



ESTIMATING WASTE EMISSIONS

PREPARED BY: DEVELOPMENT ADVISORY SERVICES



Ministry of Tourism and Environment
Republic of Maldives

CBIT Maldives

Capacity Building for Improved Transparency of
Climate Change Mitigation and Adaptation Actions in
the Maldives Project

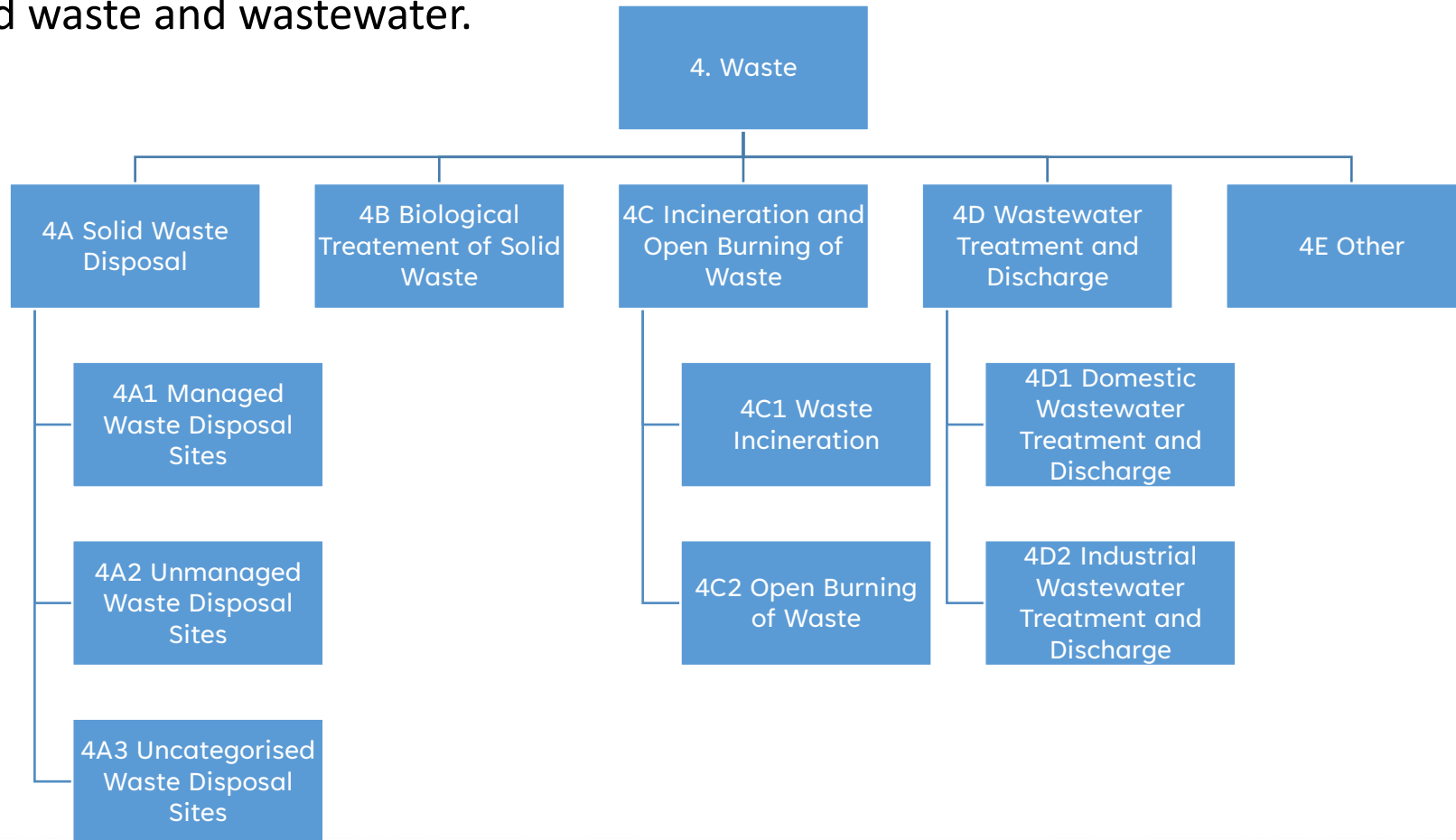


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INTRODUCTION

The waste sector accounts for emission resulting waste management practices for all types of waste including solid waste and wastewater.



KEY TERMS

Wet weight basis

Dry Weight basis

Dry Matter content

Decomposable Organic Carbon (fraction of Organic carbon that decomposes)

