# Wakefield Canada Inc.
# Greenhouse Gas Inventory
# 2008


**June 2009**

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**Version 1.2**

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# Introduction

Wakefield Canada Inc. has formed a strategic alliance with Castrol Canada for the distribution of Castrol products in the Canadian marketplace. These products include synthetic and natural lubricants for automotive applications.

In 2008, Wakefield Canada Inc. made a corporate decision to improve its carbon performance. In the summer of 2008, Wakefield completed its first corporate greenhouse (GHG) inventory covering calendar year 2007. The inventory covered emissions from the operations of its two facilities (Toronto and Laval), its vehicle fleet and business travel. Total emissions for the previous calendar year, 2007, amounted to 1,812 tonnes of $CO_2e$. An energy audit of the Toronto and Laval facilities were undertaken and recommendations on how to improve the carbon performance of facilities were made.

In the fall of 2008, Wakefield created a Green Committee to review the recommendations and implement measures to improve sustainability. The following actions were undertaken:

- More energy efficient trucks and cars are being purchased to replace older ones.
- All vehicles in Toronto are being refilled on-site by a service provider (4Refuel (Petroleum provider). This avoids short trips and detours to service stations and saves GHG emissions.
- New, more efficient Nissan forklifts were purchased. This resulted in reducing propane cylinder requirement from 970 units in 2007 to 843 units in 2008.
- An incentive program was implemented to encourage employee car pooling.
- Video conferencing is increasingly being used to reduce the need for travel.
- Employees are encouraged to telework.
- Campaigns were implemented to turn off lights and other equipment when not in use.
- Thermostat programming devices have been installed. Temperature has been set to 22 degrees during the week (5AM to 6PM) and to 18 degrees during the week-end when the facilities are not occupied. This has resulted in reduced heating costs
- Best in class energy efficient computer equipment is being purchased to replace older equipment.

- At the Laval facility, new investments are planned to install a green roof, replace existing lighting system with a more energy efficient one and right size the existing boiler which is too large for the facility.
- Additional green measures have been implemented such as:
    - The elimination of plastic bottles, the purchase of mugs and the installation of two energy efficient dishwashers to reduce waste.
    - Campaigns to reduce the use of paper products and to purchase recycled paper.
    - Use of green cleaning products.
    - Regular staff reminder communications to turn off lights when exiting a room and shutting down computers at end of day.
    - Weekly email ideas about how to reduce your footprint at home and the workplace
    - Overhead presentations are promoted as opposed to paper hand outs.
    - Stretch wrap is recycled and segregated into Gaylord boxes. Those are sold for profit which also reduced garbage disposal bin requirements by two yard bins and result in $1,000 annual savings.

It is anticipated that these measures, and others, will result in emissions savings in future years; 2009 and beyond.

In continuation of their carbon management strategy, Wakefield developed their second GHG inventory in 2009 to quantify emissions from the calendar year 2008. The results of this process, the 2008 carbon footprint, are described in detail within this report. The scope of the inventory remains the same as the base year (currently the 2007 inventory), however a third facility based in Edmonton (Alberta) has been added to the corporation in 2008, and its GHG emissions are included in this report.

This report follows the CSA/ISO 14064-1 standard entitled *Specification with Guidance at the Organization Level for Quantification and Reporting of Greenhouse Gas Emissions and Removals.*

Wakefield Canada Inc. has committed to offset unavoidable GHG emissions occurring in 2008 through the purchase verified emission reduction units. To this end, a carbon neutral report, providing details on the purchase of verified emission reductions, will be published. These actions, along with posting documentation on a publically available registry, such as CSA's GHG CleanStart Registry, will enable Wakefield Canada to claim carbon neutral status for the operations covered within the scope of this inventory report

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## Reporting Period

The inventory covers the 2008 calendar year from January 1st 2008 to December 31st 2008.

## Organizational Boundaries

Wakefield Canada is a Canadian based company. In 2008 the company was based in three locations: Toronto (Ontario), Laval (Quebec) and Edmonton (Alberta). Wakefield Canada works to distribute lubricant products. Operations do not involve manufacturing or testing of products.

The corporate organizational boundaries for the inventory were defined according to the requirements of clause 4.1 of the CSA/ISO 14064-1 standard. The following specifications were adhered to in defining organizational boundaries:

- The operational control approach was used for consolidation of GHG emissions. Therefore 100% of emissions were accounted for at facilities or for operations where Wakefield Canada exercised operational control:
    - The operational control approach was applied to account for all Canadian operations at the time of the inventory.

# Operational Boundaries- Selection of GHG Sources, Sinks and Reservoirs

After assessing the operations at each of the operationally controlled facilities, five (5) GHG sources were determined to be relevant within the organizational boundaries:

1. Truck Fleet
2. Car Fleet
3. Employee Air Travel
4. Energy Usage in Buildings
    a. GHG from Offsite Electricity Production (grid electricity)
    b. Direct Fuel burning (Natural Gas for Heating)
5. Propane Vehicles

No sinks or reservoirs were identified within the organizational or operational boundaries; therefore there are no GHG removals included in this GHG inventory.

CSA/ISO 14064-1 requires separate reporting of emissions from biomass. After identifying all relevant emission sources, it was identified that there are no $CO_2$ emissions resulting from the combustion of biomass. All combustion related Wakefield's emissions are from fossil fuels for space heating or transportation.

