

SPECIFIED GAS REPORTING REGULATION

ALBERTA ENVIRONMENT REPORT ON 2007 GREENHOUSE GAS EMISSIONS



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Executive summary

In 2002, Alberta signaled its commitment to manage climate change and greenhouse gas emissions in the province by passing the *Climate Change and Emissions Management Act*. One of the first actions taken under the new legislation was to develop a mandatory reporting program for large industrial emitters in Alberta. Beginning in November 2004, large industrial emitters in the province were required to submit an annual report on their previous year's greenhouse gas emissions. Two thousand and seven was the fourth year of greenhouse gas reporting in Alberta.

Alberta's regulatory framework continued to evolve. In 2007, Alberta passed the *Specified Gas Emitters Regulation*, reinforcing its commitment to regulate greenhouse gas emissions from large industrial emitters. This regulation requires all facilities in Alberta emitting over 100,000 tonnes of carbon dioxide equivalent per year to reduce their emissions intensity by 12 per cent below a baseline based on 2003-2005 emissions. In the future, Alberta will look to consolidate both regulations to streamline and reduce the overall reporting burden for Alberta's large emitters.

In 2008, the province released its *2008 Climate Change Strategy*, establishing practical, achievable goals for further reductions in greenhouse gas emissions. The strategy commits to taking action on three themes: conserving and using energy efficiently; implementing carbon capture and storage; and greening energy production. By 2050, Alberta will see a reduction of 200 megatonnes (one megatonne = one million tonnes) over business-as-usual projections.

Alberta recognizes that continuous changes and targeted actions will be required as we learn more, achieve positive results, and identify new opportunities and solutions. The strategy also reflects Alberta's unique position as an energy supplier to the world and the reality that, for the foreseeable future, the world will continue to rely on Alberta's secure supply of oil and gas. By beginning now to reduce the rate of emissions, Alberta will ensure that significant and lasting reductions will occur.

Results of the 2007 Reporting Program

Since the *National Mandatory Greenhouse Gas Reporting Program* began, reported Alberta greenhouse gas emissions have increased by 5.3 megatonnes (Mt) or 4.9 per cent (from 109.1 Mt in 2004 to 114.4 Mt in 2007). The number of facilities reporting has also increased (from 98 in 2004 to 106 in 2007).

In 2007, there were 106 Alberta facilities that reported total greenhouse gas emissions of 114.4 Mt. There were three more facilities that reported emissions in 2007 than in 2006. Emissions from all facilities decreased by less than 1 per cent from the 115.0 Mt reported for 2006. Carbon dioxide accounted for 96 per cent of the total emissions with the remainder coming from methane (2 per cent), nitrous oxide (1 per cent), hydrofluorocarbons (<1 per cent) and sulphur hexafluorine (<1 per cent). No Alberta facilities reported emissions of perfluorocarbons.

There were 100 Alberta facilities that reported both in 2006 and 2007. Total reported emissions from these facilities decreased by 1 per cent (from 114.8 Mt to 113.9 Mt). There were 40 facilities that reported higher emissions and 60 that reported lower.

The utilities sector was the largest emitting source at 43 per cent followed by oil sands (23 per cent), chemical manufacturing (9 per cent), in-situ (8 per cent) and conventional oil and gas extraction (7 per cent) sectors. The remaining 10 per cent of emissions came from the waste management, pipeline transportation, mineral manufacturing, paper manufacturing and coal mining sectors. Eighty-five per cent of provincial emissions are from stationary fuel combustion with the remainder generated by industrial process (9 per cent), other fugitive (2 per cent), venting and flaring (3 per cent), on-site transportation (1 per cent) and waste and wastewater (<1 per cent) sources.

Canada-wide large industrial emitters released 278.1 Mt of greenhouse gas emissions in the 2007 reporting year. Alberta was the largest contributor at 41 per cent. This is due to the large energy industry in Alberta and the large portion of Alberta's electricity coming from coal fired power plants. Other major provincial emitters are Ontario (27 per cent), Saskatchewan (8 per cent), Quebec (8 per cent) and British Columbia (5 per cent).

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Abbreviations

AENV:	Alberta Environment
CEMS:	Continuous Emissions Monitoring Systems
CH ₄ :	methane
CO ₂ :	carbon dioxide
CO ₂ e:	carbon dioxide equivalent
EDR:	Electronic Data Reporting System
EPEA:	Environmental Protection and Enhancement Act
GDP:	Gross Domestic Product
GWP:	Global Warming Potential
HFCs:	hydrofluorocarbons
IPCC:	Intergovernmental Panel on Climate Change
kt:	kilotonne
Mt:	megatonne
N ₂ O:	nitrous oxide
PFCs:	perfluorocarbons
SF ₆ :	sulphur hexafluoride
UNFCC :	United Nations Framework Convention on Climate Change

1.0 Alberta taking action on climate change

1.1 Goals and policies

The Government of Alberta is committed to reducing greenhouse gas emissions. Alberta's plans are outlined in its *2008 Climate Change Strategy*. The strategy builds on what has already been done: implementing the first legislation of its kind in Canada to reduce greenhouse gas emissions, laying out the long-term roadmap to Alberta's 2020 and 2050 reduction objectives.

The strategy reflects Alberta's unique position as an energy supplier to the world and the reality that, for the foreseeable future, the world will continue to rely on Alberta's secure supply of oil and gas. The strategy also establishes practical, achievable goals for real reductions in greenhouse gas emissions. Instead of setting arbitrary targets, Alberta's approach breaks the problem down into manageable "wedges" for action with corresponding reductions in emissions set for each wedge. Alberta recognizes that continuous changes and targeted actions will be required as we learn more, achieve positive results, and identify new opportunities and solutions.

Alberta's 2008 Climate Change Strategy commits to taking action on three themes: conserving and using energy efficiently; implementing carbon capture and storage; and greening energy production to transform the way we produce energy and to introduce cleaner, more sustainable approaches to energy production. The strategy also commits to quantitative results:

Year	Goal	Result
2010	Reduce projected emissions by 20 megatonnes	Meet intensity target established in 2002 plan
2020	Reduce projected emissions by 50 megatonnes	Stabilize greenhouse gas emissions and begin reductions
2050	Reduce projected emissions by 200 megatonnes	Emissions reduced by 50 per cent below business as usual level and 14 per cent below 2005 levels

Alberta's provincial *Specified Gas Reporting Program* is an important aspect of managing climate change, providing real data to inform and enable effective policies for reducing industrial emissions of greenhouse gases. The three main components of the *Specified Gas Reporting Program* are: the *Specified Gas Reporting Standard*, the *Specified Gas Reporting Regulation*, and the *Climate Change and Emissions Management Act*. The reporting program is intended to work in concert with the *Specified Gas Emitters Regulation*. Information gathered under the program is needed to assist both the province and industry in characterizing emission sources and identifying opportunities for emission reductions. The program provides an annual inventory of greenhouse gas emissions from large industrial facilities in the province and provides a platform for smaller facilities to voluntarily report their greenhouse gas emissions. It also assists the government in monitoring the results of greenhouse gas reduction strategies.

1.2 Specified Gas Reporting Program

The Alberta *Specified Gas Reporting Program* requires that all large Alberta industrial facilities emitting more than 100,000 tonnes of greenhouse gases in carbon dioxide equivalent (CO₂e) units per year—based on the sum of direct emissions of carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O), hydrofluorocarbons (HFC), perfluorocarbons (PFC) and sulphur hexafluoride (SF₆)—report their greenhouse gas emissions to Alberta Environment. Facilities that do not exceed the 100 kt regulatory threshold may voluntarily report their emissions under the *Specified Gas Reporting Program*.

Facilities are required to submit their reports through an Electronic Data Reporting (EDR) system, which is administered by Statistics Canada. In 2005 (for 2004 emissions collection), Alberta harmonized its *Specified Gas Reporting Program* with the *National Mandatory Greenhouse Gas Reporting Program*. Alberta Environment and Environment Canada have jointly collected 2004, 2005, 2006 and 2007 greenhouse gas data from Alberta's largest industrial emitters. Alberta facilities report once through the EDR and results are forwarded to Environment Canada and Alberta Environment to satisfy both provincial and federal reporting requirements. Alberta facilities are required to submit separate statements of certification and requests for confidentiality directly to both Environment Canada and Alberta Environment via mail or courier.

1.3 Specified Gas Emitters Regulation

The *Specified Gas Emitters Regulation* came into force on July 1, 2007 and is an important step in delivering on the Alberta's *2008 Climate Change Strategy*. The new requirement for large industry to reduce their emissions intensity by 12 per cent is mandated under a regulation in the *Climate Change and Emissions Management Act*.

The *Specified Gas Emitters Regulation* requires all facilities in Alberta emitting over 100,000 tonnes of carbon dioxide equivalent (CO₂e) per year to reduce their emissions intensity by 12 per cent below a baseline based on 2003-2005 emissions. New facilities, or those facilities that began operation on or after January 1, 2000 and that have completed less than 8 years of commercial operation, are required to reduce their emissions intensity by 2 per cent per year starting in their fourth year of commercial operations. Facilities have several options to meet their emissions intensity reduction targets:

- Improve facility operations and efficiency.
- Pay \$15 per tonne of CO₂e into the Climate Change and Emissions Management Fund, which creates a pool of resources to enable additional projects or technology aimed at reducing greenhouse gas emissions in the province.
- Purchase emission offset credits generated from projects by facilities not subject to the *Specified Gas Emitters Regulation*. These credits must be from Alberta-based projects that occurred after January 1, 2002.

- Purchase emission performance credits from facilities that are subject to the *Specified Gas Emitters Regulation*. Some facilities may have reduced their emissions intensity beyond their target and may want to sell any extra reduction as a credit.

Facilities that exceed the 100,000 tonnes CO₂e reporting threshold must satisfy the requirements of both the *Specified Gas Emitters Regulation* and the *Specified Gas Reporting Regulation*. In time, Alberta will move to harmonize the two regulations to ensure easier reporting for facilities. The data collected under the *Specified Gas Emitters Regulation* will be used to update the emissions reported in the *Specified Gas Reporting Regulation* as this data must be verified by a third party and should therefore be of higher accuracy.

2.0 Specified Gas Reporting Regulation Annual Report

2.1 Objective

This report is designed to communicate results from the 2007 reporting year of the *Specified Gas Reporting Program* and to provide analysis of those results that are not provided elsewhere to Albertans. This report builds on previous annual reports available at:

www.environment.alberta.ca/2881.html

2.2 Report content

The 2007 data collected under the *Specified Gas Reporting Regulation* is examined by greenhouse gas species, facility type and by source category. The 2007 data is also compared to the data from past years of specified gas reporting.

The 2007 Alberta data is also compared to the 2007 greenhouse gas emissions data collected under the *National Mandatory Greenhouse Gas Reporting Program*, which is a harmonized program that covers large industrial facilities for all of Canada. The data collected under the *Specified Gas Reporting Program* provides an annual inventory of greenhouse gas emissions from large industrial facilities in the province. It is also used to help track progress of greenhouse gas emission reduction strategies.

2.3 About the data

This report uses data from the *Specified Gas Reporting Program* that is current as of September 3, 2007. Any changes to the Alberta or national greenhouse gas databases after this date are not reflected in this report. Rounding of emissions data has been done to present workable numbers in this report. As a result, the numbers presented in this report may differ slightly in sections of this report and may also differ slightly from the same data presented from other sources. This report uses greenhouse gas emissions data from two sources: the Alberta *Specified Gas Reporting Program* and the *National Mandatory Greenhouse Gas Reporting Program*.

The 2003, 2004, 2005, 2006 and 2007 reported Alberta greenhouse gas data was collected in accordance with the *Climate Change & Emissions Management Act*, *Specified Gas Reporting Regulation* and the associated *Specified Gas Reporting Standard* collected through the one window reporting system.

Reported greenhouse gas data for the rest of Canada was collected through the *National Mandatory Greenhouse Gas Reporting Program*, under the authority of the *Canadian Environmental Protection Act*, 1999 and is published on Environment Canada's website at:

www.ec.gc.ca/pdb/ghg/facility_e.cfm

2.4 Data changes

The 2007 greenhouse gas data was collected using the March 2007 *Specified Gas Reporting Standard*. There have been updates to the 2003, 2004, 2005 and 2006 datasets used in this report and therefore data in this report may differ from what was published in previous Alberta Environment greenhouse gas reports.

2.5 Changes to Reporting

There has been a change to way data is being reported by Alberta Environment for the 2007 greenhouse gas emissions data collected under the *Specified Gas Reporting Program* compared to other reporting years. The breakdown of the sectors has been classified based on the reported North American Industrial Classification System (NAICS) code and grouped into the following industrial sectors:

- Waste Management (Previously Landfills)
- Pipeline Transportation (Previously Pipelines)
- Mineral Manufacturing (Previously cement, lime and metal manufacturing)
- Chemical Manufacturing (Previously fertilizer and petroleum chemicals)
- Refineries
- Paper Manufacturing (Previously Forestry)
- Utilities (Previously Electricity)
- Coal Mining
- Oil Sands
- In-Situ (Previously Heavy Oil)
- Conventional Oil and Gas Extraction (Previously Gas Processing)

In most illustrations within this report the waste management, pipeline transportation, mineral manufacturing, paper manufacturing and coal mining have been aggregated together as an “other” category because of the small size of emissions from these sectors relative to the others.

2.6 Data quality and program enforcement

The 2007 greenhouse gas emissions data that was collected under the *Specified Gas Reporting Program* has undergone several checks by Alberta Environment, Environment Canada and Statistics Canada to ensure facilities exceeding the threshold complied with the requirement to report and to attempt to identify major errors in submitted data. As these are reported values, it is up to the reporting facilities to submit the most accurate greenhouse gas emissions data possible.

Facilities are required to retain all records, data and information used in the preparation of a specified gas report for at least three years after the report is submitted. Facilities must also submit a statement of certification signed by a certifying official at the facility (a person with authority to bind the reporting company) stating that they reviewed the

specified gas report, and exercised due diligence to ensure that the submitted information is true and complete and that the amounts and values being submitted are accurate, based on reasonable estimates using available data. These regulatory requirements ensure that facilities are submitting reasonably correct emissions information and that there is a paper trail in case Alberta Environment needs to verify the submitted emissions data.

Reporting to the *Specified Gas Reporting Program* is a mandatory regulatory requirement for facilities exceeding the 100 kt CO₂e reporting threshold. The program provides an inventory of greenhouse gas emissions in the province for large emitters only, and does not include smaller sources of emissions. Some unregulated facilities that do not exceed the threshold are voluntary participants in the program and are included in the inventory.

