WASTE SECTOR INVENTORY









DISCLAIMER

All rights reserved. No part of this publication may be reproduced, stored in a retrieval system or transmitted, in any form or by any means, electronic, photocopying, recording or otherwise, for commercial purposes without prior permission of Vanuatu. Otherwise, material in this publication may be used, shared, copied, reproduced, printed and/or stored, provided that appropriate acknowledgement is given to Vanuatu and ICAT as the source. In all cases the material may not be altered or otherwise modified without the express permission of Vanuatu.

PREPARED UNDER

The Initiative for Climate Action Transparency (ICAT), supported by Austria, Canada, Germany, Italy, the Children's Investment Fund Foundation and the Climate Works Foundation.



The ICAT Secretariat is managed and supported by the United Nations Office for Project Services (UNOPS)

Changement climatique Canada

UNOPS

Climate Change Canada







Table of Contents

DISCLAIMER	1
PREPARED UNDER	1
LIST OF TABLES	3
LIST OF FIGURES	4
ABBREVIATIONS AND ACRONYMS	5
4.1: WASTE OVERVIEW	6
4.1.1: CATEGORY OVERVIEW	6
4.1.2: SOLID WASTE DISPOSAL (SWD) ON LAND AND DOMESTIC WAS VANUATU	TEWATER IN
4.2: REFERENCE MANUAL	8
4.2.1: DATA COLLECTION	8
4.2.2. DATA SOURCES (DEPARTMENTS, STAKEHOLDERS)	11
4.2.3. DATA ASSUMPTIONS	15
4.3. CALCULATING GREENHOUSE GAS EMMISSIONS FROM WASTE S	SECTOR 17
4.4. IMPROVEMENT PLAN	97
4.5 REFERENCES	
4.6 ANNEX	







LIST OF TABLES

Table 1 Key Parameters for Activity Data (AD) in Solid Waste Disposal on Land8
Table 2 Additional activity data required to estimate methane (CH ₄) emissions in domestic water.
Table 3 Detailed Information of Collecting Data from Sources
Table 4 Percentage values for each of the different MSW site types29
Table 5 Percentage values for each of the different Industrial site types29
Table 6 Default values for each of the different types of sites
Table 7 Default value for MCF (fraction) and OX for the 2 types of SWDS
Table 8 Default values for MCF and OX under the Unmanaged Waste Disposal Sites53
Table 9 Annual emissions data from the base year of 1994 through 2023, including the emissions
values, their units, the emission factors, and the methods used to estimate the emissions57
Table 10 QC activities and procedures that will be followed59
Table 11 Responsibilities assigned to each party64
Table 12 Estimates of uncertainties associated with the default activity data and parameters in the
FOD method for CH ₄ emissions from SWDs68
Table 13 The QC activities and procedures that will be followed
Table 14 Annual emissions of CH ₄ and N ₂ O from the base year of 1994 to 2023, including the
emissions values, emission factors, and the methods used to estimate these emissions
Table 15 Default uncertainty ranges for Domestic Wastewater 95
Table 16 N ₂ O Methodology Default Emission factor and Activity data96







LIST OF FIGURES

Figure 1: Decision Tree Utilized for Method Selection in Estimating CH ₄ Emissions from Solid	
Waste Disposal Sites in Vanuatu1	7
Figure 2: Emissions of CH4 and N2O (in Gg) from Solid Waste Disposal and Wastewater, 2007-	-
2015	8
Figure 3: Decision Tree for Method Selection in Estimating Actual Emissions from Sub-	
Category 4.D.1 Domestic Wastewater Treatment and Discharge79	0







ABBREVIATIONS AND ACRONYMS

BOD	Biochemical Oxygen Demand
CH ₄	Methane
CO ₂	Carbon dioxide
DEPC	Department of Environmental Protection and Conservation
DOCC	Department of Climate Change
DOC	Degradable Organic Carbon
DWR	Department of Water Resources
FOD	First Order Decay
GHG	Greenhouse Gas
IPCC	Intergovernmental Panel on Climate Change
J-PRISM	Japanese Technical Cooperation Project for Promotion of Regional Initiative on Solid Waste Management in Pacific Island Countries
MCF	Methane Correction Factor
MSW	Municipal Solid Waste
N_2O	Nitrous Oxide
NMVOCs	Non-methane volatile organic compounds
OX	Oxidation Factor
PVCC	Port Vila City Council
PWD	Public Works Department
QA/QC	Quality Assurance/Quality Control
RTI	Right to Information
SWD	Solid Waste Disposal







4.1: WASTE OVERVIEW

4.1.1: CATEGORY OVERVIEW

The waste sector in the 2006 IPCC Guidelines for National Greenhouse Gas Inventories provides methodological guidance for estimation of carbon dioxide (CO₂), methane (CH₄) and nitrous oxide (N₂O) emissions from the following waste categories (See Figure A4.1 in Annex):

- Solid Waste Disposal (SWD)
- ✤ Biological treatment for solid waste
- Incineration and open burning of waste
- ✤ Wastewater treatment and discharge

Usually, CH₄ emissions from Solid Waste Disposal sites (SWDS) are the largest source of greenhouse gas emissions within the waste sector. Incineration and open burning of waste having fossil carbon such as plastics are major sources of CO_2 emissions under the waste sector. In SWDS, wastewater treatment and burning of non-fossil waste, CO_2 is also produced. However, the CO_2 produced is of biogenic origin hence it is not recommended to be reported in this sector¹. The N₂O oxide is produced in most of the treatments addressed in the waste sector. It is significant in various ways depending mostly on conditions and treatment type.

Non-methane volatile organic compounds (NMVOCs) such as nitrogen oxide (NO_x), carbon monoxide (CO) and ammonia (NH₃) are also products from waste and wastewater treatment and discharge. Nonetheless, the waste volume does not provide specific methodologies for the estimation of emissions from these gases. In general, indirect N₂O produced from NMVOCs within the waste sector is expected to be insignificant (Pipatti & Svardal, 2006).

Solid Waste Disposal on land (excluding burning of waste) and Domestic wastewater treatment and discharge occurs in Vanuatu. Hence, these are the two waste categories that will be covered in this manual.

4.1.2: SOLID WASTE DISPOSAL (SWD) ON LAND AND DOMESTIC WASTEWATER IN VANUATU

The waste sector in Vanuatu encompasses of solid waste and wastewater. The main gases in this sector comprise mainly of methane (CH₄) and nitrous oxide (N₂O) emissions estimated from the two categories, Solid waste Management and Disposal (excluding biological waste) and Domestic and Commercial wastewater (no industrial wastewater generation) (Ministry of Climate Change, 2020).

In solid waste management and disposal, the key source of methane emissions in Vanuatu is mostly from anaerobic decomposition of wastes that are discarded at Bouffa landfill sites in Port Vila,

¹ CO₂ emissions of biogenic origin are either covered by the methodologies and reported as carbon stock change in the AFOLU Sector, or do not need to be accounted for because the corresponding CO₂ uptake by vegetation is not reported in the inventory (e.g., annual crops).







Luganville and Lenakel SWDs. SWD constitutes to a great amount of total greenhouse gas (GHG) emissions in Vanuatu from the waste sector itself. The GHG emission from this sector is a major concern for the country. The common practice in the country of municipal solid waste (MSW) disposal comprises of disposal on land (collected and disposes on landfills), open backyard dumpsite, and disposal on unused land. SWD in urban areas poses many hazards compared to scattered waste in rural areas. The reason being high urban population produces a higher per capita MSW where the generation of organic fraction is relatively high. On the other hand, the shallow waste depths of disposal do not induce anaerobic conditions. These allows for lower emissions of methane in the rural areas in Vanuatu (MOCC, 2021)

The domestic wastewater in Vanuatu is greatly decentralized focusing on privately managed households and commercial septic tanks for collecting human wastes. The by-product of sludge and wastewater are produced from the waste decomposition process. Over time, residual sludge is extracted by private services through tankers and is disposed at allocated waste sites or the sea. The major GHG emissions from domestic wastewater include CH₄ and N₂O emissions. Reports have stated that though GHG emissions from wastewater may not be relevant in Vanuatu, the emissions are posing environmental hazards by increasing in time. Moreover, Tourism sector is a major contributor to the country's economy hence the waste sector may negatively impact the tourism sector in Vanuatu (Ministry of Climate Change, 2020).







4.2: REFERENCE MANUAL

4.2.1: DATA COLLECTION

4.2.1.1: SOLID WASTE DISPOSAL ON LAND

The basic activity data requirements needed for First Order Decay (FOD) for Solid Waste Disposal on Land in Vanuatu comprises of:

- The total population and GDP for the period of 1950 to 2022 to estimate CH₄. The activity data can be actual or modelled.
- Waste generation per capita (kg/cap/year). If not available, use IPCC default value for Caribbean.
- Waste Composition (If no country-specific data is available, break the total waste diverted to SWDs into composition with the use of default IPCC default for Oceania). If country-specific data are available, use either the *waste composition* or a *bulk waste* approach. The *waste composition* approach is a great initiative if the waste management practices changes.
- The types of solid waste management sites in Vanuatu with the distribution (%) of waste among these sites.

Table 1: Key Parameters for Activity Data (AD) in Solid Waste Disposal on Land

Activity Data	Key Parameters	Units
Key Parameters for AD-1		
General Population and	The country's population	In millions
Climate Data	 Total population served by waste 	In millions
	management services	
	 The mean average temperature 	In Degree Celsius
	 Climate Zone: Tropical Wet for Vanuatu 	(°C)
Characteristics of the solid	✤ Anaerobically	
waste disposal sites in	 Semi-aerobically 	
Vanuatu, the fraction of waste	 Deep sites and/or high-water table 	
managed:	 Shallow Sites 	
	 Uncategorized 	
Key Parameters for AD-2		
Information on total waste	 Total MSW (municipal solid waste) 	(tonne/capita/yr.)
generation by population	generation	
	 Does MSW include industrial waste 	
	generated? (Yes, or no?)	In kilo tonnes
	If No, estimate total industrial waste	(kt).
	generated	
	Is sludge deposited in SWDS?	In kilo tonnes
	If yes, how much sludge was deposited?	(Kt)
		In kilo tonnes (kt)







	Total clinical waste (generally not included)	
	in MSW)	
	 Total hazardous waste (generally not 	In kilo tonnes (kt)
	included in MSW)	
Key Parameters for AD-3		
Waste flows: fraction of total	\checkmark % of the amount collected that goes to	
MSW collected (should total	solid waste disposal sites (SWDS).	
to 100%)	 % of the amount collected that fraction sent to compositing 	
	• % of the amount collected that fraction is	
	open burned.	
	\checkmark % of the amount collected that in	
	incinerated	
	\clubsuit % of the amount collected that sent to	
	recycling.	
Waste flows: fraction of	\clubsuit % of the amount not collected waste that is	
MSW not collected (should	sent to composting.	
total up to 100%)	\clubsuit % of the amount not collected waste that is	
	open burned	
	\diamond % of the amount not collected waste that is	
	sent to recycling.	
Key Parameters for AD-4		
Composition of waste in	✤ % Food	
Vanuatu (should total to	✤ % Garden	
100%)	✤ % Paper/Cardboard	
	♦ Wood	
	✤ % Textiles	
	✤ % Rubber/leather, etc	
	If data is not available, use IPCC default values for	
	Caribbean.	
Management practices at	✤ Are you recovering landfill gas? (Yes/No)	Landfill gas unit
Landfills	If yes, amount of landfill gas recovered)	in kt
	• How is landfill gas recovery estimated?	

4.2.1.2: DOMESTIC WASTEWATER

4.2.1.2.1: METHANE (CH₄) EMISSIONS IN DOMESTIC WASTEWATER

The activity data for Domestic Wastewater in Vanuatu to estimate methane (CH₄) is the total amount of organically degradable material in wastewater (TOW). To calculate TOW, the required data should be gathered:

- ➤ The country's population
- Country-specific per capita Biological Oxygen Demand (BOD), (g/person/day). If unavailable, use default value for region "Latin America", being the closest to Caribbean (*Refer to Annex* Table A4.1).







- > 0.001 = To convert from BOD (grams) to BOD (kilograms)
- The correction factor (I) for additional industrial BOD that is discharged into sewers. (Note that for collected the default value is 1.25, for uncollected the default is 1.00).

(See 2006 IPCC Guidelines, Volume 5 Chapter 6, Wastewater treatment and Discharge, Section 6.2.2.3 for the Choice of Activity Data and Equation 6.3).

Table 2: Additional activity data required to estimate methane (CH₄) emissions in domestic water.

ACTIVITY DATA	NOTES	UNITS
Total Organic Component		kg BOD/yr.
removed as sludge		
Fraction of Population in	Income groups in Vanuatu	In millions
Income group (i)	High Income Group	
	Medium Income	
	Group	
	Low Income Group	
The degree of utilization of	Vanuatu lacks proper sewage	
treatment/discharge pathway or	and wastewater treatment	
system, j, for each income	systems. Waste is disposed	
group fraction	via:	
	• Illegal stormwater	
	connections	
	• Direct discharge to	
	poor	
	designed/maintained	
	septic systems that	
	leach contaminants	
	into coastal and	
	freshwater system	
The Emission factor	Use default for values for B _o	kg CH4 /kg BOD
	and MCF _j to calculate EF	
	from equation.	
	$EFj = Bo \bullet MCFj$	
	(See Annex Table A4.2 &	
	Table A4.3)	
The amount of CH ₄ recovered		kg CH ₄ /yr.

(See 2006 IPCC Guidelines, Volume 5 Chapter 6, Wastewater treatment and Discharge, Section 6.2.2.1 for the Domestic wastewater Choice of Method and Equation 6.1).







4.2.1.2.2: INDIRECT NITROUS OXIDE (N2O) EMISSIONS IN DOMESTIC WASTEWATER

At present, Vanuatu lacks treatment plants. When treatment plants are established in the future, Direct N₂O emissions can be calculated utilizing the following activity data requirements:

- > The total amount of nitrogen in wastewater effluent (N/yr.)
- Country's population (millions)
- > Protein consumption (annual per capita protein consumption (kg/person/year.)).
- Fraction of nitrogen in protein, default = 0.16 (N/kg protein)
- > Default factor for non-consumed protein added to the wastewater. (See Annex Table A4.4 for $F_{NON-CON}$)
- Default factor for industrial and commercial co-discharged protein into the sewer system. (See Annex Table A4.4 for F_{IND-COM})
- > Nitrogen removed with sludge (default = zero), kg N/yr.

(See 2006 IPCC Guidelines, Volume 5 Chapter 6, Wastewater treatment and Discharge, Section 6.3.1.3 for the Domestic wastewater, Choice of Activity Data and Equation 6.8).

4.2.2. DATA SOURCES (DEPARTMENTS, STAKEHOLDERS)

The country's specific data can be collected from the following departments/stakeholders/organization:

- Department of Environmental Protection and Conservation (DEPC)
- Department of Water Resources (DWR)
- Port Vila City Council (PVCC)
- Environment Unit, Public Health at the Ministry of Health
- Department of Climate Change (DOCC)
- UNELCO Engie
- Public Works Department (PWD)

Once a data set is selected, a more detailed formal specification of data should be created. A clear clarity of data requirements will allow data that is requested from the different departments/organizations to be delivered upon expectation (Goodwin, Woodfield, Ibnoaf, Koch, & Yan, 2006). The specification should include details such as:

- Definition of the data set (e.g., time series, sectors and sub-sector detail, national coverage, requirements for uncertainty data, emission factors and/or activity data units).
- The format (e.g., spreadsheet) and structure (e.g., what different tables are needed and their structure) of the data set,
- Description of any assumptions made regarding national coverage, the sectors included, representative year, technology/management level, and emission factors or uncertainty parameters.







- Identification of the routines and timescales for data collection activities (e.g., how often is the data set updated and what elements are updated).
- Reference to documentation and QA/QC procedures.
- Contact name and department/ organization.
- Date of availability.

Flow chart 4.1: Details of access to data sources by Department of Climate Change (DOCC)



Table 3 Detailed Information of Collecting Data from Sources.

Department/	Roles and	Dates	Relevant	Contact Person	Comments
Organization	Responsibility		Governing		
			Arrangement		
Department of	To provide	First week of	A Memorandum	Department of	For significant
Water	information on	April– First	of understanding	water resources	information and
Resources	measurements	week of May	or Right to	Tel:	data collection,
(DWR)	and analysis of	every year	Information (RTI)	(678)22423/3343	DOCC needs to
	BOD, COD, and		can be provided	5	send a prompt
	activity data on		between DWR	Email:	letter to DWR
	Domestic		and DOCC	esteitoka@vanua	two
	wastewater			<u>tu.gov.vu</u>	months prior.
	operations				
	(collection and				A follow-up
	disposal of				email or call is
	waste) in rural				crucial as well.
	areas in Vanuatu.				
Department of	To provide	First week of	A Memorandum		
Environmental	relevant	April– First	of understanding	Environment	For significant
Protection &	information on	week of May	or Right to	Unit	information and
Conservation	activity data and	every year	Information (RTI)		data collection,
(DEPC)			can be provided		DOCC needs to







	key parameters on SWD on land.		between DEPC and DOCC	Name: Ionie Bolenga (Principal Officer on Waste Management and Pollution Control) Email: ibolenga @vanuatu.gov.v U Name: Annabelle Alilee (Pollution Control Officer) Email: aalilee@vanuatu. gov.vu	send a prompt letter to DEPC two months prior. A follow-up email or call is crucial as well.
Public Works Department (PWD)	To provide relevant information and data on the operation (collection and disposal) of domestic wastewater in Urban and sub- urban areas.	First week of April– First week of May every year	A Memorandum of understanding or Right to Information (RTI) can be provided between PWD and DOCC	Public Works Department Email: <u>pwdheadoffice@</u> <u>vanuatu.gov.vu</u> Tel: 33460 or 22790	For significant information and data collection, DOCC needs to send a prompt letter to PWD two months prior. A follow-up email or call is crucial as well.
UNELCO Engie	To provide relevant information and data on the operation (collection and disposal) of domestic wastewater in Urban and sub- urban areas.	First week of April– First week of May every year	A Memorandum of understanding or Right to Information (RTI) can be provided between UNELCO and DOCC	UNELCO ENGIE Email: <u>unelco@engie.co</u> <u>m</u> Tel: 26000	For significant information and data collection, DOCC needs to send a prompt letter to UNELCO two months prior. A follow-up email or call is crucial as well.
Port Vila City Council (PVCC)	To provide relevant information and	First week of April– First	A Memorandum of understanding or Right to		For significant information and data collection,







	data on the	week of May	Information (RTI)		DOCC needs to
	operation of	every year	can be provided		send a prompt
	SWD on land		between PVCC		letter to PVCC
	and domestic		and DOCC		two
	wastewater				months prior.
	management				
	within its				A follow-up
	jurisdiction.				email or call is
					crucial as well.
Densaturent		Dehmann	Drozvida a	Nome Nelsen	
Department of	DOCC 18	February –	Provide a	Name: Nelson	DOCC IS
Chimate	responsible to	March every	Memorandum of	Kalo Director of	doing a fallow
(DOCC)	send a formal	year	understanding or	Director of	doing a lonow-
(DUCC)	relevant data and		Right to	Email:	depertments or
	information on		to the	Elliali.	departments of
	SWD on land		to the Environmental	<u>nekalo@vanuatu</u>	the required
	and Domostic		Division and	<u>.gov.vu</u>	dete to bo
	Westewater to		Conservation		dalivered upon
	the		The Department		schedule
	Environmental		of Water		senedule.
	Protection and		Resources Public		
	Conservation		Works		
	The Department		Department		
	of Water		UNELCO. Port		
	Resources.		Vila City		
	Public Works		Council, and the		
	Department,		Environment Unit		
	UNELCO, Port		under the		
	Vila City		Ministry of		
	Council, and the		Climate Change		
	Environment				
	Unit under the				
	Ministry of				
	Climate Change.				







4.2.3. DATA ASSUMPTIONS

Solid Waste Disposal

The main considerations and assumptions made are provided for both bulk and waste composition options to estimate methane emissions on Solid waste disposal on land in Vanuatu (See 2006 IPCC Guidelines, Volume 5 Chapter 3 Solid Waste Disposal, Section 3.2.3, Choice for emission factors and parameters under Half-life).

- The default assumption for the time delay is that the reaction starts on the first of January in the year of deposition, which is equivalent to an average delay time of six months before decay to methane commences ("Delay time = 6"). It is best to assume an average delay time of six months. If a value greater than six months is chosen, evidence to support this must be provided.
- Waste composition (especially the organic component) is one of the main factors influencing both the amount and the timing of CH4 production.
- Moisture content of a SWDS is an essential element for anaerobic decomposition and CH4 generation. A simplified method assumes that the moisture content of a SWDS is proportional to the mean annual precipitation (MAP) in the location of the SWDS (Pelt *et al.*, 1998; U.S. EPA, 1998; Environment Canada, 2003) or to the ratio of MAP and potential evapotranspiration (PET).
- The extent to which ambient air temperatures influence the temperature of the SWDS and gas generation rates depends mainly on the degree of waste management and the depth of SWDS.
- Waste in shallow open dumps generally decomposes aerobically and produces little CH4, and the emissions decline in shorter time than the anaerobic conditions. Managed (and deep unmanaged) SWDS creates anaerobic conditions.