Biogenic carbon content / Fossil carbon content

Methane Correction Factor

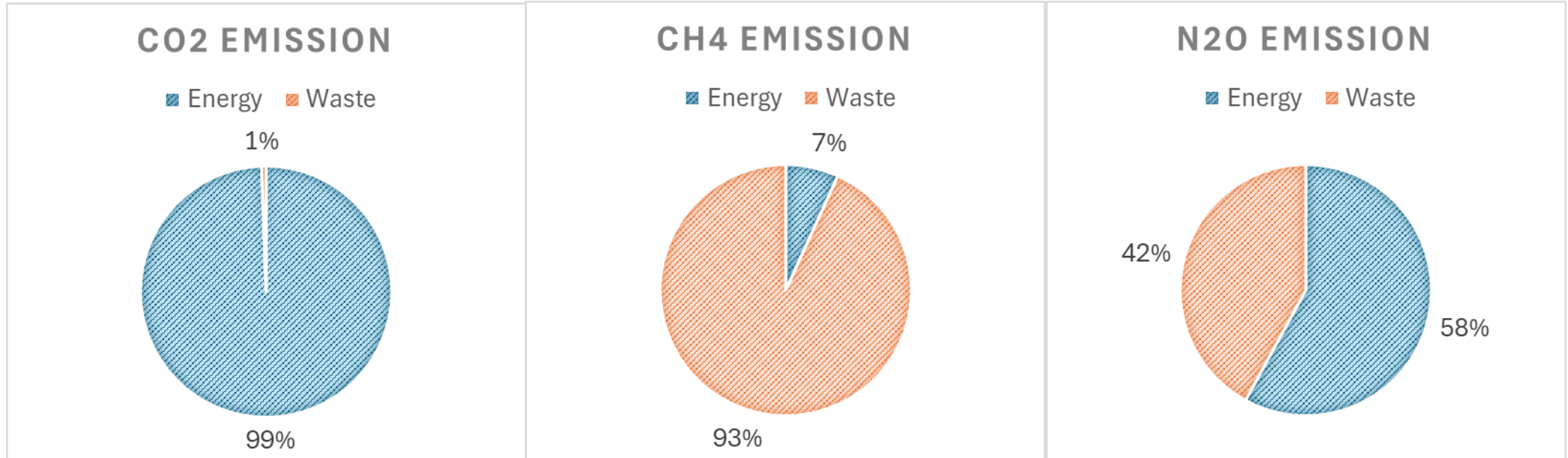
Methane Generation Rate/Half-Life

Oxidation Factor

BOD



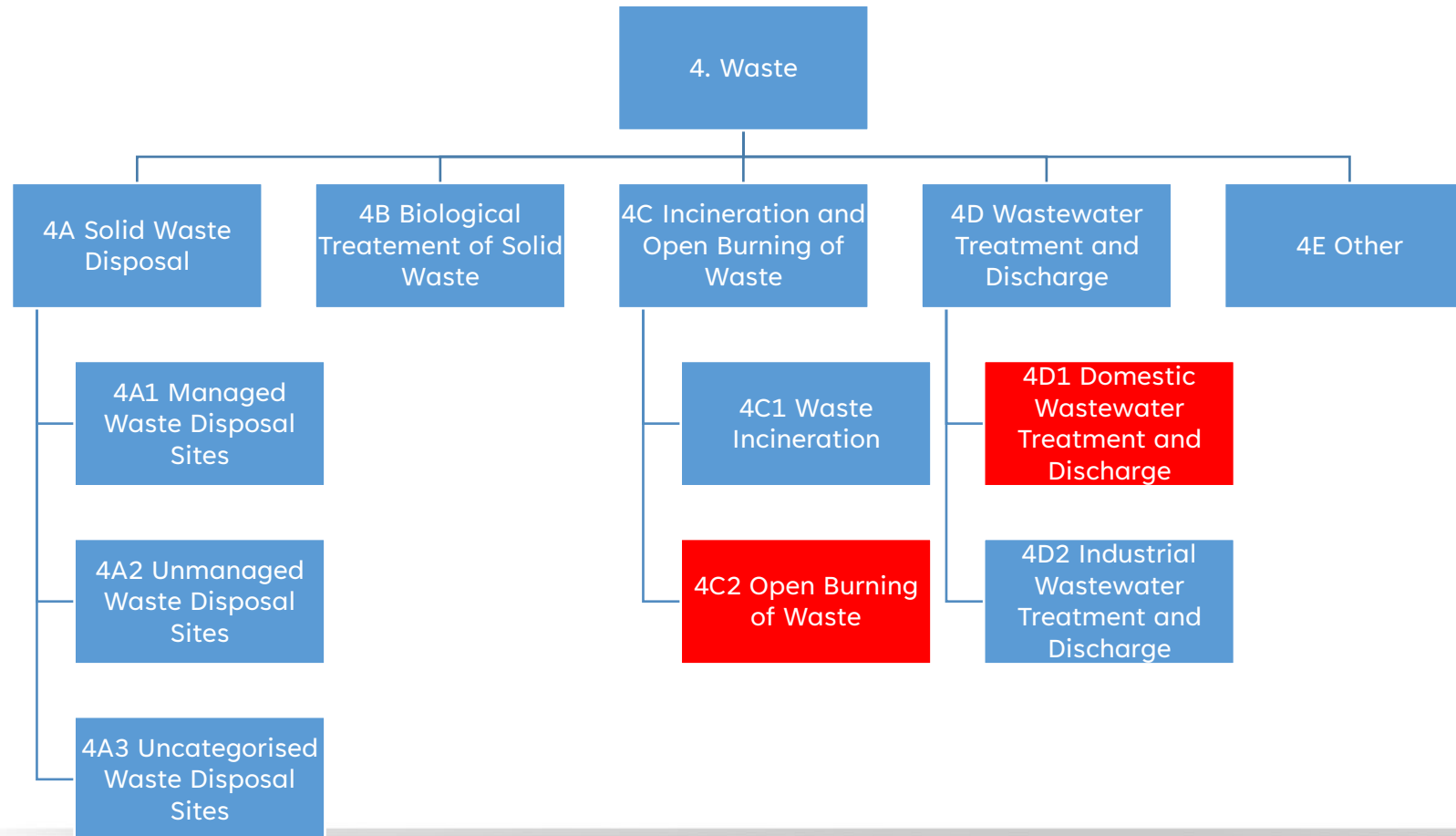
NATIONAL CONTEXT - WASTE



Maldives GHG inventory 2022: Waste accounts for majority of CH4 and significant portion of N2O emissions in Maldives

Main method of waste management in Maldives is unmanaged open burning with limited incineration in resorts and dumping biodegradable waste into the sea.

