



IPCC Inventory Software: Waste Sector

Remote Training on the IPCC Inventory Software for National Greenhouse Gas Inventories for the Latin America and Caribbean Regions

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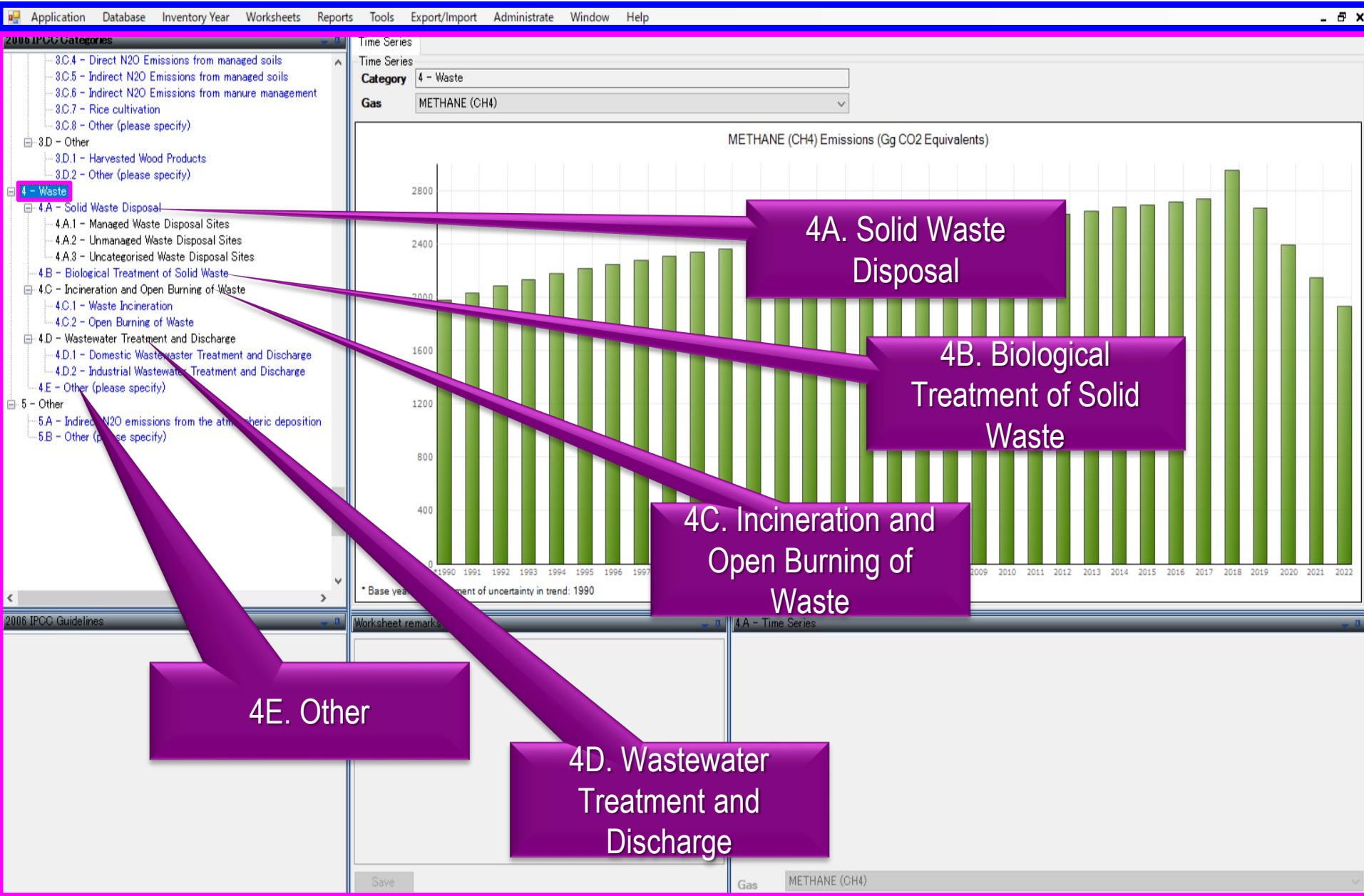
INTERGOVERNMENTAL PANEL ON climate change