The *Specified Gas Reporting Program* has no requirement for facilities to use consistent methods across different reporting years, no requirement for similar facilities to use the same calculation methods and no requirement for a provincial or national auditing program.

Facilities that fail to meet the regulatory requirements of the *Specified Gas Reporting Program* could face enforcement action. Additional information on enforcement can be found by consulting the *Specified Gas Reporting Regulation, Administrative Penalty Regulation* and the *Climate Change and Emissions Management Act*.

2.7 Voluntary reporting

Under the *Specified Gas Reporting Program* facilities that do not exceed the 100 kt CO₂e reporting threshold may choose to voluntarily submit a specified gas report. There were 18 Alberta facilities that voluntarily reported 2007 emissions to Alberta Environment. The combined total reported greenhouse gas emissions of these 18 facilities were 1.1 Mt or 1 per cent of total 2007 reported greenhouse gas emissions. Total reported greenhouse gas emissions from these 18 voluntary reporters ranged from 0.6 to 98.1 kt. Alberta Environment encourages industrial facilities that do not exceed the reporting threshold to voluntarily report their greenhouse gas emissions to the *Specified Gas Reporting Program*.

Alberta Environment would like to acknowledge the following companies for voluntarily submitting a specified gas report for one or more of their facilities.

Alberta-Pacific Forest Industries Inc.
Imperial Oil Resources
PENGROWTH CORPORATION
MEGlobal Canada Inc.
Apache Canada Ltd.
Daishowa-Marubeni International Ltd.
City of Calgary

EnCana Oil & Gas Co. Ltd.
Mazeppa Processing Partnership
TransCanada Energy Ltd.
Dow Chemical Canada Inc.
ATCO Power Alberta Limited Partnership
Alberta Power (2000) Ltd.
General Scrap Partnership

3.0 2007 reported Alberta greenhouse gas emissions

3.1 Total reported greenhouse gas emissions

Alberta facilities reported a total of 114.4 Mt CO₂e of greenhouse gas emissions through the *Specified Gas Reporting Program* in 2007. Total reported greenhouse gas emissions are the sum of carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O), species of hydrofluorocarbons (HFC), species of perfluorocarbons (PFC) and sulphur hexafluoride all converted to carbon dioxide equivalent units using global warming potentials specified in the *Specified Gas Reporting Standard*. Reported greenhouse gas emissions by facility are presented in Table 3 in the appendix.

Carbon dioxide emissions made up the largest portion of greenhouse gas emissions, contributing 96 per cent of the total with 110.0 Mt. Methane (2 per cent or 3 Mt CO₂e), nitrous oxide (1 per cent or 2 Mt CO₂e), hydrofluorocarbons (< 1 per cent or 2 kt CO₂e) and sulphur hexafluoride (<1 per cent or 5 t CO₂e) all contributed to the total in smaller quantities. There were no emissions of perfluorocarbons reported for 2007. Figure 1 shows the breakdown of total reported emissions by each greenhouse gas.

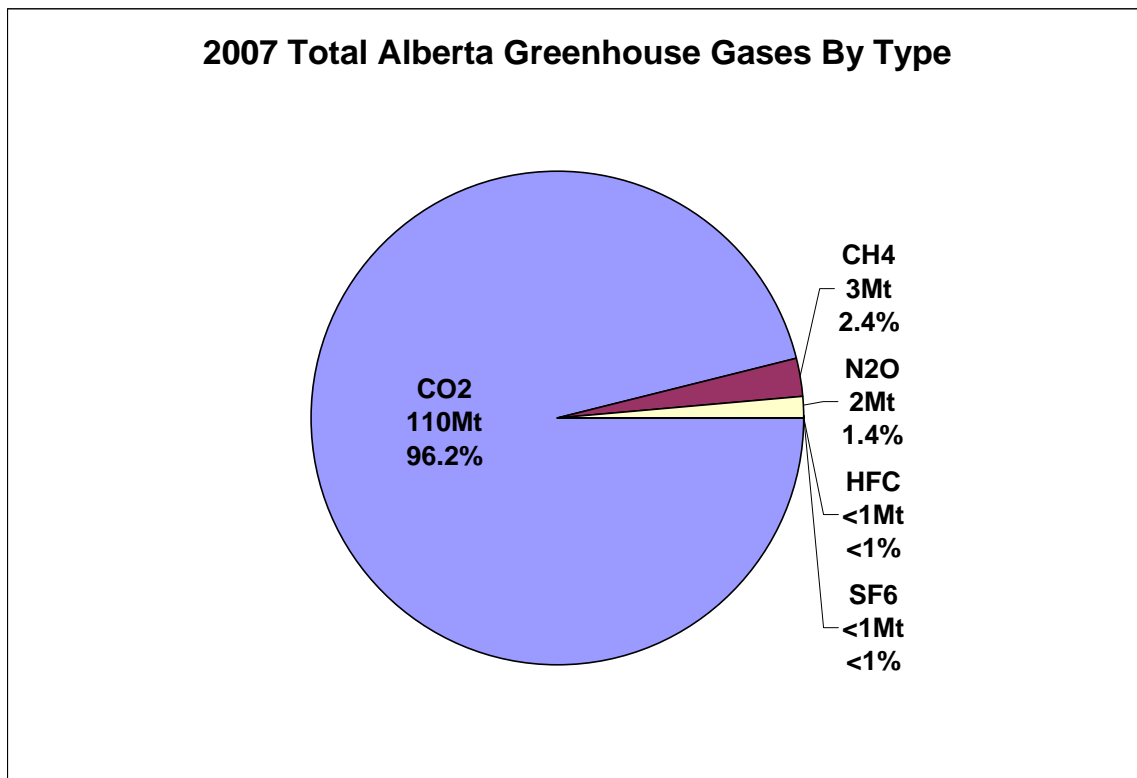


Figure 1: 2007 Total Reported AB GHG Emissions by Gas Type.

In 2007 a total of 106 Alberta facilities reported greenhouse gas emissions to Alberta Environment. Carbon dioxide was reported by all of these 106 Alberta facilities. One hundred-three and 101 facilities reported emissions of methane and nitrous oxide respectively. The facilities that reported no emissions of methane were in the mineral manufacturing sectors. The five facilities that reported no emissions of nitrous oxide were in the mineral manufacturing, waste management and chemical sectors.

3.2 Total greenhouse gas emissions by sector

The utilities sector was the largest source of 2007 emissions with 49.9 Mt representing 44 per cent of 2007 total emissions. Oil sands facilities were the second largest source with 23 per cent of total emissions or 26.5 Mt. Chemical facilities were also a significant source of emissions with 10.5 Mt or 9 per cent of total emissions. In-situ operations added 8.9 Mt of emissions and represented 8 per cent of the grand total. Conventional oil and gas extraction facilities represented 7 per cent of total reported emissions with 7.7 Mt. The oil refining facilities made up 4 per cent of the total reported emissions with 4.3 Mt. Facilities in the waste management, pipeline transportation, mineral manufacturing, paper manufacturing and coal mining sectors together accounted for the remaining 6.6 Mt or 6 per cent of total reported emissions. [Figure 2](#) shows the breakdown of total reported greenhouse gas emissions by industrial sector.

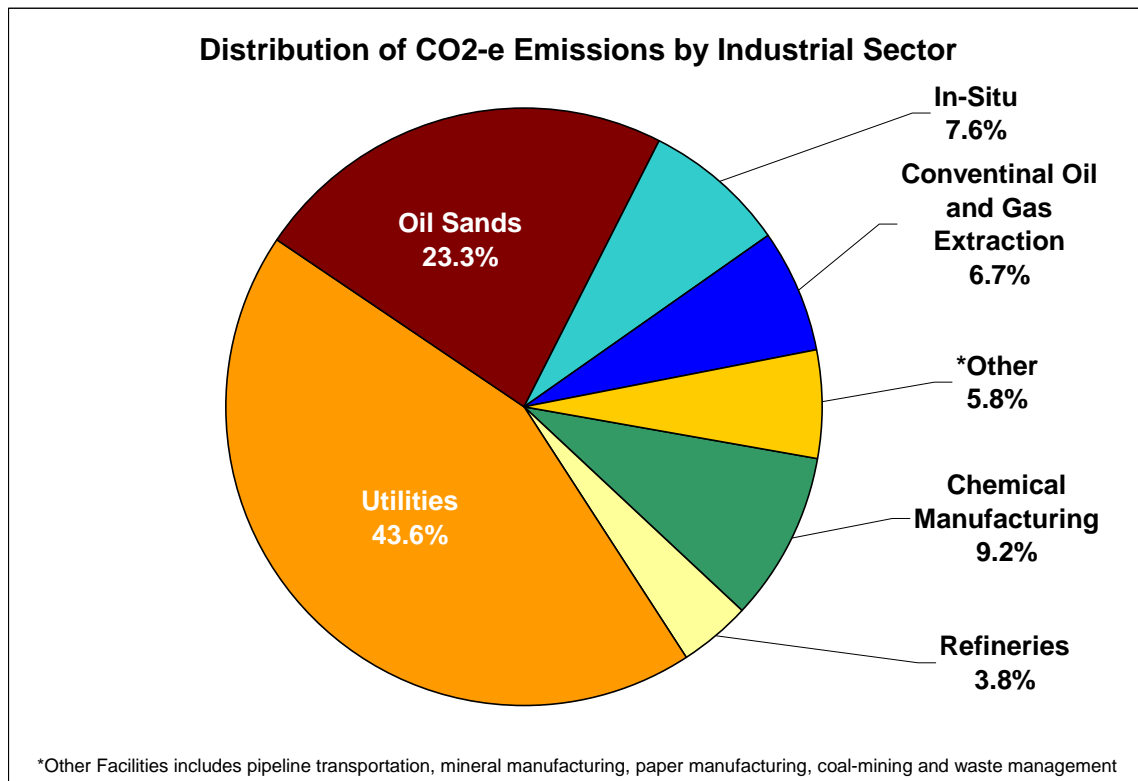


Figure 2: 2007 Total Reported AB GHG Emissions by Industrial Sector (total emissions = 114.4 Mt CO₂e).

There were 106 Alberta facilities that reported 2007 greenhouse gas emissions under the *Specified Gas Reporting Program*. Table 1 shows the number of facilities reporting and average emissions by sector for facilities reporting greenhouse gas emissions for 2007. The conventional oil and gas extraction sector included the largest number of facilities at 32 and had average greenhouse gas emissions of 239 kt CO₂e per facility. There were 24 utilities facilities that reported 2007 greenhouse gas emissions to Alberta Environment. These facilities had an average of 2,078 kt CO₂e per facility of greenhouse gas emissions. The utilities sector was the largest sectoral contributor to 2007 total reported Alberta greenhouse gas emissions. The five oil sands facilities averaged 5,328 kt CO₂e per facility of greenhouse gas emissions. This sector was the second largest source of greenhouse gas emissions. The 17 chemical manufacturing facilities averaged 618 kt CO₂e per facility of greenhouse gas emissions and was the third largest source of reported greenhouse gas emissions in 2007. The in-situ sector contained 8 facilities and had an average of 1,093 kt CO₂e per facility of emissions. This was the fourth largest sectoral contributor to the total. The remaining 20 facilities were distributed among the waste management, pipeline transportation, mineral manufacturing, refining, paper manufacturing and coal mining sectors. The average reported greenhouse gas emission for all 106 facilities was 1,079 kt CO₂e per facility, 3.3 per cent less than the average in 2006.

Table 1: Average Facility Emissions by Sector.

Industrial Sector	Facilities Reporting	Average Facility Emissions (kt)
Waste Management	1	90
Pipeline Transportation	4	830
Mineral Manufacturing	6	401
Chemical Manufacturing	17	618
Refineries	3	1,446
Paper Manufacturing	4	115
Utilities	24	2,078
Coal Mining	2	183
Oil Sands	5	5,328
In-Situ	8	1,093
Conventional Oil and Gas Extraction	32	239
Total	106	1,079

3.3 Emissions distribution

The 106 Alberta facilities that reported emissions for 2007 did not equally contribute to the 114.4 Mt total emissions that were reported. The largest 32 emitting facilities in Alberta were responsible for 100.1 Mt or 87 per cent of total 2007 reported emissions. The other 74 facilities that reported greenhouse gas emissions for 2007 accounted for the remaining 13 per cent or 14.3 Mt of the reported emissions. The eight largest emitters all reported over four Mt and together accounted for 62 per cent of total emission. Of these eight facilities, five were utilities facilities, two were oil sands facilities and one was an in-situ facility. [Figure 3](#) shows the reported emissions from the largest to the smallest emitting facilities for 2007 specified gas reporting.

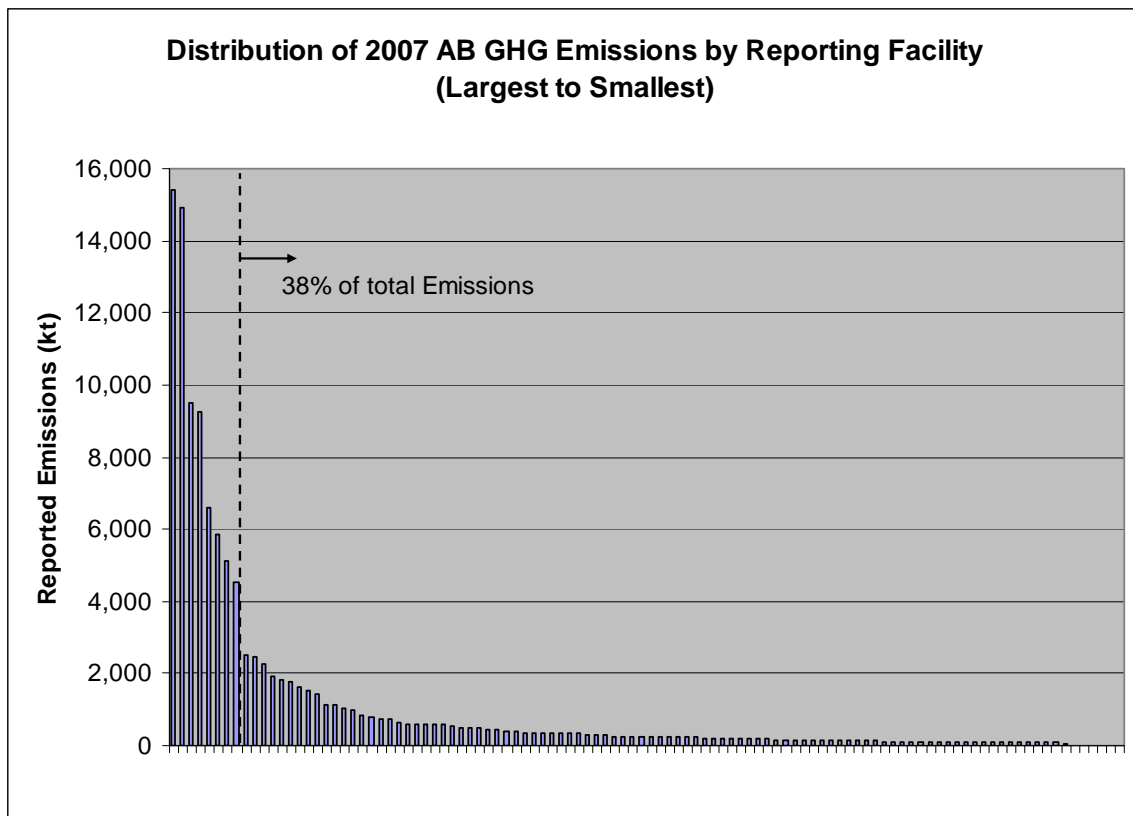


Figure 3: Distribution of 2007 Alberta GHG Emissions by Reporting Facility (Largest to Smallest).

