REVIEW OF SOURCE ATTRIBUTES

Plains CO_2 Reduction Partnership Phase III
Task 1 – Deliverable D1

Prepared for:

Andrea Dunn

U.S. Department of Energy
National Energy Technology Laboratory
626 Cochrans Mill Road
PO Box 10940
Pittsburgh, PA 15236-0940

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Prepared by:

Kyle A. Glazewski
Justin T. Kovacevich
Melanie D. Jensen
Wesley D. Peck
Charles D. Gorecki

Energy & Environmental Research Center
University of North Dakota
15 North 23rd Street, Stop 9018
Grand Forks, ND 58202-9018

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NOMENCLATURE AND ABBREVIATIONS

CH_4	methane
CO_2	carbon dioxide
CO_2eq	carbon dioxide equivalent
DOE	U.S. Department of Energy
DSS	Decision Support System
EPA	U.S. Environmental Protection Agency
HFC	hydrofluorocarbon
HFC-23	fluoroform
N_2O	nitrous oxide
NATCARB	National Carbon Sequestration Database and Geographic Information System
NO_x	nitrogen oxides
PCOR	Plains CO_2 Reduction
PFC	perfluorocarbon
PFC-116	hexafluoroethane
PFC-14	tetrafluoromethane
RCSPs	Regional Carbon Sequestration Partnerships
SF_6	sulfur hexafluoride
SO_2	sulfur dioxide

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EXECUTIVE SUMMARY

The Plains CO_2 Reduction (PCOR) Partnership maintains a database of regional sources of carbon dioxide (CO_2) emissions and evaluates it on an annual basis. The database is an important part of assessing potential CO_2 capture–transportation–storage scenarios that could reduce greenhouse gas emissions in the PCOR Partnership region. The emission measurements compiled in this database are typically acquired through online databases of the U.S. Environmental Protection Agency and Environment Canada. The updated database shows that there are 443 significant (greater than 100,000 metric tons) CO_2 emission sources that emit 340 million tonnes on an annual basis.

REVIEW OF SOURCE ATTRIBUTES

INTRODUCTION

The Plains CO_2 Reduction (PCOR) Partnership maintains a database of significant regional point sources of carbon dioxide (CO_2). The database is a key in the development of CO_2 capture–transportation–storage scenarios that have the potential to reduce greenhouse gas emissions in the PCOR Partnership region. To maintain a reasonably current status, the data set undergoes an annual review during which new or missing sources are identified and added, CO_2 emission rates are updated, and facility locations are verified. This report summarizes the data review that took place between September 16, 2014, and September 8, 2015.

APPROACH

Actual emission measurements are used whenever possible, but measured data are not always available for each of the sources. In cases where measured data are unavailable, emissions are estimated using the methodologies developed for the U.S. Department of Energy (DOE) National Energy Technology Laboratory by the DOE Regional Carbon Sequestration Partnerships' (RCSPs') Capture and Transportation Working Group (Capture and Transportation Working Group of the DOE Regional Carbon Sequestration Partnerships, 2010). Web searches are used to acquire updated information regarding fuel type, heat content, and usage rate and/or product slate and quantities; these values are used to estimate CO_2 emission rates for specific sources.

Four primary data sets were used to update the PCOR Partnership's CO_2 emission database:

- The Environment Canada Reported Facility Greenhouse Gas Data (Environment Canada, 2015), an online greenhouse gas search engine, provides the annual emissions of CO_2, CH_4 (methane), N_2O (nitrous oxide), SF_6 (sulfur hexafluoride), PFCs (perfluorocarbons), HFCs (hydrofluorocarbons), and other greenhouse gases for point sources from all sectors. The Canadian point sources in the PCOR Partnership database were updated using 2013 data (the most current data). The search engine can be accessed at www.ec.gc.ca/pdb/ghg/onlineData/dataSearch_e.cfm.

- The U.S. Environmental Protection Agency (EPA) Air Markets Program Data online emission search engine (U.S. Environmental Protection Agency, 2015a) provides CO_2, SO_2 (sulfur dioxide), and NO_x emission data for electric utilities and larger industrial

heat/power plants. The PCOR Partnership database was updated using facility data from 2014 so as to incorporate the most current data for these plants. This search engine can be accessed at http://ampd.epa.gov/ampd/.

- EPA's Greenhouse Gas Reporting Program Data for Calendar Year 2013 (U.S. Environmental Protection Agency, 2015b) is a searchable site that contains CO_2, N_2O, CH_4, PFC-14 (tetrafluoromethane), PFC-116 (hexafluoroethane), and HFC-23 (fluoroform) emission data reported from large facilities in nine industry groups: power plants, landfills, metal manufacturing, mineral production, petroleum refineries, pulp and paper manufacturing, chemical manufacturing, government and commercial facilities, and other industrial facilities. The Greenhouse Gas Reporting Program Data can be accessed at http://ghgdata.epa.gov/ghgp/main.do.

