Waste Sector

All emissions presented here are as of 1/10/2017. The reported emissions exclude biogenic CO_2. GHG data displayed here 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.

Highlights

- The most prevalent greenhouse gas emitted by the waste sector is methane, and municipal solid waste (MSW) landfills are the largest emitter of methane in the Waste Sector.
- Reported emissions from the waste sector have decreased from 2011 to 2015. Emissions in 2015 were 0.8% lower than in 2014, and 3.5% lower than in 2011. The decrease in emissions is primarily driven by MSW landfills. A methodological change to the emission calculation procedures for MSW landfills was implemented in 2013 and is a primary factor in the emissions reductions.
- Seventy-four percent of the MSW landfills that reported have landfill gas collection and control systems (GCCS).
- Emissions from industrial waste landfills, industrial wastewater treatment, and solid waste combustion have remained relatively consistent since 2011.

About this Sector

The waste sector comprises MSW landfills, industrial waste landfills, industrial wastewater treatment systems, and solid waste combustion at waste-to-energy facilities.

- **MSW landfills** are landfills that dispose or have disposed of MSW. MSW includes, among other components, solid-phase household, commercial/retail, and institutional wastes. MSW landfills may also dispose of non-MSW wastes, including construction and demolition debris and other inert materials. This sub-sector excludes dedicated industrial, hazardous waste, or construction and demolition landfills. An MSW landfill comprises the landfill, landfill GCCS, and combustion devices that are used to control landfill gas emissions.
- **Industrial waste landfills** are landfills that accept or have accepted primarily industrial wastes. This subsector excludes landfills that accept hazardous waste and those that receive only construction and demolition or other inert wastes. An industrial waste landfill includes the landfill, landfill GCCS, and combustion devices that are used to control landfill gas emissions. Less than one percent of facilities reporting under this subpart have landfill GCCS. The organic composition of waste streams disposed at industrial landfills tends to be similar over time, leading to a relatively consistent emissions rate, while the waste streams at MSW landfills may fluctuate seasonally and/or annually.
- **Industrial wastewater treatment** comprises anaerobic lagoons, reactors, and anaerobic sludge digesters at facilities that perform pulp and paper manufacturing, food processing, ethanol production, and petroleum refining. This subsector does not include anaerobic processes used to treat wastewater and wastewater treatment sludge at other industrial facilities. It also does not include emissions from municipal wastewater treatment plants, separate treatment of sanitary wastewater at industrial facilities, oil and/or water separators, or aerobic and anoxic treatment of industrial wastewater.
- **Solid waste combustion** comprises combustors and incinerators at facilities under North American Industry Classification System (NAICS) code 562213 that burn non-hazardous solid waste either to recover energy or to reduce the volume of waste.

Who Reports?

For reporting year 2015, 1,546 facilities in the waste sector reported emissions of 111.7 million metric tons CO_2e (MMT CO_2e). In 2015, the waste sector represented 3.7% of the facilities reporting direct emissions to the GHGRP and 1.7% of total U.S. direct emissions.[1]

Table 1: Waste Sector – Reporting Schedule and GHGRP Coverage by Subpart (2015)

Subpart	Source Category	Applicability	First Reporting Year	Estimated % of Industry Facilities Covered	Estimated % of Industry Emissions Covered
HH	MSW Landfills	Facilities that accepted waste after January 1, 1980, and that generate CH_4 that is equivalent to ≥ 25,000 metric tons CO_2e/year	2010	75%[a,b]	90.2%[c]
II	Industrial Wastewater Treatment	Facilities operating an anaerobic process to treat industrial wastewater and/or industrial wastewater treatment sludge, and meeting one of the following:			
		Petroleum Refineries: Facilities subject to reporting under subpart Y (Petroleum Refineries)[d]	2011	-	-
		Pulp and Paper Manufacturing: Facilities subject to reporting under subpart AA (Pulp and Paper Manufacturing)		5%[e]	23%[f]
		Ethanol Production: Facilities that emit ≥ 25,000 metric tons CO_2e/year		45%[e]	>90%[f]
		Food processing facilities (as defined in subpart II) that emit ≥ 25,000 metric tons CO_2e/year		1%[e]	45%[f]
TT	Industrial Waste Landfills	• Accepted waste after January 1, 1980, and • Design capacity ≥ 300,000 metric tons, and • Located at a facility that emits ≥ 25,000 metric tons CO_2e/year.	2011	7.0%[a,g]	57.7%[h]

[1] Total U.S. GHG emissions in 2015 were 6,586.7 MMT CO_2e, as presented in the Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2015. U.S. Environmental Protection Agency. April 2017. EPA 430-P-17-001. Available at: https://www.epa.gov/ghgemissions/inventory-us-greenhouse-gas-emissions-and-sinks-1990-2015.

Subpart	Source Category	Applicability	First Reporting Year	Estimated % of Industry Facilities Covered	Estimated % of Industry Emissions Covered
C	Solid Waste Combustion	• Facilities that reported only under subpart C (Stationary Fuel Combustion) and reported NAICS code 562213 (Solid Waste Combustors and Incinerators) • Such facilities that emit ≥ 25,000 metric tons CO_2e/year.	2010	95%[i]	95%[i]

[a] Industry coverage estimates for MSW and industrial waste landfills are uncertain, because the exact number of MSW and industrial waste landfills in the U.S. is not known.

[b] Estimate of the size of the industry is based on the Environmental Research and Education (EREF) Municipal Solid Waste Management in the U.S. 2010 & 2013 report published in 2016. Based on analysis of EREF data, an estimate of 1,540 MSW landfills is used here (the 2013 count).

[c] Estimate of total industry emissions is from the U.S. EPA Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2015 (U.S. EPA, 2016). Emissions were estimated to be 100.8 MMT CO_2e.

[d] No petroleum refineries reported industrial wastewater emissions.

[e] Number of facilities covered by the GHGRP for this subsector were determined using the 2007 US economic census (food processing), the Renewable Fuel Association's list of facilities from January 2013 (ethanol), and EPA's Office of Air Quality Planning and Standards (OAQPS) Information Collection Request conducted in 2011 for purposes of the National Emission Standards for Hazardous Air Pollutants (NESHAP) for pulp and paper.

[f] Emissions covered by the GHGRP were calculated using the US GHG Inventory values for industrial wastewater and the RY2013 emissions for subpart II as reported by February 2015.

[g] Estimated size of the industry based on 2,322 industrial waste landfills in the 1988 Report to Congress: Solid Waste Disposal in the United States (U.S. EPA, 1988) for the year 1985. While the data from this report are over 25 years old, it is the only comprehensive, published data source available on industrial waste landfills in the U.S.

[h] Estimated size of industry emissions based on the industrial waste landfill emissions estimates from the U.S. EPA Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2015 (U.S. EPA, 2016). These emissions estimates are based on nationwide estimated amounts of annual waste generation and are not facility-specific emissions estimates.

[i] 64 GHGRP facilities were classified as meeting the criteria for the Solid Waste Combustion subsector in 2015. MSW combustion also takes place at facilities classified under the MSW Landfill subsector and Power Plant sector. According to data provided by the Energy Recovery Council (ERC) (http://energyrecoverycouncil.org/wp-content/uploads/2016/06/ERC-2016-directory.pdf), there were 77 operating waste-to-energy facilities in the U.S. in 2016, with one starting operation in 2015. Three additional waste-to-energy facilities operated in 2015 but ceased operation in 2016 and were not included in ERC's 2016 directory. In total, 79 facilities were assumed to be operating in 2015; 64 reported to the GHGRP for 2015 and are classified under the Solid Waste Combustion source category, 6 were classified under the Power Plant sector, and 5 were classified under the MSW Landfill source category. Three facilities in the ERC do not report to the GHGRP, and one facility reported waste combustion under subpart D (electricity generation) rather than subpart C (stationary combustion).

Table 2: Waste Sector – Number of Reporters (2011–2015) [a]

Source Category	Number of Reporters				
	2011	2012	2013	2014	2015
Total Waste Sector	**1,642**	**1,656**	**1,638**	**1,634**	**1,546**
MSW Landfills	1,231	1,250	1,237	1,234	1,160
Industrial Wastewater Treatment	169	162	159	155	148
Industrial Waste Landfills	174	175	175	178	173
Solid Waste Combustion	68	69	67	67	64

[a] The total number of reporters may be less than a sum of the number of reporters in each individual source category because some facilities contain more than one source category.

MSW landfills made up the majority of waste sector reporters for all reporting years. The decrease in the number of MSW landfill reporters between 2012 and 2015 is a result of facilities that qualified to discontinue reporting (off-ramping from the program).[2] Between 2011 and 2015, the number of reporters for industrial wastewater treatment decreased by 21, while the number of reporters for industrial waste landfills remained relatively consistent. The number of solid waste combustion facilities has also remained relatively constant over the reporting years, decreasing by four facilities since 2011.

Reported Emissions

Methane is the primary GHG reported by MSW landfills, industrial waste landfills, and industrial wastewater treatment. Methane is generated by the anaerobic decomposition of organic waste in landfills and in anaerobic wastewater treatment systems. Landfill gas typically contains approximately 50% CH_4, 50% CO_2, and less than 1% non-methane organic compounds (NMOC). Industrial wastewater treatment gas contains about 65-70% CH_4, 25-30% CO_2, and small amounts of N_2, H_2, and other gases. The emissions presented in Table 3 also include CO_2, CH_4, and N_2O from stationary fuel combustion units that are located at the waste sector facilities that reported.

Table 3: Waste Sector – Emissions by Subsector (2011–2015)

Waste Sector	Emissions (MMT CO_2e)[a, b]				
	2011	2012	2013	2014	2015
Total Waste Sector	**115.3**	**116.5**	**112.2**	**112.6**	**111.7**
MSW Landfills	94.2	95.3	91.7	91.6	91.0
Industrial Wastewater Treatment	2.6	2.1	2.1	2.6	2.1
Industrial Waste Landfills	8.8	9.2	8.3	8.6	8.6
Solid Waste Combustion	9.6	9.8	10.0	9.9	10.1

[a] Biogenic emissions of CO_2 are not included in the CO_2e emissions in this table. Landfill gas recovered from MSW landfills and industrial waste landfills is considered biogenic. Thus, CO_2 emissions from combustion of landfill gas are NOT included in CO_2e emissions in this table. Biogenic CO_2 emissions from the combustion of the biogenic fraction of MSW are also not included in CO_2e emissions in this table.
[b] Totals may not sum due to independent rounding.

[2] See FAQ: When is a facility eligible to stop reporting? http://www.ccdsupport.com/confluence/pages/viewpage.action?pageId=243139271

Biogenic CO_2 emissions result primarily from combustion of landfill gas, municipal solid waste and other biogenic fuels in reciprocating internal engines, municipal waste combustors and other combustion units. As shown in Table 4, emissions of biogenic CO_2 at waste sector facilities decreased by 1.2 MMT from 18.8 MMT in 2011 to 17.6 MMT in 2015.

