

6

Waste

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6. Waste

The waste sector state-level estimates include the following sources consistent with the national-level *GHGIA*:

- Solid waste disposal
  - Municipal solid waste landfills
  - Industrial landfills
- Biological treatment of solid waste
  - Anaerobic digestion at (stand-alone) biogas facilities
  - Composting
- Wastewater treatment and discharge
  - Domestic wastewater treatment
  - Industrial wastewater treatment

More information on national-level emissions and methods is available in Chapter 7 (Waste) of the national-level *GHGIA*. Note that emissions from waste incineration are discussed in Chapter 2 of this methodology report.

Methodology

Table 6-1 summarizes the different approaches used to estimate state-level waste emissions. Overall, the specific methods used to develop state-level estimates for 1990–2024 are the same as EPA (2024), and any relevant updates are described under "Additional Information". For users seeking a comprehensive technical understanding of the compilation of *GHGIA by State* emission and sink estimates, this methodology report is best read in conjunction with the corresponding sections of the three references provided in Table 6-2. The *GHGIA by State* emission and sink estimates are compiled to be consistent with the latest national-level *GHGIA* data and largely apply and extend methodologies and data previously published by EPA at the national and state level. Methodological detail is only included in this document for new sources not included in EPA (2024a). Unless otherwise noted, readers should refer to EPA (2024a) for detailed descriptions of disaggregation methodologies. Where previously published methods remain unchanged, CGS summarizes the disaggregation approaches rather than repeating information from the latest national-level inventory report or the previous state-level methodology report. Recalculations at the national-level *GHGIA* that affect state-level estimates are discussed in the national-level *GHGIA* Chapter 7. Geographic completeness is consistent with the national-level *GHGIA* and is summarized in Annex 2 by sector and source.

Table 6-1: Methodology Summary for State-Level Waste Sector GHG Emission Estimates

Category	Gas	Disaggregation Approach	Changes to 1990–2023 estimates from previously published EPA GHGI by State	Additional Information	Data Appendices
Landfills					
MSW landfills (*GHGIA* Section 7.1)	CH_4	State-level emissions are estimated by allocating national-level *GHGIA* emission estimates to states using a combination of proxy approaches across the time series. **1990–2009:** National-level *GHGIA* CH_4 net emissions are allocated to each state based on each state's share of waste landfilled (as reported by landfills in each state to GHGRP's Subpart HH for historical years) for each year. **2010–2024:** National-level *GHGIA* CH_4 net emissions are allocated to each state by applying each state's share to national net CH_4 emissions (as reported by landfills in each state to Subpart HH) for each year.	Yes	No changes were made to the disaggregation methods, and the approach is consistent with that used in EPA (2024a). Revisions to the state emissions (primarily for 2016–2023) are due to recalculations of national estimates (see Recalculations discussed in national-level *GHGIA*, Section 7.1), incorporation of latest GHGRP data impacting state shares, and correction of minor computational errors.	N/A

Category	Gas	Disaggregation Approach	Changes to 1990–2023 estimates from previously published EPA GHGI by State	Additional Information	Data Appendices
Industrial landfills (*GHGIA* Section 7.1)	CH_4	State-level emissions from pulp, paper, food, and beverage industrial landfills are estimated by allocating national-level *GHGIA* emission estimates to states using source-specific state proxies, including pulp and paper mill counts and relevant food and beverage manufacturing data.	Yes	No changes were made to the disaggregation methods, and the approach is consistent with that used in EPA (2024a). Revisions to the state emissions time series are due to recalculations of national estimates (see Recalculations discussed in national-level *GHGIA*, Section 7.1), incorporation of latest GHGRP data impacting state shares, and correction of minor computational errors.	F-1: Mills by State F-2: Food and Beverage Manufacturing NAICS Codes Assumed to Generate Waste that May Be Disposed in an Industrial Waste Landfill F-3: Percentage of Waste Disposed of by State for the Selected NAICS Codes
Biological Treatment of Solid Waste					
Composting (*GHGIA* Section 7.3)	CH_4 N_2O	State-level emissions are estimated by allocating national-level *GHGIA* emissions to each state based on a combination of approaches across the time series. **1990–1999:** National-level *GHGIA* emissions are allocated to each state using the share of material composted by state in 2000. **2000–2024:** National-level *GHGIA* emissions are allocated to each state based on the state's share of material composted.	Yes	No changes were made to the disaggregation methods, and the approach is consistent with that used in EPA (2024a). Revisions to the state emissions (primarily for 2019–2023) are due to incorporation of updated activity data at the national and state level. See Recalculations discussion in national-level *GHGIA* section 7.3. These national-level changes are reflected in the state-level emissions estimates.	F-4: Percentage of Material Composted by State, Calculated Using Available State Data (%)