3.4 Reported emissions by industrial sector and gas type

Carbon dioxide made up the majority of reported greenhouse gas emissions for most sectors for 2007 specified gas reporting. Figure 4 shows the percentage contribution of each greenhouse gas to total reported greenhouse gas emissions for each sector. Carbon dioxide was the source of more than 90 per cent of greenhouse gas emissions for the mineral manufacturing, chemical manufacturing, refineries, utilities, oil sands and conventional oil and gas extraction sectors. Methane emissions were significant for waste management (85 per cent), coal-mining (45 per cent), pipeline transportation (12 per cent), paper manufacturing (11 per cent), conventional oil and gas extraction (7 per cent), oil sands (approximately 4 per cent) and in-situ (2 per cent) facilities. Emissions of nitrous oxide were significant for chemical manufacturing (8 per cent) and forest products (11 per cent) facilities. Emissions of hydrofluorocarbons were reported in very small quantities and are therefore excluded from the figure.

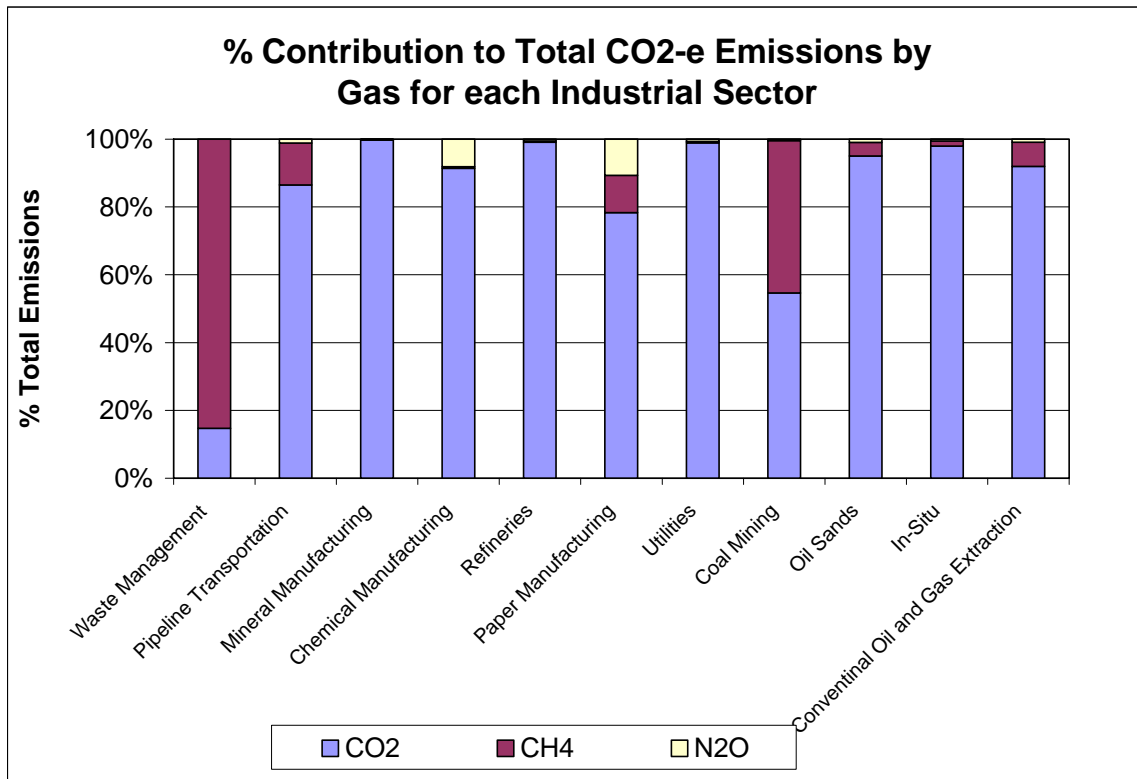


Figure 4: 2007 Total Reported AB GHG Emissions by Gas and Industrial Sector.

4.0 2007 reported Alberta greenhouse gas emissions by source category

The Alberta *Specified Gas Reporting Program* requires reporting of six greenhouse gases: carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O), hydrofluorocarbons (HFC), perfluorocarbons (PFC) and sulphur hexafluoride (SF₆). Emissions of CO₂, CH₄ and N₂O must be reported according to six source categories: stationary fuel combustion, industrial process, other fugitive, venting and flaring, on-site transportation and waste and wastewater. A description of each of these source categories is found in the [Glossary](#) of this document and in each section below.

4.1 Greenhouse gases by source category

The largest quantity of 2007 reported Alberta greenhouse gas emissions were from stationary fuel combustion sources. Emissions from this source category totaled 96.3 Mt or 84 per cent of the 114.4 Mt reported by all Alberta facilities. The second largest quantity (10 per cent) of reported Alberta greenhouse gas emissions came from industrial process sources, with emissions totaling 10.8 Mt. Other fugitive and venting and flaring sources each were responsible for 2 and 3 per cent of total reported Alberta emissions respectively. On-site transportation accounted for 1.6 Mt or 1 per cent of total reported Alberta emissions. Waste and wastewater sources had total emissions of 0.1 Mt, which represented less than 1 per cent of total reported 2007 Alberta emissions. [Figure 5](#) presents the breakdown of 2007 total reported Alberta greenhouse gas emissions by source category.

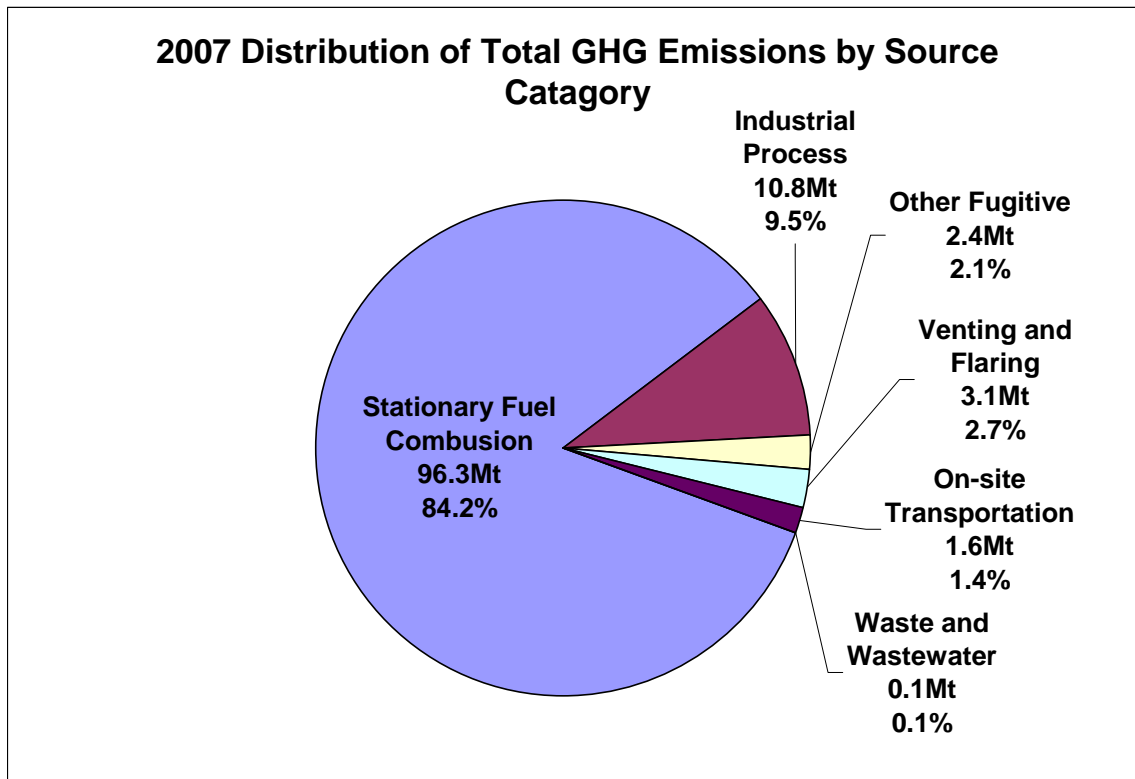


Figure 5: 2007 Distribution of Total GHG Emissions by Source Category.

4.2 Source category by facility type

4.2.1 Stationary fuel combustion

Stationary fuel combustion emissions are direct emissions resulting from non-vehicular combustion of fossil or biomass fuel for the purpose of producing energy. They do not include biomass combustion CO₂ emissions. Stationary fuel combustion is a common source of greenhouse gas emissions and is produced in most industrial sectors. The stationary fuel combustion source category includes on-site waste incineration if the waste is combusted for the purpose of energy production.

The industrial sector with the largest 2007 reported Alberta greenhouse gas emissions from stationary fuel combustion sources was the utilities sector. Greenhouse gas emissions from stationary fuel combustion sources for this sector totaled 49.7 Mt or 52 per cent of the 96 Mt reported combustion emissions by all Alberta facilities. The second largest quantity (20 per cent) of reported Alberta greenhouse gas emissions from stationary fuel combustion sources was the oil sands sector, with emissions totaling 18.9 Mt. In-situ facilities contributed 9 per cent or 8.7 Mt of greenhouse gas emissions to the total combustion emissions. Chemical manufacturers were the source of 7.0 Mt or 7 per cent of total reported greenhouse gas emissions from stationary fuel combustion sources. Gas plants were another major contributor to reported greenhouse gas emissions from stationary fuel combustion sources with 4.8 Mt or 5 per cent of reported emissions from this source category. The refining sector added an additional 2.7 Mt of combustion

emissions, accounting for 3 per cent of the total combustion emissions. The remaining 4.4 Mt or 5 per cent of reported greenhouse gas emissions from stationary fuel combustion sources were from the other category which incorporates the pipeline transportation, paper manufacturing, mineral manufacturing, coal-mining and waste management sectors. Figure 6 presents the breakdown of 2007 total reported Alberta greenhouse gas emissions from stationary fuel combustion sources by facility type.

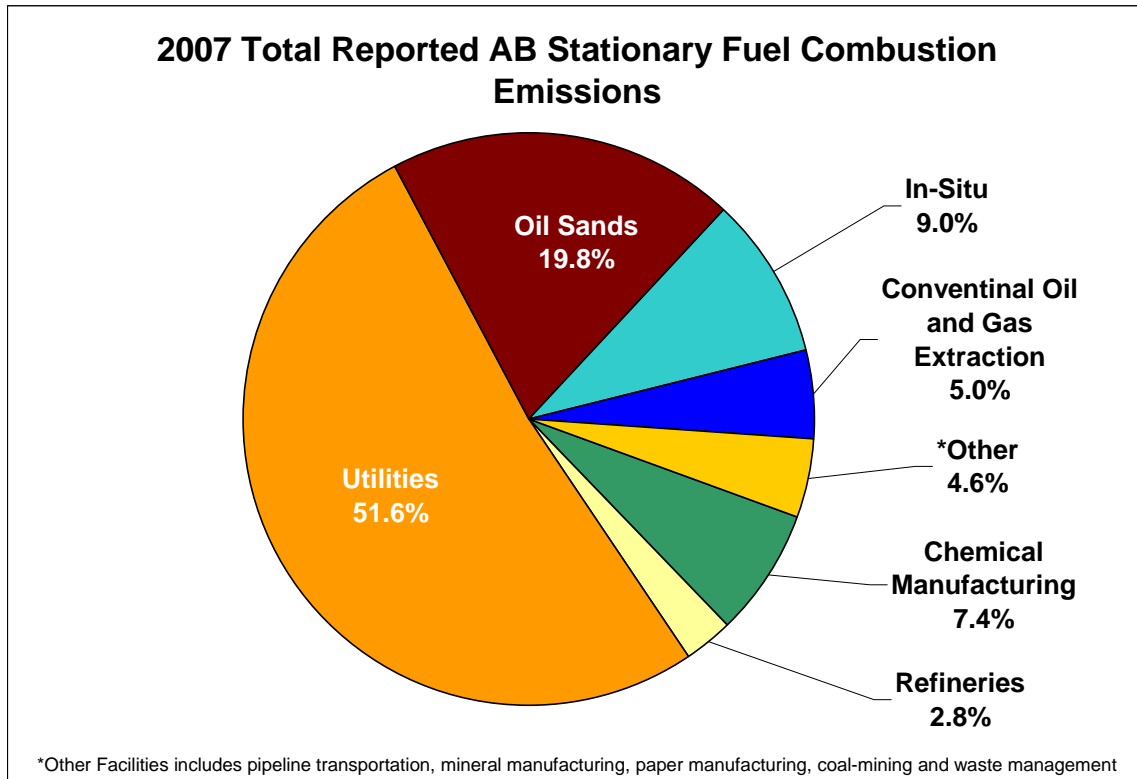


Figure 6: 2007 Total Reported AB Stationary Fuel Combustion Emissions.

4.2.2 Industrial process

Industrial process emissions are defined as direct emissions from an industrial process involving chemical or physical reactions, other than combustion, and where the primary purpose of the industrial process is not energy production. This includes mineral, metal and chemical production. This source category is more sector-specific than stationary fuel combustion and is not found in all industrial sectors.