Table 4: Waste Sector – Biogenic CO_2 Emissions (2011–2015)

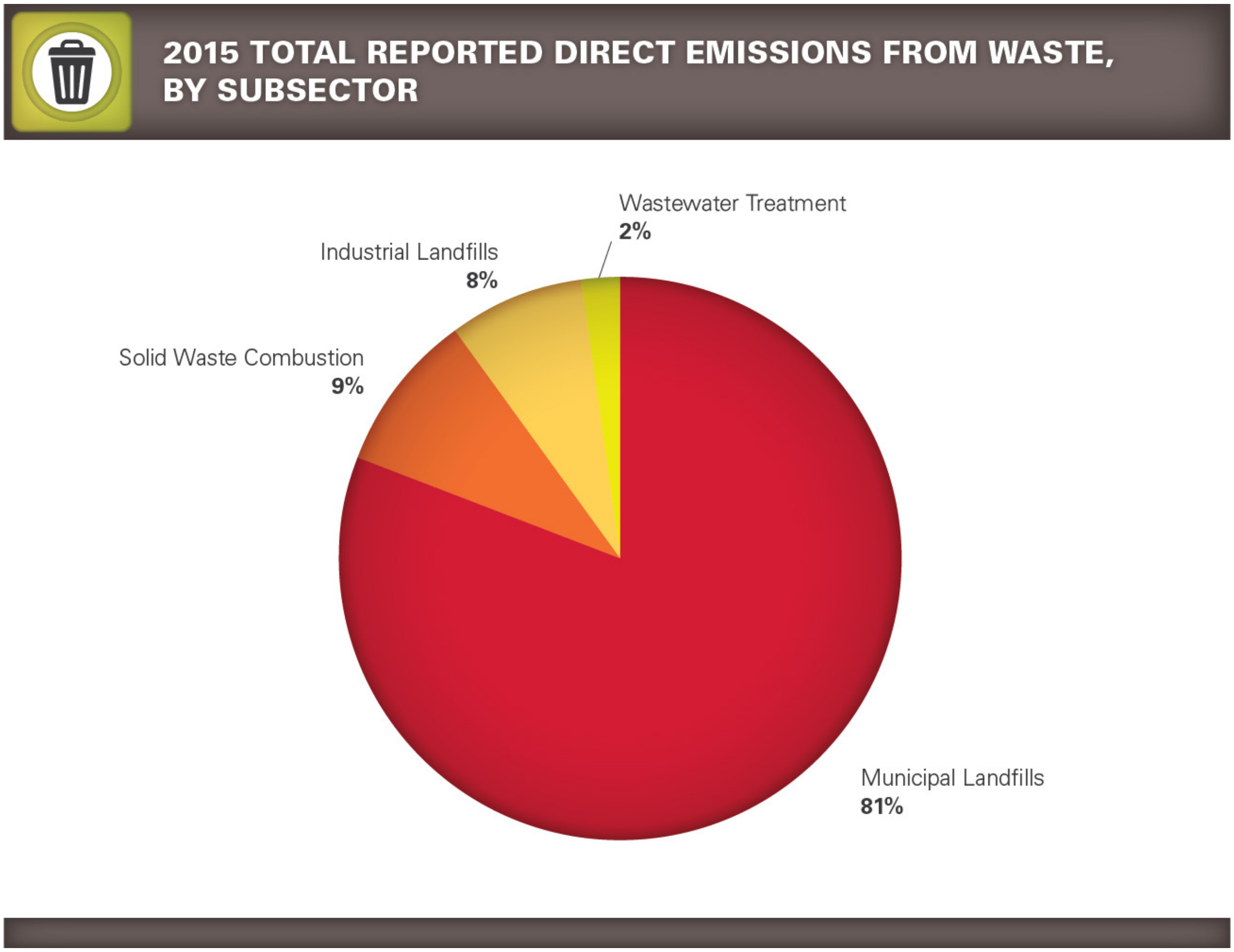
Waste Sector	Biogenic CO_2 Emissions (MMT CO_2)[a]				
	2011	2012	2013	2014	2015
Total Biogenic CO_2 Emissions	**18.8**	**18.5**	**18.2**	**17.8**	**17.6**
MSW Landfills	4.1	4.1	3.9	3.8	3.9
Solid Waste Combustion	14.7	14.4	14.3	14.0	13.7

[a] Totals may not sum, due to independent rounding.

Figure 1 illustrates the reported non-biogenic emissions by subsector. Figures 2 through 6 show the location and range of emissions for the entire waste sector (Figure 2) and each sub-sector individually (Figures 3 through 6). The size of each circle corresponds to a specified range of emissions in metric tons of CO_2e reported by that particular facility. Many large industrial waste landfills are in Southeastern states and along the coastline with the Gulf of Mexico, which is also where numerous petroleum refineries, pulp and paper, and chemical manufacturing facilities are located. The locations of industrial wastewater treatment facilities are driven primarily by the location of ethanol facilities, which account for more than half of all industrial wastewater treatment reporters and tend to be in the Midwest. Eighty-five percent of solid waste combustors are in the Northeastern States and in Florida, and the remaining facilities are in the Midwest and Western states.

Readers can identify the largest emitting facilities by visiting the Facility Level Information on GreenHouse gases Tool (FLIGHT) website (https://ghgdata.epa.gov).

Figure 1: Waste Sector – Emissions by Subsector (2015)



[Click here to view the most current information using FLIGHT.]()

Figure 2: Location and Emissions Range for Each Reporting Facility in the Waste Sector (as of 8/13/16)

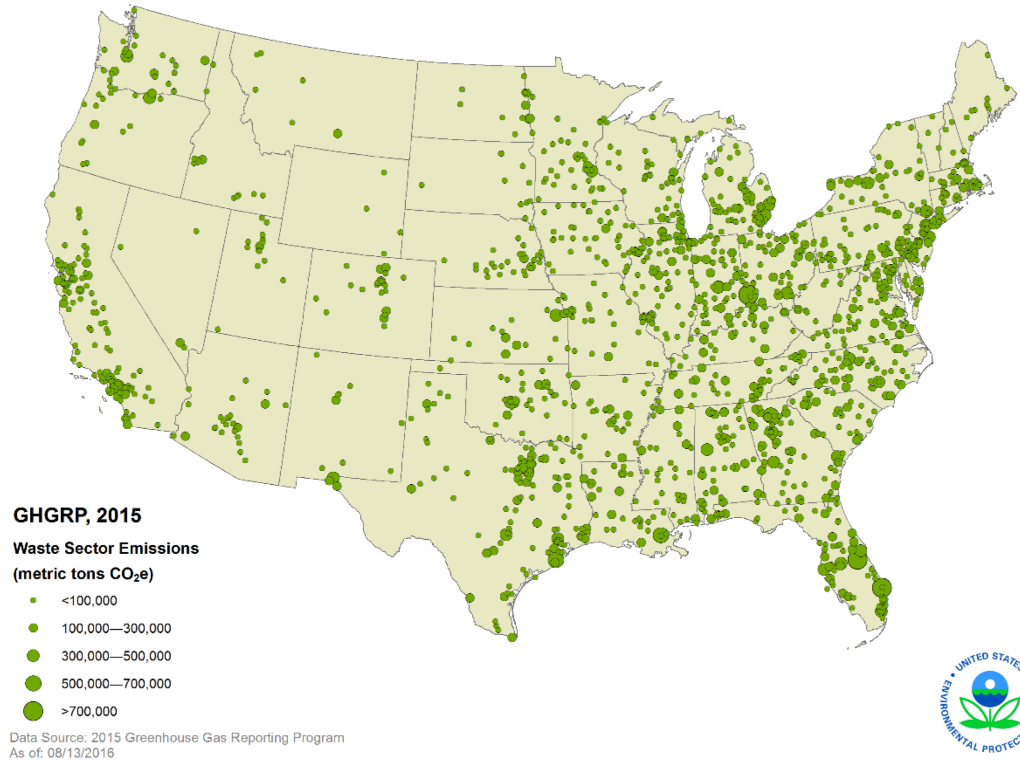


Figure 3: Location and Emissions Range for Each Reporting Facility in the MSW Landfill Subsector (as of 8/13/16)

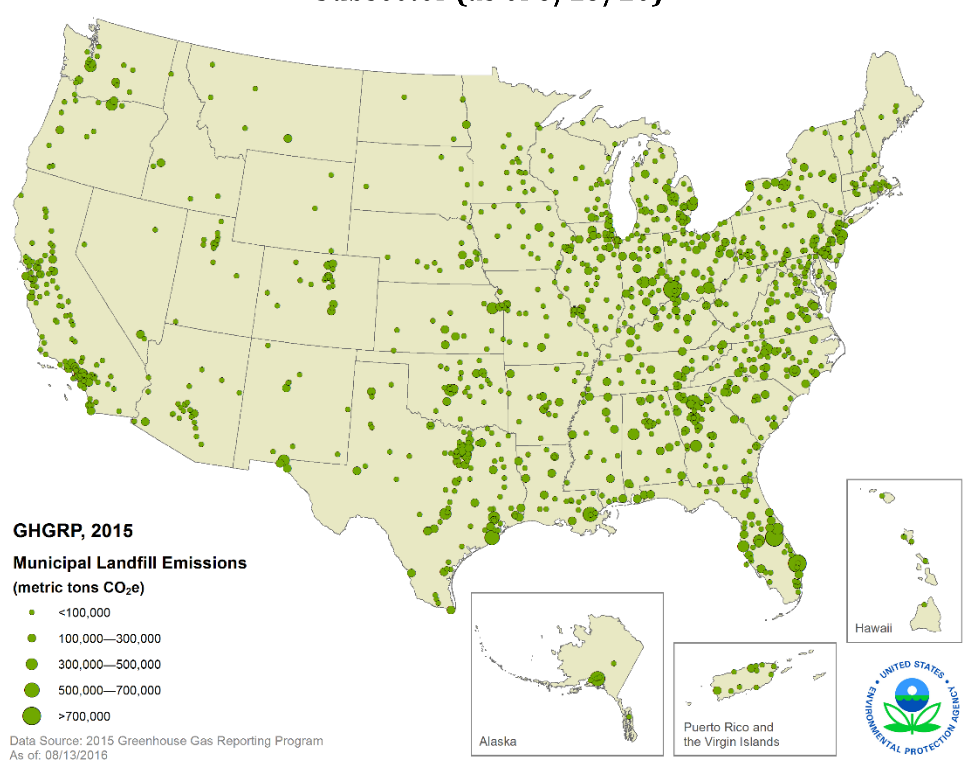


Figure 4: Location and Emissions Range for Each Reporting Facility in the Industrial Wastewater Treatment Subsector (as of 8/13/16)

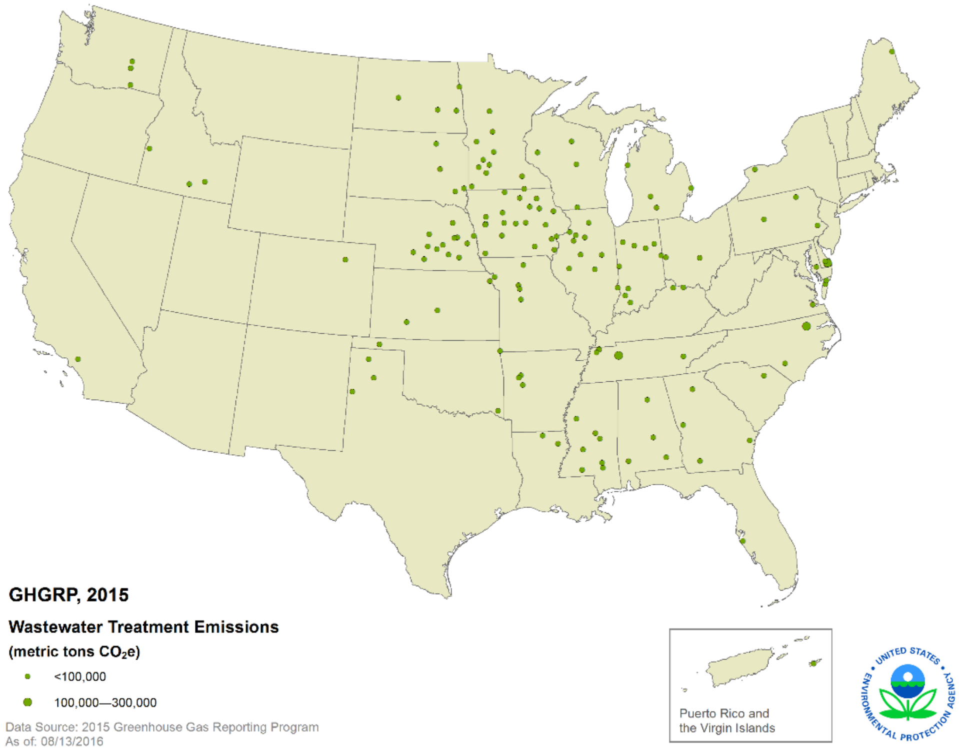


Figure 5: Location and Emissions Range for Each Reporting Facility in the Industrial Waste Landfill Subsector (as of 8/13/16)