Domestic Wastewater

The emission factor for N_2O emissions is based on limited field especially on specific assumptions considering the occurrence of denitrification and nitrification activities in rivers and estuaries (See 2006 IPCC Guidelines, Volume 5 Chapter 6, Wastewater treatment and Discharge, Section 6.3.1.2, Choice for emission factors and Section 6.3.4, QA/QC, Completeness, Reporting and Documentation). The assumptions provided are:

- All nitrogen is discharged with the effluent.
- N₂O production in rivers and estuaries is directly related to nitrification and denitrification and, thus, to the nitrogen that is discharged into the river. (See Volume 4, Table 11.3 of Section 11.2.2 in Chapter 11, N₂O Emissions from Managed Soils, and CO2 Emissions from Lime and Urea Application).







• All nitrogen associated with consumption and domestic use, as well as nitrogen from codischarged industrial wastewater, will eventually enter a waterway. As such, this estimate can be seen as a conservative estimate and covers the entire source associated with domestic wastewater use.







4.3. CALCULATING GREENHOUSE GAS EMMISSIONS FROM WASTE SECTOR

SOLID WASTE DISPOSAL (SWD)

4.3.1 METHODOLOGY CHOICE FOR SOLID WASTE DISPOSAL(SWD)

Figure 1: Decision Tree Utilized for Method Selection in Estimating CH₄ Emissions from Solid Waste Disposal Sites in Vanuatu



Figure 4.1: (See 2006 IPCC Guidelines, Vol.5, Figure 3.1)

Note: Due to the national circumstances (lack of resources) Vanuatu does not have yet reliable country-specific emission factors and parameters and therefore, and is therefore applying the default parameters and Tier 1 methods to estimate emissions from the category 4A – Solid Waste Disposal and its subcategories 4.A.1 Managed disposal sites, 4.A.2 Unmanaged Disposal Sites and 4.A.3 Uncategorized Waste Disposal.







EQUATIONS USED

1. Determine the Amount of Decomposed DOC Deposited in the SWDs Each Year

Step 1: FOD (first-order decay)

1.1 Estimating the mass of waste available for decomposition (DDOCm)

Equation 1

EQUATION 3.2 DECOMPOSABLE DOC WASTE DISPOSAL DDOCm = W x DOC x DOC_f x MCF

Where:

- **W** = Amount of waste (See 2006 IPCC Guidelines, Vol.5, Pg. 9, EQUATION 3.2)
- **DOC** = Degradable organic carbon in the waste (See 2006 IPCC Guidelines, Vol.5, Pg. 9, EQUATION 3.2).
- DOC_f = Fraction of DOC that can decompose anaerobically (See 2006 IPCC Guidelines, Vol.5, Pg. 9, EQUATION 3.2)
- ➤ MCF = Amount that will decompose anaerobically (See 2006 IPCC Guidelines, Vol.5, Pg. 9, EQUATION 3.2).
- **DOC**_f uses a default value of 0.5 (See IPCC Guidelines, Vol.5 Pg. 27, Table 3.5).

1.2 Determining the time series of waste decomposing

Equation 2

EQUATION 3.4

DDOCm ACCUMULATION IN THE SWDS AT THE END OF THE YEAR T

 $DDOC_{maT} = DDOC_{mdT} + (DDOC_{maT-1} \times e^{-k})$

Where:

- DDOC_{maT} = Mass of decomposable DOC accumulated at the end of the year. (See 2006 IPCC Guidelines, Vol.5, Pg. 9, EQUATION 3.4)
- DDOC_{mdT} = Amount of DOC deposited in the current year (See 2006 IPCC Guidelines, Vol.5, Pg. 9, EQUATION 3.4)
- (DDOC_{maT-1} x e^{-k}) = Amount of degradable waste accumulated from the previous year that has not yet decomposed (See 2006 IPCC Guidelines, Vol.5, Pg. 9, EQUATION 3.4)







Equation 3

EQUATION 3.5

 $DDOC_{m decompT} = DDOC_{maT-1} \times (1 - e^{-k})$

Where:

- T = Inventory year (See 2006 IPCC Guidelines, Vol.5, Pg. 9, EQUATION 3.5)
- DDOC_{maT} = DDOCm accumulated in the SWDS at the end of year T, Gg (See 2006 IPCC Guidelines, Vol.5, Pg. 9, EQUATION 3.5)
- DDOC_{maT-1} = DDOCm accumulated in the SWDS at the end of the year (T-1), Gg (See 2006 IPCC Guidelines, Vol.5, Pg. 9, EQUATION 3.5)
- DDOCmdT = DDOCm deposited into the SWDS in year T, Gg (See 2006 IPCC Guidelines, Vol.5, Pg. 9, EQUATION 3.5)
- DDOCm decompT = DDOCm decomposed in the SWDS in year T, Gg (See 2006 IPCC Guidelines, Vol.5, Pg. 9, EQUATION 3.5)
- ▶ \mathbf{k} = reaction constant, $k = \ln (2)/t1/2$ (y-1) (See 2006 IPCC Guidelines, Vol.5, Pg. 9, EQUATION 3.5)
- \blacktriangleright t1/2 = half-life time (y) (See 2006 IPCC Guidelines, Vol.5, Pg. 9, EQUATION 3.5)

2. Determine Methane Generated as a Result of Decomposition Each Year

Step 2: Converting DDOC to Methane Generated

Equation 4



CH4 GENERATED FROM DECAYED DDOCm

CH₄ generated = DDOCm decomp_T x F x 16/12,

Where:

- CH4 generated = Amount of CH4 generated from decomposable material (See 2006 IPCC Guidelines, Vol.5, Pg. 10, EQUATION 3.6)
- DDOCm decompt = DDOCm decomposed in year T, Gg (See 2006 IPCC Guidelines, Vol.5, Pg. 10, EQUATION 3.6).
- ➤ F = Fraction of CH₄, by volume, in generated landfill gas (fraction) (See 2006 IPCC Guidelines, Vol.5, Pg. 10, EQUATION 3.6).
- 16/12 = molecular weight ratio CH₄/C (ratio) (See 2006 IPCC Guidelines, Vol.5, Pg. 10, EQUATION 3.6).







> The **default value of** (**F**) = 0.5 (See 2006 IPCC Guideline, Vol.5, Pg.27, Table 3.1)

3. Determine Methane Emissions

Step 3: Converting Methane to Methane Emissions

Equation 5

EQUATION 3.1

CH₄ EMISSION FROM SWDS

CH₄ EMISISONS = $\left[\sum CH_4 \text{ GENERATED }_{X,T} - R\right] \times (1 - OX_T)$

Where:

- CH₄ Emissions = CH₄ emitted in year T, Gg (See 2006 IPCC Guidelines, Vol.5, Pg. 8, EQUATION 3.1)
- > $\mathbf{T} =$ Inventory year (See 2006 IPCC Guidelines, Vol.5, Pg. 8, EQUATION 3.1)
- **X** = Waste category or type/ material (See 2006 IPCC Guidelines, Vol.5, Pg. 8, EQUATION 3.1)
- R_T = Recovered CH₄ in year T, Gg (See 2006 IPCC Guidelines, Vol.5, Pg. 8, EQUATION 3.1)
- > $OX_T = Oxidation factor in year T. (fraction)$
- $\blacktriangleright \quad \text{Default value } \mathbf{R} = 0$
- > Default $OX_T = 0\%$ (See 2006 IPCC Guideline, Vol 5, pg. 15, Table 3.2)







<u>4.3.2 STEP – BY – STEP CALCULATION, DOCUMENTING RESOURCES</u> <u>USED</u>

1. USING THE FOD MODEL PARAMETERS:

FILE <u>https://www.ipcc-</u> nggip.iges.or.jp/public/2006gl/pdf/5 Volume5/IPCC Waste Model.xls

1.0 Open Google Browser and type in "IPCC Guidelines for National Greenhouse Gas Inventories" (See illustrations below)



1.1 Click on the website "2006 IPCC Guidelines for National Greenhouse Gas" (See illustration below).









1.2 Click on the "Vol.5 Waste" (See illustration below)

← → C ipcc-nggip.iges.or.jp/public/2006gl/			☆ ⊻ 💿 :
Task Force on National Greenhor	ise Gas Inventories	INTERGOVERNMENTAL PANEL ON CLIMATE CHARGE	Î
	Publications		
Home IPCC IPCC-TFI Home Organization Publications 2019 Refinement Wetlands Supplement KP Supplement 2006 IPCC Gudelines GPG-LUJUCF	2006 IPCC Guidelines for National Gree 2006 IPCC Guidelines Top 4 Vol 1 GGR 4 Vol 2 Energy Vol 3 IPPU Vol 4 Zenergy Vol 4 Zenergy Vol 4 Zenergy Vol 5 Waster 4 Valic Arabic Cick on the	nhouse Gas Inventories 2006 IPCC Guidelines for nal Greenhouse Gas Inventories Cover, Foreword and Preface The Overview The Overview The	
Degradation of Forest GPG2000 Revised 1996 IPCC Guidelines Totobicito Buildines	Chinese "Vol.5 Waste" French "Vol.5 Waste" Russian Spanish	List of Contributors as of April 2007.	
Fresentation Doctorino Presentation Support to Inventory Compilers Emission Factor Database (EFDB) Inventory Software	Cert Adobe Reader	sists of five volumes: <u>Volume 1 General Guidance and Reporting</u>	
Meetings FAOs Links Electronic Discussion Group (EDG)		<u>Volume 2 Energy</u>	

1.3 Click on the "IPCC Waste Model (MS Excel) (See illustration below)









1.4 Open the file, IPCC model https://www.ipcc-

nggip.iges.or.jp/public/2006gl/pdf/5_Volume5/IPCC_Waste_Model.xls

1.5 Note that the possible data entries are in tabs colored yellow (See red arrows below)

Y = IPCC_Waste_Model_Vanuatu_Pop Data [Compatibility Mode] - Excel Search	Sign in 🖬 – D X
File Home Insert Page Layout Formulas Data Review View Help	r Share
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	at ↓ Fill × Sort & Find & ↓ Fill × Sort & Find & \\ ↓ Fill × Sort & Find & \\ ↓ Fill × Sort & Find & \\ \end{pmatrix}
Clipboard 😼 Font 🔂 Alignment 🔂 Number 🔂 Styles Cells	Editing
M11 \checkmark : \times \checkmark f_x	۷
A B C D E F G H I J K L M	N O P Q 🔺
This spreadsheet implements the Tier 1 method for estimating emissions of methane from solid waste disposal sites. For details of the method and the 2006 IRCC Childeling of a Method Coopenance Coopenace Coopenance Coopenance Coopenace Coopenance Coopenance Coopena	
details of the method see the 2000 (FCC Guidelines for National Greenhouse das inventiones Volume 5 Chapter 5	
9 10 ©IPCC 2006	
12	
13 Introduction	
14 This spreadsheet has been developed by the IPCC to enable countries to estimate emissions of methane from solid waste disposal 15 sites (SWDS) using the frst order decay method. It also allows an estimation of the carbon stored in the SWDS by in the Harvested	
13 Wood Products (HWP) category as well as methane from HWP in SWDS. See Volume 4 Chapter 12 for details. 16	
17 Worksheets	
18 Instructions (This worksheet) Step by step guidance for using the model	
Parameters Data entry for praameters such as DOC and decay half life OL MCF Data entry for forstrolling of waste management threes (used to estimate a time series for the weighted average	
21 methane correction factor)	
Z2 Activity Usate entry for population and gross domestic product to estimate M SW and industrial waste generation 2 Amount Deposited D tate entry for waste end undustrial waste (from Activity Sheet)	
ZA Recovery_OX Data entry for methane recovery	
25 Results Displays results (methane generated and emitted) Start C Displays results (methane generated and emitted)	
26 Solido Company Calculation solidon and an entropy of the SNDS and methane emitted from Harvested Wood Products	
Theory Background to the First Order Decay theory and equations used in the model	
29 values iPCC default value primetna neration te constants by material type and te to the context of the cont	
30 Food Calculations to the steep of the ste	
31 Garden Calculations brother in (yang) wark wa 32 Paper Calculations brother in waste	
Instructions Parameters MCE Activity Amnt Deposited Recovery OX Results HWP Stored C Theory Defaults A : a	V
	■ ■ □ + 100%
η του μ	







1.6 Click on the tab "Parameters" (See red arrow in illustration below)

☐ ♡ · ♡ · ▼ IPCC_Waste_Model_Vanuatu_Pop Data [Compatibility Mode] - Excel		Sign ir	n 🖻 – Ö X
File Home Insert Page Layout Formulas Data Review View Help			යි Share
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	Format as Cell Inse Table ~ Styles ~ ~	rt Delete Format	Sum * A V Sort & Find & Filter * Select *
Clipboard 🔂 Font 🗔 Alignment 🔂 Number 🔂 St	tyles	Cells	Editing
M11 * : × ✓ fx			×
A B C D E F G H I J K	L	M N	0 P Q 🔺
This spreadsheet implements the Tier 1 method for estimating emissions of methane from solid waste disposal sites. For			
details of the method see the 2006 IPCC Guidelines for National Greenhouse Gas inventories volume 5 Chapter 3			
9 10 ©IPCC 2006			
12 13 Introduction			
14 This spreadsheet has been developed by the IPCC to enable countries to estimate emissions of methane from solid waste disposal			
15 Wood Products (HWP) category as well as methane from HWP in SWDS. See Volume 4 Chapter 12 for details.			
17 Worksheets			
18 Name Details Instructions (This worksheet) Step by step guidance for using the model			
19 Parameters Data entry for parameters such as DOC and decay half-life			
20 MCF Data entry for distribution of waste management types (used to estimate a time series for the weighted average methane correction factor)			
22 Activity Data entry for population and gross domestic product to estimate M SW and industrial waste generation			
23 Amnt_Deposited Data entry for waste am ounts disposed (or calculated from Activity sheet)			
24 Recovery_0X Data entry for methane recovery Recuter Displays results for Methane dependence of emitted (
25 Results Displays results and generated and emined (
T HWP Displays carbon store in the SWDS and methane emitted from Harvested Wood Products			
Theory Background to be First Order Decay theory, and equations used in the model			
29 Detaults IPCC detault values or methane generation rate constants by matenial type and climate zone, DOC values by waste type, doc waste or diversion composition, and disposal by region			
30 Food Calculations to bod viste			
31 Garden Calculations for any financial (yard) and park waste			
32 Paper Calculations for paper waste			•
Instructions Parameters MCF Activity Amnt_Deposited Recovery_OX Results HWP Stored_C	Theory Defaults	(+) : (•
B		E I	III _ ■ _ ± 10.09/

1.7 Click on the cell Country and enter Vanuatu (See red arrow below)

8	') · · · ▼ IPCC_Waste_Model_Vanuat	u_Pop Data [0	Compatibility N	/lode] - Excel	✓ Search				Sign in 📧 - O X
File	Home Insert Page Layout Fo	ormulas I	Data Revi	iew View	Help				🖻 Share
Past	$\begin{bmatrix} X \\ \Box \end{bmatrix} = \begin{bmatrix} Arial \\ B \end{bmatrix} I \\ \Box \end{bmatrix} = \begin{bmatrix} D $	× = = - = =	= ≫ ~ = = =	ab Wrap Te	ext 32 Center ~ \$ ~ %		Conditional Format as Cell Formatting ~ Table ~ Styles ~	Insert Delete Format	∑ AutoSum ~ A Z Fill ~ Sort & Find & Clear ~ Filter ~ Select ~ Etiting
Cipt		121	Aligi	interit	131 140		Styles	Cells	
G2	\bullet : $\times \checkmark J_x$								*
A	В	С	D	E	F			G	·
1 2 3 4 5 6	Parameters Please enter parameters in the yellow cells. Help on parameter selection can be found in t	Country Region f no national the 2006 IPC	Vanuatu_te Oceania: Oth data are avai C guidelines	<mark>st</mark> her Oceania lable, copy tł	ne IPCC default value.				
7		IPCC def	ault value	Countr	y-specific parameters				
8	Starting year		1950	Value 1950	Reference and rema	rks Notes			
10	Suring you		1550	1000					
11	DOC (Degradable organic carbon)	Waste by c	omposition 🔻						
12	(weight fraction, wet basis)	Range	Default						
13	Food waste	0.08-0.20	0.15	0.15		May include	garden waste provided that a suitable i	alue of DOC is used	
14	Garden	0.18-0.22	0.2	0.2		Garden (yard	i) and park waste and other moderate	/ fast degrading waste	
15	Paper Wood and straw	0.30-0.45	0.4	0.4					
17	Textiles	0.35-0.46	0.43	0.43		Natural textile	es such as wool and cotton. The defau	# DOC value assumes 40% of	textiles are synthetic materials that do not contain D
18	Disposable nappies	0.18-0.32	0.24	0.24		Hatarartoxia			textiles are synthetic indication and do not contain b
19	Sewage sludge	0.04-0.05	0.05	0.05					
20									
21	Industrial waste	0-0.54	0.15	0.15		The composi	tion of industrial waste will vary signific	antly by country. This DOC val	lue should match the amounts entered (see Guidelin
22 23 24	DOCf (fraction of DOC dissimilated)		0.5	0.5					
25	Methane generation rate constant (k)	Wet tempe	rate 💌						
4	Instructions Parameters	ИCF Activ	/ity Amnt	_Deposited	Recovery_OX Re	sults HWP	Stored_C Theory Defa	ults 🕂 🗄 🖣	•
Ready								=	□ □ + 100%







1.8 Click on the "Region" tab and choose "Oceania: other Oceania" (see illustration below).

] り、ピ、 マ IPCC_Waste_Model_Vanua	atu_Pop Data [(Compatibility N	/lode] - Excel	₽ Search				Sign in 🖻 — 🔿 X
File	Home Insert Page Layout F	ormulas	Data Revi	iew View	Help				🖻 Share
Past	$\begin{bmatrix} 1 & X \\ \vdots & \vdots \\ \vdots & \vdots \\ \bullet & \checkmark \\ B & I & \cup & \neg & 0 \\ B & I & \cup & \neg & 0 \\ board & 5 & Font \\ \end{bmatrix}$	A× = ≡	= ≫ ~ =	ab Wrap Te	ext & Center ~ \$ ~ \$	% 9 (Conditional Format as Formatting ~ Table ~ Sty Styles	Cell Insert Delete Format Cells	∑ AutoSum × A Z Fill × Sort & Find & Clear × Filter × Select × Editing ∧
G2	\bullet : $\times \checkmark f_x$								•
	N P	L C	D	E	F			C	
1 2	Parameters	Country	Vanuatu te	st			-		
3 4 5	Please enter parameters in the yellow cells. Help on parameter selection can be found in	Region If no national the 2006 IPC	Oceania: Oth data are avai C guidelines	ner Oceania Iable, copy th	ne IPCC default value.				
6 7		IPCC def	ault value	Countr	y-specific parameters	s			
8	I. .			Value	Reference and rem	arks Notes			
9	Starting year		1950	1950					
10	DOC (Degradable organic carbon)	Waste by c	omposition 🔻						
12	(weight fraction, wet basis)	Range	Default						
13	Food waste	0.08-0.20	0.15	0.15		May include g	arden waste provided that a su	itable value of DOC is used	
14	Garden	0.18-0.22	0.2	0.2		Garden (yard) and park waste and other mod	lerately fast degrading waste	
15	Paper	0.36-0.45	0.4	0.4					
16	Wood and straw	0.39-0.46	0.43	0.43					
1/	l'extiles	0.20-0.40	0.24	0.24		Natural textile	s such as wool and cotton. The	default DOC value assumes 40% of t	textiles are synthetic materials that do not contain D
19	Sewage sludge	0.04-0.05	0.24	0.24					
20	eenage diauge	0.04 0.00	0.05	0.00					
21	Industrial waste	0-0.54	0.15	0.15		The composit	ion of industrial waste will vary	significantly by country. This DOC val	lue should match the amounts entered (see Guidelin
22									
23	DOCf (fraction of DOC dissimilated)		0.5	0.5					
24		-	· –						
25	Methane generation rate constant (k)	wet tempe	rate 💌						.
4	Instructions Parameters	MCF Activ	vity Amnt	_Deposited	Recovery_OX R	esults HWP	Stored_C Theory	Defaults (+) 🗄 🔳	Þ
Ready	y .								■