The industrial sector with the largest 2007 reported Alberta greenhouse gas emissions from industrial process sources was the oil sands sector. Greenhouse gas emissions from industrial process sources for this sector totaled 4.2 Mt or 39 per cent of the 10.8 Mt reported by all Alberta facilities. The second largest quantity (29 per cent) of reported Alberta greenhouse gas emissions from industrial process sources were from the chemical manufacturers, with greenhouse gas emissions totaling 3.2 Mt. The refining sector reported 1.5 Mt of industrial process emissions accounting for 14 per cent of the

total industrial process emissions. Gas plants added 0.6 Mt of industrial processing emissions or 5 per cent of total industrial process sources. The remaining 13 per cent of reported Alberta greenhouse gas emissions from industrial process sources came from the mineral manufacturing, paper manufacturing, and coal mining sectors. The waste management, pipeline transportation, utilities and in-situ sectors did not report any industrial process emissions. Figure 7 presents the breakdown of 2007 total reported Alberta emissions from industrial process sources by facility type.

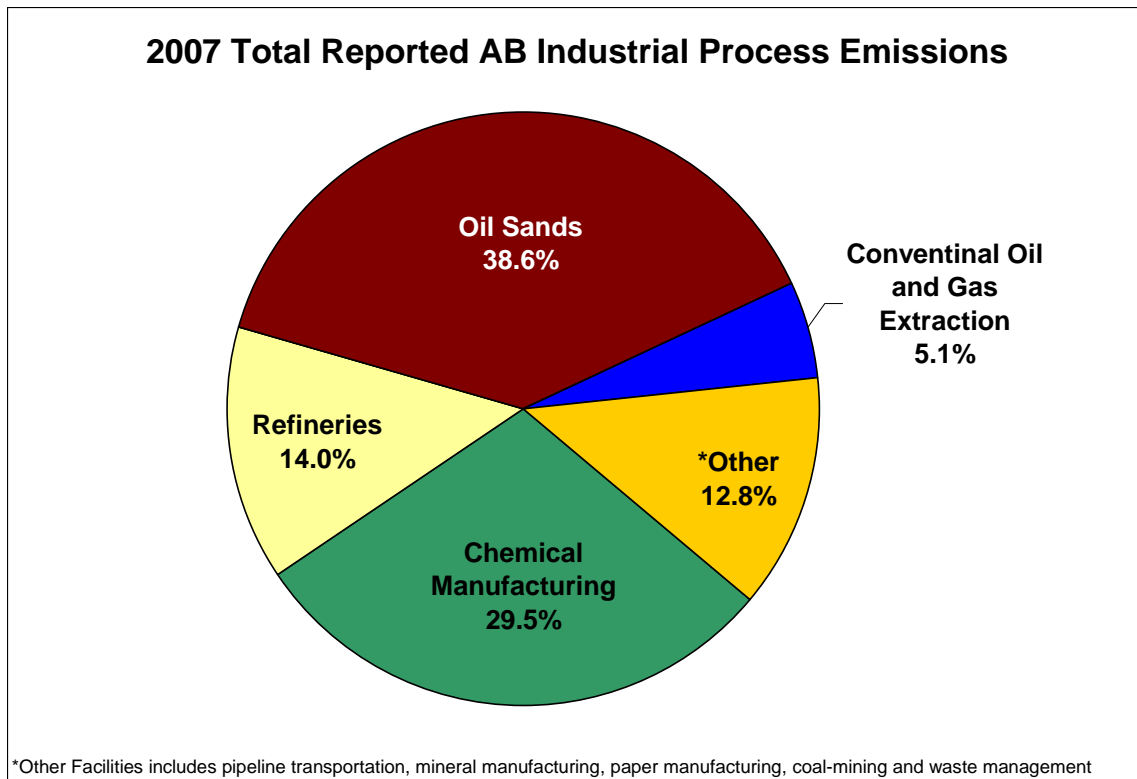


Figure 7: 2007 Total Reported AB Industrial Process Emissions.

4.2.3 Venting and flaring

Flaring emissions are direct emissions from the controlled combustion of a gas or liquid stream produced on site not for the purpose of producing energy. Venting emissions are direct emissions from intentional releases to the atmosphere of a waste gas or liquid stream. Together both of these types of emissions make up the venting and flaring category.

The largest venting and flaring emissions reported originated from the conventional oil and gas extraction sector. Greenhouse gas emissions from venting and flaring from this sector totaled 1.9 Mt or 61 per cent of the 3.1 Mt total reported by all Alberta facilities. The second largest source of venting and flaring emissions (24 per cent) were from the oil sands sector, with greenhouse gas emissions totaling 0.8 Mt. Chemical manufacturers were next largest source with approximately 0.2 Mt or 6 per cent of reported venting and

flaring emissions. Refineries accounted for 5 per cent of the total venting and flaring emissions, which added approximately 0.1 Mt of emissions. The remaining venting and flaring emissions originated in the pipeline transportation, utilities and in-situ sectors. Figure 8 presents the breakdown of 2007 total reported Alberta emissions from venting and flaring sources by facility type.

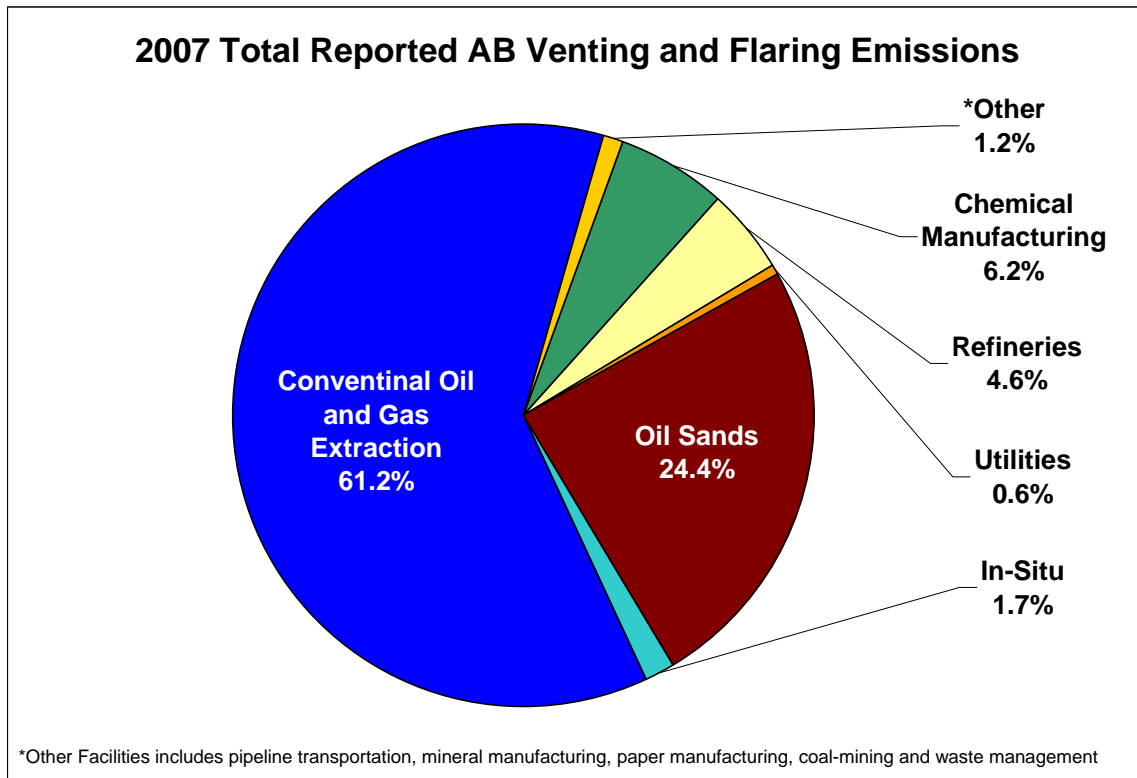


Figure 8: 2007 Total Reported AB Venting and Flaring Emissions.

4.2.4 Other fugitive

Other fugitive emissions are direct emissions that do not fall under stationary fuel combustion emissions, industrial process emissions, venting emissions, flaring emissions, on-site transportation emissions, or waste and wastewater emissions. In general, emissions from other fugitive sources are a result of the handling or processing of various types of fuel in the fossil fuel industry. Other fugitive emissions are mainly methane which makes up 89.2 per cent of the total other fugitive category.

The industrial sector with the largest 2007 reported Alberta greenhouse gas emissions from other fugitive sources was the oil sands sector. Greenhouse gas emissions from other fugitive sources for this sector totaled 1.2 Mt or 51 per cent of the 2.4 Mt reported by all Alberta facilities. The second largest source of other fugitive emissions (22 per cent) was the amalgamated other sector, which was dominated by the pipeline transportation sector. Total other emissions accounted for 0.5 Mt. Conventional oil and gas extraction facilities were the third largest source of fugitives with 16 per cent or 0.4

Mt of emissions. The remaining 11 per cent of reported greenhouse gas emissions from other fugitive sources were from the utilities, in-situ, chemical manufacturing and refining sectors. [Figure 9](#) presents the breakdown of 2007 total reported Alberta emissions from other fugitive sources by facility type.

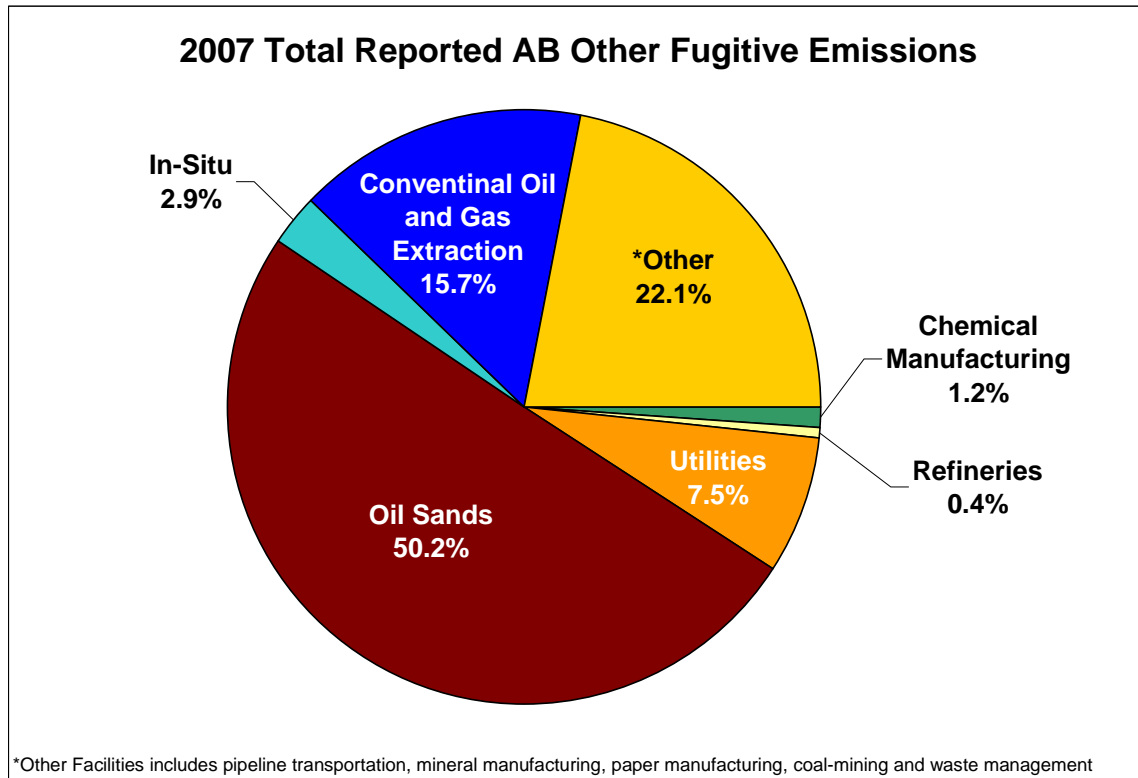


Figure 9: 2007 Total Reported AB Other Fugitive Emissions.

4.2.5 On-site transportation

On-site transportation is a greenhouse gas source category with direct emissions resulting from fuel combustion in machinery used for the on-site transportation of products and materials integral to the production process.

The industrial sector with the largest 2007 reported Alberta greenhouse gas emissions from on-site transportation sources was the oil sands sector. Greenhouse gas emissions from on-site transportation in this sector totaled 1.4 Mt or 89 per cent of the 1.6 Mt reported by all Alberta facilities. The only other major source of reported Alberta greenhouse gas emissions from on-site transportation sources were from the coal-mining sector (included in the amalgamated other category). The total other group, dominated by coal-mining, had greenhouse gas emissions of 10 per cent or 0.2 Mt of total reported Alberta greenhouse gas emissions from this source category. The remaining emissions from on-site transportation sources were from the in-situ, chemical manufacturing and electricity sectors. [Figure 10](#) presents the breakdown of 2007 total reported Alberta emissions from on-site transportation sources by facility type.

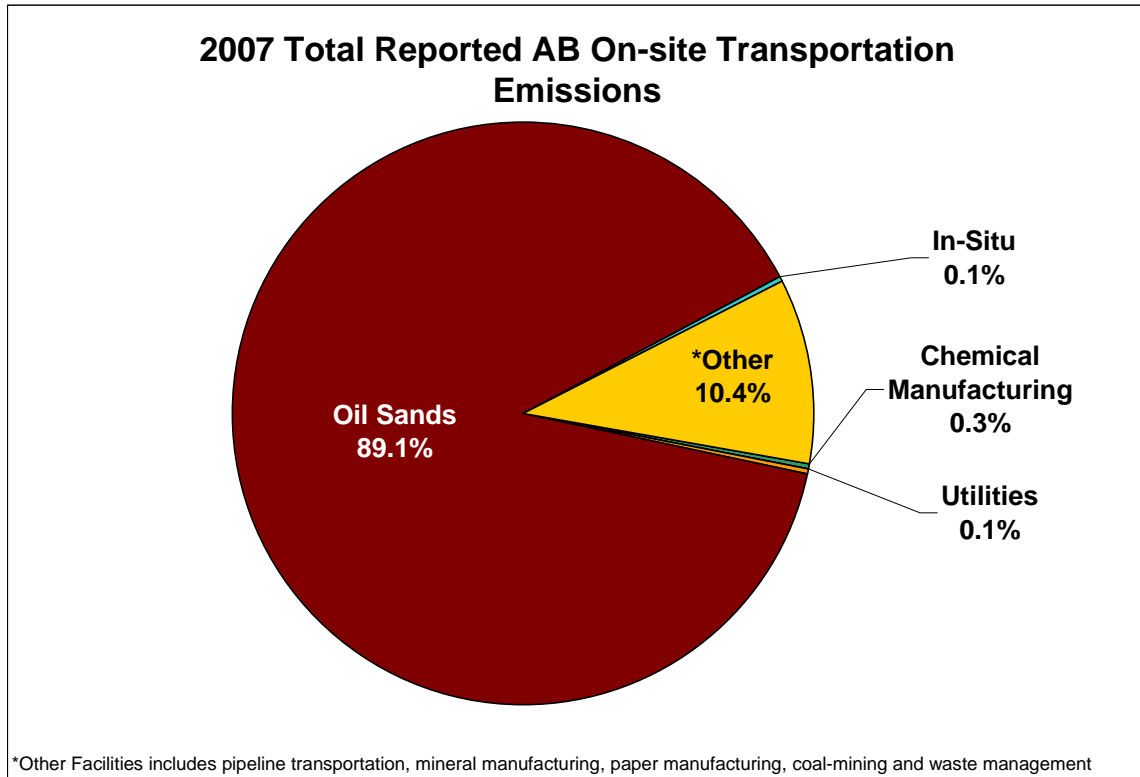


Figure 10: 2007 Total Reported AB On-site Transportation Emissions.

