Solid Waste Emissions Estimation Tool
USER MANUAL

Version 5.0
June 2025

CONTENTS

SECTION 1. OVERVIEW

1.1 Organization of User Manual

This User Manual accompanies Version 5.0 of the Solid Waste Emissions Estimation Tool (SWEET). SWEET was developed by the U.S. Environmental Protection Agency under the auspices of the Global Methane Initiative (GMI) and in support of the Climate and Clean Air Coalition (CCAC). U.S. EPA managed the tool's development with technical support from Abt Global and SCS Engineers. The tool assists users in determining first-order city-level estimates of annual emissions of methane, black carbon, and other pollutants (e.g., carbon dioxide) from various sources in the waste sector. The tool was designed with a particular focus on methane and black carbon, which are short-lived climate pollutants (SLCPs).[1]

This manual contains:

- An overview of the tool and its design (Section 1),
- Detailed documentation on how to use the tool and interpret results (Section 2),
- Explanation of the tool's limitations, methodology, and assumptions (Section 3),
- Answers to frequently asked questions (Section 4)
- Links to download a data collection sheet (Section 5)
- Links to key resources including videos and case studies (Section 6)
- A bibliography with a list of sources used to develop this user manual (Section 7)

1.2 Organization of Spreadsheet Tool

SWEET is divided into five color-coded sections, each comprising several tabs. Below is a description of each section.

- Brown (■) tabs provide instructions, notes, assumptions, default values, references, and additional information.
- Blue (■) tabs: Users are required to enter data into all five blue tabs. Each tab includes relevant instructions and tips to guide you in completing it.
- Black (■) tabs: The three black tabs provide tables and charts that summarize the tool's outputs.
- Grey (■) tabs: The six grey tabs provide more detailed emissions results from the baseline ("business-as-usual") and alternative scenarios.

---

[1] For more information on SLCPs in general, see the Climate and Clean Air Coalition's website.

1.3 Entering Data

When you open the tool, you will be prompted to enable the tool's macros. You must enable macros for the tool to function correctly. You will either be prompted with a pop-up upon opening the tool, or a yellow warning bar will appear at the top of the program asking you to "Enable Content." If you did not choose to enable macros, close the tool and reopen it, and you will have the option again to enable macros.

The tool requires data inputs for all stages of waste management, from collection to disposal and including diversion. Ensure you have all the necessary data before proceeding with the tool. A list of necessary data points can be found in *Section 5: Data Collection Sheet.*

In addition to assessing emissions from your current waste management scenario, SWEET allows you to explore alternative scenarios and their impact on emissions. It is best to have these alternative scenarios defined before beginning to use the tool. Alternative scenarios are plans that your city could pursue for municipal solid waste management that differ from what is currently planned. Defining a scenario means knowing the year the plan would be implemented and what sizes/types of equipment and facilities it would use.

Enter data for your city's current waste management situation and alternative scenarios into <u>all</u> **blue** (■) cells. You can also enter data in **green** (■) cells, which are not required but appear as options when you enter certain information into blue cells on the *Landfills and Dumpsites* tab. Many of the blue and green cells contain helpful hints and definitions that will appear when you click on them.

Yellow (■) cells are default values that are automatically provided. You can change these values if you have local data available. You can reset any user-entered data to original default values by clicking on the "Reset Default Values" buttons provided on each data input page.

The light **grey** (■) cells, except for those in columns labeled "source" or "notes," contain calculated values that cannot be edited.

Specific instructions for entering data into each tab can be found in the sections below.

SECTION 2. USING SWEET: TAB-BY-TAB GUIDE

2.1 Basic Tool Information (Brown Tabs)

2.1.1 Cover

The *Cover* tab includes the tool name and attribution.

2.1.2 Contents

The *Contents* tab has the names of all tabs in the SWEET tool color-coded and listed as hyperlinks so that clicking on one will take you to that tab.

2.1.3 Introduction

The *Introduction* tab contains a few paragraphs briefly describing the types of analyses for which SWEET is useful.

2.1.4 SWEET History

As of July 2025, there have been eleven public releases of SWEET. *Annex 1* contains the description of SWEET's history along with explanations of the differences between its various versions.

2.1.5 Instructions

The *Instructions* tab briefly describes what a user must do to complete a SWEET run and offers tips on data entry.

2.1.6 Recommended Citation

The *Recommended Citation* tab provides a brief citation for citing SWEET in studies, reports, documents, journal articles, etc.

2.2 Data Inputs (Blue Tabs)

Review the instructions provided at the top of each data input tab. Note the pop-up text that appears when you click certain cells. The text is designed to help you correctly fill in the information for that specific cell.

The guidance below is provided to assist you with the data entry fields of the blue tabs.

2.2.1 General Information

This tab collects information about your city, its waste composition, and how waste flows from collection to disposal or beneficial use.

For each table, instructions are provided above the table to guide you.

<u>General</u>

Enter your city name and country name. For the "Global Region" field, select the appropriate region from the drop-down list. Population values for those in and outside of formal collection zones are number of people, not percentages. "Inside formal collection zones" refers to areas within the city where waste collection services are provided by the municipality or a licensed private company. "Outside formal collection zones" refers to areas where there are no licensed waste collection services.

If inputs such as waste composition or generation are unknown, SWEET provides recommended inputs for various global regions sourced from the guidelines of the Intergovernmental Panel on Climate Change (IPCC) from 2019 and 2006.

<u>Climate</u>

Enter average temperature and annual precipitation information (available at www.worldclimate.org) for the closest location with climate data. Average annual precipitation is used in SWEET to estimate the rate of waste decay and methane generation, which is critical for calculating methane emissions.

<u>Waste Generation & Collection Rates</u>

Waste generation and collection inputs are used to estimate emissions in almost every category of the analysis. This input data is especially crucial for calculations on the tabs *Landfills and Dumpsites* and *Waste Burning*. For per capita waste generation rate inside formal collection zones, if information on actual waste collection rates is unavailable, SWEET can apply default values from the IPCC 2019 that are accessed using the "Reset Per Capita Waste Generation Rate" button. Note that you can test the effect of different collection rates by opening two SWEET spreadsheets, modeling all inputs the same way except for the waste collection rates, and comparing the differences in results from two workbooks.

Double check that the total waste collected and generated inside formal collection zones is similar to your city's expected amount of waste. These values are calculated automatically and appear in rows 22 and 23.

Average Composition of Collected Waste

Enter your city's waste composition in terms of *percentage* breakdown, *not metric tons*, of waste collected (for example, 50% food waste, 20% plastic, 10% paper, and 20% other). Note that any decimal values entered will convert to percentages (i.e., if you enter 0.5, it will become 50%). Use estimates from the most recent available studies of the types of municipal solid waste (MSW) disposed of by the city, province, or country. If waste composition data is not available, the IPCC (2006, 2019) has published default waste composition estimates for all regions of the world, which can be applied in SWEET using the "Use Waste Defaults" button, and are listed in the "Default Values" tab.