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 appropriate fields.

| Emission Source | CSA/ISO 14064-1 Emissions Classification |
|---|---|
| Truck Fleet | Direct Emissions |
| Car Fleet | Direct Emissions |
| Employee Air Travel | Other Indirect Emissions |
| Energy Usage in Buildings *(Offsite Electricity Production)* | Energy Indirect Emissions |
| Energy Usage in Buildings *(Natural Gas Burning for Heating)* | Direct Emissions |
| Use of Propane Vehicles | Direct Emissions |

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

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

## Accounting for 'Other Indirect Emissions' (Scope 3)

Operational Boundaries were set for all Direct and Energy Indirect emissions over which Wakefield maintains operational control, as discussed above. Further to these required emission sources 'other indirect emissions', commonly referred to as scope 3 emissions, were further assessed for inclusion in the inventory (on a voluntary basis).

All potential scope 3 emissions were analysed from a quantitative and qualitative basis to assess the validity of their inclusion. Parameters were set to include all scope 3 emissions for which Wakefield was directly responsible and, more specifically, for those significant emissions that occur due to the normal operation of Wakefield's business. This rationale was set as to provide an inventory which accounts for a true and accurate assessment of normal corporate operations.

To this end, identified scope 3 sources that were excluded from quantification include;

- Cab, bus or train travel by employees for business;
- Employee commuting;
- Travel and transportation resulting from work performed by suppliers on behalf of Wakefield Canada.

First and foremost; these sources were omitted because they were not operationally controlled by Wakefield.

More specifically, these identified scope 3 emissions have been left out of the inventory as they do not provide a significant source of emissions compared to the inventory total and do not directly contribute to the normal operating requirements of the Wakefield operations, as these emissions would occur independently of Wakefield's operations.

After assessment of scope 3 sources, air travel was determined to be a significant source of emissions which was vital to the Wakefield operation. These emissions have therefore been included into the scope of the inventory even though Wakefield does not hold operational control over the aircraft.

# Base Year

Wakefield has selected a rolling base year approach. The time interval selected for rolling the base year is set to be one year, with each inventory being compared directly to the previous year.

A rolling base year approach has been implemented due to the large number of foreseen acquisitions expected to be made by Wakefield in upcoming years. Wakefield is proud to showcase continual growth and development and a rolling approach will simplify the process of updating the base year, and will allow for relevant comparisons on a yearly basis; as the base year will be more in line with current organizational structure.

Thus, the 2007 GHG inventory forms the base year for this year's 2008 inventory. This is the second corporate GHG inventory which Wakefield Canada has completed.

## Base Year Recalculation Policy

As per the ISO 14064-1 standard, section 5.3.2, Wakefield is required to apply and document a base-year recalculation policy.

To this end, Wakefield has determined update the base year at any point where a corporate change adds or subtracts anything greater than 5% of the total base year sum.

Changes will be assessed, at a minimum, as any difference in;

- Changes to operational boundaries
- Changes in ownership/control of GHG sources or sinks transferred into or out of the organizational boundaries
- Changes in quantification techniques or emission factor improvements

As per the ISO 14064-1 standard, section 5.3.2, Wakefield will not recalculate or change its base year to account for any organic growth (changes in facility production levels or the closing or opening of facilities).

## Recalculation Review: Current Inventory to 2007 Base Year

As per the base year recalculation policy, described above, Wakefield has completed a review of the 2008 Inventory scope and compared this to the 2007 base year inventory.

Subsequent to this review it was identified that there was a change in quantification technique which resulted in a 5% difference, compared to that of the base year calculation methods. The change resulted in an updated approach to calculating emissions from the Wakefield Canada Inc truck fleet:

> The 2007 Wakefield Canada Inc. (WCI) fleet emissions were calculated using a KM travelled basis, however, in 2008 it was identified that some vehicles consume fuel without moving (stationary combustion). This resulted in a change from using a KM traveled basis, to now a fuel consumption basis starting in 2008. Reliable fuel records were utilized to more accurately account for emissions from the fleet (including stationary combustion).
>
> The methodological change for 2008 resulted in an 18% difference in total emissions for the 2008 inventory (from that of using a KM basis for 2008). As this methodological change resulted in an alteration greater than 5%, an update to this 2007 base year was triggered.

It was also noted that the 2007 base year did not include the emissions of the newly acquired Alberta facility. This building was not owned or operated by Wakefield in the previous year, however, the addition of this facility is defined as organic growth, and as such, does not trigger a recalculation or update to the base year emissions inventory.

Thus, Wakefield has increased its distribution network by opening a new facility and as such emissions inventory for 2008 will inherently be larger than that of base year, due to organic growth.

## Quantification Methodologies

The methodologies used to collect and assess emissions data varied throughout the inventory. The primary methodology used was multiplying GHG activity data by appropriate GHG emission factors. All methodologies used were selected based on their ability to provide accurate and consistent results. The use of activity data and emission factors was feasible due to the availability of both accurate activity data for the majority of sources and standard emission factors from reputable organizations.

There has been only one change to the prescribed methodologies compared to the 2007 inventory. This change, as described above, resulted from shifting the calculation method for the WCI Fleet. Detailed discussions of the calculation methods follow.

