2011-2021 Greenhouse Gas Reporting Program Industrial Profile: Minerals

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Introduction

All emissions presented here reflect the most recent information reported to EPA as of 8/12/2022. The reported emissions exclude biogenic carbon dioxide (CO_2). Greenhouse gas (GHG) data displayed here in units of carbon dioxide equivalent (CO_2e) and reflect the global warming potential (GWP) values from Table A-1 of 40 CFR 98, which is generally based on the International Panel on Climate Change (IPCC) Assessment Report (AR4), with the addition of GWPs from the IPCC AR5 for fluorinated GHGs that did not have GWPs in the AR4. The AR4 GWP value for methane (CH_4) is 25 and AR4 GWP value for nitrous oxide (N_2O) is 298.

Highlights

- Emissions from the Minerals Sector were 114.3 million metric tons of carbon dioxide equivalent (MMT CO_2e) in 2021. There were 373 facilities that reported to the Greenhouse Gas Reporting Program (GHGRP) for reporting year 2021.
- The largest emitting subsector was Cement Production, which emitted 2.6 times more CO_2e than the next largest subsector (Lime Manufacturing).
- Emissions from this sector increased by about 4.4% from 2020 to 2021. The largest increase in reported emissions was observed in the Cement Production sector.

About this Sector

As shown in Table 1, the Minerals sector consists of the following subsectors: Cement Production, Glass Production, Lime Manufacturing, Soda Ash Production, and Other Minerals production facilities that operate under NAICS codes beginning with 327 (Nonmetallic Mineral Product Manufacturing). Facilities under this sector transform mined or quarried nonmetallic minerals, such as sand, gravel, stone, clay, and refractory materials, into products for intermediate or final consumption. Cement Production, Glass Production, and Lime Manufacturing facilities report both process emissions from the calcination of carbonate-based raw materials and GHG emissions from stationary combustion sources. The Other Minerals production subsector comprises facilities that report GHG emissions only from stationary fuel combustion sources. A small number of facilities in this sector collect CO_2 either for use in their other production processes (e.g., sugar refining), to transfer to other users, or to sequester or otherwise inject underground. Process emissions reported under this sector include this CO_2.

Who Reports?

In 2021, 373 facilities in the Minerals Sector reported emissions of 114.2502 MMT CO_2e. Table 2 shows the number of Minerals sector reporters by subsector for all reporting years. The Minerals Sector represents 4.9% of the facilities reporting direct emissions to the GHGRP. As of 2020 (the

most current year for which U.S. Greenhouse Gas Inventory data are available), the Minerals Sector represented about 1.9% of total U.S. GHG emissions.[1]

Table 1: Minerals Sector Reporting Schedule by Subpart

Subpart	Subsector	Applicability	First Reporting Year
H	Cement Production	All facilities	2010
S	Lime Manufacturing	All facilities	2010
N	Glass Production	Facilities emitting > 25,000 metric tons CO2e/year	2010
C	Other Minerals	Facilities under NAICS codes beginning with 327 (nonmetallic mineral product manufacturing) that emit ≥ 25,000 metric tons CO2e/year from stationary fuel combustion	2010
CC	Soda Ash Production	All facilities	2010

Table 2: Minerals Sector - Number of Reporters (2011 - 2021)

Subsector	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Cement Production	98	98	96	95	95	95	94	92	92	92	92
Glass Production	112	109	109	110	107	104	102	104	102	101	100
Lime Manufacturing	75	75	75	76	75	75	75	74	72	71	68
Other Minerals	80	85	96	98	102	99	104	113	115	114	110
Soda Ash Production	4	4	4	4	4	3	4	4	4	4	4
Total Minerals Sector	**367**	**369**	**378**	**381**	**381**	**374**	**377**	**386**	**384**	**381**	**373**

Note: The number of reporters in each subsector may sum to more than the number of total Minerals Sector reporters because some facilities report to more than one subsector.

Table 3 shows the estimated percentage of facilities and emissions reported to GHGRP for each Minerals subsector. When the program began in 2010, for all of the subsectors, all U.S. facilities reported to the GHGRP. Due to the GHGRP off-ramping provisions, some facilities may have qualified to discontinue reporting.[2]

[1] Total U.S. GHG emissions in 2020 were 5,981 MMT CO_2e as reported in the Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2019. U.S. Environmental Protection Agency. April 14, 2021. EPA 430-R-21-005. Available at: https://www.epa.gov/ghgemissions/inventory-us-greenhouse-gas-emissions-and-sinks

[2] See FAQ: When is a Facility Eligible to Stop Reporting? Available: https://ccdsupport.com/confluence/pages/viewpage.action?pageId=243139271

Table 3: Minerals Sector - GHGRP Coverage

Subsector	GHGRP Coverage of Industry	Estimated Percent of Industry Facilities Covered by GHGRP	Estimated Percent of Industry Emissions Covered by GHGRP
Cement Production	All facilities	100%	100%
Lime Manufacturing	All facilities	100%	100%
Glass Production	Facilities emitting > 25,000 metric tons CO2e/year	29%[a]	60%-86%[b]
Other Minerals	Facilities emitting > 25,000 metric tons CO2e/year	N/A[c]	N/A[c]
Soda Ash Production	All facilities	100%	100%