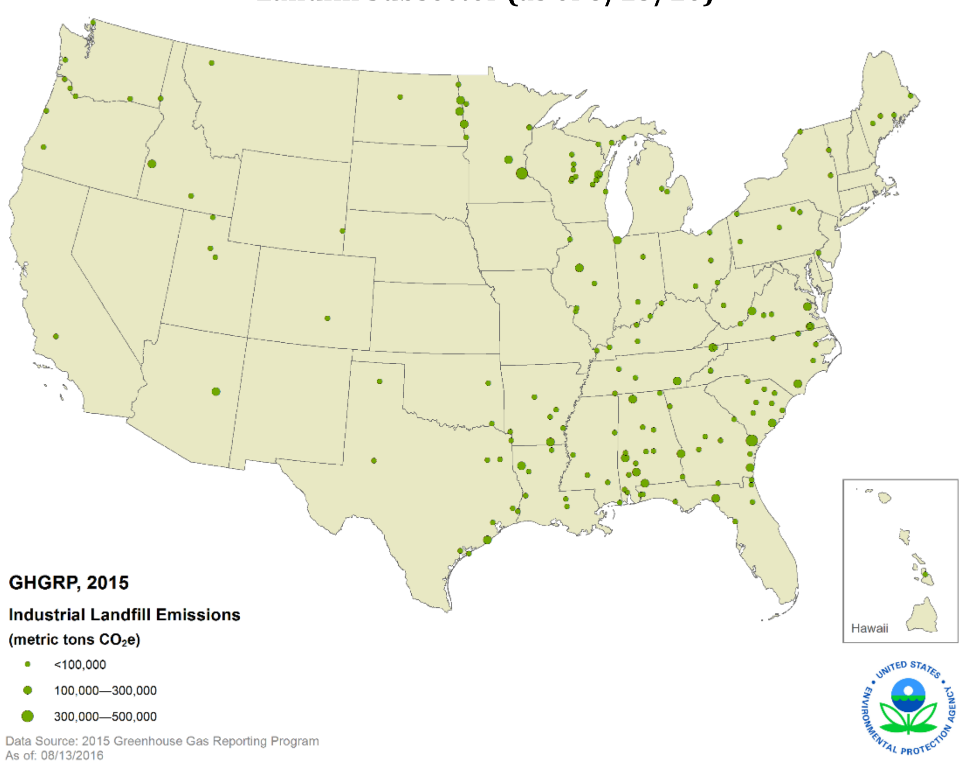


Figure 6: Location and Emissions Range for Each Reporting Facility in the Solid Waste Combustion Subsector (as of 8/13/16)

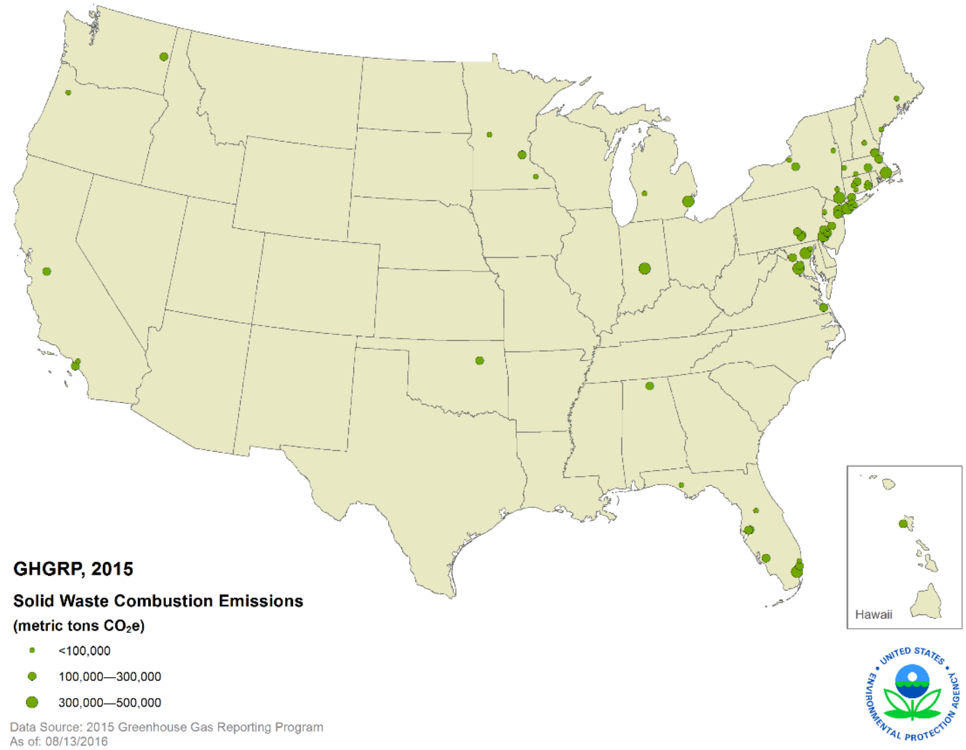
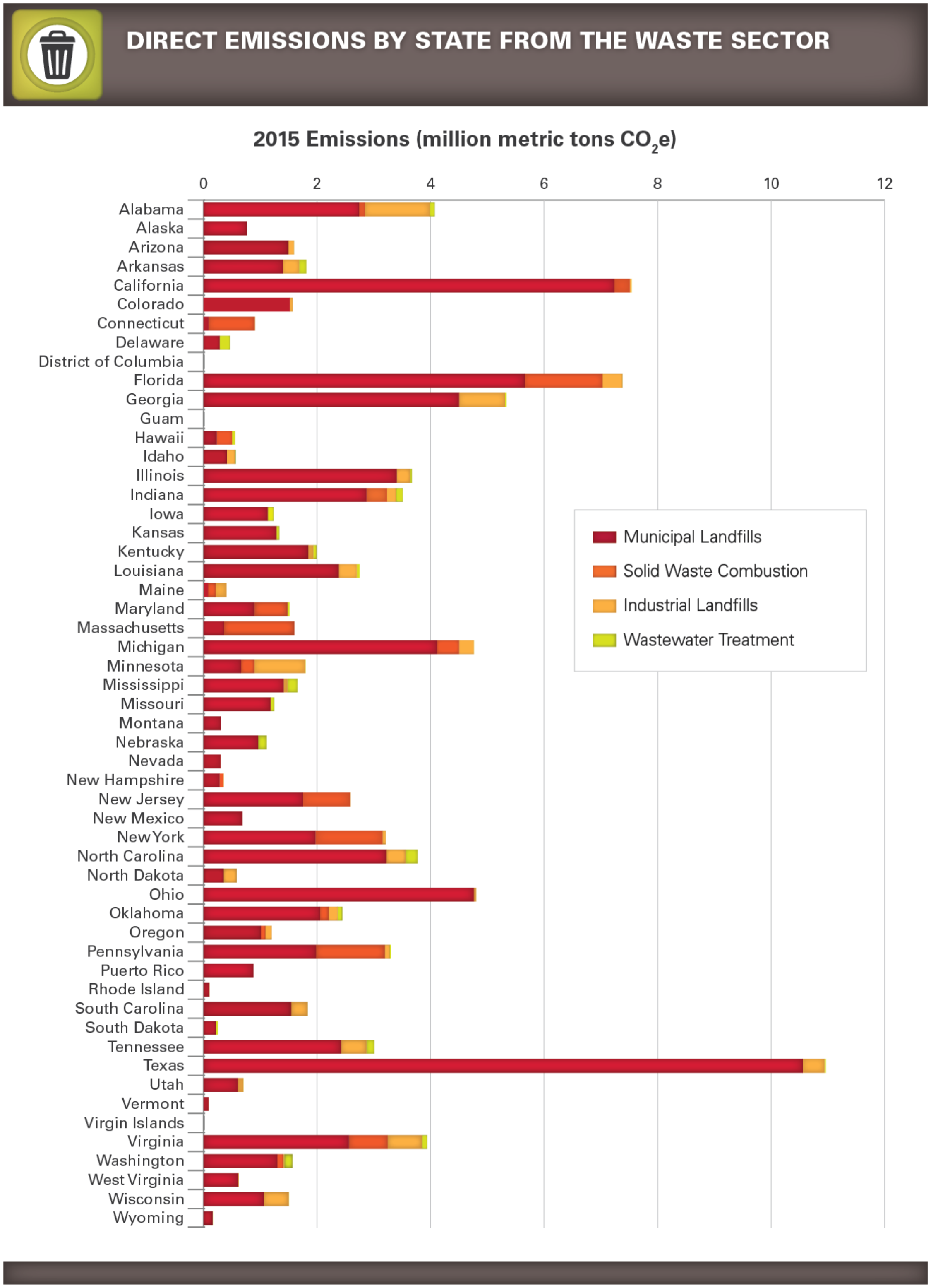


Figure 7: Waste Sector – Emissions by State (2015)[a]



[a] Represents total emissions reported to the GHGRP in these industries. Additional emissions may occur at facilities that have not reported; for example, those below the 25,000 metric ton CO_2e reporting threshold for industries where the threshold applies.

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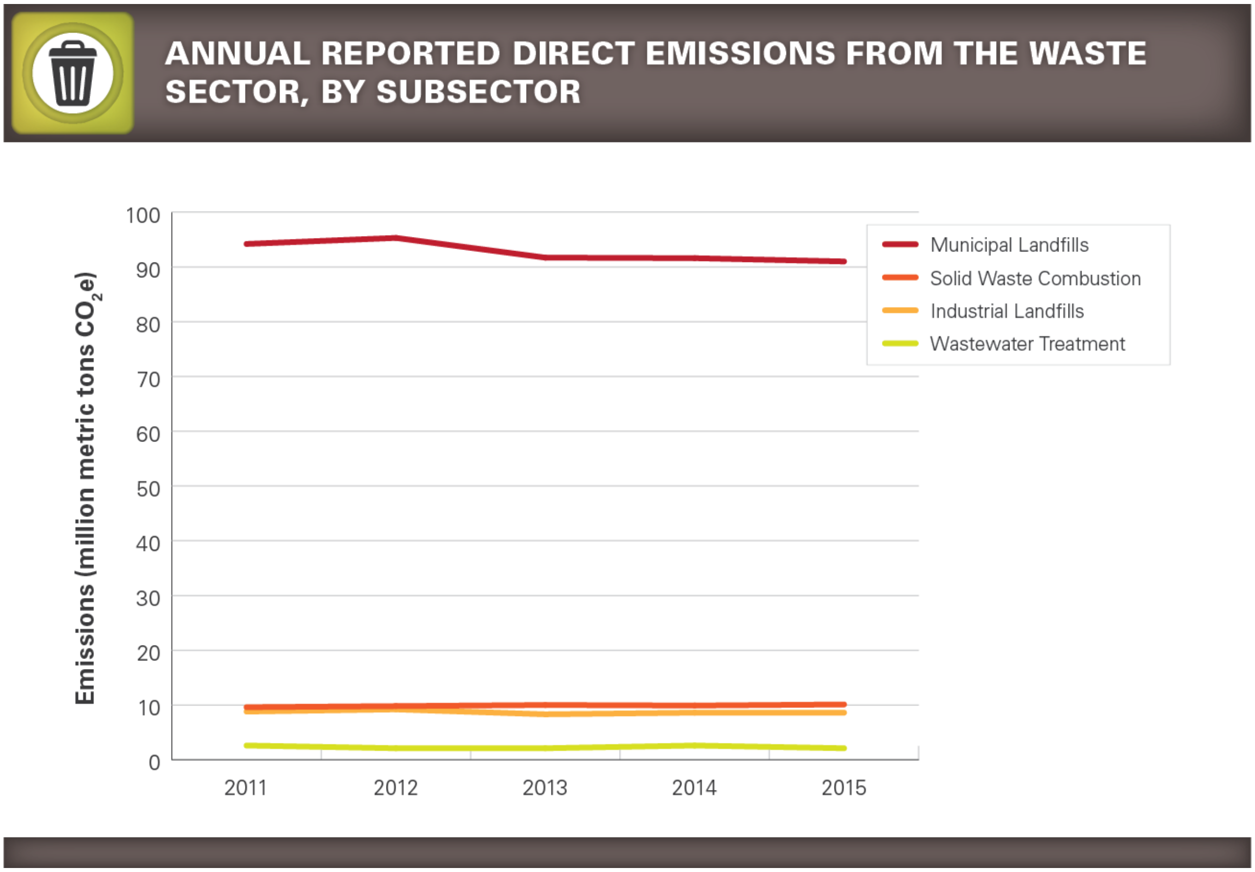
Waste Sector: Emissions Trends 2011 to 2015