# *1.0 WCI (Truck) Fleet -Direct Emissions*

## 1.1 Methodology

### a) Compilation of a list of Wakefield Canada trucks

- The Wakefield Canada fleet consisted of 26 leased trucks during the 2008 year.

- Full details of each vehicle including VIN number were made available by the leasing companies, through Sandi Hack at Wakefield Canada.

### b) Compilation of activity data for WCI Fleet

- Kilometres travelled during the 2008 year were available for all vehicles;

- Total fuel usage of the fleet was also obtained; values provided via monthly records of fuel purchased from all fuel suppliers

- Using fuel-usage data, the total volume consumed by the vehicle fleet was totalled;

## 1.2 Estimation of Emissions

- Since it was not possible to obtain accurate fuel usage on a vehicle basis, it was assumed that all fuel was consumed by heavy duty vehicles with *moderate* control technologies.

    - All vehicles may be categorized as moderate control heavy duty diesel vehicles or advanced control vehicles. Table A-5 on page 23 of the EPA Climate Leaders Document Direct Emissions from Mobile Combustion Sources document[2] defines moderate control vehicles as those manufactured from1983-1995 and advanced control vehicles as those manufactured from1996-2004. As stated, to be conservative, all fuel was assumed to be consumed in moderate vehicles;

- Emission factors were taken from the Environment Canada inventory report 1990-2006, as shown in Table 2. These were multiplied by the total fuel consumption to calculate diesel emissions;

[2] http://www.epa.gov/climateleaders/documents/resources/mobilesource_guidance.pdf

- Total emissions as carbon dioxide equivalent were calculated using global warming potential values taken from the ISO 14064-1:2006 standard.

| Type of Control | Emission Factor (g $CO_2$/l fuel) | Emission Factor (g $CH_4$/l fuel) | Emission Factor (g $N_2O$/l fuel) |
|---|---|---|---|
| Advanced Control | 2663 | 0.12 | 0.082 |
| Moderate Control | 2663 | 0.14 | 0.082 |

**Table 2: Emission Factor for Heavy Duty Diesel Vehicles**[3]

## 1.3 Estimation of Uncertainty

The activity data (fuel usage) for this category is available from third party organisations; the fuel suppliers, via monthly invoices. Data in the form of monthly supplier invoices, from a third party, is often preferred by verifiers as fuel purchased is assumed to equal that of amount consumed, and these volumes are confirmed supporting evidence.

The emission factors used are current and from reputable sources. More research could be undertaken in order to find more specific fuel efficiency values for each vehicle model.

The level of uncertainty linked to this quantification methodology and subsequent calculations are therefore considered to be low.

[3] Canadian National Inventory Report 1990-2006, Table A12-7, p. 595

# *2.0 Car Fleet - Direct Emissions*

## 2.1 Methodology

### a) Compilation of activity data from miles driven in personal vehicles of employee

- Sandi Hack of Wakefield Canada was able to provide a list of all employees and their vehicles, including most VIN numbers;
- Expense reports were used to collate kilometres of car travel claimed by each Wakefield Canada employee during the 2008 year;
- Using the VIN numbers as much information was obtained about the model of vehicle as possible, using http://www.carfax.com;
- Fuel consumption values were needed for each vehicle, therefore fuel efficiency values were found for each make and model using the 2008 Natural Resources Canada (NRCan) Fuel Consumption Guide[4]. Where information for the particular vehicle was not available from this source the US Department of Energy Fuel Economy website was used[5];
- In order to use consistent units of litres and kilometres for all calculations, the following conversions were applied: one mile = 1.6093 km and one gallon = 3.7854 litres[6];
- Fuel efficiency values are available as highway and city driving averages. It was assumed that Wakefield Canada employees drive 55% in the city and 45% on the highway;
- The weighted fuel efficiency values were multiplied by the number of kilometres travelled in each vehicle, in order to calculate a fuel consumption value for the duration of the year;

## 2.2 Estimation of Emissions

- The vehicles were all found to be gasoline vehicles. They were all assumed to be light duty gasoline vehicles based on information available about engine size. Due to their age (all 2004 or newer) it was assumed that they all had advanced controls and therefore were

[4] http://oee.nrcan.gc.ca/transportation/tools/fuelratings/fuel-consumption-guide-2008.pdf
[5] http://www.fueleconomy.gov/feg/bymodel/bymakemodelNF.shtml
[6] http://www.epa.gov/ttn/chief/ap42/appendix/appa.pdf

considered Tier One vehicles in their category;

| Emission Factor (g $CO_2$/l fuel) | Emission Factor (g $CH_4$/l fuel) | Emission Factor (g $N_2O$/l fuel) |
|---|---|---|
| 2289 | 0.12 | 0.16 |

**Table 3: Emission factors for Light Duty Gasoline Tier One** [7]

- The emission factors were multiplied by the fuel consumption values for each vehicle to calculate emissions of each gas type for the year;

- Total emissions in carbon dioxide equivalent were then calculated using global warming potential values, as used in the methodology for fleet vehicles.

### 2.2 Estimation of Uncertainty

The data collection for this category is considered to be robust. Expense reports are checked for accuracy by supervisors and accountants. The quantification methodologies are considered to be accurate and relevant for this calculation.