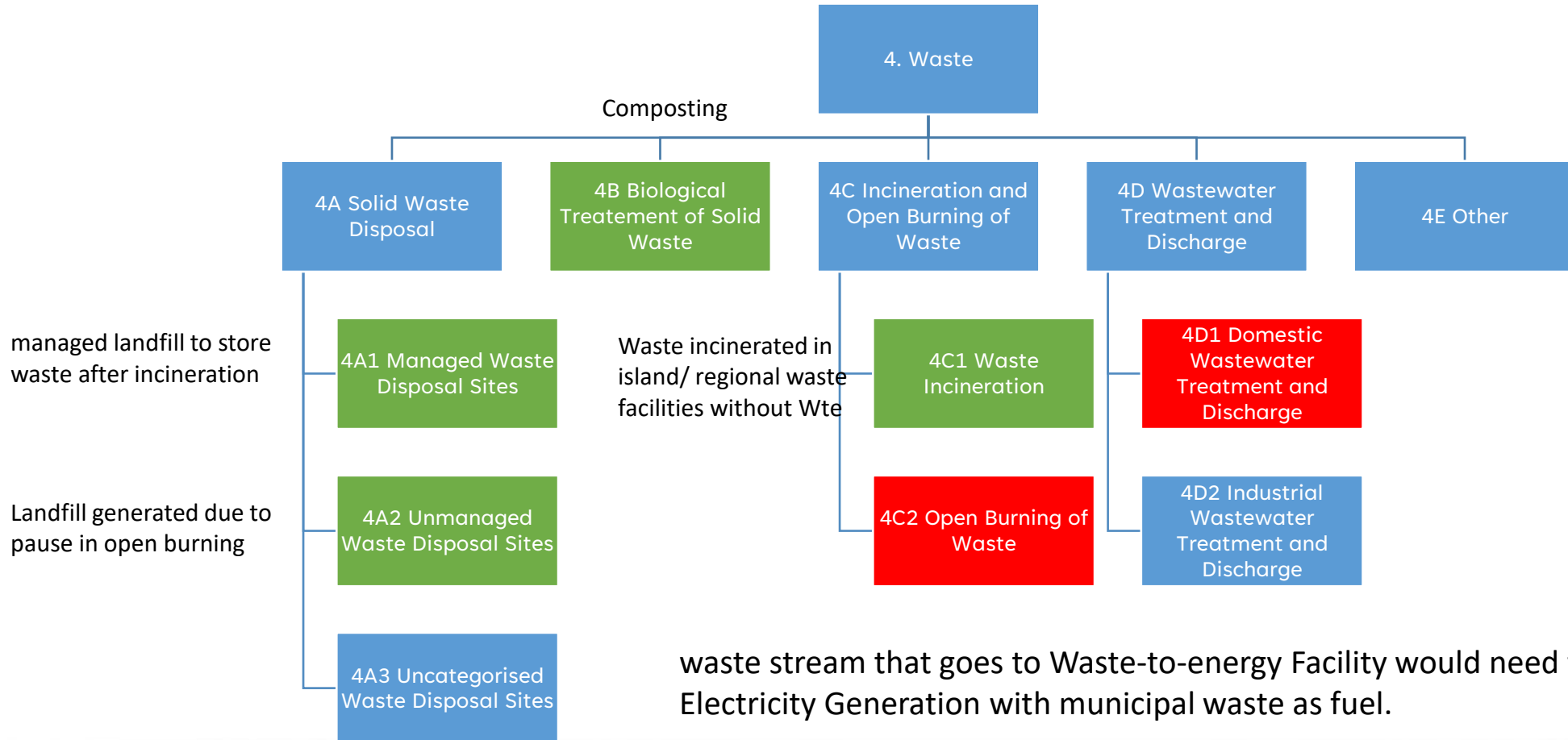
NATIONAL CONTEXT - WASTE



Plans for the sector to consider in future inventories

- Waste to Energy Facilities in Thilafushi, Addu and Vandhoo with managed landfill for incinerated waste
- Promoting composting in organic waste
- Phasing out Open burning

NATIONAL CONTEXT - WASTE



METHODOLOGICAL APPROACH

Step 1: Estimate total solid waste generated - default

Tier 1 IPCC default

$$\text{Total Solid Waste} = \frac{\text{Population}}{\text{NBS}} \times \text{Waste generation rate}$$

0.91 ton per capita per year



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METHODOLOGICAL APPROACH

Step 1: Estimate total solid waste generated – country specific

$$\text{Bulk Waste (in tons)} = \text{Waste in Male'} + \text{Waste in Other islands} + \text{Waste in Resorts}$$

$$\text{Waste in Male'} = \text{Waste Generation Rate}_{\text{Male'}} \times \text{Population}_{\text{Male'}} \times \frac{365}{1000}$$

2.8 kg per person per day NBS

$$\text{Waste in Other Island} = \text{Waste Generation Rate}_{\text{Other island}} \times \text{Population}_{\text{Other Island}} \times \frac{365}{1000}$$

1 kg per person per day NBS

$$\text{Waste in Resorts} = \text{Waste Generation Rate}_{\text{Resorts}} \times \text{Tourist Bednights}_{\text{Resorts}}$$

7.2 kg per resort bednight MTE



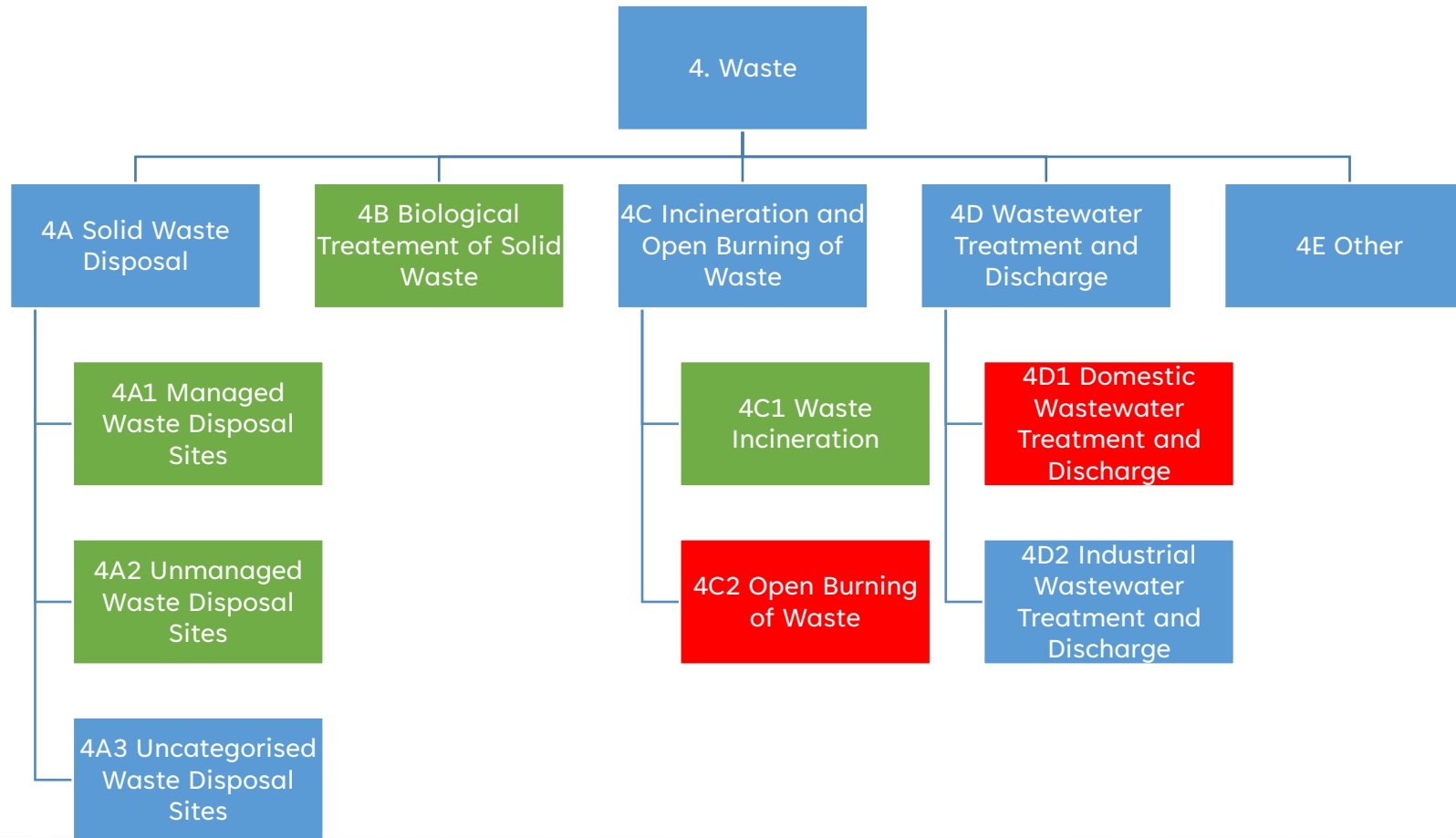
METHODOLOGICAL APPROACH

STEP 2 – composition of Waste – optional for all but 1 category

Waste Type	Default Waste Composition for South Asia (%)
Food Waste	66.1
Garden Waste	0
Paper/Cardboard	9.2
Wood	0
Textiles	1.2
Nappies	0
Rubber/Leather	0.4
Plastic	7
Metal	0.9
Glass	1.5
Other	13.9
Bulk Waste	100



