2011–2016 Greenhouse Gas Reporting Program
Industrial Profile: Metals

October 2018

CONTENTS

METALS SECTOR

Highlights

- Greenhouse gas (GHG) emissions from the Metals sector decreased by 22.6% from 2011 to 2016 mainly due to a reduction in emissions from a handful of large iron and steel reporters, and reductions from aluminum reporters.
- The majority of the emissions from the Metals sector are from facilities located in the central region of the United States, with the largest portion of emissions taking place in the midwestern states of Indiana, Ohio, Michigan, and Pennsylvania.
- Facilities in the Metals sector have found ways to reduce emissions through involvement in voluntary programs such as Energy Star, switching to less GHG-intensive fuels, and improving efficiency through process modifications.

All emissions presented in this document are as of 8/5/2017 and exclude biogenic carbon dioxide (CO_2). GHG data displayed in this document in units of carbon dioxide equivalent (CO_2e) reflect the global warming potential (GWP) values from Table A-1 of 40 CFR 98, which is generally based on the IPCC AR4.

About this Sector

The Metals sector[1] consists of metal production facilities that smelt, refine, and/or cast ferrous and nonferrous metals, including primary aluminum, ferroalloy, iron and steel, lead, magnesium, and zinc from ore, pig, or scrap using electrometallurgical and other methods.[2] Table 1 provides information on the source categories included in the Metals sector. The sector covers coke ovens, regardless of whether or not they are located at an integrated iron and steel facility. The sector also includes stationary fuel combustion sources at foundries and other metal production facilities operating under North American Industry Classification System (NAICS) codes beginning with 331 (Primary Metal Manufacturing). More than half of the GHG emissions in the Metals sector are generated by stationary fuel combustion.

Process CO_2 emissions are generated from the processing of metal ore with carbonaceous materials and fluxes, production of coke, consumption of carbon-containing electrodes, and the use of fluorinated cover gases. Facilities in this sector also emit several other GHGs including methane (CH_4), nitrous oxide (N_2O), sulfur hexafluoride (SF_6), hydrochlorofluorocarbons (HCFCs), and perfluorocarbons (PFCs). However, emissions of CO_2 are significantly higher than emissions of other GHGs in this sector.

Who Reports?

In total, 298 facilities in the Metals sector reported to the GHGRP in 2016. Table 2 summarizes the number of reporters by year. Total reported emissions were 86.7 million metric tons (MMT) CO_2e.

[1] The Greenhouse Gas Reporting Program (GHGRP) covers both primary and secondary production of metals. A description of each metal production source category can be found in the Glossary at the end of this report.

[2] The sector covers coke ovens, regardless of whether located at an integrated iron and steel facility or not.

The Metals sector reflects 3.9% of the facilities reporting direct emissions to the GHGRP and 1.3% of total U.S. GHG emissions.[3]

Table 1: Metals Sector Reporting Schedule and GHGRP Coverage by Subpart

Subpart	Source Category	Applicability	First Reporting Year	Estimated Percent of Industry Facilities Covered by GHGRP	Estimated Percent of Industry Emissions Covered by GHGRP
F	Aluminum Production[a]	All operating facilities	2010	100%	100%
K	Ferroalloy Production[b]	Facilities emitting ≥ 25,000 metric tons CO_2e/year	2010	59%	94–99%
Q	Iron and Steel Production[c]	Facilities emitting ≥ 25,000 metric tons CO_2e/year	2010	~ 100%	~ 100%
R	Lead Production[d]	Facilities emitting ≥ 25,000 metric tons CO_2e/year	2010	100%	100%
T	Magnesium Production and Processing[e]	Facilities emitting ≥ 25,000 metric tons CO_2e/year	2011	77%	76%
GG	Zinc Production[f]	Facilities emitting ≥ 25,000 metric tons CO_2e/year	2010	100%	100%
C	Other Metals[g]	Facilities under NAICS codes beginning with 331 that emit ≥ 25,000 metric tons CO_2e/year from stationary fuel combustion	2010	NA	NA

[a] The GHGRP covers all operating primary aluminum production facilities that manufacture aluminum using the processes outlined in the rule regardless of the amount of GHGs emitted from the facility.

[b] Estimates of the size of the industry are based on information from the U.S. Geological Survey (USGS) Minerals Yearbook – Ferroalloys, September 2016; and from the GHGRP and substituting a range of 5,000 to 20,000 metric tons CO_2e for facilities not reporting.

[c] Estimates of integrated iron and steel facilities, coke plants, and electric arc furnace steel plants were compiled in Available and Emerging Technologies for Reducing Greenhouse Gas Emissions from the Iron and Steel Industry, EPA, Office of Air and Radiation, September 2012. Some facilities listed in this reference did not operate in 2012. A list of eight facilities operating taconite indurating furnaces was obtained from Heller, K. et al., Taconite Iron Ore NESHAP Economic Impact Analysis, EPA-452/R-03-015, August 2003. It should be noted that there may be a few facilities that are not covered by the GHGRP and thus the coverage under the Iron and Steel sector is generally estimated to be slightly less than 100%.

[d] The estimate of the size of the industry is based on the 2016 USGS Minerals Yearbook and the Technical Support Document for the Lead Production Sector, January 2017.

[e] The estimate of the size of the industry is based on estimates from U.S. Greenhouse Gas Emissions and Sinks: 1990–2012 and EPA's SF_6 Emission Reduction Partnership for the Magnesium Industry.

[f] The estimate of the size of the industry is based on the 2016 USGS Minerals Yearbook and the Technical Support Document for the Zinc Production Sector, January 2017. Only six facilities manufacture zinc using waelz kilns or electrothermic furnaces.

[g] Due to the diversity of facilities and products within the other metals subsector, the U.S. population of all facilities similar to this subsector of GHGRP reporters is not available. However, fuel and feedstock data for 2014 from the U.S. Energy Information Administration's data publication indicate that virtually all facilities reporting to EIA under NAICS code 331XXX (Primary Metals Manufacturing) also reported emissions to the GHGRP in 2014.

[3] The total U.S. GHG emissions are 6,586.7 MMT CO_2e as reported in the *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990–2015*. U.S. Environmental Protection Agency (EPA). April 15, 2017. EPA 430-R-14-003.

Table 2: Metals Sector – Number of Reporters (2011–2016)

Metals Sector	Number of Reporters					
	2011	2012	2013	2014	2015	2016
Total Metals Sector	**299**	**301**	**302**	**304**	**300**	**298**
Aluminum Production	11	11	11	10	9	8
Ferroalloy Production	10	10	10	10	10	10
Iron and Steel Production	129	127	127	128	127	124
Lead Production	13	14	14	12	12	11
Magnesium Production and Processing	9	10	9	11	11	10
Zinc Production	6	6	6	6	5	5
Other Metals	121	123	125	127	126	130

Reported Emissions

Table 3 and Figure 1 show the reported metals emissions by subsector from 2011 through 2016.