1.9 Enter the default starting year as 1950 in the "Parameters" Worksheet. (See below).

۵	』り、ペッ マ IPCC_Waste_Model_Vanu	atu_Pop Data [0	Compatibility N	/lode] - Excel	₽ Search					Sign in 📧 —	o x
File	e Home Insert Page Layout	Formulas	Data Rev	iew View	Help						🖻 Share
Pas ⁻	$ \begin{array}{c} \begin{array}{c} \begin{array}{c} \begin{array}{c} \begin{array}{c} \\ \end{array} \\ \end{array} \\ \end{array} \\ \begin{array}{c} \\ \end{array} \\ \end{array} \\ \end{array} \\ \end{array} \\ \begin{array}{c} \\ \end{array} \\ \end{array} \\ \begin{array}{c} \end{array} \\ \end{array} \\ \end{array} \\ \begin{array}{c} \begin{array}{c} \end{array} \\ \end{array} \\ \end{array} \\ \begin{array}{c} \begin{array}{c} \end{array} \\ \end{array} \\ \end{array} \\ \begin{array}{c} \begin{array}{c} \end{array} \\ \end{array} \\ \end{array} \\ \end{array} \\ \begin{array}{c} \end{array} \\ \end{array} \\ \end{array} \\ \begin{array}{c} \begin{array}{c} \end{array} \\ \end{array} \\ \end{array} \\ \end{array} \\ \begin{array}{c} \end{array} \\ \end{array} \\ \end{array} \\ \end{array} \\ \begin{array}{c} \end{array} \\ \end{array} \\ \end{array} \\ \end{array} \\ \begin{array}{c} \end{array} \\ \end{array} \\ \end{array} \\ \end{array} \\ \begin{array}{c} \end{array} \\ \end{array} \\ \end{array} \\ \end{array} \\ \end{array} \\ \end{array} \\ \begin{array}{c} \end{array} \\ \end{array} $	A [×] Ξ Ξ	= %* * =	åb Wrap Te 臣 Merge 8	ext & Center ~ \$ ~	% 9	←0 .00 .00 →0 Conditional Formatting ~	Format as Cell Table ~ Styles ~	Insert Delete Format	∑ AutoSum ~ Ar Fill ~ Zr Sort & Find & Filter ~ Select ~	
Clip	board S Font	5	Aligr	nment	51	Number	F <u>a</u>	Styles	Cells	Editing	~
yea	ar $\overline{}$: $\times \checkmark f_x$ 1950										~
	АВ	С	D	E	F				G		
1 2 3 4 5 6	Parameters Please enter parameters in the yellow cells Help on parameter selection can be found i	Country Region f no national n the 2006 IPC	Vanuatu_te Oceania: Oth data are avai C guidelines	r <mark>st</mark> ner Oceania ilable, copy tł	ne IPCC default value	.					
7		IPCC def	ault value	Countr	y-specific paramete	ers					
8			4050	Value	Reference and re	marks No	otes	Tatas the Start			
9	Starting year		1950	1950		<u> </u>		Enter the start	nig year		
11	DOC (Degradable organic carbon)	Waste by c	omposition 🔻				-				
12	(weight fraction, wet basis)	Range	Default								
13	Food waste	0.08-0.20	0.15	0.15		Ма	ay include garden waste pro	ovided that a suitable va	alue of DOC is used		
14	Garden	0.18-0.22	0.2	0.2		Ga	arden (yard) and park wast	e and other moderately	fast degrading waste		
15	Paper	0.36-0.45	0.4	0.4							
10	Vvood and straw	0.39-0.46	0.43	0.43		N.	Access the second second second	and anthen The default	D00		t anatala D
18	Disposable nannies	0.20-0.40	0.24	0.24		na	itural textiles such as wool	and cotton. The default	DOC value assumes 40% of t	extiles are synthetic materials that do no	it contain D
19	Sewage sludge	0.04-0.05	0.05	0.05							
20											
21	Industrial waste	0-0.54	0.15	0.15		Th	e composition of industrial v	waste will vary significa	antly by country. This DOC vali	ue should match the amounts entered (s	ee Guidelin
22											
23	DOCf (fraction of DOC dissimilated)		0.5	0.5							
24											
25	Methane generation rate constant (k)	Wet tempe	rate 💌								V
	Instructions Parameters	MCF Activ	/ity Amnt	_Deposited	Recovery_OX	Results	HWP Stored_C	Theory Defau	lts (+) ∶ ((Þ







1.10. Fill in the "DOC (Degradable Organic Carbon)" in the "Parameters" Worksheet (See the red arrow pointing to where to fill in the values for DOC and the Blue arrow indicates where the IPCC Default values are if no national data is available.)

File	Home	e Insert	Page Layout	Formulas	Data Rev	riew View	Help											Ŕ	Share	
Past		Arial B I <u>U</u> ∽	• 10 • A^	A [×] Ξ Ξ	= % ~ = = = =	ề₽ Wrap Te ➡ Merge 8	xt & Center 👻 \$	• % 9	× 0.0.0.⊖ 0.0	Conditional Formatting ~	Format as Table ~	Cell Styles ~	Insert v	Delete For	rmat	∑ AutoSun ↓ Fill ∽ ♦ Clear ∽	n 🎽 A Z Sort & Filter ~	Find & Select ¥		
Clip	board 🗔		Font	5	Aligi	nment	5	Number	F3		Styles			Cells			Editing			^
cou	ntry 🔻	: × •	∫ <i>f</i> ∗ Vanu	atu_test																۷
A	AI.	В		С	D	E	F							G						
1																				П
2	Parame	eters		Country	Vanuatu_te	est														
3				Region	Oceania: Ot	her Oceania		•												
4	Please er	nter parameters	in the yellow cells	. f no nationa	al data are ava	ilable, copy th	ne IPCC default v	alue.												
5	Help on p	arameter selecti	ion can be found i	n the 2006 IP(CC guidelines															
6																				
7				IPCC de	fault value	Countr	y-specific paran	neters												
8						Value	Reference and	d remarks	Notes											
9	Starting	year			1950	1950														
10																				
11	DOC (De	gradable orgai	nic carbon)	Waste by	composition V															
12	(weight	t fraction, wet t	asis)	Range	Default	0.45														
13	Food was	ste		0.00.02	0 0.15	0.15			May include	garden waste pr	ovided that a	suitable va	alue of DOC	is used						
14	Garden		1 1 1 1	26.0.4	2 0.2	0.2	\leq		Girden (yard) and park wast	e and other i	moderately	fast degrad	ding waste						
16	Wood and	d etraw	derault value	0.30-0.4	6 0.4	0.4	To for the second		-											
17	Textiles	a shaw		0 20-0 4	0 0.43	0.43	If no nationa	ues. 1	Natural textile	es such as wool	and cotton	The default	DOC value	assumes 40)% of tex	tiles are synth	netic materials	that do not co	ontain D	
18	Disposab	le nappies		0.18-0.3	2 0.24	0.24	data is availa	ihle												•
19	Sewage s	sludge		0.04-0.0	5 0.05	0.05	then use the													
20							default value	s												
21	Industrial	waste		0-0.5	4 0.15	0.15			The composi	tion of industrial	waste will va	ary significa	antly by cou	untry. This D	OC value	e should match	the amounts	entered (see	Guidelin	
22																				
23	DOCf (fra	action of DOC d	issimilated)		0.5	0.5														
24																				
25	Methane	generation ra	te constant (k)	Wet temp	erate 💌															Ŧ
	•	Instructions	Parameters	MCF Act	ivity Amn	t_Deposited	Recovery_OX	Results	HWP	Stored_C	Theory	Defau	lts 🤆	€ : ∢					Þ	

1.11. Enter the DOC default value 0.5 into the yellow cell E23 (See red arrow below)

File	Home Insert Page Layout Fo	ormulas (Data Revi	ew View	Help		ピ Share
Past	$ \begin{array}{c c} X \\ \hline \\ e \\ \hline \\ \hline$	× = = = =	= ॐ * ≡ ∈ = =	ê <mark>b</mark> Wrap Te 臣 Merge 8	ext & Center ~ \$ •	• % 9	Conditional Formatias Cell Formating v Table v Styles v V → V
Clipt	ooard 🔂 Font	F _N	Align	ment	Fal	Numbe	r 🗟 Styles Cells Editing 🧄
F13	▼ : × √ f _x						v
		0	D	-	5		0
A		U	U	E	F		G A
2	Parameters	Country	Vanuatu_te	st			
3		Region	Oceania: Oth	er Oceania		•	
4	Please enter parameters in the yellow cells.	f no national	data are avai	lable, copy th	ne IPCC default valu	Ie.	
5	Help on parameter selection can be found in t	he 2006 IPC(C guidelines				
6							
7		IPCC defa	ault value	Countr	y-specific parame	ters	
8			1050	Value	Reference and r	emarks	Notes
9	Starting year	0.0.54	1950	1950			The compatible of industrial wasts will you considerably by equator. This DOC value should eater the amounts estand (see Ovidelia
21	industrial waste	0-0.54	0.15	0.15			The composition of industrial waste will vary significantly by country. This DUC value should match the amounts entered (see Guidelin
22	DOCF (fraction of DOC dissimilated)		0.6	0.6			Enter 0.5 as the default
2.5	Doer (naction of Doe dissimilated)		0.5	0.5			value in the yellow cell
25	Methane generation rate constant (k)	Wet tempe	rate 🔻				
26	(vears-1)	Pango	Default				
27	Food waste	0.1_0.2	0.185	0 185			Nav include parties waste provided that a suitable value of DOC is used
28	Garden	0.06-0.1	0.103	0.103			Garden (vard) and park waste and other moderately fast deprading waste
29	Paper	0.05-0.07	0.06	0.06			y and the second s
30	Wood and straw	0.02-0.04	0.03	0.03			
31	Textiles	0.05-0.07	0.06	0.06			Natural textiles such as wool and cotton. Synthetic textiles are assumed not to contain DOC
32	Disposable nappies	0.06-0.1	0.1	0.1			
33	Sewage sludge	0.1-0.2	0.185	0.185			
34							
35	Industrial waste	0.08-0.1	0.09	0.09			The composition of industrial waste will vary significantly by country. This DOC value should match the amounts entered (see Guidelin
36			0				
51	[Delay time (months)		6	6		-	
1	Instructions Parameters N	Activ	nty Amnt	Deposited	Recovery_OX	Results	HWP Stored_C Theory Defaults (+) :
Ready							III III+ 100%







1.12. Click on the Methane drop-down menu and select Wet temperate (see illustration below)

F13	▼ : × √ fx					v
A	В	С	D	Е	F	G
1	Parameters	Country	Vanuatu_te	st		
3		Region	Oceania: Oth	er Oceania		▼
4	Please enter parameters in the yellow cells.	f no national	data are avai	lable, copy tl	ne IPCC default value.	_
5	Help on parameter selection can be found in	the 2006 IPC	C guidelines			
7		IPCC def	ault value	Countr	y-specific parameters	
8				Value	Reference and rema	ks Notes
23	DOCf (fraction of DOC dissimilated)		0.5	0.5		
24		_				
25	Methane generation rate constant (k)	Moist and	wet tropica 💌			
26	(years ⁻¹)	Dry temper Wet tempe	ate			
27	Food waste	Dry tropica	all a	0.185		May include garden waste provided that a suitable value of DOC is used
28	Garden	Moist and	wet tropical	0.1		Garden (yard) and park waste and other moderately fast degrading waste
29	Paper	0.05-0.07	0.06	0.06		
30	Wood and straw	0.02-0.04	0.03	0.03		
31	l'extiles	0.05-0.07	0.06	0.06		Natural textiles such as wool and cotton. Synthetic textiles are assumed not to contain DOC
32	Disposable napples	0.00-0.1	0.10	0.195		_
3/	Sewage sludge	0.1-0.2	0.100	0.100		-
35	Industrial waste	0.08-0.1	0.09	0.09		The composition of industrial waste will vary significantly by country. This DOC value should match the amounts entered (see Guidelin
36						
37	Delay time (months)		6	6		
38						
39	Fraction of methane (F) in developed gas		0.5	0.5		▼
	Instructions Parameters I	MCF Activ	vity Amnt	Deposited	Recovery_OX Re	ults HWP Stored_C Theory Defaults + : •
Ready						·····································

1.13 Enter the default values from the grey cells D27 to D35 into the yellow cells. Vanuatu does not have any Country specific values (See red arrow in the illustration below)

File	Home	Insert	Page Layout	Formulas	Data Re	view View	Help							🖻 Share
Pas		Arial B I <u>U</u> ∽	• 10 • A		= = % ~ = = = = =	eb Wrap Te	ext & Center →	\$ • % \$	` 00. 0.⇒ 0.← 00.	Conditional Fo Formatting ~ T	ormat as Cell fable ~ Styles ~	Insert Delete Format	∑ AutoSum ~ A ↓ Fill ~ Z ↓ Clear ~ Sort & Filter ~ S	Find & Select ~
Clip	board 🕠		Font	5	Alig	gnment	5	Numb	er 🗇	Sty	les	Cells	Editing	~
F13	Ŧ	: × ·	$\int f_x$											~
						-		-				0		
1	4	B		U U	U	E		F				G		^
2	Parame	eters		Country	Vanuatu t	est								
3				Region	Oceania: O	ther Oceania		•	1					
4	Please en	iter parameters	in the yellow cells	s. If no nation	al data are av	ailable, copy t	he IPCC defau	ult value.	=					
5	Help on pa	arameter selec	tion can be found	in the 2006 IP	CC guidelines									
6				1000 1			10		-					
1				IPCC de	efault value	Countr	y-specific pa	rameters	Notos					
0	DOCE Ifra	ction of DOC	discimilatod)		0		Reference	and remarks	Notes					
24	Doci fila		uissiiniuteuj		0.	0.0			1					
25	Methane	generation ra	ate constant (k)	Wet temp	oerate 🔻	1								
26		(years	s ⁻¹)	Range	Default									
27	Food wast	te		0.1-0.	.2 0.18	5 0.185			May include	garden waste provid	led that a suitable v	value of DOC is used		
28	Garden			0.06-0.	.1 0.	1 0.1			Garden (yar	d) and park waste ar	nd other moderately	y fast degrading waste		
29	Paper	Latan		0.05-0.0	07 0.0	6 0.06		-	1	6				
30	Textiles	i straw		0.02-0.0	17 0.0	5 0.05 6 0.06			Natural taxtil	lault values	cotton Synthetic t	taxtilae are seeumad not to co	ntein DOC	
32	Disposable	e nappies		0.06-0.	.1 0.	1 0.1			Hatarartexa		outen. cynnicae i		Main 500	
33	Sewage s	ludge		0.1-0.	.2 0.18	5 0.185								
34														
35	Industrial v	waste		0.08–0.	.1 0.0	9 0.09			The compos	tion of industrial was	te will vary signific	cantly by country. This DOC va	alue should match the amounts e	ntered (see Guidelin
36	Delawitin	- (c			4					
37	Delay tim	ie (months)		_		0 b			-					
39	Fraction of	of methane (F) in developed cas	6	0	5 0.5			1					T
4	•	Instructions	Parameters	MCF Act	tivity Amr	nt_Deposited	Recovery	OX Result	s HWP	Stored_C T	heory Defa	ults 🕂 🗄 🖣		Þ







1.14 Enter the default values from the grey cells into the yellow cells:

- Delay time: 6
- Fraction of Methane: 0.5
- Oxidation Factor (OX): 0
- % Paper in industrial waste: 0%
- % Wood in industrial waste: 0%

(See the red outline in the figure below)



1.15 Click on the "MFC" tab (see red arrow below)

File	Home Insert	Page Layout F	ormulas I	Data Rev	iew View	Help										🖻 Share	е
Past	Arial e ≪ Arial B I □ ~	• 10 • A^ . ⊞ ~ <u>⊘</u> ~ <u>A</u>	A [×] Ξ Ξ	= % ~ = = =	란 Wrap Te 臣 Merge	ext & Center 👻 \$	~ % 9	~ .00 .00 .00 →0	Conditional Formatting ~	Format as Table ~ S	Cell Styles ~	insert Delete	Format	∑ AutoSun ↓ Fill ~ ♦ Clear ~	n * Arr O Sort & Find & Filter ~ Select ~		
Clip	board 🖓 I	Font	5	Aligr	nment	15	Number	Es.		Styles		Cells			Editing		^
cour	ntry 🔻 i 🖂 🗸	∫ <i>f</i> _× Vanuat	u_test														۷
	В		С	D	E	F						G					
1 2 3 4 5 6	Parameters Please enter parameters Help on parameter selecti	in the yellow cells. ion can be found in	Country Region If no national the 2006 IPC	Vanuatu_te Oceania: Oth data are avai C guidelines	e <mark>st</mark> her Oceania ilable, copy ti	he IPCC default va	 lue.										
7			IPCC def	ault value	Countr	y-specific param	eters										
8					Value	Reference and	remarks	Notes									4
35	Industrial waste		0 08-0 1	0.09	0.09			The composit	ion of industrial y	waste will van	v significantly	by country. Th	is DOC val	ue should match	the amounts entered (see Guidelir	
36											,,	-,,-					1
37	Delay time (months)			6	6												
38																	
39	Fraction of methane (F)) in developed gas		0.5	0.5												
40	Conversion factor C to	CH		1 33	1 33												
42																	
43	Oxidation factor (OX)			0	0												
44																	
45	Parameters for carbon	storage															
46	% paper in industrial wast	te		0%	0%												
48	76 WOOD IN INDUSTRIAL WASL	e		0%	0%												
	For Harwested Wood P	roducts															
40	calculations for Bulk w	sto ontion only						1				<u> </u>				_	
4	 Instructions 	Parameters	MCF Activ	rity Amnt	Deposited	Recovery_OX	Résults	HWP	Stored_C	Theory	Defaults	(+) :	4) F	







1.16 Enter the IPCC default values from grey cells 12C to 12M into the yellow cells 13C to 13M. Vanuatu has no country-specific value hence the IPCC default value will be used.

		(MCF)										c	alculated va	alues for MCI	F
		ed average N national value Ition of waste 100% (see "c	ICF from the es into the y disposals distribution (e estimate ellow MCF (by mass) check'' valu	d distribution cells in row between site ies)	of site types 12 types in the o	columns be	low.			Default v since Var country s	values to be us nuatu has no specific value	sed, s		
_		w					Indust	rial					MSW	Industrial	
		Managed, semi- aerobic	Uncate- gorised	Distri- bution Check	Un- managed, shallow	Un- managed, deep	Managed	Managed, semi- aerobic	Uncate- gorised	Distri- bution Check	References/ remarks				
		MCF	MCF		MCF	MCF	MCF	MCF	MCF					Weighted	
IF	PCC default	0.5	0.6		0.4	0.8	1	0.5	0.6				Weighted	average MCF	
Col	untry-specific value	0.5	0.6		0.4	0.8	1	0.5	0.6			${\mathbf <}$	average wc for MSW	for Industrial Waste	
		Vaste Manao	ement Type	e	Dis	tribution of V	Vaste bv W	aste Manaq	ement Type			Enter valu	es		
"Fi) sj	xed" Country- pecifc value	5%	15%	Total	20%	30%	25%	5%	20%	Total		into the ye cells	llow		
	Year	%	%	(100%)	%	%	%	%	%	(100%)			wt. fraction	wt. fraction	
	1950	5%	15%	100%	20%	30%	25%	5%	20%	100%			0.71	0.72	
	1951	5%	15%	100%	20%	30%	25%	5%	20%	100%			0.71	0.72	
\vdash	1952	5%	15%	100%	20%	30%	25%	5%	20%	100%			0.71	0.72	
\vdash	1953	5%	15%	100%	20%	30%	25%	5%	20%	100%			0.71	0.72	
\vdash	1954	5%	15%	100%	20%	30%	25%	5%	20%	100%			0.71	0.72	
F	Instru	stions D	arameters	MCE	Activity	Ampt Do	opsited	Pacovopu	OV Doc	ulte		- Default	G. 1	0.72	

1.17 Enter the % waste for MSW and Industrial see the tables below for the values. An illustration is also provided after the tables (see figure below, after the tables)

Table 4: Percentage values for each of the different MSW site types

The yellow cells on the excel file where the values are to be entered. These percentages should total to 100%.

MSW	% of waste	Cell
Unmanaged Shallow	25	C16
Unmanaged Deep	30	D16
Managed	25	E16
Managed Semi-aerobic	5	F16
Uncategorized	15	G16
Total =	100%	

Table 5: Percentage values for each of the different Industrial site types

The yellow cells where the values are to be entered. These percentages have to equal to 100%.