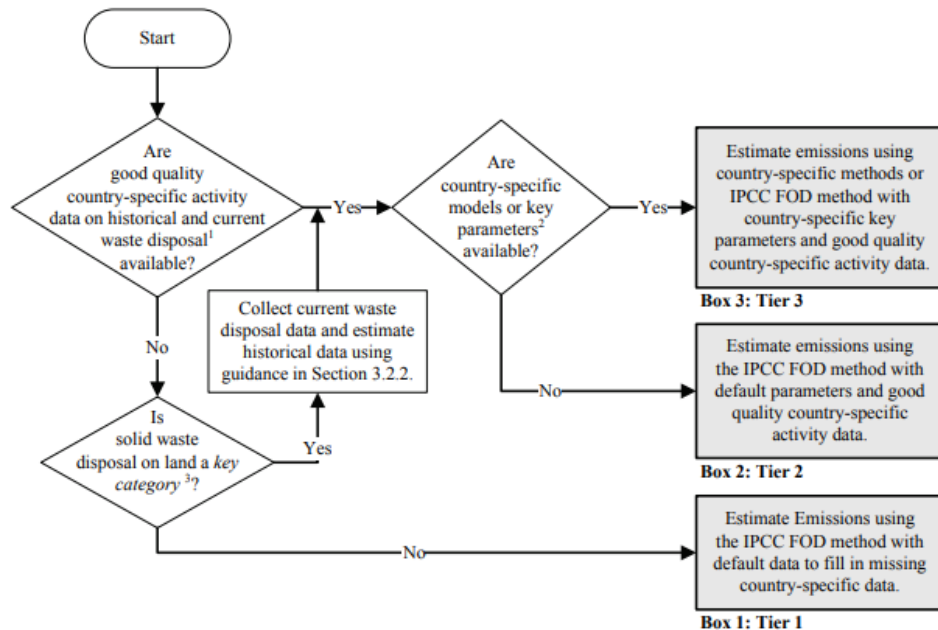
METHODOLOGICAL APPROACH



SOLID WASTE DISPOSAL SITES

Treatment and disposal of municipal, industrial and other solid waste produces significant amounts of methane (CH_4).

The IPCC methodology for estimating CH_4 emissions from SWDS is based on the First Order Decay (FOD)



Note:

1. Good quality country-specific activity data mean country-specific data on waste disposed in SWDS for 10 years or more.

2. Key parameters mean DOC/L_{∞} , DOC_t and half-life time.

3. See Volume 1 Chapter 4, "Methodological Choice and Identification of Key Categories" (noting Section 4.1.2 on limited resources), for discussion of key categories and use of decision trees.

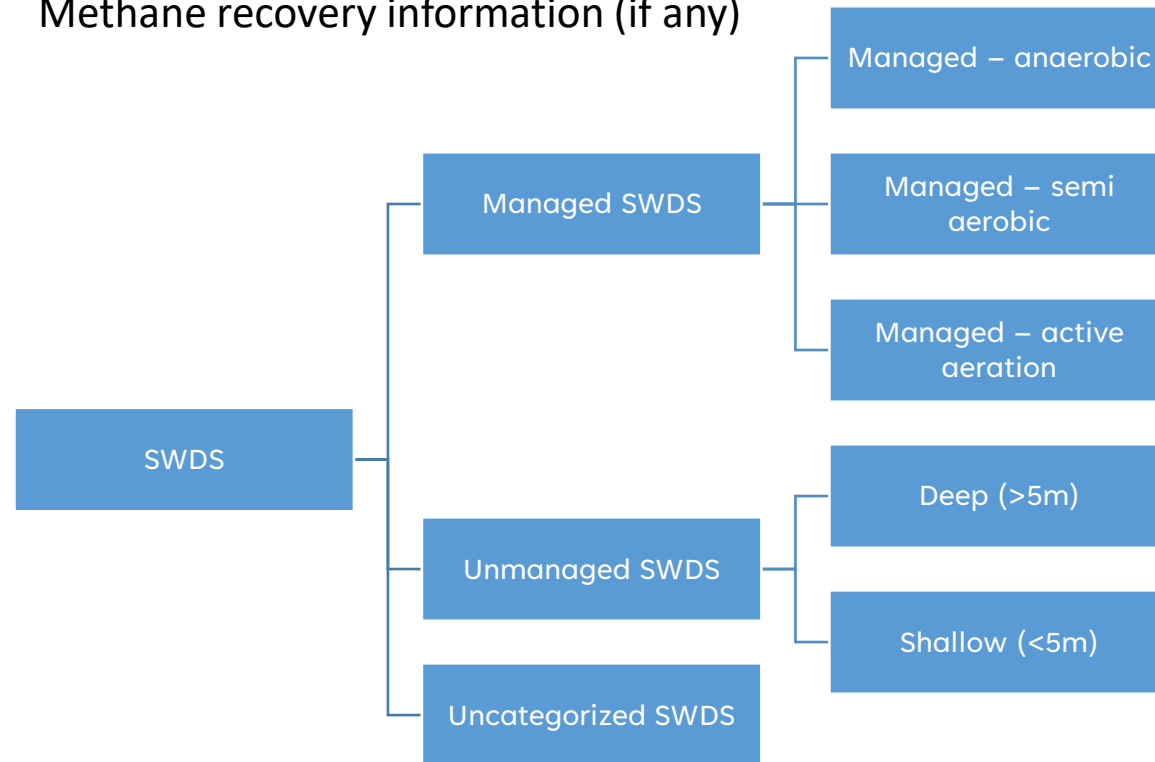
* A site is considered SWDS for emission calculation if the waste collected at the site remains for more than one year and accumulates over multiple years (2+ years) without transfer or burning

SOLID WASTE DISPOSAL SITES

Activity Data Required:

percentage of waste deposited at SWDS segregated by type of SWDS (WAMCO)

Methane recovery information (if any)



SOLID WASTE DISPOSAL SITE

STEP 3 – Set initial parameters (a must for SWDS emission estimate)

Parameters | SWDS Types - Utilization | Activity Data | Amount Deposited | Long Term stored C in SWDS | Harvested Wood Products

Country/Territory Maldives
Region Asia - South-Central
Subdivision: Unspecified +
Climate Zone Tropical wet

Main parameters and Waste Types for selected Subdivision

Starting year 1950
Delay Time (months) 6
Fraction of methane (F) in developed gas 0.500
Conversion Factor, C to CH₄ 1.33333

Waste Type Parameters for selected Subdivision...

