Ryerson University:

Greenhouse Gas Inventory Data Collection Plan

Final Version

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PREPARED FOR:

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1   INTRODUCTION

For the past four years, Internat Energy Solutions Canada (IESC) has assisted the Facilities Management and Development (FMD) department in completing the University's annual greenhouse gas (GHG) inventory, and perform related analysis. As part of building new capacity and bringing efforts related to GHG accounting and management in house, IESC has provided training to the FMD and this document is meant to provide a clear and succinct process to ensure all data collection and population of Ryerson's annual GHG inventory can be executed internally going forward.

IESC's work started with the main source of energy consumption on campus, and over the years, has expanded to include additional categories covering the main direct and indirect emissions sources of the University from:

- ► Campus Energy Usage
    - Campus Natural Gas Use
    - Campus Electricity Use
    - Campus Chilled Water use
    - Campus Steam use
- ► Purchased Services
- ► Student and Staff Commuting (added in 2014)
- ► Waste (added in 2014)
- ► Business Travel (added in 2014)

The following sections will outline the key data sources, and data collection process for each of the above emission categories and the annual updates required to the calculation tool to ensure the accuracy of the annual GHG inventory.

2 CAMPUS ENERGY USE – NATURAL GAS

Current data available and annual collection methodology

Natural Gas is used primarily for space or water heating in specific Ryerson buildings. For these meters, the gas is metered by revenue grade meters and tracked by Enbridge. This data is delivered to Ryerson's Purchasing and Payment department via invoices, which outline the cost, and consumption (m^3). Before payment, Purchasing and Payment emails a scan of the invoice to the specific department accountable for the bill, to verify and approve payment. At this point, Larry Arsenault is copied on this communication and logs the consumption data into the 'Ryerson Utility Database.accdb'.

Data Source
The 'Ryerson Utility Databse.accdb' is the source of natural gas consumption across the campus. This database is maintained by Larry Arsenault.

Data Collection Process
On an annual basis, contact Larry Arsenault via email at larsenau@ryerson.ca, who is able to provide an annual breakdown by calendar year of the natural gas consumption across campus buildings.

Data Entry Process
Enter the natural gas consumption in m^3 across the campus in the 'Energy' tab for the corresponding year, the blue cells indicate the cells where data entry is completed, the grey cells are the cells that are automatically calculated:

Raw Data:

	2012	2013	2014	2015	2016	2017	2018	2019	2020
Natural Gas (m3)		908,883	1,188,165						
Electricity Usage (kWh)		54,116,720	55,391,743	61,858,646					
Chilled Water (ton hrs)		563,383	532,683	583,742					
Steam (lbs)		110,540,352	117,561,007	110,719,731					

Emissions (kg CO2e)

	2012	2013	2014	2015	2016	2017	2018	2019	2020
Natural Gas (m3)	-	2,019,402	2,639,924	-	-	-	-	-	-
Electricity Usage (kWh)	-	7,684,574	5,760,741	6,495,158	-	-	-	-	-
Chilled Water (ton hrs)	-	26,761	14,010	27,436	-	-	-	-	-
Steam (lbs)	-	8,544,769	9,498,929	8,503,275	-	-	-	-	-

Emissions (tCO2e)

	2012	2013	2014	2015	2016	2017	2018	2019	2020
Natural Gas (m3)	-	2,019	2,640	-	-	-	-	-	-
Electricity Usage (kWh)	-	7,685	5,761	6,495	-	-	-	-	-
Chilled Water (ton hrs)	-	27	14	27	-	-	-	-	-
Steam (lbs)	-	8,545	9,499	8,503	-	-	-	-	-

Figure 1: 'Energy' tab data entry

Annual Calculation Tool Update
On an annual basis, check that there have been no changes to the emission factor for natural gas. The emission factor can be updated in the 'EFs' tab of the tool.

| Emission Factor | Unit | Year | | | | | | | | | Source |
		2012	2013	2014	2015	2016	2017	2018	2019	2020	
Chilled Water	kgCO2e/ton hrs	0.0619	0.0475	0.0263	0.047	0.0416					Via Enwave
District Steam	kgCO2e/lb	0.0782	0.0773	0.0808	0.0768	0.0743					Via Enwave
Natural Gas	kgCO2e/m3	2.22	2.22	2.22	2.22	2.22					Encompass Life Cycle EF (combustion EF from NIR, and upstream EF for natural gas from various sources)
Electricity	kgCO2e/kWH	0.166	0.142	0.104	0.105	0.096					Life cycle electricity EF based on IESO Generation Data, includes 10% factor for line losses

Figure 2: Energy emission factor update in 'EFs' tab

In general, the emission factor for natural gas should stay consistent year over year. The emission factor that has been used corresponds to the life cycle emission factor for natural gas. This includes the emissions from combustion, which come from Environment Canada's National Inventory Report on Greenhouse Gases and Sinks, as well as upstream emissions from the natural gas extraction and production process, which come from GHGenius

model, which analyzes the lifecycle emissions of the production and use of traditional and alternative transportation vehicle fuels (including natural gas).

