

CHEMICALS SECTOR (NON-FLUORINATED)

All emissions presented here are as of 9/1/2013 and exclude biogenic CO₂.

Highlights

- The Chemicals Sector has the fourth largest GHG emissions among sectors reporting to the GHGRP.
- The facilities and GHG emissions in this sector are located predominantly in Texas and Louisiana.
- Emissions from the Chemicals Sector were 158.7 million metric tons of carbon dioxide equivalent (MMT CO₂e) in 2012.
- Emissions from this sector decreased by four percent from 2011 to 2012, while the number of reporters increased by seven facilities.

About this Sector

The Non-fluorinated Chemical Manufacturing Sector consists of facilities that emit GHGs from the manufacturing of organic or inorganic chemicals. For this summary, the non-fluorinated chemicals subsector comprises facilities that produce [adipic acid](#), [ammonia](#), [hydrogen](#) (both merchant and captive plants), [nitric acid](#), [petrochemicals](#), [phosphoric acid](#), [silicon carbide](#), and [titanium dioxide](#). Besides the emissions from these chemical production processes, the sector includes combustion emissions from facilities that produce pesticides, fertilizer, pharmaceuticals, and other organic and inorganic chemicals.

Who Reports?

In 2012, 447 facilities in the Chemicals Sector submitted a GHG report. Total reported emissions were 158.7 million metric tons of carbon dioxide equivalent (MMT CO₂e). In 2012, the Chemicals Sector represents about 6% of the facilities reporting direct emissions to the GHGRP and 2.4% of total U.S. GHG emissions^a.

Table 1: Chemicals Sector – Reporting Schedule by Subpart

Subpart	Source Category	Applicability	First Reporting Year
E	Adipic Acid Production	All facilities	2010
G	Ammonia Manufacturing	All facilities	2010
P	Hydrogen Production	Facilities emitting $\geq 25,000$ metric tons CO ₂ e/year	2010
V	Nitric Acid Production	All facilities	2010
X	Petrochemical Production	All facilities	2010
Z	Phosphoric Acid Production	All facilities	2010
BB	Silicon Carbide Production	All facilities	2010
EE	Titanium Dioxide Production	All facilities	2010
C	Other Chemicals	Facilities with NAICS codes starting with 325 (except for 325193, 3252XX, 325510, 325920) that report under subpart C (stationary fuel combustion sources) only.	2010

^a The total U.S. GHG emissions are 6,525.6 MMT CO₂e as reported in the Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2012. U.S. Environmental Protection Agency. April 15, 2014. EPA 430-R-14-003. Available at: <http://www.epa.gov/climatechange/ghgemissions/usinventoryreport.html>.

Table 2: Chemicals Sector – Number of Reporters (2010–2012)^a

Source Category	Number of Reporters		
	2010	2011	2012
Total Chemicals Sector	440	440	447
Adipic Acid Production	2	3	3
Ammonia Manufacturing	22	22	22
Hydrogen Production	101	103	106
Nitric Acid Production	37	36	36
Petrochemical Production	64	64	65
Phosphoric Acid Production	13	13	12
Silicon Carbide Production	1	1	1
Titanium Dioxide Production	7	7	7
Other Chemicals	216	215	219

^a The total number of reporters is less than a sum of the number of reporters in each individual source category because some facilities contain more than one source category.

Table 3: Chemicals Sector – GHGRP Coverage

Source Category	GHGRP Coverage of Industry	Estimated Percent of Industry Facilities Covered by GHGRP	Estimated Percent of Industry Emissions Covered by GHGRP
Adipic Acid Production	All facilities	100%	100%
Ammonia Manufacturing	All facilities	100%	100%
Hydrogen Production	Facilities emitting \geq 25,000 metric tons CO ₂ e/year	57% ^a	88% ^b
Nitric Acid Production	All facilities	100%	100%
Petrochemical Production	All facilities	100%	100%
Phosphoric Acid Production	All facilities	100%	100%
Silicon Carbide Production	All facilities	100%	100%
Titanium Dioxide Production	All facilities	100%	100%
Other Chemicals	Facilities emitting \geq 25,000 metric tons CO ₂ e/year	N/A ^c	N/A ^c

^a Estimate of size of industry based on the following source: Hydrogen Analysis Resource Center, Pacific National Laboratory. *Merchant Liquid and Compressed Gas Hydrogen Production Capacity in the U.S. and Canada by Company and Location*. http://hydrogen.pnl.gov/filedownloads/hydrogen/datasheets/merchant_hydrogen_producers.xls.

^b Estimate of size of industry emissions based on the above source as well as CO₂ intensity information from the following source: Praxair. *Analysis of CO₂ Emissions, Reductions, and Capture for Large-Scale Hydrogen Production Plants*. October 2010. <http://www.praxair.com/~media/North%20America/US/Documents/Reports%20Papers%20Case%20Study%20and%20Presentations/Our%20Company/Sustainable%20Development/Praxair%20CO2%20Emissions%20Reduction%20Capture%20White%20Paper.ashx>.

^c Due to the diversity of facilities and products within the Other Chemicals subsector, the U.S. population of all facilities in this subsector of GHGRP reporters is not available. However, GHG emissions estimates derived from fuel and feedstock data for 2010 (available from EIA's MECS data publication at <http://www.eia.gov/consumption/manufacturing/about.cfm>) indicate that approximately 182 million tons of CO₂ were emitted from MCS facilities with NAICS code 325XXX (Chemicals Manufacturing). GHGRP facilities with NAICS code 325XXX reported 185 million tons of CO₂ in 2010. This comparison (of the emissions estimate for MCS facilities with NAICS code 325XXX to reported emissions for GHGRP facilities with NAICS code 325XXX) indicates that all facilities with NAICS 325XXX that report to MCS also reported to the GHGRP in 2010.

Reported Emissions

All GHG emissions data, displayed in units of carbon dioxide equivalent (CO₂e) reflect the global warming potential (GWP) values from the Intergovernmental Panel on Climate Change (IPCC), Climate Change 1995: The Science of Climate Change (Second Assessment Report (SAR), Cambridge, United Kingdom: Cambridge University Press). The SAR values also can be found in the version of Table A-1 to 40 CFR part 98, published in the Federal Register on October 30, 2009 (74 FR 56395).