## *3.0 Employee Air Travel - Other Indirect Emissions*

### 3.1 Methodology

The methodology to calculate emissions from air travel consisted of three steps: (a) determining flight activity, (b) compiling and organizing data, and then using this in conjunction with emission intensities to estimate emissions. The details of this methodology, and the data used, are provided below.

**a) Determining Flight Activity**

Flight activity was determined by tabulating a list of all Wakefield Canada employees and accompanying spouses (when applicable) and their respective flight totals.

- Activity data was available from two sources: expense reports and a report from a travel agent;

- Data from both sources was compiled and then compared in spreadsheets. The column headings include:
  i. Passenger name
  ii. Region
  iii. Cost

[7] Environment Canada National Inventory Report 1990-2006 Table A12-7 on page 594

iv. Country of Departure
v. Employer
vi. International or domestic flight
vii. Departure Data
viii. Departure and Arrival Cities

- Using this data, kilometres flown for each flight was calculated using websites designed for this purpose, such as web-flyer.com [8].

**b) Compiling and Organizing Data**
Aggregation of employee flights and find total kilometres flown:

- Each flight was categorized as short, medium or long, using the following guidelines from The Greenhouse Gas Protocol Initiative, World Resources Institute (WRI)[9].

| Category | Flight Distance (km) |
|---|---|
| Short | 0-452 |
| Medium | 453-1599 |
| Long | > 1600 |

**Table 4: Categories of Flight Length[10]**

Total kilometres flown in each flight category were summed.

## 3.2 Estimating Emissions

### a) Estimating total GHG emissions from employee air travel

Emission factors for each flight category were developed by CSA using statistical data about Canadian air travel. This methodology is described in detail in Annex A. To summarize, using information on flights in Canada, including what types of aircraft were flown, along with the technical details of these aircraft (e.g. fuel burn rates for both the cruise and landing and take off cycle and the number of seats, by class), emission intensities were calculated. This is summarized within Table 5: Emission factors used for air travel.

[8] http://www.webflyer.com/travel/milemarker/
[9] http://www.ghgprotocol.org/calculation-tools/all-tools
[10] Definitions taken from WRI/WBCSD GHG Protocol Template for Mobile Combustion Calculation Tool, Jan 2005, Version 1.3.

| Flight distance (km) | Configuration | Cruise emission intensity (kg $CO_2$/PKT) | | Landing Take Off (LTO) emission intensity (kg $CO_2$/seat) | | Flight emission intensity (kg $CO_2$/PKT) | |
|---|---|---|---|---|---|---|---|
| | | ***Economy*** | ***Executive*** | ***Economy*** | ***Executive*** | ***Economy*** | ***Executive*** |
| > 1,600 | Economy and executive | 0.103 | 0.193 | 30.87 | 58.65 | 0.12 | 0.23 |
| 500 to 1,600 | Economy and executive | 0.101 | 0.145 | 25.69 | 36.62 | 0.13 | 0.18 |
| 500 to 1,600 | Only economy class | 0.10 | | 27.37 | | 0.1296 | |
| 500 to 1,600 | Small regional jet (e.g. 50 seater CRJ) | 0.15 | | 18.77 | | 0.1668 | |
| <500 | Small regional jet (e.g. 30 seater Dash 8) | 0.11 | | 13.41 | | 0.1353 | |

**Table 5: Emission factors used for air travel**

- Note that there are three categories for *medium* length flights. Flight distances between 500 km and 1,600 km may be on (a) aircraft with both economy and executive classes (e.g. most Air Canada flights), (b) aircraft with only economy class (e.g. all Westjet flights), or (c) smaller regional aircraft with either jet or turbo prop engines. Each has differing emission factors as shown.

- For the Wakefield Canada inventory it was assumed that medium length flights were aboard aircraft with both economy and executive seating, with all of these being economy class.

- In 2008 the emission factors for Cruise Intensity and Landing and Take-off were combined into one factor called 'Flight Emission Intensity'. To calculate total flight emission intensity; the LTO was divided by an average flight length for the distance classification and then added to the cruise emission factor. This value is then multiplied by average passenger to freight ratio to obtain the overall flight intensity value.

    - Ie: Only Economy Class (500-1600km)
        - Average Flight distance assumed to be 750 km
        - Passenger to feight ratio 95%

      **0.1296** = [ 0.10 + (27.37 / 750) ] *0.95

- The total number of kilometres in each category was multiplied by the relevant total emission intensity emission factor for each category to calculate total $CO_2$ emissions in kilograms, which was then converted to tonnes (1 tonne = 1000 kg);

**b) Computation of the amount of each specific gas type emitted**

- Total $CO_2$ emissions were broken down further into specific gas types using Environment Canada's National Inventory Report, 1990-2006. Emission factors for each gas type were found for Aviation Turbo Fuel, shown within Table 4.

| Greenhouse Gas | Aviation Turbo Fuel Emission Factor (g/L fuel) | Global Warming Potential (GWP) |
|---|---|---|
| **$CO_2$** | 2534.00 | 1 |
| **$CH_4$** | 0.08 | 21 |
| **$N_2O$** | 0.23 | 310 |

**Table 6: Emission factor for Aviation Jet Fuel[11]**

- Total $CO_2$ emissions from flights (as calculated according to methodology described in section 1.2.a of this report) were broken down into equivalent emissions of each specific gas using the emission factors and Global Warming Potentials shown in Table 6.
    - The break down of gas types was completed by summing total grams of emissions per litre of fuel and then calculating a percentage break down for each gas type. This percentage was then multiplied by the total emissions, to give an approximate total amount of each gas.