[a] *Note: This estimate has not been updated since 2009. In 2009, EPA estimated the size of the Glass subsector using data from the 2006 "Glass Factory Directory," a proprietary data source. Based on this data source, EPA estimated that there were 374 glass production facilities in the United States. In 2010, 110 glass production facilities reported to the GHGRP. These glass production facilities emitted 25,000 metric tons CO_2e per year or more and were therefore required to report GHG emissions to the GHGRP. Based on the 2009 estimate of the number of glass production facilities (374) and the facilities that reported to the GHGRP in 2010 (110), the estimated GHGRP coverage of glass production facilities in the United States was 29%.*

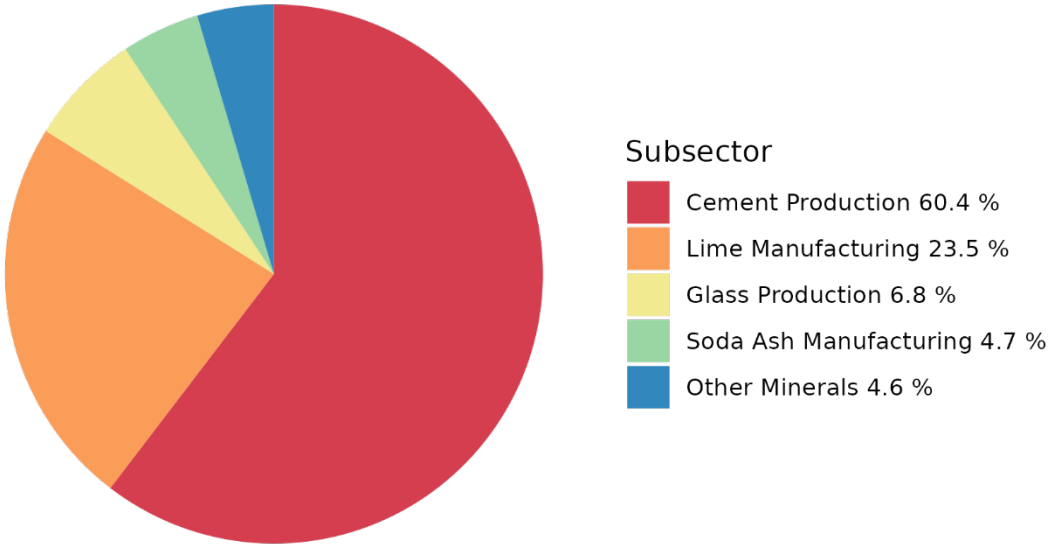
[b] *This estimate has not been updated since 2009. In 2009, EPA estimated total emissions from this sector using data from the 2006 "Glass Factory Directory", a proprietary data source. In order to estimate the amount of coverage for CO2e emissions for the glass production industry, an average assumed emissions range of 5,000 to 20,000 metric tons CO2e per year for each of the 264 facilities not covered by the GHGRP was used to estimate a total emissions range of 1.3 to 5.3 million metric tons CO_2e per year. Using the reported 2010 GHGRP emissions total of 8.1 million metric tons CO_2e, GHGRP emissions coverage for the glass production industry was estimated to be between 60% and 86%.*

[c] *Due to the diversity of facilities and products within the Other Minerals subsector, the U.S. population of all facilities in this subsector of GHGRP reporters is not available.*

Reported Emissions in 2021

Figure 1 shows the total reported emissions by Minerals subsector for 2021.

Figure 1: Minerals Sector - Emissions by Subsector (2021)