Table 4: Chemicals Sector – Emissions by Subsector (2010–2012)

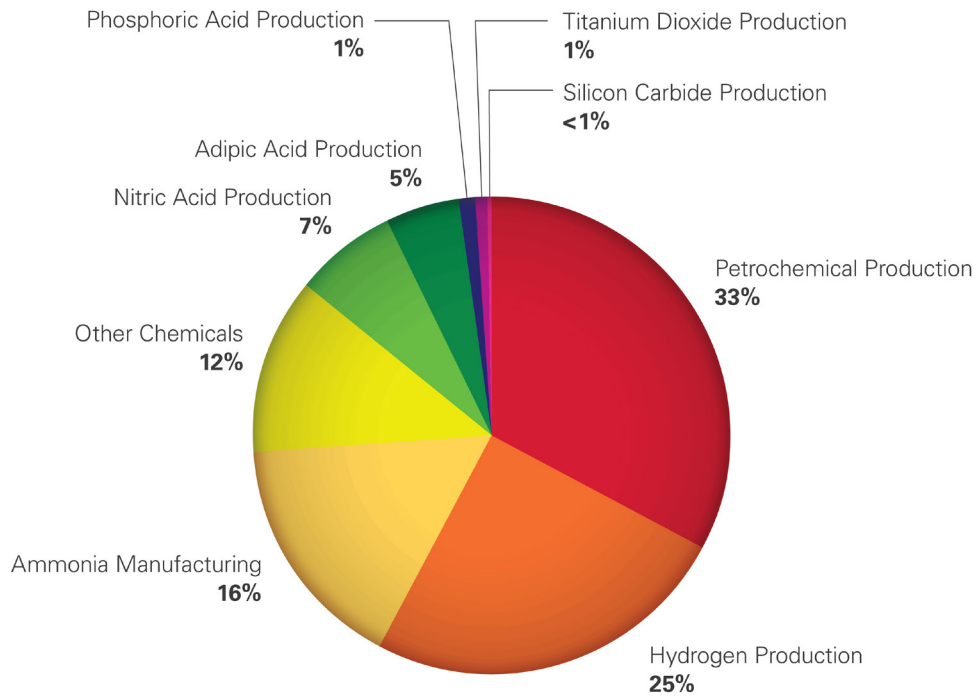
Chemicals Sector	Emissions (million metric tons CO ₂ e) ^{a,b}		
	2010	2011	2012
Total Chemicals Sector	156.0	164.5	158.7
Adipic Acid Production	5.9	12.3	7.4
Ammonia Manufacturing	24.5	24.8	25.0
Hydrogen Production	35.1	37.2	39.5
Nitric Acid Production	12.6	11.9	11.5
Petrochemical Production	52.1	52.8	51.7
Phosphoric Acid Production	2.0	2.0	2.1
Silicon Carbide Production	0.1	0.1	0.1
Titanium Dioxide Production	2.4	2.4	2.1
Other Chemicals	21.2	21.0	19.3

^a These values represent total emissions reported to the GHGRP in these industry sectors. Additional emissions may occur at facilities that have not reported, for example, those below the 25,000 metric ton CO₂e reporting threshold.

^b Totals might not sum due to independent rounding.

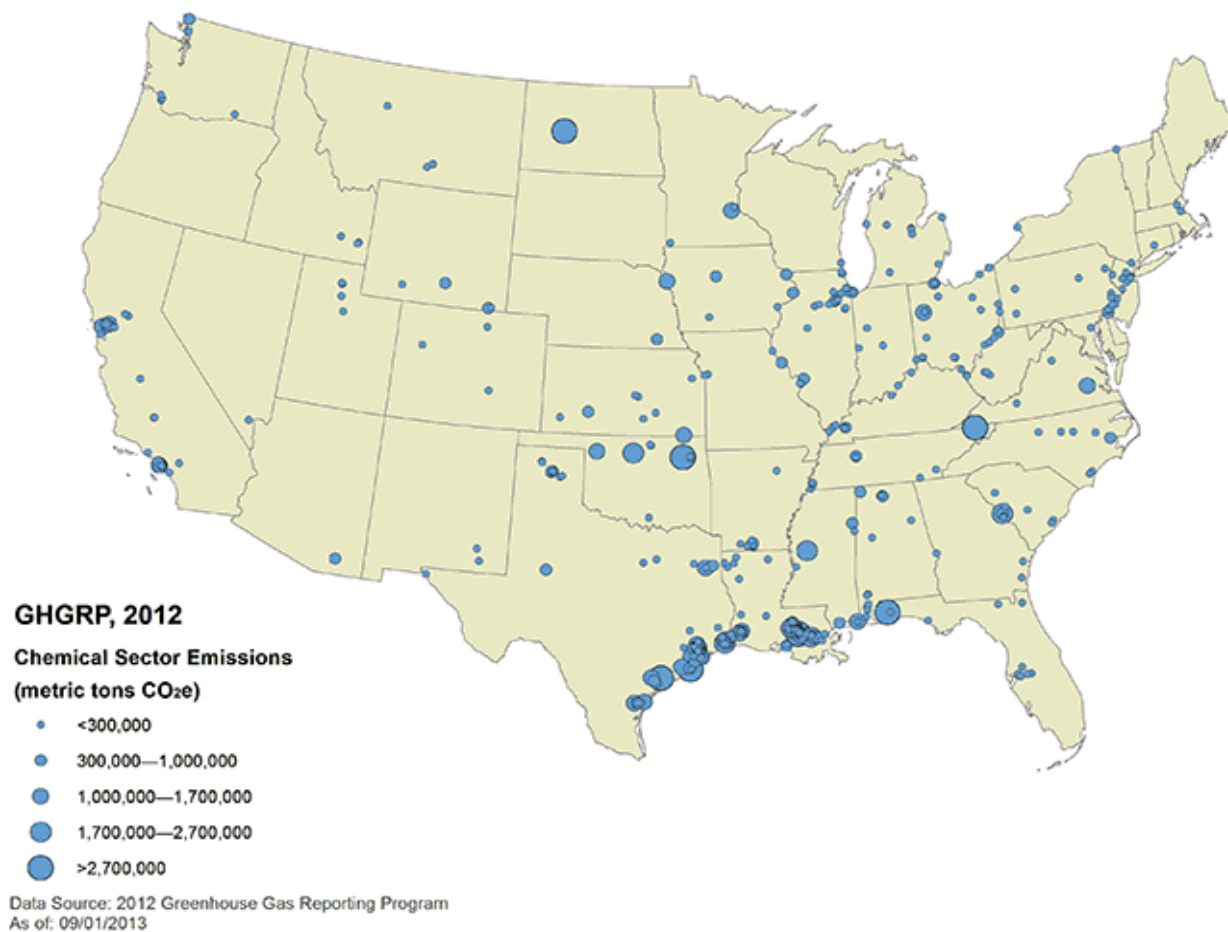
Figure 1: Chemicals Sector – Emissions by Subsector (2012)