3 CAMPUS ENERGY USE – ELECTRICITY USE

Current data available and annual collection methodology

The local distribution company, Toronto Hydro, measures the total amount of electricity consumed by the University. This data is delivered to Ryerson's Purchasing and Payment department via invoices, which outline the cost, consumption and generation volumes. Before payment, FMD receives a scanned copy of the invoice and logs the consumption electronically into the 'Ryerson Utility Database.accdb'.

Data Source
The 'Ryerson Utility Databse.accdb' is the source of electricity consumption across the campus. This database is maintained by Larry Arsenault.

Data Collection Process
On an annual basis, contact Larry Arsenault via email at larsenau@ryerson.ca, who is able to provide an annual breakdown by calendar year of the electricity consumption across campus buildings.

Data Entry Process
Enter the electricity usage in kWh across the campus in the 'Energy' tab for the corresponding year, the blue cells indicate the cells where data entry is completed, the grey cells are the cells that are automatically calculated:

Raw Data:

	2012	2013	2014	2015	2016	2017	2018	2019	2020
Natural Gas (m3)		908,883	1,188,165						
Electricity Usage (kWh)		54,116,720	55,391,743	61,858,646					
Chilled Water (ton hrs)		563,383	532,683	583,742					
Steam (lbs)		110,540,352	117,561,007	110,719,731					

Emissions (kg CO2e)

	2012	2013	2014	2015	2016	2017	2018	2019	2020
Natural Gas (m3)	-	2,019,402	2,639,924	-	-	-	-	-	-
Electricity Usage (kWh)	-	7,684,574	5,760,741	6,495,158	-	-	-	-	-
Chilled Water (ton hrs)	-	26,761	14,010	27,436	-	-	-	-	-
Steam (lbs)	-	8,544,769	9,498,929	8,503,275	-	-	-	-	-

Emissions (tCO2e)

	2012	2013	2014	2015	2016	2017	2018	2019	2020
Natural Gas (m3)	-	2,019	2,640	-	-	-	-	-	-
Electricity Usage (kWh)	-	7,685	5,761	6,495	-	-	-	-	-
Chilled Water (ton hrs)	-	27	14	27	-	-	-	-	-
Steam (lbs)	-	8,545	9,499	8,503	-	-	-	-	-

Figure 3: 'Energy' tab data entry

Annual Calculation Tool Update
On an annual basis, the emission factor for electricity consumption should be updated to reflect the indirect emissions from electricity consumption on campus. The emission factor can be updated in the 'EFs' tab of the tool.

Energy		Year									Source
Emission Factor	Unit	2012	2013	2014	2015	2016	2017	2018	2019	2020	
Chilled Water	kgCO2e/ton hrs	0.0613	0.0475	0.0263	0.047	0.0416					Via Enwave
District Steam	kgCO2e/lb	0.0782	0.0773	0.0808	0.0768	0.0743					Via Enwave
Natural Gas	kgCO2e/m3	2.22	2.22	2.22	2.22	2.22					Encompass Life Cycle EF (combustion EF from NIR, and upstream EF for natural gas from various sources)
Electricity	kgCO2e/kWH	0.166	0.142	0.104	0.105	0.096					Life cycle electricity EF based on IESO Generation Data, includes 10% factor for line losses

Figure 4: Energy emission factor update in 'EFs' tab

IESC has calculated annual life cycle emission factors for electricity consumed in Ontario based on Independent Electricity System Operator (IESO) data on electricity generation (http://www.ieso.ca/power-data/data-directory).

IESC will continue to provide Ryerson with annual life cycle based emission factors for electricity as part of IESC's continued support to Ryerson. Kevin Tse from IESC can be contacted to provide the emission factor. He can be reached at k.tse@internatenergy.com.

An alternative emission factor source for electricity consumption that is commonly used is Canada's National Inventory Report submitted annually as part of Canada's submission to the United Nations Framework Convention on Climate Change (UNFCC). However, the report lags behind 2 years in terms of the emission factors included. For example the April 2016 Natural Inventory Report covers the period from 1990-2014, and does not include emission factors for 2015 an 2016.

4   CAMPUS ENERGY USE – CHILLED WATER

Current data available and annual collection methodology

Externally purchased chilled water is currently only used at the Ted Rogers School of Management, the chilled water is metered by revenue grade meters and tracked by Enwave. Monthly invoices provide the usage data, which is sent to Ryerson's Purchasing and Payment department and later verified and entered into the 'Ryerson Utility Database.accdb' by FMD.