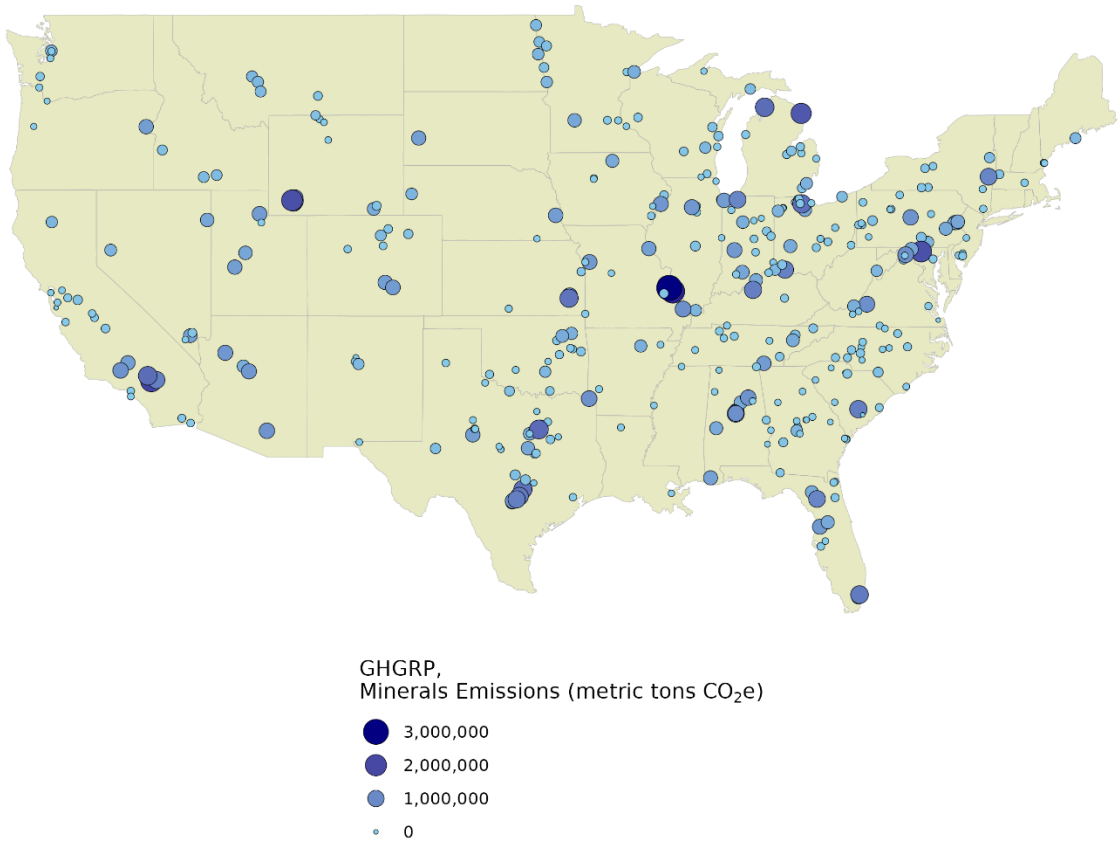


Note: Represents total emissions reported to the GHGRP from this sector. Additional emissions may occur at facilities that have not reported; for example, those below the reporting threshold.

Click here to view the most current data using the Facility Level Information on Greenhouse Gases Tool (FLIGHT).

Figure 2 shows the geographic distribution and emissions range for Minerals facilities in 2021.

Figure 2: Location and Relative Emissions Range for Facilities Reporting in the Minerals Sector (as of 2021)

