories

Inventory Year	Emissions due to Natural Gas (tCO_2e)
2006/2007	2,327.78
2007/2008	1,886.20

Air Travel

During the 2006/2007 inventory, air travel data was obtained solely from the Carlson Wagonlit database; however, during the 2007/2008 inventory, data was also extracted from employee expense reports. Table 16: **Air Travel Emissions for Current and Base Year Inventories** below summarizes the North American air travel emissions of the two inventories, in order to accurately compare the emissions.

Table 16: Air Travel Emissions for Current and Base Year Inventories

Inventory Year	Emissions due to Air Travel (tCO_2e)
2006/2007	
Carlson Wagonlit Travels	**3,565.98**
2007/2008	
Carlson Wagonlit Travels	
Cleveland	
Irvine	
Total North American	**3,420.95**

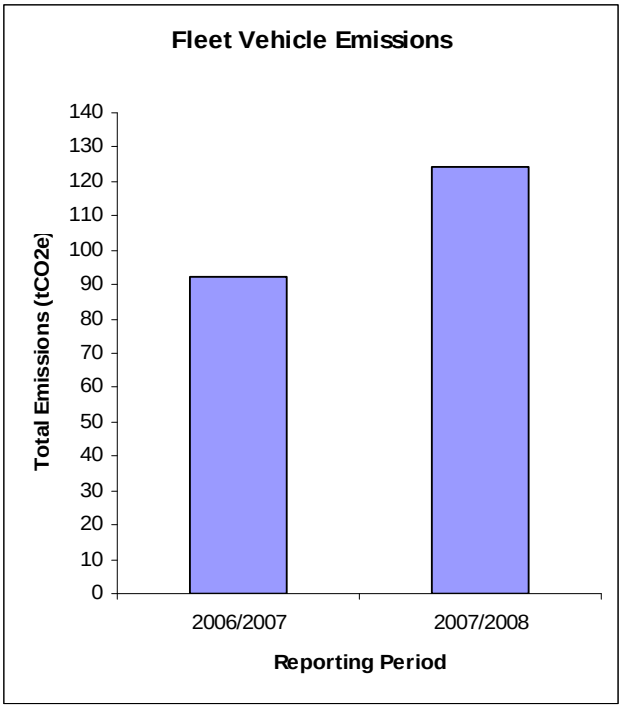
Trend: There is an overall decrease of 145.03 tCO_2e, which may be a result of the fact that CSA now operates in more locations, reducing the need to travel by air. Also, video and teleconferencing have become relatively common within the workplace, further reducing the need to travel by air.

CSA Fleet Vehicles

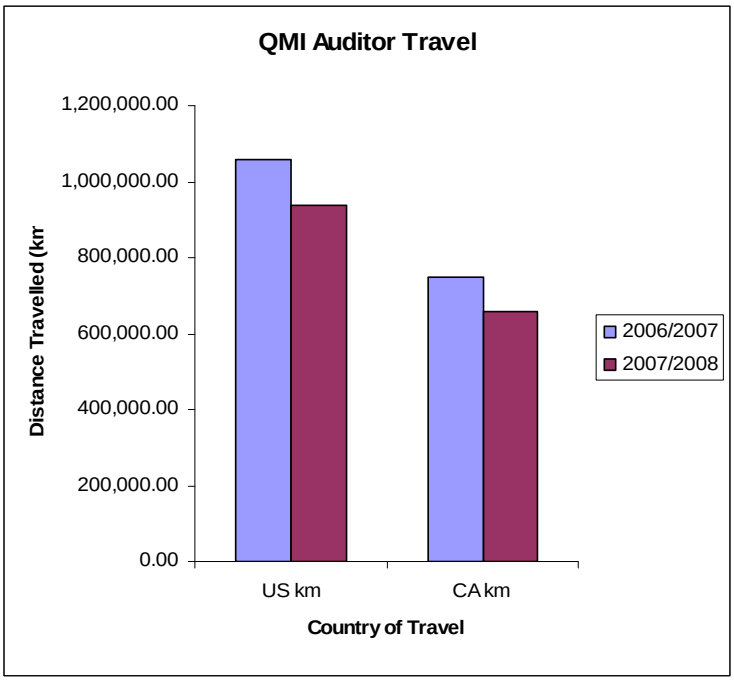
Trend: This data between the two years remained relatively constant. The fiscal year 2007/2008 has experienced an increase of approximately 10 tCO2e in comparison to the 2006/2007 fiscal year. This may be because employees may be choosing to drive to locations, in order to reduce the greater emissions resulting from air travel. Table 17 indicates the emissions for each of the two years.