Waste Sector

- Volume 5 of the 2006 IPCC Guidelines provides methodological guidance for estimation of CO₂, CH₄ and N₂O emissions from Waste sector:
 - Solid waste disposal (4A)
 - Biological treatment of solid waste (4B)
 - Incineration and open burning of waste (4C)
 - Wastewater treatment and discharge (4D)
- Typically, CH₄ emissions from solid waste disposal sites (SWDSs) are the largest source in Waste sector
- Biogenic CO₂ emissions are not included in Waste sector
- All greenhouse gas (GHG) emissions from waste-to-energy should be estimated and reported under Energy sector

IPCC Inventory Software



IPCC Inventory Software (ver.2.83): Major Updates

- Subnational disaggregation at a category level
- Implements Tier 3 equation in the *2006 IPCC Guidelines (Volume 5)* and methods in the *Wetlands Supplement (Chapter 6)*
 - Default values are incorporated but gives users the flexibility to use their own country-specific data and information
- Improvements in worksheet structure and layout - more streamlined user interface

Note: Some fixes have been already identified so there will be some changes in Waste sector worksheets of the software.

Solid Waste Disposal: First Order Decay (FOD) Method

- Decomposition of organic materials in waste under anaerobic condition produces significant amount of CH₄
- Waste disposal practices in SWDSs vary in the control, placement of waste and management of the site
 - Methane correction factor (MCF) reflects the way waste is managed and the effect of site structure and management practices on CH₄ generation
- Methodology in the *2006 IPCC Guidelines* for estimating CH₄ emissions from SWDS is based on FOD method
 - Degradable organic component in waste at landfills decays slowly throughout a few decades
 - A “running total” of the amount of degradable organic carbon (DOC) decomposable in the disposal site, taking account of the amount deposited each year and amount remaining from previous years, is used to calculate CH₄ emissions each year
 - A simple spreadsheet model (IPCC Waste Model) to assist countries in using the FOD method <https://www.ipcc-nggip.iges.or.jp/public/2006gl/vol5.html>

Solid Waste Disposal: FOD Method

- Three tiers for estimation of CH₄ emissions
 - Tier 1: Mainly default activity data (AD) and default parameters
 - Tier 2: Some default parameters but requires good quality country-specific AD on current and historical waste disposal at SWDSs
 - Tier 3: Good quality country-specific AD and the use of either the FOD method with (1) nationally developed key parameters, or (2) measurement derived country-specific parameters.
- Key parameters: half-life, and either CH₄ generation potential (L₀) or DOC content in waste and fraction of DOC which decomposes (DOC_f)
- Requires data on historical disposals of waste
 - Amount of municipal solid waste (MSW) can be estimated from population and per capita waste generation data (Tier 1)

Solid Waste Disposal: CH₄ Emissions

- CH₄ emissions in year *T* from SWDS (Gg)

$$CH_4 Emissions = \left[\sum_x CH_4 generated_{x,T} - R_T \right] * (1 - OX_T)$$

T : inventory year

x : waste category or type/material

R_T : recovered CH₄ in year T, Gg

OX_T : oxidation factor in year T, fraction

- CH₄ generated is estimated based on the amount of Decomposable Degradable Organic Carbon (*DDOC_m*) which is the part of the organic carbon that will degrade under the anaerobic conditions in SWDS

Solid Waste Disposal

- Subdivision allows estimation of emissions at subnational level (e.g., regions by climate zone)

Application Database Inventory Year Worksheets Reports Tools Export/Import Administrate Window Help

2006 IPCC Categories Parameters Methane Correction Factor Activity Data Amount Deposited Methane Calculations Methane Recovery Summary Long Term stored C in SWDS Harvested Wood Products

3.C.14 - Other (please specify)
3.D - Other
3.D.1 - Harvested Wood Products
3.D.2 - Other (please specify)
Waste
4.A - Solid Waste Disposal
4.A.1 - Managed Waste Disposal Sites
4.A.2 - Unmanaged Waste Disposal Sites
4.A.3 - Uncategorised Waste Disposal Sites
4.B - Biological Treatment of Solid Waste
4.C - Incineration and Open Burning of Waste
4.C.1 - Waste Incineration
4.C.2 - Open Burning of Waste
4.D - Wastewater Treatment and Discharge

Country/Territory Japan
Region Asia - Eastern
Subdivision: Subdivision_A
Approach Bulk waste data only
Activity Data Population / GDP (Tier 1)

Starting year 1970
DOCf (fraction of DOC dissimilated) 0.500
Delay Time (months) 6
Fraction of methane (F) in 0.500

DOC (Decomposable organic carbon) [weight %] [basis]
Methane generation rate constant (k) [1 / years]
Garden (HWP) [weight %] [basis]
Paper (HWP) [weight %] [basis]
Wood and straw (HWP) [weight %] [basis]
Bulk MSW 0.180 Bulk MSW 0.050
Sewage sludge 0.050 Sewage sludge 0.060
Industrial Waste 0.150

4.A - Subdivision

Subdivision	
Subdivision_A	
Subdivision_B	X
*	X

Default 'Unspecified' subdivision cannot be deleted but can be rename...