Double check that the sum of all values entered equals 100%. The total is automatically calculated in row 39, and an error message will appear in row 40 if the total does not equal 100%.

Note that the category for "green" waste means the same thing as yard waste and may include agricultural residues, sticks, weeds, garden debris, leaves, or other non-edible organic materials.

Waste composition is held constant in SWEET; the values you enter in this section of the tool will apply to all years during the time period you analyze. As with waste generation and collection rates, you may wish to test the effects of various waste compositions on emissions by opening two SWEET spreadsheets simultaneously, modeling all inputs in the same way except for the waste composition, and comparing the results from the two workbooks.

REVIEW – Key Inputs Check Box

There are two tables in this tab that will alert you to errors or missing data.

The first table is on rows 42-47. Each row in this table lists names of other *General Information* tables. If you have left out an input in a table

above, the cell next to the table's name will be red, with the word "YES." If all data points

are filled in, the cell will be light grey and say "NO." *Double check that all cells say "NO" before proceeding with data entry.*

<u>Waste Flow – Business-as-Usual</u>

For each type of diversion facility that exists or is planned under a business-as-usual (BAU) scenario (e.g., composting plant), enter the year the facility started operating (or is expected to start) in the "Diversion Scenario Start Year" field in row 53, and the average total tonnage of waste sent to the facility each year in the "Metric Tons of Waste Delivered To Diversion Facility Per Year" field in row 54.

In the section of the table labeled "Composition of Waste Targeted for Diversion from Disposal," enter the composition of the waste sent to the individual facility (or facilities) in terms of percentages. For example, if you are sending 1,000,000 tons to the composting facility, and 500,000 tons is food waste, enter 50% in the food waste cell. Make sure that for each waste category, the resulting value from multiplying the percentage times the total amount of waste diverted to the facility (row 54) is not greater than the amount you are collecting for that category. The amount you are collecting for each category is noted in the table "Average Composition of Collected Waste," in cells D29-D38. If the percentage in table Waste Flow – Business-as-Usual does result in a tonnage of waste greater than that being collected, you will see an error message in rows 107-110 in the "REVIEW" box at the bottom of the *General Information* tab. For more information on troubleshooting errors, see below the section *Checking for Errors and Troubleshooting*.

The sum of the waste composition must sum to 100% for each individual facility; totals are automatically calculated in row 69, and an error message will appear in row 70 if a given column does not add up to 100%.

<u>Alternative Scenario Selection</u>

For each dropdown menu in row 74, choose "Yes" or "No" depending on the number of scenarios you would like to evaluate, starting with Alternative Scenario 1. If you would like to evaluate two alternative scenarios, choose "Yes" for Alternative Scenario 1 and Alternative Scenario 2 and "No" for Alternative Scenario 3 and Alternative Scenario 4. For every alternative scenario you wish to analyze, you will see additional cells highlighted in the Waste Flow – Alternative Scenarios section that need inputs for the model to generate emissions estimations. Also, you must enter a *future* start year for each alternative scenario you will analyze in the field "Alternative Scenario Start Year" in row 75, which sets the first year that alternative scenario emissions can be different from BAU scenario emissions when new diversion programs start.

<u>Waste Flow – Alternative Scenarios</u>

Name each alternative scenario and provide a description if desired. We suggest labeling each scenario with a descriptive name (such as "Close Dump in 2022") so that you can easily compare scenarios by name in the summary tabs. "Diversion Scenario Start Year" in row 83 is for listing the year of the specific technology or program change or expansion within each scenario. There can be up to four different diversion programs within each alternative scenario. The tool uses diversion program start years to know when to change waste flows to different facilities and calculate emissions in each alternative scenario, assuming the scenario start year assigned in row 75 has been reached. If you have a diversion scenario start year greater than the current year, and you have a positive waste growth rate, the amounts collected will be slightly greater than those values currently listed in the table "Average Composition of Collected Waste" (cells D29-38).

If you would like to model a scenario in which you send more waste to a diversion facility than in the BAU scenario, enter this *additional, incremental waste quantity* in row 84. For example, consider a BAU scenario in which you are sending 1,000,000 tons of waste to a composting facility. If in one alternative scenario you would like to explore the impact of sending 1,500,000 tons to the composting facility, enter 500,000 into row 84. Note that you can also consider the impact of sending less waste to a facility than in the BAU scenario. To do so, enter a *negative* value into row 84. For example, if in your alternative scenario, you plan to develop a composting facility that will divert 500 tons from a waste combustion facility, enter 500 into row 84 for the composting facility and -500 into row 84 for the waste combustion facility.

In the section of the table "Composition of Waste Targeted for Diversion from Disposal", starting in row 89, enter the composition of waste sent to the individual facility or diversion scenario, as you did in the "Waste Flow – Business-As-Usual" table. *The sum of the waste composition must equal 100% for each individual facility*; totals are automatically calculated in row 100, and an error will appear in row 101 if the sum does not equal 100%.

Make sure that for each waste category, the percentage multiplied by the total amount of waste does not result in a value greater than the amount you will be collecting in the start year for these diversion scenarios. If the percentages proposed for "Composition of Waste Targeted for Diversion from Disposal" result in tonnage of waste greater than that being collected overall, you will see an error message in row 106-109 in the following "REVIEW" box.

<u>REVIEW – Error Check</u>

The second error check box is at the bottom of the tab (rows 104-112) and points out values that are inaccurate or inappropriate. Errors are shown in the same format as described above.[2] Address errors in the order in which they are shown. Ensure all cells say "NO" before proceeding to the next tab in the model. The error checks ask the following questions:

- Are you diverting more waste than you are collecting overall?
  - If yes, the total tonnage you have entered in "Metric Tons Delivered to Diversion Facility Per Year" (row 54) or "Additional Metric Tons of Waste Delivered to Facility Per Year, Compared to Business-as-Usual" (row 84) is greater than the BAU waste being collected in that year according to cell D39.
  - To troubleshoot the BAU scenario, double check the values listed for the "Metric Tons Delivered to Diversion Facility Per Year" (row 54). You will have to make at least one value in this row smaller.
  - To troubleshoot the alternative scenarios, reduce at least one of the values in row 84, "Additional Metric Tons of Waste Delivered to Facility Per Year, Compared to Business-as-Usual" as much as needed until the error message is gone.