 **2012 TOTAL REPORTED EMISSIONS FROM THE CHEMICALS (NON-FLUORINATED) SECTOR, BY SUBSECTOR**



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Figure 2: Location and Emissions Range for Each Reporting Facility in the Chemicals Sector (as of 9/1/13)

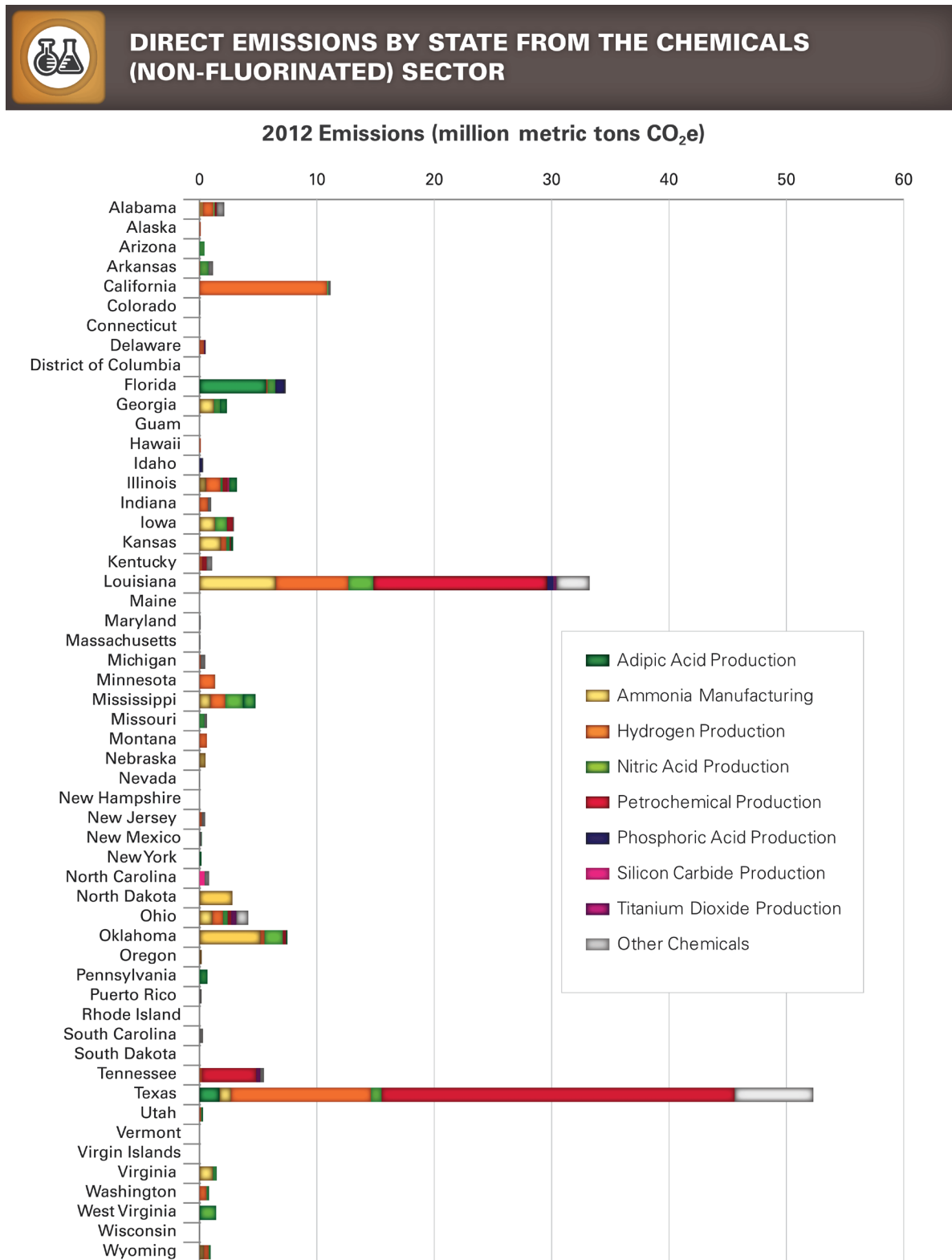


This map shows the locations of direct-emitting facilities. The size of a circle corresponds to the quantity of emissions reported by that facility. There are also chemical manufacturing facilities located in Alaska, Hawaii, Puerto Rico, and the U.S. Virgin Islands (<http://www.epa.gov/ghgreporting/ghgdata/reported/chemicals.html>).

Readers can [identify the largest emitting facilities](http://ghgdata.epa.gov) by visiting the Facility Level Information on Greenhouse Gases (FLIGHT) website (<http://ghgdata.epa.gov>).

A large percentage of CO₂e emissions from the Chemicals Sector originates in Texas and Louisiana. The emissions from these two states total 85.5 MMT CO₂e, which is 54% of the total emissions from the Chemicals Sector. Eight of the nine subsectors are represented in these two states. The petrochemical production subsector is especially concentrated here, with about 86% of both facilities and GHG emissions from the subsector located in these two states. Only silicon carbide production, which contains one reporter, is not represented in Texas or Louisiana.

Figure 3: Chemicals Sector – Emissions by State (2012)^a



^a Represents total emissions reported to the GHGRP from this industry. Additional emissions may occur at facilities that have not reported, such as those below the reporting threshold.