Save Undo Close

Uncertainties Reset to default Save

Category 4 A - Solid Waste Disposal
Sheet Parameters
Activity Data Uncertainties
Lower -30.00 % Upper +20.00 %
Emission Factors Uncertainties
Gas METHANE (CH4)
Lower -30.00 % Upper +20.00 %

OK Cancel

Gas METHANE (CH4)

Click to define subdivision

Select climate zone

IPCC default values will be adjusted (e.g., CH₄ generation rate constant)

Two options: Bulk waste and Waste composition

Click and enter uncertainties of AD and emission factor (EF)

Biological Treatment of Solid Waste

Application Database Inventory Year Worksheets Reports Tools Export/Import Administrate Window Help

2006 IPCC Categories

- 3C.14 - Other (please specify)
- 3D - Other
 - 3D.1 - Harvested Wood Products
 - 3D.2 - Other (please specify)
- 4 - Waste
 - 4.A - Solid Waste Disposal
 - 4.A.1 - Managed Waste Disposal Sites
 - 4.A.2 - Unmanaged Waste Disposal Sites
 - 4.A.3 - Uncategorised Waste Disposal Sites
 - 4.B - Biological Treatment of Solid Waste
 - 4.C - Incineration and Open Burning of waste
 - 4.C.1 - Waste Incineration
 - 4.C.2 - Open Burning of Waste
 - 4.D - Wastewater Treatment and Discharge
 - 4.D.1 - Domestic Wastewater Treatment and Discharge
 - 4.D.2 - Industrial Wastewater Treatment and Discharge
 - 4.E - Other (please specify)
- 5 - Other
 - 5.A - Indirect N₂O emissions from the atmospheric dep
 - 5.B - Other (please specify)

Biological Treatment of Solid Waste

Worksheet: Waste
Sector: Biological Treatment of Solid Waste
Category: 4.B - Biological Treatment of Solid Waste
Subcategory: Emissions from Biological Treatment of Solid Waste
Sheet: Emissions from Biological Treatment of Solid Waste

Data
Gas: METHANE (CH₄)

Equation 4.1, 4.2

Subdivision	Biological Treatment System	Waste Category	Type of Waste	Waste basis	Total Annual amount treated by biological treatment facilities	Emission Factor [g CH ₄ / kg waste treated]	Gross Annual Methane Generation [Gg]	Recovered / Flared Methane per Year [Gg]	Net Annual Methane Emissions [Gg]
					A	B	C = (A * B) / 1000	D	E = (C - D)
Subdivision A	Composting	Municipal Solid Waste	Food waste	Wet	45	4	0.18	0	0.18
Total					45				0.18

Uncertainties Time Series data entry...

Worksheet notes

User notes

4.B - Time Series

METHANE (CH₄) Emissions (Gg CO₂ Equivalents)

* Base year for assessment of uncertainty in trend: 1990

Gas: METHANE (CH₄)

2006 IPCC Guidelines

Save

Select gas

Select dry or wet basis from drop-down list

Parameters of worksheets can be edited across existing inventory years

Select gas from drop-down list

Incineration and Open Burning of Waste

- Estimation of amount of waste open-burned (Equation 5.7, Chapter 5, Volume 5, 2006 IPCC Guidelines)

Application Database Inventory Year Worksheets Reports Tools Export/Import Administrate Window Help

2006 IPCC Categories

Worksheet: Open Burning of Waste

Sector: Waste
 Category: Incineration and Open Burning of Waste
 Subcategory: 4.C.2 - Open Burning of Waste
 Sheet: Emissions from Open Burning

Data
 Gas: METHANE (CH4)

Equation 5.1, 5.2, 5.4, 5.5

Subdivision	Waste Category	Type of Waste	Total Amount of Waste open-burned (Wet Weight) (Gg Waste)	Methane Emission Factor (kg CH4/Gg Wet Waste)	Methane Emissions (Gg)
			A	E	F = A * E / 10 ⁶
Subdivision_A	Municipal Solid Waste	Total MSW	Eq. 5.7	6500	0.0568
Subdivision_B			Specified	6500	0.18
Total			28.7381		0.1868