- Are you recycling more than collecting?
  - If yes, this error means that for at least one waste category (e.g., metal), the input values indicate that you are sending more to the recycling facility than you are collecting, which does not make sense.
  - To troubleshoot, double check for each waste category the percentages listed in rows 59-69 in the table "Waste Flow – Business-As-Usual" or rows 90-100 in the table "Waste Flow – Alternative Scenarios".
    - As a test, multiply each percentage indicated above by the corresponding value in either "Metric Tons Delivered to Diversion Facility Per Year" (row 54) for the business-as-usual scenario or "Additional Metric Tons of Waste Delivered to Facility Per Year, Compared to Business-as-Usual" (row 84) for the alternative scenarios.
    - If one of the resulting values is higher than the metric tons collected in cells D29-D38 for the BAU scenario from the table "Average Composition of Collected Waste", you will need to lower the input percentage you typed in rows 61-68 or 91-98 until it results in a tonnage value lower than that collected.

---

[2] There is one error check (diversion start year) where an answer of "no" denotes an error, but the formatting (a red cell with white font) will be the same.

- Are you sending more waste to anaerobic digestion or composting than you are collecting?
  - If yes, this means that for at least one waste category (e.g., food), the input values indicate that you are sending more to the composting or anaerobic digestion facility than you are collecting.
  - To troubleshoot, double check for each waste category the percentage listed in rows 59-62 in the table "Waste Flow – Business-As-Usual" or rows 90-93 in the table "Waste Flow – Alternative Scenarios".
    - Multiply this percentage by the value in the field "Metric Tons Delivered to Diversion Facility Per Year" (row 54) or "Additional Metric Tons of Waste Delivered to Facility Per Year, Compared to Business-as-Usual" (row 84).
    - If one of the resulting values is higher than the metric tons collected in cells D29-D38 for the BAU scenario from the table "Average Composition of Collected Waste", you will need to lower the input percentage you typed in rows 61-68 and 91-98 until it results in a tonnage value lower than that collected.

- Are you combusting more waste than collecting?
  - If yes, this means that for at least one waste category (e.g., green), the input values indicate that you are sending more to the waste combustion facility than you are collecting.
  - To troubleshoot, decrease the amount of waste sent to the waste combustion facility in row 54 or 84. This error can occur when too much waste is already diverted by other means such as anaerobic digestion, recycling, or composting.

- Do all alternative scenario waste diversion programs start after the current year?
  - If no, then for at least one facility in the alternative scenario, you have entered a diversion start year in the table "Waste Flow – Alternative Scenarios" (row 83) that is earlier than the start year listed in the table "Waste Flow – Business-As-Usual" (row 53). Modify the value in row 83 causing this problem so that it is a year after the year in row 53.

2.2.2 Collection – Transportation

On this tab, you will enter in information about your waste collection vehicle fleet (both primary and secondary collection).

<u>Number of Trucks in Operation</u>

When entering the number of heavy-duty and light-duty trucks that are currently being used in your fleet, you will need to disaggregate your fleet vehicles by fuel type – diesel, gasoline, and natural gas. You can use SWEET to explore the impacts of changing this fleet mix in the alternative scenarios section. If you want to keep the same fleet in your alternative scenario, copy the values from the "Business-As-Usual" column into the columns for the appropriate alternative scenario(s).

Activity Data

If you know the average number of miles traveled by heavy-duty or light-duty trucks each year, you can update the default value provided. Similarly, if you have more data on the number of hours trucks spend idling, you can update the default values. If you would like to reset the defaults to the original values provided by the model, press the "Reset Default Kilometers & Hours" button at the top of the table. This button will reset all default values for kilometers driven and hours idling. Note that SWEET's default values are based on data from the United States (EPA, 2017) and users should review these values to determine the relevance to their scenarios.

Emission Factors

You can alter emission factors if you have local data. If you would like to reset to the defaults, click on the "Reset Default Emissions Factors" button at the top of the table.

2.2.3 Landfills and Dumpsites

This tab is where you will enter data about up to four landfills and/or dumpsites your city currently operates or plans to operate. Landfills and dumpsites are often the most significant source of methane emissions in the waste sector, so it is important that data entered into this tab be as accurate as possible.

How many landfills and dumpsites would you like to analyze?

Choose how many disposal sites you would like to analyze; do not forget to include any landfills you might wish to add in an alternative scenario. You can enter up to four sites, either currently operating or closed.

Enter data for the disposal sites you want to analyze. If you need to remove data for any disposal sites from previous entries or any other reason, click on each cell's data and delete it – be aware that some entries are automatically copied in from the BAU column and must be deleted there first (e.g., site name, annual disposal, waste depth). Be sure to

delete any data for disposal sites you do not wish to include in the analysis and then review the number of disposal sites to be analyzed in row 7.

Detailed Disposal Site(s) Information

Begin by entering data for the BAU scenario. Start with entering historical disposal site information under "Landfill/Dumpsite #1" and proceed to enter data for up to three additional sites, including currently operating and future disposal sites. The oldest year SWEET allows for "Site opening year" is 1960. If your disposal site was opened prior to 1960, enter 1960. The opening and closing years for each disposal site define the years the facility will operate and receive waste, which can overlap with the years given for other sites.

Assign approximate annual waste disposal rates for each facility (estimated averages during years of operation), which are used along with opening and closing years to determine when each site receives waste. *Annual rates of waste delivery to disposal sites operating in any calendar year are calculated based on the annual waste collection rates minus the amounts diverted in each scenario.* Assuming that 100% diversion is not achievable, waste disposal will occur in all years in SWEET's calculations and continue past the last site closure year entered in this worksheet.

Under "Landfill or dumpsite?" select "Dumpsite", "Controlled dumpsite", or "Landfill" depending on the site management practices. To assist you in selecting the appropriate disposal site type in rows 17, 32, 47, and 62, *Table 1. Characteristics of Solid Waste Disposal Site Types*, shown below, provides a comparison of the characteristics of the three disposal site type options. If a controlled dumpsite was formerly an open dumpsite, you should enter it as a controlled dumpsite. Similarly, if a landfill was formerly a controlled dumpsite, you should enter it as a landfill. The type of disposal facility affects calculated methane generation, oxidation, and emissions, and sets limits on landfill gas (LFG) collection efficiency if an active collection system is installed.