Data Source

The 'Ryerson Utility Databse.accdb' is the source of externally purchased chilled water across the campus. This database is maintained by Larry Arsenault.

Data Collection Process

On an annual basis, contact Larry Arsenault via email at larsenau@ryerson.ca, who is able to provide an annual breakdown by calendar year of the chilled water consumption across campus buildings.

Data Entry Process
Enter the chilled usage in ton hours across the campus in the 'Energy' tab for the corresponding year, the blue cells indicate the cells where data entry is completed, the grey cells are the cells that are automatically calculated:

Raw Data:

	2012	2013	2014	2015	2016	2017	2018	2019	2020
Natural Gas (m3)		908,883	1,188,165						
Electricity Usage (kWh)		54,116,720	55,391,743	61,858,646					
Chilled Water (ton hrs)		563,383	532,683	583,742					
Steam (lbs)		110,540,352	117,561,007	110,719,731					

Emissions (kg CO2e)

	2012	2013	2014	2015	2016	2017	2018	2019	2020
Natural Gas (m3)	-	2,019,402	2,639,924	-	-	-	-	-	-
Electricity Usage (kWh)	-	7,684,574	5,760,741	6,495,158	-	-	-	-	-
Chilled Water (ton hrs)	-	26,761	14,010	27,436	-	-	-	-	-
Steam (lbs)	-	8,544,769	9,498,929	8,503,275	-	-	-	-	-

Emissions (tCO2e)

	2012	2013	2014	2015	2016	2017	2018	2019	2020
Natural Gas (m3)	-	2,019	2,640	-	-	-	-	-	-
Electricity Usage (kWh)	-	7,685	5,761	6,495	-	-	-	-	-
Chilled Water (ton hrs)	-	27	14	27	-	-	-	-	-
Steam (lbs)	-	8,545	9,499	8,503	-	-	-	-	-

Figure 5: 'Energy' tab data entry

Annual Calculation Tool Update
On an annual basis, the emission factor for chilled water should be updated. The emission factor can be entered in the 'EFs' tab of the tool.

Energy			Year									Source	
Emission Factor	Unit	2012	2013	2014	2015	2016	2017	2018	2019	2020			
Chilled Water	kgCO2e/ton hrs	0.0619	0.0475	0.0263	0.047	0.0416					Via Enwave		
District Steam	kgCO2e/lb	0.0782	0.0773	0.0808	0.0768	0.0743					Via Enwave		
Natural Gas	kgCO2e/m3	2.22	2.22	2.22	2.22	2.22					Encompass Life Cycle EF (combustion EF from NIR, and upstream EF for natural gas from various sources)		
Electricity	kgCO2e/kWH	0.166	0.142	0.104	0.105	0.096					Life cycle electricity EF based on IESO Generation Data, includes 10% factor for line losses		

Figure 6: Energy emission factor update in 'EFs' tab

The emission factor for chilled water can be obtained on an annual basis directly from Enwave by contacting:

Peter Harasti, Director, Customer Energy Services
PHarasti@enwave.com
T: (416) 338-8941

5   CAMPUS ENERGY USE – STEAM USE

Off-site heat energy generation (steam) is used to heat the majority of Ryerson buildings on campus. Two meters are located on campus, one meter that services the Ted Rogers School of Management and the other services the rest of the campus. Steam usage is metered by a revenue grade meters and tracked by Enwave. Monthly invoices provide the usage data, which is sent to Ryerson's Purchasing and Payment department, who send a scan of the invoice to FMD who verify the data, and enter it into the 'Ryerson Utility Database.accdb'.

Data Source

The 'Ryerson Utility Databse.accdb' is the source of steam consumption across the campus. This database is maintained by Larry Arsenault.

Data Collection Process

On an annual basis, contact Larry Arsenault via email at larsenau@ryerson.ca, who is able to provide an annual breakdown by calendar year of the steam consumption across campus buildings.

Data Entry Process

Enter the steam usage in pounds across the campus in the 'Energy' tab for the corresponding year, the blue cells indicate the cells where data entry is completed, the grey cells are the cells that are automatically calculated:

Raw Data:

	2012	2013	2014	2015	2016	2017	2018	2019	2020
Natural Gas (m3)		908,883	1,188,165						
Electricity Usage (kWh)		54,116,720	55,391,743	61,858,646					
Chilled Water (ton hrs)		563,383	532,683	583,742					
Steam (lbs)		110,540,352	117,561,007	110,719,731					

Emissions (kg CO2e)