Click here

Worksheet notes

Amount of waste open-burned

Equation 5.7

Region, city, etc.	Population - P (Capita)	Fraction of Population Burning Waste - P frac (Fraction)	Per Capita Waste Generation - MSWp (kg waste/capita/day)	Fraction of the waste amount burned relative to the total amount of waste treated - Bfrac (Fraction)	Number of days by year (Day)	Total Amount of MSW Open-burned - MSWb (Gg / yr)
	P	Pfrac	MSWp	Bfrac	D	MSWb = P * Pfrac * MSWp * Bfrac * D * 10 ⁻⁶
Subdivision_A	200000	0.35	0.57	0.6	365	8.7381
Total						8.7381

Cancel Save

* Base year for assessment of uncertainty in trend: 1990

Gas: METHANE (CH4)

Incineration and Open Burning of Waste: Tier 3 Method

- Estimation of N₂O emissions from waste incineration based on site specific data and flue gas concentration (Equation 5.6, Chapter 5, Volume 5, 2006 IPCC Guidelines)

Application Database Inventory Year Worksheets Reports Tools Export/Import Administrate Window Help

2006 IPCC Categories

3.C - Aggregate sources and non-CO2 emissions so

- 3.C.1 - Burning
 - 3.C.1.a - Burning in Forest Land
 - 3.C.1.b - Burning in Cropland
 - 3.C.1.c - Burning in Grassland
 - 3.C.1.d - Burning in All Other Lands
- 3.C.2 - Liming
- 3.C.3 - Urea application
- 3.C.4 - Direct N2O Emissions from managed soil
- 3.C.5 - Indirect N2O Emissions from managed so
- 3.C.6 - Indirect N2O Emissions from manure ma
- 3.C.7 - Rice cultivation
- 3.C.8 - CH4 from Drained Organic Soils
- 3.C.9 - CH4 from Drainage Ditches on Organic S
- 3.C.10 - CH4 from Rewetting of Organic Soils
- 3.C.11 - CH4 Emissions from Rewetting of Mang
- 3.C.12 - N2O Emissions from Aquaculture
- 3.C.13 - CH4 Emissions from Rewetted and Cre
- 3.C.14 - Other (please specify)

3.D - Other

- 3.D.1 - Harvested Wood Products
- 3.D.2 - Other (please specify)

Waste

- 4.A - Solid Waste Disposal
 - 4.A.1 - Managed Waste Disposal Sites
 - 4.A.2 - Unmanaged Waste Disposal Sites
 - 4.A.3 - Uncategorised Waste Disposal Sites
- 4.B - Biological Treatment of Solid Waste
- 4.C - Incineration and Open Burning of Waste
 - 4.C.1 - Waste Incineration**
 - 4.C.2 - Open burning of waste
- 4.D - Wastewater Treatment and Discharge
 - 4.D.1 - Domestic Wastewater Treatment and Dis
 - 4.D.2 - Industrial Wastewater Treatment and Dis
- 4.E - Other (please specify)

Other

Worksheet: Waste incineration Fossil liquid incineration **N2O Emissions from Incineration of waste - Tier 3**

Sector: Waste
 Category: Incineration and Open Burning of Waste
 Subcategory: 4.C.1 - Waste Incineration
 Sheet: N2O Emissions from Incineration of waste - Tier 3
 Data

Equation 5.6

Subdivision	Type of Waste	Total Amount of Waste incinerated (IWi) (Gg Waste)	N2O emission concentration in flue gas from the incineration of waste type i (ECi) (mg N2O/m3)	Flue gas volume by amount of incinerated waste type i (FGVi) (m3/Mg)	N2O Emissions (Gg N2O)
	i	A	B	C	D = A * B * C * 10 ⁻⁹
Subdivision_B	Industrial Waste	2000	5.5	25800	0.2838
Total		2000			0.2838

Uncertainties Time Series data entry...