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Chemicals Sector Emissions Trends 2010 to 2011

Emissions from the Chemicals Sector increased by 8.5 MMT CO₂e from 2010 to 2011 (a five percent increase). Emissions from one adipic acid reporter increased by 6 MMT CO₂e (a 127 percent increase from 2010). Emissions from hydrogen production facilities increased by 2 MMT CO₂e (a six percent increase from 2010). All other subsectors had an emissions change of 0.7 MMT CO₂e or less between the two years.

Chemicals Sector Emissions Trends 2011 to 2012

Emissions from the Chemicals Sector decreased by 5.8 MMT of CO₂e from 2011 to 2012 (4% decrease). Emissions from one adipic acid reporter decreased by 5.3 million metric tons CO₂e (a 48% decrease from 2011). All other subsectors had an emissions change of 0.4 MMT CO₂e or less between the two years.

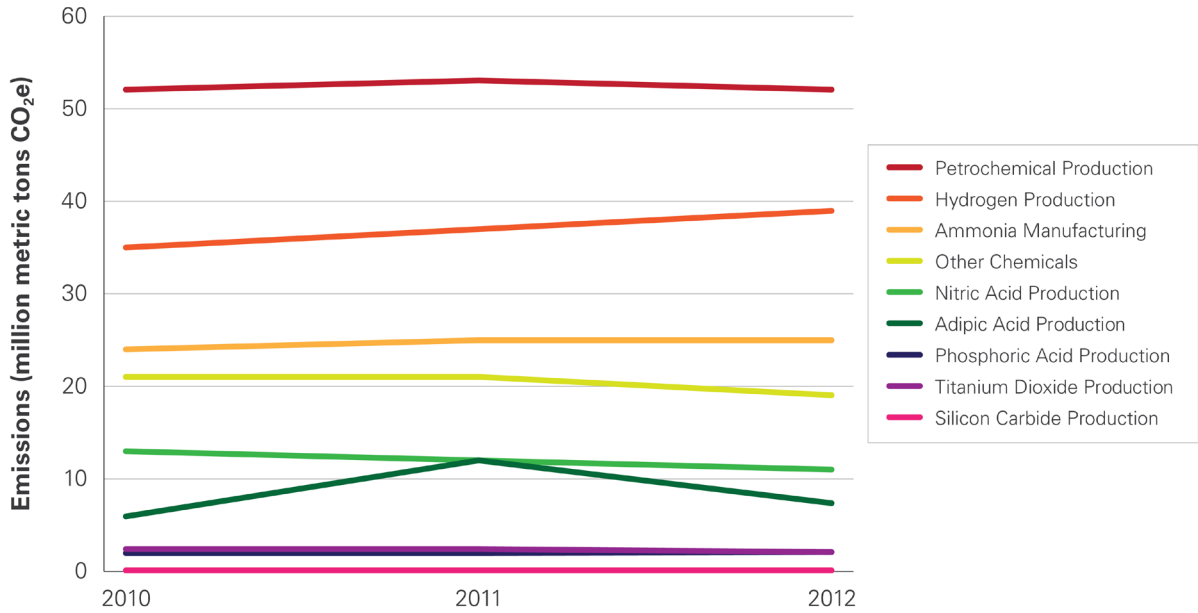
The adipic acid and hydrogen production subsectors were the only subsectors with significant changes over the three-year reporting period.

Adipic Acid. Emissions from the adipic acid source category have been highly variable. Between 2010 and 2011, there was a large spike in emissions from one of the three facilities that reported under this subsector. In 2012, the emissions from the reporter dropped to a level more consistent with 2010 than 2011. The reason for this spike is that during RY2010 and RY2012 the facility used a N₂O abatement device with a relatively high destruction efficiency to reduce their N₂O emissions from the production of adipic acid. However, during RY2011, the N₂O abatement device was undergoing maintenance for part of the year. This resulted in a lower percentage of N₂O abatement and thus higher N₂O emissions in RY2011.

Hydrogen Production. GHG emissions from hydrogen production increased steadily by six percent per year from 2010 to 2012. The increased emissions reflect an increase in the quantity of hydrogen produced.

Figure 4: Chemicals Sector - Emissions Trend (2010-2012)

 **ANNUAL REPORTED DIRECT GHG EMISSIONS FROM THE UNDERGROUND COAL MINES SECTOR**



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Table 5: Chemicals Sector – Emissions by GHG (MMT CO₂e)^a

Chemicals (Non-Fluorinated) Sector	Reporting Year		
	2010	2011	2012
Number of facilities	440	440	447
Total emissions (MMT CO₂e)	156.0	164.5	158.7
Emissions by GHG			
Carbon dioxide (CO₂)			
• Adipic Acid Production	1.5	1.6	1.6
• Ammonia Manufacturing	23.6	23.8	24.0
• Hydrogen Production	35.1	37.2	39.5
• Nitric Acid Production	0.7	0.6	0.6
• Petrochemical Production	51.8	52.6	51.4
• Phosphoric Acid Production	2.0	2.0	2.1
• Silicon Carbide Production	0.1	0.1	0.1
• Titanium Dioxide Production	2.4	2.4	2.1
• Other Chemicals	21.2	21.0	19.3
Methane (CH₄)			
• Adipic Acid Production	**	**	**
• Ammonia Manufacturing	**	**	**
• Hydrogen Production	**	**	**
• Nitric Acid Production	**	**	**
• Petrochemical Production	0.1	0.1	0.1
• Phosphoric Acid Production	**	**	**
• Silicon Carbide Production	**	**	**
• Titanium Dioxide Production	**	**	**
• Other Chemicals	**	0.2	**
Nitrous oxide (N₂O)			
• Adipic Acid Production	4.4	10.6	5.8
• Ammonia Manufacturing	**	**	**
• Hydrogen Production	**	**	**
• Nitric Acid Production	12.0	11.3	10.9
• Petrochemical Production	0.1	0.1	0.1
• Phosphoric Acid Production	**	**	**
• Silicon Carbide Production	**	**	**
• Titanium Dioxide Production	**	**	**
• Other Chemicals	**	**	**

^a Totals might not sum due to independent rounding. CO₂ emissions from the combustion of biomass are NOT included.