	2012	2013	2014	2015	2016	2017	2018	2019	2020
Natural Gas (m3)	-	2,019,402	2,639,924	-	-	-	-	-	-
Electricity Usage (kWh)	-	7,684,574	5,760,741	6,495,158	-	-	-	-	-
Chilled Water (ton hrs)	-	26,761	14,010	27,436	-	-	-	-	-
Steam (lbs)	-	8,544,769	9,498,929	8,503,275	-	-	-	-	-

Emissions (tCO2e)

	2012	2013	2014	2015	2016	2017	2018	2019	2020
Natural Gas (m3)	-	2,019	2,640	-	-	-	-	-	-
Electricity Usage (kWh)	-	7,685	5,761	6,495	-	-	-	-	-
Chilled Water (ton hrs)	-	27	14	27	-	-	-	-	-
Steam (lbs)	-	8,545	9,499	8,503	-	-	-	-	-

Figure 7: 'Energy' tab data entry

Annual Calculation Tool Update

On an annual basis, the emission factor for steam use should be updated. The emission factor can be updated in the 'EFs' tab of the tool.

Energy			Year									Source	
Emission Factor	Unit		2012	2013	2014	2015	2016	2017	2018	2019	2020		
Chilled Water	kgCO2e/ton hrs		0.0619	0.0475	0.0263	0.047	0.0416					Via Enwave	
District Steam	kgCO2e/lb		0.0782	0.0773	0.0808	0.0768	0.0743					Via Enwave	
Natural Gas	kgCO2e/m3		2.22	2.22	2.22	2.22	2.22					Encompass Life Cycle EF (combustion EF from NIR, and upstream EF for natural gas from various sources)	
Electricity	kgCO2e/kWH		0.166	0.142	0.104	0.105	0.096					Life cycle electricity EF based on IESO Generation Data, includes 10% factor for line losses	

Figure 8: Energy emission factor update in 'EFs' tab

The emission factor for chilled water can be obtained on an annual basis directly from Enwave by contacting:

> Peter Harasti, Director, Customer Energy Services
> PHarasti@enwave.com
> T: (416) 338-8941

6 PURCHASED SERVICES

With every purchased good or service, GHG emissions can be related to producing that good or providing that service. Extraction, production, and transportation of goods and services purchased all have a GHG emissions associated with it. In order to calculate an emissions value from purchased goods and services, the amount spent for specific categories are needed, records of which are kept by the financial services department.

Data Source

General ledger data is provided by Financial Services, who pull the corresponding account numbers from their financial database. Due to the way the financial database is set up, only fiscal year, and not calendar year data is available.

Data Collection Process

On an annual basis, contact either of the following individuals to request the required data:

Timothy Chiu	**Herbert Wong**
Controller, Financial Services	Senior Financial Analyst
tchiu@ryerson.ca	h8wong@ryerson.ca
416-979-5019	416-979-5000 ext 6982

Data Entry Process

Due to slight differences in the expense categories used by Ryerson, and the emission factors available, the data is re-categorized based on the those where emission factors are available. This has already been completed, and does not need to be completed again. The excel tool used in previous years can be used to categorize and add all of the expenses in each category automatically.

Enter the expenses across the campus in the 'Tertiary Services' tab for the corresponding year, the blue cells indicate the cells where data entry is completed, the grey cells are the cells that are automatically calculated:

Figure 9: 'Tertiary Services' tab data entry

Annual Calculation Tool Update

The emission factors used in the tool are from "Human Activity and the Environment. Annual Statistics 2009" published by Statistics Canada. The report includes emission factors for various tertiary services. After the 2009 report, the annual publication focused on a featured article instead of the broader annual statistics. No emission factors for tertiary services for subsequent years have been provided. If a separate source of emission factors is found, the emission factor can be updated in the 'EFs' tab of the tool.

Figure 10: 'Tertiary Services' emission factor update in 'EFs' tab

7   STUDENT AND STAFF COMMUTING

With over 35,000 combined student and staff at Ryerson, travel to and from the campus represents a significant source of GHG emissions. Starting with the 2014 GHG inventory, sufficient data was available to estimate the GHG emissions from student and staff commuting.

Data Source

A 2015 Sustainability Survey asked students and staff about their commutes, including the distance they travel on their way to Ryerson and the method that they use to get there. Using this information, the survey results were extrapolated across the entire Ryerson population. However, the sample size of the survey was rather small (n=118) compared to the overall population at Ryerson.

For student (undergraduate and graduate) commuting, an initiative called StudentMoveTO looked to better understand the commuting habits of students at four Toronto universities (OCAD U, Ryerson University, the

University of Toronto, and York University). A survey was conducted with almost 3,000 respondents from Ryerson. The modal breakdown and average distance travelled for Ryerson students from this survey is used going forward due to the more robust data available. The model breakdown data from the 2015 Sustainability Survey and subsequent annual surveys will still be used for staff and faculty travel.