Table 1. Characteristics of Solid Waste Disposal Site Types

Factor	Dumpsite	Controlled Dumpsite	Landfill
Environmental Factors			
Atmosphere			
Fires	Intentional burning common	Limited, can be present	Unlikely
Release of hazardous gases	Yes, if no collection exists	Yes, if no collection exists	Yes, if no collection exists

Factor	Dumpsite	Controlled Dumpsite	Landfill
LFG collection and control	Possible, poor collection efficiency expected	Likely, collection efficiency will depend on site conditions	Likely
Unpleasant odors	Yes	Possible, depending on site conditions and whether LFG is uncontrolled	Minimal, if the right measures are taken to cover waste and control LFG
Ground/Soil			
Topographical Modification	Yes	Yes	Yes
Contamination (leachate)	Yes	Possible, depending on base or liner conditions	No
Gas Migration	Yes	Possible, depending on site conditions	No
Water (Surface and Ground Water)			
Channeling runoff	No	Possible, depending on site conditions	Yes
Contamination	Likely underground and surface water	Possible if low-permeability liners are not used	Minimal
Monitoring system present	No	No	Yes
Flora			
Vegetative cover alteration	Yes	Yes	Yes
Fauna			
Changes in diversity	Likely	Yes	No
Vector control	No	Potentially, depending on site conditions	No
Socioeconomic Factors			
Landscape			
Alteration of Condition	Yes	Yes, can be mitigated with visual buffer (for example, a forest buffer)	Yes, can be mitigated with visual buffer (for example, a forest buffer)
Humans			
Health hazards	Yes	Potentially, depending on site conditions	Potentially, depending on site conditions
Negative image	Yes	Yes	Yes, improved if there is post-closure utilization of land
Environmental education	No	Yes, in some cases	Yes, with careful planning
Economics			
Decline of land value	Yes	Yes	Yes
Formal employment	No	Yes	Yes

Factor	Dumpsite	Controlled Dumpsite	Landfill
Changes in land use	Yes	Yes	Yes
Social			
Waste pickers	Yes	Yes, in some cases	No

After entering BAU scenario data you can enter data for alternative scenarios. Remember that the alternative scenarios are in columns to the right of the business-as-usual scenario. You will notice that the fields "Name," "Annual disposal: most recent year data or estimate," and "Average waste depth" automatically fill in based on the information you entered in the business-as-usual scenario. All other inputs for the alternative scenarios will need to be entered manually, even if the value is the same as in the business-as-usual scenario. For each disposal site, enter any changes you would like to analyze in each alternative scenario. Examples of scenarios you can analyze are:

- Converting a controlled dumpsite to a landfill, or a dumpsite to a controlled dumpsite,
- Opening a future landfill earlier than initially planned,
- Closing an existing landfill earlier than initially planned, or
- Installing a gas collection system at a currently operating or closed landfill.

If there will be no change for a given landfill, copy and paste the business-as-usual data into the appropriate alternative scenario. For example, if the first alternative scenario involves changes to Landfill/Dumpsite #1 but not 2, 3, or 4, then copy and paste the information from the business-as-usual column for Landfill/Dumpsite #2, 3, and 4 into the first alternative scenario's column.

2.2.4 Waste Burning

This tab collects data about open waste burning, both by residents and at the disposal site(s), in your municipality.

Open Burning Rates (I.)

Enter the percentage of waste that is burned in areas outside formal collection zones, inside formal collection zones, and at the landfill or dumpsite for the business-as-usual scenario.

Enter the variables for the alternative scenarios. If there will be no change between the alternative and BAU scenarios, copy and paste the values from the BAU scenario into the appropriate alternative scenario(s).

<u>Open Burning Rates (II.)</u>

If you want to test alternative burning rates in future years this information can be entered in rows 15 – 19. By selecting "Yes" in row 15 under each alternative scenario, the cells in rows 16 – 19 will change color to blue to highlight the areas where new information must be entered. Please completely fill out the new highlighted cells.

<u>Waste Burning Default Emission Factors</u>

Default values are provided for the emissions factors for each pollutant. If you have local data, you can alter these values. We recommend you provide sources and justification in the relevant "Sources & Notes" cells. You can reset these values back to the default values by clicking the "Reset Emissions Factors" button near the bottom of the sheet, by the "Waste Burning Default Emission Factors" table.

2.2.5 Waste Handling Equipment

On this tab, you will enter information about your waste handling equipment, excluding equipment used during waste collection, which you entered in the tab *Collection – Transportation.*

<u>Number of Pieces of Equipment</u>

In the appropriate row, enter the number of pieces of each equipment type you have, categorized by fuel type (diesel or gasoline). You can analyze the impacts of changing this vehicle mix in the alternative scenarios section. If you want to keep the same fleet in your alternative scenarios, copy the values from the business-as-usual scenario into the appropriate alternative scenario(s).

Default values are provided for the average number of hours each vehicle is used each year, the vehicle's average horsepower, and the gallons of fuel the vehicle uses on average each year. You can alter these values if you have the appropriate data. Note that if you click the "Reset Default Usage and Horsepower Ratings" button at the top of the page, it will reset all the default values.

2.3 Outputs (Black Tabs)

There are three tabs of summary data:
1) Summary – Emissions
2) Summary – Changes vs BAU
3) Summary – Graphics

2.3.1 Summary – Emissions

This tab shows emissions results in table format for eight pollutants:
- Carbon dioxide (CO_2)
- Black carbon
- Organic carbon
- Methane (CH_4)
- Sulfur oxides (SO_x)
- Two kinds of particulate matter (PM) – $PM_{2.5}$ and PM_{10}

Table 1

Table 1 presents the total emissions of each scenario for each year. Data is presented in terms of metric tons of carbon dioxide equivalent (CO_2e). The following pollutants are converted to CO_2e: CO_2, CH_4, black carbon, and organic carbon. The CO_2e values *exclude* SOx, $PM_{2.5}$, and PM_{10}. (Note: Black carbon and organic carbon are components of $PM_{2.5}$.)

Table 2

Table 2 presents total emissions (in metric tons of CO_2e) for the BAU scenario broken down by sector. In addition, total emissions of CH_4, SO_x, $PM_{2.5}$, and PM_{10} are shown.

Tables 3 through 6

Tables 3-6 present total emissions (in tons of CO_2e) for each alternative scenario broken down by sector. Table 3 is for Alternative Scenario 1, Table 4 is for Alternative Scenario 2, Table 5 is for Alternative Scenario 3, and Table 6 is for Alternative Scenario 4 – you will see in the name of each table the scenario name you provided in the *General Information* tab. In addition to CO_2e, total emissions in metric tons of CH_4, SO_x, $PM_{2.5}$, and PM_{10} are shown.

2.3.2 Summary – Changes vs BAU

This tab shows, in table format, the changes in emissions that result from each alternative scenario as compared to the BAU scenario.

As in the *Summary – Emissions* tab, the following pollutants are converted to CO_2e: CO_2, CH_4, black carbon, and organic carbon.

Table 1

Table 1 presents the total emission changes for metric tons of CO_2e for each alternative scenario.