Worksheet notes

1990

Wastewater Treatment and Discharge

- Methods for estimation of CH₄ and N₂O emissions from constructed wetlands for wastewater treatment

Application Database Inventory Year Worksheets Reports Tools Export/Import Administrate Window Help

2006 IPCC Categories

- 3.C.14 - Other (please specify)
- 3.D - Other
 - 3.D.1 - Harvested Wood Products
 - 3.D.2 - Other (please specify)
- 4 - Waste
 - 4.A - Solid Waste Disposal
 - 4.A.1 - Managed Waste Disposal Sites
 - 4.A.2 - Unmanaged Waste Disposal Sites
 - 4.A.3 - Uncategorised Waste Disposal Sites
 - 4.B - Biological Treatment of Solid Waste
 - 4.C - Incineration and Open Burning of Waste
 - 4.C.1 - Waste Incineration
 - 4.C.2 - Open Burning of Waste
 - 4.D - Wastewater Treatment and Discharge
 - 4.D.1 - Domestic Wastewater Treatment and Discharge**
 - 4.D.2 - Industrial wastewater treatment and discharge
 - 4.E - Other (please specify)
 - 5.A - Indirect N2O emissions from the atmospheric deposit
 - 5.B - Other (please specify)

N2O Emissions from Plants Indirect N2O Emissions

Regions and TOWs - Tier 1 **CH4 Emission Factors - Tier 1** CH4 Emissions - Tier 1 **CH4 Emissions from Constructed Wetlands - Tier 1** CH4 Emission Factors - Tier 2 CH4 Emissions - Tier 2

Worksheet

Sector: Waste
 Category: Domestic Wastewater Treatment and Discharge
 Subcategory: 4.D.1 - Domestic Wastewater Treatment and Discharge
 Sheet: Organically Degradable Material in Domestic Wastewater - Tier 1

1990

Data

Equation 6.3						
Subdivision (Region, city, etc.)	Constructed Wetlands	Population - P (Capita)	Degradable organic component - BOD (kg BOD/cap/yr)	Correction factor for industrial BOD discharged in sewers (f)	Organically degradable material in wastewater - TOW (kg BOD/yr)	
		A	B	C	D = A * B * C	
Subdivision A1	<input checked="" type="checkbox"/>	1000	15.33	1.25	19162.5	
Subdivision A2	<input type="checkbox"/>	10000	15.33	1	153300	
Total					172462.5	

N2O Emissions from Plants Indirect N2O Emissions

Regions and TOWs - Tier 1 **CH4 Emission Factors - Tier 1** CH4 Emissions - Tier 1 **CH4 Emissions from Constructed Wetlands - Tier 1** CH4 Emission Factors - Tier 2 CH4 Emissions - Tier 2

Worksheet

Sector: Waste
 Category: Domestic Wastewater Treatment and Discharge
 Subcategory: 4.D.1 - Domestic Wastewater Treatment and Discharge
 Sheet: CH4 Emission Factors for Domestic Wastewater - Tier 1

1990

Data

Subdivision (Region, city, etc.)	Type of treatment or discharge
Subdivision A1	Horizontal Subsurface Flow
Subdivision A2	Anaerobic deep lagoon

N2O Emissions from Plants Indirect N2O Emissions

Regions and TOWs - Tier 1 CH4 Emission Factors - Tier 1 CH4 Emissions - Tier 1 **CH4 Emissions from Constructed Wetlands - Tier 1** CH4 Emission Factors - Tier 2 CH4 Emissions - Tier 2

Worksheet

Sector: Waste
 Category: Domestic Wastewater Treatment and Discharge
 Subcategory: 4.D.1 - Domestic Wastewater Treatment and Discharge
 Sheet: CH4 Emissions from Constructed Wetlands - Tier 1

1990

Data

Equation 6.1 WS				
Subdivision (Region, city, etc.)	Type of treatment or discharge pathway	Organically degradable material in wastewater (kg BOD/yr)	Emission Factor (kg CH ₄ / kg BOD)	Net methane emissions (kg CH ₄ / yr)
		TOW (Sheet 1)	EFj (Sheet 2)	E = TOW * EFj
Subdivision A1	Horizontal Subsurface Flow	19162.5	0.06	1149.75
Total				1149.75

Save

Gas METHANE (CH₄)

Waste Data

- Collection of data is a fundamental part of inventory compilation. It is preferable to use national data, however waste data covering all waste types and treatment techniques may not be available
- Chapter 2 of Volume 1 gives general guidance on data collection
- Volume 5 of the *2006 IPCC Guidelines* provides default values for Waste sector e.g., default data on waste generation, management, composition, and default EFs/parameters
- IPCC Emission Factor Database (EFDB) contains EFs and other parameters with background technical information that can be used for estimation of GHG emissions and removals <https://www.ipcc-nggip.iges.or.jp/EFDB/main.php>

Thank you

<https://www.ipcc-nggip.iges.or.jp/>