In addition, a survey equivalent to the StudentMoveTO survey was created and distributed to Ryerson staff and faculty in the summer of 2016, and had over 1,300 responses. The results of this survey can be used and applied to staff and faculty going forward.

Data Collection Process

From speaking with the organizers at StudentMoveTO the survey is not expected to be completed on an annual basis. Therefore the modal breakdown for student commuting from the 2015 survey will be used until the survey is repeated. For the modal breakdown for staff and faculty, the annual Sustainability Survey results can be used to update the tool.

Data on the Ryerson student and faculty population can be obtained from the University Planning Office website (http://www.ryerson.ca/upo/statistics/). The site includes the number of full time faculty, undergraduate students, and graduate students. Full time equivalent staff at Ryerson was 1,700 according to the Ryerson website. However the URL of the site where that number was obtained is no longer active (http://www.ryerson.ca/news/media/quickfacts/). It is recommended that a new source for this number be obtained and the number updated on an annual basis.

Data Entry Process
The key data to be entered on an annual basis is:

- The number of staff, faculty, and students (undergraduate/undergraduate)
- The modal breakdown for each population segment
- The average distance travelled for each mode of transport for each population segment

Ryerson Population	Year								
Demographic	2012	2013	2014	2015	2016	2017	2018	2019	2020
Administration/ Staff		1,700	1,700	1,700					
Faculty		847	847	847					
Student- graduate		2358	2358	2358					
Student- undergraduate		30,875	30,875	30,875					
(blank)									
TOTAL	0	35,780	35,780	35,780	0	0	0	0	0

Figure 11: Ryerson population data entry

As mentioned above, it is not expected that the modal breakdown or distance travelled will be updated with respect to student travel, as the survey will not be completed on an annual basis. However for staff and faculty travel, the numbers can be updated based on the results of each annual survey.

Annual Calculation Tool Update
The emission factors for commuting are based on life cycle emission factors that IESC has calculated. The sources of data for which the emission factors for public transportation were derived included:
- TTC. (2008). *Service Improvements for 2008*
- TTC. (2007). Staff Response to Commission Inquiry - Energy Efficiency and Cost Savings.
  http://www3.ttc.ca/About_the_TTC/Commission_reports_and_information/Commission_meetings/2007/Feb_27_2007/Other/Energy_Efficiency_an.jsp
- TTC. (2009a). 2008 Operating Statistics.
  http://www3.ttc.ca/About_the_TTC/Operating_Statistics/2008.jsp.
- TTC. (2009b). Environemental Plan. TTC Environnemental Plan 2008-2009.
  http://www3.ttc.ca/About_the_TTC/Projects_and_initiatives/Environmental_plan.jsp
- TTC. (2009c). Trolley Bus Service Review.
- US Department of Transportation. Federal Transit Administration. (2007). Useful Life of Transit Buses and Vans. Report No. FTA VA-26-7229-07.1

Emission factors for vehicle travel were obtained from GHG Protocol's 'Emission-Factors-from-Cross-Sector-Tools-(April 202014)_0.xlsx. No updated emission factors have been calculated since the initial life cycle emission factors were calculated. However, if a separate source of emission factors is found, the emission factor can be updated in the 'EFs' tab of the tool.

Commute EF's		Year									Source
Mode	Unit	2012	2013	2014	2015	2016	2017	2018	2019	2020	
Bicycle	kgCO2e/passenger.km	0	0	0	0	0	0	0	0	0	
Bus	kgCO2e/passenger.km		0.0434	0.0434	0.0434	0.0434					Encompass Life Cycle EF's (adapted from 2008 TTC data)
Carpool	kgCO2e/passenger.km		0.381	0.381	0.381	0.381					Encompass Life Cycle EF (adapted from GHG Protocol)
Drive alone (including motorcycle)	kgCO2e/passenger.km		0.381	0.381	0.381	0.381					Encompass Life Cycle EF (adapted from GHG Protocol)
Not Applicable	kgCO2e/passenger.km										
Other	kgCO2e/passenger.km										
Subway	kgCO2e/passenger.km		0.0434	0.0434	0.0434	0.0434					Encompass Life Cycle EF's (adapted from 2008 TTC data)
Train	kgCO2e/passenger.km		0.0434	0.0434	0.0434	0.0434					Encompass Life Cycle EF's (adapted from 2008 TTC data)
Walk	kgCO2e/passenger.km	0	0	0	0	0	0	0	0	0	

Figure 12: 'Commute' emission factor update in 'EFs' tab

8 WASTE

Before the 2014 inventory, it was unclear what exactly Ryerson student and staff were throwing into the garbage. No audit had been completed previously to understand the make-up of what was going to landfill, making calculating the GHG emissions from waste difficult. In 2014, a waste audit was completed by GFL across the campus that looked to address this deficiency and to help Ryerson to better tackle waste management on campus. GHG emissions from waste can now calculated based on the weight of recycling and waste streams on campus provided by GFL, and the waste audit conducted in 2014 that provide the composition of the waste stream.