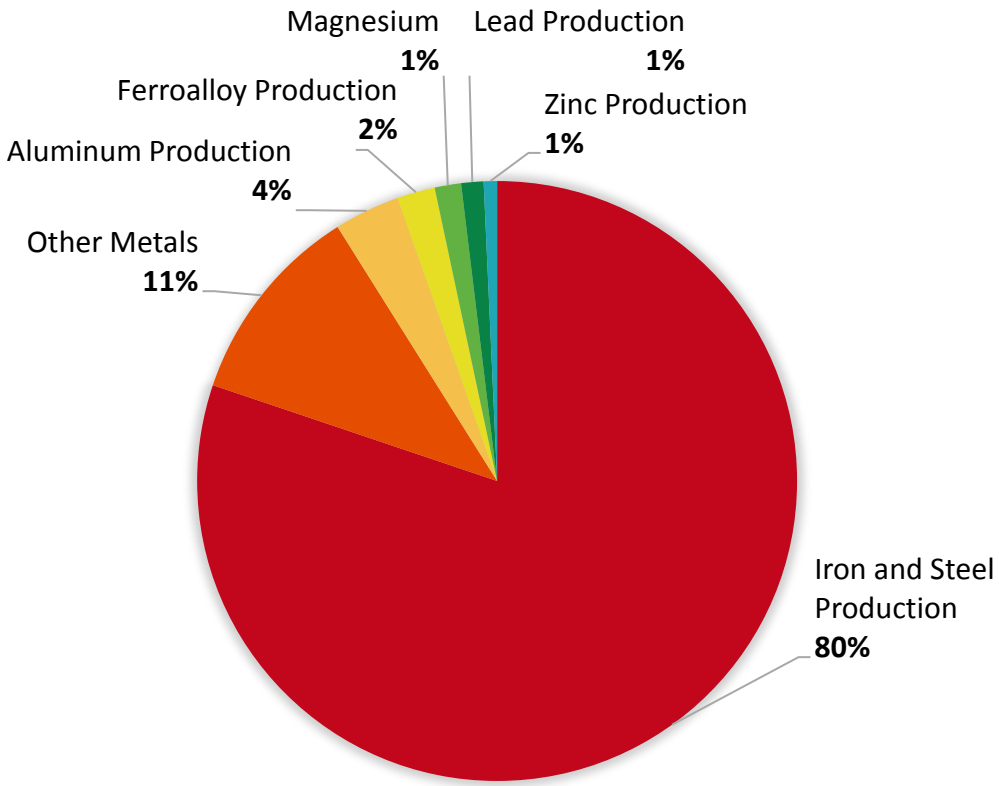
Table 3: Metals Sector Emissions by Subsector (2011–2016)

Metals Sector	Emissions (MMT CO_2e)[a]					
	2011	2012	2013	2014	2015	2016
Total Metals Sector[b]	**112.0**	**106.8**	**106.9**	**104.4**	**90.8**	**86.7**
Aluminum Production	7.3	6.9	6.8	5.9	5.3	3.1
Ferroalloy Production	2.3	2.4	2.3	2.2	2.1	1.8
Iron and Steel Production	89.2	84.0	84.0	82.9	70.8	69.5
Lead Production	1.1	1.1	1.2	1.1	1.0	1.0
Magnesium Production and Processing	1.8	1.6	1.5	1.2	1.2	1.2
Zinc Production	0.9	1.0	0.9	0.7	0.6	0.6
Other Metals (Subpart C)	9.4	9.8	10.3	10.5	9.8	9.4

[a] Emissions of CH_4 and N_2O from process units within the Iron and Steel sector are excluded, except for a relatively small number of process units that monitor emissions using continuous emissions monitoring systems (CEMS).

[b] Represents total emissions reported to the GHGRP from these industries. Additional emissions may occur at facilities that have not reported (e.g., those below the reporting threshold).

Figure 1: Metals Sector – Emissions by Subsector (2016)



Access the most recent data using FLIGHT.

Figure 2 shows the locations of direct-emitting facilities. The size of a circle corresponds to the quantity of emissions reported by that facility.

Readers can identify the largest emitting facilities on the Facility Level Information on GreenHouse gases Tool (FLIGHT) website.

Figure 2: Location and Emissions Range for Each Reporting Facility in the Metals Sector (as of 8/5/2017)