4.2.6 Waste and wastewater

Waste and wastewater emissions are direct emissions from disposal of waste and waste or wastewater treatment.

The industrial sector with the largest 2007 reported Alberta greenhouse gas emissions from waste and wastewater sources was the waste management and paper manufacturing sectors (included in the amalgamated other category). Greenhouse gas emissions from waste and wastewater sources for this sector totaled 135.9 kt or 92 per cent of the 148.5 kt reported by all Alberta facilities. The only other major source of emissions from waste and wastewater sources were from the oil sands sector, with greenhouse gas emissions totaling 11.3 kt or 8 per cent of total reported Alberta greenhouse gas emissions from this source category. The remaining quantity (less than 1 per cent) of reported greenhouse gas emissions from waste and wastewater was generated in the in-situ and chemical manufacturing sectors. [Figure 11](#) presents the breakdown of 2007 total reported Alberta emissions from waste and wastewater sources by facility type.

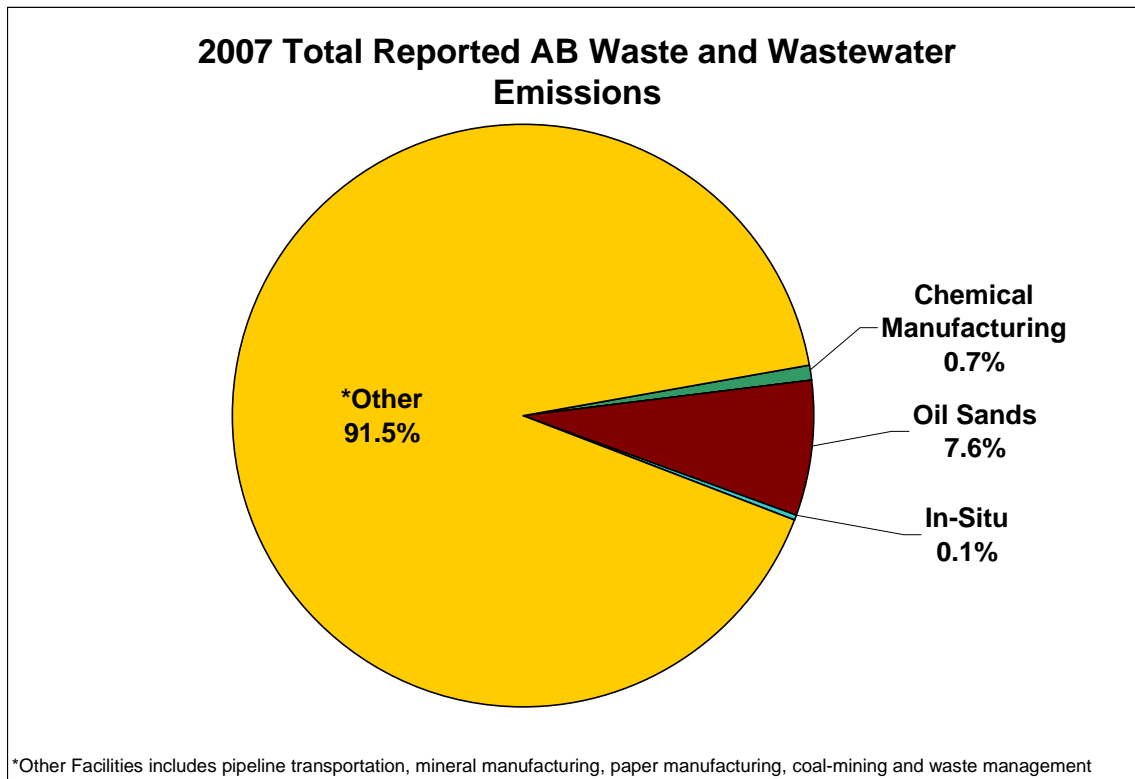


Figure 11: 2007 Total Reported AB Waste and Wastewater Emissions.

4.2.7 Biomass

Biomass is plant materials, animal waste or any product made of either of these. Reporting of carbon dioxide emissions from the combustion of biomass is a mandatory reporting requirement in the *Specified Gas Reporting Program*, however in accordance with national and international reporting requirements, these emissions are not included in CO₂ emissions totals. Emissions of CH₄ and N₂O from biomass combustion are included as stationary combustion emissions and included in the emission totals. This is in order to be consistent with the *Intergovernmental Panel on Climate Change (IPCC) guidelines for national greenhouse gas inventories*. The IPCC guidelines state that CO₂ emissions from biomass may not be net emissions if the biomass is sustainably produced. Therefore CO₂ emissions from biomass are treated separately from other categories of CO₂ and are excluded from the greenhouse gas emission totals.

There were nine Alberta facilities that reported 2007 CO₂ emissions from the combustion of biomass. A total of 5.2 Mt of CO₂ emissions from biomass combustion were reported. Four of the facilities reporting CO₂ biomass combustion emissions were from the paper manufacturing sector, three were from the oil sands sector, one was from the waste management sector and one was in the chemical manufacturing industry. The forest products facilities were responsible for the majority of the reported CO₂ emissions from biomass combustion with 4.9 Mt or 94.4 per cent of reported emissions. The oil sands facilities were the source of 0.3 Mt or 5.5 per cent of reported CO₂ emissions from biomass combustion. The waste management and chemical facilities were both a source

of <1 per cent of emissions with 1.4 kt and 2.3 kt respectively. [Figure 12](#) presents the 2007 total reported Alberta CO₂ emissions from the major sources of biomass combustion emissions by facility type.

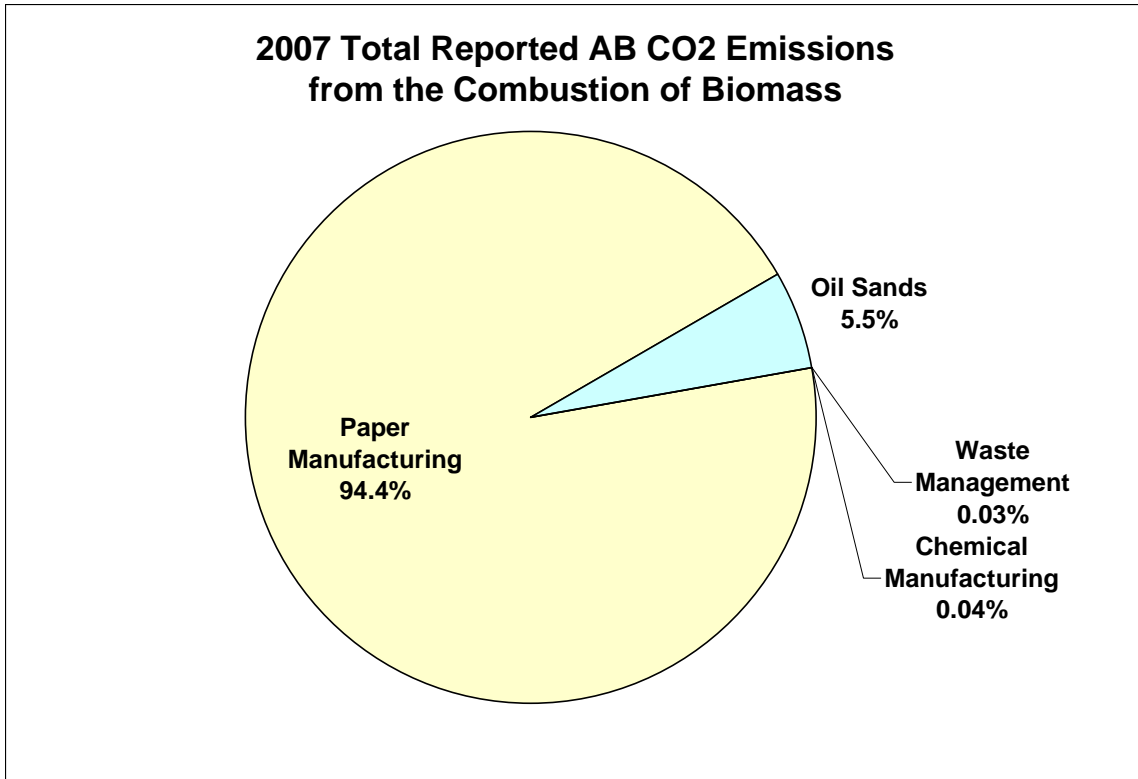


Figure 12: 2007 Total Reported AB CO₂ Emissions from Biomass Combustion.

5.0 Comparison with previous reporting periods

Two thousand seven was the fifth year of mandatory greenhouse gas emissions reporting for large industrial facilities in Alberta. Approximately 100 Alberta facilities have been reporting to the *Specified Gas Reporting Program* during this time, although the actual facilities reporting have varied somewhat between years due to facilities falling above or below the reporting threshold. This section of the report examines trends in reported emissions over the past five years.

Note: There are limitations to how comparable the reported emissions are between the reporting years, due primarily to a lack of information being collected on the calculation methods and reference materials used by facilities in determining their emissions. The present amount of information collected is insufficient to determine if a facility has calculated its emissions consistently across reporting years. Some of the changes in the reported emissions of facilities may be the result of changes to calculation methods used instead of changes to the actual greenhouse gas emissions coming from that facility.

Similarly, industrial sectors are not required to use the same calculation methods and reference materials across the sector. Two similar facilities may therefore be using different methods to calculate emissions and therefore the emissions of these facilities may not be comparable. Differences or changes may occur simply due to the different ways facilities calculated their emissions.

5.1 Comparison of 2006 and 2007 reported greenhouse gas emissions

Total reported greenhouse gas emissions from Alberta facilities decreased from 115.4 to 114.4 Mt between the 2006 and 2007 reporting years. This was a 1.0 Mt or about a 1 per cent decrease in the total reported emissions. There was an increase of three facilities reporting greenhouse gas emissions between 2006 and 2007 (from 103 to 106). [Figure 13](#) shows the number of Alberta facilities reporting 2006 and 2007 greenhouse gas emissions by facility type. There were the same numbers of waste management, pipeline transportation, chemical manufacturing, refinery, forestry and coal mining facilities reporting 2006 and 2007 greenhouse gas emissions. There were two additional mineral manufacturing facilities, one additional oil sands facility, one additional in-situ facility and one additional utility facility that reported 2007 greenhouse gas emissions versus 2006 reporting. There were two fewer conventional oil and gas extraction facilities that reported 2007 greenhouse gas emissions than reported 2006 emissions. Changes in the number of facilities reporting greenhouse gas emissions can be due to facilities falling or rising above the 100 kt CO₂e reporting threshold in different years due to shutdowns, changes in production or operations or additions of control technologies. Changes in the number of facilities reporting greenhouse gas emissions also results from fluctuations in the number of facilities voluntarily reporting.

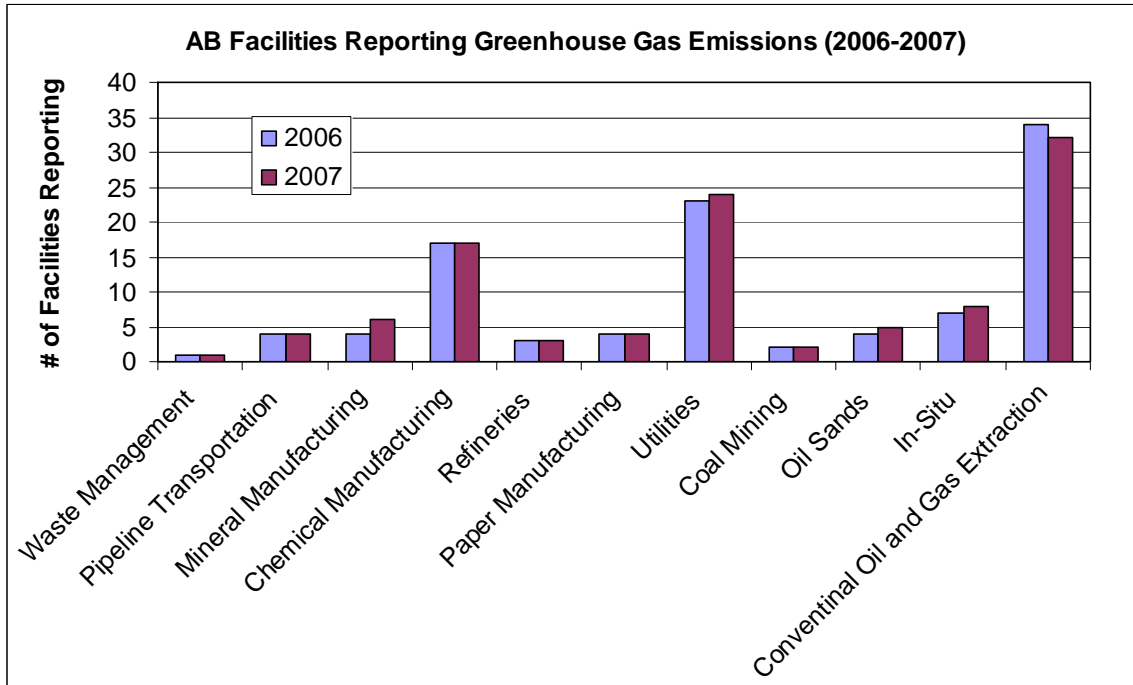


Figure 13: AB Facilities Reporting GHG Emissions (2006 and 2007).