Table 17: Fleet Vehicle Emissions for Current and Base Year Inventories

Inventory Year	Emissions due to Fleet Vehicles (tCO_2e)
2006/2007	92.39
2007/2008	124.03



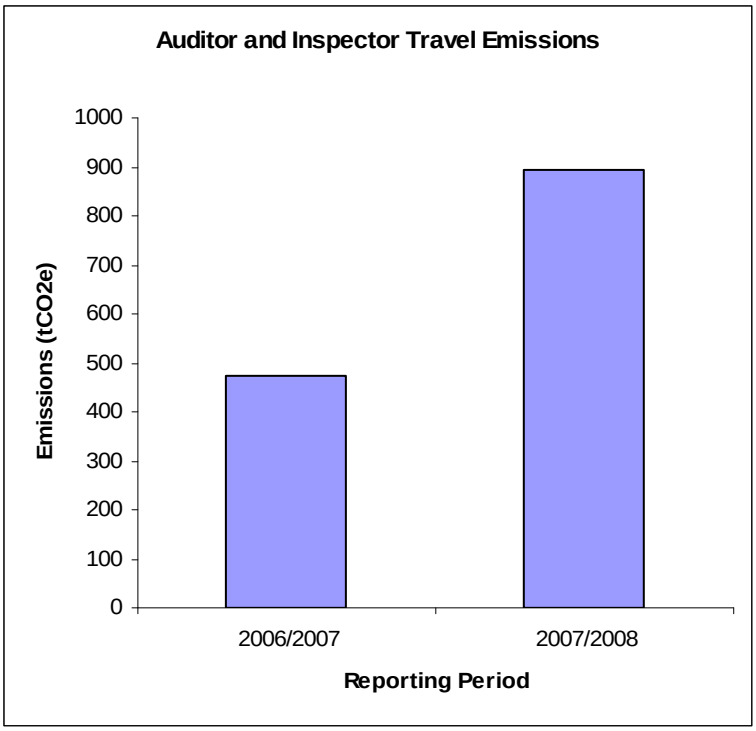
Auditor and Inspector Travel



Trend: The distance travelled by QMI auditors has decreased by a total of 205,330.64 km between the two reporting periods. This can be explained due to the geographic layout of the facilities such that employees are present in client locations, allowing them to encompass greater area without the need to travel large distances. Table 18 indicates the distances travelled during each of the two years.

Table 18: QMI Inspector Travel for Current and Base Year Inventories

Inventory Year	Distance travelled by inspectors (km)
2006/2007	1,803,964
2007/2008	1,598,634



Trend: The increase in these values can be explained due to the change in quantification methodology, as described in this report. The emissions displayed in the graph have been displayed in Table 19 below.

Table 19: Emissions due to Auditor and Inspector Travel for Current and Base Year Inventories

Inventory Year	Emissions due to inspector and auditor travel (tCO_2e)
2006/2007	472.34
2007/2008	895.82

Direct Building Emissions

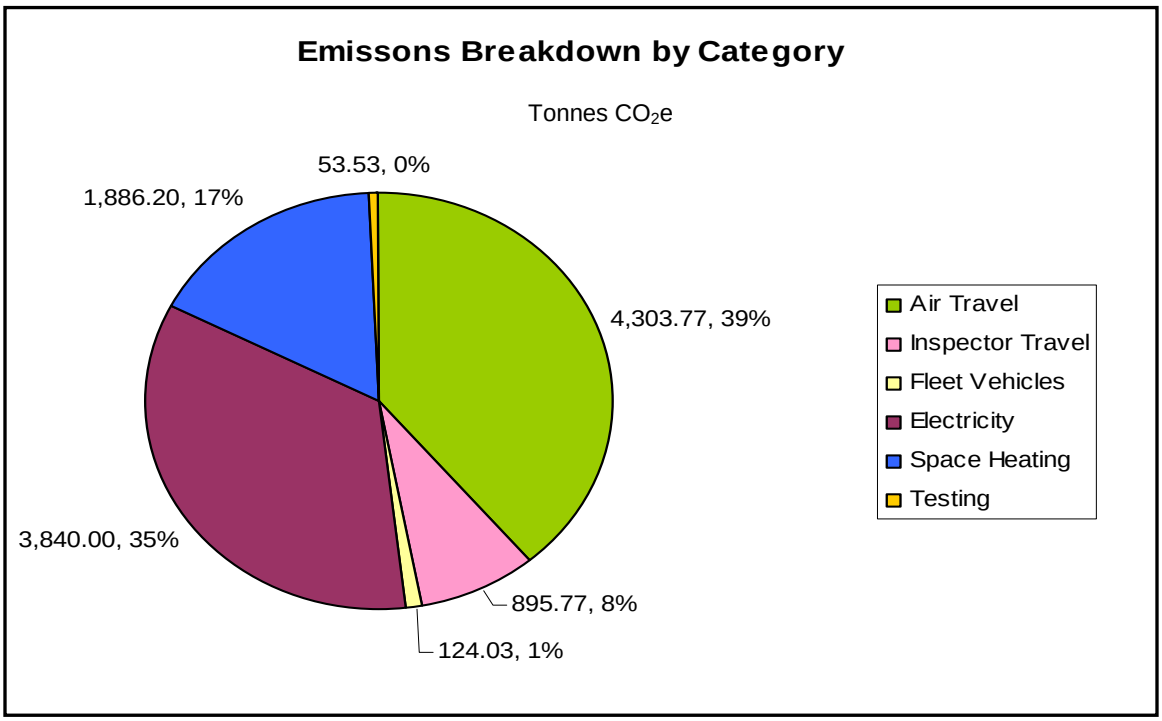
Table 20 below summarizes the quantity of fuels used for testing during the two years.