** Total reported emissions are less than 0.05 MMT CO₂e.

Carbon dioxide is the primary GHG emitted from all chemical production subsectors with the exception of the nitric acid and adipic acid subsectors. Nitrous oxide is produced as a by-product of the nitric acid and adipic acid processes and is the primary GHG emitted from these two subsectors. Small amounts of CH₄ are emitted from facilities in all subsectors, primarily from combustion of process off-gasses for energy recovery or to control emissions of volatile organic compounds or organic hazardous air pollutants.

Figure 5: Chemicals Sector – Average Emissions per Reporter (2012)

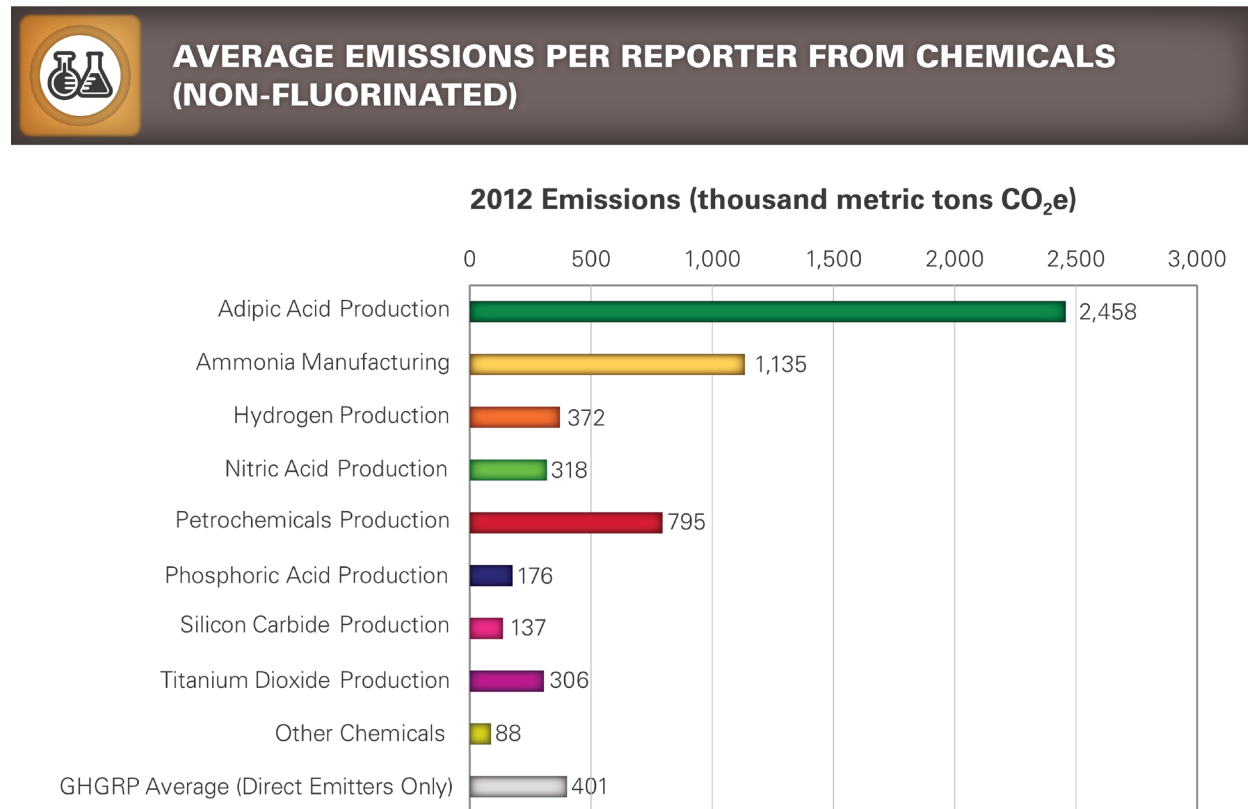
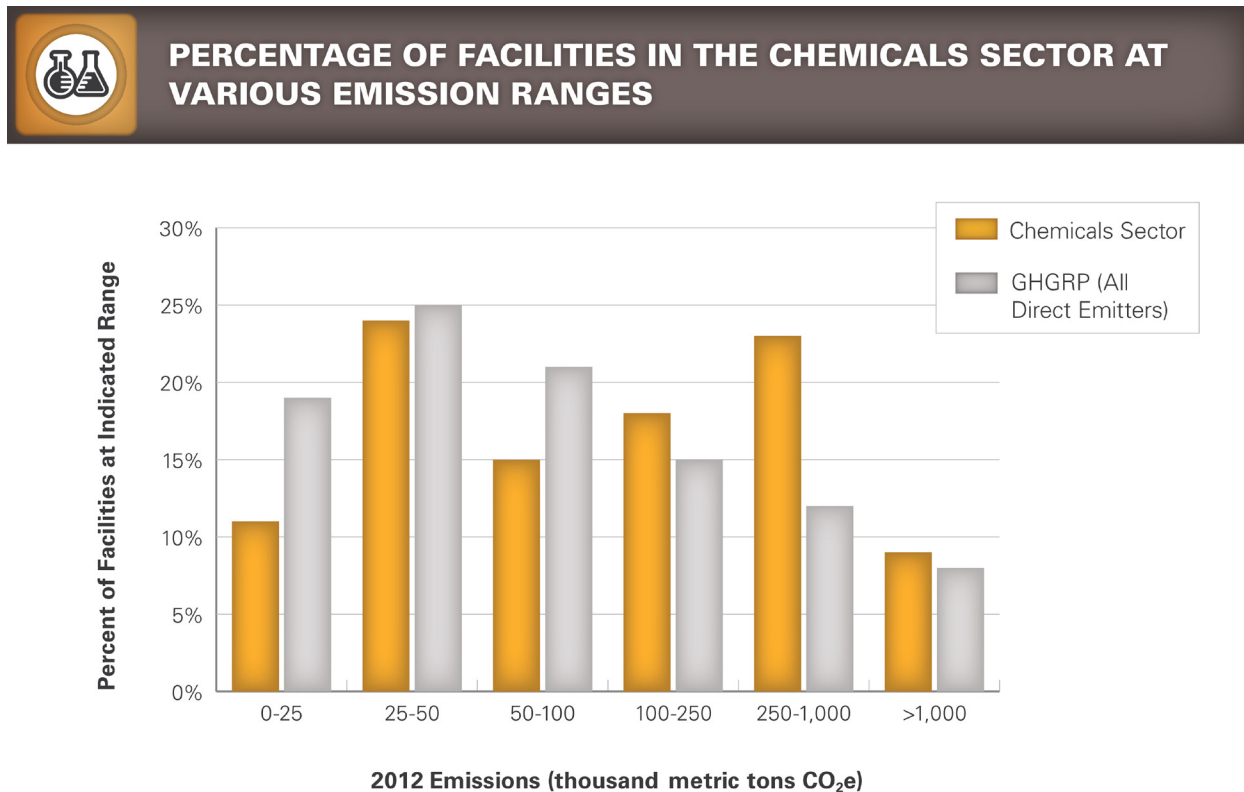