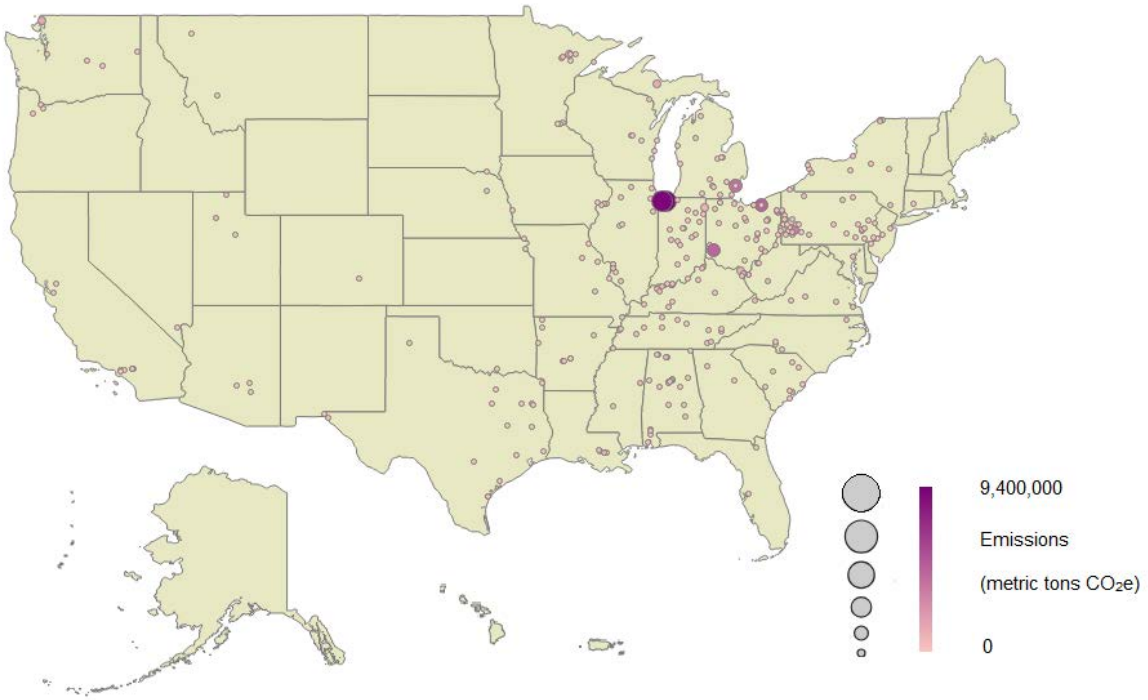
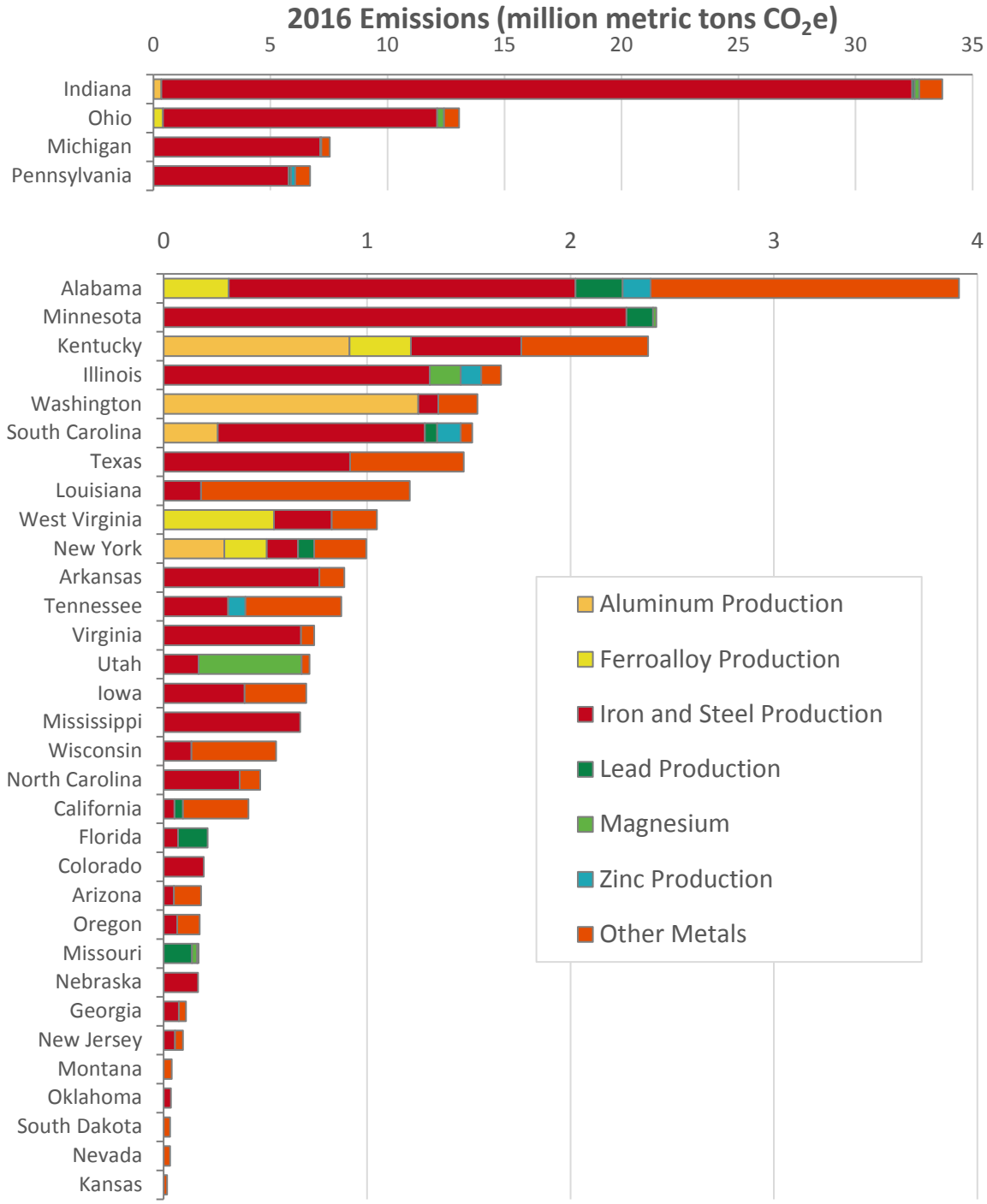


Figure 3: Metals Sector – Emissions by State (2016)[a]



[a] Represents total emissions reported to the GHGRP from this sector. Additional emissions occur at facilities that have not reported (e.g., those below the reporting threshold). States with no reported Metal sector emissions not shown.
Click here to view the most recent data using FLIGHT.

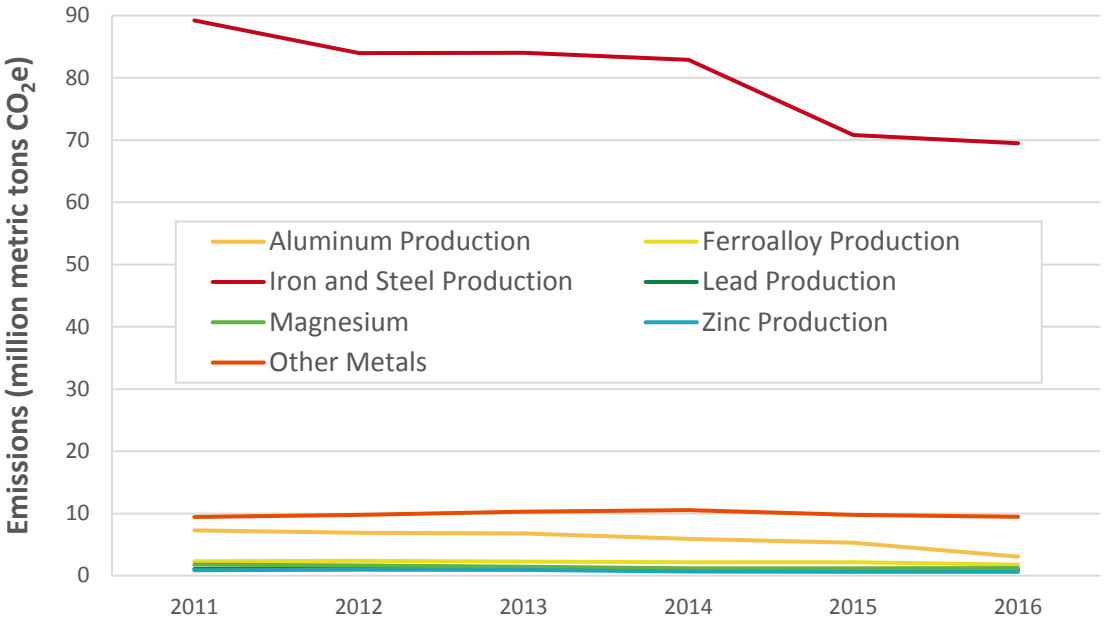
Figure 3 shows the total reported emissions under the Metals sector by state. Indiana, Ohio, Michigan, Pennsylvania, and Alabama have the highest total emissions, which correlate to the large metals industries in these states. The main source of emissions from these states is the Iron and Steel industry, which thrives in the Upper Midwest/Great Lakes region and in northern Alabama due to the availability of raw materials and the close proximity to waterways used for the transport of goods.