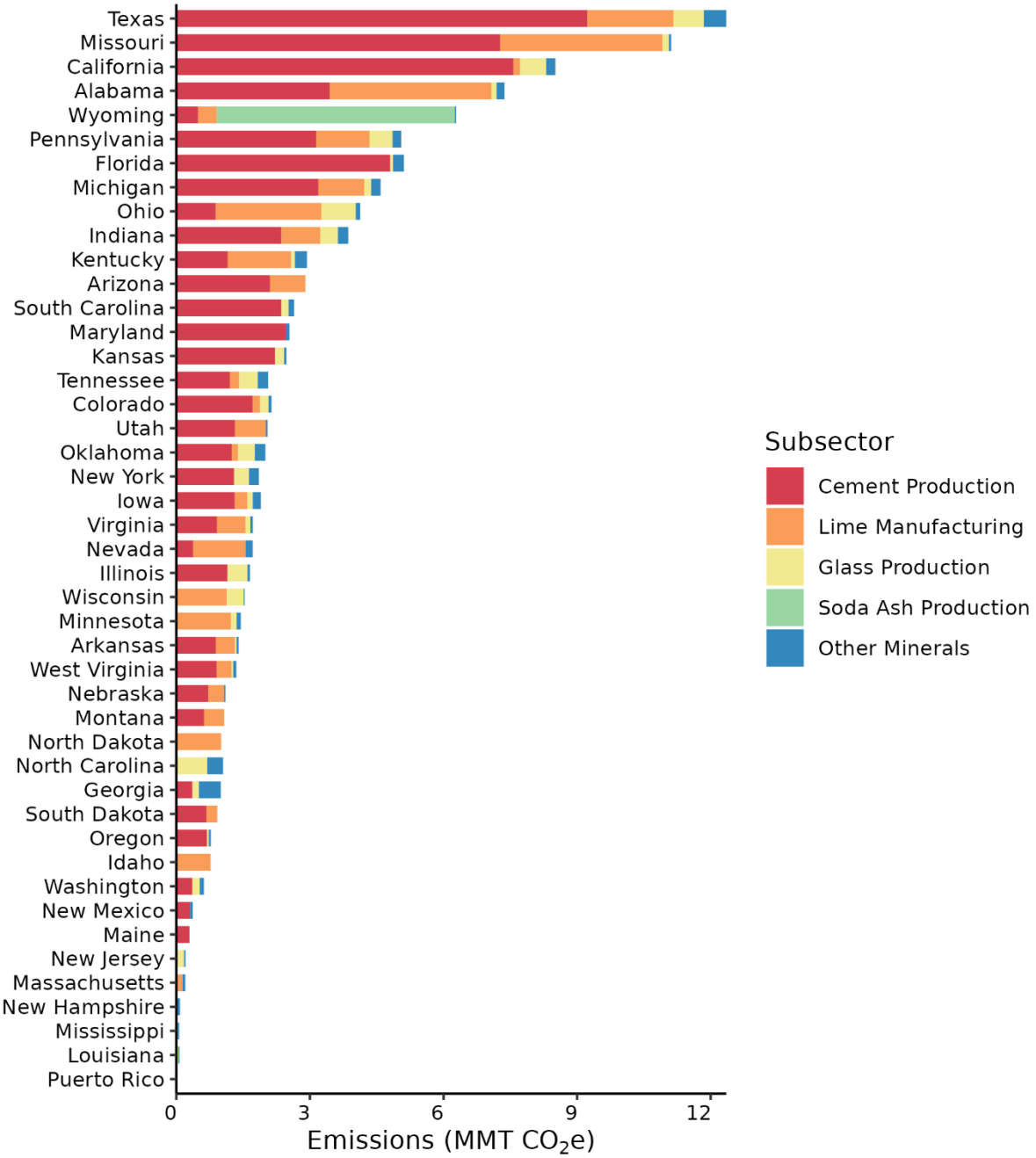


This map shows the locations of direct-emitting facilities. The size of a circle corresponds to the quantity of emissions reported by that facility. There are also Minerals Sector facilities located in Puerto Rico (https://www.epa.gov/ghgreporting/ghgrp-minerals). No facilities that reported to the Minerals Sector in 2021 are located in Alaska or Hawaii.

Readers can identify the largest emitting facilities by visiting FLIGHT.

Facilities in the Minerals Sector are not highly concentrated geographically. Mineral facilities are located in 44 states and Puerto Rico. Figure 3 shows the breakdown of Minerals emissions by state and subsector in 2021.

Figure 3: Minerals Sector - Emissions by State (2021)



Note: Represents total emissions reported to the GHGRP from this industry. Additional emissions occur at facilities that have not reported, for example those below the reporting threshold. Click here to view the most current information using FLIGHT.

Note: States where no Minerals facilities reported to GHGRP for the current reporting year are not listed.

Minerals Sector Emissions Trends from 2011 to 2021

Mineral sector emissions were 11.0 MMT CO_2e higher in 2021 than in 2011 (10.7% increase). The largest increase in emissions was seen in the Cement Production subsector, where emissions increased by 13.5 MMT CO_2e.

Mineral sector emissions were 4.8 MMT CO_2e higher in 2021 than 2020 (4.4% increase). The largest increase in emissions was seen in the Cement Production subsector, where emissions increased by 2.6 MMT CO_2e.

Greenhouse Gas Reporting Program (GHGRP) emissions reported for the minerals sector increased from 103.2 million metric tons (MMT) CO_2e in 2011 to 114.3 MMT CO_2e in 2021, an increase of 11%. Reported emissions reached a maximum of 117.0 MMT CO_2e in 2014. Emissions for the sector increased by 4.4% in 2021 from 109.4 MMT CO_2e in 2020 to 114.3 MMTCO_2e in 2021. Emissions from all subsectors were higher in 2021 compared with 2020, except the other mineral production subsector.

The cement production subsector accounts for 60% of total reported emissions from the minerals sector and is largely responsible for trends in the minerals sector. Emissions from the lower-emitting glass and lime subsectors also affect the overall emissions trends for this sector.

Cement Production. The reported emissions for cement production include both the process emissions from the calcination of limestone and the combustion emissions from the burning of fuels. The process emissions consist of CO_2 generated during the calcination of limestone in a kiln to produce clinker. Emissions from calcination and the combustion of fossil fuels each account for about one-half of the total CO_2 emissions from kilns. Reported emissions from the cement production subsector have increased by 24%, from 55.6MMT CO_2e in 2011 to 69.0 MMT CO_2e in 2021, even though there were 6 fewer cement production facilities reporting in 2021 than in 2011. From 2020 to 2021, emissions increased by about 4%, from 66.4 to 69.0 MMT CO_2e.

Increases and decreases in clinker production can be attributed to an increase or decrease in demand for cement in new residential and non-residential construction. Clinker production decreased in 2020 and CO_2e emissions declined by 0.86 MMT compared with 2019. Production increased slightly in 2021 due to improved economic conditions following the COVID-19 pandemic; however, growth continued to be constrained by closed or idle plants, underutilized plant capacity, production disruptions due to upgrades, and relatively inexpensive imports.[3]

Lime Manufacturing. The reported emissions for lime manufacturing include both the process emissions and the combustion emissions from the burning of fossil fuels. The process emissions consist of CO_2 generated during the calcination of limestone. Major uses of lime include industrial, chemical, and environmental applications. Reported emissions from the lime production subsector have remained relatively steady as demand for lime has remained fairly stable. The emissions have varied from a low of 25.1 MMT CO_2e reported in 2020 to a high of 31.6 MMT CO_2e in 2014. The average emission rate from 2011 to 2021 is 29.0 MMT CO_2e. The lowest emissions occurred in 2020 and was likely due to plant shutdowns cause by the COVID-19 pandemic. Annual emissions for this subsector have no consistent upward or downward trend. Emissions decreased from 29.7 MMT in

[3] U.S. Geological Survey (USGS), Minerals Yearbook, Cement, Advance Data Release, 2020 Annual Tables; Mineral Industry Surveys, Cement. March 2022; and Mineral Commodity Summaries, Cement, January 2022. Available https://www.usgs.gov/centers/national-minerals-information-center/cement-statistics-and-information.