Table 6: Chemical Sector – Number of Reporters by Range of Emissions (2012)

Source Category	Emissions Range (MMT CO ₂ e)					
	0 - 0.025	0.025 - 0.05	0.05 - 0.1	0.1 - 0.25	0.25 - 1	> 1
Total Chemicals Sector^a	52	107	72	85	112	40
Adipic Acid Production					1	2
Ammonia Manufacturing		1		1	11	9
Hydrogen Production	9	14	9	29	37	8
Nitric Acid Production	5	3	5	6	14	3
Petrochemical Production	2	3	4	11	28	17
Phosphoric Acid Production		1	2	6	3	
Silicon Carbide Production				1		
Titanium Dioxide Production				2	5	
Other Chemicals	36	85	52	29	16	1

^a For each emissions range, the number of reporters in the “Total Chemicals Sector” row might be less than a sum of the number of reporters in the respective individual source categories because some facilities contain more than one source category.

Figure 6: Percentage of Reporters by Range of Emissions (2012)



Calculation Methods Used

Facilities must calculate GHG emissions using one of the following methods:

- **CEMS.** Operate a CEMS to measure CO₂ emissions according to requirements specified in 40 CFR part 98, subpart C (does not apply to the adipic and nitric acid subsectors).
- **Carbon mass balance.** Calculate process CO₂ emissions based on measurements of the annual mass of process inputs/outputs, and periodic analyses of the weight fraction of carbon in all inputs and outputs.
- **Site-specific emission factor.** Develop an emission factor by conducting performance tests and measuring process feed rates during the tests.
- **Default emission factors.** Use a default emission factor provided in the rule. The default emission factor was calculated as the average emissions for facilities in a source category based on all available data of acceptable quality (i.e. a population average).
- **Alternative method.** For the adipic acid and nitric acid subsectors, facilities may submit a request to EPA for approval of an alternative emission estimation method. For ethylene process units (in the petrochemical subsector), facilities can use an alternative method (without prior approval) based on measuring emissions from the combustion of ethylene process off gas streams.

Table 7: Adipic Acid Production – Methodologies

Type of Emissions	Methodology	Percentage of Emissions Monitored by Method (by Type)		
		2010	2011	2012
Process Emissions	Facility-specific emission factors	8.7%	4.8%	16.7%
	Alternative method	91.3%	95.2%	83.3%
Combustion Emissions	Measured carbon content, and, if applicable, molecular weight (Tier 3)	52.4%	55.3%	54.4%
	Measured high heating values (HHVs) and default emission factors (Tier 2)	47.5%	44.7%	45.6%
	Default HHVs and emission factors (Tier 1)	0.1%	**	0.1%

** Value is between 0 and 0.05%.

Table 8: Ammonia Manufacturing – Methodologies

Type of Emissions	Methodology	Percentage of Emissions Monitored by Method (by Type)		
		2010	2011	2012
Process Emissions	Mass balance	100%	100%	100%
Combustion Emissions	Alternative Part 75 Methodology: CEMS per §98.33(a)(5)(iii)	0.9%	0%	0%
	Measured carbon content, and, if applicable, molecular weight (Tier 3)	28.0%	26.8%	25.6%
	Measured high heating values (HHVs) and default emission factors (Tier 2)	64.2%	68.7%	66.5%
	Default HHVs and emission factors (Tier 1)	6.9%	4.5%	7.9%

Table 9: Hydrogen Production – Methodologies

Type of Emissions	Methodology	Percentage of Emissions Monitored by Method (by Type)		
		2010	2011	2012
Process Emissions	CEMS	3.9%	3.7%	2.2%
	Mass balance	96.1%	96.3%	97.8%
Combustion Emissions	Alternative Part 75 Methodology: CEMS per §98.33(a)(5)(iii)	20.9%	22.5%	24.5%
	Measured carbon content, and, if applicable, molecular weight (Tier 3)	24.4%	24.2%	23.1%
	Measured high heating values (HHVs) and default emission factors (Tier 2)	46.9%	46%	45.3%
	Default HHVs and emission factors (Tier 1)	7.8%	7.3%	7.1%

Table 10: Nitric Acid Production – Methodologies

Type of Emissions	Methodology	Percentage of Emissions Monitored by Method (by Type)		
		2010	2011	2012
Process Emissions	Facility-specific emission factors	94.3%	92.4%	96.0%
	Alternative method	5.7%	7.6%	4.0%
Combustion Emissions	Measured high heating values (HHVs) and default emission factors (Tier 2)	75.5%	71.0%	71.8%
	Default HHVs and emission factors (Tier 1)	24.5%	29%	28.2%

Table 11: Petrochemical Production – Methodologies

Type of Emissions	Methodology	Percentage of Emissions Monitored by Method (by Type)		
		2010	2011	2012
Process Emissions	Mass balance	86.4%	88.3%	86.0%
	Optional method – Ethylene ^a	13.6%	11.7%	14.0%
Combustion Emissions ^b	CEMS (Tier 4, Subpart C)	8.7%	8.7%	9.0%
	Measured carbon content, and, if applicable, molecular weight (Tier 3)	44.5%	44.9%	44.6%
	Measured high heating values (HHVs) and default emission factors (Tier 2)	44.1%	42.7%	42.6%
	Default HHVs and emission factors (Tier 1)	2.6%	3.7%	3.8%

^a The optional method is specified in the rule and can be used for ethylene processes without prior approval by EPA. Process emissions reported by facilities utilizing this optional method include only flare emissions. Emissions from process off-gas combustion are included in the combustion emissions below. Tier 3 is generally required to estimate process off-gas combustion emissions from facilities using this optional method, which accounts for the relatively high use of Tier 3 below for this subsector.