## 3.3 Estimation of Uncertainty

The level of uncertainty linked to this quantification methodology, and the subsequent calculations, is considered low. The data collection system-corroborating expense reports with travel agent reports, is considered to be a robust data collection system.

The emission factors used are current and relevant for the inventory. See Annex A for more information.

[11] Canadian National Inventory Report 1990-2006, Table A12-7, p. 595. Global Warming Potentials from ISO 14064-1 standard, Annex C

# *4.0 Energy Usage in Buildings- Energy Indirect Emissions and Direct Emissions*

## 4.1 Methodology

### a) Compilation of a list of activity data for the buildings

- Wakefield Canada used three facilities in 2008, one in Laval, Quebec one in Toronto, Ontario and one in Edmonton, Alberta for a portion of the year. Electricity and natural gas invoices were available for all facilities. Electricity consumption values are either metered or estimated by the Electricity companies and are provided in kilowatt-hours (kWh). Natural gas consumption values were provided in cubic meters and again the values are either metered or estimated by the supplier;

- Toronto Hydro adds a line loss factor to the metered electricity values and bills by this adjusted value. For the purposes of this inventory the actual consumption rate value has been used as opposed to the value accounting for line loss factors;

- Note: electricity emissions are considered energy indirect emissions, whereas the combustion of natural gas, for the purposes of heating, are considered to be direct emissions for the purposes of this GHG inventory;

- In some cases the billing periods on the invoices do not correspond with the chosen inventory time period and so average consumption per day was calculated over the billing period and this was multiplied by the number of days during that billing period that fit inside the inventory time period boundaries.

## 4.2 Estimation of Emissions

- Provincial average grid emission factors for the Canadian Provinces were obtained from the *Environment Canada National GHG Inventory Report 1990-2006*. The 2006 overall total grid emissions intensity values were used.

- These emission factors for electricity production have been multiplied directly by the total electricity consumption values for the year to calculate emissions due to electricity usage

- Emission factors for natural gas were obtained from the *Environment Canada National Inventory Report 1990-2006* where Table A12-1 on page 589 provides the emission factors for Residential, Construction, Commercial/Institutional and Agriculture sources as; 1891 g / $m^3$ for $CO_2$, 0.037g / $m^3$ for $CH_4$ and 0.035 g / $m^3$ for $N_2O$ respectively;

- These emission factors natural gas consumption have been multiplied directly by the total natural gas consumption values for the year at each facility to calculate emissions due to natural gas usage;

- Emissions of each specific gas type cannot be determined for electricity usage, based on the complexity of the grid based emission factor, and thus resulting emissions can only be reported in terms of carbon dioxide equivalent. Emissions from natural gas consumption can be found in terms of each gas and consequently also in terms of carbon dioxide equivalent using global warming potential values.

### 4.3 Estimation of Uncertainty

The level of uncertainty for this methodology is considered to be low. The invoices provide an accurate form of data collection and the emission factors used and current and relevant to Canadian buildings.

## *5.0 Propane Vehicle Emissions- Direct Emissions*

### 5.1 Methodology

#### a) Compilation of activity data

- The propane supplier to the Toronto facility was able to provide an estimate of propane cylinders delivered over the duration of the year. This information was further verified by invoices from the supplier;

- The cylinders are measured in weight. This value was converted from pounds to kilograms using the conversion factor one pound = 0.45 kilograms[12]. To convert weights to volumes, the density of propane was found. Density of Propane was taken from the EPA AP42 Miscellaneous Data and Conversion Factor appendix[13] and was found to be 0.507 kg / litre;

- Using the number of cylinders delivered (assumed to be the number of cylinders used), the weight of each cylinder and the density of

[12] http://www.epa.gov/ttn/chief/ap42/appendix/appa.pdf
[13] http://www.epa.gov/ttn/chief/ap42/appendix/appa

propane, total volume of propane used over the course of the year was found;

### 5.2 Estimation of Emissions

- Emission factors were multiplied by the volume of propane used to calculate total emissions per gas type. Total emissions in carbon dioxide equivalent were found using global warming potential values.

| Source | Emission Factor (g/L) | | |
|---|---|---|---|
| | $CO_2$ | $CH_4$ | $N_2O$ |
| Propane Vehicle | 1510 | 0.64 | 0.028 |

**Table 7: Emission factors for Propane Vehicles** [14]

### 5.3 Estimation of Uncertainty

Invoices provide an accurate record of fuel delivered. If all of the fuel is not used, the delivered amount provides a conservative estimate. Emission factors are from reputable sources. Therefore the assessment of uncertainty for this calculation is considered to be low.

## 6.0 GHG Inventory Data Quality Management

Wakefield Canada has retained copies of all activity data related to this inventory. The data is in the form of invoices and notifications from leasing companies. This data will be retained for the verification process, for future inventories, and for any events were data would need to be checked or recalculations are necessary.

## 7.0 Summary of Emissions

As the CSA/ISO 14064-1 standard stipulates, emissions are reported by gas, by category and by source. Tables 8 and 9 fulfil this requirement.