Reported emissions from the Waste sector have decreased slightly from 115.3 MMT CO_2e in 2011 to 111.7 MMT CO_2e in 2015, a decrease of 3.1%. Reported emissions peaked in 2012 at 116.5 MMT CO_2e and then generally decreased through 2015. The largest decrease in emissions (3.7%) occurred between 2012 and 2013. Over 80% of reported emissions from the waste sector were reported by MSW landfills. Changes in MSW landfill emissions were the most important driver of waste sector emission trends.

Municipal Solid Waste Landfills. The decrease in emissions from 2012 to 2013 may have been driven by methodological changes in the rule for calculating methane emissions from MSW landfills – in particular, the allowance for facilities to use higher oxidation fractions in their emissions calculations, resulting in lower emissions values. In 2013, approximately 45% of facilities used these higher oxidation fractions. The number of reporting facilities also had an impact on total reported emissions, because it peaked in 2012 and decreased in the years afterward. Of the facilities that stopped reporting, 29 facilities qualified to stop reporting in 2013, 23 qualified to stop reporting in 2014, and 77 qualified to stop reporting in 2015. For these years some landfills began reporting to the GHGRP for the first time, but in each year the number of reporters decreased. While the number of MSW landfills reporting to the GHGRP decreased, the impact on emissions was not significant because only MSW landfills whose emissions were below 15,000 MT CO_2e for three consecutive years or 25,000 MT CO_2e for five consecutive years were allowed to cease reporting.

Industrial Waste Landfills. Reported emissions from industrial waste landfills decreased by nearly 1 MMT CO_2e from 2012 to 2013 and have remained relatively consistent through 2015. This decrease in emissions may have been driven, in part, by the same methodological change for calculating methane emissions related to oxidation fractions that occurred for MSW landfills. In 2013, approximately 10% of industrial waste landfills used the higher oxidation fractions.

Figure 8: Waste Sector - Emissions Trends (2011–2015)



Click here to view the most current information using FLIGHT.

Table 5: Waste Sector – Emissions by GHG (MMT CO_2e)[a]

Waste Sector	Reporting Year				
	2011	**2012**	**2013**	**2014**	**2015**
Number of facilities	1,642	1,656	1,638	1,634	1,546
Total emissions (MMT CO_2e)	115.3	116.5	112.2	112.6	111.7
Emissions by GHG					
Carbon dioxide (CO_2)					
MSW Landfills[b]	1.0	1.0	1.1	1.2	1.3
Solid Waste Combustion	9.1	9.3	9.4	9.4	9.6
Methane (CH_4)					
MSW Landfills	93.1	94.3	90.6	90.4	89.7
Solid Waste Combustion	0.2	0.2	0.2	0.2	0.2
Industrial Waste Landfills	8.8	9.2	8.3	8.6	8.6
Industrial Wastewater Treatment	2.6	2.1	2.2	2.6	2.1
Nitrous oxide (N_2O)					
MSW Landfills[b]	**	**	**	**	**
Solid Waste Combustion	0.3	0.3	0.3	0.3	0.3

[a] Totals might not sum due to independent rounding.

[b] Emissions shown for CO_2 and N_2O result from the combustion of fossil fuels and the non-biogenic portion of MSW that is combusted.

** Total reported emissions are less than 0.05 MMT CO_2e.

Table 6: Waste Sector – Emissions from Waste Sector Processes and Fuel Combustion

Waste Sector	Emissions (MMT CO_2e)[a,b,c]				
	2011	**2012**	**2013**	**2014**	**2015**
Total Waste Sector	**115.3**	**116.5**	**112.2**	**112.6**	**111.7**
Municipal Solid Waste Landfills	**94.2**	**95.3**	**91.7**	**91.6**	**91.0**
Fuel Combustion	1.0	1.0	1.2	1.2	1.3
Waste Sector Processes	93.2	94.3	90.5	90.4	89.7
Industrial Wastewater Treatment	**2.6**	**2.1**	**2.2**	**2.6**	**2.1**
Waste Sector Processes	2.6	2.1	2.2	2.6	2.1
Industrial Waste Landfills	**8.8**	**9.2**	**8.3**	**8.6**	**8.6**
Waste Sector Processes	8.8	9.2	8.3	8.6	8.6
Solid Waste Combustion	**9.6**	**9.8**	**10.0**	**9.9**	**10.1**
Fuel Combustion	9.6	9.8	10.0	9.9	10.1

[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 reporting threshold.

[b] Totals might not sum, due to independent rounding.

[c] Emissions from Fuel Combustion are defined here as emissions reported under subpart C.

Table 7: Waste Sector – Combustion Emissions by Fuel Type

Fuel Type	Emissions (MMT CO_2e)[a,b]				
	2011	2012	2013	2014	2015
Municipal Solid Waste Landfills	**1.0**	**1.0**	**1.2**	**1.2**	**1.3**
Coal	0.0	0.0	0.1	0.1	0.1
Natural Gas	0.4	0.4	0.3	0.3	0.3
Petroleum Products	0.1	0.1	0.1	0.1	0.1
Other Fuels[a]	0.5	0.5	0.6	0.7	0.8
Solid Waste Combustion	**9.6**	**9.8**	**10.0**	**9.9**	**10.1**
Natural Gas	0.1	0.1	0.1	0.1	0.2
Petroleum Products	**	0.1	**	**	0.1
Other Fuels[a]	9.5	9.6	9.8	9.8	9.8

[a] Excludes biogenic CO_2.
[b] Totals might not sum, due to independent rounding.
** Total reported emissions are less than 0.05 MMT CO_2e.

Figure 9: Waste Sector – Average Emissions per Reporter (2015)

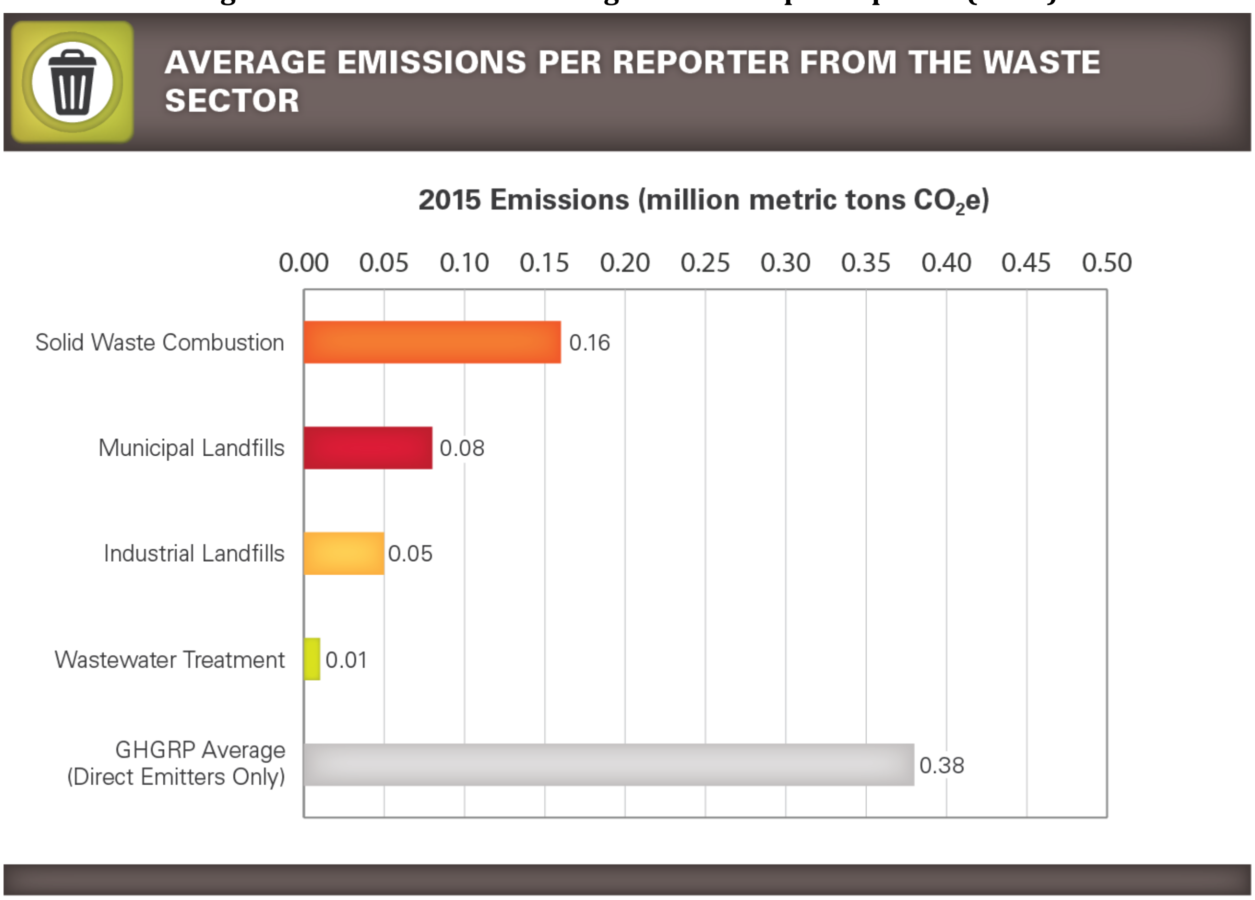


Figure 10: Waste Sector – Percentage of Reporters by Emissions Range (2015)