Industrial	% of waste	Cell
Unmanaged Shallow	25	I16
Unmanaged Deep	30	J16
Managed	25	K16







Calculated val

Managed Semi-aerobic	5	L16
Uncategorized	15	M16
Total =	100%	

Methane Correction Factor (MCF)

This worksheet calculates a weighted average MCF from the estimated distribution of site types Enter either IPCC default values or national values into the yellow MCF cells in row 12 Then enter the approximate distribution of waste disposals (by mass) between site types in the columns below. Totals on each row must add up to 100% (see "distribution check" values)

			MS	SW					Indus	trial				MSW
	Un- managed, shallow	Un- managed, deep	Managed	Managed, semi- aerobic	Uncate- gorised	Distri- bution Check	Un- managed, shallow	Un- managed, deep	Managed	Managed, semi- aerobic	Uncate- gorised	Distri- bution Check	References / remarks	
IPCC default	MCF	MCF	MCF 1	MCF	MCF		MCF	MCF		MCF	MCF			Mataba d
Country-specific value		0.0	1	0.5	0.6			0.8	1	0.5	0.6			average MCF for MSW
	Dis	tribution of	Waste by	Naste Manaq	ement Tvr)e	Dist	ribution of V	Vaste bv W	aste Manac	ement Typ	e		
"Fixed" Country- specifc value	25%	30%	25%	5%	15%	Total	20%	30%	25%	5%	20%	Total		
Year	%	%	%	%	%	(100%)	%	%	%	%	%	(100%)		wt. fraction
1957	25%	30%	25%	5%	15%	100%	20%	30%	25%	5%	20%	100%		0.71
1958	25%	30%	25%	5%	15%	100%	20%	30%	25%	5%	20%	100%		0.71
1959	25%	30%	25%	5%	15%	100%	20%	30%	25%	5%	20%	100%		0.71
1960	25%	30%	25%	5%	15%	100%	20%	30%	25%	5%	20%	100%		0.71
1061	25%	200/	25%	£0/.	15%	100%	20%	20%	25%	E0/.	20%	100%		0.71
 Instruct 	tions Par	ameters	MCF A	<mark>ctivity</mark> Am	nt_Deposite	ed Red	covery_OX	Results	HWP St	ored_C T	heory D	efaults	+ : •	Þ

1.18 Click on the "Activity" tab at the bottom of the page (see red arrow in illustration)

B	り・ ペ・ =	IPCC_W	/aste_Model_V	′anuatu_Pop∣	Data (Comp	oatibility Moc	le] - Excel	2	Search						Sign in	Ŧ	-	o x
File	Home Ins	sert P	age Layout	Formula	s Data	Review	View	Help										🖻 Share
Paste	X C≞ ~ ≪ B I	<u>U</u> ~	10 10 10	A^ A [×]		8⁄2 ~	란 Wrap Tex 화 Merge &	: Center ~	General \$ ~ % 9	` 00.00 00.+00	Conditiona Formatting	I Format as Table Y St	Cell Insert	Delete Format	∑ AutoSur ↓ Fill ~ ♦ Clear ~	m × AZ Sort & Filter	, O Find & Select ~	
Clipbo	ard 🗔	Fo	nt	F <u>s</u>		Alignme	nt		Number	F _N		Styles		Cells		Editing		^
W11		× v	f_{x}															~
	в	н			к		м	N	0		P O	R	8	т п	v	W	x	
1 2 3 4 5		estimate	d distribution	of site types	ĸ	L					c	alculated va	alues for MC	F				
5 7 3 9		(by mass) check" valu	between site ies)	types in the	columns be Indust	low. trial			l		ſ	MSW	Industrial					
		Distri-	Un-	Un-		Managed,	Uncete	Distri-										
0		Check	shallow	deep	Managed	aerobic	gorised	Check	References / rema	irks							_	
1	IPCC default		MCF 0.4	MCF 0.8	MCF 1	MCF 0.5	MCF 0.6					Weighted	Weighted		l		-	
3	Country-specific value		0.4	0.8	1	0.5	0.6					average MCF for MSW	average MCF for Industrial Waste					
4		2	Dis	tribution of V	Nas	aste Manag	ement Type											
6	"Fixed" Country- specifc value	Total	20%	30%		5%	20%	Total										
7	Year 1054	(100%)	%	%		%	%	(100%)				wt. fraction	wt. fraction					
3	1954	100%	20%	30%		5%	20%	100%		_		0.71	0.72					
4	1956	100%	20%	30%		5%	20%	100%				0.71	0.72					
!5	1957	100%	20%	30%		5%	20%	100%			[0.71	0.72					
6	1958	100%	20%	30%	<u>//</u>	5%	20%	100%				0.71	0.72					
.7	1959	100%	20%	30%	5%	5%	20%	100%				0.71	0.72					-
-	 Instru 	ictions	Parameters	MCF	Activity	Amnt_De	eposited	Recove	ry_OX Results	HWP	Stored_C	Theory	Defaults	+ : •				Þ
leady														=			-	+ 93%







1.19 Enter population data in yellow cell C12 to Yellow cell C84 (See red figure below).

8	७ • ९	v v IPCC <u></u> Wa	ste_Model_Vanı	uatu_Pop Data [Compatibility	/ Mode] - Exe	cel 🔎	Search							Sign in 🖬	- 0	×
File	Home	Insert Pa	ge Layout	Formulas	Data Re	eview Vie	w Help									ß	Share
Paste	×	Arial B I <u>U</u> ∽ ∰	• 10 • A^	A* Ξ Ξ A* Ξ Ξ	= » = = =	ab Wrap →= 団 Merg) Text ne & Center ⇒	General \$ ~ 9	69	• Condi	itional Forma tting ~ Table	t as Cell * Styles *	Insert Delet	e Format	∑ AutoSum マ ↓ Fill マ ♦ Clear マ	AZY O Sort & Find & Filter ~ Select ~	
Clipbe	bard 🖼	Fon		E I	Ali	gnment		⊡ N	umber	5	Styles		Cells	5	Editin	ig	^
C72	-	: × 🗸	<i>f_x</i> =+C7	1*1.00574													*
	A B	С	D	E	F	G	Н	1	J	К	L	М	N	0 P	Q	R	-
1 2 3 4 5 6 7		MSW activ Enter the p Enter populat He p and defa Industrial was IFCC Region	vity data opulation da ion, waste p ault regional ite activity d al defaults	<mark>ata up to year</mark> per capita a I values are lata must be	2023 nd MSW given in the entered	waste com he 2006 IF separately	position ir PCC Guide starting ir	nto the yell elines. n Column (ow cells. 2.						Industrial M Enter GDP, wa Help and defa	waste activ aste generatio ult regional val	/ity n rat ues
8																	
•			690		85%	68%	0%	6%	3%	0%	0%	24%	100%				
9			690		85%	68% Com	0% position c	6% of waste g	3% oing to s	0% olid waste	0% e disposal	24% sites	100%				
9	Year	Population	690 Waste per capita	Total MSW	85% % to SWDS	68% Com Food	0% position c Garden	6% of waste g Paper	3% oing to s Wood	0% olid waste Textile	0% e disposal Nappies	24% sites Plastics, other inert	100% Total		Year	GDP	gei
9 10 11	Year	Population millions	690 Waste per capita kg/cap/yr	Total MSW Gg	85% % to SWDS %	68% Com Food %	0% position c Garden %	6% of waste g Paper %	3% oing to s Wood %	0% olid waste Textile %	0% e disposal Nappies %	24% sites Plastics, other inert %	100% Total (=100%)		Year	GDP \$ millions	gei (
9 10 11 82	Year	Population millions 0.29855931	690 Waste per capita kg/cap/yr 690	Total MSW Gg 206.0059	85% % to SWDS % 85%	68% Com Food % 68%	0% position c Garden % 0%	6% of waste g Paper % 6%	3% oing to s Wood % 3%	0% olid wast Textile % 0%	0% e disposal Nappies %	24% sites Plastics, other inert % 24%	100% Total (=100%) 100%		Year	GDP \$ millions 946.44	gei
9 10 11 82 83 84	Year 2020 2021	Population millions 0.29855931 0.30027304	690 Waste per capita kg/cap/yr 690 690	Total MSW Gg 206.0059 207.1884	85% % to SWDS % 85% 85%	68% Com Food % 68% 68%	0% position c Garden % 0% 0%	6% of waste g Paper % 6% 6%	3% oing to s Wood % 3% 3%	0% olid waste Textile % 0% 0%	0% e disposal Nappies % 0% 0%	24% sites Plastics, other inert % 24% 24%	100% Total (=100%) 100% 100%		Year 2020 2021 2022	GDP \$ millions 946.44 956	gei (
9 10 11 82 83 84 85	Year 2020 2021 2022 2023	Population millions 0.29855931 0.30027304	690 Waste per capita kg/cap/yr 690 690 690	Total MSW Gg 206.0059 207.1884 0	85% % to SWDS % 85% 85% 85% 85%	68% Com Food % 68% 68% 68%	0% position c Garden % 0% 0% 0%	6% of waste g Paper % 6% 6% 6%	3% oing to s Wood % 3% 3% 3%	0% olid waste Textile % 0% 0% 0%	0% e disposal Nappies % 0% 0% 0%	24% sites Plastics, other inert % 24% 24% 24%	100% Total (=100%) 100% 100% 100%		Year 2020 2021 2022 2023	GDP \$ millions 946.44 956	gei (
9 10 11 82 83 84 85 86	Year 2020 2021 2022 2023 2024	Population millions 0.29855931 0.30027304	690 Waste per capita kg/cap/yr 690 690 690 690	Total MSW Gg 206.0059 207.1884 0 0 0	85% % to SWDS % 85% 85% 85% 85%	68% Com Food % 68% 68% 68% 68%	0% position c Garden % 0% 0% 0%	6% of waste g Paper % 6% 6% 6% 6%	3% oing to s Wood % 3% 3% 3% 3% 3%	0% olid waste Textile % 0% 0% 0% 0%	0% e disposal Nappies % 0% 0% 0%	24% sites Plastics, other inert % 24% 24% 24% 24%	100% Total (=100%) 100% 100% 100% 100%		Year 2020 2021 2022 2023 2023	GDP \$ millions 946.44 956	gei (
9 10 11 82 83 84 85 86 87	Year 2020 2021 2022 2023 2024 2024	Population millions 0.29855931 0.30027304	690 Waste per capita kg/cap/yr 690 690 690 690 690 690	Total MSW Gg 206.0059 207.1884 0 0 0 0	85% % to \$WD\$ % 85% 85% 85% 85% 85% 85% 85%	68% Com Food % 68% 68% 68% 68% 68%	0% position c Garden % 0% 0% 0%	6% of waste g Paper % 6% 6% 6% 6% 6% 6% 6% 6%	3% oing to s Wood % 3% 3% 3% 3% 3%	0% olid wast Textile % 0% 0% 0% 0%	0% e disposal % 0% 0% 0% 0%	24% sites Plastics, other inert % 24% 24% 24% 24% 24% 24% 24%	100% Total (=100%) 100% 100% 100% 100% 100%		Year 2020 2021 2022 2023 2024 2025	GDP \$ millions 946.44 956	gei (
9 10 11 82 83 84 85 86 87	Year 2020 2021 2022 2023 2024 2025	Population millions 0.29855931 0.30027304	690 Waste per capita kg/cap/yr 690 690 690 690 690	Total MSW 206.0059 207.1884 0 0 0 0 0 0 0 0 0 0 0	85% % to \$WD\$ % 85% 85% 85% 85% 85% 85% 25% 85% 85% 85% 85% 85% 85% 85% 85% 85% 8	68% Com % 68% 68% 68% 68% 68% 68% 68%	0% position c Garden % 0% 0% 0% 0% 0% 0%	6% f waste g Paper % 6% 6% 6% 6% 6% 6% 6% 8% 8% 8% 8% 8% 8% 8% 8% 8% 8% 8% 8% 8%	3% oing to s Wood % 3% 3% 3% 3% 3% 3% 3% 3% 3% 3% 1% V FHV	0% olid waste Textile % 0% 0% 0% 0% 0% 0% 0% 0% 0%	0% e disposal % 0% 0% 0% 0% 0% 0% 0%	24% sites Plastics, other inert % 24% 24% 24% 24% 24% 24% 24% 24% 24% 2	100% Total (=100%) 100% 100% 100% 100% 100% 100% 100%	4	Year 2020 2021 2022 2023 2024 2025	GDP \$ millions 946.44 956	gei (

1.20 Enter in the IPCC Regional default value of 690 for waste per capita in yellow cell D12 (See illustration below)

	MSW acti	ivit <mark>y data</mark>	ter this IPCC	Regional d	lefault									Industrial	waste activ	vity
	Enter population was e per capita and MSW waste composition into the yellow cells. Help and default regional values are given in the 2006 IPCC Guidelines. Industrial waste activity data must be entered separately starting in Column Q. IPCC Regional defaults 690 85% 68% 00% 6% 3% 0% 0% 24% 100%												Enter GDP, w Help and defa	aste generatior ult regional valu	i rë Jes	
	IPCC Regional defaults 690 85% 68% 0% 6% 3% 0% 0% 24% 100% Composition of waste going to solid waste disposal sites Composition of waste going to solid waste disposal sites 100% 10%															
					Com	position o	of waste g	joing to s	olid waste	disposal	sites					
Year	Population	Waste per capita	Total MSW	% to SWDS	Food	Garden	Paper	Wood	Textile	Nappies	Plastics, other inert	Total		Year	GDP	ge
	millions	kg/cap/yr	Gg	%	%	%	%	%	%	%	%	(=100%)			\$ millions	
1950	0.2	690	138	85%	68%	0%	6%	3%	0%	0%	24%	100%		1950	468.335101	
1951	0.201148	690	138.7921	85%	68%	0%	6%	3%	0%	0%	24%	100%		1951	473.065759	
1952	0.20230259	690	139.5888	85%	68%	0%	6%	3%	0%	0%	24%	100%		1952	477.844201	
1953	0.20346381	690	140.39	85%	68%	0%	6%	3%	0%	0%	24%	100%		1953	482.67091	
1954	0.20463169	690	141.1959	85%	68%	0%	6%	3%	0%	0%	24%	100%		1954	487.546373	
1055	0 20580627	000	1/2 0063	85%	68%	0%	6%	30%	0%	0%	2/10%	100%		1055	102 171081	_
	Instructions	Parameters	MCF Acti	vity Am	nt_Deposited	d Recove	ry_OX Re	esults HV	VP Stored	LC Theo	ry Default	(+) :	•	— —		P





1.21 Enter in yellow Cell F12 Enter the default value of 85% from the grey cell F8.

	୭ ୯	- ⇒ IPCC_Wa	ste_Model_Van	uatu_Pop Data	Compatibility	/ Mode] - Exc	el 🔎	Search							Sign in 🖬	1 – O	×
File	Home	insert Pa	ge Layout	Formulas	Data Re	eview Vie	w Help									e :	Share
Paste V	× © ~ ≪	Arial B I <u>U</u> ~ ∰	• 10 • A	^ a~ = = <u>A</u> ~ = =	= »~ = = =	환 Wrap 프 I Merg	Text e & Center ~	General \$ ~ \$	% 9 58	.00 Condi →0 Forma	tional Forma tting ~ Table	t as Cell Styles ~	Insert Delet	te Format	∑ AutoSum → III → III → Clear →	AZY P Sort & Find & Filter ~ Select ~	
Clipbo	ard 🕠	Fon	t	Es l	Ali	gnment		n N	lumber	FSI	Styles		Cells	s	Editir	ng	^
L4	~	: × ✓	fx														~
		0		-		0				K					0	D	
1	В	L	U	E	F	G	н		J	n	L	IVI	N	U P	Q	к	
2		MSW acti	vity data	1	I	Enter the IP nto the yell	CC Regiona ow cells F8	il default va 2 till you r	alue 85% each 2023						Industrial	waste activ	vity
4		Enter populat	ion, waste	per capita a	nd MS V	waste com	position in	nto the yel	low cells.						Enter GDP, w	aste generatio	n rat
6		Industrial was	te activity of	data must be	e entered :	separately	starting in	Column (Q.						noip and doit	alt regional fai	
7		IPCC Region	al defaults	5	<u> </u>												
8			690		85%	68%	0%	6%	3%	0%	0%	24%	100%				
9						Com	position o	of waste g	joing to s	olid waste	e disposa	sites					_
			Waste	Total	% to							Plastics,					
10	Year	Population	capita	MSW	SWDS	Food	Garden	Paper	Wood	Textile	Nappies	inert	Total		Year	GDP	ge
								· ·									
11		millions	kg/cap/yr	Gg	%	%	%	%	%	%	%	%	(=100%)			\$ millions	(
82	2020	0.29855931	690	206.0059	85%	68%	0%	6%	3%	0%	0%	24%	100%		2020	946.44	
83	2021	0.30027304	690	207.1884	85%	68%	0%	6%	3%	0%	0%	24%	100%		2021	956	
84	2022		690	0	85%	68%	0%	6%	3%	0%	0%	24%	100%		2022		
86	2023		690		00% 85%	68%	0%	6%	3%	0%	0%	24%	100%		2023		
87	2024		690		85%	68%	0%	6%	3%	0%	0%	24%	100%		2024		
	+	Instructions	Parameters	MCF	Am	nt_Deposited	I Recove	ry_OX R	<mark>esults</mark> HV	VP Store	d_C Theo	ry Defaul	• (+) :	4			Þ

1.22 Enter the IPCC Regional default values for the Different Compositions of waste going to the Solid Waste Disposal Site (SWDS) into yellow cells G12 to M12 using the values from the grey cells in G8 to M8 (See figure below). Note that the total percentage should add up to 100%.

8	७ • ९		ste_Model_Vanu	uatu_Pop Data [Compatibility	/Mode] - Exc	el 🔎	Search							Sign in		
File	Home	Insert Pa	ge Layout	Formulas	Data Re	eview Vie	w Help									ß	Share
Paste	× ↓ √ oard √	Arial B I U → I II Fon	• 10 • A^ • <u>⊘</u> • <u>/</u> t		= ॐ~~ = ⊡ ∃ Ali	eb Wrap 르 턴 Merg gnment	Text e & Center ⇒	General \$ ~ 9	% 9 €0 	.00 Condi TS	itional Forma tting ~ Table Styles	t as Cell • Styles •	Insert Delet	e Format	∑ AutoSum ➤ I Fill ➤ I Clear ➤ Edition	AZY P Sort & Find & Filter ~ Select ~	~
L4	-	: × 🗸	f_{x}														~
	A B	С	D	Е	F	G	Н	T	J	К	L	М	N	0 P	Q	R	
1 2 3		MSW acti	vity data	I							Enter th in the y	iese IPCC de ellow cells (fault values 582 to M82		Industrial	waste activ	vity
4		Enter populat	ion, waste p	per capita a	nd MSW	waste com	position ir	to the yell	ow cells.		,				Enter GDP, w	aste generatio	n rat
5		Help and defa Industrial was	ault regiona ste activity c	l values are lata must be	given in ti entered s	ne 2006 IF separately	starting in	lines. Column (C						Help and defa	iult regional val	ues
7		IPCC Region	al defaults				y										
8			690		85%	68%	0%	6%	3%	0%	0%	24%	100%				
9			10/			Com	position c	f waste g	joing to s	olid wast	e disposal	sites					
			vvaste	Total	% to							other					ge
10	Year	Population	capita	MSW	SWDS	Food	Garden	Paper	Wood	Textile	Nappies	inert	Total		Year	GDP	
11		millions	kg/cap/yr	Gg	%	%	%	%	%	%	%	%	(=100%)	Use IPCC	default values	\$ millions	Ċ
82	2020	0.29855931	690	206.0059	85%	<mark>68%</mark>	0%	<mark>6%</mark>	3%	0%	0%	24%	100%	_	2020	946.44	
83	2021	0.30027304	690	207.1884	85%	68%	0%	6%	3%	0%	0%	24%	100%		2021	956	
84	2022		690	0	85%	68%	0%	6%	3%	0%	0%	24%	100%		2022		
86	2023		690	0	85%	68%	0%	6%	3%	0%	0%	24%	100%		2023		
87	2024		600	0	85%	68%	0%	6%	3%	0%	0%	2470	100%		2024		-
4	•	Instructions	Parameters		Am	nt_Deposited	i Recove	ry_OX Re	e <mark>sults</mark> HV	VP Store	d_C Theo	ry Default	· (+)	4			Þ