[14] Canada's National Inventory Report 1990-2006, Table A12-7 Page 595- Propane Vehicles

| Category | Emissions (tonnes) | | | |
|---|---|---|---|---|
| | $CO_2$ | $CH_4$ | $N_2O$ | $CO_2e$ |
| **Truck Fleet** | 1337.54 | 0.070317 | 0.041186 | 1351.78 |
| **Car Fleet** | 367.47 | 0.019264 | 0.025686 | 375.83 |
| **Employee Air Travel** | 112.76 | 0.003560 | 0.010235 | 116.01 |
| **Toronto Natural Gas** | 251.15 | 0.004914 | 0.004649 | 252.70 |
| **Toronto Electricity** | - | - | - | 137.97 |
| **Laval Natural Gas** | 173.03 | 0.003386 | 0.000320 | 173.20 |
| **Laval Electricity** | - | - | - | 1.04 |
| **Edmonton Natural Gas** | 96.22 | 0.008576 | 0.000017 | 96.41 |
| **Edmonton Electricity** | - | - | - | 66.52 |
| **Propane Equipment** | 39.14 | 0.016590 | 0.000726 | 39.71 |
| **Total** | **2,377.32** | **0.1266** | **0.0828** | **2,611.19** |

**Table 8: Emissions Summary by Gas and by Source**

| Category | Emissions (tonnes) | | | |
|---|---|---|---|---|
| | $CO_2$ | $CH_4$ | $N_2O$ | $CO_2e$ |
| **Direct Emissions** | 2264.55 | 0.12 | 0.07 | 2289.64 |
| **Indirect Energy Emissions** | n/a | n/a | n/a | 205.53 |
| **Other Indirect Emissions** | 112.76 | 0.00 | 0.01 | 116.01 |
| **Total** | 2377.32 | 0.13 | 0.08 | 2611.19 |

**Table 9: Emissions Summary by Category and by Gas**

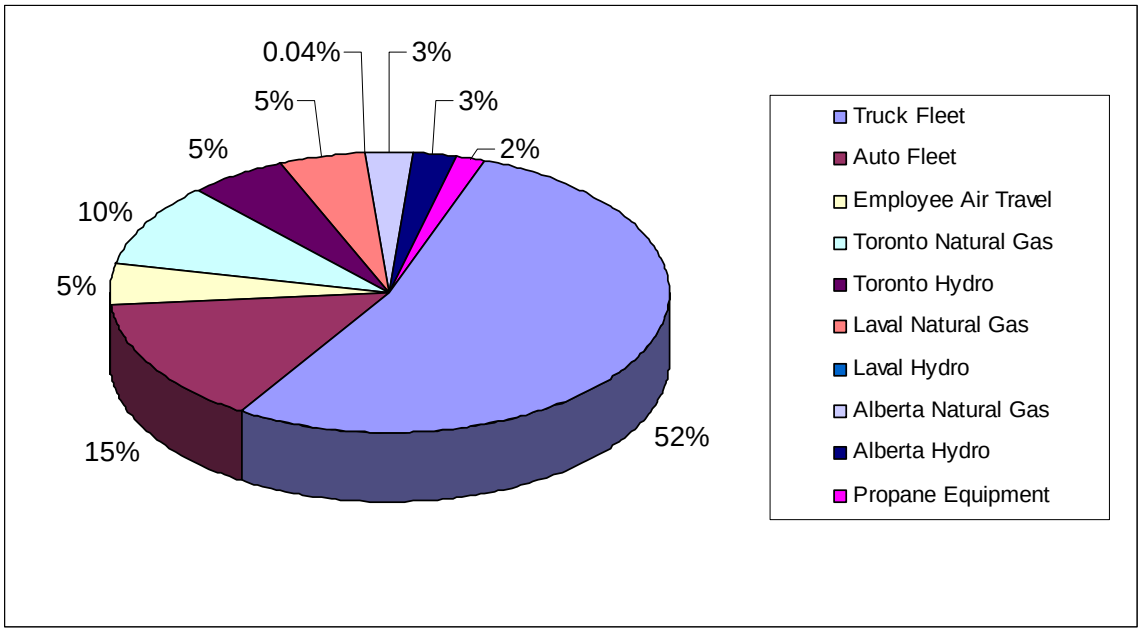


Figure 1: 2008 Emission Summary

## 7.1 Truck Fleet

In 2008, Wakefield had 26 vehicles in its truck fleet. The fleet used 502,267 litres of fuel resulting in 1352 tonnes of CO2e. In the 2007 base year, 18 trucks logged 866,901 km and used 347,098 litres of fuels resulting in 934 tonnes of $CO_2e$ emissions. The increase in number of trucks and distance logged is related to the acquisition of the Edmonton facility and additional business generated in 2008. It should be noted that km travelled and litres used do not correlate; this is due to some vehicles remaining stationary while consuming fuel for the purpose of pumping activities.

## 7.2 Car Fleet

In 2008, the Wakefield had 39 cars and light duty trucks in its car fleet. The cars logged 1,480,773 km and used 160 535 litres of fuel resulting in 376 tonnes of $CO_2e$ emissions. In 2007, 39 vehicles logged 1,159,857 km and used 127,801 litres of fuel resulting in 299 tonnes of $CO_2e$. The increase is due to the addition of the Edmonton facility and increased business activity in 2008 compared to 2007.