2018 to 25.1 MMT in 2020. Emissions increased again to 26.8 MMT CO2e in 2021. The reported emissions correlate with lime production, which declined from a high of 18,000 million tons in 2018 to a low of 15,800 million tons in 2020. Lime production rebounded in 2021 to 17,000 metric tons due to improved economic conditions.[4]

Glass Production. Glass production is an energy and raw-material intensive process that results in the generation of CO_2 from both the energy consumed and the glass production process itself. The U.S. glass industry can be divided into four main categories: containers, flat (window) glass, fiber glass, and specialty glass. Most commercial glass produced is container and flat glass.[5] From 2011 to 2021, reported annual emissions from the glass production subsector has decreased from 8.4 MMT to 7.8 MMT CO_2e (8.0%). There were 12 fewer glass production facilities reporting in 2021 than in 2011. From 2020 to 2021, the annual emissions related to glass production increased from 7.4 MMT to 7.8 MMT CO_2e (4.5%). In general, these fluctuations were related to the behavior of the export market and the U.S. economy. Due to the COVID-19 pandemic, glass production dropped in the spring of 2020 but rebounded in 2021.[6]

Soda Ash Manufacturing. CO_2 is generated as a byproduct of calcining trona ore to produce soda ash. Commercial soda ash is used as a raw material in a variety of industrial processes and in many familiar consumer products such as glass, soap and detergents, paper, textiles, and food.[7] Approximately 50% of soda ash is used for glass production. Soda ash production remained relatively steady between 2017 and 2019, however, production decreased by 14.6% in 2020 from 2019 levels primarily due to the COVID-19 pandemic and returned to pre-pandemic levels in 2021.[8] The emissions reported include both the process emissions and the emissions from burning fossil fuels. The reported emissions have varied from a low of 3.8 MMT CO_2e in 2016 to a high of 5.4 MMT CO_2e in 2014 and 2017. Reported emissions in 2021 were 5.3 MMT CO_2e, an 11.7% increase from 4.8 MMT CO_2e in 2020, coinciding with a return to pre-pandemic levels of production.

Other Mineral Production. The other mineral production facilities are those operating under NAICS codes beginning with 327 (non-metallic mineral product manufacturing). Unlike the other subsectors, these facilities report only GHG emissions from stationary fuel combustion sources. Between 2011 and 2021, the reported emissions increased by 49% (1.74 MMT CO_2e) from 3.5 MMT CO_2e in 2011 to 5.3 MMT CO_2e in 2021. This increase was due to both an increase in the number of facilities reporting (30 more facilities reported in 2021 than in 2011) and an increase in the average annual emissions per facility (up from about 44,000 MT per facility in 2011 to 48,000 MT per facility in 2021). The maximum emissions for this sector were reported in 2019 (6.3 MMT CO_2e). Reported emissions have decreased since then with 5.7 MMT CO_2e reported in 2020, and 5.3 MMT CO_2e reported in 2021. The decrease in emissions observed between 2019 and 2021 is due in part to a decrease in the number reporting facilities, which decreased from 115 in 2019 to 114 in 2020

[4] USGS, Lime, Mineral Commodity Summaries, January 2022. Available at https://pubs.usgs.gov/periodicals/mcs2022/mcs2022-lime.pdf.

[5] U.S. Environmental Protection Agency (USEPA), Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2020, 2022.

[6] U.S. Environmental Protection Agency (USEPA), Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2020, 2022.

[7] U.S. Environmental Protection Agency (USEPA), Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2020, 2022.

[8] U.S. Geological Survey (USGS), Soda Ash. Mineral Commodity Summaries, January 2022.

and 110 in 2021. The average emissions per facility also decreased from 54,000 MT in 2019 to 48,000 MT in 2021.

In recent years, this subsector has seen a reduction in emissions from combustion of coal and petroleum products. In 2018, emissions from coal combustion were 947,664 MT. By 2021, the number of facilities reporting coal combustion had dropped from 13 to 12 and reported CO_2e emissions had decreased to 446,351 MT. In 2019, emissions from coal combustion comprised about 13% of the total reported emissions for this subsector, but by 2021, coal combustion accounted for only 8% of the reported emissions. Emissions from combustion of petroleum products decreased from 287,829 MT in 2019 to 1,703 MT in 2021. However, emissions from all fuel types decreased between 2019 and 2021, with emissions from natural gas combustions decreasing from 5.1 MMT to 4.8 MMT. Natural gas combustion remains the largest contributor to emissions from this subsector, accounting for approximately 86% of emissions in 2011 and increasing to 90% in 2021.