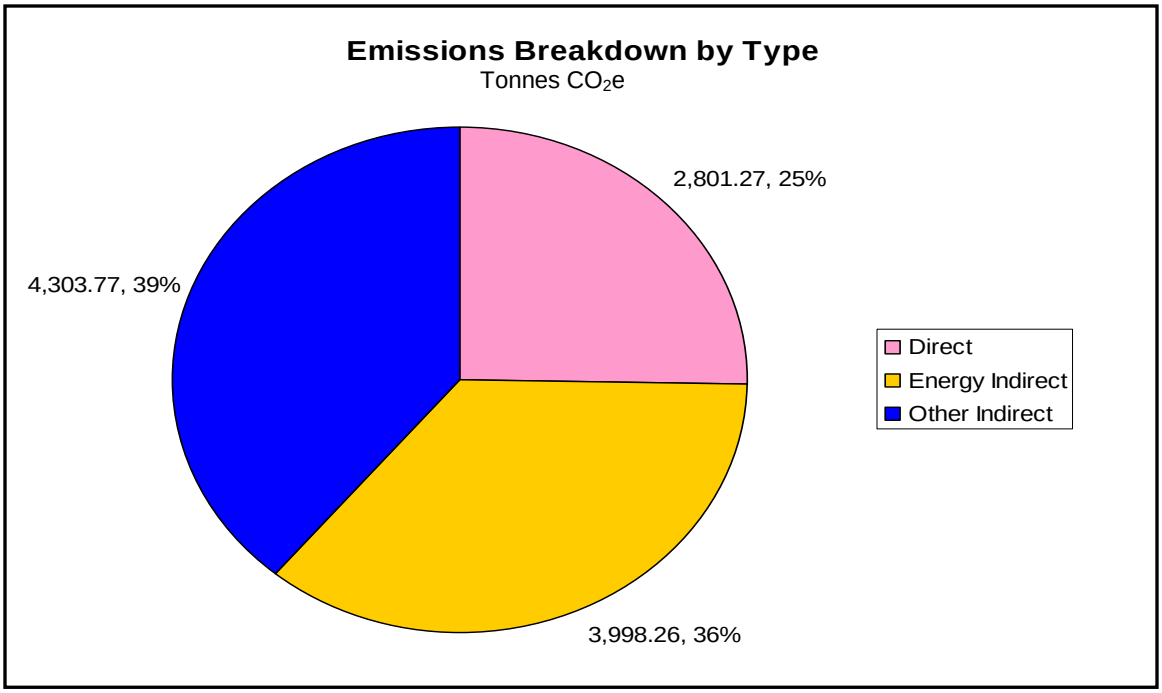
Table 20: Gases Used for Testing by Each Facility

Cleveland		
Gas	2006/2007	2007/2008
	L	L
Butane	1,544.43	61.29
Propane	3,203.78	3,547.66
Gasoline	1,759.68	817.66
Irvine		
Gas	2006/2007	2007/2008
	L	L
Butane	352.5329301	192.0306509
Propane	1,726.15	1,322.331
Edmonton		
Item	2006/2007	2007/2008
	Quantity	Quantity
Acetylene	20,000 L	252.2 L
Ethylene	40,000 L	13,600 L
Methane	20,000 L	8 L
Dry Ice	1,200 lb	1,970.93 lb

Note: It is not possible to explain a trend based on these values, as these gases are used for testing, which is not consistent overtime. Therefore, since gases are purchased based on the requirements of testing, if there is less testing requiring any of these gases during a year, there would be fewer emissions. Since this process is variable, it is not possible to draw comparative conclusions.