1.23 Enter the collected data on GDP for years 1950 to 2023 into the yellow cell R12 to R85 (See figure below).

8	%~ ~~	⇒ IPCC_V	Vaste_Model_\	Vanuatu_Pop [Data [Compatil	oility Mode]	- Excel 🔎	Search					Sign in	•	- 0	×
File	Home	Insert F	age Layout	Formulas	5 Data	Review	View Help								් Sha	are
Paste Clipbo	Å Carial ≪ ≪ B ard 「S	I I <u>U</u> ∽ Fe	- 10		= = = * = = = =	Alignment	Wrap Text Merge & Center 👻	General \$ ~ % 9	✓ Cond Cond Forma	itional Format as ttting ~ Table ~ Styles	Cell Ins Styles ~ ~	ert Delete Forr Cells	The provided HTML AutoSum The provided HTML	Sort & Filter ~	Find & Select ~	^
G12	•	XV	f _x =0	3\$8												~
		K		м	N	0 P	0	D	S	т	п	V	\M/	v		VA
1		K	L	IVI	IN		U.	K	5		0	v	vv	~		-1
2							Industrial	waste activ	vitv data							
3								_								
4	ow cells.						Enter GDP, w	aste ger eratio	n rate, % to SN	NDS and dis	tribution of v	vaste betwee	en site types in	to the ye	llow cells.	
5							Help and defa	ault regional val	les are given	in the 2006 IF	PCC Guidelii	nes.		-		
6	2 .															
7					-											
8	3%	0%	0%	24%	100%			Ent	er the GDP from	collected date	in 000					
9	oing to se	olid waste	e disposal	sites				V yer	ow cell K12 ull y	ou reach year z	025.					
				Plastics,					Waste	Total						
10		-		other			N.		generation	industrial	% to	Total to				
10	vvood	lextile	Napples	inert	Iotai		Year	GDP	Ca/\$m	waste	SWDS	SWDS				
11	%	%	%	%	(=100%)			\$ millions	GDP/yr	Gg	%	Gg				
12	3%	0%	0%	24%	100%		1950	468.335101	5	2341.6755	100%	2341.676				
13	3%	0%	0%	24%	100%		1951	473.065759	5	2365.3288	100%	2365.329				
14	3%	0%	0%	24%	100%	1	1952	477.844201	5	2389.221	100%	2389.221				
15	3%	0%	0%	24%	100%		1953	482.67091	1.5	724.00636	100%	724.0064				
16	3%	0%	0%	24%	100%		1954	487.546373	1.5	731.31956	100%	731.3196				
17	20%	∩% tructions	∩% Deremet	2/0/A		Ampt Doro	rited Receive		15	738 70663	100%	738 7066	l			

1.24 Enter the data for waste generation rate for the years 1950 to 2023 into yellow cells S12 to S85 (see figure below)

8	b. G.	⇒ IPCC_\	Waste_Model_	Vanuatu_Pop [Data [Compati	bility Mode]	- Excel	Search					Sign in	Œ	- 0	
File	Home	Insert I	Page Layout	Formulas	s Data	Review	View Help								ß	Share
Paste Clipbo	Aria	I <u>U</u> ~ F	~ 10 ~	A^ A' =	= = = *	P → eb = →= iiii Alignment	Wrap Text Merge & Center ~	General \$ ~ % 9 Number	Conc .00 →00 Forma	ditional Format as atting ~ Table ~ Styles	Cell Ins Styles ~ ~	ert Delete For Cells	→ AutoSur → Fill ~ ↓ Clear ~	n ~ A Sort Filter Editing	7 & Find & ~ Select ~	^
G12	· · ·	× v	f _x =0	3\$8												v
	J K L M N O P Q R S T U V W X Y															
1			_				_									<u> </u>
2							Industrial	waste activ	vity data							
3																
4	ow cells.						Enter GDP, w	aste generatio	n ra <mark>to S</mark> '	WDS and dis	tribution of v	vaste betwe	en site types ir	nto the y	ellow cells	
5							Help and defa	ult regional va	lues liven	in the 2006 If	PCC Guideli	nes.				
6	Q .															
7									E	nter the values	for Waste					
8	3%	0%	0%	24%	100%				G G	eneration Rate	from year					
9	oing to s	olid wast	e disposa	sites					1	950 to 2023			•			
				Plastics,					Waste	Total						
				other					generation	industrial	% to	Total to				
10	Wood	Textile	Nappies	inert	Total		Year	GDP	rate	waste	SWDS	SWDS	-			
11	%	%	%	%	(=100%)			\$ millions	GDP/yr	Gg	%	Gg				
12	3%	0%	0%	24%	100%	1	1950	468.335101	5	2341.6755	100%	2341.676				
13	3%	0%	0%	24%	100%]	1951	473.065759	5	2365.3288	100%	2365.329]			
14	3%	0%	0%	24%	100%		1952	477.844201	5	2389.221	100%	2389.221]			
15	3%	0%	0%	24%	100%		1953	482.67091	1.5	724.00636	100%	724.0064				
16	3%	0%	0%	24%	100%		1954	487.546373	1.5	731.31956	100%	731.3196				
17	20%	0%	0%	2/10/~	100%		1055	102 171084	15	738 70663	100%	738 7066	I			
	Ins	structions	Parameters	5 MCF	Activity	Amnt_Depo	sited Recover	y_OX Results	HWP Store	d_C Theory	Defaults	(+) : 1				•







1.25 Enter 100% for all of the years in yellow cells U12 to U85 under the "% to SWDS" column.

8	% ~ %	⇒ IPCC_\	Waste_Model_\	Vanuatu_Pop (Data (Compati	bility Mode]	- Excel 🔎	Search					Sign in	Ē	— ć) X
File	Home	Insert I	Page Layout	Formula	5 Data	Review	View Help								l	🖻 Share
Paste	Å Aria G → B sard 5	I I <u>U</u> ~	• 10 • ⊞ ~		= = = *	Ø~ eb ≣ ± Ē	Wrap Text Merge & Center 🕞	General \$ ~ % 9		ditional Format as atting ~ Table ~	Cell Insi Styles -	ert Delete Forr	The fill → fill	n Y AZS Sort Filter	7 D & Find & ~ Select ~	
040				-												
G12	· ·		Jx =(358												v
- A A	A J	K	L	М	Ν	0 P	Q	R	S	Т	U	V	W	X		Y 🔺
1 2 3 4 5 6 7 8 9	ow cells. 2. 3% joing to s	0% olid wast	0% e disposal	24% sites	100%]	Industrial Enter GDP, w Help and defa	waste activ aste generatio ult regional val	vity data n rate, % to S' ues are given	WDS and dis in the 2006 II	tripution of w	nter 100% for 023 vaste betwee nes.	r year 1950 to en site types ir	nto the y	ellow cel	ls.
				Plastics,		1			Waste	Total						
10	Wood	Toxtile	Nannica	other	Total		Voor	CDP	generation	industrial	% to	Total to				
10	vv000	Textile	Nappies	mert	Total	1	rear	GDP	Gg/\$m	waste	30003	31403				
11	%	%	%	%	(=100%)			\$ millions	GDP/yr	Gg	%	Gg				
12	3%	0%	0%	24%	100%		1950	468.335101	5	2341.6755	100%	2341.676				
13	3%	0%	0%	24%	100%		1951	473.065759	5	2365.3288	100%	2365.329				
14	3%	0%	0%	24%	100%	4	1952	477.844201	5	2389.221	100%	2389.221				
15	3%	0%	0%	24%	100%	4	1953	482.67091	1.5	724.00636	100%	724.0064				
16	3%	0%	0%	24%	100%	4	1954	487.546373	1.5	/31.31956	100%	/31.3196				
	► Ins	structions	Parameters	MCF	Activity	Amnt Depo	sited Recover	y_OX Results	HWP Store	d_C Theory	Defaults	(+) : (

2. ALTERNATIVE METHOD TO CALCULATING CH₄ EMISSIONS FROM THE SWDS USING THE IPCC SOFTWARE.

1.0 Open Google chrome and search "Inventory Software – IPCC-TFI" (See illustration below)







1.2 Click on the "New Version 2.91 – IPCC Inventory Software (See illustration below)

Google	Inventory Software - IPCC-TFI	× ↓ ⊙ <	(人) 🐃 🕅	:: a
	All Images Videos Shopping News : More	Tools		SafeSearch 💌
	About 6,580 results (0.47 seconds)			
	ipcc-nggip https://www.ipcc-nggip.iges.or.jp > software			
	New Version 2.91 – IPCC Inventory Software		Click on the "New Version 2.91 ~ IPCC Inventory	
	IPCC inventory sortware released on 5 April, 2024 Please note that the Software They have been compiled by IPCC TFI TSU, and have not been	IPCC	Sonware	
	Intergovernmental Panel on Climate Change (IPCC) https://www.ipcc.ch > assets > uploads > 2018/12 PDF			
	Inventory Software			
	7 Dec 2018 — IPCC TFI Side-event. UN Climate Change The IPCC Inventor implements the 2006 IPCC Guidelines The IPCC Inventory Software can	ry Software		
	People also ask :			
	What is the National greenhouse gas inventories Program?	~		
www.ipcc.ch/site/assets/upload	ds/2018/12/COP24 IPCC Inventory Software-7Dec	~		

1.3 Click on the "ver 2.91 IPCC inventory Software – 32bit" (See illustration below).

÷	\rightarrow	G	• ipcc-nggip.iges.or.jp/software/index.ht	tml	7	☆	± (a	:
			Task Force on National Greenho	use Gas Inventories					
				Inventory Software					1
			Home IPCC	New Version 2.91 – IPCC Inventory Software					
			IPCC-TFI Home Organization	This is the new version 2.91 of the IPCC Inventory Software released on 5 April, 2024. Changelog					1
			Publications Emission Factor Database (EFDB)	Please note that version 2.91 comes in 2 different files for installation. Thus, before downloading the file you shall check which one you actually need by using this decision tree.					l
			Inventory Software	Ver. 2.91 IPCC Inventory Software - 64bit					
			Meetings FAOs	Ver. 2.91 IPCC Inventory Software - 32bit					
			Links	If you find any issues in the use of the IPCC Inventory oftware, come back to us at jpcc-software@iges.or.jp.					
			Electronic Discussion Group (EDG)	Thank you very much for your support.					
			Contraction of the second s	Important!					
				When setting YOUR Password always set YOUR Password Hint too. It is highly recommended that you take note of your password and store it in a safe place. In case you lose or forget your password, the IPCC Inventory Software does not have a mechanism to restore your					
			©	password, this means that you can no longer access your database.					
			IPCC honoured with the 2007 Nobel Peace Prize	Please note that the IPCC Inventory Software cannot be used with IOS (Apple Computers).					
			Convright	Getting started with the IPCC Inventory Software					
			Disclaimer	After installing the IPCC Inventory Software, launch it for the first time and you will be asked to initialize the associated database by any initian XOLID Lexin (Lock Name) and XOLID Received					






- 1.4 Launch the Ver. 2.901 IPCC Inventory Software 32bit and install to your PC.
- 1.5 Create your password and username.
- 1.6 Type in the year of your choosing or the current inventory year.

1.7 Locate the bar labeled "IPCC categories" on the left side of the page (See Illustration below)

IPCC Inventory Software - ANITAKAY	[Worksheets]										- 0)	×
2006 IPCC Categories	Admini	strate Worksh	s Parameters - Tier	2 F-Gas Emiss	Reports Windov	v Help Gas Emissions - Ti	er 2b				_ 6	,
2.C.5 - Lead Production 2.C.6 - Zine Production 2.C.7 - Other (please specify) - Non-Energy Products from Fuels and 2.D.1 - Lubricant Use 2.D.2 - Paraffin Wax Use	Sector: Category: Subcategory Sheet: Data	Industrial Proc Product Uses 2.F.1.a - Refrij HFC-134a (Ch	esses and Product I as Substitutes for O; geration and Station I2FCF3) Emissions -	Use zone Depleting Sul ary Air Conditioning Tier 1	bstances						2023	
2.D.3 - Solvent Use 2.D.4 - Other (please specify) - Electronics Industry	Subdivision	Unspecified 1993 Gr	✓ Gas owth Rate (%) ¹	HFC-134a (CH2	FCF3) ~	Chemical Da 5 EF (%)	15 Destroy	red (%) 0				
2.E.1 - Integrated Circuit or Semiconduc						Eq	uation 7.2				-	-
2.E.2 - TFT Flat Panel Display 2.E.3 - Photovoltaics 2.E.4 - Heat Transfer Fluid 2.E.5 - Other (please specify) - Product Uses as Substitutes for Ozone	Year	Production (tonnes)	Exports (tonnes)	Imports (tonnes)	Total new agent to domestic market (tonnes)	Agent in retired equipment (tonnes)	Destruction of agent in retired equipment (tonnes)	Release of agent from retired equipment (tonnes)	Bank (tonnes)	Emissions (tonnes)		
2.F.1 - Refrigeration and Air Conditionin 2.F.1.a - Refrigeration and Stationar	t ∆⊽						(Recovery/100 ?)					
2.F.1.b - Mobile Air Conditioning	2019	0	0	16.4	16.4	0.57828	0	0.57828	82.33718	12.92886	2	
2.F.2 - Foam Blowing Agents	2020	0	0	17.11	17.11	0.6307	0	0.6307	86.46591	13.60058		
2 F 4 - Aerosols	2021	0	0	17.83	17.83	0.68398	0	0.68398	90.64204	14.28029		
2.F.5 - Solvents	2022	0	0	18.55	18.55	0./3814	0	0./3814	94.85/59	14.966/8		
2.F.6 - Other Applications (please specif	► 2023	0	0	19.27	19.27	0.7923	0	0.7923	99.10665	15.6583		
Other Product Manufacture and Use 2.G.1 - Electrical Equipment 2.G.1 a - Manufacture of Electrical E											Uncertainties	
- 2.G.1.b - Use of Electrical Equipmen	User notes						2.F.1.a - Time Se	ries			*	ą
2 G 2 - SE6 and PECs from Other Produ								н	IFC-134a (CH2FCF3) Emissions (Gq CO2 Equivalents)		
2.G.2.a - Military Applications 2.G.2.b - Accelerators 2.G.2.c - Other (please specify) 2.G.3.a - N20 from Product Uses 2.G.3.a - Medical Applications 2.G.3.b - Propellant for pressure and							20 10 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	1993 1994 1995 1998	2001 2011 2012 2014 2014 2014 2017 2017 2017 2017 2017 2017 2017 2017	2009 2011 2011 2015 2015 2015 2015 2015 2017	2018 2019 2020 2021 2022 2023 2023 2023	2025
- 2.G.3.c - Other (Please specify)							* * Base year for ass	essment of uncertaint	y in trend: 1990			
Worksheet notes 2006 IPCC Guidelines	Save						Gas HFC-	134a (CH2FCF3)				~
Country/Territory: Vanuatu Inventory Ye	ar: 2023 Base v	ear for assessme	nt of uncertainty i	n trend: 1990	CO2 Equivalents:	AR5 GWPs (100)	(ear time horizon)	Database file: (C:	ProgramData\IPCC2006Sc	oftware\ipcc2006.accdb)		

1.8 Scroll Down the category list till you get to 4 – Waste, then select 4 A – Solid Waste

Disposal (See red arrow in figure below)

IPCC Inventory Software - ANITAKAY - Application Database Inventor	[Worksheets] (Vear Administrate Wo	orksheets Tools Ev	nort/import Rend	orts Window Help	
2006 IPCC Categories	Parameters SWDS Types	- Utilization Activity Da	ata Amount Deposite	ed Long Term stored C in SWDS	Harvested Wood Products
-3.C.9 - CH4 from Tranage -3.C.11 - CH4 from Rewetting -3.C.11 - CH4 from Rewetting -3.C.12 - N20 Emissions fro -3.C.13 - CH4 Emissions fro -3.C.13 - CH4 Emissions fro -3.D.1 - Harvested Wood Pro -3.D.2 - Other (please specif) -4. Vaste -4.A.1 - Managed Waste Disp -4.A.2 - Unmanaged Waste Disp -4.C.2 - Open Burning of Waste Disp -4.C.1 - Waste Incineration -4.C.2 - Open Burning of Waste Disp -4.D.1 - Domestic Wastewate -4.D.2 - Industrial Wastewate -5.B - Indirect N20 emissions fro -5.B - Indirect CO2 emissions fro -5.B - Indirect CO2 emissions	Country/Territory W Region O Subdivision: Un Climate Zone B Main parameters and Wast Climate Zone C A Main parameters and Wast Climate Zone A Main parameters and Wast Climate Zone Climate Zone Cli	anuatu ceania - Australia & New nspecified oreal and temperate dry ite Types for selected Sub k on this tab -Solid waste posal developed gas H4 uncertainties	Zeland V + V division 1950 C 6 C 0.500 C 1.333333 vision Waste Type N	Parameters for HWP (Bulk MSW) % garden in municipal waste % paper in municipal waste % wood in municipal waste Parameters for HWP (Bulk Industri % paper in industrial waste % wood in industrial waste Manager	0.00 % 순 0.00 % 순 0.00 % 순 al Waste) 0.00 % 순 0.00 % 순
	User notes			→ ₽	4.A - Time Series
Worksheet notes 2006 IPCC Guidelines	Save				Gas METHANE (CH4)

:ountry/Territory: Vanuatu | Inventory Year: 2016 | Base year for assessment of uncertainty in trend: 1990 | CO2 Equivalents: AR5 GWPs (100 year time horizon) | Database file: (C:\ProgramData\\PC







1.9 Click on the "Region" drop-down tab and select "Oceania – Other Oceania (See illustration below)

Application Database Invent	ory Year Administrate Worksheets Tool	s Export/Import Report	s Window Help	
6 IPCC Categories	Parameters SWDS Types - Utilization Act	tivity Data Amount Deposited	Long Term stored C in SWDS	Harvested Wood Prod
	Country/Territory Vanuatu Region Oceania - Other Oc Subdivision: Oceania - Australia	ceania	Click Drop Selec Ocea	on the "Region" down tab and t "Oceania ~ Other nia"
3.C. 14 - Other (please specif	Climate Zone	ceania		
3.D.1 - Harvested Wood Pro 3.D.2 - Other (please specify	Main parameters and Waste Types for select	ted Subdivision	Parameters for HWP (Bulk MSW)	
- Waste ⊒ 4.A - Solid Waste Disposal	Starting year	1950 🗢	% garden in municipal waste	0.00 % 🚖
4.A.1 - Managed Waste Disp 4.A.2 - Unmanaged Waste D	Delay Time (months)	6 🜩	% paper in municipal waste	0.00 % 🗢
4.A.3 - Uncategorised Waste 4.B - Biological Treatment of Sol	Fraction of methane (F) in developed gas	0.500 🜩	% wood in municipal waste	0.00 % 🖨
	Conversion Factor, C to CH4	1.333333	Parameters for HWP (Bulk Industr	ial Waste)
 4.C.2 - Open Burning of Was 4.D - Wastewater Treatment and 4.D.1 - Domestic Wastewate 4.D.2 - Industrial Wastewate 	Waste Type Parameters for selecte	d Subdivision	% wood in industrial waste	0.00 % 🗢
4.5.2 - Industrial vostewate 4.E Other (please specify) - Other - 5.A - Indirect N2O emissions fro - 5.B - Indirect CO2 emissions fro - 5.6 - C C C C C C C	Save Uncertainti	es Waste Type Mar	ager	
	User notes		↓ ₽	4.A - Time Series

1.10 Click the Subdivision drop-down tab and select "Unspecified" (see illustration below)

Parameters	SWDS Types - Utilization	Activity Data	Amount Deposited	Long Term stored C in SWDS	Harvested Wood Products				
Country/ Region Subdivis Climate 2	Territory Vanuatu Oceania - Aus ion: Unspecified Zone Unspecified	tralia & New Zel nperate ory		Click fl tab and	ne Subdivision drop down l Select "Unspecified"				
Main para	meters and Waste Types for	selected Subdivi	sion	Parameters for HWP (Bulk MSW)					
Starting y Delay Tim Fraction o Conversio	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 * garden in municipal waste 0.00 * + Save Uncertainties Waste Type Manager								
User notes				▼ ₽	4.A - Time Series				







1.11 Select the "Climate zone" drop-down bar and Select "Tropical Wet"

v/Territory Vanuatu Oceania - Other Oceania Ision: Unspecified Zone Tropical wet Boreal and temperate dry Boreal and temperate wet Tropical wet me (months) of methane (F) in developed gas 0.500 (*) ion Factor, C to CH4 1.333333	Parameters for HWP (Bulk MS "Unden in municipal waste per monopal waste "Tropical wet" "Wood in municipal waste Parameters for HWP (Bulk Ind "paper in industrial waste "wood in industrial waste	ISW) = 0.00 % (● 0.00 % (● 0.00 % (● 0.00 % (● 0.00 % (● 0.00 % (●
ion Factor, C to CH4 1.333333 Waste Type Parameters for selected Subdivision	Parameters for HWP (Bulk Ind % paper in industrial waste % wood in industrial waste	ndustral Waste) 0.00 % (≏) 0.00 % (≏)
Save Uncertainties Waste Ty	vpe Manager	
	- A 4	4 û - Time Series

1.12 Enter the following default values into the "Main Parameters and waste types for Selected Subdivision (See illustration below)

Default Value:

- Starting year:1950
- Delay Time (months): 6 Fraction of methane (F) in developed gas: 0.5

Parameters SWDSTy	pes - Utilization Activity Data	Amount Deposited	Long Term stored C in SWDS	Harvested Wood Products
Country/Territory Region Subdivision: Climate Zone	Vanuatu Oceania - Australia & New Z Unspecified Boreal and temperate wet	eland v v +	Enter the IPCC parameters ar Subdivision	C default values for the Main Id Waste Types for selected
Main parameters and Starting year Delay Time (months) Fraction of methane (f Conversion Factor, C f	Waste Types for selected Subdiv F) in developed gas to CH4	vision 1950 € 6 € 0.500 € 1.333333	ISW) % garden in municipal waste % paper in municipal waste % wood in municipal waste Parameters for HWP (Bulk Industri	0.00 % € 0.00 % € 0.00 % €
Waste Type	Parameters for selected Subdivis	sion	% paper in industrial waste	0.00 % 🗢
Save	Uncertainties	Waste Type Mar	nager	
User notes			→ ₽	4.A - Time Series







1.13 Click the "Waste Type Parameters for Selected Subdivision" tab (See illustration below)

2006 IPCC Categories	Parameters SWDS Types - Utilization Activity Data Amount Deposited Long Term stored C in SWDS Harvested Wood Products	
2006 IPCC Categories -3.C.9 - CH4 from Drainage -3.C.10 - CH4 from Rewetting -3.C.11 - CH4 Emissions fro -3.C.12 - N20 Emissions fro -3.C.13 - CH4 Emissions fro -3.C.14 - Other (please specif -3.D - Other -3.D.2 - Other (please specify	Parameters SWDS Types - Utilization Activity Data Amount Deposited Long Term stored C in SWDS Harvested Wood Products Country/Territory Vanuatu Region Oceania - Australia & New Zeland Subdivision: Unspecified + Climate Zone Boreal and temperate wet Main parameters and Waste Types for selected Subdivision Parameters for HWP (Bulk MSW)	
- 4 - Waste	Starting year 1950 🖨 🎇 garden in municipal waste 0.00 % 🚖	
■ 4.A - Solid Waste Disposal	Delay Time (months) 6 % global ministrapia made 0.00 % % paper in municipal waste 0.00 %	
4.A.3 - Uncategorised Waste	Fraction of methane (F) in developed gas 0.500 🗢 % wood in municipal waste 0.00 % 🜩	
- 4.C - Incineration and Open Bur - 4.C 1 - Waste Incineration	Conversion Factor, C to CH4 1.333333 Parameters for HWP (Bulk Industrial Waste)	
- 4.C.2 - Open Burning of Was - 4.D - Wastewater Treatment and - 4.D.1 - Domestic Wastewate	Waste Type Parameters for selected Subdivision Bit is dubted waste 0.00 % 🔄	
	Save Uncertainties Waste Type Manager Parameters for selected Subdivisions" tab	
····· 5.C - Other	User notes 🚽 🖡 4.A - Time Series	_

1.14 and click on the "methane generation rate constant" drop-down tab to select the default values as illustrated below. Click OK.