## 7.3 Employee Air Travel

In 2008, Wakefield employees logged 561 trips totalling 864,145 kilometres and 116 tonnes of $CO_2e$. This is an increase from the 2007 base year where employees logged 196 trips totalling 303,114km and 41 tonnes of CO2e. The increase is due to increased business activity in 2008.

## 7.4 Toronto Facility

In 2008, GHG emissions from the Toronto facility totalled 391 $tCO_2e$ (253 $tCO_2e$ from natural gas combustion and 138 tCO2e from electricity use). Measures implemented to conserve energy in the Toronto facility have resulted in avoided emissions of 42 $tCO_2e$. In 2007, GHG emissions totalled 433 $tCO_2e$ (294 $tCO_2e$ from natural gas combustion and 139 $tCO_2e$ for electricity use).

## 7.5 Laval Facility

In 2008, GHG emissions from the Laval facility totalled 174 $tCO_2e$ (173 tCO2e from natural gas combustion and 1 tCO2e from electricity use). In 2007, GHG emissions totalled 88 tCO2e (87 $tCO_2e$ from natural gas combustion and 0.5 $tCO_2e$ from electricity use).

## 7.6 Edmonton Facility

In 2008, GHG emissions from the Edmonton facility totalled 163 $tCO_2e$ (96 $tCO_2e$ from natural gas combustion and 67 $tCO_2e$ from electricity use). As the Edmonton facility was not operational in 2007, benchmarking progress will take place with the 2009 GHG inventory.

### 7.7 Propane Equipment

In 2008, use of propane equipment resulted in GHG emissions of 40 $tCO_2e$, less than 2007 emissions which stood at 44 $tCO_2e$. This is due to the use of new, more efficient forklifts.

## 8.0 Historical Analysis

Comparing the 2008 inventory to the 2007 base year illustrates the historical trends in emission releases resulting from Wakefield Canada's operations. Tracking emission performance over time allows for meaningful comparisons of emissions data, compared to the inventory base year. To this end, Wakefield has analyzed tends between 2007 and 2008 to indicate any emissions savings resulting from corporate green-initiatives, as were explained within the introduction section of this report.

As expected, the 2008 emission rates are shown to be higher than the 2007 year. This is due to the organic growth attributed to the addition of the Alberta facility. The Alberta expansion increased not only the building emission profile but also added a substantial number of fleet vehicles, auto vehicles as well as employee air travel.

As shown in Figure 2: **Comparison of 2007 - 2008 Corporate Emissions**emissions from truck fleet, auto fleet, air travel and building emissions (in Alberta) all show an increase over the past year, as expected. Positive changes were seen regarding propane emissions as well as noticeable savings in natural gas being realized at the Toronto location.

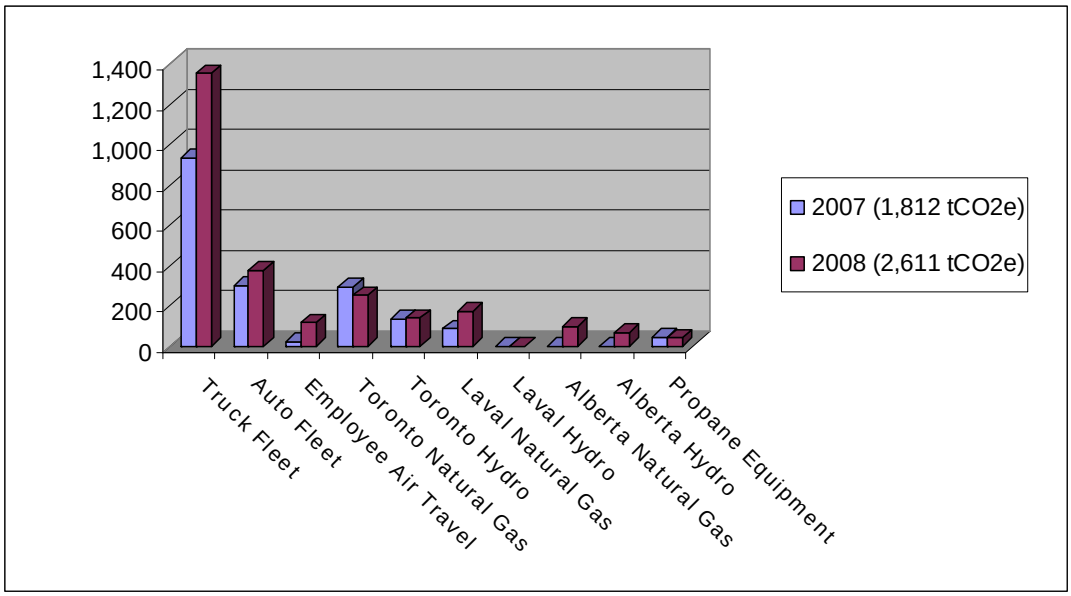


Figure 2: Comparison of 2007 - 2008 Corporate Emissions

# 9.0 GHG Assertions

1. The Wakefield Canada Inc. GHG Inventory for 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. Wakefield Canada's emissions for 2008 from truck fleet, car fleet, employee air travel, energy use in buildings and propane use were 2,611.19 tonnes $CO_2e$.

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# Annex A
# Derivation of Emission Factors for Air Travel

Appendix A describes the methodology used by Paul Steenhof of CSA Climate Change in Ottawa, who developed emission factors for Canadian based air travel.