8.0 Visual Summary





Appendix 1: Emission Factors

National Electricity Emission Factors			
Country	CO_2 (tonne/MWh)	CH_4 (kg/MWh)	N_2O (kg/MWh)
Canada	0.223	0.00390	0.00351
Korea	0.493	0.00758	0.00672
China (including Hong Kong)	0.839	0.01458	0.01841
India	0.999	0.01664	0.01959
Provincial Electricity Emission Factors - Canada			
Country		CO_2 (kg/kWh)	
Quebec		0.006	
Ontario		0.180	
British Columbia		0.020	
Alberta		0.930	
Regional Electricity Emission Factors - US			
Region	CO_2 (kg/kWh)	CH_4 (kg/kWh)	N_2O (kg/kWh)
Georgia	0.619	5.85E-06	1.03E-05
California	0.275	3.04E-06	1.68E-06
Ohio	0.817	5.90E-06	9.62E-06
Tennessee	0.588	4.76E-06	9.62E-06
North Carolina	0.563	4.76E-06	9.21E-06
Texas	0.664	3.36E-06	6.62E-06
Illinois	0.528	3.72E-06	8.16E-06
Fuel Emission Factors			
Fuel Type	CO_2 (g/L)	CH_4 (g/L)	N_2O (g/L)
Propane	1500	0.024	0.108
Butane	1730	0.024	0.108
Gasoline	2289	2.700	0.050
Vehicle Emission Factors			
Gasoline			
Engine Volume	Engine Size	gCO_2 per km	
<1.4L	Small	180.90	
1.4-2.0 L	Medium	213.90	
>2.0L	Large	295.80	
Diesel			
<1.7L	Small	151.30	
1.7-2.0 L	Medium	188.10	
>2.0L	Large	258.00	
Air Travel Emission Factors			
Flight Type	gCO_2 per pkm		
Short Haul			
Weighted Average	175.3		
Medium Haul			
Economy	93.7		
Business	140.5		

Weighted Average	98.3
Long Haul	
Economy	80.7
Economy+	129.1
Business	234.0
First class	322.8
Weighted average	110.6

Fuel Type	kgCO_2/L
Gasoline	
CO_2	2.36000
CH_4	0.00012
N_2O	0.00026
Diesel	
CO_2	2.73000
CH_4	0.00007
N_2O	0.00020

Appendix 2: Conversion Factors

Conversion Factors	
Density of Water	1.00 g/mL
1 gallon	3785.4 mL
1 gallon	0.00379 m^3
1 lb	453.5924 g
1 mL	1 cm^3
1 m^3	1000000 cm^3
Acetylene Combustion Reaction	$C_2H_2 + 2.5\ O_2 \rightarrow 2CO_2 + H_2O$
Ethylene Combustion Reaction	$C_2H_4 + 3\ O_2 \rightarrow 2CO_2 + 2H_2O$
Propane Specific Gravity	0.51
Butane Specific Gravity	0.5669
1 tonne	2204.61 lb
1 m^3	35.31 ft^3
1 ft^3 of natural gas	1028 btu

Automobile Fuel Economy				
Make	Model	Year	Fuel Economy (L/100 km)	
			City	Highway
Chevrolet	Cheyenne	1997	18.10	12.40
Mercedes Benz	C Class	2004	15.70	9.80
Mercedes Benz	C350	2007	13.80	8.70
Hummer	H3 SUV	2006	16.80	13.10
Audi	TT	2004	13.10	8.70
Audi	TT	2007	13.10	8.70
Acura	TL	2007	14.70	9.00
Infiniti	G35 Aero M6	2005	16.80	10.70
Ford	Explorer	2006	19.60	13.10
Volvo	S60	2005	14.70	9.80
Lexus	R330	2005	15.70	10.70
Lexus	ES 330	2005	13.10	8.70
Chevrolet	Silverado 2500	2001	18.10	13.10
Dodge	Caravan	2003	13.80	9.80
Volkswagen	Jetta	2006	8.10	6.20

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- Google Calculator