Metals Sector Emissions Trends from 2011 to 2016

GHG emissions from all subsectors have decreased from 2011 to 2016, as shown in Figure 4 and Table 4. The main driver for this decrease is increased competition from international manufacturers. The number of reporters for the aluminum, iron and steel, lead, and zinc subsectors have all decreased since 2011. The total emissions from the Metals sector has also decreased from 112 MMT CO_2e to 86.7 MMT CO_2e, a decrease of 22.5%. The largest decrease came from the Iron and Steel sector, which saw a decrease of 22%, or 19.7 MMT CO_2e. No subsector saw a net increase in emissions between 2011 and 2016.

Table 5 shows the combustion emissions by fuel type from the Metals sector.

Figure 4: Metals Sector – Emissions Trend (2011–2016)



Click here to view the most recent data using FLIGHT.

Table 4: Metals Sector – Emissions by GHG for 2011–2016 (MMT CO_2e)[a, b]

Metals Sector	Reporting Year					
	2011	2012	2013	2014	2015	2016
Number of Facilities	**299**	**301**	**302**	**304**	**300**	**298**
Total Emissions	112.0	106.8	106.9	104.4	90.8	86.7
Carbon Dioxide						
• Aluminum Production	3.8	4.0	3.8	3.4	3.3	1.7
• Ferroalloy Production	2.3	2.4	2.2	2.2	2.1	1.8
• Iron and Steel Production[c]	89.2	83.9	84.0	82.8	70.8	69.5
• Lead Production	1.1	1.1	1.2	1.1	1.0	1.0
• Magnesium Production and Processing	0.3	0.4	0.4	0.4	0.4	0.4
• Zinc Production	0.9	1.0	0.9	0.7	0.6	0.6
• Other Metals	9.4	9.7	10.3	10.5	9.8	9.4
Methane						
• Aluminum Production	c	c	c	c	c	c
• Ferroalloy Production	c	c	c	c	c	c
• Iron and Steel Production[d]	c	c	c	c	c	c
• Lead Production	c	c	c	c	c	c
• Magnesium Production and Processing	c	c	c	c	c	c
• Zinc Production	c	c	c	c	c	c
• Other Metals	c	c	c	c	c	c
Nitrous Oxide						
• Aluminum Production	c	c	c	c	c	c
• Ferroalloy Production	c	c	c	c	c	c
• Iron and Steel Production[d]	c	c	c	c	c	c
• Lead Production	c	c	c	c	c	c
• Magnesium Production and Processing	c	c	c	c	c	c
• Zinc Production	c	c	c	c	c	c
• Other Metals	c	c	c	c	c	c
Hydrofluorocarbons						
• Magnesium Production and Processing	c	c	0.1	0.1	0.1	0.1
Perfluorocarbons						
• Aluminum Production	3.5	2.9	3.0	2.5	2.0	1.3
Sulfur Hexafluoride						
• Magnesium Production and Processing	1.5	1.3	1.0	0.7	0.7	0.8

[a] Represents total emissions reported to the GHGRP in this industry sector. Additional emissions occur at facilities that have not reported (e.g., those below the 25,000 metric ton CO_2e reporting threshold).

[b] Totals may not sum due to rounding.

[c] Total reported emissions are less than 0.05 MMT CO_2e.

[d] Includes reports of CH_4 and N_2O emissions from only a relatively small number of emissions points monitored by CEMS.

Table 5: Metals Sector – Combustion Emissions by Fuel Type[a, b]

Fuel type	Emissions (MMT CO_2e)[a]					
	2011	2012	2013	2014	2015	2016
Aluminum Production	**0.5**	**0.5**	**0.6**	**0.5**	**0.5**	**0.4**
Natural Gas	0.5	0.5	0.6	0.5	0.5	0.4
Petroleum Products	c	c	c	c	c	c
Ferroalloy Production	**c**	**c**	**c**	**c**	**c**	**c**
Natural Gas	c	c	c	c	c	c
Petroleum Products	c	c	c	c	0.0	0.0
Other Fuels[d]	0.0	0.0	c	c	c	c
Iron and Steel Production	**58.5**	**53.8**	**54.3**	**52.4**	**46.5**	**45.1**
Coal	0.8	0.6	0.7	0.8	0.6	0.3
Natural Gas	15.0	14.2	14.4	14.9	13.5	12.9
Petroleum Products	0.1	0.2	0.3	0.2	0.1	0.1
Other Fuels[d, e]	42.6	38.8	38.9	36.5	32.4	31.8
Lead Production	**0.3**	**0.4**	**0.4**	**0.3**	**0.3**	**0.4**
Coal	c	c	c	c	c	c
Natural Gas	0.2	0.2	0.3	0.2	0.2	0.3
Petroleum Products	c	c	c	c	c	c
Other Fuels[d]	c	c	c	0.0	0.0	0.0
Magnesium Production and Processing	**0.3**	**0.4**	**0.4**	**0.4**	**0.4**	**0.4**
Natural Gas	0.3	0.3	0.3	0.4	0.4	0.4
Petroleum Products	c	c	c	c	c	c
Zinc Production	**0.1**	**0.1**	**0.1**	**0.1**	**c**	**0.1**
Natural Gas	0.1	0.1	0.1	0.1	c	0.1
Petroleum Products	c	c	c	c	0.0	c
Other Metals	**9.4**	**9.7**	**10.3**	**10.5**	**9.8**	**9.4**
Coal	1.3	1.3	1.4	1.5	1.4	1.3
Natural Gas	8.1	8.4	8.8	9.0	8.3	8.1
Petroleum Products	c	c	c	c	c	c
Other Fuels[d]	0.0	0.0	c	c	c	c

Access the most current FLIGHT data. Select a Fuel Type from the Emissions by Fuel Type filter.

[a] In cases where CO_2 emissions were reported at the unit level (i.e., CEMS-monitored sources), fuel-level CO_2 emissions were estimated by EPA based on other data directly reported by facilities, as well as default emissions factors. Fuel-level emissions values presented may differ slightly from other publicly available GHGRP data due to minor differences in the calculation methodology.