^b Combustion emissions from five ethylene plants not included here because the plants are co-located within refineries and so the combustion emissions are attributed to the petroleum refining sector.

Table 12: Phosphoric Acid Production – Methodologies

Type of Emissions	Methodology	Percentage of Emissions Monitored by Method (by Type)		
		2010	2011	2012
Process Emissions	Mass balance	100%	100%	100%
Combustion Emissions	Measured high heating values (HHVs) and default emission factors (Tier 2)	38.9%	35.6%	42.4%
	Default HHVs and emission factors (Tier 1)	58.8%	63.6%	55.9%
	Sorbent emissions	1.2%	0.7%	0.9%

Table 13: Silicon Carbide Production – Methodologies

Type of Emissions	Methodology	Percentage of Emissions Monitored by Method (by Type)		
		2010	2011	2012
Process Emissions	Facility-specific emission factor	100%	100%	100%
Combustion Emissions	Default high heating values and emission factors (Tier 1)	100%	100%	100%

Table 14: Titanium Dioxide Production – Methodologies

Type of Emissions	Methodology	Percentage of Emissions Monitored by Method (by Type)		
		2010	2011	2012
Process Emissions	Mass balance	100%	100%	100%
Combustion Emissions	Measured high heating values (HHVs) and default emission factors (Tier 2)	75.3%	75.5%	74.7%
	Default HHVs and emission factors (Tier 1)	24.7%	24.5%	25.3%

Table 15: Other Chemicals – Methodologies

Type of Emissions	Methodology	Percentage of Emissions Monitored by Method (by Type)		
		2010	2011	2012
Combustion Emissions	CEMS (Tier 4)	3.5%	4.5%	2.9%
	Alternative Part 75 Methodology: CEMS per §98.33(a)(5)(iii)	6.0%	5.2%	13.1%
	Measured carbon content, and, if applicable, molecular weight (Tier 3)	8.9%	16.0%	9.5%
	Measured high heating values (HHVs) and default emission factors (Tier 2)	36.4%	42.6%	43.4%
	Default HHVs and emission factors (Tier 1)	22.1%	30.4%	31.2%
	Abbreviated reporting ^a	22.8%	0%	0%
	Sorbent emissions	0.1%	1.3%	**

^a Abbreviated reporting was only allowed for RY2010.

** Value is between 0 and 0.05%.

Best Available Monitoring Methods (BAMM)

During the first year that the GHGRP applied, facilities were allowed to optionally use a best available monitoring method (BAMM) to determine emission inputs for specific emissions sources for a limited amount of time. The use of BAMM was allowed because it was not always feasible for a newly subjected facility to acquire, install, and operate all of the required monitoring equipment by the data required by the GHGRP. EPA's BAMM provision provided time for these facilities to replace their equipment in a way that could minimize impacts to normal business operations. From January 1, 2010 to March 31, 2010, all facilities in the Chemicals Sector were allowed to use BAMM. [Learn more about BAMM.](#)

When the BAMM period expired, facilities were required to follow applicable monitoring and QA/QC requirements unless an extension was approved by EPA. No extensions were granted beyond December 31, 2010 for this sector with the exception of facilities in the hydrogen production and petrochemical production subsectors, which were allowed to apply to use BAMM through December 31, 2015.

Table 16: BAMM Use as Percent of Facilities

BAMM Use	2010	2011	2012
Adipic Acid Production	0%	Not allowed	Not allowed
Ammonia Manufacturing	32%	Not allowed	Not allowed
Hydrogen Production	7% ^a	0%	0%
Nitric Acid Production	0%	Not allowed	Not allowed
Petrochemical Production	23% ^b	8%	5%
Phosphoric Acid Production	0%	Not allowed	Not allowed
Silicon Carbide Production	0%	Not allowed	Not allowed
Titanium Dioxide Production	0%	Not allowed	Not allowed

^a Hydrogen production facilities co-located with petroleum refineries are not included as BAMM users in calculating the percentage of hydrogen production facilities that used BAMM.

^b Four ethylene production facilities co-located with petroleum refineries used BAMM only for Subpart C and other non-petrochemical operations; these four facilities are not included as BAMM users in calculating the percentage of petrochemical facilities that used BAMM.

Data Verification and Analysis

As a part of the reporting and verification process, EPA evaluates annual GHG reports with electronic checks. EPA contacts facilities regarding potential reporting issues and facilities resubmit reports as errors are identified. Additional information on EPA's verification process is available [here](#).

Other Information

Carbon dioxide emissions typically are uncontrolled; however, a few facilities in this sector collect CO₂ either for use in other production processes or for sale, and they report these quantities under subpart PP (Supplies of CO₂). Facilities that reported both as a direct emitter and a supplier of CO₂ include an average of 19 hydrogen producers per year, two ethylene oxide producers, and 18 ammonia manufacturing facilities. Some of the CO₂ reported by ammonia manufacturers was reported both as a direct emission and CO₂ supplied. Some of the N₂O emissions at nitric acid and adipic acid facilities are routed to an abatement technology. Methane emissions are typically uncontrolled.

The EPA currently uses two methods of estimating greenhouse gases: the GHGRP data and the Inventory of U.S. Greenhouse Gas Emissions and Sinks (Inventory). The Inventory estimates the total greenhouse gas emissions across all sectors of the economy using national-level data while the GHGRP collects emissions data from the nation's largest GHG emitting facilities. The processes and industries covered by the Chemicals Sector are also covered by the Inventory, but the emissions are not directly correlated due to differences in coverage and difference in calculation methodologies. More details about the differences between the Inventory and the GHGRP are provided here: <http://www.epa.gov/ghgreporting/ghgdata/reported/inventory.html>.