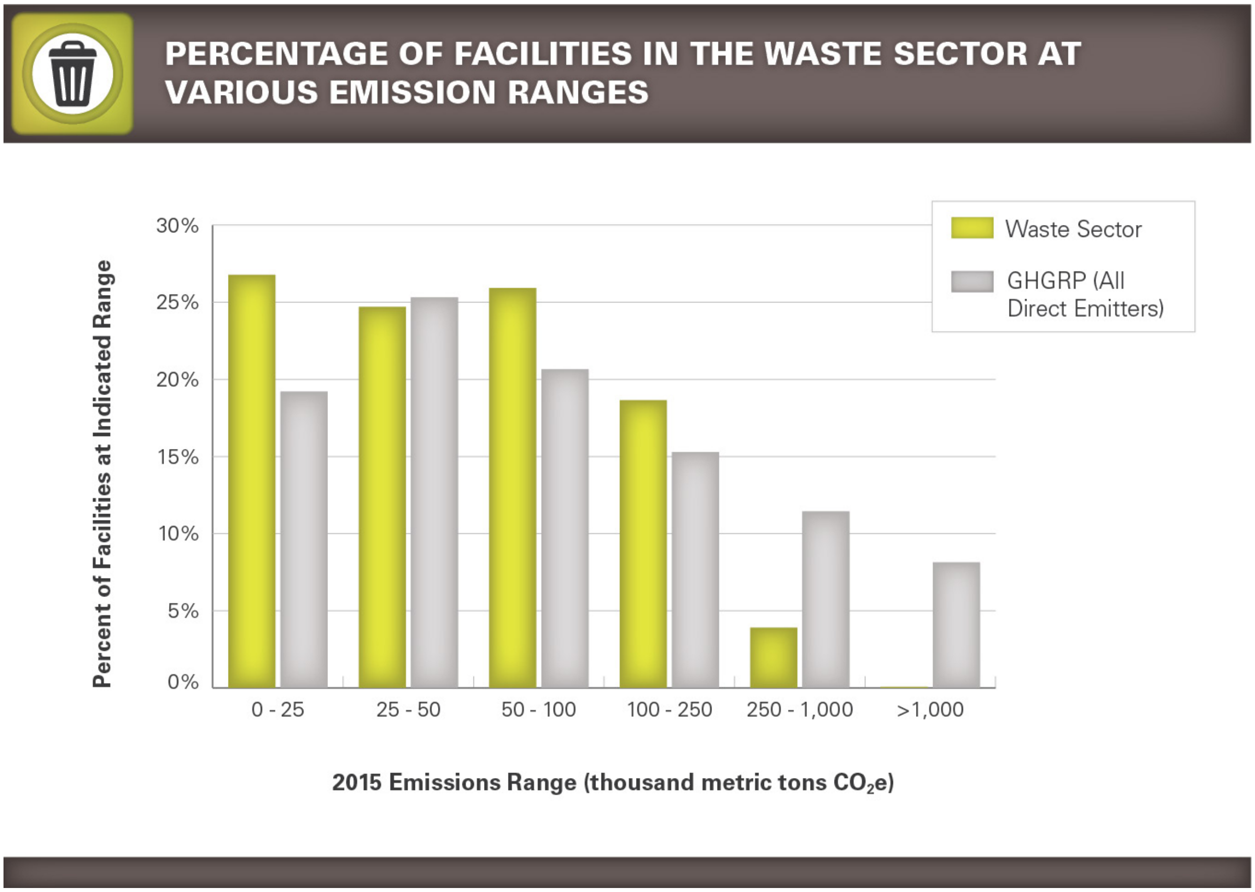


Table 8: Waste Sector – Number of Reporters by Emissions Range (2015)

Waste Sector	Number of Facilities Within Emissions Range (MMT CO_2e)[a]					
	0 - 0.025[b]	0.025 - 0.05	0.05 - 0.1[c]	0.1 - 0.25	0.25 - 1	> 1
Total Waste Sector	**419**	**379**	**392**	**283**	**65**	**1**
Industrial Landfills	74	43	28	25	3	0
Municipal Landfills	234	312	340	231	42	1
Solid Waste Combustion	1	4	15	24	20	0
Wastewater Treatment	110	20	9	3	0	0

[a] This table uses data from August 13, 2016, and thus the total number of RY15 reporters (1,539) is different than the total shown in Table 2 of this document (1,545). Within this table, the total number of facilities shown in the row for Total Waste Sector represents the number of unique facilities. The totals in this row may not equal the sum of the rows below, due to six facilities reporting under multiple industry types.

Municipal Solid Waste Landfill Details

Table 9: Characteristics of MSW Landfills in 2011–2015

Operational Characteristic	2011	2012	2013	2014	2015
Number of reporting facilities	1,231	1,250	1,237	1,234	1,160
Number of open landfills	950	962	965	966	939
Number of closed landfills	281	288	272	268	221
Number of landfills with gas collection	909	926	926	923	860
Number of landfills without gas collection	322	324	311	311	300

Facilities are required to report under subpart HH if their methane generation value meets or exceeds 25,000 metric tons of CO_2e. However, these facilities can cease reporting if their emissions are under 25,000 metric tons CO_2e for five consecutive years, or under 15,000 metric tons CO_2e for three consecutive years. Nearly 70% of the facilities that have ceased reporting under subpart HH reporting are closed landfills with a gas collection system in place.

Table 10: Methane Emissions by Type of MSW Landfill in 2011–2015 (MMT CO_2e)

Operational Characteristic	2011	2012	2013	2014	2015
Total emissions	**92.7**	**94.3**	**90.5**	**90.4**	**89.7**
Emissions for open landfills	83.5	85.1	82.1	82.1	81.9
Emissions for closed landfills	9.2	9.2	8.4	8.3	7.8
Emissions for landfills with gas collection	69.6	71.5	69.5	69.7	68.9
Emissions for landfills without gas collection	23.1	22.8	21.0	20.7	20.8

Figure 11: MSW Landfill Emissions Aggregated by 2015 Operational Status and Decade Waste was First Accepted

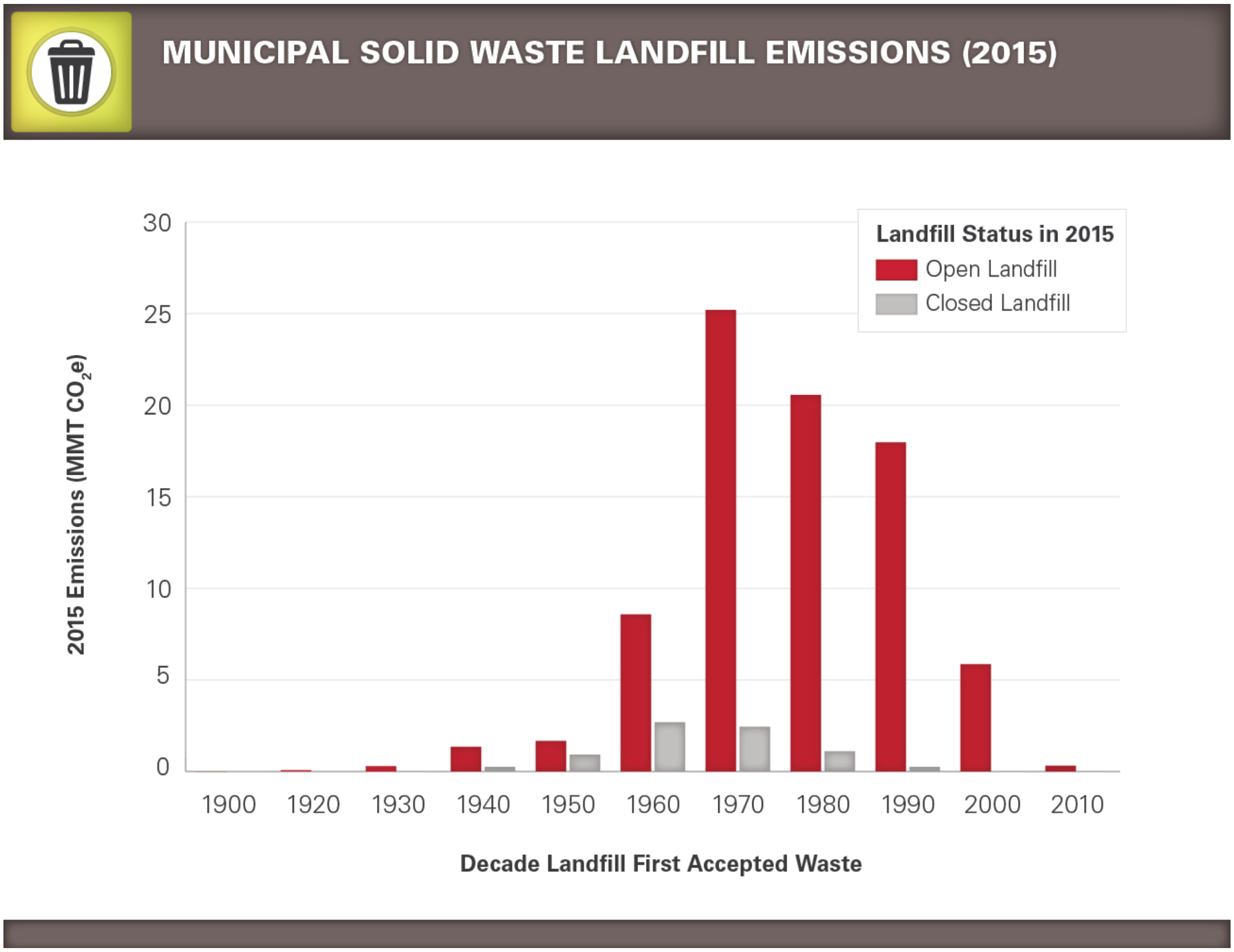


Figure 11 displays total methane emissions (in MMT CO_2e) and the operational status of the landfill (i.e., open and closed landfills) in 2015, grouped by the decade the landfill first accepted waste. The waste sector is unique because emissions in the current reporting year are heavily impacted by the quantity of waste already in place at landfills and the age of that waste (i.e., the year, or decade in this case, that waste was first disposed in the landfill). Figure 11 shows that most emissions in the current reporting year result from landfills that first accepted waste between the 1970s and 1990s, and are still open in 2015. The largest number of reporting landfills first opened and started accepting waste the 1970s. More than 300 of these landfills still accept waste in 2015, which explains why the 1970s-era landfills contribute the most to current methane emissions.

Figure 12: Number of MSW Landfills and Quantity of Emissions Aggregated by Waste-in-Place (2015)