[b] Totals might not sum due to rounding.

[c] Total reported emissions are less than 0.05 MMT CO_2e.

[d] Excludes biogenic CO_2.

[e] Other major fuels include blast furnace gas, coke oven gas, and coal coke

Aluminum Production Emissions[4]

From 1990 to 2016, process emissions of CO_2 have declined by 80 percent, from 6.83 MMT CO_2 to 1.33 MMT CO_2.[5] This decline is due primarily to reductions in domestic aluminum production, which has declined by 80 percent since 1990.[6]

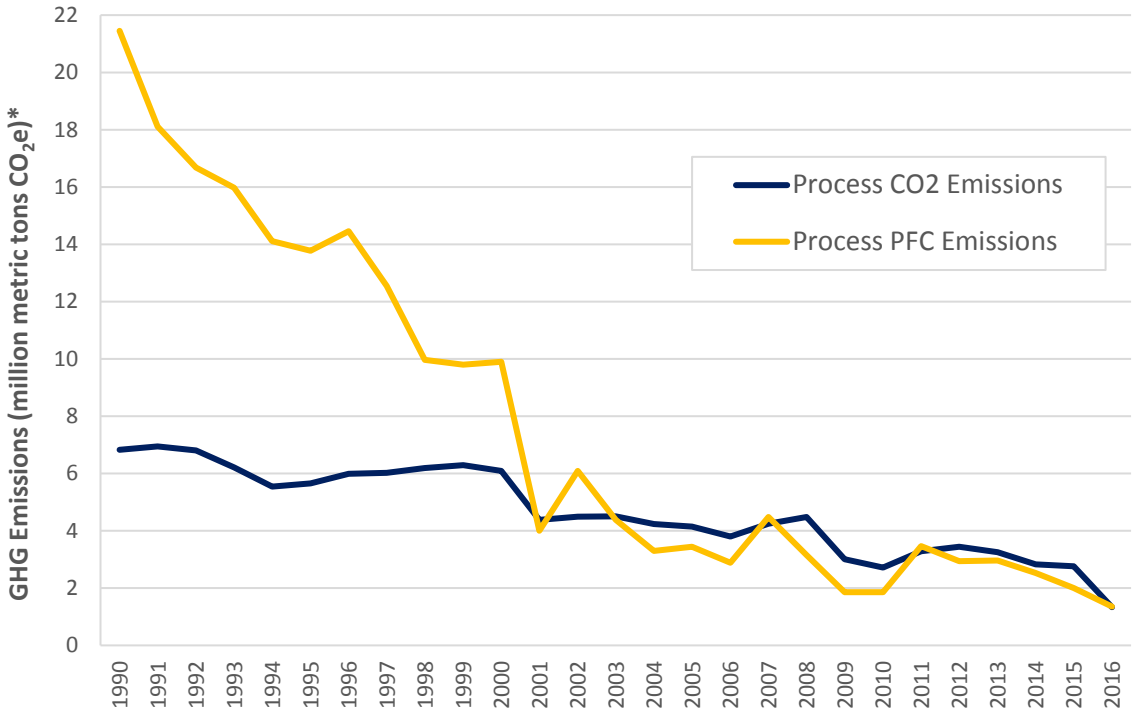
Since 1990, emissions of tetrafluoromethane (CF_4) and hexafluoroethane (C_2F_6; i.e., PFC) have declined by 95 percent and 87 percent, respectively, to 0.9 MMT CO_2e of CF_4 and 0.4 MMT CO_2e of C_2F_6 in 2016. This decline is due both to reductions in domestic aluminum production and to actions taken by aluminum smelting companies to reduce the frequency and duration of anode effects. These actions include technology and operational changes such as employee training, use of computer monitoring, and changes in alumina feeding techniques. For example, from 1995 to 2010, the majority of U.S. primary aluminum producers reported their process CF_4 and C_2F_6 emissions and aluminum production to EPA under a voluntary program, and committed to voluntary reduction goals. From 2010 to 2016, aluminum reporters have reported process emissions of CF_4, C_2F_6, and CO_2 to EPA's GHGRP. Figure 5 shows process CO_2 and C_2F_6 emissions for the primary aluminum sector by year.

[4] As reported under EPA's voluntary program for the Aluminum Production sector and to EPA's GHGRP.

[5] This value is less than the total reported emissions from aluminum production because it excludes fuel combustion.

[6] Calculated from the 1990 value reported in "USGS (1994) Minerals Yearbook: Aluminum Annual Report 1994. U.S. Geological Survey, Reston, VA" and the 2016 value from "USGS (2017) 2017 Mineral Commodity Summaries: Aluminum. Geological Survey, Reston, VA."