The emission data obtained from the EPA Greenhouse Gas Reporting Program are relatively easily incorporated into the PCOR Partnership data set, with the exception of the ethanol plants. The PCOR Partnership tracks combustion- and process-related CO_2 emissions separately for potential carbon utilization purposes. The EPA site breaks down the emissions as either combustion-related or biogenic CO_2, which includes CO_2 that is formed by either combustion or decomposition of a biomass source. In other words, biogenic CO_2 includes both CO_2 that is fermentation process-related as well as the result of combusting biomass, making it difficult to determine the amount of CO_2 produced by processes other than combustion.

The EPA searchable database presents a second challenge in that it is difficult to determine the total CO_2 emissions as opposed to the total CO_2 equivalent (CO_2eq) emissions for some of the source types. One example of this is sugar-processing facilities with their inherent lime production. This is not true for all source types.

A final note about the use of the EPA database: the power plants are listed as producing CO_2 from both "stationary combustion" and "electricity generation." These values must be summed to produce the total CO_2 emissions at such sites.

The decision was made to change the threshold for inclusion of the sources into the PCOR Partnership data set to 100,000 tonnes/yr. This is a substantial increase from the original threshold of 13,608 tonnes/yr (15,000 short tons/yr). The threshold was chosen for several reasons:

- 100,000 tonnes/yr is generally thought to be the minimum emission level that would be useful to a commercial end user.

- The cost to capture and transport CO_2 from a system producing a smaller CO_2 stream than this would likely be prohibitively expensive.

- The other RCSPs have generally reported their CO_2 data for sources that produce at least 100,000 tonnes CO_2/yr. This change will put the PCOR Partnership data set on the same basis as the other RCSP data sets within NATCARB (National Carbon Sequestration Database and Geographic Information System).

RESULTS

As of September 8, 2015, the updated PCOR Partnership database contains 443 sources that produce an estimated 340 million tonnes of CO_2 annually. This compares to the 2014 values of 911 sources producing an estimated 562 million tonnes of CO_2 a year; however, it is important to remember the different threshold values between the data sets, as mentioned above. The breakdown of the CO_2 emissions by broad source category is presented in Table 1. The breakdown of the CO_2eq emissions by broad source category is given in Table 2, while Table 3 shows the types and CO_2eq of the other greenhouse gases emitted by the CO_2 sources tracked in the PCOR Partnership data set.

Figure 1 shows the locations of eight new facilities that were found to be missing from the data set and were, therefore, added to it.

When available, the CO_2eq emissions due to CH_4, N_2O, HFCs, PFCs, and/or SF_6 are incorporated into the PCOR Partnership database. This information was found for as many as 366 (depending on the greenhouse gas) of the 443 sources and is summarized in Table 3. Roughly 83% of the large CO_2 point sources in the PCOR Partnership region emit other greenhouse gases in addition to CO_2.

The process of moving this latest data set to the PCOR Partnership Decision Support System (DSS) is currently under way. When the process is complete, the updated emission data will be reflected via the online geographic information systems on the PCOR Partnership DSS and DOE's national portal.

Table 1. Summary of CO_2 from Point Sources Found Within the PCOR Partnership Region as of September 8, 2015

Category	Count	Total CO_2, tonnes	% of Sources	% of Emissions
Agricultural and Agriculture-Related Processing	19	6,222,254	4.3	1.8
Electricity Generation	121	154,382,583	27.3	45.4
Chemical and Fuel Production	23	16,373,724	5.2	4.8
Ethanol Manufacture	109	44,632,356	24.6	13.1
Cement/Clinker Production	21	16,887,339	4.7	5.0
Industrial	22	7,694,829	5.0	2.3
Small-Scale Heat and Power	10	2,321,507	2.3	0.7
Manufacturing	7	1,568,452	1.6	0.5
Petroleum- and Natural Gas-Related	91	80,553,432	20.5	23.7
Paper and Wood Products	17	8,553,697	3.8	2.5
Waste Processing	3	539,346	0.7	0.2
Total	**443**	**339,729,518**	**100.0**	**100.0**

Table 2. Summary of CO_2-Equivalent Emissions from Point Sources Found Within the PCOR Partnership Region as of September 8, 2015