Table 4 shows Minerals emissions by subsector over time. Table 5 further breaks Minerals emissions down by greenhouse gas.

Table 4: Minerals Sector Emissions (MMT CO_2e) by Subsector (2011 to 2021)

Subsector	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Cement Production	55.5	60.3	62.9	67.3	68.2	66.3	66.8	66.9	67.3	66.4	69.0
Glass Production	8.4	8.2	8.2	8.1	8.1	8.1	7.8	7.9	7.8	7.4	7.8
Lime Manufacturing	30.6	30.3	30.7	31.6	28.9	27.7	29.3	29.7	28.3	25.1	26.8
Other Minerals	3.5	3.8	4.3	4.6	4.6	4.9	5.1	6.2	6.3	5.7	5.3
Soda Ash Production	5.1	5.2	5.3	5.4	5.2	3.8	5.4	5.3	5.3	4.8	5.3
Total Minerals Sector	103.2	107.8	111.5	117.0	115.0	110.8	114.4	116.1	114.9	109.4	114.3

Table 5: Minerals Sector - Emissions by GHG (MMT CO_2e)

Greenhouse Gas	Subsector	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Carbon Dioxide	Cement Production	55.3	60.1	62.7	67	68	66.1	66.6	66.8	67.1	66.3	68.8
	Lime Manufacturing	30.5	30.2	30.6	31.5	28.8	27.6	29.2	29.6	28.2	25.1	26.8
	Glass Production	8.4	8.2	8.2	8	8.1	8.1	7.8	7.8	7.8	7.4	7.8
	Other Minerals	3.5	3.8	4.3	4.6	4.6	4.9	5	6.2	6.2	5.7	5.3
	Soda Ash Production	5.1	5.1	5.3	5.4	5.2	3.7	5.4	5.3	5.3	4.8	5.3
Methane	Cement Production	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
	Lime Manufacturing	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
	Glass Production	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
	Other Minerals	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
	Soda Ash Production	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Nitrous Oxide	Cement Production	0.1	0.1	0.1	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1
	Lime Manufacturing	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	<0.05	<0.05	<0.05
	Glass Production	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
	Other Minerals	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
	Soda Ash Production	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05

<0.05 - Less than 0.1 MMT CO_2e reported in 2021.

Facility-Level Emission Distributions

Figure 4 shows the average emissions per reporter for each subsector in the minerals sector, compared to the GHGRP average.

Figure 4: Minerals Sector - Average Emissions per Reporter (2021)