Figure 5: Process CO_2 and PFC Emissions for the Primary Aluminum Sector

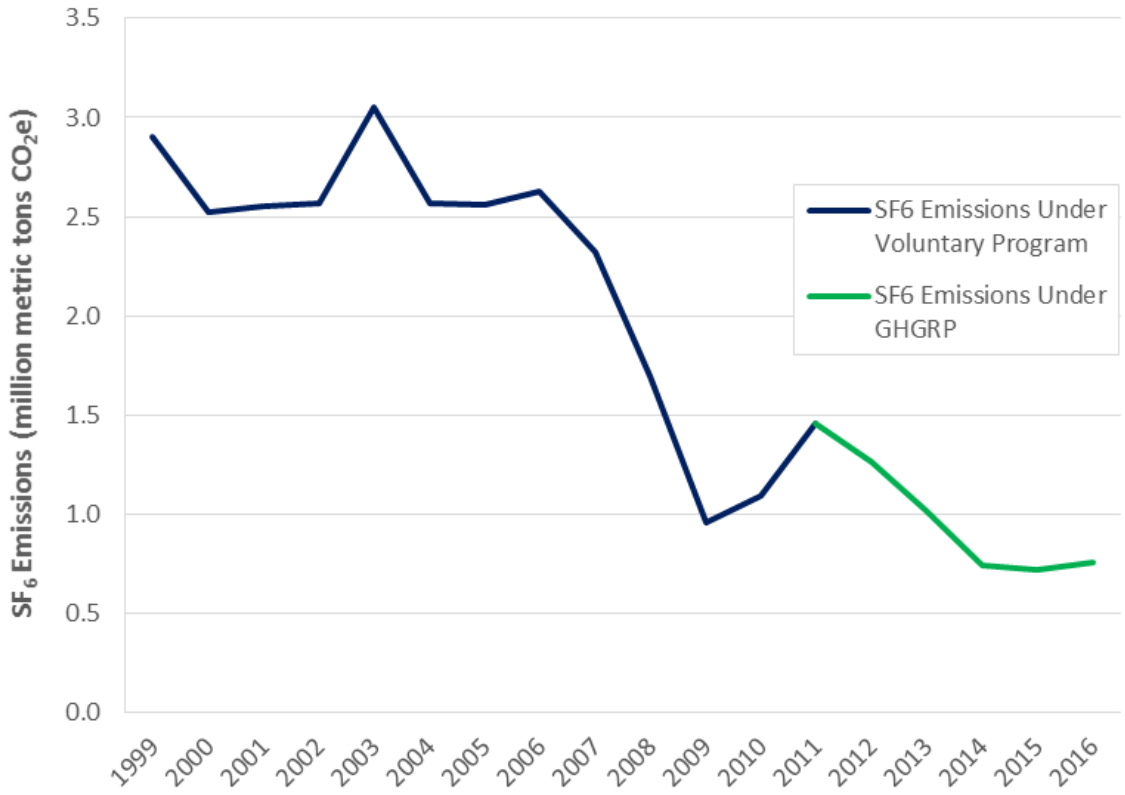


Source: As reported under EPA's voluntary program for the Aluminum Production sector and to EPA's GHGRP.

Magnesium Production and Processing Emissions[7]

EPA launched the "SF_6 Emission Reduction Partnership for the Magnesium Industry" in 1999. The partnership, between the EPA and the U.S. magnesium industry, with support from the International Magnesium Association, launched with the goal of reducing emissions of SF_6 and gaining a better understanding of this potent GHG in light of global climate change. Partners in EPA's SF_6 Emission Reduction Partnership for the magnesium industry provided data to EPA stating their SF_6 emissions (partners did not submit estimates of CO_2 emissions) from the beginning of the program in 1999 until 2011 (see Figure 6). Starting in 2011, most U.S. producers of magnesium began reporting to EPA's GHGRP.

Figure 6: SF_6 Emissions for the Magnesium Production and Processing Sector



Source: As reported under EPA's voluntary program for the Magnesium Production and Processing sector and to EPA's GHGRP.

Figure 6 shows the estimated emissions of SF_6 by the U.S. magnesium industry from 1999 to 2016. Sulfur hexafluoride had been extensively used by industry as a cover gas by diluting it in dry air and/or CO_2, and used as a protectant for molten magnesium metal from oxidation or burning. Protecting the molten magnesium ensures that oxidation of magnesium in the presence of air is minimized, thus reducing the formation of magnesium oxide deposits that would reduce the quality

[7] As reported under EPA's voluntary program for the Magnesium Production and Processing sector and to EPA's GHGRP.

and strength of the product. The emissions have declined dramatically since 1999 for several reasons. First, the magnesium industry was deeply affected by the economic recession and, as a result, suffered from decreased demand for the product and a reduced number of operating facilities. In particular, from 2006 to 2009 the magnesium industry suffered losses due to the economic recession resulting in less production and closure of some facilities. Even with the economy rebounding after 2010, the magnesium industry has still declined in comparison to 1999 levels. Second, there has been an increased demand for the use of aluminum metal over magnesium metal in the automobile industry, which is one of the leading consumers of magnesium metal products. Third, over the past 30 years, the industry has relied less on SF_6 and has instituted best practices, including optimizing how SF_6 is used so that less is needed while still achieving product goals, and by switching to an alternative cover gas.

Figure 7 shows the average emissions per reporter under the Metals sector. Iron and steel production has average emissions per reporter that are greater than the average for all reporters in the program. Table 6 and Figure 8 show the number and percentage of reporters falling within different emission ranges, respectively.

Figure 7: Metals Sector – Average Emissions per Reporter (2016)

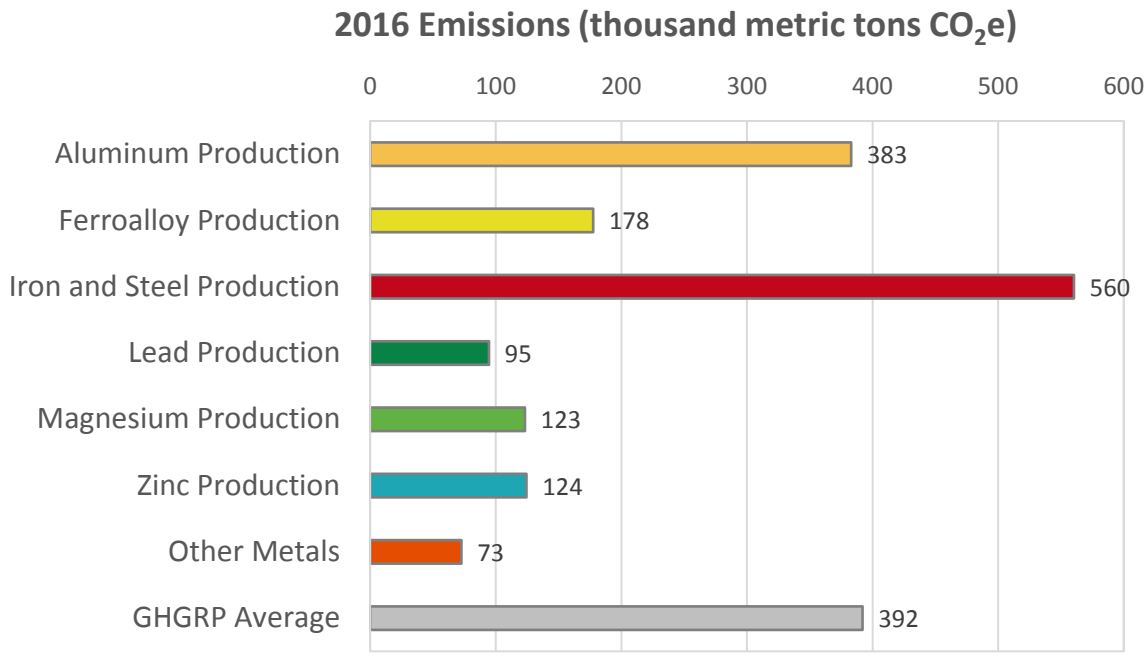
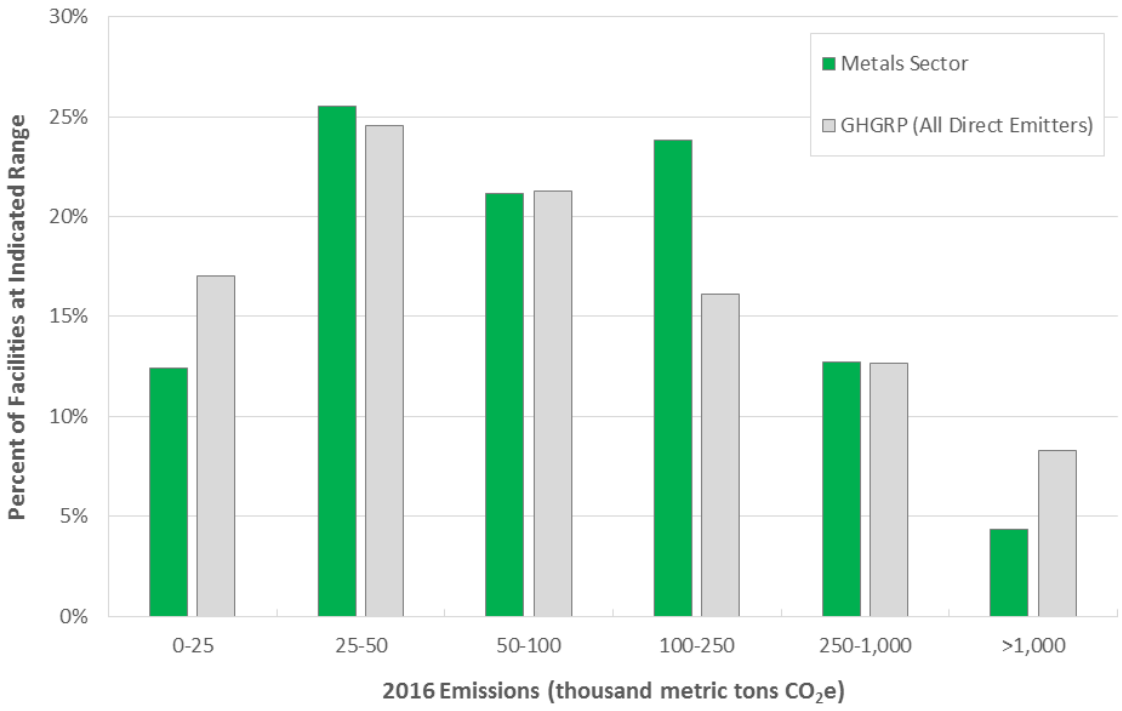