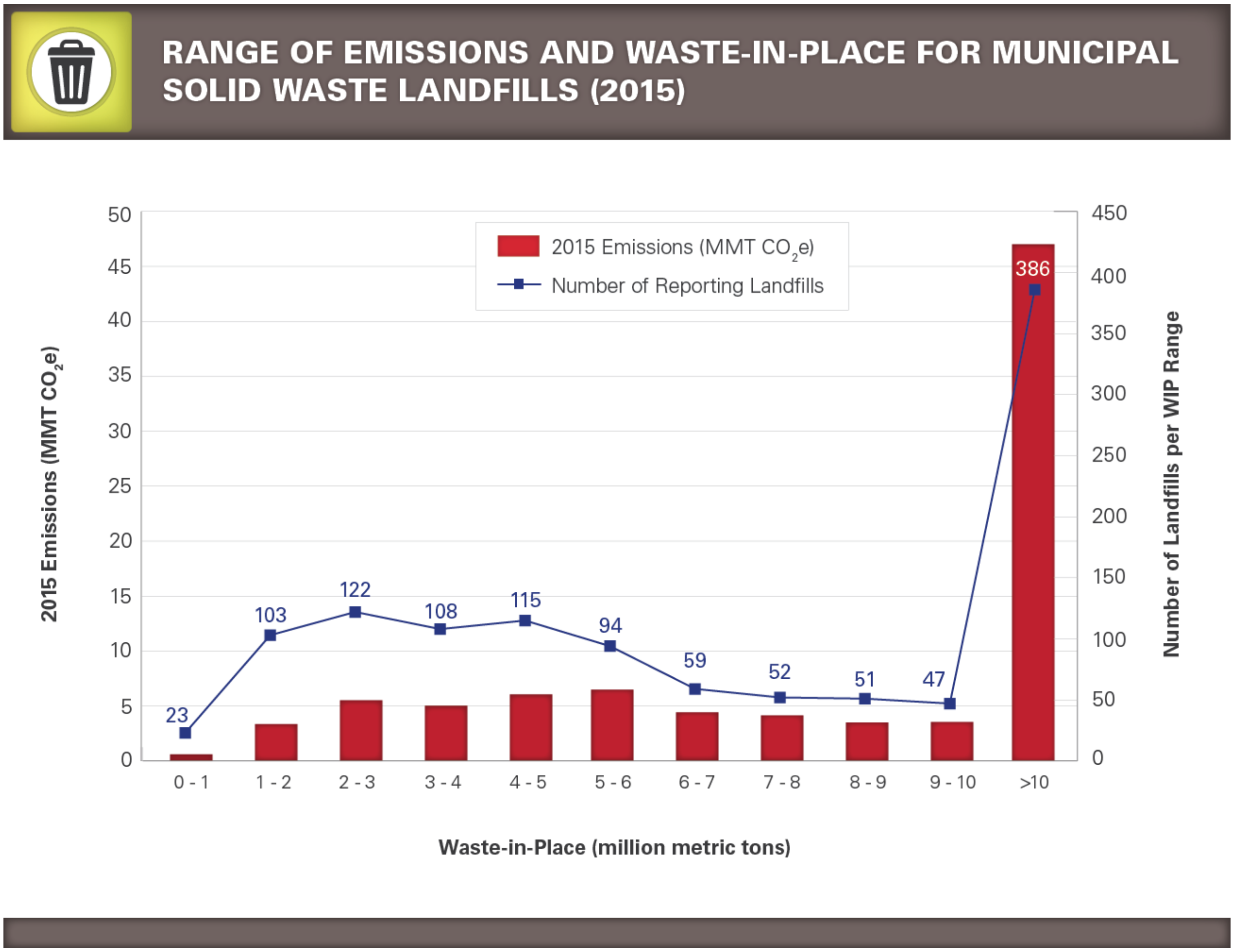


Figure 12 displays the number of reporting landfills in 2015 (blue line) and total methane emissions for the 2015 reporting year (red bars) by the range of waste-in-place at the landfill. The vertical red bars represent the number of facilities grouped into each waste-in-place range. In 2015, 33% of facilities (or 386 facilities) have more than 10 MMT of waste-in-place and contribute 47.0 MMT CO_2e in emissions (52.5% of total emissions from MSW landfills in the 2015 reporting year). The data show that there are significantly more small landfills (with less than 5 MMT of waste-in-place) than large landfills (with more than 10 MMT of waste-in-place). However, the small landfills reported fewer cumulative emissions than the large landfills. The average waste-in-place across all reporting MSW landfills for the 2015 reporting year was 11.2 MMT, and the median was 6.2 MMT. In reporting year 2013, the average waste-in-place was 6.8 MMT, and the median was 3.7 MMT. One reason for these changes is that some small facilities qualified to cease reporting.

Industrial Wastewater Treatment Details

Table 11: Characteristics of Industrial Wastewater Treatment in 2011–2015[a]

Data	2011	2012	2013	2014	2015
Number of processes with biogas recovery	161	130	136	130	121
Number of processes without biogas recovery	50	50	57	56	57
Number of lagoons	81	81	87	86	85
Number of reactors	124	93	97	92	85
Number of digesters[b]	6	6	9	8	8

[a] Facilities that report industrial wastewater treatment may report more than one industrial wastewater treatment process (lagoon, reactor, or digester) at their facility.

[b] Assumes that all digesters for industrial wastewater treatment plants have biogas recovery.

Table 12: Methane Emissions from Industrial Wastewater Treatment in 2011–2015 (MMT CO_2e)

Emissions Type[a]	2011	2012	2013	2014	2015
Total Emissions	2.6	2.1	2.2	2.6	2.1
Emissions from processes with biogas recovery	0.9	0.4	0.5	0.5	0.3
Emissions from processes without biogas recovery	1.7	1.7	1.7	2.1	1.8

[a] Subpart II does not account for facilities where the wastewater treatment is not co-located with the industrial facility or digesters without biogas recovery. This may result in an underestimation of emissions.

Table 13: Major NAICS Codes and Emissions for Industrial Wastewater Treatment (2015)

Major NAICS Code	Industry	Facility Count	Facility Percent	Emissions (MMT CO_2e)	Emissions Percent
3114	Fruits and Vegetables	12	8%	0.13	6%
3116, 112340	Meat and Poultry	56	38%	1.66	81%
221112, 311221, 311222, 312120, 312140, 325193, 325199	Ethanol	70	47%	0.06	3%
322110, 322121, 322130	Pulp and Paper	10	7%	0.21	10%
	Total	**148**	**100%**	**2.06**	**100%**

Industrial Waste Landfills Details

Table 14: Characteristics of Industrial Waste Landfills in 2011–2015

Data	2011	2012	2013	2014	2015
Number of reporting landfills	171	175	175	178	174
Number of open landfills	140	141	138	142	140
Number of closed landfills	31	34	37	36	34
Number of landfills with gas collection	2	2	2	2	1
Number of landfills without gas collection	169	173	173	176	173

Table 15: Methane Emissions for Industrial Waste Landfills in 2011–2015 (MMT CO_2e)[a]

Data	2011	2012	2013	2014	2015
Total emissions	8.8	9.2	8.3	8.6	8.6
Total emissions for open landfills	8.1	8.5	7.6	7.9	7.9
Total emissions for closed landfills	0.8	0.7	0.7	0.7	0.6
Total emissions for landfills with gas collection	0.4	0.4	0.4	0.5	0.3
Total emissions for landfills without gas collection	8.5	8.8	7.9	8.1	8.2

[a] Totals might not sum, due to independent rounding.

Figure 13: Industrial Waste Landfill Emissions Aggregated by 2015 Operational Status and Decade Waste was First Accepted

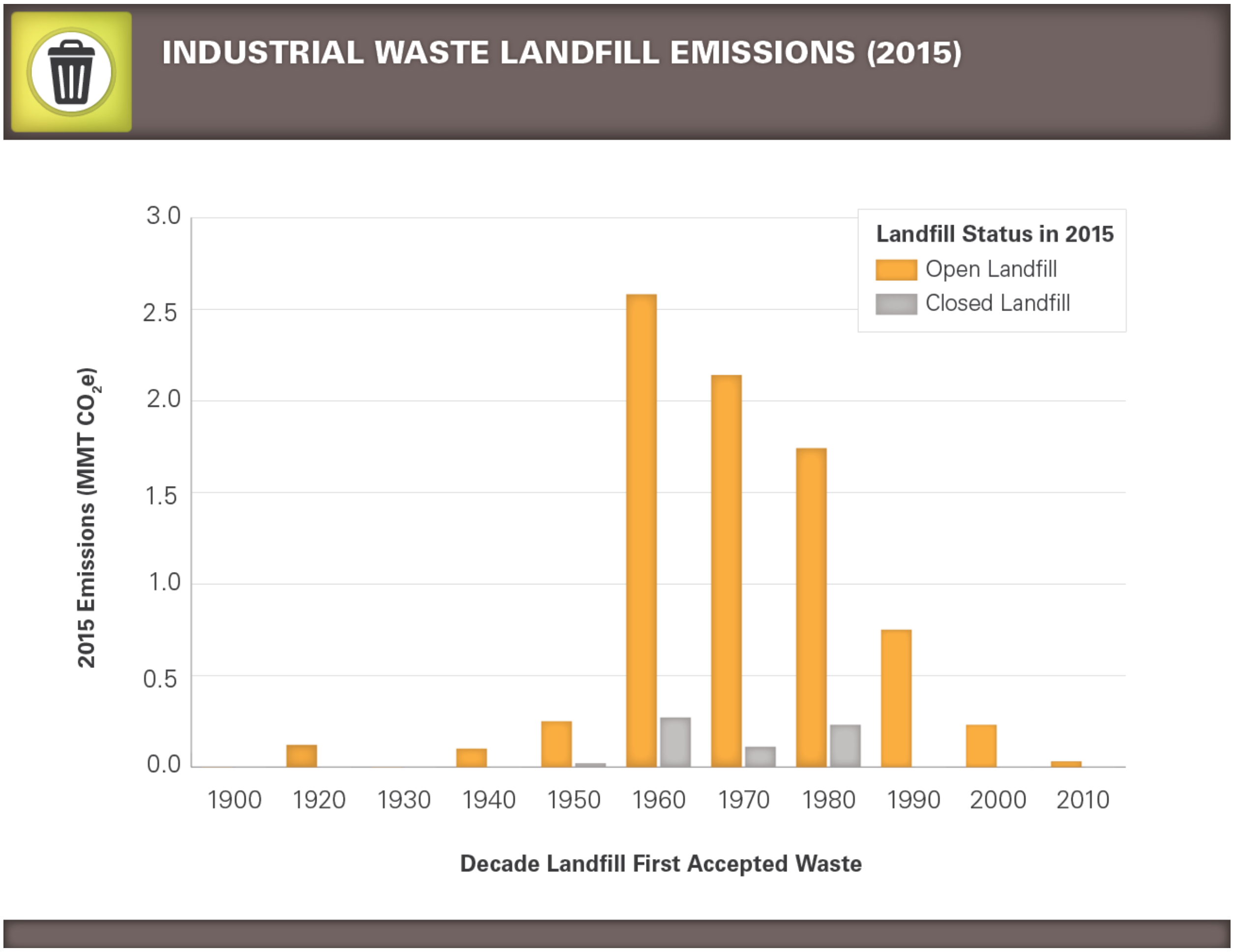


Figure 13 displays total methane emissions (in MMT CO_2e) and the operational status of industrial waste landfills in 2015 (i.e., open and closed landfills) by the decade the landfill first accepted waste. The majority of 2015 emissions result from landfills that first accepted waste between the 1960s and 1980s and are still open in 2015. There are significantly more open landfills than closed landfills contributing to total emissions in the current reporting year. Forty-seven of the landfills that opened in the 1960s were still accepting waste in 2015, which is why emissions from landfills that opened in that decade are higher than other decades.