Data Source

Monthly summaries of the waste sent to landfill and the amount recycled is provided to Ryerson by GFL.

Data Collection Process

The monthly summaries can be obtained by contacting Garth Poppleton at gpopplet@ryerson.ca.

Data Entry Process

The key data to be entered on an annual basis is:

- The weight (tonnes) of recycling across the campus
- The weight (tonnes) of landfilled waste across the campus
- The weight (tonnes) of recycling for the residences
- The weight (tonnes) of landfilled waste for the residences

Waste (tonnes)
Data Source: Waste report from GFL

	2012	2013	2014	2015	2016	2017	2018	2019	2020
Recycling Campus		475.14	508.27	564.7	442.96				
Recycling Residence		61.31	133.51	168.96	445.92				
Landfill Campus		786.77	863.81	1375.24	1394.67				
Landfill Residence		786.77	145.09	89.84	177.4				

	2012	2013	2014	2015	2016	2017	2018	2019	2020
Recycling Total		536.45	641.78	733.66	888.88	0	0	0	0
Landfill Total		1573.54	1008.9	1465.08	1572.07	0	0	0	0
Recycling Diversion %	#DIV/0!	25%	39%	33%	36%	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Landfill %	#DIV/0!	75%	61%	67%	64%	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!

Figure 13: Recycling and landfill waste data entry

When another waste audit is completed in the future, the composition of the landfill waste can be updated to reflect any changes to the waste stream.

Waste to landfill %'s
Data Source: Campus Waste Audit

	2012	2013	2014	2015	2016	2017	2018	2019	2020
Paper	21%	21%	21%	21%	21%	21%	21%	21%	21%
Plastic	14%	14%	14%	14%	14%	14%	14%	14%	14%
Metal	2%	2%	2%	2%	2%	2%	2%	2%	2%
Glass	2%	2%	2%	2%	2%	2%	2%	2%	2%
HSW	0%	0%	0%	0%	0%	0%	0%	0%	0%
Organics	56%	56%	56%	56%	56%	56%	56%	56%	56%
Other	4%	4%	4%	4%	4%	4%	4%	4%	4%

Figure 14: Landfill composition data entry

Annual Calculation Tool Update

The emission factors for recycling and landfilled waste for the various materials are based on life cycle emission factors that have been adapted from the Bilan Carbone, as well as other various sources. It is not expected that updates will be required for the waste emission factors. If a separate source of emission factors is found, the emission factor can be updated in the 'EFs' tab of the tool.

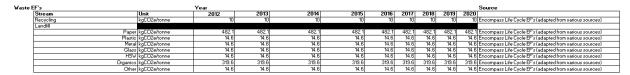| Waste EF's		Year									Source
Stream	Unit	2012	2013	2014	2015	2016	2017	2018	2019	2020	
Recycling	kgCO2e/tonne	10	10	10	10	10	10	10	10	10	Encompass Life Cycle EF's (adapted from various sources)
Landfill											
Paper	kgCO2e/tonne	482.1	482.1	482.1	482.1	482.1	482.1	482.1	482.1	482.1	Encompass Life Cycle EF's (adapted from various sources)
Plastic	kgCO2e/tonne	14.6	14.6	14.6	14.6	14.6	14.6	14.6	14.6	14.6	Encompass Life Cycle EF's (adapted from various sources)
Metal	kgCO2e/tonne	14.6	14.6	14.6	14.6	14.6	14.6	14.6	14.6	14.6	Encompass Life Cycle EF's (adapted from various sources)
Glass	kgCO2e/tonne	14.6	14.6	14.6	14.6	14.6	14.6	14.6	14.6	14.6	Encompass Life Cycle EF's (adapted from various sources)
HSW	kgCO2e/tonne	14.6	14.6	14.6	14.6	14.6	14.6	14.6	14.6	14.6	Encompass Life Cycle EF's (adapted from various sources)
Organics	kgCO2e/tonne	319.6	319.6	319.6	319.6	319.6	319.6	319.6	319.6	319.6	Encompass Life Cycle EF's (adapted from various sources)
Other	kgCO2e/tonne	14.6	14.6	14.6	14.6	14.6	14.6	14.6	14.6	14.6	Encompass Life Cycle EF's (adapted from various sources)

Figure 15: 'Waste' emission factor update in 'EFs' tab

9 BUSINESS TRAVEL

This emission source includes air travel by Ryerson staff, emissions from Ryerson owned vehicles, and any additional business car travel. Air Travel distances and emissions are derived from financial expenditure data for Canadian and international flights. Emissions from Ryerson owned vehicles were estimated from the annual mileage travelled. Finally, Additional business car travel emissions were derived from financial expenditure data for car rentals, mileage reimbursements, and cab rentals

Data Source

Ryerson Owned Vehicles

Odometer readings are to be taken yearly for Ryerson owned vehicles by FMD in November/December. From this reading, the gasoline or diesel consumption for the year for each vehicle is calculated using the rated vehicle fuel efficiency from the NRCAN Fuel Consumption Ratings Search Tool (http://oee.nrcan.gc.ca/fcr-rcf/public/index-e.cfm).