The following are some specific points regarding the petrochemical subsector:

1. Emissions from the petrochemicals subsector in the Inventory consist only of CO₂ from carbon black processes and CH₄ from carbon black, methanol, EDC, and ethylene processes. (CO₂ emissions from the other petrochemical processes are included in the total Carbon Emitted from Non-Energy Use of Fossil Fuels.)
2. The CO₂ emissions from carbon black processes in the Inventory are in excellent agreement with the CO₂ reported for carbon black processes under the GHGRP.
3. The CH₄ emissions in the Inventory are nearly all from ethylene processes. They are more than an order of magnitude greater than the methane emissions from flares and combustion units that burn off-gas from ethylene processes as reported under the GHGRP. The difference most likely is due to different methodologies. Specifically, a default IPCC emission factor is used to estimate fugitive CH₄ emissions from the steam cracking process in the Inventory, whereas under the GHGRP, fugitive emissions are not determined by ethylene manufacturing units using the optional ethylene combustion calculation methodology and are assumed to be emitted as CO₂ by ethylene manufacturing units using the mass balance calculation methodology.

GLOSSARY

Adipic acid is a white crystalline solid used in the manufacture of synthetic fibers, plastics, coatings, urethane foams, elastomers, and synthetic lubricants. Food-grade adipic acid is used to provide some food products with a tangy flavor.

Ammonia is mainly used as fertilizer, directly applied as anhydrous ammonia, or further processed into urea, ammonium nitrates, ammonium phosphates, and other nitrogen compounds. Ammonia also is used to produce plastics, synthetic fibers and resins, and explosives.

BAMM means Best Available Monitoring Methods. Facilities approved for BAMM may use best available monitoring methods for any parameter (e.g., fuel use, feedstock rates) that cannot reasonably be measured according to the monitoring and QA/QC requirements of a relevant subpart.

Direct emitters are facilities that combust fuels or otherwise put greenhouse gases into the atmosphere directly from their facility. Alternatively, **Suppliers** are entities that supply certain fossil fuels or fluorinated gases into the economy that—when combusted, released or oxidized—emit greenhouse gases into the atmosphere.

FLIGHT refers to EPA's GHG data publication tool, named Facility Level Information on Greenhouse Gases Tool (<http://ghgdata.epa.gov>).

Fluorinated Chemicals sector is separate from the Chemicals sector. Fluorinated Chemicals sector includes facilities that produce hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), sulfur hexafluoride (SF₆), nitrogen trifluoride (NF₃), other fluorinated GHGs such as fluorinated ethers, and chlorofluorocarbons (CFCs) and hydrochlorofluorocarbons (HCFCs), including chlorodifluoromethane (HCFC-22). The category also includes facilities that destroy HFC-23, which is a by-product of HCFC-22 production and may be emitted from the destruction process.

GHGRP means EPA's Greenhouse Gas Reporting Program (40 CFR part 98).

GHGRP vs. GHG Inventory: EPA's Greenhouse Gas Reporting Program (GHGRP) collects and disseminates annual greenhouse gas data from individual facilities and suppliers across the U.S. economy. EPA also develops the annual Inventory of U.S. Greenhouse Gas Emissions and Sinks (GHG Inventory) to track total national emissions of greenhouse gases to meet U.S. government commitments to the United Nations Framework Convention on Climate Change. The GHGRP and Inventory datasets are complementary and may inform each other over time. However, there are also important differences in the data and approach. For more information, please see <http://www.epa.gov/ghgreporting/ghgdata/reported/inventory.html>.

Hydrogen production: Hydrogen is mostly used in the production of ammonia and other chemicals or in industrial applications such as hydrocracking or hydrotreating processes during petroleum refining, metals treating, and food processing. Hydrogen production processes are classified as either captive or merchant. A captive process is owned by the facility that uses the hydrogen in a production process. A merchant plant sells hydrogen to another entity. The hydrogen production subsector comprises emissions from all merchant hydrogen production facilities and from captive processes at petroleum refineries. The GHG emissions from captive hydrogen processes at ammonia manufacturing facilities are included in the ammonia manufacturing subsector.

MMT means million metric tons.

NAICS means the North American Industry Classification System, the standard used by federal statistical agencies to classify business establishments into industrial categories for collecting and publishing statistical data related to the U.S. economy.

Nitric acid is used in the manufacture of nitrogen-based fertilizers, adipic acid, and explosives. Nitric acid is also used for metal etching and processing of ferrous metals.

Petrochemical production source category consists of processes that produce acrylonitrile, carbon black, ethylene, ethylene dichloride, ethylene oxide, or methanol.

- The primary use of acrylonitrile is in the production of synthetic fibers.
- Carbon black is used primarily as a reinforcing agent in tires and other rubber compounds, and also has applications as a pigment.
- Ethylene is used as a feedstock in the production of polyethylene and other chemicals such as ethylene oxide, ethylene dichloride, and ethylbenzene.
- Nearly all ethylene dichloride is used in the production of vinyl chloride monomer, which is used in the production of polyvinyl chloride, a common plastic.
- Ethylene oxide is used as a feedstock in the manufacture of glycols, glycol ethers, alcohols, and amines.

- Methanol is used as a feedstock in the production of acetic acid, formaldehyde, and other chemicals.

Phosphoric acid is used primarily in the manufacture of phosphate fertilizers, but it is also used in food and animal feed additives.

Silicon carbide is used as an industrial abrasive and to produce ceramics for applications requiring high endurance. Applications of silicon carbide include semiconductors, body armor, brakes, clutches, and the manufacture of Moissanite, a diamond substitute.

Titanium dioxide is used as a white pigment in paint manufacturing, paper, plastics, and other applications.

Other Chemicals subsector comprises facilities that reported under subpart C (stationary fuel combustion sources) only and reported NAICS codes starting with 325. This subsector excludes NAICS codes 325193 (ethyl alcohol), 3252XX (synthetic rubber/fibers), 325510 (paints/coatings), and 325920 (explosives), which are included in the sector called "Miscellaneous Combustion Sources."