Category	Count	Total CO_2eq, tonnes	% of Sources	% of Emissions
Agricultural and Agriculture-Related Processing	19	6,743,888	4.3	1.9
Electricity Generation	121	154,851,318	27.3	44.5
Chemical and Fuel Production	23	17,449,098	5.2	5.0
Ethanol Manufacture	109	44,808,573	24.6	12.9
Cement/Clinker Production	21	16,924,612	4.7	4.9
Industrial	22	7,854,104	5.0	2.3
Small-Scale Heat and Power	10	2,337,788	2.3	0.7
Manufacturing	7	1,821,624	1.6	0.5
Petroleum- and Natural Gas-Related	91	86,029,559	20.5	24.7
Paper and Wood Products	17	8,889,122	3.8	2.6
Waste Processing	3	548,901	0.7	0.2
Total	**443**	**348,258,587**	**100.0**	**100.0**

Table 3. Summary of Non-CO_2 Greenhouse Gases Emitted by Sources in the PCOR Partnership Region

Greenhouse Gas	CO_2 Equivalent Value	Number of Sources	Quantity, tonnes CO_2eq
CH_4	21	366	6,228,099
N_2O	310	365	2,041,017
SF_6	23,900	10	1,703
HFC	140 to 11,700	6	8,579
PFC	6500 to 9200	2	249,672

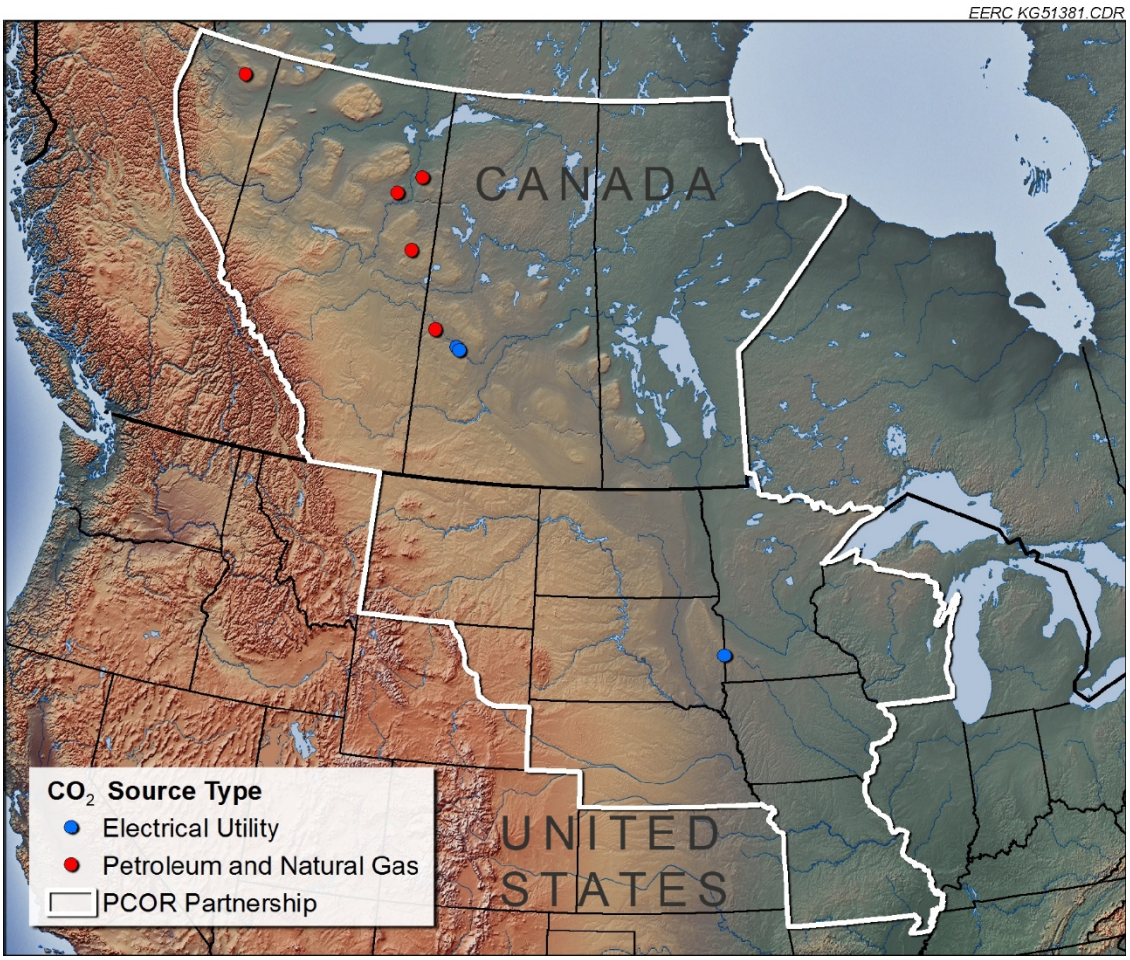

Figure 1. Location of the new facilities identified during this database update.

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