Waste Category		Waste Type / Industry Type		Degradable organic carbon	Degradable organic carbon which decomposes in SWDS	Methane generation rat constant (k)
۵7	Class of decomposability ムマ	Type 🛆	Use in calculations	DOC (Fraction of wet weight)	DOCf (Fraction)	ĸ
Industrial Waste	Bulk waste	Bulk Industrial Waste		0.15	0.5	(
	Highly decomposable waste	Food, beverages and tobacco		0.15	0.7	
	Less decomposable waste	Construction and demolition		0.04	0.5	
		Wood and wood products		0.43	0.5	
	Moderately decomposable w	Pulp and paper		0.4	0.5	
		Textile		0.24	0.5	
Municipal Waste	Bulk waste	Bulk Municipal Waste	2	0.18	0.5	9
	Highly decomposable waste	Food waste	2	0.15	0.7	
		Garden and park		0.2	0.7	
	Less decomposable waste	Wood		0.43	0.5	0
	Moderately decomposable w.	Disposable nappies		0.24	0.5	3
		Paper and cardboard		0.4	0.5	1
		Textile		0.24	0.5	2
Other waste	Bulk waste	Clinical waste		0.15	0.5	
	141-55	Hazardous waste			0.5	
Sludge	Highly decomposable waste	Industrial sewage sludge		0.09	0.5	
		Municipal sewage sludge		0.05	0.5	







1.15 Click on the save button (see Illustration below)

Application Database Inventor	yYear Administrate Worksheets Tools Export/Import Reports Window Help
06 IPCC Categories	Parameters SWDS Types - Utilization Activity Data Amount Deposited Long Term stored C in SWDS Harvested Wood Products
	Country/Territory Vanuatu Region Oceania - Other Oceania Subdivision: Unspecified Climate Zone Boreal and temperate wet
	Main parameters and Waste Types for selected Subdivision Parameters for HWP (Bulk MSW)
 4 - Waste 4 A - Solid Waste Disposal 4 A 1 - Managed Waste Disp 	Starting year 1950 Image: 1950 I
4.E - Other (please specify)	Save /aste Type Manager
5 - Other 5.A - Indirect N2O emissions fro 5.B - Indirect CO2 emissions fro 5.B - Other	Click the Save button
J.C - Other	User notes 🗸 🗸 🗍 4.A - Time Series

1.16 Click on the "SWDS Type – Utilization" tab at the near top of the page (see illustration below)

IPCC Inventory Software - ANITAKAY - IPCC Inventor Database Inventor	[Worksheets] y Year Administrate Worksheets Tools Export/Import Reports Window Help	
2006 IPCC Categories	Parameters SWDS Types - Utilization Activity Data Amount Deposited Long Term stored C in SWDS	Harvested Wood Products
- 3.C.9 - CH4 from Drainage - 3.C.10 - CH4 from Rewetting - 3.C.11 - CH4 Emissions fro - 3.C.12 - N2O Emissions fro - 3.C.13 - CH4 Emissions fro - 3.C.14 - Other (please specif E-3.D - Other - 3.D.1 - Harvested Wood Pro	Country/Territory Vary Region Cher Oceania Subdivision: V Climate Zone E temperate wet	
	Main parameters and Wa for selected Subdivision Parameters for HWP (Bulk MSW) Starting year Click on "SWDS Types ~ 1950 * ///>(garden in municipal waste) Delay Time (months) top of the page. 6 * //>(yaper in municipal waste) Fraction of methane (F) in developed gas 0.500 * //>(wood in municipal waste) Conversion Factor, C to CH4 1.333333 Parameters for HWP (Bulk Industrial waste) Waste Type Parameters for selected Subdivision //>//>// wood in industrial waste) //>///>// Save Uncertainties Waste Type Manager	0.00 % (후) 0.00 % (후) 0.00 % (후) al Waste) 0.00 % (후)
5.B - Indirect CO2 emissions fro	User notes v 7	4.A - Time Series







1.17 Click on the drop-down tab under the "Unmanaged shallow (%)" tab and select the Default factor 25.



1.18 click on the blue arrow beside the drop-down sign under the Unmanaged- Shallow to update all the years starting from 1950 to 2025. (%) (See illustration below).

Parameters S Worksheet Sector: Category: Subcategory: Sheet: Data	WDS Types - Utilizat Waste Methane emission 4.A - Solid Waste SWDS Types - Ut	ion Activity Dates from Solid Was Disposal tilization	ata A	mount Deposited	Long Term stored C in :	Click the k arrow to n an update all years starting fro	sted Wood Produ Ilue nake for om	cts							
Subdivision	Unspecified	~	Waste	e Category Mun	icipal Waste \lor	1950 to 20	023								
		naged				Manageo					Uncategorise		Distributi Check	ion (
Year	Unmanaged – shallow (%)	Unmanaged - deep (%)	-	Managed – anaerobic 🦃 (%)	Managed poorly - semi-aerobic (%)	Managed wel - semi-aerobi (%)	Managed – active a (%)	poorly eration 🬮)	Managed well – active aeration (%)	?	Uncategorised SWDS (%)	?	Total (%)		
1950	2 🕕		30	2	5		5					15		100	
1951	25		30	2	5		5					15		100	
1952	25		30	2	5		5					15		100	2
1953	25		30	2	5		5					15		100	1
1955	25		20	2	5		5					15		100	H.
1956	25		30	2	5		5					15		100	1
1957	25		30	2	5		5					15		100	F.
1958	25		30	2	5		5					15		100	Ē.
1959	25		30	2	5		5					15		100	
1960	25		30	2	5		5					15		100	Í
User notes						-	ime Series								
									METHANE (CH4)	Emissia	ons (Go CO2 Equival	ents)			_
						0 0	8 4 1661 1665 1665 1665 1665 1665 1665	1995 1996 1997 1998 1998	2000 2000 2000 2003 2003 2004 2004	2005 2006	2007 2008 2010 2011 2011 2012	2013 2014	2015 2016 2017	2019	2020
							METHANE	(0114)							_







1.19 Replicate steps 2.5 and 2.6 using the IPCC default values for the following tabs (see illustration below):

Table 6: Default values for each of the different types of sites.

They should all give a total of 100%.

Unmanaged		Managed		Uncategorized	Distribution Check
Unmanaged - Shallow %	Unmanaged- Deep %	Managed- Anaerobic	Managed well – semi-aerobic %	Uncategorized SWDS %	Total (%)
25	30	25	5	15	100%









1.20 Select "Activity Data" at the near top of the page (See illustration below)



1.21 Click on the "subdivision" tab and select "Unspecified" (see illustration below).

Parameters Worksheet Sector: Category: Subcategory Sheet: Data	SWDS Type Waste Methal y: 4.A - S Activity	s ation of Disp	Activity D om Solid Wa posal <u>Cli</u> and	ata Amount D ste Disposal Site ck on the "S d select "Un	eposited es iubdivisio uspecified	Long Term sto on" tab d"	red C in SWDS	Harvested	Nood Products						2	2016
Subdivision	Unspecifie	ed	~	Waste Categ	ory Muni	cipal Waste	⊻ Total W	Composi	ted from Popula	tion V W	aste Type Ar	nounts % of	Total Waste go	ing to SW[)S	
Year	Populatio n (Capita)	Waste per capita (kg/cap/yr)	Total Waste (Gg)	% to SWDS (%)	Total to SWDS (Gg)	Food waste	Garden and park	Disposable nappies	Paper and cardboard	Textile	Wood	Bulk Municipal Waste	Inert	Total		
	A	в	C = A* B * 10^-6	D	E = C * (D/100)	% of E	% of E	% of E	% of E	% of E	% of E	% of E	% of E	%		
 ▶ 1950 ■ 1951 ■ 1952 ■ 1953 ■ 1954 ■ 1955 ■ 1956 ■ 1957 ■ 1958 														0 0 0 0 0 0 0 0 0 0 0 0 0 0		
User notes							▼ ‡	4.A - Time	Series	MET	HANE (CH4) Emis	ssions (Gq CO2 Eq	uivalents)			•







1.22 Click on the Waste Sector tab and select "Municipal Waste", see illustration below.

Para Work Sec Cate Sub She Dat	meters (sheet tor: egory: pcategory eet: a odivision	SWDS Type Waste Methar r: 4.A - Si Activity Unspecifie	is - Utilization ne emissions fro olid Waste Disp v Data ed	Activity D	ata] Amount D ste Disposal Site Waste Categ	eposited es ory Munic	Long Term s	in SWDS	Harvested Lick on the rop down t funicipal w aste Calcula	Wood Products "Waste Cat ab and selec raste sted from Popula	egory" ct tion ~ W	aste Type Ar	nounts % of	Fotal Waste go	bing to SWD:	201 s ~	6
									Compos	ition of waste g	joing to solid	waste disposa	al sites.				P
	Year	Populatio n (Capita)	Waste per capita (kg/cap/yr)	Total Waste (Gg)	% to SWDS (%)	Total to SWDS (Gg)	Food waste	Garden and park	Disposable nappies	Paper and cardboard	Textile	Wood	Bulk Municipal Waste	Inert	Total		
		А		C = A* B * 10^-6	D	E = C * (D/100)	% of E	% of E	% of E	% of E	% of E	% of E	% of E	% of E	%		
▶	1950														θ 0	2 🖬 🤈	
	1951														0		
	1952														e 0		- 1
	1953														0		-
	1994														0 0		-
	1956														0		-
	1957														0 0	2	1
	1958														0	2	1
User	notes							↓ ₽	4.A - Time	Series							• 4
									0.8		MET	HANE (CH4) Emis	ssions (Gq CO2 Eq	uivalents)			

1.23 Click on the Total Waste drop-down tab and select "Calculated from the population"

ector: ategory: abcategory neet: ata	Methar y: 4.A - Si Activity	ne emissions fro olid Waste Disp v Data	m Solid Wa oosal	ste Disposal Site	95					♥	Click on t down tab from Popt	he "Total W and select " ulation".	aste" drop Calculated	ĩ		20
ubdivision	Unspecifie	ed	~	Waste Categ	ory Muni	cipal Waste	✓ Total W	aste Calcula	ted from Popula	tion 🗸 N	Vaste Type Ar	mounts % of 1	Total Waste go	oing to SV	VDS	
								Composi	tion of waste g	joing to solid	l waste disposa	al sites.				
Year	Populatio n (Capita)	Waste per capita (kg/cap/yr)	Total Waste (Gg)	% to SWDS (%)	Total to SWDS (Gg)	Food waste	Garden and park	Disposable nappies	Paper and cardboard	Textile	Wood	Bulk Municipal Waste	Inert	Tota	I	
	A	В	C = A* B * 10^-6	D	E = C * (D/100)	% of E	% of E	% of E	% of E	% of E	% of E	% of E	% of E	%		
1950														0	0 📝	
1951														0		\square
1953														ă	0 7	\vdash
1954														ě	0 📝	H
1955														Ð	0 📝	Π
1956														θ	0 📝	
1957														θ	0 📝	
1958														θ	0 📝	







1.24 Click on the "Waste Type Amounts" drop-down tab and select "% of Total Waste going to SWDS".

Parameters Worksheet Sector: Category: Subcategory Sheet: Data	SWDS Type Waste Methar y: 4.A - S Activity	s - Utilization ne emissions fro olid Waste Disp v Data	Activity Dai om Solid Wast posal	a Amount D e Disposal Site	leposited es	Long Term sto	red C in SWDS	Harvested	Nood Products				Click on th Type Amou select "% of going to SV	ie "Waste 1nt" and f Waste NDS"		
Subdivision	Unspecifie	ed	~ V	Vaste Categ	ory Muni	cipal Waste	✓ Total W	aste Calcula	ted from Popula	tion 🗸 W	aste Type An	nounts % of	Total Waste go	oing to SWD	S	×
								Composi	tion of waste g	oing to solid	waste disposa	I sites.				
Year	Populatio n (Capita)	Waste per capita (kg/cap/yr)	Total Waste (Gg)	% to SWDS (%)	Total to SWDS (Gg)	Food waste	Garden and park	Disposable nappies	Paper and cardboard	Textile	Wood	Bulk Municipal Waste	Inert	Total		
	A	в	C = A * B * 10^-6	D	E = C * (D/100)	% of E	% of E	% of E	% of E	% of E	% of E	% of E	% of E	%		
▶ 1950														θ 0	2	19
1951														θ 0	2	
1952														0		\square
1953														e 0		+
1954														0		+
1956														0		+
1957														0 0	7	+
1958														θ 0	2	\square
er notes							▼ 4	4.A - Time	Series							

1.25 Enter the data for the population under the "Population n (Capita)" tab for the years 1950 to 2023 (see Illustration below).

Parameter	s SWDSTyp	es - Utilization	Activity Da	ata Amount D	eposited	Long Term sto	red C in SWDS	Harvested	Nood Products								
Sector: Category Subcate Sheet:	Wast : Meth gory: 4.A - Activi	e ane emissions fr Solid Waste Dis ty Data	om Solid Was posal	te Disposal Site	es											20 ⁻	16
Subdivis	ion Unspeci	fied	~ 1	Waste Categ	ory Muni	cipal Waste	✓ Total W	aste Calcula	ted from Popula	ation 🗸 W	aste Type Ar	nounts % of	Fotal Waste go	oing to SW[)S	`	-
								Composi	tion of waste g	joing to solid	waste disposa	I sites.					P
Year	Populatio n (Capita)	Waste per capita (kg/cap/yr)	Total Waste (Gg)	% to SWDS (%)	Total to SWDS (Gg)	Food waste	Garden and park	Disposable nappies	Paper and cardboard	Textile	Wood	Bulk Municipal Waste	Inert	Total			
	A	в	C = A* B * 10^-6	D	E = C * (D/100)	% of E	% of E	% of E	% of E	% of E	% of E	% of E	% of E	%			
 195 	D 1 2 3 4 5 6 7 8			Enter of Var 1950	data for nuatu sta to 2023	the populat rting from								0 0 0 0 0 0 0 0 0 0 0 0 0 0			
User notes							↓ ₽	4.A - Time	Series								• 9







1.26 Under the "Waste per Capita (Kg/cap/yr.)" tab, enter 690 as the Regional Default value. Enter national data if available. See illustration below. (See 2006 IPCC Guideline, Vol.5, pg. 19, Table 2A.1).

bcategory eet: ata	y: 4.A - S Activity	olid Waste Disp / Data	osal													
ubdivision	Unspecifie	ed	~	Waste Categ	ory Munic	cipal Waste	Y Total W	aste Calcula	ted from Popula	tion 🗸 W	aste Type Ar	nounts % of	Total Waste go	ing to SW[)S	
								Composi	tion of waste <u>o</u>	joing to solid	waste disposa	I sites.				
Year	Populatio n (Capita)	Waste per capita (kg/cap/yr)	Total Waste (Gg)	% to SWDS (%)	Total to SWDS (Gg)	Food waste	Garden and park	Disposable nappies	Paper and cardboard	Textile	Wood	Bulk Municipal Waste	Inert	Total		
	A	В	C = A*B *10^-6	D	E = C * (D/100)	% of E	% of E	% of E	% of E	% of E	% of E	% of E	% of E	%		
1950		690		_										θ) 🕜	
1951		690												θ) 📝	
1952		690			Er	iter the Reg	ional Defat	ilt Value						θ) 📝	
1953		690			fo	r years 195	0 to 2023							θ) 🛃	_
1954		690												0		
1955		690												θ		
1956		690												e		_
1957		690												e		_

1.27 Click on the green cell below "Total Waste (Gg)" to generate the value (see illustration below).







1.28 Under the "% to SWDS (%)", enter 85 for all years starting from 1950 to 2023 (see illustration below).

rksheet ctor: tegory: bcategor eet:	Waste Methar y: 4.A - Si Activity	ne emissions froi olid Waste Disp r Data	m Solid Was Iosal	ste Disposal Site	95										2	.01
ata I bdivision	Unspecifie	ed	~	Waste Categ	ory Munic	cipal Waste	✓ Total W	laste Calcula	ated from Popula	ation V W	aste Type Ar	mounts % of	Total Waste go	oing to SWD	S	~
								Compos	ition of waste <u>c</u>	joing to solid	waste disposa	al sites.				
Year	Populatio n (Capita)	Waste per capita (kg/cap/yr)	Total Waste (Gg)	% to SWDS (%)	Total to SWDS (Gg)	Food waste	Garden and park	Disposable nappies	Paper and cardboard	Textile	Wood	Bulk Municipal Waste	Inert	Total		
	A	В	C = A*B *10^-6	D	E = C * (D/100)	% of E	% of E	% of E	% of E	% of E	% of E	% of E	% of E	%		
1950	230	690	0.1587	85	0.1349									0	2	19
1951		690		85										θ 0	2	
1952		690		85										θ 0	2	
1953		690		85										θ 0	2	
1954		690		85			Enter 85 f	or all years	starting					θ 0		
1955		690		85			from 1950) to 2023						θ 0		
1956		690		85										0	2	
1957		690		85		-								0	2	
		C00					1					1		•	(1	1

1.29 Click the green cell under the "Total to SWDS) to generate the value.

1.30 For each of the following waste compositions going to a solid waste disposal facility, enter the default values by clicking on the drop-down button and choosing the default value (See Illustration below). (See 2006 IPCC guidelines, Vol.5, page12, Table 2.3). Enter national data if available.