Table 6: Metals Sector – Number of Reporters by Range of Emissions (2016)

Metals Sector	Emissions Range (MMT CO_2e)					
	0–0.025	0.025–0.05	0.05–0.1	0.1–0.25	0.25–1	> 1
Total Metals Sector	**37**	**76**	**63**	**71**	**38**	**13**
Aluminum Production	1	0	1	1	4	1
Ferroalloy Production	1	2	0	5	2	0
Iron and Steel Production	7	16	30	34	25	12
Lead Production	0	3	3	5	0	0
Magnesium Production and Processing	4	2	0	2	2	0
Zinc Production	0	0	1	4	0	0
Other Metals	24	53	28	20	5	0

Figure 8: Percentage of Reporters by Range of Emissions (2012)



Emissions Calculation Methods Available for Use

Emissions Calculation Methodologies for Process Emissions Sources

Metals facilities must calculate GHG emissions using one of the following methods:

- **CEMS –** Operate a CEMS to measure CO_2 emissions according to requirements specified in 40 CFR Part 98, Subpart C.
- **Carbon mass balance –** Calculate GHG emissions based on measurements of the annual mass of process inputs or outputs, or both (depending on the subsector); and periodic analyses of the weight fraction of carbon in inputs and outputs.
- **Site-specific emissions factors –** Calculate process GHG emissions using emissions factors derived through emissions testing at the facility.
- **Default emissions factors –** Calculate process GHG emissions using an emission factor provided in the rule.

Emissions Calculation Methodologies for Process Emissions Sources

For fuel combustion emissions, facilities must generally follow the applicable tier method prescribed in Subpart C (general stationary fuel combustion sources) to estimate CO_2, CH_4, and N_2O emissions. Access an explanation for the calculation methodologies for Subpart C.

Monitoring Methodologies Used for Process and Combustion Emissions Sources

Tables 7 through 13 summarize the monitoring methodologies used by year for each subsector.

Table 7: Aluminum Production – Methodologies (2011–2016)

Type of Emissions	Methodology	Portion of Emissions Monitored by Method (by Type)					
		2011	2012	2013	2014	2015	2016
Process Emissions – CO_2	Mass balance[a]	100%	100%	100%	100%	100%	100%
Process Emissions – CF_4 and C_2F_6	Site-specific emission factors[b]	100%	100%	100%	100%	100%	100%
Combustion Emissions	Measured high heating values (HHVs) and default emission factors (Tier 2)	54.7%	58.7%	48.7%	55.3%	55.9%	40.7%
	Default HHVs and emission factors (Tier 1)	45.3%	41.3%	51.3%	44.7%	44.1%	59.3%

[a] Facilities had the option of using CEMS.
[b] Some facilities had the option to use default emissions factors.

Table 8: Ferroalloy Production – Methodologies (2011–2016)[a]

Type of Emissions	Methodology	Portion of Emissions Monitored by Method (by Type)					
		2011	2012	2013	2014	2015	2016
Process Emissions – CO_2	Mass balance	100%	100%	100%	100%	100%	100%
Process Emissions – CH_4	Default emissions factors	100%	100%	100%	100%	100%	100%

Table 8: Ferroalloy Production – Methodologies (2011–2016)[a]

Type of Emissions	Methodology	Portion of Emissions Monitored by Method (by Type)					
		2011	2012	2013	2014	2015	2016
Combustion Emissions	Measured carbon content and, if applicable, molecular weight (Tier 3)	16.8%	15.4%	14.3%	12.1%	14.3%	15.5%
	Default HHVs and emission factors (Tier 1)	83.2%	84.6%	85.6%	87.9%	85.7%	84.5%

[a] Percentages may not total to 100% due to rounding.

Table 9: Iron and Steel Production – Methodologies (2011–2016)[a]

Type of Emissions	Methodology	Portion of Emissions Monitored by Method (by Type)					
		2011	2012	2013	2014	2015	2016
Process Emissions	CEMS[b]	15.6%	18.0%	20.4%	15.1%	23.9%	29.4%
	Mass balance (including flares)	58.0%	54.3%	54.3%	38.8%	50.1%	47.7%
	Site-specific emission factor	25.9%	27.1%	24.7%	45.5%	25.1%	22.3%
	Default emission factor for coke pushing	0.5%	0.7%	0.7%	0.5%	0.8%	0.6%
Combustion Emissions	CEMS (Tier 4)	0.4%	0.6%	0.2%	0.3%	0.4%	0.4%
	Measured carbon content and, if applicable, molecular weight (Tier 3)	33.9%	37.4%	32.4%	33.0%	31.4%	26.9%
	Measured HHVs and default emission factors (Tier 2)	55.3%	52.5%	57.0%	55.7%	57.4%	61.7%
	Default HHVs and emission factors (Tier 1)	10.4%	9.4%	10.4%	10.9%	10.8%	11.0%

[a] Percentages may not total to 100% due to rounding.