Category	Gas	Disaggregation Approach	Changes to 1990–2023 estimates from previously published EPA GHGI by State	Additional Information	Data Appendices
Anaerobic digestion at (stand-alone) biogas facilities (*GHGIA* Section 7.4)	CH_4	State-level emissions are estimated by allocating national-level *GHGIA* emissions to each state based on each state's share of operational facilities.	Yes	No changes were made to the disaggregation methods, and the approach is consistent with that used in EPA (2024a). Revisions to the state emissions for 2022 and 2023 are due to incorporation of the latest facility data collection project by EPA's Office of Resource Recovery and Conservation (ORCR). See Recalculations discussion in national-level *GHGIA* Section 7.4. These national-level changes are reflected in the state-level emissions estimates.	F-5: Count of Operational and Shutdown [Standalone] Biogas Facilities by State
Wastewater Treatment and Discharge					
Domestic wastewater (*GHGIA* Section 7.2)	CH_4 N_2O	State-level emissions are estimated by allocating national-level *GHGIA* emission estimates to each state based on population share and state-level septic system use (from periodic census surveys).	Yes	No changes were made to the disaggregation methods, and the approach is consistent with that used in EPA (2024a). Revisions to the state emissions across the time series are due to incorporation of updated activity data at the national and state level (e.g., state-level population). See Recalculations discussion in national-level *GHGIA* Section 7.2. These national-level changes are reflected in the state-level emission estimates.	F-6: Share of population with septic systems

Category	Gas	Disaggregation Approach	Changes to 1990–2023 estimates from previously published EPA GHGI by State	Additional Information	Data Appendices
Industrial wastewater (*GHGIA* Section 7.2)	CH_4	State-level emissions are estimated by allocating national-level *GHGIA* emissions to each state based on industrial-source specific proxy data (e.g., state-specific wastewater outflows from pulp and paper facilities, state-level production of meat/poultry processing, fruits and vegetables processing, beer, ethanol, and/or petroleum).	Yes	No changes were made to the disaggregation methods, and the approach is consistent with that used in EPA (2024a). Revision to state emissions across the time series are due to incorporation of updated activity data at the national level (see Recalculations in national-level *GHGIA* Section 7.2). These national-level changes are reflected in the state-level emissions estimates. Revisions are also due to incorporation of updated state-level production for pulp and paper, beer, ethanol, and petroleum with latest data from ECHO (EPA 2026), EIA (2026a; 2026b), EIA SEDS (2025c), and TTB (2026a; 2026b).	F-7: State Percentages based on Total Wastewater Flow from Pulp and Paper Facilities F-8: List of NPDES pulp and paper permits removed from the analysis F-9: State-level Meat and Poultry Production by State F-10: – State-level Fruits and Vegetables Production Data F-11: – State-level Petroleum Production Data F-12: – State-level Ethanol Production Data F-13: – State-level Breweries Production Data

Table 6-2: Key References for Data Users

Geographic Scope	Report	Publication Source	Publication Date	What to Read
State	Methodology Report Inventory of U.S. Greenhouse Gas Emissions and Sinks by State: 1990–2022	EPA (2024a)	September 2024	Chapter 1 (Introduction) and Chapter 6 (Waste) sector/ source-level "Background", "Methods/Approach" and "Uncertainty"
National	Inventory of U.S. Greenhouse Gas Emissions and Sinks 1990–2023	EPA (2025a)	May 2025 (FOIA Release)	Read the Chapter 7 (Waste) source category-level upfront discussion and "Methodology and Time-Series Consistency" and "Uncertainty" sections
National	Greenhouse Gas Inventory and Analysis for the United States: 1990–2024 (*GHGIA*)	Center for Global Sustainability (Desai et al., 2026)	April 2026	Read the Chapter 7 (Waste) source category-level "Methodology," "Recalculation," and "Uncertainty" sections as appropriate, and "Future Areas for Improvement"

Methodology for newly added sources

No new sources were added to the waste sector for this current report.

Comparison to national totals

The sum of state totals aligns with the national-level *GHGIA*. Quality control procedures were implemented to review changes to the time series and confirm that waste source estimates sum to national estimates. Issues identified during these checks were addressed, and errors were corrected (e.g., computational formula errors, transcription errors, etc.).

Future areas of improvement

Areas for improving state-level estimates are the same as those presented in Section 7.1 of the previous national-level *GHGIA* (Desai et al., 2026), including improvement of geographic completeness. In addition to these improvements, some state-level planned improvements for waste sources include:

- Reviewing 2024 Greenhouse Gas Reporting Program data published via FOIA (EPA, 2025b)
- Identifying state-level sources for the type of wastewater treatment systems in use for municipal, domestic, or industrial wastewater (by industrial sector).
- Conducting a review of state-level BOD or total nitrogen data from municipal wastewater treatment and significant industrial wastewater sources.
- Identifying waste characterization data to improve waste source emission estimates where data are currently lacking (e.g., Alaska, U.S. Territories).

References

The references listed below only include new references used for compiling and updating the current *GHGIA by State*. Full citations for all references relevant to compiling national-level Waste estimates are found at the end of Chapter 7 (Waste) of the national-level *GHGIA* (Desai et al., 2026) and its Annexes 5.18 and 5.19. The national-level *GHGIA* is available online at https://ghgi.cgs.umd.edu/.

General Waste

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Wastewater Treatment and Discharge

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