A range of emission intensities are provided for air travel. These reflect differences in aircraft size, engine type, the number of seats on the aircraft, the configuration and size of seats, as well as operational details such as the length of the flight:

- **In terms of aircraft size**, very large aircraft (such as those used for intercontinental trips) are much heavier compared to small regional jets, and subsequently burn more fuel per unit of travel. Countering this, however, is the fact that these aircraft carry many more passengers than a smaller regional aircraft (relative to their size);
- **In terms of trip length**, since more fuel is required to lift an aircraft to 3,000 feet (termed the landing and take-off cycle, or LTO) than is required during the 'cruise' phase of the flight, shorter trips will be more emission intensive when measured on a passenger kilometre traveled (PKT) basis, and;
- **In terms of seat configuration**, since seats in first/executive/business class require upwards of twice the amount of space than those in economy class, these seats result in more emissions on a passenger basis. The configuration of seats on an aircraft will also have important impacts on the emission intensity of air travel. In particular, the more passengers on an aircraft, the lower the emission intensity on a per passenger basis.

For the purposes of the aviation emission calculator, flights are categorized by flights greater than 1,600 km, flights between 500 km and 1,600 km, and flights less than 500 km. For flights over 1,600 km, emission intensities are provided for both executive and economy classes. Flights between 500 km and 1,600 km are further broken down by flights with both executive and economy seat classes, flights with only economy class, flights on smaller regional aircraft with jet engines (e.g. the CRJ), and flights on regional aircraft with turbo prop engines. The rational behind this breakdown is fourfold:

- The length of flight dictates the size and type of airplane. Aircraft such as the Boeing 767-300 series, for example, are most used for long-haul flights over 1,600 kms, whereas for mid-range flights between 500 km and up to 1,600 km, smaller aircraft such as the Airbus 320, CRJ or turbo props are used. Comparatively, these aircraft differ significantly in terms

of size and required engine power, as well as the number of passengers and configuration of seats. Aircraft size and required engine power in turn dictate fuel burn rates (FBR) and the amount of emissions released;

- The length of flight dictates the contribution of the LTO cycle to the average emission intensity of the flight (shorter flights are more intensive per passenger kilometre traveled since more fuel is burned during the LTO relative to the cruise cycle);
- As suggested, the configuration of seats and the physical size of seats are dependent on flight length. For example, executive seats on international flights are approximately twice the size of the executive seats on domestic flights. In terms of seat configuration, this means that these flights will have fewer seats relative to the size of the aircraft;
- In terms of flight distances between 500 km and 1,600 km, this might be on a aircraft with both economy and executive classes, aircraft with only economy class (e.g. Westjet), or smaller regional aircraft with either jet or turbo prop engines. In terms of the latter breakout, differentiating between regional aircraft with jet and turbo prop engines is important as turbo prop engines are approximately 30% to 40% more fuel efficient than jet engines.

These different parameters are summarized in the table below for each flight category considered in the aviation calculator.

| **Flight distance (km)** | **Example of aircraft type** | **FBR (kg/km)[a]** | **Number of seats[b]** | | **Footprint of seat (pitch * height) (inches$^2$)[b]** | |
|---|---|---|---|---|---|---|
| | | | *Economy* | *Executive* | *Economy* | *Executive* |
| > 1,600 | Boeing 767 300 series | 5.26 | 173 | 30 | 605 | 1,230 |
| 500 to 1,600 | Airbus 320 | 3.36 | 120 | 20 | 544 | 777 |
| 500 to 1,600 | Boeing 737 300 series (only economy class) | 3.01 | 137 | | 544 | |
| | Canadian regional jet | 1.66 | 50-70 | | 544 | |
| | Regional turbo prop aircraft[c] | 1.01 | 50-70 | | 544 | |
| <500 | Dash 8 | 0.49 | 37 | | 544 | |

**Table 10: Parameters affecting the emissions associated with air travel**

Table notes:

a) Fuel burn rates are for the cruise cycle, and are from the International Air Transport Association (IATA)
b) The number and size of seats on each type of aircraft is taken from www.seatguru.com.
c) For regional turbo prop aircraft, industry data indicated that these aircraft are 30%-40% more fuel efficient than comparable regional jets (Bombardier-http://www.q400.com/q400/en/turbo.jsp).

One of the most important factors influencing the emission intensity of air travel is the configuration and size of the seats on an aircraft. For example, according to www.seatguru.com, in the most recent version of the Boeing 767-300 (of which Air Canada has seven aircraft), executive seats have a pitch of 70 inches and a

width of 20.5 inches. As a result, and as can be identified in Table 10, those who sit in the executive class will result in approximately twice the level of GHG emissions than those who fly in economy class.

It is also important to note that there are large variations in the FBRs and the subsequent emission intensities *within* the different categories of aircraft. For example, for flights above 1,600 kilometres, the aircraft used might be Boeing 767 300 series, an Airbus 343, or a Boeing 767 299 series, all of which have different seat configurations and technical efficiencies. In order to provide a suitable metric within the aviation emissions calculator, we have therefore taken a representative sample of aircraft within each distance range to generate an average FBR and emission factor. This is summarized by distance category in Table 5, the table from which emission factors for the 2007 inventory were taken.