There were 100 Alberta facilities that reported both 2006 and 2007 greenhouse gas emissions. The net change in emissions for these 100 facilities was a decrease of 0.9 Mt between 2006 and 2007 (from 114.8 to 113.9 Mt). There were 40 facilities that reported higher greenhouse gas emissions for 2007 than 2006 and 60 facilities that reported lower emissions for 2007. Greenhouse gas emissions from facilities seeing increases rose by a total of 3.7 Mt. Greenhouse gas emissions from facilities that reported decreases declined by a total of 4.6 Mt.

The average change in emissions for the 100 facilities was a 2.4 per cent decrease. However, there was significant variability in these facilities emissions illustrated by an average absolute change in emissions of 13.8 per cent.

5.2 Comparison of 2004 and 2007 reported greenhouse gas emissions

Total reported greenhouse gas emissions from Alberta facilities increased from 109.1 Mt to 114.4 Mt between 2004 and 2007. This is a 5.3 Mt or a 5 per cent increase in the total reported emissions. The number of facilities reporting also increased from 98 to 106 facilities over this time period. The same number of facilities had reported in the waste management, pipeline transportation, refinery and paper manufacturing sectors. There were four utilities, two mineral manufacturing, two chemical manufacturing, one oil sand, one in-situ and one coal mine which had reported in 2007 but not in 2004. There were three conventional oil and gas extraction facilities that had reported in 2004 but not 2007. [Figure 14](#) shows the number of facilities that reported in 2004 and 2007 by sector.

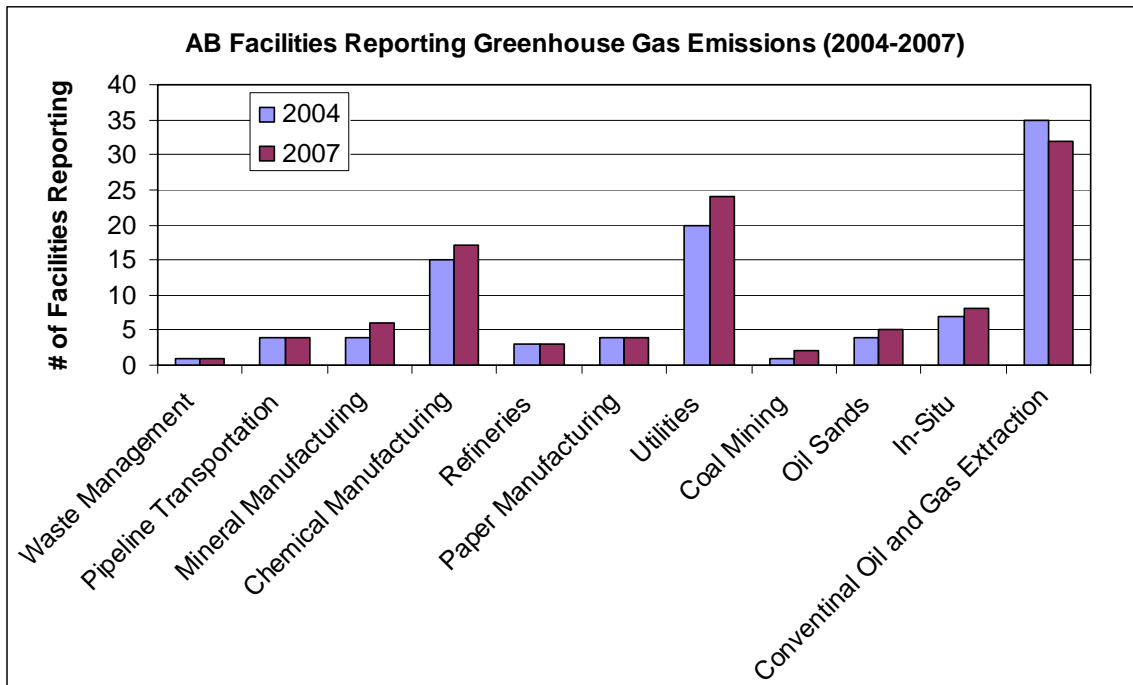


Figure 14: AB Facilities Reporting GHG Emissions (2004 and 2007).

There were 86 Alberta facilities that reported both 2004 and 2007 greenhouse gas emissions. The net change in emissions for these 86 facilities was an increase of 4.4 Mt between 2004 and 2007 from 107.0 to 111.4 Mt. There were 38 facilities that reported higher greenhouse gas emissions for 2007 than 2004 and 48 facilities that reported lower emissions for 2007.

The average change in emissions for these 86 facilities was a 3.2 per cent decrease. The average absolute change for these facilities was 17.8 per cent which illustrated the significant variability in emissions data from 2004 to 2007.

6.0 2007 national reported greenhouse gas emissions

Environment Canada collects greenhouse gas emissions data from large industrial facilities with annual emissions of 100 kt CO₂e or more through the *National Mandatory Greenhouse Gas Reporting Program*. Alberta Environment harmonized the *Specified Gas Reporting Program* with the federal *National Mandatory Greenhouse Gas Reporting Program* in 2005. This section of the report examines the 2007 greenhouse gas emissions data collected through the harmonized one-window Electronic Data Reporting System for all of Canada.

6.1 2007 reported greenhouse gas emissions by province

A total of 278.1 Mt of greenhouse gas emissions were reported by large industrial facilities in Canada for the 2007 reporting period. The distribution of these reported

emissions among the provinces and territories is presented in [Figure 15](#). The 106 facilities located in Alberta were the source of the largest portion of total reported greenhouse gas emissions with 114.4 Mt or 41 per cent of Canadian emissions. Facilities in Ontario were the next largest source of reported Canadian greenhouse gas emissions with 73.9 Mt or 27 per cent of the total. Facilities in Saskatchewan and Quebec each accounted for 8 per cent of total reported Canadian emissions at 22.9 Mt and 23.4 Mt respectively. Facilities in British Columbia submitted 12.7 Mt or 5 per cent of total reported Canadian emissions. The remaining provinces and territories did not emit more than 5 per cent of total reported emissions each. Combining the remaining provinces and territories contributed 30.8 Mt or 11 per cent of total reported Canadian greenhouse gas emissions. This category (identified as “other” in Figure 17) includes New Brunswick, Nova Scotia, Newfoundland and Labrador, Manitoba, the Northwest Territories, Nunavut, the Yukon and Prince Edward Island.

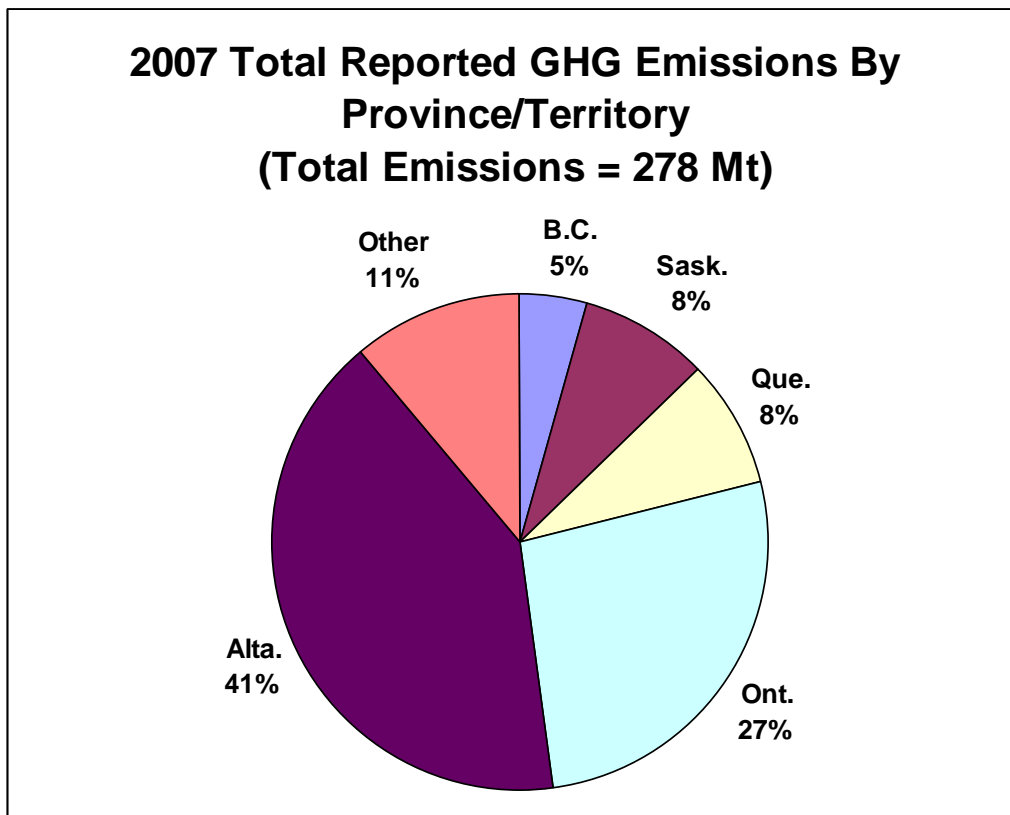


Figure 15: 2007 Total Reported GHG Emissions by Province/Territory.

7.0 Data confidentiality and access

7.1 Confidentiality process

The *Specified Gas Reporting Regulation* sets out confidentiality provisions for data collected under the *Regulation*. Section 5 of the *Regulation* permits facilities subject to the *Regulation* to request confidentiality for some or all of the information in their specified gas report. Confidentiality may be requested and granted for up to 5 years if the information is proved to be commercial, financial, scientific or technical information that would reveal proprietary business, competitive or trade secret information about a specific facility, technology or corporate initiative. The request from the facility needs to state exactly what is being requested confidentiality and for what reasons it should be deemed confidential.

The following factors are considered during the confidentiality review process:

- Whether disclosure could reasonably be expected to significantly harm the competitive position of the specified gas reporter;
- Whether disclosure could reasonably be expected to interfere significantly with the negotiating position of the specified gas reporter;
- Whether disclosure could reasonably be expected to result in undue financial loss or gain to any person or organization;
- The availability of the information from other public sources;
- Whether there are any other competing interests that would suggest disclosure of the information is warranted.

The Director under the *Climate Change and Emissions Management Act* has 90 days to review and reach a decision on each confidentiality request. The Director can also grant a portion or the entire request by deeming the information to be held as confidential for up to five years. Decisions on the 2007 confidentiality requests were made by August 29, 2008 and letters were sent to the designated certifying official of the requesting facility to inform them of the decision.

Section 8 of the *Regulation* requires the designated Director to submit a report on confidentiality requests to the Information and Privacy Commissioner. In accordance with the *Regulation*, the report must contain: the number of confidentiality requests received, number of confidentiality requests approved and the period of time prescribed for each approved request. The confidentiality process is outlined in [Figure 16](#).

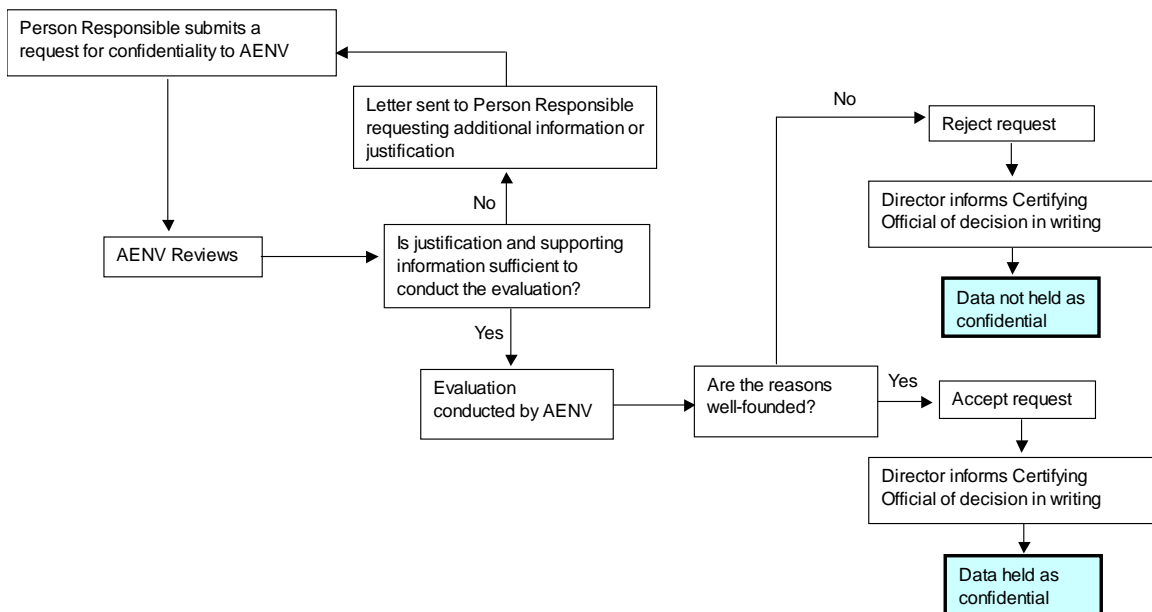


Figure 16: Confidentiality process for the *Specified Gas Reporting Program*.

7.2 2006 confidentiality requests and decisions

There were seven Alberta facilities that submitted a confidentiality request to Alberta Environment for 2007 specified gas reporting. All seven facilities requested that section III (A) of their specified gas report be kept confidential. Section III (A) of the 2007 specified gas report contains detailed greenhouse gas emissions by source category. The Director granted confidentiality for six of the requests and refused one request. [Table 2](#) shows the facilities that requested confidentiality for 2007 and the decision reached by the Director for each of these requests.

Table 2: 2007 Confidentiality Decisions.

Company Name	Facility Name	Decision:
Imperial Oil	Cold Lake	Section III (A) deemed confidential for 5 years.
Petro-Canada	Edmonton Refinery	Section III (A) deemed confidential for 5 years.
Graymont	Exshaw	Section III (A) deemed confidential for 5 years.
Shell Canada Limited	Scotford Upgrader and Upgrader Cogen	Section III (A) deemed confidential for 5 years.
Shell Canada Limited	Shell Scotford Refinery	Section III (A) deemed confidential for 5 years.
Imperial Oil	Strathcona Refinery	Section III (A) deemed confidential for 5 years.
Air Products	Edmonton Hydrogen	Section III (A) not deemed confidential.

7.3 Publishing greenhouse gas data

Section 7 of the *Specified Gas Reporting Regulation* permits the Director to publish data and information in any specified gas report in any form or manner the Director considers appropriate. Alberta Environment has published an annual report on the results of the

Specified Gas Reporting Program since 2003 when the mandatory greenhouse gas reporting program began.