Figure 14: Range of Waste-in-Place and Industrial Waste Landfill Emissions, 2015

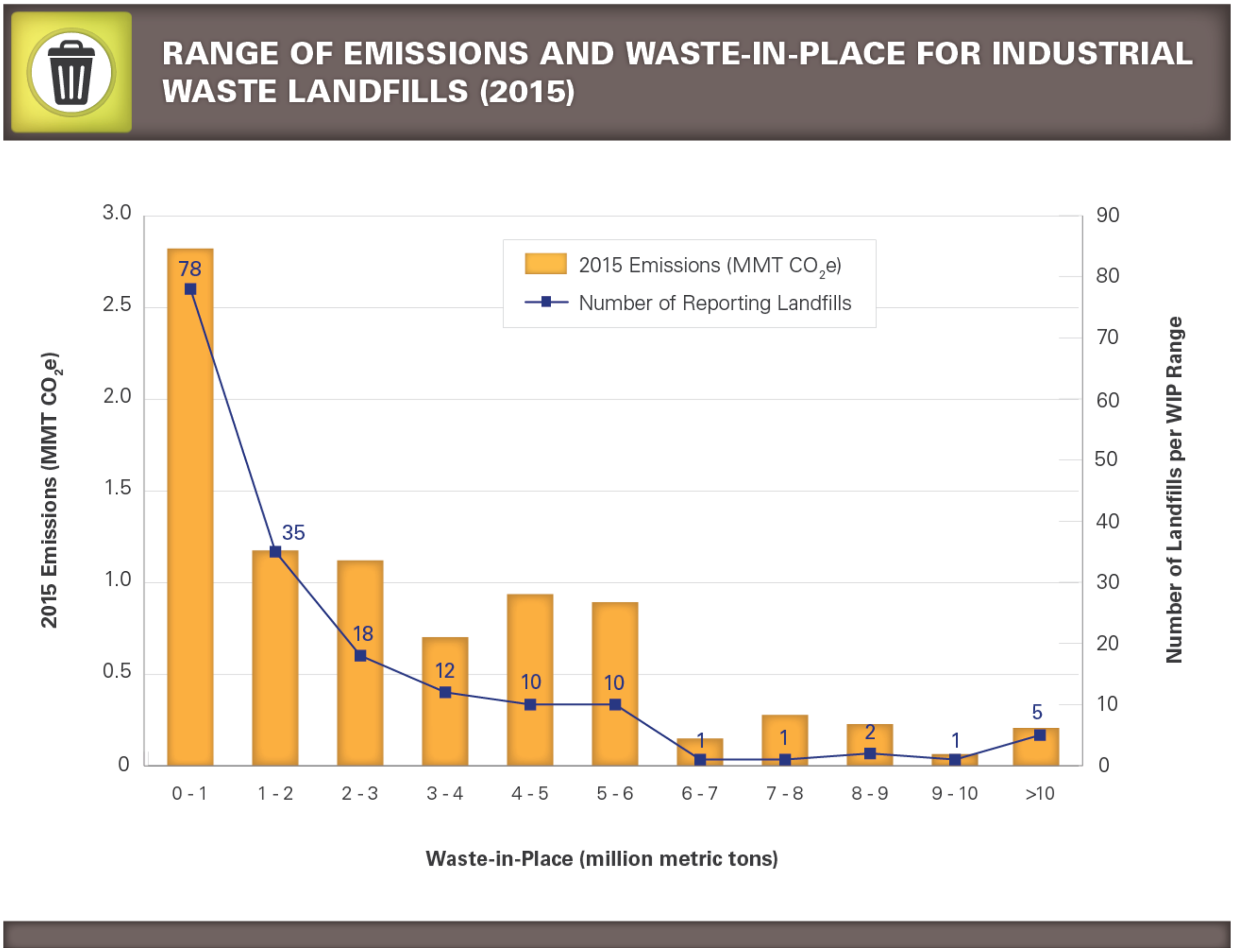


Figure 14 shows the number of reporting industrial waste landfills in 2015 (blue line) and total methane emissions (orange bars) by the range of waste-in-place (in million metric tons of waste). The data labels represent the number of facilities grouped into each waste-in-place range. In 2015, 78 facilities had less than 1 MMT of waste-in-place, but contributed 41.8% of total emissions (2.8 MMT CO_2e). Industrial waste landfills are smaller than MSW landfills. The average waste-in-place across all reporting industrial waste landfills for the 2015 reporting year was 2.6 MMT and the median was 1.7 MMT. Similar to the MSW landfills subsector, small facilities that qualified to cease reporting by 2015 are driving changes in annual and median waste-in-place.

Table 16: Major NAICS Code Groups Represented by Reporting Industrial Waste Landfills (2015)

Major NAICS Code	NAICS Code Description	Combined Facility Count[a]	Unique Facility Count	Percent of Total Facilities	Emissions (MMT CO_2e)[b]	Percent of Total Emissions
111	Crop Production	1	1	0.57%	0.05	0.54%
212	Mining (except Oil and Gas)	1	1	0.57%	0.02	0.25%
221	Utilities	9	4	2.3%	0.19	2.16%
311	Food Manufacturing	14	12	6.9%	0.65	7.63%
321	Wood Product Manufacturing	4	2	1.15%	0.02	0.19%
322	Paper Manufacturing	125	93	53.45%	5.10	59.54%
324	Petroleum and Coal Products Manufacturing	4	4	2.3%	0.05	0.55%
325	Chemical Manufacturing	33	17	9.77%	0.52	6.06%
327	Nonmetallic Mineral Product Manufacturing	1	0	0.00%	[c]	[c]
331	Primary Metal Manufacturing	22	19	10.92%	0.70	8.18%
332	Fabricated Metal Product Manufacturing	3	1	0.57%	<0.01	0.01%
562	Waste Management and Remediation Services	21	19	10.92%	1.27	14.84%
	Total	**238**	**174**	**100%**	**8.6**	**1**

[a] Facilities may report multiple NAICS codes based on the operations conducted at their facility. The counts presented in this column do not represent unique facilities. A total of 174 facilities reported 238 NAICS codes.

[b] The data presented in this column represent the total emissions for facilities that reported the NAICS code as their primary code so as not to double count emissions. This column does not sum the emissions from the facilities that reported the respective NAICS codes as secondary, tertiary, or otherwise.

[c] No facility reported NAICS code 327 as their primary business.

The majority of industrial facilities that report emissions under the industrial waste landfill subsector have dedicated on-site landfills. These landfills are presumed to only accept waste generated by that particular facility. Some industrial waste landfills are not associated with any particular industrial sector (i.e., NAICS code 562), and these facilities accept mixed industrial waste from various industries.

Paper manufacturing facilities contributed the majority of industrial waste landfill emissions in 2015 (5.10 MMT CO_2e or 59.5%). Waste management and remediation facilities (1.27 MMT CO_2e or 14.8%) and primary metal manufacturing sector facilities (0.70 MMT CO_2e or 8.2%) comprise the next largest shares.

Calculation Methods Available for Use

Facilities in the waste sector emit methane from the decomposition of organic matter in wastes and emit carbon dioxide, methane, and nitrous oxide from the combustion of solid wastes, captured methane, and other fuels.

Emission Calculation Methodology from Stationary Fuel Combustion Units

For MSW and industrial landfills, emissions from combustion of any collected biogas are included with emissions for the landfill facility if the landfill is not collocated with a process in another industry sector that is covered by the reporting rule (e.g. a petroleum refinery or pulp and paper facility). If the landfill is co-located, then the combustion emissions are included with the emissions from the co-located industry sector. For industrial wastewater, combustion emissions are included with the emissions from the pulp and paper, ethanol manufacturing, food processing or petroleum refining industry sector, as appropriate. The calculation methodology for stationary fuel combustion sources (subpart C) is explained here.

Emission Calculation Methodologies for Process Emissions Sources

MSW Landfills Emission Calculation Methodology

Because there is no internationally agreed upon and cost-effective approach to directly measure the amount of methane emitted from landfills, the emission estimation methodology uses a combination of gas measurements, models, and calculations. The calculation procedure for MSW landfills depends on whether the landfill has an active landfill gas collection and control system (GCCS).

- **Landfills without GCCS**. MSW landfills without an active landfill gas collection system must calculate methane generation using a first order decay model for methane generation in the landfill (Equation HH-1 of the rule, which is based on the 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 5). Equation HH-1 uses the quantities and types of wastes disposed in the landfill, a default or measured methane fraction in the landfill gas, and other characteristics of the landfill as model inputs. The methane generation is corrected using Equation HH-5 to account for methane that oxidizes (and therefore is not emitted) as it passes through the landfill cover material.
- **Landfills with active GCCS**. MSW landfills with active GCCS must calculate emissions using Equations HH-6 and HH-8 of the rule and specify which method they consider most accurate for their facility. FLIGHT displays the emissions from both methods but uses the facility-specified value to calculate total emissions from the MSW landfills subsector. If the facility does not specify which equation to use, FLIGHT uses the higher value
    - Equation HH-6 estimates emissions using the modeled methane generation rate (Equation HH-1, described above) minus the measured amount of methane recovered and destroyed. Methane generated in excess of the measured methane recovery is corrected to account for methane oxidation in the landfill cover material.
    - Equation HH-8 estimates emissions based on the measured quantity of methane recovered for destruction and an estimated landfill gas collection efficiency, which varies by type of landfill cover material used. This equation back-calculates the quantity of uncollected gas, which is then corrected to account for methane oxidation in the landfill cover material. Emissions from the gas collected and intended for destruction are estimated based on the methane destruction efficiency of the combustion device.

The values resulting from Equation HH-6 and HH-8 may vary significantly, depending on the characteristics of the landfill. For example, the amount of recovered methane can vary by year, and the landfill gas collection efficiency will change yearly for open landfills. The collection efficiency will change yearly because it is estimated using an area-weighted approach that is dependent on the surface area of each stage of cover (daily, intermediate, or final). While Equation HH-8 incorporates more site-specific information, it might not provide the most accurate GHG emissions estimate for every landfill due to the many variables that affect landfill GHG emissions.

Until 2013, all landfills were required to use a methane oxidation fraction of 0.10 in the methane emissions equations. In 2013, a rule change allowed for the use of different default methane oxidation fractions each year if the facility opted to calculate its landfill methane flux using the provided methodology. A default value of 0.10 must be used if the facility chooses not to calculate landfill methane flux. The results of the methane flux calculations, combined with the extent of soil cover at the landfill, direct the reporter to the appropriate oxidation fraction to use. The methane oxidation fraction values available for use are 0.0, 0.10, 0.25, and 0.35. Using a higher oxidation fraction value results in lower methane emissions than when a lower oxidation fraction value is used.

Beginning in 2013, facilities were required to report the oxidation fraction used for each relevant emissions equation. Table 17 shows the oxidation factor used in each equation. While most facilities still used the default value of 0.10 in 2015, approximately 28% of facilities without gas collection used the higher oxidation fractions of 0.25 or 0.35, and 3% used a value of 0. A larger percentage of facilities with landfill gas collection (45-48%) used the higher oxidation values (25-35%), while approximately 1% used a value of 0.

Table 17: MSW Landfills – Methane Oxidation Fraction Values Used by MSW Landfills (2015)

Oxidation Factor Default Value	Emissions Equation									
	Without Gas Collection Systems		With Gas Collection Systems							
	HH-5		HH-5[a]		HH-6		HH-7[a]		HH-8	
	Count	%	Count	%	Count	%	Count	%	Count	%
0	8	2.7	9	1.0	9	1.0	9	1.0	9	1.0
0.1	209	69.7	554	64.4	460	53.5	514	59.8	439	51.0
0.25	72	24.0	281	32.7	286	33.3	288	33.5	214	24.9
0.35	11	3.7	16	1.9	105	12.2	49	5.7	198	23.0
Total	**300**	**100**	**860**	**100**	**860**	**100**	**860**	**100**	**860**	**100**

[a] Landfills with gas collection systems must report landfill gas generation using both Equation HH-5 and HH-7 in addition to calculating emissions using both Equations HH-6 and HH-8.

The table below presents the percentage of emissions monitored by method and type. A larger percentage of process and combustion emissions are emitted by facilities with GCCS, because there are significantly more facilities with GCCS than without (3:1).

Table 18: MSW Landfills – Methodologies

Type of Emissions	Methodology	Percentage of Emissions Monitored by Method (by Type)				
		2011	2012	2013	2014	2015
Process Emissions	Landfills without GCCS: All landfills without GCCS use modeled CH_4 generation adjusted for oxidation	24.9%	24.1%	23.2%	22.9%	23.1%
	Landfills with GCCS: Equation HH-6: Modeled CH_4 generation and measured CH_4 collection[a]	26.0%	28.6%	31.8%	33.1%	33.6%
	Landfills with GCCS: Equation HH-8: Measured CH_4 collection and a default factor for collection efficiency[a]	49.1%	47.2%	44.9%	44.0%	43.3%
Combustion Emissions	CEMS (Tier 4)[b]	34.0%	40.6%	38.7%	43.9%	49.9%
	Measured carbon content, and, if applicable, molecular weight (Tier 3)	0%	0%	**	0%	**
	Measured high heating values (HHVs) and default emission factors (Tier 2)	13.2%	13.0%	12.6%	11.9%	11.2%
	Default HHVs and emission factors (Tier 1)	52.8%	46.4%	48.7%	44.2%	38.9%

[a] Facilities report both measured and modeled emissions, and identified the most accurate emissions value for their facility. For FLIGHT and this report, EPA selected the emissions value that was identified by the facility.

[b] CEMS emissions include CO_2 from fossil fuel combustion plus, if applicable, CO_2 from sorbent.

** Total reported emissions are less than 0.05% of the total.

The table below presents the number of facilities with GCCS and the calculation method used (either Equation HH-6 or HH-8) for each reporting year. Facilities may use the equation they feel is most appropriate based on their facility operations. Facilities are not required to use the same equation across reporting years, but most facilities did use the same equation for multiple years. Most facilities used Equation HH-8 for all five reporting years. Equation HH-8 is based on the measured quantity of recovered methane, while Equation HH-6 is based on the amount of modeled methane generation.