[b] Some continuous emissions monitoring systems (CEMS) monitor a mixture of process and combustion emissions in a common stack. In these cases, facilities are not required to report the discrete fractions of process and combustion emissions; only the combined total is reported. This table excludes emissions from CEMS that co-monitor process and combustion emissions.

Table 10: Lead Production – Methodologies (2011–2016)[a]

Type of Emissions	Methodology	Portion of Emissions Monitored by Method (by Type)					
		2011	2012	2013	2014	2015	2016
Process Emissions	Mass balance[b]	100%	100%	100%	100%	100%	100%
Combustion Emissions	Measured carbon content and, if applicable, molecular weight (Tier 3)	1.2%	0%	0%	0%	0%	0%
	Measured HHVs and default emission factors (Tier 2)	10.3%	10.7%	23.4%	10.3%	9.1%	9.1%
	Default HHVs and emission factors (Tier 1)	72.2%	72.9%	66.2%	79.2%	79.3%	79.2%
	Sorbent emissions	16.3%	16.3%	10.4%	10.5%	11.7%	11.8%

[a] Percentages may not total to 100% due to rounding.

[b] Facilities had the option to use CEMS.

Table 11: Magnesium Production and Processing – Methodologies (2011–2016)[a]

Type of Emissions	Methodology	Portion of Emissions Monitored by Method (by Type)					
		2011	2012	2013	2014	2015	2016
Process Emissions	Mass balance by cover/carrier gas inventory	32.5%	54.1%	34.0%	59.9%	47.9%	73.3%
	Mass balance by gas cylinder weighing	67.4%	45.9%	66.0%	40.1%	52.1%	26.7%
Combustion Emissions	Default HHVs and emission factors (Tier 1)	100%	100%	100%	100%	100%	100%

[a] Percentages may not total to 100% due to rounding.

Table 12: Zinc Production – Methodologies (2011–2016)[a]

Type of Emissions	Methodology	Portion of Emissions Monitored by Method (by Type)					
		2011	2012	2013	2014	2015	2016
Process Emissions	Mass balance[b]	100%	100%	100%	100%	100%	100%
Combustion Emissions	Default HHVs and emission factors (Tier 1)	100%	100%	100%	100%	100%	100%

[a] Percentages may not total to 100% due to rounding.

[b] Facilities had the option to use CEMS.

Table 13: Other Metals Production – Methodologies (2011–2016)

Type of Emissions	Methodology	Portion of Emissions Monitored by Method (by Type)					
		2011	2012	2013	2014	2015	2016
Combustion Emissions[d]	Alternative Part 75 Methodology: CEMS per §98.33(a)(5)(iii)[a, b]	0.3%	0.3%	0.5%	0.2%	0.2%	0.2%
	Measured carbon content and, if applicable, molecular weight (Tier 3)	2.4%	2.5%	2.7%	2.3%	2.1%	2.7%
	Measured HHVs and default emission factors (Tier 2)	24.4%	22.8%	22.2%	21.8%	20.8%	22.6%
	Default HHVs and emission factors (Tier 1)	72.9%	74.4%	74.3%	75.7%	76.9%	74.5%
	Sorbent emissions	[c]	[c]	[c]	[c]	[c]	[c]

[a] Units that are required to monitor emissions according to 40 CFR Part 75 can report CO_2 emissions under Subpart C using Part 75 calculation methods and monitoring data that they already collect under Part 75 (e.g., heat input, fuel use).

[b] Some CEMS monitor a mixture of process and combustion emissions in a common stack. In these cases, discrete fractions of process and combustion emissions are not reported; only the combined total is reported.

[c] Value is between 0% and 0.05%.

[d] Percentages may not total to 100% due to rounding.

Data Verification and Analysis

As a part of the reporting and verification process, EPA evaluates annual GHG reports with electronic verification checks. EPA contacts facilities regarding potential reporting issues. Statistics related to EPA's verification of reports from this sector are provided below. Access additional information on EPA's verification process.

Glossary

Aluminum production means the manufacturing of primary aluminum using the Hall-Héroult manufacturing process. The primary aluminum process comprises electrolysis in prebake and Söderberg cells, and anode baking for prebake cells. This subsector excludes experimental cells and research and development process units.

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

The **ferroalloy production** subsector comprises facilities that use pyrometallurgical techniques to produce any of the following metals: ferrochromium, ferromanganese, ferromolybdenum, ferronickel, ferrosilicon, ferrotitanium, ferrotungsten, ferrovanadium, silicomanganese, or silicon metal.

FLIGHT refers to EPA's GHG data publication tool, named the Facility Level Information on Greenhouse Gases Tool.

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 GHG 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 GHGs to meet U.S. government commitments to the United Nations Framework Convention on Climate Change. The GHGRP and GHG Inventory datasets are complementary and may inform each other over time. However, there are also important differences in the data and approach. Access more information.

The **iron and steel production** subsector comprises facilities that make iron from iron ore and coke in a blast furnace, and refine the molten iron (and some ferrous scrap) in a basic oxygen furnace to make steel. Electric arc furnace operations that remelt the ferrous scrap and direct reduced iron are also included, as are processes that decarburize raw steel. This subsector also includes taconite (iron ore) processing facilities, coke-making facilities, and direct reduced iron production facilities.

The **lead production** subsector comprises primary and secondary lead smelters. A primary lead smelter produces lead metal from lead sulfide ore concentrates through the use of pyrometallurgical processes. A secondary lead smelter produces lead and lead alloys from lead-bearing scrap metal. Lead is used in products such as batteries, ammunition, construction materials, electrical components and accessories, and vehicle parts.

The **magnesium production and processing** subsector consists of any process in which magnesium metal is produced through smelting (including electrolytic smelting), refining, or remelting operations; and any process in which molten magnesium is used in alloying, casting, drawing, extruding, forming, or rolling operations.

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.

The **other metals** subsector comprises metals production facilities under NAICS codes beginning with 331 that are not otherwise subject to a metals Subpart under Part 98.

Primary metal manufacturing refers to the production of metal products from ore using electrometallurgical and other process metallurgical techniques. **Secondary metal manufacturing** refers to the production of alloys from ingots and the recovery of metal from scrap and salvage.

The **zinc production** subsector comprises primary zinc smelters and zinc recycling processes.