7.4 Requesting greenhouse gas data

Written requests for information contained in a submitted specified gas report that has not been deemed confidential can be submitted to the designated Director at AENV.GHG@gov.ab.ca. The Director shall respond to these requests within a reasonable amount of time. Figure 17 below shows the process for requesting non-confidential greenhouse gas data.

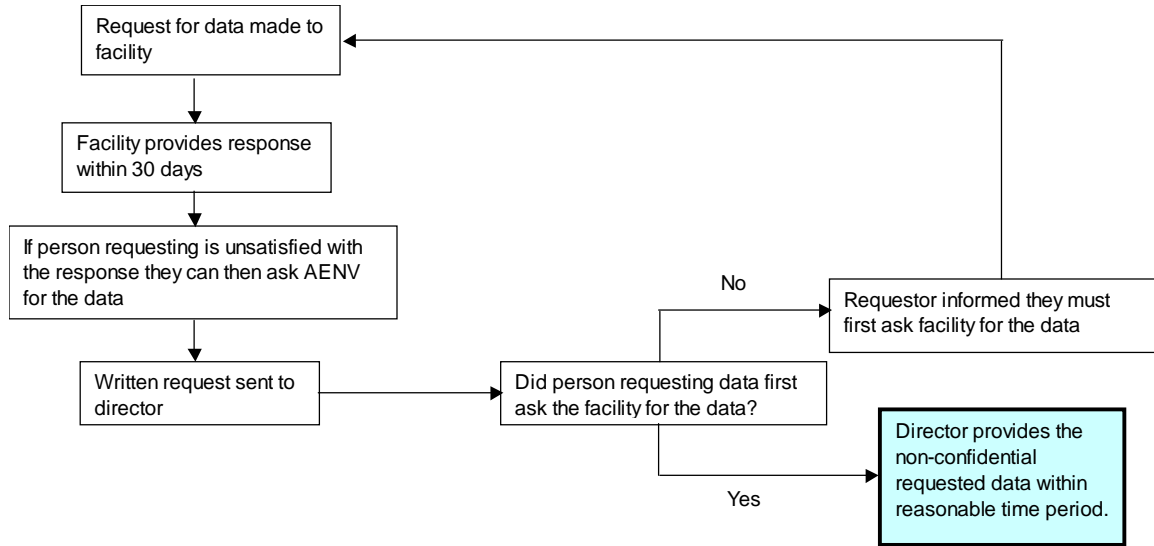


Figure 17: Process for requesting non-confidential Alberta greenhouse gas data.

Glossary of terms

Average absolute change: The average of the absolute value of all percentage changes in facility emissions between reporting years.

Average change: The average of all the percentage increases and decreases in facility emissions between reporting years.

Biomass: Plant materials, animal waste or any product made of either of these and includes without limitation wood and wood products, charcoal, agricultural residues and wastes including organic material above and below ground, both living and dead, such as trees, crops, grasses, tree litter, roots, municipal and industrial wastes where the organic material is biological in origin, landfill gas, bio-alcohols, black liquor, sludge gas, animal or plant-derived oils.

Carbon dioxide (CO₂): Carbon dioxide is a colourless, odourless gas found in the air. It is absorbed by plants and exhaled by animals. Carbon dioxide is also a greenhouse gas that traps infrared radiation in the atmosphere. The main human activity that produces carbon dioxide is the combustion of fossil fuels such as coal, oil, natural gas in power plants, vehicles and industrial facilities.

Carbon dioxide equivalent (CO₂e): Carbon dioxide equivalent is the concentration of CO₂ that would cause the same amount of absorption of infrared radiation in the atmosphere as another greenhouse gas. CO₂e is calculated by multiplying the emissions of a greenhouse gas by an established global warming potential to get an equivalent quantity of carbon dioxide. Using CO₂e permits the calculation of total greenhouse gas emissions for a particular source.

Direct emissions: The release of specified gases from sources actually located at a facility, expressed in tonnes on a CO₂e basis.

Electronic Data Reporting System (EDR): The Electronic Data Reporting System is a one-window secure web-based reporting tool for facilities to report greenhouse gas emissions to under the *Specified Gas Reporting Program* and the *National Mandatory Greenhouse Gas Reporting Program*.

Emissions: Emissions are a quantity of a substance that is released to the air from a source.

Emissions intensity: Emissions intensity is a measure of a quantity of emissions against some associated unit of production. Emissions can be measured against Gross Domestic Product, barrels of oil, tonne of coal, megawatt hour of electricity, etc.

Facility: Any plant, structure or thing where an activity listed in section 2 of the Schedule of Activities to the *Environmental Protection and Enhancement Act* occurs, and a site or one or more contiguous or adjacent sites that are operated and function in an

integrated fashion where an activity listed in any of sections 3 to 11 of the Schedule of Activities to the *Environmental Protection and Enhancement Act* occurs, including all the buildings, equipment, structures, machinery and vehicles that are an integral part of the activity.

Flaring emissions: Flaring emissions are direct emissions from the controlled combustion of a gas or liquid stream produced on site not for the purpose of producing energy and includes without limitation emissions arising from waste petroleum incineration, hazardous emissions prevention systems (whether in pilot or active mode), well testing, natural gas gathering systems, processing plant operations, crude oil production, pipeline operations, petroleum refining and chemical fertilizer and steel production.

Global warming potential (GWP): Global warming potential is the relative measure of the warming effect that the emission of a specified gas might have on the Earth's atmosphere calculated as the ratio of the time-integrated radiative forcing that would result from the emission of one kilogram of a given specified gas to that from the emission of one kilogram of carbon dioxide.

Greenhouse gases: Greenhouse gases are any gas that absorbs infrared radiation in the Earth's atmosphere. Greenhouse gases can come from both natural and human activities. Common greenhouse gases that result from human activities include carbon dioxide, methane and nitrous oxide.

Gross domestic product (GDP): Gross domestic product is the total value of goods and services produced by a jurisdiction, such as a province, territory or country.

Hydrofluorocarbons (HFC): Hydrofluorocarbons are synthetic industrial gases emitted in small quantities but are powerful greenhouse gases with global warming potentials of hundreds to thousands of times that of carbon dioxide. Hydrofluorocarbons include the following HFC Species: CHF₃, CH₂F₂, CH₃F, C₅H₂F₁₀ (structure: CF₃CHFCHF₂CF₃), C₂HF₅, C₂H₂F₄ (structure: CHF₂CHF₂), C₂H₂F₄ (structure: CH₂FCF₃), C₂H₃F₃ (structure: CHF₂CH₂F), C₂H₃F₃ (structure: CF₃CH₃), C₂H₄F₂ (structure: CH₃CHF₂), C₃HF₇ (structure: CF₃CHF₂CF₃), C₃H₂F₆ (structure: CF₃CH₂CF₃) and C₃H₃F₅ (structure: CH₂FCF₂CHF₂). Only HFC emissions from industrial process and industrial product use are reported under the *Specified Gas Reporting Program*. Sources of HFC emissions from industrial process and industrial product use include emissions from foam blowing and the use of HFC as a cover gas in metal production. HFC emissions from other applications such as refrigeration, air conditioning, aerosol propellants, fire extinguishers, some solvents, etc, are not considered industrial process or industrial product use and are not reported under the *Specified Gas Reporting Regulation*.

Industrial process emissions: Direct emissions from an industrial process involving chemical or physical reactions, other than combustion, and where the primary purpose of the industrial process is not energy production. This includes mineral, metal and chemical production. This source category is more sector-specific than stationary fuel combustion and is not found in all industrial sectors.

Industrial product use emissions: Direct emissions from the use of a product that does not react in the process and includes without limitation SF₆ and HFC use as a cover gas and use of SF₆ in electrical equipment.

Kilotonne: One thousand tonnes. Designated by kt.

Megatonne: One million tonnes. Designated by Mt.

Methane (CH₄): Methane is a colourless, odourless, flammable gas formed naturally by the decomposition of organic matter. Methane is also a greenhouse gas that traps infrared radiation in the atmosphere. Methane has a global warming potential 21 times that of carbon dioxide. Natural sources of methane include wetlands, permafrost, termites, water bodies and forest fires. Methane is also a hydrocarbon gas and is the principal constituent of natural gas. Human activities that are sources of methane emissions include fossil fuel production, animal husbandry, rice cultivation, biomass burning, and waste management.

Nitrous oxide (N₂O): Nitrous oxide is a colourless, non-flammable gas with a sweet odour. Nitrous oxide is also a powerful greenhouse gas that traps infrared radiation in the atmosphere. Nitrous oxide has a global warming potential 310 times that of carbon dioxide. Nitrous oxide is produced naturally from a wide variety of biological sources in soil and water, particularly microbial action in wet tropical forests. Human activities that are sources of nitrous oxide include agricultural soil management, animal manure management, sewage treatment, mobile and stationary combustion of fossil fuel, and some chemical production.

On-site transportation: On-site transportation is a greenhouse gas source category with direct emissions resulting from fuel combustion in machinery used for the on-site transportation of products and material integral to the production process. Examples are the transportation of raw or intermediate products and materials within the production process; such as equipment used at an oil sands operation to mine and/or move materials to subsequent on-site processing, or equipment used at above or below ground mining operations to mine and/or move mined materials or other intermediate products or materials to different on-site production processes.

Other fugitive: Other fugitive emissions are direct emissions that do not fall under stationary fuel combustion emissions, industrial process emissions, venting emissions, flaring emissions, on-site transportation emissions, or waste and wastewater emissions and includes without limitation intentional or unintentional releases of gases arising from the production, processing, transmission, storage and use of solid, liquid or gaseous fuels. In general, emissions from other fugitive sources are a result of the handling or processing of various types of fuel in the fossil fuel industry. Other fugitive sources include leaks from natural gas transmission lines and processing plants, accidental releases from oil and gas wells and releases from the mining and handling of coal.

Perfluorocarbons (PFC): Perfluorocarbons are synthetic industrial gases emitted in small quantities but are powerful greenhouse gases with global warming potential of hundreds to thousands of times that of carbon dioxide. Perfluorocarbons include the

following PFC species: CF₄, C₂F₆, C₃F₈, C₄F₁₀, c-C₄F₈, C₅F₁₂, and C₆F₁₄. Only PFC emissions from industrial process and industrial product use are reported under the *Specified Gas Reporting Program*. Sources of PFC emissions from industrial process and industrial product use include aluminum production and foam blowing. PFC emissions from other applications such as refrigeration, air conditioning, semiconductor manufacturing, aerosol propellants, fire extinguishers, some solvents, etc are not considered industrial process or industrial product use and are not reported under the *Regulation*.

Specified gas: Specified gases are those identified in the *Specified Gas Reporting Regulation*. This includes: carbon dioxide, methane, nitrous oxide, species of hydrofluorocarbons, species of perfluorocarbons and sulphur hexafluoride.

Stationary fuel combustion: Stationary fuel combustion emissions are direct emissions resulting from non-vehicular combustion of fossil or biomass fuel for the purpose of producing energy but do not include biomass combustion CO₂ emissions. Stationary fuel combustion is a common source of greenhouse gas emissions and is produced in most industrial sectors. The stationary fuel combustion source category includes on-site waste incineration if the waste is combusted for the purpose of energy production.

Sulphur hexafluoride (SF₆): Sulphur hexafluoride is a synthetic industrial gas that is emitted in small quantities but is a powerful greenhouse gas with a global warming potential thousands of times that of carbon dioxide. Only SF₆ emissions from industrial process and industrial product use are reported under the *Specified Gas Reporting Program*. Sources of SF₆ from industrial process and industrial product use are uses such as a cover gas in magnesium smelting and casting, as foundry products in the aluminum industry, or as an insulating gas in electrical equipment such as circuit breakers. SF₆ emissions from other applications such as fire suppression, explosion protection, leak detection and electronic applications are not considered industrial process or industrial product use and are not reported under the *Regulation*.

Venting emissions: Venting emissions are direct emissions from intentional releases to the atmosphere of a waste gas or liquid stream and includes without limitation emissions of casing gas, associated (or solution) gas, treater, stabilizer, dehydrator off-gas, blanket gas and emissions from pneumatic devices which use natural gas as a driver, compressor start-up, pipeline and other blowdowns and metering and regulation station control loops.

Waste and wastewater: Waste and wastewater emissions are direct emissions from disposal of waste and waste or wastewater treatment and includes without limitation sources of emissions from on-site waste disposal and waste or wastewater treatment at a facility such as landfilling of solid waste, flaring of landfill gas, treatment of liquid waste and waste incineration.

Appendix

Table 3: 2006 Reported Alberta Greenhouse Gas Emissions by Facility Type.