Table 19: MSW Landfills – Use of Equation HH-6 Versus HH-8 by Reporting Year

	2011	2012	2013	2014	2015
Facilities with GCCS	909	926	926	923	860
Facilities that used Equation HH-6	246	279	279	290	281
Facilities that used Equation HH-8	663	647	647	633	579
Facilities that switched the equation used at some point in the time series[a]	N/A	80	98	84	60
Facilities that kept the same equation across the time series[a]	N/A	802	784	839	800

[a] Only facilities that reported for all five reporting years are included.

N/A means not applicable.

Industrial Waste Landfills Calculation Methodology

The calculation methodology for industrial waste landfills parallels the methodology for MSW landfills. A change was made in 2013 to add a default factor for degradable organic carbon content (DOC) and a decay rate for industrial sludge. These changes directly impact the modeled methane generation and methane emissions for facilities that dispose of industrial sludges.

Table 20: Industrial Landfills – Methodologies

Type of Emissions	Methodology	Percentage of Emissions Monitored by Method (by Type)				
		2011	2012	2013	2014	2015
Landfills without GCCS	All facilities use modeled CH_4 generation adjusted for oxidation	99%	99%	99%	99%	99%
Landfills with GCCS	Equation HH-6: Modeled CH_4 generation and measured CH_4 collection	1%	1%	1%	1%	1%
	Equation HH-8: Measured CH_4 collection and a default factor for collection efficiency	0%	0%	0%	0%	0%

Note: Only two industrial waste landfills (1% of reporters for that subsector) have a GCCS.

Industrial Wastewater Treatment Calculation Methodology

The calculation procedure of industrial wastewater treatment depends on whether biogas is recovered from the anaerobic reactor(s) or lagoon(s) operating at the facility. All anaerobic sludge digesters are assumed to recover biogas. The methodology for sludge digesters does not include calculating methane generation using COD or BOD_5, because it is assumed that all generated methane is recovered.

- **No biogas recovery**. All facilities with anaerobic reactors or lagoons calculate emissions using measurements of the volume of wastewater, measurements of the average weekly concentration of either COD or BOD_5, and a default methane conversion factor. All methane generated during the process is emitted (Equation II-3).

- **With biogas recovery**. All facilities with anaerobic reactors, lagoons, or sludge digesters that recover biogas calculate emissions using measurements of the flow of recovered biogas; methane concentration, temperature, pressure, and moisture; and default values for biogas collection efficiency and methane destruction efficiency. Equation II-4 determines the amount of methane recovered in the process and Equation II-5 uses the collection efficiency to estimate the amount of methane that leaks out of equipment. Equation II-6 determines total methane emissions by summing methane leakage and methane not destroyed in the destruction device.

Table 21: Industrial Wastewater – Methodologies and Percentage of Emissions by Type of Treatment System (2015)

Types of Industrial Wastewater Treatment Systems		Percentage of Emissions Monitored by Type	Methodology
No biogas recovery	Anaerobic reactors	4.2%	Monitor either the 5-day BOD or the COD of the material entering the reactor or lagoon, and use default values for methane generation potential and methane conversion factor.
	Anaerobic lagoons	73.7%	
With biogas recovery	Anaerobic reactors	1.7%	Monitor biogas flow rate and CH_4 concentration, and use default values for biogas collection efficiency and the efficiency of the biogas destruction device.
	Anaerobic lagoons	18.8%	
	Sludge digesters	1.7%	

Solid Waste Combustion facilities must report under Subpart C, and the reporter generally must use one of four calculation methodologies (tiers) to calculate CO_2 emissions (Table 22), depending on fuel type and unit size. The calculation methodologies for Subpart C are explained in more detail here. Units that are not subject to Subpart D but are required by states to monitor emissions according to 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 and fuel use). Methane (CH_4) and nitrous oxide (N_2O) mass emissions are also required to be reported for fuels that are included in Table C-2 of Part 98 and are calculated using either an estimated or measured fuel quantity, default or measured HHV, and default emission factors.

Table 22: Solid Waste Combustion – Methodologies

Type of Emissions	Methodology	Percentage of Emissions Monitored by Method (by Type)				
		2011	2012	2013	2014	2015
Combustion Emissions	CEMS (Tier 4)[a]	59.0%	57.9%	59.2%	57.1%	60.0%
	Measured carbon content, and, if applicable, molecular weight (Tier 3)	**	0%	0%	0%	0%
	Measured high heating values (HHVs) and default emission factors (Tier 2)	39.7%	41.0%	38.5%	37.7%	39.1%
	Default HHVs and emission factors (Tier 1)	1.2%	1.1%	2.3%	5.2%	1.0%

[a] CEMS emissions include CO_2 from fossil fuel combustion plus, if applicable, CO_2 from sorbent.
** Total reported emissions are less than 0.05% of the total.

Data Verification and Analysis

As a part of the reporting and verification process, EPA evaluates annual GHG reports with electronic checks and staff review as needed. EPA contacts facilities regarding potential substantive errors and facilities resubmit reports as errors are identified. Additional information on EPA's verification process is available here.

Other Information

The U.S. Environmental Protection Agency's Landfill Methane Outreach Program (LMOP) is a voluntary assistance program that promotes the reduction of methane emissions from landfills by encouraging the recovery and beneficial use of landfill gas (LFG) as an energy resource. By joining LMOP, companies, state agencies, organizations, landfill operators, and communities gain access to a vast network of industry experts and practitioners, as well as various technical and marketing resources that can help with LFG energy project development. LMOP maintains a list of candidate landfills where available data indicate that installing a landfill gas-to-energy (LFGTE) project is likely to provide financial benefits. LMOP defines a candidate landfill as one that is accepting waste or has been closed for five years or less, has at least one million tons of waste, and does not have an operational, under-construction, or planned LFGTE project.

EPA's U.S. Greenhouse Gas Inventory (hereafter referred to as the Inventory) estimates total U.S. GHG emissions from waste sector sources. National level emissions presented in the Inventory report differ from the total emissions reported to the GHGRP for several reasons:

- The Inventory accounts for emissions from all facilities in a given sector. The GHGRP, on the other hand, includes only those facilities that meet the reporting thresholds. The coverage and the emissions methodologies differ between the two programs (see Table 3 for estimated coverage across the waste sector).
- The Inventory estimates for MSW landfills are a combination of top-down and bottom-up estimates for certain years in the Inventory time series, representing national emissions that are intended to be inclusive of all facilities within a given sector. The 1990-2015 Inventory for MSW landfills incorporated directly-reported methane emissions from

facilities reporting to the GHGRP (for years 2010 to 2015) with a scale-up factor to account for emissions from MSW landfills that do not meet the GHGRP's reporting threshold.[3]

- The Inventory estimate for industrial waste landfill emissions includes only pulp and paper and food and beverage sector facilities, whereas subpart TT of the GHGRP covers many more industries. Due to a lack of industrial waste disposal data for all facilities within each industrial sector, the inventory uses proxy data (i.e., annual production data multiplied by a disposal factor) to estimate the amount of waste disposed of by the pulp and paper and food and beverage sectors. The GHGRP uses a bottom-up calculation approach and requires facilities to report the amount of waste disposed.
- The Inventory estimate for industrial wastewater treatment includes aerobic ponds with anaerobic portions, but under the GHGRP, only emissions from strictly anaerobic processes are required to be reported.
- The Inventory does not capture emissions from wastewater sludge digesters or methane recovered from anaerobic treatment processes, while the GHGRP does.

[3] Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2015. U.S. Environmental Protection Agency. April 2017. EPA 430-P-17-001. Available at: https://www.epa.gov/ghgemissions/inventory-us-greenhouse-gas-emissions-and-sinks-1990-2015.

GLOSSARY

Anaerobic process refers to a procedure in which organic matter in wastewater, wastewater treatment sludge, or other material is degraded by micro-organisms in the absence of oxygen, resulting in the generation of CO_2 and CH_4. This source category consists of the following: anaerobic reactors, anaerobic lagoons, anaerobic sludge digesters, and biogas destruction devices (for example, burners, boilers, turbines, flares, or other devices) (40 CFR part 98.350).

Biogenic CO_2 emissions means carbon dioxide released from the combustion or decomposition of biologically-based materials other than fossil fuels.

Continuous Emission Monitoring System or CEMS means the total equipment required to sample, analyze, measure, and provide, by means of readings recorded at least once every 15 minutes, a permanent record of gas concentrations, pollutant emission rates, or gas volumetric flow rates from stationary sources (40 CFR part 98.6).

Ethanol production means an operation that produces ethanol from the fermentation of sugar, starch, grain, or cellulosic biomass feedstocks, or the production of ethanol synthetically from petrochemical feedstocks, such as ethylene or other chemicals.

FLIGHT refers to EPA's GHG data publication tool, named the Facility Level Information on GreenHouse Gases Tool (https://ghgdata.epa.gov).

Food processing means an operation used to manufacture or process meat, poultry, fruits, and/or vegetables as defined under NAICS 3116 (Meat Product Manufacturing) or NAICS 3114 (Fruit and Vegetable Preserving and Specialty Food Manufacturing). For information on NAICS codes, see http://www.census.gov/eos/www/naics/.

GCCS means a landfill's gas collection and control system.

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/climatechange/ghgemissions/usinventoryreport.html.

IPCC AR4 refers to the Fourth Assessment Report by the Intergovernmental Panel on Climate Change. *Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change [Core Writing Team, Pachauri, R.K. and Reisinger, A. (eds)]. IPCC, Geneva, Switzerland, 2007.* The AR4 values also can be found in the current version of Table A-1 in subpart A of 40 CFR part 98.

Industrial wastewater means water containing wastes from an industrial process. Industrial wastewater includes water which comes into direct contact with or results from the storage, production, or use of any raw material, intermediate product, finished product, by-product, or waste product. Examples of industrial wastewater include, but are not limited to, paper mill white water, wastewater from equipment cleaning, wastewater from air pollution control devices, rinse water, contaminated stormwater, and contaminated cooling water.

Industrial waste landfill means any landfill other than a municipal solid waste landfill, a Resource Conservation and Recovery Act (RCRA) Subtitle C hazardous waste landfill, or a Toxic Substances Control Act (TSCA) hazardous waste landfill, in which industrial solid waste, such a RCRA Subtitle D wastes (nonhazardous industrial solid waste, defined in §257.2 of this chapter), commercial solid wastes, or conditionally exempt small quantity generator wastes, is placed. An industrial waste landfill includes all disposal areas at the facility.

Industrial wastewater treatment sludge means solid or semi-solid material resulting from the treatment of industrial wastewater, including but not limited to biosolids, screenings, grit, scum, and settled solids.

Landfill Methane Outreach Program or LMOP is a voluntary assistance program run by the EPA to help reduce methane emissions from landfills by encouraging the recovery and beneficial use of landfill gas as an energy resource (http://www.epa.gov/lmop/).

MT means metric tons.

MMT means million metric tons.

Municipal Solid Waste Landfills, as defined by the GHGRP, means an entire disposal facility in a contiguous geographical space where household waste is placed in or on land. An MSW landfill may also receive other types of RCRA Subtitle D wastes (40 CFR 257.2) such as commercial solid waste, nonhazardous sludge, conditionally exempt small quantity generator waste, and industrial solid waste. Portions of an MSW landfill may be separated by access roads, public roadways, or other public right-of-ways. An MSW landfill may be publicly or privately owned (40 CFR part 98.6).

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.

Wastewater Treatment Systems are the collection of all processes that treat or remove pollutants and contaminants, such as soluble organic matter, suspended solids, pathogenic organisms, and chemicals from wastewater prior to its reuse or discharge from the facility.