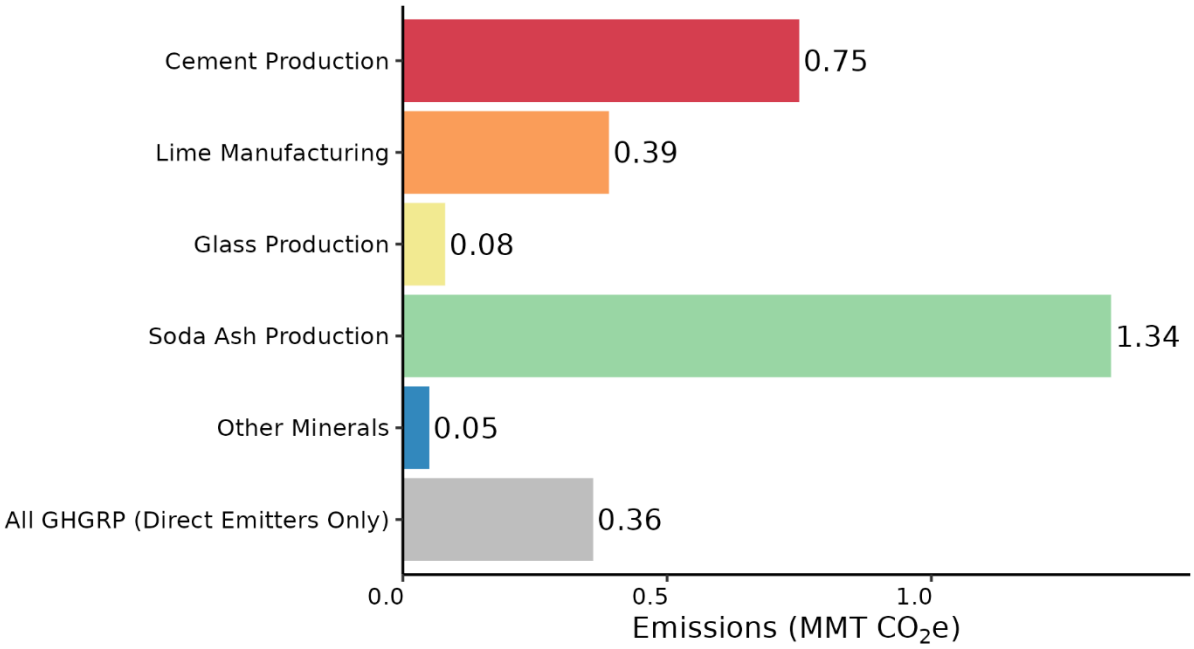


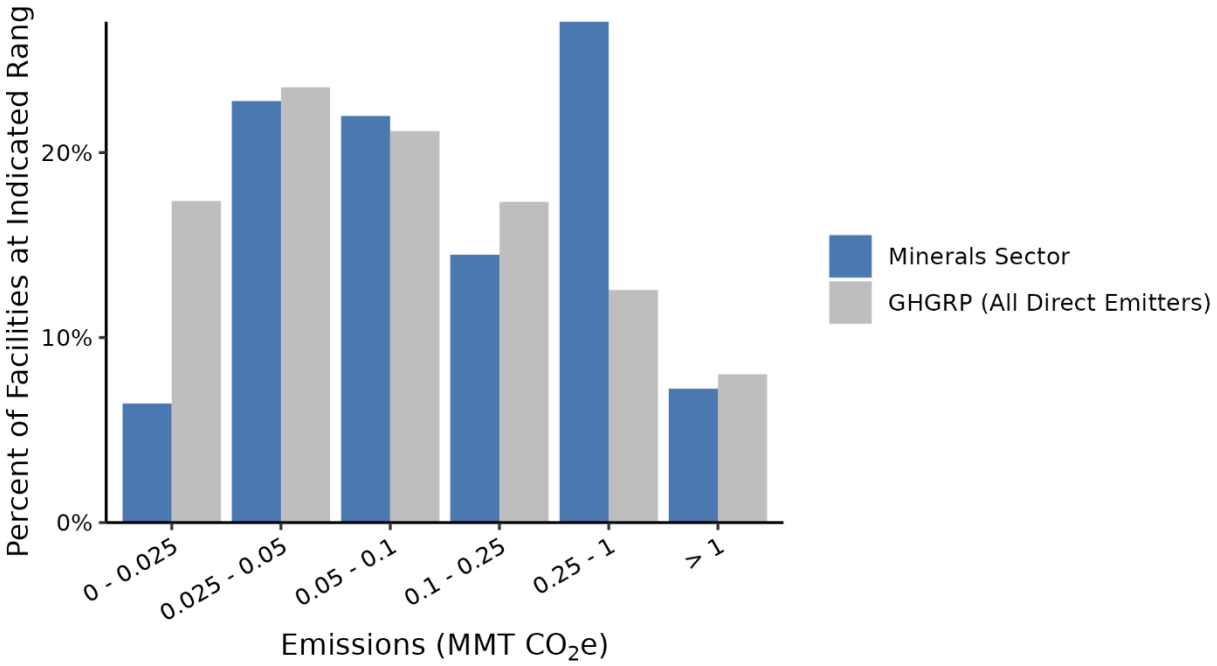
Table 6 and shows the number of Minerals sector reporters by emissions range in 2021.

Table 6: Minerals Sector - Number of Reporters by Emissions Range (MMT CO_2e) (2021)

Subsector	0 - 0.025	0.025 - 0.05	0.05 - 0.1	0.1 - 0.25	0.25 - 1	> 1
Cement Production	2	0	1	4	65	20
Lime Manufacturing	0	4	4	21	35	4
Glass Production	4	28	44	24	0	0
Other Minerals	18	54	33	5	0	0
Soda Ash Production	0	0	0	0	1	3

Figure 5 shows the percentage of reporters in each emissions range for both the Minerals sector and all GHGRP direct emitters in 2021.

Figure 5: Percentages of Reporters by Emissions Range (MMT CO_2e) (2021)



Calculation Methods Used

The production of mineral products results in both process-related emissions (CO_2 from the calcination of carbonaceous raw materials in kilns and furnaces) and fuel combustion emissions (CO_2, CH_4, and N_2O from the burning of fuel in kilns and furnaces to produce heat).

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

- **Process emissions**
  - **CEMS -** Operate a CEMS to measure CO_2 emissions according to requirements specified in 40 CFR part 98, subpart C.
  - **Carbon mass balance -** Calculate process CO_2 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.
- **Fuel combustion emissions -** Follow the applicable tier method prescribed in subpart C (general stationary fuel combustion sources) to estimate CO_2 emissions. All facilities use default emission factor to estimate CH_4 and N_2O emissions from fuel combustion. As stated above, if a CEMS is used at the facility, combustion emissions are not reported separately from combustion emissions.

Tables 7 through 10 show the percent emissions reported under the different methodologies used for each subsector. As shown in Table 7, most reporters in the cement subsector use a CEMS. Figure 4 shows the emission trends for each subsector. Table 5 shows a breakdown of emissions by gas type.