Ryerson Staff Air travel

Expenditure data from financial services for 'Airfare-Canada' and 'Airfare – International' is used to estimate the emissions from Ryerson staff air travel. The expenditure is converted to air travel mileage based on the Passenger and Cargo Yield Report produced by Airlines.org (http://airlines.org/dataset/a4a-monthly-yield/) which provides the 'revenue passenger mile' for domestic and international flights. This number represents the average price paid by customers to fly one mile. The data from Airlines.org is based on USD which must be converted to CAD based on exchange rates, which were obtained from the Canadian Forex historical yearly average rates (http://www.canadianforex.ca/forex-tools/historical-rate-tools/yearly-average-rates).

Ryerson Car Travel

Expenditure data from financial services for 'Travel: Car Mileage, 'Travel:Car Rental/ln' and 'Taxi Expense' is used to estimate the emissions from Ryerson staff car travel. An average cost per km travelled is used to convert the expense to a distance travelled. This was obtained from 'Transport Canada Full-Cost Investigation Report'.

Data Collection Process

Ryerson Owned Vehicles

On an annual basis, odometer readings will need to be taken by FMD for each of the Ryerson owned vehicles.

Ryerson Staff Air travel

This will be obtained as part of the financial data that Financial Services provides

Ryerson Car Travel

This will be obtained as part of the financial data that Financial Services provides

Data Entry Process
The key data to be entered on an annual basis is:

- The odometer readings for each Ryerson owned vehicle
- The fuel efficiency (L/100km- Combo) for each Ryerson owned vehicle (via NRCAN – Fuel Consumption Ratings Search Tool) if a new vehicle is added, or a vehicle is replaced
- Amount spent on domestic flights ('Airfare – Canada')
- Amount spent on international flights ('Airfare – International')
- The annual average kilometers travelled per dollar spent on airfare (via airlines.org A4A monthly passenger and cargo yield)
- USD to Canadian exchange rate

1) Ryerson Owned Vehicles

Data Source: Vehicle Mileage Ryerson University
Fuel Efficiency: NRCAN - Fuel Consumption Ratings Search Tool

		Fuel Eff. (L/100km-Combo)	Mileage Reading (December)								
			2012	2013	2014	2015	2016	2017	2018	2019	2020
Vehicle 4, Receiving, 2012 Chevrolet Express Cargo	1GWGFBA8C1100926,	14	673	1,545	2,580	3,383	4,185				
Vehicle 6, President, 2010 Volkswagen (2010 VOLKSWAGEN CC SPORT)	WVWMN9AN9AE553204,	9.6	73,267	85,132	–	–	–	–	–	–	–
Vehicle 7, President, 2012 BMW (X5 XDRIVE35I)	5UXZV4C5XCL754659,	12.7	25,968	53,657	69,756	–	–	–	–	–	–
Vehicle 1, Security, 2013 Ford Escape (assumed 2.5 Cyl)	1FMCU0F71DUA81896,	9.4	3,473	14,540	25,438	31,993	38,547				
Vehicle 3, Receiving, 2006 EXPRESS CUTAWAY G3500 (assummed CHEVROLET G15 EXPRESS CARGO CONV)	1GBJG31U261246784,	16.2	11,233	13,337	15,134	16,735	18,335				
Vehicle 2, Receiving, 2004 Chevrolet Cutaway Van	1GBJG31U411763890,	16.2	36,302	41,595	47,285	52,803	58,321				
Vehicle 5, CPF, 2001 GMC Sierra 1500	1GTEC14W1Z298800,	14.1	28,256	30,175	33,256	36,455	39,654				
2014 Kia	KNAHU8A31E7032501		49,000	49,000	49,000	49,000	49,000				
2017 Prius	JTDZN3EU2HJ063564	4.5									