Parameters for HWP (Bulk MSW)

% garden in municipal waste 0.00 %
% paper in municipal waste 0.00 %
% wood in municipal waste 0.00 %

Parameters for HWP (Bulk Industrial Waste)

% paper in industrial waste 0.00 %
% wood in industrial waste 0.00 %

Save Waste Type Manager

SOLID WASTE DISPOSAL SITE

STEP 3 – Set parameters and EF (a must for SWDS emission estimate)

Waste Type Parameters						
Waste Category	Waste Type / Industry Type			Degradable organic carbon	Degradable organic carbon which decomposes in SWDS	Methane generation rate constant (k)
	Class of decomposability	Type	Use in calculations	DOC (Fraction of wet weight)	DOCf (Fraction)	k
Industrial Waste	Bulk waste	Bulk Industrial Waste	<input checked="" type="checkbox"/>	0.15	0.5	0.17
	Highly decomposable waste	Food, beverages and tobacco	<input checked="" type="checkbox"/>	0.15	0.7	
	Less decomposable waste	Construction and demolition	<input checked="" type="checkbox"/>	0.04	0.5	
		Wood and wood products	<input checked="" type="checkbox"/>	0.43	0.5	
	Moderately decomposable waste	Pulp and paper	<input checked="" type="checkbox"/>	0.4	0.5	
		Textile	<input checked="" type="checkbox"/>	0.24	0.5	
Municipal Waste	Bulk waste	Bulk Municipal Waste	<input checked="" type="checkbox"/>	0.18	0.5	0.17
	Highly decomposable waste	Food waste	<input checked="" type="checkbox"/>	0.15	0.7	0.4
		Garden and park	<input checked="" type="checkbox"/>	0.2	0.7	0.17
	Less decomposable waste	Wood	<input checked="" type="checkbox"/>	0.43	0.5	0.035
	Moderately decomposable waste	Disposable nappies	<input checked="" type="checkbox"/>	0.24	0.5	0.17
		Paper and cardboard	<input checked="" type="checkbox"/>	0.4	0.5	0.07
Other waste	Bulk waste	Clinical waste	<input checked="" type="checkbox"/>	0.15	0.5	
		Hazardous waste	<input checked="" type="checkbox"/>		0.5	
Sludge	Highly decomposable waste	Industrial sewage sludge	<input checked="" type="checkbox"/>	0.09	0.5	
		Municipal sewage sludge	<input checked="" type="checkbox"/>	0.05	0.5	

SOLID WASTE DISPOSAL SITE

STEP 3 – Set parameters and EF

SWDS Types - MCF and OX Methane Generated Methane Emissions

Worksheet

Sector: Waste 2024

Category: Methane emissions from Solid Waste Disposal Sites

Subcategory: 4.A.1 - Managed Waste Disposal Sites

Sheet: SWDS Types - Methane Correction Factors and Oxidation Factors

Data

Subdivision Unspecified

Year	Managed – anaerobic		Managed poorly – semi-aerobic		Managed well – semi-aerobic		Managed poorly – active aeration		Managed well – active aeration				
	MCF (Fraction)	OX (Fraction)	MCF (Fraction)	OX (Fraction)	MCF (Fraction)	OX (Fraction)	MCF (Fraction)	OX (Fraction)	MCF (Fraction)	OX (Fraction)			
1950	1	0											
1951	1	0											
1952	1	0											
1953	1	0											
1954	1	0											
1955	1	0											
1956	1	0											
1957	1	0											
1958	1	0											
1959	1	0											
1960	1	0											
1961	1	0											
1962	1	0											
1963	1	0											

Type of Site	MCF Default values
Managed - anaerobic	1
Managed well – semi aerobic	0.5
Managed poorly – semi aerobic	0.7
Managed well – active aeration	0.4
Managed poor – active aeration	0.7
Unmanaged – deep (>5m waste)	0.8
Unmanaged – shallow (<5m waste)	0.4
Uncategorized SWDS	0.6



SOLID WASTE DISPOSAL SITE

STEP 4 – Input methane recovery if any (zero for Maldives)

SWDS Types - MCF and OX
Methane Generated
Methane Emissions

Worksheet

Sector: Waste
Category: Methane emissions from Solid Waste Disposal Sites
Subcategory: 4.A.1 - Managed Waste Disposal Sites
Sheet: Methane Emissions

2024

Data

Subdivision: Unspecified
SWDS Type: Managed – anaerobic

Year	Methane generated					Methane recovered		Methane oxidised		Methane Emissions			
	Municipal Waste (Gg)	Industrial Waste (Gg)	Sludge (Gg)	Other waste (Gg)	Total methane generated (Gg)	Flaring (Gg)	Energy use (Gg)	OX (Fraction)	Methane oxidised (Gg)	Methane Emissions (Gg)			
	A	B	C	D	E = A + B + C + D	F	G	H	I = (E - F - G) * H	J = E - F - G - I			
1950	0	0	0	0	0			0	0	0			
1951	0.11139	0	0	0	0.11139			0	0	0.11139			
1952	0.20536	0	0	0	0.20536			0	0	0.20536			
1953	0.28465	0	0	0	0.28465			0	0	0.28465			
1954	0.35154	0	0	0	0.35154			0	0	0.35154			
1955	0.40797	0	0	0	0.40797			0	0	0.40797			
1956	0.45558	0	0	0	0.45558			0	0	0.45558			
1957	0.49574	0	0	0	0.49574			0	0	0.49574			
1958	0.52963	0	0	0	0.52963			0	0	0.52963			
1959	0.55822	0	0	0	0.55822			0	0	0.55822			

BIOLOGICAL TREATMENT OF SOLID WASTE

Biological treatment of waste includes composting, anaerobic digestion of organic waste and mechanical-biological treatment of waste.

The primary emissions from these processes considered in this category are Methane and Nitrous Oxide.

National Waste accounts, no waste is recorded as being composted
Need to collect data on waste composting to report GHG emissions from this sector

?

NBS, Local council, WAMCO



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BIOLOGICAL TREATMENT OF SOLID WASTE

The CH₄ and N₂O emissions of biological treatment can be estimated using the following equation

$$CH_4 \text{ emissions} = M \times EF \times 10^{-3} - R$$

$$N_2O \text{ emissions} = M \times EF \times 10^{-3}$$

Where

M = mass of organic waste treated in Gg or 1000 tons

EF = relevant emission factor from Table below

R = total amount of methane recovered

Type of biological treatment	CH ₄ emission factor (g CH ₄ / kg waste treated)		N ₂ O emission factor (g N ₂ O / kg waste treated)	
	Dry weight basis	Wet weight basis	Dry weight basis	Wet weight basis
Composting	10 (0.08 - 20)	4 (0.03 - 8)	0.6 (0.2 - 1.6)	0.24 (0.06 - 0.6)
Anaerobic digestion at biogas facilities	2 (0 - 20)	0.8 (0 - 8)	negligible	negligible

BIOLOGICAL TREATMENT OF SOLID WASTE

Biological Treatment of Solid Waste

Worksheet

Sector: Waste

Category: Biological Treatment of Solid Waste

Subcategory: 4.B - Biological Treatment of Solid Waste

Sheet: Emissions from Biological Treatment of Solid Waste

2024

Data
Gas: METHANE (CH4)

Equation 4.1, 4.2

Subdivision	Biological Treatment System	Waste Category	Type of Waste	Total Annual amount treated by biological treatment facilities	Emission Factor (g CH4 / kg waste treated)	Gross Annual Methane Generation (Gg)	Methane recovered (Gg)	Net Annual Methane Emissions (Gg)	
Δ ▾	Δ ▾	Δ ▾	Δ ▾	A	B	C = (A * B) / 1000	Flaring F	Energy use D	E = (C - F - D)
Unspecified	Composting	Municipal...	Food was...	2	4	0.008	0	0	0.008
Total				2			0	0	0.008

Waste Type Manager Uncertainties Time Series data entry...