Table 7: Cement Production - Percent Emissions by Methodology and Emissions Type

Monitoring Method	Emissions Category	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
CEMS	Process and Combustion Emissions	88.7%	87.2%	87.9%	89.5%	89.7%	89.7%	91.8%	93.2%	94.4%	94.5%	95.5%
Non-CEMS	Process Emissions: Mass Balance	7.0%	8.8%	8.3%	6.9%	6.3%	6.8%	4.7%	4.2%	3.4%	3.4%	2.6%
	Combustion Emissions	4.3%	4.1%	3.8%	3.5%	4.0%	3.4%	3.4%	2.7%	2.2%	2.2%	1.9%

Table 8: Glass Production - Percent Emissions by Methodology and Emissions Type

Monitoring Method	Emissions Category	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
CEMS	Process and Combustion Emissions	1.4%	0.0%	0.6%	0.4%	1.2%	1.4%	1.6%	1.4%	1.7%	1.4%	1.8%
Non-CEMS	Process Emissions: Mass Balance	23.3%	24.3%	23.5%	24.1%	23.4%	24%	23.6%	23.7%	23.3%	23.5%	23.8%
	Combustion Emissions	75.3%	75.7%	76%	75.5%	75.4%	74.6%	74.9%	74.9%	75.0%	75.1%	74.4%

Table 9: Lime Manufacturing - Percent Emissions by Methodology and Emissions Type

Monitoring Method	Emissions Category	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
CEMS	Process and Combustion Emissions	5.7%	5.8%	6.0%	7.7%	8.3%	10.1%	9.5%	10.2%	10.4%	10.5%	10.9%
Non-CEMS	Process Emissions: Mass Balance	47.2%	47.3%	48.0%	47.1%	48.0%	46.7%	47.0%	47.0%	47.4%	47.8%	48.2%
	Combustion Emissions	47.0%	46.8%	46.0%	45.2%	43.8%	43.2%	43.5%	42.7%	42.2%	41.7%	40.9%

Table 10: Soda Ash Production - Percent Emissions by Methodology and Emissions Type

Monitoring Method	Emissions Category	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
CEMS	Process and Combustion Emissions	5.4%	5.7%	5.3%	5.1%	5.9%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Non-CEMS	Process Emissions: Site-Specific Emission Factor Method	0.7%	0.7%	0.4%	0.5%	0.7%	0.9%	0.6%	0.6%	0.5%	0.6%	0.7%
	Process Emissions: Mass Balance	20.0%	20.4%	20.0%	19.9%	19.0%	24.2%	23.6%	23.7%	24.1%	22.2%	23.9%
	Combustion Emissions	73.9%	73.3%	74.3%	74.6%	74.4%	74.8%	75.9%	75.6%	75.4%	77.2%	75.4%

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.

GLOSSARY

Cement Production comprises kilns at facilities that manufacture Portland cement, which is the basic ingredient of concrete, mortar, stucco, and most non-specialty grout. During the cement production process, calcium carbonate ($CaCO_3$) (usually from limestone and chalk) is combined with silica-containing materials (such as sand and shale) and is heated in a cement kiln at a high temperature. To provide heat, fuel is fired inside the kiln, and both process and combustion emissions exit the same stack. Cement kilns can combust a wide variety of fuels, including fossil fuels and industrial and commercial waste materials. The product of the kiln is clinker, an intermediate product of rock-like nodules that are eventually ground into a powder and mixed with calcium sulfate and other minor constituents to produce the final Portland cement product. This calcination process produces CO_2 as a by-product, and the CO_2 is released to the atmosphere. Small amounts of other carbonates and organic carbon can also be present in the raw materials, both of which generate additional CO_2.

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/ghgp).

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 https://www.epa.gov/ghgreporting/greenhouse-gas-reporting-program-and-us-inventory-greenhouse-gas-emissions-and-sinks.

Glass Production comprises facilities that manufacture glass (including flat, container, or pressed and blown glass) or wool fiberglass using continuous glass melting furnaces. Experimental furnaces and research and development process units are excluded. Emissions from glass production come from fuel combustion to melt the raw materials used to make glass and from chemical transformation of the raw materials when they are heated in the glass furnace. The raw materials

used in glass manufacturing include silica (SiO_2); carbonates, such as limestone ($CaCO_3$), dolomite ($CaMg(CO_3)_2$), and soda ash (Na2CO3); and other minor ingredients. When heated in glass melting furnaces, these materials form CO_2, which is subsequently emitted from the furnace.

Lime Manufacturing comprises facilities that manufacture marketed and non-marketed lime products (e.g., calcium oxide, high-calcium quicklime, calcium hydroxide, hydrated lime, dolomitic quicklime, dolomitic hydrate, or other lime products) by calcination of limestone, dolomite, shells or other calcareous substances. The sector excludes lime kilns located at kraft pulp mills, soda pulp mills, sulfite pulp mills; and kilns that process sludge containing only calcium carbonate from water softening processes.

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.

Other Minerals comprises facilities that reported under subpart C only (general stationary fuel combustion sources) and reported NAICS codes starting with 327 (Nonmetallic Mineral Product Manufacturing).

Soda Ash Manufacturing refers to a manufacturing process that produces soda ash by calcining trona, calcining sodium sesquicarbonate, or using a liquid alkaline feedstock process that directly produces CO_2.