Table 2 presents the changes in SO_x emissions for each alternative scenario, Table 3 presents the changes in $PM_{2.5}$ emissions for each alternative scenario, and Table 4 presents the changes in PM_{10} emissions for each alternative scenario. Table 5 presents the changes in CH_4 emissions for each alternative scenario, isolating this pollutant that is also a component of the aggregate CO_2e measurement in Table 1.

2.3.3 Summary – Graphics

This tab presents the results as graphs. There are 28 figures on this tab to isolate different scenarios, sectors, and pollutants.

Overall Emissions Summary Figures (Figures 1 through 4)

Figure 1 presents total emissions by scenario. Figures 2 – 4 present overall emissions for different pollutants by scenario. Figure 2 shows methane emissions and illustrates how large a percentage of total emissions they represent. Figure 3 (organic carbon) presents negative emissions because organic carbon is an aerosol and has a net cooling effect on climate. Thus, when it is converted to metric tons of CO_2e, its value is negative. Black carbon (Figure 4) can be a significant fraction of total emissions if waste burning is prevalent.

Sector-Specific Emissions Sources (Figures 5 through 8)

Figures 5, 7 and 8 present emissions by pollutant and by source. Figure 6 shows SO_x pollution from transportation and other combustion-related processes only.

Landfill and Dumpsite Specific Information (Figures 9 through 12)

Figures 9 – 12 show black carbon and methane emissions profiles for each individual landfill or dumpsite by scenario. Figures 9 – 12 correspond to landfills/dumpsites 1 – 4, respectively. If you only enter data for one landfill or dumpsite, only Figure 9 will show data. Figures 9a to 12a show methane emissions for each landfill. Figures 9b to 12b show black carbon emissions for each landfill.

Transportation Sector Emissions Summaries (Figures 13 through 16)

Figures 13 – 16 present the transportation sector's emissions by pollutant and scenario. There is one graph per pollutant.

Waste Burning Emissions Summaries (Figures 17 through 20)

Figures 17 – 20 present emissions associated with waste burning, including open burning (e.g., in residential areas) and fires at landfills and dumpsites.

<u>Organic Waste Management Emissions Summaries (Figures 21 through 24)</u>

Figures 21 – 24 present emissions from organic waste management treatments / facilities. There are graphs per pollutant type as well as a total emissions graph.

2.4 Detailed Emissions Scenarios (Grey Tabs)

These six tabs provide more detailed output than the summary tabs for each scenario. They show resulting emissions of each pollutant in each sector for individual years from 1960 – 2120. The total amount of each GHG pollutant produced each year is visible in columns AD through AH, under the header "TOTAL GHG Pollutants".

See *Table 2. Pollutants emitted in each sector of the waste management process* below for a breakdown of which pollutants are applicable to each sector.

2.4.1 BAU Emit

The *BAU Emit* tab displays annual emissions for the business-as-usual scenario for each pollutant in each sector.

2.4.2 Alt1 Emit

The *Alt1 Emit* tab displays annual emissions for Alternative Scenario 1 for each pollutant in each sector.

2.4.3 Alt2 Emit

The *Alt2 Emit* tab displays annual emissions for Alternative Scenario 2 for each pollutant in each sector.

2.4.4 Alt3 Emit

The *Alt3 Emit* tab displays annual emissions for Alternative Scenario 3 for each pollutant in each sector.

2.4.5 Alt4 Emit

The *Alt4 Emit* tab displays annual emissions for Alternative Scenario 4 for each pollutant in each sector.

2.4.6 Waste Burning Emit

The *Waste Burning Emit* tab displays annual emissions for each scenario for each pollutant, with one table each for total waste burning, open burning, and landfill fires.

Table 2. Pollutants emitted in each sector of the waste management process

Sector	Pollutant							
	CO_2	NOx	Black Carbon	Organic Carbon	CH_4	SOx	$PM_{2.5}$	PM_{10}
Waste Collection & Transport	✓	✓	✓	✓	✓	✓	✓	✓
Waste Burning	✓	✓	✓	✓	✓	✓	✓	✓
Landfills & LFG Combustion		✓	✓	✓	✓		✓	✓
Waste Handling	✓	✓	✓	✓	✓	✓	✓	✓
Organics Management					✓			
Waste Combustion	✓	✓	✓	✓	✓	✓	✓	✓

2.5 Additional Information (Brown Tabs)

2.5.1 Default Values

The *Default Values* tab displays the data applied in emissions calculations in the SWEET tool when default buttons are used in the *General Information* tab. The default values are not applied when the user has input site-specific data. This tab also notes the references for the default values.

2.5.2 Assumptions

The *Assumptions* tab displays all fixed parameter values for all calculations in the SWEET tool. It also notes the sources for each assumption value. Most values in this tab pertain to emission factors for equipment use in waste management.

2.5.3 Caveats and Notes

The *Caveats and Notes* tab explains reasoning and sources of information for the data in the SWEET tool, organized by sector.

2.5.4 Bibliography

The *Bibliography* tab lists data sources used to create the SWEET tool with web links where available.

2.5.5 More Resources

The *More Resources* tab provides a link to this user manual and web resources for the SWEET tool.

SECTION 3. LIMITATIONS, METHODOLOGY & ASSUMPTIONS

SWEET is designed to provide estimates of waste sector SLCP emissions for cities throughout the world, and to evaluate the effects of alternative waste management strategies on those emissions. Although SWEET uses state-of-the-industry assumptions and calculation methods, the emissions estimates should be considered as approximate and not a substitute for detailed technical analyses and feasibility assessments. SWEET is an international tool and provides global assumptions and default values from IPCC and academic literature to support users' analysis. SWEET uses waste emissions data and methodologies that are also used in IPCC equations and national-level reporting, however, processes such as emissions reporting and carbon credit calculations should be analyzed according to those standards and use the specific methodologies required.

For users who need a deeper understanding of the results of a SWEET analysis, we provide methodology for some of the more complex calculations in the following sections. These include landfill and dumpsite emissions, methane correction factors, gas collection efficiency, gas flaring, waste burning, and oxidation.

3.1 Overview of Data Limitations and Tool Precision

Sources of potential model inaccuracies and uncertainties include the following:
- Incorrect data used as model inputs can result in emissions estimation errors that range from insignificant to order-of-magnitude errors. Any of the following sources of error are often encountered when applying site-specific data and can have substantial impacts on calculated results:
    - Actual current and future MSW collection rates will vary significantly over time and will not be well-represented by estimated annual waste collection and growth rates.
    - Available waste composition data often is not representative of actual waste disposed at the site.
    - Estimates of waste burning rates are highly uncertain, yet they largely determine the range of possible black carbon emissions.