Facility Type	Reporting Company	Facility Name	CO2 (t CO2e)	CH4 (t CO2e)	N2O (t CO2e)	HFC (t CO2e)	SF6 (t CO2e)	Total (t CO2e)
Chemical Manufacturing	Cancarb Ltd.	Cancarb Ltd.	122,527	2,548	407	-	5	125,486
Chemical Manufacturing	Canadian Fertilizers Limited	Canadian Fertilizers Limited	1,604,736	338	4,775	-	-	1,609,849
Chemical Manufacturing	Orica Canada Inc	Carseland Works	468	10	809,745	-	-	810,223
Chemical Manufacturing	Agrium Inc.	Agrium Redwater Fertilizer Operation	679,764	25,444	13,020	-	-	718,227
Chemical Manufacturing	Agrium Inc.	Fort Saskatchewan Nitrogen Operation	600,797	534	1,879	-	-	603,209
Chemical Manufacturing	Agrium Inc	Carseland Nitrogen Operations	505,309	12,390	1,941	-	-	519,639
Chemical Manufacturing	Air Products Canada Ltd	Edmonton-1 Hydrogen Facility	476,846	221	310	-	-	477,377
Chemical Manufacturing	Air Liquide Canada Inc.	Scotford Complex	408,112	578	3,224	-	-	411,914
Chemical Manufacturing	Dow Chemical Canada Inc.	Western Canada Operations	1,427,852	1,900	4,056	2,080	-	1,435,888
Chemical Manufacturing	Alberta Envirofuels Inc.	Alberta Envirofuels Inc.	341,051	255	2,151	-	-	343,457
Chemical Manufacturing	MEGlobal Canada Inc.	Prentiss Manufacturing Facility	223,037	792	220	-	-	224,048
Chemical Manufacturing	Celanese Canada Inc.	Edmonton Facility	127,291	85	522	-	-	127,898
Chemical Manufacturing	MEGlobal Canada Inc.	FS1 EOEG	94,183	928	-	-	-	95,112
Chemical Manufacturing	NOVA Chemicals Corporation	NOVA Chemicals Corporation (Joffre)	2,498,808	2,478	11,660	-	-	2,512,946
Chemical Manufacturing	Shell Chemicals Canada Ltd	Scotford Chemical Plant	330,265	162	640	-	-	331,066

Facility Type	Reporting Company	Facility Name	CO2 (t CO2e)	CH4 (t CO2e)	N2O (t CO2e)	HFC (t CO2e)	SF6 (t CO2e)	Total (t CO2e)
Chemical Manufacturing	INEOS Canada Partnership	Joffre LAO Plant	117,267	81	641	-	-	117,989
Chemical Manufacturing	Dow Chemical Canada Inc.	Prentiss Manufacturing Facility	43,594	709	12	-	-	44,316
Coal Mining	TransAlta Utilities Corporation	Highvale Coal Mine	85,959	125,996	786	-	-	212,741
Coal Mining	Coal Valley Resources Inc.	Coal Valley Mine	113,924	38,358	804	-	-	153,086
Conventional Oil and Gas Extraction	Husky Energy	ram River	752,727	5,032	2,699	-	-	760,458
Conventional Oil and Gas Extraction	Shell Canada Limited	Waterton Complex	496,711	80,456	6,071	-	-	583,238
Conventional Oil and Gas Extraction	Shell Canada Limited	Shell Caroline Complex	503,782	66,148	3,847	-	-	573,777
Conventional Oil and Gas Extraction	Petro-Canada Oil & Gas	Hanlan Robb Gas Plant	435,073	15,255	904	-	-	451,232
Conventional Oil and Gas Extraction	SemCams ULC	K3 1-15 GP	420,085	6,491	3,847	-	-	430,423
Conventional Oil and Gas Extraction	Inter Pipeline Extraction Ltd.	Cochrane Extraction Plant	402,840	11,742	2,535	-	-	417,117
Conventional Oil and Gas Extraction	Spectra Energy Empress LP	Empress straddle plant system	350,542	3,817	1,733	-	-	356,092
Conventional Oil and Gas Extraction	Shell Canada Limited	Shell Jumping Pound Gas Plant	257,402	83,050	2,388	-	-	342,840
Conventional Oil and Gas Extraction	Keyera Energy	Strachan GP	263,848	8,697	2,520	-	-	275,066
Conventional Oil and Gas Extraction	Imperial Oil Resources	Bonnie Glen Gas Plant	238,211	22,159	3,596	-	-	263,966
Conventional Oil and Gas Extraction	Keyera Energy	Rimbey Gas Plant	232,496	7,722	3,308	-	-	243,526
Conventional Oil and Gas Extraction	Taylor Processing Inc.	Harmattan Gas Processing Plant	223,277	14,406	1,039	-	-	238,722

Facility Type	Reporting Company	Facility Name	CO2 (t CO2e)	CH4 (t CO2e)	N2O (t CO2e)	HFC (t CO2e)	SF6 (t CO2e)	Total (t CO2e)
Conventional Oil and Gas Extraction	SemCams ULC	KA 1-12 GP	215,576	10,818	2,375	-	-	228,769
Conventional Oil and Gas Extraction	Talisman Energy Inc.	Edson Gas Plant	209,549	10,950	3,360	-	-	223,859
Conventional Oil and Gas Extraction	Nexen Inc.	Balzac Gas Processing Plant	192,190	9,866	1,448	-	-	203,503
Conventional Oil and Gas Extraction	Shell Canada Limited	Shell Burnt Timber Gas Plant	150,221	44,133	1,019	-	-	195,373
Conventional Oil and Gas Extraction	ConocoPhillips Canada	Elmworth Gas Plant	177,399	13,199	1,646	-	-	192,244
Conventional Oil and Gas Extraction	SemCams ULC	Windfall 8-17 GP	168,543	13,048	4,635	-	-	186,225
Conventional Oil and Gas Extraction	PrimeWest Energy Inc.	East Crossfield Gas Plant	131,415	5,866	500	-	-	137,781
Conventional Oil and Gas Extraction	Petro-Canada Oil & Gas	Wildcat Hills Gas Plant	127,972	3,930	2,813	-	-	134,715
Conventional Oil and Gas Extraction	Devon Canada Corporation	Wapiti Gas Plant	117,107	5,336	1,309	-	-	123,752
Conventional Oil and Gas Extraction	Pengrowth Corporation	Olds Gas Plant	116,500	2,597	1,857	-	-	120,954
Conventional Oil and Gas Extraction	Spectra Energy Field Services Canada	Nevis Gas Plant	109,159	5,941	227	-	-	115,327
Conventional Oil and Gas Extraction	Bonavista Petroleum Ltd.	Carstairs - Crossfield Gas Plant	105,365	1,027	640	-	-	107,032
Conventional Oil and Gas Extraction	Keyera Energy	Brazeau Gas Plant	93,026	6,030	3,819	-	-	102,875
Conventional Oil and Gas Extraction	Blaze Energy Ltd.	Brazeau Gas Plant	88,654	12,014	1,923	-	-	102,590
Conventional Oil and Gas Extraction	Imperial Oil Resources	Quirk Creek Gas Plant	91,149	5,395	651	-	-	97,195
Conventional Oil and Gas Extraction	Pengrowth Corporation	Judy Creek Production Complex	82,286	9,664	3,779	-	-	95,728
Conventional Oil and Gas Extraction	Apache Canada Ltd.	Zama Gas Plant: 1, 2, 3	67,467	25,320	1,066	-	-	93,852

Facility Type	Reporting Company	Facility Name	CO2 (t CO2e)	CH4 (t CO2e)	N2O (t CO2e)	HFC (t CO2e)	SF6 (t CO2e)	Total (t CO2e)
Conventional Oil and Gas Extraction	EnCana Oil & Gas Co. Ltd.	Caribou North Compressor Station	68,826	20,396	463	-	-	89,684
Conventional Oil and Gas Extraction	Mazeppa Processing Partnership	Mazeppa Sour Gas Plant	82,931	3,902	182	-	-	87,014
Conventional Oil and Gas Extraction	Pengrowth Corporation	Judy Creek Gas Conservation Plant (JCGCP)	71,199	10,189	2,074	-	-	83,462
In-Situ	Imperial Oil Resources	Cold Lake	4,502,694	10,557	24,087	-	-	4,537,337
In-Situ	Canadian Natural Resources Limited	Wolf Lake/Primrose Thermal Operation	2,377,860	73,987	16,502	-	-	2,468,349
In-Situ	FCCL Oil Sands Partnership	Foster Creek SAGD Bitumen Battery	632,379	553	1,084	-	-	634,016
In-Situ	Shell Canada Limited	Peace River Complex	322,402	40,028	5,495	-	-	367,924
In-Situ	Husky Oil Operations Ltd	Tucker Thermal	248,896	755	419	-	-	250,069
In-Situ	Japan Canada Oil Sands Limited	Hangingsstone SAGD Demonstration Facility	214,741	1,461	353	-	-	216,555
In-Situ	Petro-Canada	MacKay River, In-Situ Oil Sands Plant	158,991	314	897	-	-	160,202
In-Situ	FCCL Oil Sands Partnership	Christina Lake SAGD Bitumen Battery	111,236	135	185	-	-	111,556
Mineral Manufacturing	General Scrap Partnership	Navajo Metals	1,358	1	31	-	-	1,390
Mineral Manufacturing	General Scrap Partnership	GenAlta Recycling Inc.	617	-	-	-	-	617
Mineral Manufacturing	Lafarge Canada Inc	Exshaw Cement Plant	1,128,518	-	-	-	-	1,128,518
Mineral Manufacturing	Lehigh Inland Cement Limited	Lehigh Inland Cement	849,720	-	-	-	-	849,720

Facility Type	Reporting Company	Facility Name	CO2 (t CO2e)	CH4 (t CO2e)	N2O (t CO2e)	HFC (t CO2e)	SF6 (t CO2e)	Total (t CO2e)
Mineral Manufacturing	Graymont Western Canada Inc.	Exshaw	164,713	19	195	-	-	164,927
Mineral Manufacturing	Sherritt International Corporation	Fort Saskatchewan	255,217	4,424	3,209	-	-	262,851
Oil Sands	Syncrude Canada Ltd.	Mildred Lake and Aurora North Plant Sites	14,135,668	669,127	131,744	-	-	14,936,539
Oil Sands	Suncor Energy Inc. Oil Sands	Suncor Energy Inc. Oil Sands	8,800,098	360,707	100,632	-	-	9,261,437
Oil Sands	Shell Canada Energy Limited	Scotford Upgrader and Upgrader Cogeneration	1,811,231	8,661	11,128	-	-	1,831,021
Oil Sands	Albian Sands Energy Inc.	Muskeg River Mine	444,398	32,451	3,368	-	-	480,218
Oil Sands	Nexen Inc./Opti Canada Inc.	Long Lake Project	120,913	11,195	716	-	-	132,824
Paper Manufacturing	West Fraser Mills Ltd.	Hinton Pulp	135,987	8,629	9,602	-	-	154,218
Paper Manufacturing	Weyerhaeuser Company Limited	Grande Prairie Operations	78,578	23,764	10,471	-	-	112,813
Paper Manufacturing	Alberta-Pacific Forest Industries Inc.	Alberta-Pacific Forest Industries Inc. Pulp Mill	77,926	1,890	18,298	-	-	98,114
Paper Manufacturing	Daishowa-Marubeni International Ltd	Peace River Pulp Division	66,395	16,182	10,415	-	-	92,991
Pipeline Transportation	Nova Gas Transmission Ltd.	TransCanada Pipeline, Alberta System	1,954,687	257,366	29,432	-	-	2,241,485
Pipeline Transportation	Alliance Pipeline Ltd.	Alberta Pipeline System	551,369	26,862	3,985	-	-	582,216
Pipeline Transportation	Foothills Pipe Lines Ltd.	Foothills Pipeline, Alberta	303,782	6,847	4,073	-	-	314,702
Pipeline Transportation	ATCO Gas and Pipelines Ltd.	ATCO Pipelines	59,717	119,815	1,039	-	-	180,570

Facility Type	Reporting Company	Facility Name	CO2 (t CO2e)	CH4 (t CO2e)	N2O (t CO2e)	HFC (t CO2e)	SF6 (t CO2e)	Total (t CO2e)
Refineries	Petro-Canada	Edmonton Refinery	1,744,268	7,694	9,642	-	-	1,761,604
Refineries	Imperial Oil Limited	Strathcona Refinery	1,529,748	2,194	10,686	-	-	1,542,628
Refineries	Shell Canada Products	Shell Scotford Refinery	1,023,994	5,886	2,494	-	-	1,032,374
Utilities	Transalta Utilities Corporation	Sundance Thermal Electric Power Generating Plant	15,281,609	3,704	108,730	-	-	15,394,043
Utilities	EPCOR Power Generation Services Inc.	Genesee Thermal Generating Station	9,428,201	2,446	51,350	-	-	9,481,997
Utilities	TransAlta Utilities Corporation	Keephills Thermal Electric Power Generating Plant	6,572,725	1,522	44,869	-	-	6,619,117
Utilities	Alberta Power (2000) Ltd.	Sheerness Generating Station	5,852,534	1,283	27,281	-	-	5,881,098
Utilities	Alberta Power (2000) Ltd.	Battle River Generating Station	5,104,168	1,057	22,625	-	-	5,127,851
Utilities	TransAlta Utilities Corporation	Wabamun Thermal Electric Power Generating Plant	1,922,712	494	14,547	-	-	1,937,754
Utilities	ATCO Power Canada Ltd.	Muskeg River Cogeneration Plant	1,147,641	1,389	6,855	-	-	1,155,885
Utilities	Milner Power Limited Partnership	H.R. Milner Generating Station	983,179	294	5,333	-	-	988,806
Utilities	TransCanada Energy Ltd.	Mackay River Power Plant, Alberta	560,484	1,026	10,010	-	-	571,520
Utilities	FCCL Oil Sands Partnership	Foster Creek Cogeneration Facility	500,448	656	5,731	-	-	506,836

Facility Type	Reporting Company	Facility Name	CO2 (t CO2e)	CH4 (t CO2e)	N2O (t CO2e)	HFC (t CO2e)	SF6 (t CO2e)	Total (t CO2e)
Utilities	TransAlta Cogeneration LP	Fort Saskatchewan Thermal Electric (Cogeneration) Power Plan	348,302	567	2,918	-	-	351,788
Utilities	TransCanada Energy Ltd.	Carseland Power Plant, Alberta	343,503	441	4,111	-	-	348,055
Utilities	CITY OF MEDICINE HAT	City of Medicine Hat, Electric Utility - Generation	284,249	2,537	2,311	-	-	289,097
Utilities	ATCO Power Alberta Limited Partnership	Rainbow Lake Cogeneration Power Plant (Units 4-5)	264,282	434	2,234	-	-	266,950
Utilities	Calgary Energy Centre	Calgary Energy Centre	198,080	341	1,658	-	-	200,078
Utilities	EnCana Corporation	Cavalier Power Plant	162,686	275	1,225	-	-	164,185
Utilities	TransCanada Energy Ltd.	Redwater Cogeneration Facility, Alberta	134,822	163	1,541	-	-	136,525
Utilities	Nexen Inc.	Balzac Power Station	117,516	571	939	-	-	119,027
Utilities	TransCanada Energy Ltd.	Bear Creek Power Plant	74,432	109	992	-	-	75,533
Utilities	ATCO Power Alberta Limited Partnership	Poplar Hill Generating Station	17,377	29	147	-	-	17,553
Utilities	Alberta Power (2000) Ltd.	Rainbow Lake Generating Station (Units 1-3)	13,106	22	111	-	-	13,238
Utilities	ATCO Power Alberta Limited Partnership	Valleyview Generating Station	2,554	4	22	-	-	2,580
Utilities	Alberta Power (2000) Ltd.	Sturgeon Generating Station	1,145	2	10	-	-	1,156

Facility Type	Reporting Company	Facility Name	CO2 (t CO2e)	CH4 (t CO2e)	N2O (t CO2e)	HFC (t CO2e)	SF6 (t CO2e)	Total (t CO2e)
Utilities	ATCO Gas and Pipelines Ltd	ATCO Gas - Distribution Systems and Carbon Plant	27,854	195,325	1,677	-	-	224,856
Waste Management	City of Calgary	East Calgary Landfill	13,315	76,944	-	-	-	90,259

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