Param Works Secto Categ Subc Shee Data	eters heet or: gory: ategory t:	SWDS Type Waste Methar r: 4.A - S Activity	s - Utilization ne emissions fro olid Waste Disp / Data	Activity Da m Solid Was posal	ata Amount D te Disposal Site	eposited 's	Long Term sto	red C in SWDS	Harvested	Nood Products						2	2016
Subd	livision	Unspecifie	ed	~	Waste Categ	ory Muni	cipal Waste	⊻ Total W	aste Calcula	ted from Popula	ation 🗸 W	aste Type An	nounts % of 1	Total Waste goir	ng to SWD	S	~
									Composi	tion of waste g	going to solid	waste disposa	l sites.				
h	/ear	Populatio n (Capita)	Waste per capita (kg/cap/yr)	Total Waste (Gg)	% to SWDS (%)	Total to SWDS (Gg)	Food waste	Garden and park	Disposable nappies	Paper and cardboard	Textile	Wood	Bulk Municipal Waste	Inert	Total		
		A		C = A* B * 10^-6	D	E = C * (D/100)	% of E	% of E	% of E	% of E	% of E	% of E	% of E	% of E	%		
1	1950	230	690	0.1587	85	0.1349	67.5			6		2.5		24	100	2	
1	1951		690		85										9 0	2	
	1952		690		85										0 0	2	
	1953		690		85										0 0		
	1954		690		85				-4				V		9 0		
	1956		000		00 85					Enter f	he default v	talues for e	ach of the		0 0		+
	1957		690		85					differe	nt composi	tion of wast	e going to		0		+
1	1958		690		85					solid w	aste dispos	al site	0.00		0	2	+
User no	otes							▼ 1	4.A - Time	Series							•







- 1.31 Click on the Green cell under the "Total" tab, it should total up to 100%.
- 1.32 Go to the "2006 IPCC categories" tab and select "4.A.1 Managed Waste Disposal Sites" (See illustration below).

💀 Application Database Inventory	Year Administrate	Worksheets Tools	Export/Import Re	ports Window	Help						_ 8 ×
2006 IPCC Categories	SWDS Types - MCF a	and OX Methane Gener	ated Methane Emissio	ns							
 - 3.C.9 - CH4 from Drainage - 3.C.10 - CH4 from Rewetting - 3.C.11 - CH4 Emissions fro - 3.C.12 - N20 Emissions fro - 3.C.13 - CH4 Emissions fro - 3.C.14 - Other (please specif 	Worksheet Sector: W Category: M Subcategory: 4. Sheet: S Data	/aste lethane emissions from Solid A.1 - Managed Waste Disp WDS Types - Methane Con	Waste Disposal Sites osal Sites ection Factors and Oxida	ion Factors							2016
B-3.D - Other	Subdivision Unsp	pecified	~								
					SV	VDS					
B-4-Waste		Managed – anaerobic	Managed poor		Managed wel	I – semi-aerobic	Managed poorly	– active aeration	Managed well –	active aeration	
		F OX on) (Fraction	MCF (Fraction)	OX (Fraction)	MCF (Fraction)	OX (Fraction)	MCF (Fraction)	OX (Fraction)	MCF (Fraction)	OX (Fraction)	
4.4.2 - Uncategorised Waste D 4.4.3 - Uncategorised Waste	1951	k on the Category 4.	A. 10								3 3 7
- 4.C - Incineration and Open Bur	1952 1953										2
4.C.2 - Open Burning of Was	1954										3
- 4.D.1 - Domestic Wastewate	1956										2
4.E - Other (please specify)	1958										2
5.4 - Indirect N2O emissions fro	1959										2
		1	1	1		1	1		1		
0.0 0.0	User notes				▼ ₽	4.A.1 - Time Serie	s				▼ ₽
							M	ETHANE (CH4) Emission	ns (Gq CO2 Equivalents)	-
						0.4	994 995 996 998	0001	000/ 0008 0010 0011 0011 0012 0013	014 015 016 017 017 018 018	020 021 022 023 024 025
						* * Base year for asse	ssment of uncertainty in	trend: 1990			

1.33 Enter the following default values from the table below for the Managed – anaerobic and Managed Well- semi-aerobic into the cells for the years 1950 to 2023. For the other SWDS enter 0. (See illustration below).







Table 7: Default value for MCF (fraction) and OX for the 2 types of SWDS

	Managed - a	anaerobic	Managed w	ell- Semi aerobic
Year	MCF (fraction)	OX (fraction)	MCF	OX (fraction)
1950 - 2023	1	0	0.5	0

(See 2006 IPCC Guidelines, Vol.5, pg 14, Table 3.1)

SWDS Types - N Worksheet Sector: Category: Subcategory: Sheet: Data Subdivision	MCF and OX Me Waste Methane emissi 4.A.1 - Manage Types - Ent Uns 1 193	thane Generated ons from Solid Wast d Waste Disposal Si Methane Correction er 1 for years 50 to 2023	Methane Emission e Disposal Sites tes Factors and Oxidatio	s in Factors	Ei 1	nter 0.5 for ye 950 to 2023	ears				2016
	anaged - MCF	anaerobic OX	Managed poorly MCF	– semi-aerobic OX	Mana, J well -	DS - semi-aerobic OX	Managed poorly	– active aeration OX	Managed well – MCF	active aeration	
Year	(Fraction)	(Fraction)	(Fraction)	(Fraction)	(Fraction)	(Fraction)	(Fraction)	(Fraction)	(Fraction)	(Fraction)	
▶ 1950 1051	1	0	0	0	0.5	0	0	0	0	0 2	
1952	1	0	0	0	0.5	0	0	0	0	0 2	
1953	1	0	0	0	0.5	0	0	0	0	0 7	
1954	1	0	0	0	0.5	0	0	0	0	0 📝	
1955	1	0	0	0	0.5	0	0	0	0	0 📝	
1956	1	0	0	0	0.5	0	0	0	0	0 📝	
1957	1	0	0	0	0.5	0	0	0	0	0 📝	
1958	1	0	0	0	0.5	0	0	0	0	0 📝	
1959	1	0	01	0	0.5	0	I 0	0	01	0 1 📝	
User notes					- Ţ	4.A.1 - Time Series	ŝ				▼ {

1.34 Click on "Methane Generated" tab at the upper corner of the page (see illustration below).

WDS Types - Vorksheet Sector: Category: Subcategory: Sheet: Data	MCF and OX Waste Methane emit 4.A.1 - Manag SWDS Types	Methane Generate sions to Solid V ged W. Dispos - Methane Correct	Methane En Vaste Disposal St al Sites tion Factors and G	nissions es Oxidation Factors						
Subdivision	Unspecified	~								
					SWC	S				-
	Managed -	anaerobic	Managed poo	ony-sem⊢	Managed well -	semi-aerobic	Managed poo	ny - active	Managed well -	active aeration
Year	MCF (Fraction)	OX (Fraction)	MCF (Fraction)	OX (Fraction)	MCF (Fraction)	OX (Fraction)	MCF (Fraction)	OX (Fraction)	MCF (Fraction)	OX (Fraction)
> 1950	1	0	0	0	0.5	0	0	0	0	0
1951	1	0	0	0	0.5	0	0	0	0	0
1952	1	0	0	0	0.5	0	0	0	0	0
1953	1	0	0	0	0.5	0	0	0	0	0
1954	1	0	0	0	0.5	0	0	0	0	0
1955	1	0	0	0	0.5	0	0	0	0	0
1956	1	0	0	0	0.5	0	0	0	0	0
1957	1	0	0	0	0.5	0	0	0	0	0
1958	1	0	0	0	0.5	0	0	0	0	0
1959	1	0	0	0	0.5	0	0	0	0	0
1960	1	0	0	0	0.5	0	0	0	0	0
1961	1	0	0	0	0.5	0	0	0	0	0
1962	1	0	0	0	0.5	0	0	0	0	0
1007	1	0	0	0	0.5	0	0	0	0	0







1.35 Click on the "SWDS Type" and select "Managed - anaerobic" (see illustration below).

Sect Cate Subo Shee	or: gory: category: et:	Waste Methane emiss 4.A.1 - Manage Methane Gene	ions from Solid Was d Waste Disposal S rated across SWDS	te Disposal Stes Sites 5 Types and Waste Types					2016
Sub	division	Unspecified	SWDS T	pe Managed - anaerobic	~	Waste Category M	unicipal Waste 🗸 🗸	Waste Type Food was	te 🗸 DO
k	0.4	Half-life t	ime (h=ln(2)/k)	2328679513: exp1=	exp(-k) 0.67032	0046035 Month of	reaction start (M)	13 exp2=exp(-k	•((13-M)/12)) 1
		Amount deposited (Gg)	MCF (Fraction)	ecomposable DOC IDOCm) deposited (Gg)	DDOCm not reacted in deposition year (Gg)	DDOCm decomposed in deposition year (Gg)	DDOCm accumulated in SWDS at the end of year (Gg)	DDOCm decomposed (Gg)	CH4 generated (Gg)
	Year	w	MCF	D = W * DOC * DOCf * MCF	B=D*exp2	C = D * (1-exp2)	H = B + (H(y-1) * exp1)	E = C + H(y-1) * (1- exp1)	Q=E*16/12*F
	1950	5.10378	1	0.5359	0.5359	0	0.5359	0	0
	1951	5.18929	1	0.54488	0.54488	0	0.9041	0.17667	0.11778
	1952	5.28124	1	0.55453	0.55453	0	1,16057	0.29806	0.19871
	1953	5.38516	1	0.56544	0.56544	0	1.34339	0.38262	0.25508
	1954	5.49769	1	0.57726	0.57726	0	1.47776	0.44289	0.29526
	1955	5.61863	1	0.58996	0.58996	0	1.58053	0.48719	0.32479
	1956	5.7474	1	0.60348	0.60348	0	1.66294	0.52107	0.34738
	1957	5.8917	1	0.61863	0.61863	0	1.73333	0.54824	0.36549
	1958	6.05114	1	0.63537	0.63537	0	1.79725	0.57144	0.38096
	1959	6.2185	1	0.65294	0.65294	0	1.85768	0.59252	0.39501
					0.07414	-	* *****		a

1.36 The green cell under the "CH₄ generated (Gg) will give the amount of methane generated for each year (see illustration below).

Sec Cat Sub She Dat	ctor: legory: bcategory: eet: ta	Waste Methane emissi 4.A.1 - Manage Methane Gener	ons from Solid Wa d Waste Disposal rated across SWD:	ite Disposal Sites Sites S Types and Waste Types					2016
Su	bdivision	Unspecified	SWDS T	ype Managed - anaerobic	~ •	Waste Category M	unicipal Waste 🗸 🗸	Waste Type Food was	te DO
k	0.4	Half-life t	ime (h=ln(2)/k)	1.7328679513! exp1=	exp(-k) 0.670320	046035 Month of	f reaction start (M)	13 exp2=exp(-k	*((13,)/12)) 1
		Amount deposited (Gg)	MCF (Fraction)	Decomposable DOC (DDOCm) deposited (Gg)	DDOCm not reacted in deposition year (Gg)	DDOCm decomposed in deposition year (Gg)	DDOCm accumulated in SWDS at the end of year (Gg)	DDOCm decomposed (Gg)	CH4 generated (Gg)
	Year	w	MCF	D = W * DOC * DOCf * MCF	B = D * exp2	C = D * (1-exp2)	H = B + (H(y-1) * exp1)	E = C + H(y-1) * (1- exp 1)	Q = E * 16/12 * F
	1950	5.10378	1	0.5359	0.5359	0	0.5359	0	0
	1951	5.18929	1	0.54488	0.54488	0	0.9041	0.17667	0.11778
	1952	5.28124	1	0.55453	0.55453	0	1.16057	0.29806	0.19871
	1953	5.38516	1	0.56544	0.56544	0	1.34339	0.38262	0.25508
	1954	5.49769	1	0.57726	0.57726	0	1.47776	0.44289	0.29526
	1955	5.61863	1	0.58996	0.58996	0	1.58053	0.48719	0.32479
	1956	5.7474	1	0.60348	0.60348	0	1.66294	0.52107	0.34738
	1957	5.8917	1	0.61863	0.61863	0	1.73333	0.54824	0.36549
	1958	6.05114	1	0.63537	0.63537	0	1.79725	0.57144	0.38096
	1959	6.2185	1	0.65294	0.65294	0	1.85768	0.59252	0.39501
-	1000	A 55165							

1.37 Repeat steps 1.35 and 1.36 by selecting "Managed well- semi aerobic" from the "SWDS Type".







1.38 Run the Cursor over the graph below to give the CH_4 Emissions (Gg Co₂ Equivalent) (see illustration below).

Vorksheet notes Ø 2006 IRCC Categories 3 C B - CH4 from Drained Organic Solls 3 C D - CH4 from Drained Organic Solls 3 C 10 - CH4 from Bravetting of Organic Solls 3 C 11 - CH4 from Revetting of Mass Soll Soll Soll Soll Soll Soll Soll Soll	SMDS Types - I Worksheet Sector: Category: Subcategory: Sheet:	MCF and OX Me Waste Methane emiss 4.A.1 - Manage Methane Gene	ethane Generated ions from Solid Wat id Waste Disposal 3 rated across SWD3	Methane Emissions te Disposal Sites Sites 5 Types and Waste Types					2016
3.C.12 - N2O Emissions from Aquaculture 3.C.13 - CH4 Emissions from Rewetted and C	Subdivision	Unspecified	SWDS T	me Managed well - semi-ar	erobic 🗸)	Waste Category	unicipal Waste 🔍	Waste Type Food wa	te v DOC
3.C.14 - Other (please specify)	k 0.4	Half-life t	time (h-In(2)/k)	1.7328679513: exp1-	exp(-k) 0.67032	0046035 Month o	of reaction start (M)	13 exp2-exp(4	(*((13-M)/12)) 1
- Other 3.D.1 - Harvested Wood Products 3.D.2 - Other (please specify) ite - Solid Waste Disposal		Amount deposified (Gg)	MCF (Fraction)	Decomposable DOC (DDOCm) deposited (Gg)	DDOCm not reacted in deposition year (Cg)	DOOCm decomposed in deposition year (Og)	0000cm accumulated in SWDS at the end of year (Gg)	DDOCm decomposed (Gg)	CH4 generated ((Gg)
4 A 1 - Managed Waste Disposal Sites 4 A 2 - Unmanaged Waste Disposal Sites	Year	w	MCF	D = W * DOC * DOCF* MCF	8 - 0 * exp2	C = D * (1-exp2)	H = 8 + (H(y-1) * exp1)	E=C+H(y-1)*(1- exp1)	Q = E* 16/12*F
4 A.3 - Uncategorised Waste Disposal Sites - Biological Treatment of Solid Waste - Incineration and Open Burning of Waste	1950	1.02076	0.5	0.05359	0.05359	0	0.05359	0	0.01178
4.C.1 - Waste Incineration	User notes			# 4A.1 - Time Series					- 4
Vastewater Treatment and Discharge 4.D.1 - Domesic Wastewater Treatment and 4.D.2 - Industrial Wastewater Treatment and Other (please specify) # Indirect N20 emissions from the atmospheri Indirect CO2 emissions from the atmospheri Other				80 60 40 20 0 000 * Base year for assess	5 000 1000 1000 1000 1000 1000 1000 100	METHANE (C)	H) Emissions (Dig CO2 Eau)		
Worksheet notes 2006 IPCC Guidelines	Save			Gas METHAN	E (CH4)				

1.39 Click on the tab "Methane Emissions" at the top-hand corner of the page (see illustration below)

Vor	DS Types - ksheet	MCF and OX Me	sthane Generated	Methane Emissions							
Sector: Waste Category: Methane emissions from Sold Wast Subcategory: 4.A.1 - Managed Waste Disposal S Sheet: Methane Generated across SWDS Data			ions from Solid Wa d Waste Disposal rated across SWD	ste Disperentes Sites S Types – /aste Types	Displayees 2016						
Su	bdivision	Unspecified	SWDS T	ype Managed well - semi-ae	robic 🗸 ۱	Waste Category M	unicipal Waste 🛛 🗸	Waste Type Food was	te 🗸 DOC		
k	0.4	Half-life t	ime (h=ln(2)/k)	1.7328679513! exp1=	exp(-k) 0.670320	0046035 Month o	f reaction start (M)	13 exp2=exp(-k	*((13-M)/12)) 1		
		Amount deposited (Gg)	MCF (Fraction)	Decomposable DOC (DDOCm) deposited (Gg)	DDOCm not reacted in deposition year (Gg)	DDOCm decomposed in deposition year (Gg)	DDOCm accumulated in SWDS at the end of year (Gg)	DDOCm decomposed (Gg)	CH4 generated (Gg)		
	Year	w	MCF	D + W * DOC * DOC! * MCF	8 = 0 * exp2	C = D * (1-exp2)	H = B + (H(y-1) * exp1)	E = C + H(y-1) * (1- exp1)	Q=E*16/12*F		
	1950	1.02076	0.5	0.05359	0.05359	0	0.05359	0	0		
	1951	1.03786	0.5	0.05449	0.05449	0	0.09041	0.01767	0.01178		
	1952	1.05625	0.5	0.05545	0.05545	0	0.11606	0.02981	0.01987		
	1953	1.07703	0.5	0.05654	0.05654	0	0.13434	0.03826	0.02551		
	1954	1.09954	0.5	0.05773	0.05773	0	0.14778	0.04429	0.02953		
	1955	1.12373	0.5	0.059	0.059	0	0.15805	0.04872	0.03248		
	1956	1.14948	0.5	0.06035	0.06035	0	0.16629	0.05211	0.03474		
	1957	1.17834	0.5	0.06186	0.06186	0	0.17333	0.05482	0.03655		
	1958	1.21023	0.5	0.06354	0.06354	0	0.17973	0.05714	0.0381		
	1959	1.2437	0.5	0.06529	0.06529	0	0.18577	0.05925	0.0395		
	1960	1.27887	0.5	0.06714	0.06714	0	0.19166	0.06124	0.04083		







1.40 Green cells under the "Methane Emissions" tab display the total methane emission for a given year for the designated SWDS type (see illustration below).

ector: ategory: ubcategory: heet: lata	Waste Methane emi 4.A.1 - Mana Methane Em	issions from Solid iged Waste Dispo issions	Waste Disposal sal Sites	Sites							201
ubdivision	Unspecified	~	SWDS Ty	pe Managed	- anaerobic	~					
		м	thane generat	ed		Methane	recovered	Methan	e 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)	
Year	A	в	C	D	E=A+B+C+ D		G	н	I = (E - F - G) * H	J=E-F-G-I	
1953	0.26949	0	0	0	0.26949			0	0	0.26949	2
1954	0.31409	0	0	0	0.31409			0	0	0.31409	3
1955	0.34788	0	0	0	0.34788			0	0	0.34788	3
1956	0.37458	0	0	0	0.37458			0	0	0.37458	3
1957	0.39669	0	0	0	0.39669			0	0	0.39669	2
1958	0.41605	0	0	0	0.41605			0	0	0.41605	3
1959	0.43392	0	0	0	0.43392			0	0	0.43392	3
1960	0.45095	0	0	0	0.45095			0	0	0.45095	3
1961	0.46761	0	0	0	0.46761			0	0	0.46761	2
1962	0.4842	0	0	0	0.4842			0	0	0.4842	2
1963	0.50089	0	0	0	0.50089			0	0	0.50089	3
1964	0.51785	0	0	0	0.51785			0	0	0.51785	3
										Unc	ertainties

1.41 Click on the 4.A.2 – "Unmanaged Waste Disposal" under the "2006 IPCC categories" tab (see illustration below)

Worksheet notes P 2006 IPCC Categories	SWDS Types - MCF at Worksheet Sector: Wa Category: Me Subcategory: 4,4 Sheet: SV	nd OX Methane Generated Methan aste thane emissions from Solid Waste Disposal X2 - Unmanaged Waste Disposal Sites VDS Types - Methane Correction Factors	e Emissions al Stes and Oxidation Factors				:	2016
- 3.C.12 - N2O Emissions from Aqua - 3.C.13 - CH4 Emissions from Rewe - 3.C.14 - Other (please specify) - 3.D - Other - 3.D - J. Homested Weed Broducts	Subdivision Unspe	ecfied ~	sw	ros				
- 3.D.2 - Other (please specify)		Unmanaged		Unmanage	ed – deep			
I - 4 - Waste I - 4.A - Solid Waste Disposal I - 4.A.1 - Managed Waste Disposal Si	Year	MCF (Fraction)	OX (Fraction)	MCF (Fraction)	OX (Fraction)			
4 A 2 - Unmanaged Waste Disposal 4 A 3 - Uncategorised Waste Dispo		0.4	0	0.8		0 2		2
-4.B - Biological Treatment of Solid Was -4.C - Incineration and Open Burning of	1952 1953	0.4	0	0.8		0 2		_
4.C.2 - Open Burning of Waste	1955	0.4	0	0.8			=	
 4.D.1 - Domestic Wastewater Treat 4.D.2 - Industrial Wastewater Treat 	1957	0.4	0	0.8		0 2	\square	
-4.E - Other (please specify) ∃-5 - Other	1959 1960	0.4	0	0.8		0 🕜		
-5.A - Indirect N2O emissions from the a -5.B - Indirect CO2 emissions from the a	1961 1962	0.4	0	0.8		0 🕜		
U.C Other	1963	0.4	0	0.8		0 🛛 🛪 🗋		-1







1.42 Under "SWDS Types – MCF and OX" tab, enter the following default value from the table below into the cells accordingly for all years 1950 to 2023 (see illustration below).