- Waste handling equipment emissions are significant, but lack of user data is common.
    - User inputs forecasting future conditions and scenario implementation dates always represent a large source of potential data error.
- Uncertain emission factors, particularly for waste burning and landfill methane.
- Uncertain estimates of waste decay rates and methane generation, collection, and oxidation rates at disposal sites.
- Limits to the complexity of user inputs, which were made to allow the model to be user-friendly and to limit model sensitivity to lack of data or data error.
- Limits to detailed accounting of site-specific factors influencing emissions, such as changes in waste composition or incremental changes over time in site conditions, waste diversion rates, or LFG collection system efficiency.

Given the complexity of the tool, assumptions were made for each step of the waste management process. Most of these assumptions are outlined in the tool, in the orange tabs titled *Assumptions* and *Caveats and Notes*; these tabs can be found after the grey tabs of detailed emissions scenarios.

Despite data limitations, SWEET does provide estimates which are precise enough to be appropriate for evaluating net SLCP emissions under alternative scenarios and for guiding waste management decisions. Other potential uses for SWEET include the following:

- Monitoring progress and tracking performance in reducing emissions.
- Estimating the contribution of waste management improvements to a city's emissions reduction goals.
- Benchmarking against other cities.
- Using the results as inputs for other models to estimate air quality, health, and climate change impacts of waste management decisions.

3.2 Landfills and Dumpsites Methodology

Methane emissions from disposal sites are estimated as the amount of methane generated, minus the amount either collected and destroyed in a combustion device or oxidized in cover soils. Collected, measured methane flow rates represent the only real indication of the relative amounts of methane a disposal site is generating. Methane emissions rates and oxidation rates are not measured in the field except at a few research sites, so actual methane generation, oxidation, and emissions are usually unknown and must be estimated.

Methane generation is calculated in SWEET using the following equation derived from the EPA's Landfill Gas Emissions Model (LandGEM) version 3.02 (U.S. EPA, 2005).

Equation 1 – Landfill Methane Generation

$$Q_{CH4} = \qquad (e^{-kt_i})\ (MCF)$$

Where: Q_{CH4} = maximum expected methane generation flow rate (m^3/yr)

i = 1 year time increment

n = (year of the calculation) – (initial year of waste acceptance)

k = methane generation rate (1/yr)

L_0 = potential methane generation capacity (m^3/Mg)

M_i = mass of solid waste disposed in the ith year (Mg)

t_i = age of the waste mass M_i disposed in the ith year

MCF = methane correction factor

Equation 1 is used to estimate methane generation from each waste disposal site entered in the *Landfills and Dumpsites* tab (see above section *2.2.3 Landfills and Dumpsites*). Methane is generated each year from the cumulative waste disposed up through the prior year, which has not already decayed and generated methane. The rate of waste decay and methane generation is defined by the model "k" value, which also defines the half-life of waste, the amount of time it takes for half of the waste to decompose (half-life = ln(2)/k). K varies significantly depending on organic waste type and climate and is strongly influenced by waste moisture content. The total amount of methane produced by a metric ton of waste is the potential methane generation capacity, or "L_0", which varies by organic waste type.

SWEET applies the methane generation equation separately to each of the following five organic waste categories: food waste, green waste, paper (including cardboard), wood, and textiles. Each of the organic waste categories is assigned different pairs of values for the model k and L_0 that are based on the values used in the Colombia Landfill Gas Model, which was developed by the EPA's Landfill Methane Outreach Program (U.S. EPA, 2010). This multi-material approach was initially developed by the IPCC in their methane emissions spreadsheet model (IPCC, 2006). The calculation of L_0 values used in SWEET for each organic waste category matches the method used by IPCC. Model k values used in SWEET for each waste category reflect differences in estimated waste decay rates, and the range of k values assigned to each waste category varies based on precipitation category. Precipitation categories range from "very wet" sites experiencing greater than 2,000 mm/year precipitation to "dry" climates receiving less than 500 mm/year precipitation. Total

methane generation from all wastes is calculated as the sum of the amounts of methane generated by each of the five organic waste categories.

SWEET was designed to provide an alternative to lifecycle modeling for the waste sector. By using site-level, calendar year data to calculate landfill methane emissions, SWEET presents both annual emissions estimates as well as site-specific material flows and diversion to alternative waste management scenarios. Lifecycle models often provide long-term aggregate results but can be limited in their ability to reflect a city's specific calendar year emissions and may not be able to monitor annual emissions reductions progress.

3.3 Methane Correction Factor Assumptions

Different waste disposal methods manage waste and site conditions in different ways. The Methane Correction Factor (MCF) adjusts for this by recognizing that unmanaged waste sites have partially aerobic conditions, and therefore produce less methane than well-managed, oxygen-free (anaerobic) sites. SWEET uses the MCF to lower the estimated methane emissions based on the type of waste site selected in the tool. Landfills have no reduction in estimated methane (MCF=1). Dump sites greater than 5 m deep have a 20% reduction in methane (MCF=0.8). Dump sites less than or equal to 5 m deep have a 60% reduction in methane (MCF=0.4). The MCF adjustment is responsible for potential increases in estimated landfill methane emissions when a controlled dump site is remediated to a landfill. MCF values come from the 2006 IPCC report (IPCC 2006b).

The values assigned to the Equation 1 variables k, L_0, and MCF exert a strong influence on estimates of landfill methane emissions and overall SLCP emissions, since landfill methane tends to dominate waste sector SLCP emissions. Despite their importance, the effects of waste composition and site conditions on methane generation model parameters are poorly understood. Contributing to the uncertainty in assigning values to model parameters are the lack of measurements of methane emissions in the field, the fact that there are multiple variables which combine to affect estimated methane generation and collection rates, the limited availability and reliability of waste composition data (which can be highly variable), and the large range of potential impacts of site conditions on methane generation.

3.4 Gas Collection Efficiency Assumptions

Generated methane is either collected and combusted, oxidized, or emitted. The percentage of generated methane that is collected is defined as the "collection efficiency." If you indicate that there is an existing or planned gas collection system for a landfill, a default collection efficiency value is assigned based on the disposal site management

category (landfill, controlled dump site, or dump site). Default collection efficiencies are estimated based on the professional judgement of landfill gas modeling experts. These default values are relatively conservative (i.e., low) estimates, as they are applied to disposal sites worldwide across a wide range of conditions and are used to generate long-term emissions estimates. Because methane generation rates are calculated (modeled) estimates and not measured in the field, gas system collection efficiency estimates are uncertain and represent a large potential source of error in estimating methane collection and emissions rates, and overall SLCP emissions.

In SWEET, default collection efficiency values are 60% for landfills, 50% for controlled dump sites that have been remediated to "landfill" status, 45% for controlled dump sites, 30% for dump sites that have been remediated to "controlled" status, and 0% (no gas collection possible) for unmanaged dumpsites.