Biological Treatment of Solid Waste

Worksheet

Sector: Waste

Category: Biological Treatment of Solid Waste

Subcategory: 4.B - Biological Treatment of Solid Waste

Sheet: Emissions from Biological Treatment of Solid Waste

2024

Data
Gas: NITROUS OXIDE (N2O)

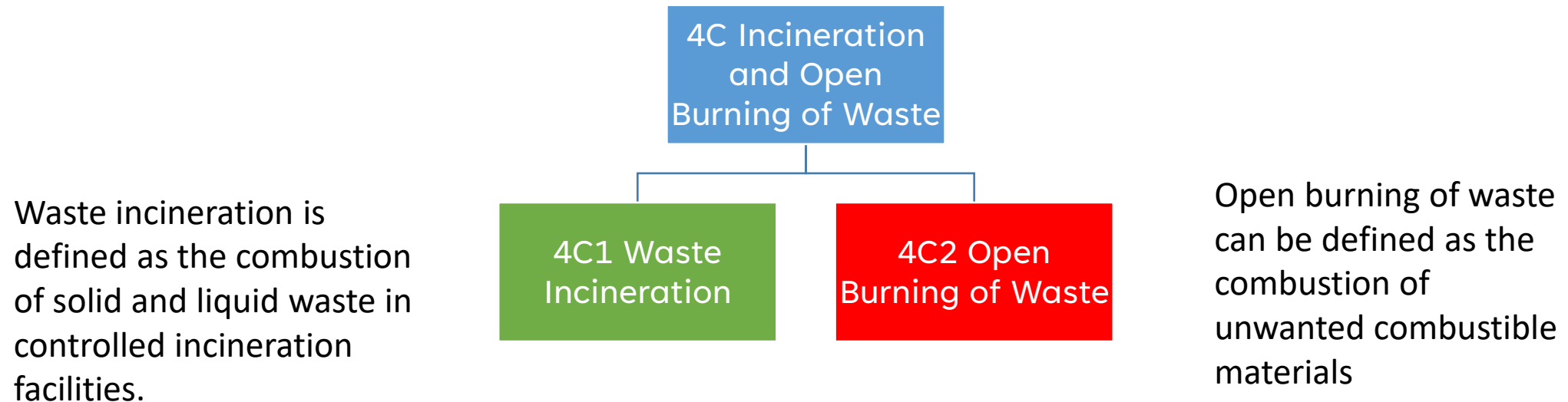
Equation 4.1, 4.2

Subdivision	Biological Treatment System	Waste Category	Type of Waste	Total Annual amount treated by biological treatment facilities (Gg)	Emission Factor (g N2O / kg waste treated)	Net Annual Nitrous Oxide Emissions (Gg)
Δ ▾	Δ ▾	Δ ▾	Δ ▾	A	B	E = (A * B) / 1000
Unspecified	Composting	Municipal Wa...	Food waste	2		
Total				2		0

Waste Type Manager Uncertainties Time Series data entry...



INCINERATION AND OPEN BURNING



Relevant gases emitted include CO₂, methane (CH₄) and nitrous oxide (N₂O).

INCINERATION AND OPEN BURNING

$$CO_2 \text{ emissions} = \sum (SW \times dm \times CF \times FCF \times OF) \times \frac{44}{12}$$

Where;

SW = total amount of Solid waste of type (wet weight)
incinerated or open burnt

Dm = dry matter content in the waste (wet weight)

CF = fraction of carbon in dry matter

FCF = Fraction of fossil carbon in total carbon

OF = Oxidation factor

Waste Type	Default Waste Composition for South Asia (%)	Dry Matter content fraction	Fraction of carbon in dry matter	Fraction of carbon in total carbon
Food Waste	66.1	0.40	0.38	0
Garden Waste	0	0.40	0.49	0
Paper/Cardboard	9.2	0.90	0.46	0.01
Wood	0	0.85	0.50	0
Textiles	1.2	0.80	0.50	0.20
Nappies	0	0.40	0.70	0.10
Rubber/Leather	0.4	0.84	0.67	0.20
Plastic	7	1	0.75	1
Metal	0.9	1	NA	NA
Glass	1.5	1	NA	NA
Other	13.9	0.9	0.03	1
Bulk Waste	100	0.579	0.359	0.213



INCINERATION AND OPEN BURNING

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

Worksheet

Sector: Waste 2024

Category: Incineration and Open Burning of Waste

Subcategory: 4.C.1 - Waste Incineration

Sheet: Emissions from Incineration of Waste

Data

Gas: CARBON DIOXIDE (CO2)

Equation 5.1, 5.2										Information for UNFCCC CRT						
Subdivision	Waste Category	Type of Waste	Total Amount of Waste incinerated (Wet Weight) (Gg Waste)			Dry Matter Content - dm (Fraction)	Fraction of Carbon in Dry Matter - CF	Fraction of Fossil Carbon in Total Carbon - FCF	Oxidation Factor - OF (Fraction)	Fossil CO2 Emissions (Gg)	Amount of total waste of fossil origin (Gg Waste)		Amount of total waste of biogenic origin (Gg Waste)		Biogenic CO2 emissions (Gg)	
Δ ▾	Δ ▾	i Δ ▾	Ai			dmi	CFi	FCFi	OFi	EFi = Ai * dmi * CFi * FCFi * OFi * 44/12	AFi = Ai * FCFi or specified		ABi = Ai * (1 - FCFi) or specified	EBi = ABi * dmi * CFi * OFi * 44/12		
Unspecified	Municipal	Bulk...	Specific...	100		0.579	0.359	0.213	1	16.233...	Calculated	21.3	Calculated	78.7	59.981...	
Total				100						16.233...		21.3		78.7	59.981...	

Waste Type Manager Uncertainties Time Series data entry...



INCINERATION AND OPEN BURNING

$$CH_4 / N_2O \text{ emissions} = \sum (IW \times EF) \times 10^{-6}$$

Where

IW = amount of solid waste of type incinerated in Gg/yr

EF = aggregate CH₄ or N₂O emission factor

Technology	CH ₄ emission factor (kg/Gg waste incinerated)	N ₂ O emission factor (kg/Gg waste incinerated)
Open Burning	6500	150 (dry weight basis)
Continuous incineration – Stoker bed	0.2	50
Continuous incineration – Fluidised bed	~0	50
Semi Continuous incineration – Stoker bed	6	50
Semi Continuous incineration – Fluidised bed	188	50
Batch incineration – stoker bed	60	60
Batch incineration – Fluidised bed	237	60
Industrial Waste – all incineration		100
Sewage sludge – incineration		900



INCINERATION AND OPEN BURNING

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: Emissions from Incineration of Waste

Data Gas: METHANE (CH4)

2024

Equation 5.4						Information for UNFCCC CRT					
Subdivision	Waste Category	Type of Waste	Total Amount of Waste incinerated (Wet Weight) (Gg Waste)	Methane Emission Factor (kg CH4/Gg Wet Waste)	Total Methane Emissions (Gg)	Amount of total waste of fossil origin (Gg Waste)	Amount of total waste of biogenic origin (Gg Waste)	Methane Emissions - Fossil Waste (Gg)	Methane Emissions - Biogenic Waste (Gg)		
Δ ▾	Δ ▾	I Δ ▾	AI	EFI	ETi = Ai * EFI / 10 ⁶	AFi	ABi	EFi = AFi * EFI / 10 ⁶	EBi = ABi * EFI / 10 ⁶		
Unspecified	Municipal...	Bulk Muni...	100	6	0.0006	21.3	78.7	0.00013	0.00047		
Total			100		0.0006	21.3	78.7	0.00013	0.00047		

Waste Type Manager Uncertainties Time Series data entry...