Figure 16: Odometer reading entry in 'Travel' tab

		Fuel Efficiency (L/100km-Combo)	Fuel Consumption								
			2012	2013	2014	2015	2016	2017	2018	2019	2020
Vehicle 4, Receiving, 2012 Chevrolet Express Cargo	1GWGFBA8C1100926,	14		122.08	144.90	112.42	112.28	–	–	–	–
Vehicle 6, President, 2010 Volkswagen (2010 VOLKSWAGEN CC SPORT)	WVWMN9AN9AE553204,	9.6		1,139.04	–	–	–	–	–	–	–
Vehicle 7, President, 2012 BMW (X5 XDRIVE35I)	5UXZV4C5XCL754659,	12.7		3,516.50	2,044.57	–	–	–	–	–	–
Vehicle 1, Security, 2013 Ford Escape (assumed 2.5 Cyl)	1FMCU0F71DUA81896,	9.4		1,040.30	1,024.41	616.17	616.08	–	–	–	–
Vehicle 3, Receiving, 2006 EXPRESS CUTAWAY G3500 (assummed CHEVROLET G15 EXPRESS CARGO CONV)	1GBJG31U261246784,	16.2		340.85	291.11	259.36	259.20	–	–	–	–
Vehicle 2, Receiving, 2004 Chevrolet Cutaway Van	1GBJG31U411763890,	16.2		857.47	921.78	893.92	893.92	–	–	–	–
Vehicle 5, CPF, 2001 GMC Sierra 1500	1GTEC14W1Z298800,	14.1		270.58	434.42	451.06	451.06	–	–	–	–
2014 Kia	KNAHU8A31E7032501			–	–	–	–	–	–	–	–
2017 Prius	JTDZN3EU2HJ063564	4.5		–	–	–	–	–	–	–	–

Figure 17: Vehicle fuel efficiency data entry

2) Ryerson Staff Air Travel

Data Source: Energy Audit 2013-14.xlsx
Conversion: Yearly $/km via:
        Airlines.org A4A Monthly Passenger and Cargo Yield   http://airlines.org/data/a4a-month
        USD to CAD Exchange Rates   Canadian Forex   http://www.canadianforex.ca/forex
Guidance: http://rs.acupcc.org/instructions/ghg/
        http://www.aashe.org/blog/guidance-scope-3-emissions-pt-2-air-travel
Assumption: Assume that 20% of expense is towards taxes and handling fees etc.

		$								
	Unit	2012	2013	2014	2015	2016	2017	2018	2019	2020
Airfare – Canada	$		$ 649,674	$ 734,523	$ 830,536	$ 963,629				
Airfare – International	$		$ 704,181	$ 964,216	$ 1,198,388	$ 1,101,140				
TOTAL	$	–	$ 1,353,855	$ 1,698,739	$ 2,028,924	$ 2,064,769	$ –	$ –	$ –	$ –

		$/mile (USD)								
	Unit	2012	2013	2014	2015	2016	2017	2018	2019	2020
Airfare – Canada	$/mile		$ 0.1698	$ 0.1698	$ 0.1407	$ 0.1543				
Airfare – International	$/mile		$ 0.1406	$ 0.1406	$ 0.1348	$ 0.1291				
TOTAL										

* 2015 $/mile international is average b/w 2014 and 2016

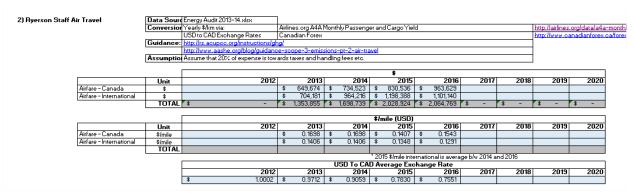| USD To CAD Average Exchange Rate									
2012	2013	2014	2015	2016	2017	2018	2019	2020
$ 1.0002	$ 0.9712	$ 0.9059	$ 0.7830	$ 0.7551				

Figure 18: Air travel expense data entry, $/mile conversion factor, and USD to CAD average exchange rate
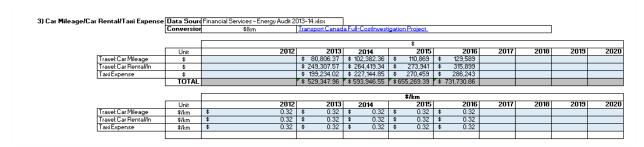
Figure 19: Car mileage/rental/taxi expense data entry, and $/km conversion factor

Annual Calculation Tool Update

The emission factors for air travel is based on GHG Protocol's:

- 'Emission_Factors_from_Cross_Sector_Tools_April_2014.xlsx', Reference - EF Public

Emission factors for vehicle travel were based on life cycle emission factors calculated by IESC. These were based on Environment Canada's National Inventory Report, as well as GHGenius.

It is not expected that updates will be required for these emission factors. If a separate source of emission factors is found, the emission factor can be updated in the 'EFs' tab of the tool.
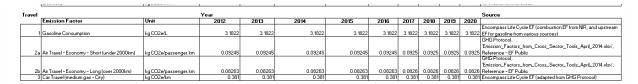

Figure 20: 'Travel' emission factor update in 'EFs' tab