Landfills that have or are planning a pipeline quality, high-Btu methane utilization project have their associated default collection efficiency reduced by 20% due to the project's stringent gas quality requirements and associated reduction in collection efficiency and methane recovery.

Default collection efficiency estimates can be overridden only for landfills if you provide actual average methane recovery flow rates (in m^3/hour) for specified data years on the *Landfills and Dumpsites* tab. The actual methane recovery rates will result in higher or lower site-specific collection efficiencies compared to the default values, when divided into model estimates of methane generation rates in the same year. Actual methane recovery data can be used to assign site-specific collection efficiencies for landfills up to a maximum of 85% (70% maximum for landfills with high-Btu projects).

3.5 Gas Flaring Assumptions

If collected, methane will in most cases be combusted in an on-site landfill gas flare, which can achieve a methane destruction efficiency of 99% (SCS Engineers, 2007). If collected methane is combusted in a facility that uses the gas as an energy source, methane destruction efficiencies can be somewhat lower. A methane destruction efficiency of 98% is assumed in SWEET based on the average of values for various combustion devices (SCS Engineers, 2007).

3.6 Waste Burning

Emission Factors for open burning of solid waste are derived from several sources: Wiedinmyer et al. (2014), Akagi et al. (2011), Christian et al. (2010) and U.S. EPA (1992). These emission factors represent typical emission factors for general open burning of municipal solid waste. However, in practice the emissions may change depending on the type and composition of waste burned. The user is encouraged to edit these emission factors to more specific emission factors if that information is available.

Municipal Solid Waste	Value (g/kg of waste burned)
Black Carbon	0.650
Organic Carbon	5.270
Methane	3.700
Carbon Dioxide	1453.0
NO$_X$	2.5
SO$_X$	0.4
PM2.5	9.8
PM10	11.9

After estimating the amount (in kg) of waste burned by the modeled municipality, SWEET multiplies the emission factors listed above to determine the pollution emitted by this combustion.

3.7 Oxidation Methodology

Rates of oxidation of uncollected methane in cover soils of disposal sites depend on cover soil type and thickness, climate, and the rate of methane flux to the cover soil per unit area. IPCC (2006) applies a 10% oxidation rate for all sites with a cover soil, but field research has found this value to significantly underestimate oxidation at landfills with active gas collection systems, particularly where high collection efficiencies (and low methane flux to the cover soils) are achieved. Oxidation rates reported by the Solid Waste Industries for Climate Solutions (SWICS) for sanitary landfills with gas collection systems ranged from 22% to 55% and averaged 35% (SCS Engineers, 2009).

SWEET has modified the IPCC default value of 10% to account for the effects of gas collection, and calculates oxidation rates according to the following equations, which vary by disposal site category:

- $Oxidation\ at\ landfills = 10\% + 15\% * (collection\ efficiency\ \%)$, for a minimum of 10% and a maximum of 23%.
- $Oxidation\ at\ controlled\ dump\ sites\ remediated\ to\ landfills = 10\% + 10\% * (collection\ efficiency\ \%)$, for a minimum of 10% and a maximum of 15%.
- Oxidation at controlled dump sites is estimated to be 0% without gas collection and 5% with gas collection.
- Oxidation at (unmanaged) dump sites is estimated to be 0%.

SECTION 4. FREQUENTLY ASKED QUESTIONS

How do you define a Dumpsite, Controlled Dumpsite, and Landfill?
See Table 1. Characteristics of Solid Waste Disposal Site Types for a complete list of explanations and definitions.

What type of waste is included in "green waste"?
Green waste includes all yard waste, wood, trees, shrubs, non-edible agricultural residues, and plant matter. This *does not* include manure, wastewater, or any other organic wastes derived from sources other than plants or trees.

My waste composition varies. Can I model different waste compositions in the same spreadsheet?
No. For simplicity, SWEET holds waste composition constant over time. To model changing waste compositions, we recommend creating two spreadsheets and modeling two separate baselines (business-as-usual scenarios) to determine the change in emissions.

Can I model different waste generation or waste collection growth rates in the same spreadsheet?
No. While SWEET does not currently model variable growth rates for waste generation or waste collection, SWEET outputs can be applied to additional user analysis. For example, users can test the effect of different collection rates by opening two SWEET spreadsheets, modeling all inputs the same way except for the waste collection rates, and comparing the differences in results from two workbooks.

What is the difference between residents inside and outside formal collection zones?
Formal collection zones are the geographic areas where waste is regularly collected from residents and businesses (including areas where informal sector workers regularly collect waste). Areas outside formal collection zones are those that do not receive regular waste collection services or cannot receive them on regular or periodic intervals.

What pollutants are considered climate forcing pollutants in the model?
SWEET considers black carbon, organic carbon, methane (CH_4), and carbon dioxide (CO_2) as climate forcing pollutants. These pollutants' effects on climate are aggregated in the emissions summary tables and charts in terms of CO_2 equivalent (CO_2e).

Why are some CO_2e values negative, such as for organic carbon?

Organic carbon is considered negative when expressed in units of CO_2e because these pollutants have a net cooling impact on climate. If you want to convert the values to metric tons, divide by their Global Warming Potential. If other results are negative, some input or assumption may have been entered incorrectly. Please check the error messages in the *General Information* tab.

Why do the graphs on the "Summary Graphics" tab present emissions for Alternative Scenarios I choose not to analyze?

Please troubleshoot your result by ensuring the cells on the *General Information* tab, row 74 select the correct values for "Yes" and "No." In addition, double check inputs entered in all possible blue and grey input cells. There can be inputs entered into alternative scenarios that you did not intend to analyze. Additional troubleshooting guidance is available above in the section *Checking for Errors and Troubleshooting*.

Do I need to fill in every blue input cell in SWEET?

We recommend assigning a value to every blue input cell, even if that value is 0 or a small value such as 0.000001.

Why do emissions continue even after disposal or treatment sites have closed?

SWEET requires that all collected waste goes to a disposal site that is not otherwise diverted, for all years in your forecast. Therefore, users must designate a disposal site in the *Landfills and Dumpsites* worksheet for all calendar years that they want to include in the waste sector emissions estimates.

Are CO_2 emissions from combustion calculated as biogenic or fossil emissions?

SWEET treats all combusted waste, both fossil and biogenic, as producing "atmospheric CO2 releases," i.e., GHG emissions, with no discounts to account for the biogenic fraction of waste. The waste combustion emission factors used in SWEET can be found in the *Assumptions* tab.

SECTION 5. DATA COLLECTION SHEET

A printable worksheet was developed to accompany users in collecting data for use in SWEET. The worksheet includes data collection instructions and tips as well as forms to collect data for each of the input tabs of SWEET. This document can be useful for collecting inputs in the field or where access to a computer is not available, and data inputs can be manually entered into the Excel tool at a later time. It can also be useful to gain a quick understanding of what inputs are needed to run SWEET.