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: Emissions from Incineration of Waste

Data Gas: NITROUS OXIDE (N2O)

2024

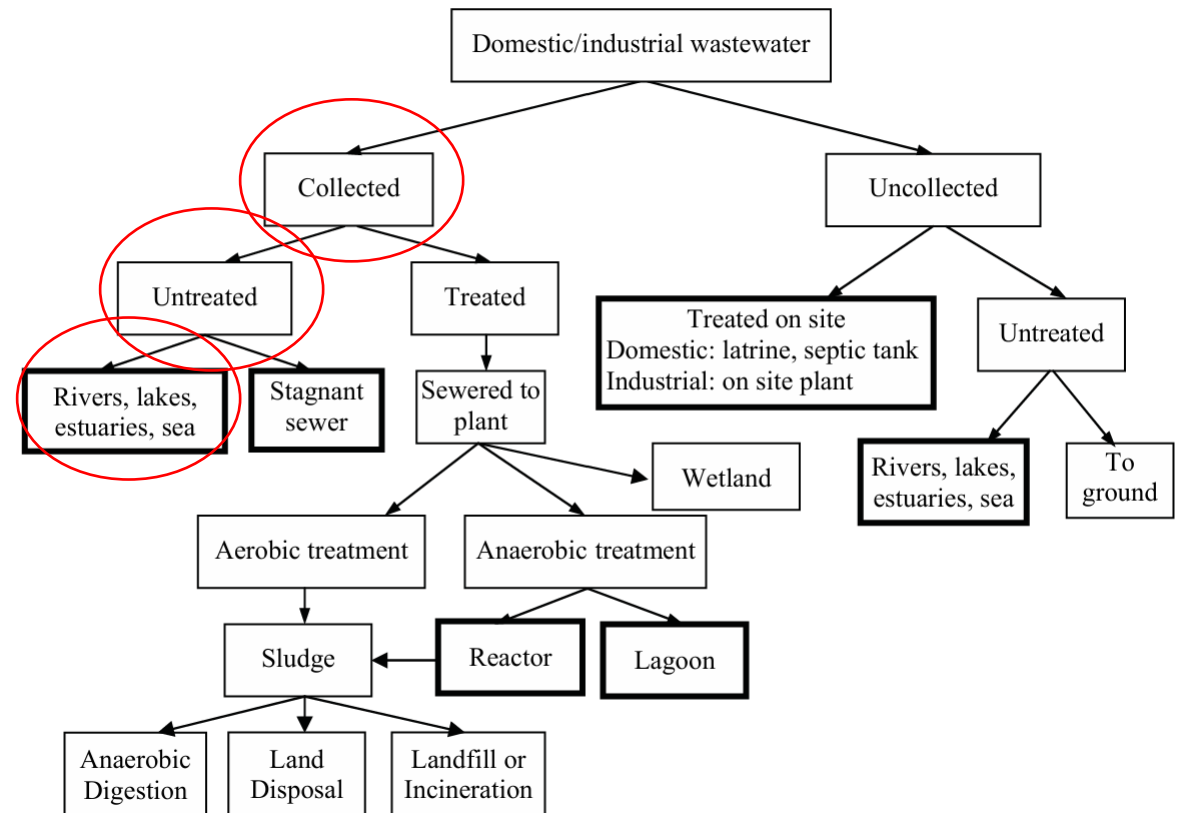
Equation 5.5						Information for UNFCCC CRT					
Subdivision	Waste Category	Type of Waste	Total Amount of Waste incinerated (Wet Weight) (Gg Waste)	N2O Tier 3	Nitrous Oxide Emission Factor (kg N2O/Gg Wet Waste)	Total Nitrous Oxide Emissions (Gg)	Amount of total waste of fossil origin (Gg Waste)	Amount of total waste of biogenic origin (Gg Waste)	Nitrous Oxide Emissions - Fossil Waste (Gg)	Nitrous Oxide Emissions - Biogenic Waste (Gg)	
Δ ▾	Δ ▾	I Δ ▾	AI	▾	EFI	ETi = Ai * EFI / 10 ⁶	AFi	ABi	EFi = AFi * EFI / 10 ⁶	EBi = ABi * EFI / 10 ⁶	
Unspecified	Municipal...	Bulk Muni...	100		50	0.005	21.3	78.7	0.00107	0.00394	
Total			100			0.005	21.3	78.7	0.00107	0.00394	

Waste Type Manager Uncertainties Time Series data entry...



WASTEWATER TREATMENT AND DISCHARGE

Wastewater can be a source of methane when treated or disposed anaerobically. It can also be a source of nitrous oxide emissions.



WASTEWATER TREATMENT AND DISCHARGE

The activity data for Methane emissions from this source category is the total amount of organically degradable material in the wastewater (TOW).

$$TOW = P \times BOD \times 0.001 \times 365$$

NBS 34 g/person/day

$$TOW_j = TOW * I * U * T$$

where,

I = correction factor for industrial BOD discharged (default for collected system is 1.25)

U = Utilization factor (which is 1 for Maldives)

T = Fraction of population in income group (assumed to be 1 for Maldives)



WASTEWATER TREATMENT AND DISCHARGE

The key activity data estimating nitrous oxide emissions from wastewater is the Total Nitrogen (TN_{dom}) present in domestic water.

$$TN_{dom} = P_{treatment} \times Protien \times F_{NPR} \times N_{HH} \times F_{NON-CON} \times F_{IND COM}$$

where,

$P_{treatment}$ = share of population served with the treatment pathway, which is 1 for Maldives

$Protien$ = annual per capita protein consumption, kg protein per person per year

F_{NPR} = fraction of nitrogen in protein, default is 0.16 kg N per kg protein

N_{HH} = additional nitrogen from household products added to the wastewater, default is 1.1

$F_{NON-CON}$ = factor for nitrogen in non – consumed protein disposed in system default is 1 for Maldives

$F_{IND COM}$ = factor for industrial and commercial codischarged protein into the system