The worksheet can be downloaded here:
https://www.globalmethane.org/mrv/sweet/SWEET%20Data%20Inputs%20Form.pdf

SECTION 6. KEY RESOURCES

The GMI webpage for the SWEET tool includes valuable resources, including translated versions of the tool, training videos, and case studies. The webpage can be found here: https://www.globalmethane.org/resources/details.aspx?resourceid=5176

SECTION 7. BIBLIOGRAPHY

Global Methane Initiative. 2025. Solid Waste Emissions Estimation Tool (SWEET) version 5.0. https://globalmethane.org/resources/details.aspx?resourceid=5176.

IPCC. 2006. 2006 IPCC Guidelines for National Greenhouse Gas Inventories. Intergovernmental Panel on Climate Change (IPCC), Volume 5 (Waste), Chapter 3 (Solid Waste Disposal), Table 3.1. https://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/5_Volume5/V5_3_Ch3_SWDS.pdf.

IPCC. 2019. Volume 5, Chapter 2: Waste generation, composition, and management data. 2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories. Intergovernmental Panel on Climate Change. Available: https://www.ipcc-nggip.iges.or.jp/public/2019rf/pdf/5_Volume5/19R_V5_2_Ch02_Waste_Data.pdf.

SCS Engineers. 2007. Current MSW Industry Position and State of the Practice on Methane Destruction Efficiency in Flares, Turbines, and Engines. Prepared for Solid Waste Industry for Climate Solutions (SWICS).

SCS Engineers. 2009. Current MSW Industry Position and State-of-the-Practice on LFG Collection Efficiency, Methane Oxidation, and Carbon Sequestration in Landfills. Prepared for Solid Waste Industry for Climate Solutions (SWICS). https://scsengineers.com/wp-content/uploads/2015/03/Sullivan_SWICS_White_Paper_Version_2.2_Final.pdf.

U.S. EPA. 2005. Landfill Gas Emissions Model (LandGEM) Version 3.02 User's Guide. EPA 600/R-05/047. May. https://www.epa.gov/air-emissions-factors-and-quantification/emissions-estimation-tools.

U.S. EPA. 2010. Colombia Landfill Gas Model Version 1.0. Developed by SCS Engineers for the U.S. EPA Landfill Methane Outreach Program. September. https://www.globalmethane.org/resources/details.aspx?resourceid=2058.

U.S. EPA. 2017. Diesel Emissions Quantifier Default Values. U.S. Environmental Protection Agency. Available: https://cfpub.epa.gov/quantifier/assets/docs/diesel_emission_quantifer_deq_default_values.pdf.

U.S. EPA. 2019. Documentation for Greenhouse Gas Emission and Energy Factors Used in the Waste Reduction Model (WARM) – Management Practices Chapters (October 2019). Available: https://www.epa.gov/sites/default/files/2020-12/documents/warm_management_practices_v15_10-29-2020.pdf.

ANNEX 1 – SWEET HISTORY

The following list briefly describes SWEET's history and explains the differences between the different versions of SWEET.

SWEET 1.0 (May - October 2017)
- Original release of SWEET was in May 2017.
- SWEET was then updated in October 2017 to address some bugs after receiving user feedback.

SWEET 2.0 (February 2018)
- Tool revised so that the user interface and input sheets are easier to understand.
- More information provided to user on waste burning.
- Additional bug fixes identified in SWEET v1.0 addressed.
- SWEET User Manual published.

SWEET 2.1 (May 2018)
- Additional bug fixes identified in SWEET v2.0 addressed.
- Adjustments and fixes made to a number of default assumptions.
- SWEET v2.1 Example, Portuguese, and Spanish versions published.

SWEET 3.0 (May 2019)
- Temporal component added to waste burning allowing user to edit open burning assumptions with time.
- Additional bug fixes identified and fixed.
- Default assumptions about methane correction factors adjusted to reflect more accurately realistic conditions in dumpsites and landfills.
- Users allowed to enter alternative scenarios start years to enhance model accuracy.

SWEET 3.1 (July 2020)
- Additional bug fixes from SWEET v3.0 addressed.

SWEET 4.0 (December 2021)
- SWEET completes official EPA Peer Review Process and moved to Global Methane Initiative website.
- Changes made to the NO_x GWP value; set to zero.
- Additional information provided on black carbon and the indirect benefits of anaerobic digestions and composting projects.

- Revisions to emissions calculations for organics management facilities were made by applying emission factors listed in EPA's Waste Reduction Model (WARM).
- Additional bug fixes from SWEET v3.1 addressed.

SWEET 4.0.3 (May 2023)
- Bug fix to address the "Use Waste Defaults" macro that populates default percent composition of collected waste values.

SWEET 4.0.4 (October 2023)
- Bug fix to address the "Are you sending more waste to Anaerobic Digestion or Composting than collecting?" formula in the "Error Check" table in the *General Information* tab.
- Added restriction to the Landfill or Dumpsite #1 site opening year in the *Landfills and Dumpsites* tab.
- Updated hidden formulas to include mass of Paper/Old Corrugated Containers (OCC) composted and anaerobically digested.
- Updated hidden formulas to include rejected waste that goes back to landfill.

SWEET 4.0.5 (March 2024)
- Disaggregated oxidation factor (% of uncollected CH4) to include values with and without active gas collection and flaring system in the *Assumptions* tab.
- Updated hidden formulas to account for the year an active gas collection and flaring system is in place so the appropriate oxidation factor can be used for years with and without this system in place.
- Updated formula in the *Assumptions* tab to calculate methane oxidation factor for "Remediated to Landfill" with active gas collection and flaring system from "0.1 + collection efficiency x 0.1" to "0.1 + collection efficiency x 0.15" to match the formula in the *Default Values* tab.
- Updated hidden formulas to account for underestimation of tons of waste anaerobically digested for alternative scenarios.

SWEET 4.0.6 (March 2025)
- Updated the *Alt Emit* tabs to clarify N_2O versus NO_x values and distinguish between the two.
- Bug fix to address a formula error in the tabs *Alt3 Emit* and *Alt4 Emit*. The updated formula now references the appropriate feedstock tonnages sent to composting and anaerobic digestion in users' alternative scenarios.

- Bug fix in the hidden *Organics Mgmt Facilities* tab to address a formula error in the composted materials reject rate summary overview. Summary reject rate percentages now include all targeted materials.

SWEET 5.0 (June 2025)
- Updated the *Assumptions* tab with current Global Warming Potential (GWP) for "Methane-bio" and "Methane-fossil" to align with the 2021 IPCC AR6 Report. Updated tool calculations using IPCC AR6 GWP values.