WASTEWATER TREATMENT AND DISCHARGE

Area	Element	Year	Unit	Value
Maldives	Protein supply quantity (g/capita/day)	2010	g/cap/d	115.65
Maldives	Protein supply quantity (g/capita/day)	2011	g/cap/d	115.71
Maldives	Protein supply quantity (g/capita/day)	2012	g/cap/d	115.94
Maldives	Protein supply quantity (g/capita/day)	2013	g/cap/d	118.07
Maldives	Protein supply quantity (g/capita/day)	2014	g/cap/d	116.86
Maldives	Protein supply quantity (g/capita/day)	2015	g/cap/d	114.91
Maldives	Protein supply quantity (g/capita/day)	2016	g/cap/d	116.52
Maldives	Protein supply quantity (g/capita/day)	2017	g/cap/d	101.6
Maldives	Protein supply quantity (g/capita/day)	2018	g/cap/d	99.15
Maldives	Protein supply quantity (g/capita/day)	2019	g/cap/d	95.37
Maldives	Protein supply quantity (g/capita/day)	2020	g/cap/d	93.66
Maldives	Protein supply quantity (g/capita/day)	2021	g/cap/d	97.54
Maldives	Protein supply quantity (g/capita/day)	2022	g/cap/d	101.76

$$Protien = Protein_{supply} \times FPC$$

kg per
capita per
year 0.96
for
SA



WASTEWATER TREATMENT AND DISCHARGE

$$CH_4 \text{ emissions (in Gg)} = TOW_j \times EF_{CH_4} \times 10^{-6}$$

$$N_2O \text{ emissions (in Gg)} = TN_{dom} \times EF_{N_2O} \times 10^{-6}$$

The Methane emission factor for a wastewater treatment and discharge pathway and system is a function of the maximum CH₄ producing potential (Bo) and the methane correction factor (MCF) for the wastewater treatment and discharge system. The default value for Bo is 0.6 kg CH₄ per kg of BOD. The tier 1 methane correction factor is 0.11 (0.004-0.27).

	EF value
Methane Emission Factor (kg CH₄/kg BOD)	0.068
Indirect Nitrous Oxide emission factor (kg N₂O / kg N)	0.005

WASTEWATER TREATMENT AND DISCHARGE

CH4 Emissions

Worksheet

Sector: Waste

Category: Wastewater Treatment and Discharge

Subcategory: 4.D.1 - Domestic Wastewater Treatment and Discharge

Sheet: CH4 Emissions from Domestic Wastewater

Data

2024

Equation 6.1, 6.3													
Subdivision (Region, city, etc.)	Weighted Emission Factor (kg CH4/kg BOD)	Population (Capita)	Degradable organic component (g/cap/day)	Correction factor for industrial BOD discharged in sewers	Organically degradable material in wastewater (kg BOD/yr)	Sludge removed (kg BOD/yr)	Methane recovered (kg CH4)	CH4 Emissions (kg CH4)	CH4 Emissions (Gg CH4)				
$\Delta \nabla$	WEF	P	BOD	I	$TOW = P \cdot BOD \cdot 0.001 \cdot I \cdot 365$ or specified	S	Flaring F	Energy use R	$E = WEF \cdot (TOW - S) - F - R$	E / 1000000			
Unspecified	Specified	0.68	1000	34	Calculated	1.25	Calculated	15512.5	0	0	0	10548.5	0.01055
Total					15512.5	0	0	10548.5	0.01055				

Correction factor for industrial BOD discharged in sewers

Correction factor for industrial BOD discharged in sewers			
Type of treatment and discharge pathway or system	Degree of utilization (Fraction)	Correction factor for industrial BOD discharged in sewers	
J	Pj	Ij	
Sea, river and lake discharge	1	1.25	
Total		$P = \sum(P_j) = 1$	
		Collect Type	Default Value
		Collected	1.25
		Uncollected	1

Cancel

Save

Weighted Emission Factor

Equation 6.1, 6.2

Income Group	Fraction of Population in Income Group (Fraction)	Weighted Emission Factor (kg CH4/kg BOD)	
i	Ui	WEFi	
Urban high income	1	0	

Type of treatment and discharge pathway or system	Degree of utilization (Fraction)	Maximum methane producing capacity (kg CH4/kg BOD)	Methane correction factor for treatment system (Fraction)	Emission Factor (kg CH4/kg BOD)	Weighted Emission Factor (kg CH4/kg BOD)
j	Tij	Bo	MCF	EFj = Bo * MCF or specified	WEFj = Ui * Tij * EFj
0.6	Calculated				

System	Type of treatment and discharge pathway or system	Comments	Methane correction factor for treatment system (Fraction)	Range
Untreated	Septic system	Half of BOD settles in anaerobic tank.	0.5	0.5
	Flowing sewer (open or closed)	Fast moving, clean. (Insignificant amounts of CH4 from pump stations, etc.)	0	0
	Sea, river and lake discharge	Rivers with high organics loadings can turn anaerobic.	0.1	0 - 0.2
	Stagnant sewer	Open and warm	0.5	0.4 - 0.8

Cancel



Ministry of Tourism and Environment
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CBIT Maldives

Capacity Building for Improved Transparency of
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WASTEWATER TREATMENT AND DISCHARGE

CH4 Emissions	CH4 Emissions from Constructed Wetlands	Direct N2O Emissions from Treatment Plants	Indirect N2O Emissions	Direct N2O Emissions from Constructed Wetlands								
Worksheet				2024								
Sector:		Waste										
Category:		Wastewater Treatment and Discharge										
Subcategory:		4.D.1 - Domestic Wastewater Treatment and Discharge										
Sheet:		Indirect N2O Emissions from Wastewater										
Data												
Equation 6.7, 6.8												
Subdivision (Region, city, etc.)	Population (P) (people)	Per capita protein consumption (Protein) (kg/person)	Fraction of nitrogen in protein (F _{np}) (kg N/kg Protein)	Fraction of non-consumption protein (F _{non-con}) (-)	Fraction of industrial and commercial co-discharged protein (F _{ind-com})	Nitrogen removed with sludge (N _{sludge}) (kg)	Total nitrogen in effluent (N _{effluent}) (kg N/yr)	Nitrogen from Wastewater plants (kg N/yr)	Emission Factor (kg N2O-N/kg N)	N2O Emissions (kg N2O/yr)	N2O Emissions (Gg N2O/yr)	
Δ ∇	A	B	C	D	E	F	G = (A*B*C*D*E)-F)	H	I	J = (G - H) * I * 44/28	K = J / 10^6	
* Unspecified	1000	37.14	0.16	1	1.25	0	7428	0.03977	0.005	58.36254	0.00006	
*												
Total							7428			58.36254	0.00006	

QA/QC

- Cross-check country-specific values for MSW generated, industrial waste generated and waste composition against the default IPCC values, to determine whether the national parameters used are considered reasonable relative to the IPCC default values
- Reviewing survey data collection methods and checking the data to ensure that they were collected and aggregated correctly.
- Cross-check the data with previous years to ensure the data are reasonable and are consistent in the time series
- Evaluating secondary data sources and referencing QA/QC activities associated with the secondary data preparation especially check the consistency of the secondary data with the data requirements of greenhouse gas inventory.
- Seek experts review for the selection of values for the parameters
- Compare national emission rates with those of similar countries that have comparable demographic and economic attributes to understand any discrepancies between countries and determine if they represent any source of errors.