 Table 8: Default values for MCF and OX under the Unmanaged Waste Disposal

 Sites

SWDS							
Unmanage	ed Shallow	Unmanaged Deep					
MCF (Fraction)	OX (Fraction)	MCF (Fraction)	OX (Fraction)				
0.4	0	0.8	0				

(See 2006 IPCC Guidelines, Vol.5, pg 14, Table 3.1)

SWDS Types - MCF and OX Methane Generated Methane Emissions Worksheet Sector: Waste Category: Methane emissions from Solid Waste Disposal Sites Subcategory: 4.A.2 - Unmanaged Waste Disposal Sites Sheet: SWDS Types - Methane Correction Factors and Oxidation Factors Data Example 1									
Subdivision Unspec	ofied	SWDS	5						
	Unmanaged – sł	nallow	Unmanage	ed – deep					
Year	MCF (Fraction)	OX (Fraction)	MCF (Fraction)	OX (Fraction)					
1950	0.4	0	0.8	0	2		2		
1951	0.4	0	0.8	0					
1952	0.4	0	0.8	0					
1953	0.4	0	0.8	0					
1954	0.4	0	0.8	0	2				
1955	0.4	0	0.8	0	2				
1956	0.4	0	0.8	0	2	\vdash			
1957	0.4	0	0.8	0	2	\vdash			
1958	0.4	0	0.8	0					
1959	0.4	0	0.8	0		\vdash			
1960	0.4	0	0.8	0		\vdash			
1961	0.4	0	0.8	0		\vdash			
1962	0.4	0	0.8	0					
1963	0.4	01	0.8	0	1 12 1	1 1	. I		

1.43 Run the cursor over the graph to give the CH_4 Emissions (Gg Co₂ Equivalent) (see illustration in step 4.0).

1.44 Repeat steps 1.34 to 1.40 for category "4.A.2 – Unmanaged Waste Disposal".







1.45 Click on the category "4.A.3-Uncategorised Waste Disposal" under the "2006 IPCC categories" (see illustration below).

1.46 under the "SWDS Types -MCF and OX" tab, enter the IPCC default value for MCF = 0.6 and OX = 0 (see illustration below)

SWDS Types - MCF and UA N Worksheet Sector: Waste Category: Methane emis Subcategory: 4.A.3 - Uncate Sheet: SWDS Types Data Subdivision Unspecified	ethane Generated Methane Emissions ions from Sold Waste Disposal Sites gorised Waste Disposal Sites Methane Correction Factors and Oxidation F Enter 0.6	Enter 0	2016
	swi	os	
	Uncategoris	sed SWDS	
Year	MCF (Fraction)	OX (Fraction)	
) 1950	0.6	0	<u> 2</u> <u>2</u> <u>2</u>
1951	0.6	0	3
1952	0.0	0	3
1954	0.6	0	
1955	0.6	0	2
1956	0.6	0	
1957	0.0	0	3
1959	0.6	0	2
1960	0.6	0	2
User notes	~ ₽	4.A.3 - Time Series	▼ ₽
		METHANE (CH4) Emissions (0g CO2 0.06 0.04 0.02 0.02 0.02 0.02 0.02 0.02 0.02	Econycelents)







1.47 Run the Cursor over the graph below to give the CH_4 Emissions (Gg Co₂ Equivalent) (see illustration in step 1.38)

1.48 Repeat steps 1.34 to 1.40 for the category "4.A.3-Uncategorised Waste Disposal".







4.3.3 TIME SERIES

According to the report produced by The Republic of Vanuatu Third National Communication to the United Nations Framework Convention on Climate Change (2020), the key source of emission from solid waste managed and disposed of included emissions from anaerobic decomposition of waste management of aerobic decomposition at the Bouffa landfill site².

Tier 1 method – IPCC First Order Decay (FOD) was used in the Third National Inventory report (2020) which covered the years 2008 to 2015. The method mainly consisted of the usage of Default value, default activity data, and default parameters 1 .

Estimates of MSW generation in Vanuatu are based on the urban populations of Port Vila, Luganville, and Lenakel in the lack of activity statistics. The majority of data is gathered from urban regions rather than rural ones because those locations are typically dispersed and fail to identify many hazards. An average figure of 1-1.5 kg/person/day was extracted from a 2015 study in which the J-PRISM team was involved ¹.

The Director General of the Ministry of Climate Change used office notifications to notify relevant ministries and departments, specified organizations, the public-private sector, and other institutions to collect data for this inventory period. The Department of Climate Change is responsible for maintaining the gathered data, database repository, and archives ¹.

Following the 2006 IPCC Guidelines, Vol. 5, Figure 3.1, the Tier 1 Method Approach specifically IPCC First Order Decay (FOD) will be used for this inventory. Estimated Emissions will be calculated using historical data and present up-to-date data.

To collect information, the Project Coordinator and the Consultants will notify Offices relevant to ministries and stakeholders such as the:

- Department of Environmental Protection and Conservation (DEPC)
- Department of Water Resources (DWR)
- Port Vila City Council (PVCC)
- Environment Unit, Public Health at the Ministry of Health
- Department of Climate Change (DOCC)
- UNELCO Engie
- Public Works Department (PWD)

The channels for requesting activity data meetings are the Electronic Single Window, emails, dialogues, and interviews. Consultants may ask the Prime Minister's Office for a Confidential Agreement or Right to Information (RTI) in specific situations where data is unavailable.

² The Republic of Vanuatu Third National Communication to the United Nations Framework Convention on Climate Change | Vanuatu Environment Data Portal (2020)







Table 9: Annual emissions data from the base year of 1994 through 2023, including the emissions values, their units, the emission factors, and the methods used to estimate the emissions.

Year	Emissions	Units	EF	Methods
1994	NE	kt CO ₂ -e	0.15Kg CH ₄ / kg DOC	Tier 1
1995	NE	kt CO ₂ -e	0.15Kg CH ₄ / kg DOC	Tier 1
1996	NE	kt CO ₂ -e	0.15Kg CH ₄ / kg DOC	Tier 1
1997	NE	kt CO ₂ -e	0.15Kg CH ₄ / kg DOC	Tier 1
1998	NE	kt CO ₂ -e	0.15Kg CH ₄ / kg DOC	Tier 1
1999	NE	kt CO ₂ -e	0.15Kg CH ₄ / kg DOC	Tier 1
2000	NE	kt CO ₂ -e	0.15Kg CH ₄ / kg DOC	Tier 1
2001	NE	kt CO ₂ -e	0.15Kg CH ₄ / kg DOC	Tier 1
2002	NE	kt CO ₂ -e	0.15Kg CH ₄ / kg DOC	Tier 1
2003	NE	kt CO ₂ -e	0.15Kg CH ₄ / kg DOC	Tier 1
2004	NE	kt CO ₂ -e	0.15Kg CH ₄ / kg DOC	Tier 1
2005	NE	kt CO ₂ -e	0.15Kg CH ₄ / kg DOC	Tier 1
2006	NE	kt CO ₂ -e	0.15Kg CH ₄ / kg DOC	Tier 1
2007	22.44	kt CO ₂ -e	0.15Kg CH ₄ / kg DOC	Tier 1
2008	23.3	kt CO ₂ -e	0.15Kg CH ₄ / kg DOC	Tier 1
2009	24.1	kt CO ₂ -e	0.15Kg CH ₄ / kg DOC	Tier 1
2010	24.9	kt CO ₂ -e	0.15Kg CH ₄ / kg DOC	Tier 1
2011	25.8	kt CO ₂ -e	0.15Kg CH ₄ / kg DOC	Tier 1
2012	26.7	kt CO ₂ -e	0.15Kg CH ₄ / kg DOC	Tier 1
2013	27.7	kt CO ₂ -e	0.15Kg CH ₄ / kg DOC	Tier 1
2014	28.6	kt CO ₂ -e	0.15Kg CH ₄ / kg DOC	Tier 1
2015	29.6	kt CO ₂ -e	0.15Kg CH ₄ / kg DOC	Tier 1
2016	NE	kt CO ₂ -e	0.15Kg CH ₄ / kg DOC	Tier 1
2017	NE	kt CO ₂ -e	0.15Kg CH ₄ / kg DOC	Tier 1
2018	NE	kt CO ₂ -e	0.15Kg CH ₄ / kg DOC	Tier 1
2019	NE	kt CO ₂ -e	0.15Kg CH ₄ / kg DOC	Tier 1
2020	NE	kt CO ₂ -e	0.15Kg CH ₄ / kg DOC	Tier 1
2021	NE	kt CO ₂ -e	0.15Kg CH ₄ / kg DOC	Tier 1
2022	NE	kt CO ₂ -e	0.15Kg CH ₄ / kg DOC	Tier 1
2023	NE	kt CO ₂ -e	0.15Kg CH ₄ / kg DOC	Tier 1

Where:

NE = Not Estimated

In improving this, the sector concern should strengthen the monitoring and reporting system for past years that are missing to satisfy the inventory process in moving forward.







The base year for MSW begins in 1994, and the collection of data will begin from 1994 to 2023. The emissions were calculated using the Tier 1 methodology approach with the default IPCC parameters and EF. The values in the Emissions need to be updated therefore no information has been placed in the table for years 1994 to 2006 and from 2016 to 2023.

Identifying Trends, Big Variations, And Outliers with A Transparent Explanation

As may be observed from the graph below, which was taken from the Third National Inventory (2020), when it comes to identifying trends and outliers The graph below shows that between 2007 and 2017, there was an increase in Gg CH_4 emissions (MSW). The growing population is the cause of the increase in emissions.

Certain trends in data can be caused by a variety of factors, including changes in underlying conditions, external influences, or anomalies such as outliers.

- 1. Inadequate data management system
- 2. The majority of the data was erased from the government system following a hack, even after it was restored.

Figure 2: Emissions of CH_4 and N_2O (in Gg) from Solid Waste Disposal and Wastewater, 2007–2015



The figure depicts an increase in the $CH_4(g)$ emissions across the years of 2007 to 2015 compared to the other categories of Waste such as Wastewater in grey and blue in the graph above.







4.3.4. QUALITY CONTROL/ QUALITY CHECK

QUALITY CONTROL (QC) METHOD

Table 10: QC activities and procedures that will be followed

The three consultants will handle the QC and Procedures based on the color in the table, Anita Kay-Pink, Florancza- Green, and Zechariah Bani- Blue.

QUALITY CONTROL	PROCEDURES	TIME TAKEN TO COMPLETE	COMMENTS
СНЕСК		PROCEDURE (DAYS)	
	Confirm that estimates		
	are reported for all		
	categories and all years		
	from the appropriate base		
	year to the period of the		
	current inventory.		
	 For subcategories, 		
	confirm that the entire		
Check the Assumptions	category is being covered.		
and criteria for the	• Provide a clear definition		
selection of activity data.	of 'Other' type categories.		
emissions factor, and	• Check that known data		
other estimation	gaps that result in		
parameters	incomplete estimates are		
1	documented, including a		
	qualitative evaluation of		
	the importance of the		
	estimate concerning total		
	emissions (e.g.,		
	subcategories classified as		
	Chapter 8 Benerting		
	Guidance and Tables)		
	• Confirm that		
	bibliographical data		
	references are properly		
Check for transcriptions	cited in the internal		
Errors in the data input	documentation.		
and references	• Cross-check a sample of		
	input data from each		
	category (either		
	measurements or		







	parameters used in calculations) for	
	transcription errors.	
Check that emissions and removals are calculated correctly	 Reproduce a set of emissions and removal calculations. Use a simple approximation method that gives similar results to the original and more complex calculation to ensure that there is no data input error or calculation error. 	
Check that parameters and units are correctly recorded and that appropriate conversion factors are used.	 Check that units are properly labeled in calculation sheets. Check that units are correctly carried through from beginning to end of calculations. Check that conversion factors are correct. Check that temporal and spatial adjustment factors are used correctly. 	
Check the integrity of database files	 Examine the included intrinsic documentation (see also Box 6.4) to: 1. Confirm that the appropriate data processing steps are correctly represented in the database. 2. Confirm that data relationships are correctly represented in the database. 3. Ensure that data fields are properly labeled and have the correct design specifications. 4. Ensure that adequate documentation of database and model structure and operation are archived. 	







Check for consistency in data between categories.	Identify parameters (e.g., activity data, constants) that are common to multiple categories and confirm that there is consistency in the values used for these parameters in the emission/removal calculations.	
Check that the movement of inventory data among processing steps is correct.	 Check that emissions and removal data are correctly aggregated from lower reporting levels to higher reporting levels when preparing summaries. Check that emissions and removal data are correctly transcribed between different intermediate products. 	
Check that uncertainties in emissions and removals are estimated and calculated correctly.	 Check that the qualifications of individuals providing expert judgment for uncertainty estimates are appropriate. Check that qualifications, assumptions, and expert judgments are recorded. Check that calculated uncertainties are complete and calculated correctly. If necessary, duplicate uncertainty calculations on a small sample of the probability distributions used by Monte Carlo analyses (for example, using uncertainty calculations according to Approach 1). 	
Check time series consistency.	 Check for temporal consistency in time series input data for each category. Check for consistency in the algorithm/method used for calculations throughout the time series. Check methodological and data changes resulting in recalculations. 	









	• Check that the effects of	
	mitigation activities have	
	been appropriately reflected	
	in time series calculations.	
	• Confirm that estimates are	
	reported for all categories and	
	all years from the appropriate	
	base year to the period of the	
	current inventory.	
	For subcategories, confirm	
	that the entire category is	
	being covered.	
	• Provide a clear definition of	
	'Other' type categories.	
Check Completeness	• Check that known data gaps	
	that result in incomplete	
	estimates are documented,	
	including a qualitative	
	evaluation of the importance	
	of the estimate concerning	
	total emissions (e.g.,	
	subcategories classified as	
	'not estimated', see Chapter	
	8, Reporting Guidance and	
	Tables)	

	Confirm that articles to a second
	• Confirm that estimates are
	reported for all categories
	and all years from the
	appropriate base year to the
	period of the current
	inventory.
	• Check the value of implied
	emission factors (aggregate
	emissions divided by activity
	data) across time series.
	1. Do any of the year's
Trend Check	show outliers that are not
field check	show outliers that are not
	explained?
	2. If they remain static
	across time series, are
	changes in emissions or
	removals being captured?
	Check if there are any
	waves and was a lair a d
	unusual and unexplained
	trends noticed for activity
	data or other parameters
	across the time series.

CATT Initiative for Climate Action Transparency	institute	Govt of Vanuatu
Review of internal documentation and archiving.	 Check that there is detailed internal documentation to support the estimates and enable the reproduction of the emission, removal, and uncertainty estimates. Check that inventory data, supporting data, and inventory records are archived and stored to facilitate detailed review. Check that the archive is closed and retained in a secure place following completion of the inventory. Check the integrity of any data archiving arrangements of outside organizations involved in inventory 	

(Table 6.1 GENERAL INVENTORY QC PROCEDURES, volume 1, 2006 IPCC Guidelines for National Greenhouse Gas Inventories).







Table 11: Responsibilities assigned to each party

Displayed are the corresponding timelines indicating the duration required for each party to complete their respective tasks

Quality Control Method	Responsibilities	Timeline (Time for completion)	
	1. Implement QA/QC at all levels of transparency		
GHG Inventory Team Members (Consultant)	2. Collect data, Inventory Preparation and Reporting		
	3. Conduct Checks on the consistency of data and information provided by the different stakeholders to ensure data integrity, correctness, and completeness	2 Months	
TWGS (Technical Working Groups) Specific group consisting of Experts and Professionals	1. Technical Review of sub-category activity data, Emission Factor, Estimation Parameters, and Calculation method	2 - 3 Weeks	
	2. Final Check of the Report		
Municipal	According to the United Nations Development Programme (UNDP) and the Government of Vanuatu, municipalities are responsible for managing solid waste in the country. This includes the collection, transportation, disposal, and sometimes treatment of solid waste. To effectively manage waste and allocate resources, accurate data on waste generation is essential.	2 Weeks upon request	
Environment Department	The Department of Environmental Protection and Conservation oversees environmental protection and regulation. The department may have information on the generation of MSW	2 Weeks upon request	







4.3.5 UNCERTAINTIES

Uncertainty in the method

As stated by the 2006 IPCC guidelines the following are the reasons behind uncertainty in the method 3 .

A first-order decay reaction may not always be followed in the complex chemical reactions that convert carbon molecules to CH₄. Reaction rates will fluctuate depending on the circumstances at the particular SWDS, and higher-order reactions might be involved. Restrictions on water access and regional differences in bacterial populations may limit reactions ².

• There are variations in SWDS. Even within a single site, conditions like temperature, moisture content, waste composition, and compaction can fluctuate significantly, and even more between sites within a country. It is challenging to choose "average" parameter values that are typical for an entire nation ².

• Using the FOD approach adds to the ambiguity around past waste disposal amounts and degradation rates (half-lives). Neither of these has been studied or understood in great detail ².

• Using the FOD approach adds to the ambiguity around past waste disposal amounts and degradation rates (half-lives). Neither of these has been studied or understood in great detail (2006 IPCC Guidelines, Vol. 5)².

Uncertainty Associated with Data Uncertainty

Using the FOD approach adds to the ambiguity around past waste disposal amounts and degradation rates (half-lives). Neither of these has been studied or understood in great detail (2006 IPCC Guidelines, Vol. 5)².

The degree of uncertainty in waste disposal data varies depending on how the data is obtained; it can be reduced when the amounts of waste in the SWDS are weighed; it will be higher if the estimates are based on waste delivery vehicle capacity or visual estimation; and it can be highest for estimates based on default activity data. The quality of CH₄ emission estimates is directly related to the quality and availability of the waste generation, composition, and management data used to derive these estimates (2006 IPCC Guidelines, Vol. 5) ².

The activity data in the waste sector includes the total municipal solid waste, total industrial waste, waste composition, and the fraction of solid waste sent to solid waste disposal sites Waste scavenging at the SWDS must be considered while analyzing the waste disposal data; otherwise, the data's level of uncertainty will rise ².

³ nggip.iges.or.jp/public/2006gl/pdf/5_Volume5/V5_3_Ch3_SWDS.pdf







Scavenging will also raise speculations about the composition of the waste that ends up in the SWDS and, in turn, about how much DOC is in the trash generally. Uncertainty estimates for the default model parameters are given in Table 4.12. The estimations are based on expert assessment. waste creation can be estimated using population (or urban population) and per-capita waste generation rates. Uncertainty may be introduced if the population does not match the population from which waste is collected. In many countries, waste is usually collected only from city dwellers. An urban area's population may fluctuate daily or seasonally due to labor force mobility ².

Uncertainty Associated with Parameters

The following Uncertainties have been extracted straight from the (2006 IPCC Guidelines, Vol. 5, Pg. 26).

Methane correction factor (MCF) There are two sources of uncertainty in the MCF. • Uncertainty in the value of the MCF for each type of site (managed-anaerobic, managed-semiaerobic, unmanaged deep and/or high-water table, unmanaged shallow): These MCF values are based on one experimental study and expert judgment and not on measured data ².

• Uncertainty in the classification of sites into the different site types: For example, the distinction between deep and shallow sites (5 m depth of waste) is based on expert opinion. Inevitably, few, if any, countries will be able to classify their unmanaged waste disposal sites into deep and shallow based on measured data. It can also be difficult to determine the sites that meet the IPCC criteria for managed sites. Degradable organic carbon (DOC)

• Uncertainty in setting the DOC for different types of waste types/materials (paper, food, etc.): There are few studies of DOC, and different types of paper, food, wood, and textiles can have very different DOC values. The water content of the waste also has an influence. DOC for industrial waste is very poorly known. Degradable organic carbon (DOC) There are two sources of uncertainty in DOC values².

• Uncertainty in the waste composition affects estimates of total DOC in the SWDS: Waste composition varies widely even within countries (for example, between urban and rural populations, between households on different incomes, and between seasons) as well as between countries ².

Fraction Of Degradable Organic Carbon Which Decomposes (DOC_f)

The uncertainty in DOCf is very high. There have been few studies, and it is difficult to replicate real SWDS conditions in experimental studies ².

Fraction Of CH₄ In Landfill Gas (F)

The CH₄ fraction of generated landfill gas, F, is usually taken to be 0.5 but can vary between 0.5 and 0.55, depending on several factors (see Section 3.2.3). The uncertainty in this figure is







relatively low, as *F* depends largely on the stoichiometry of the chemical reaction producing CH₄. The concentration of CH₄ in recovered landfill gas may be lower than the actual value because of potential dilution by air, so *F* values estimated in this way will not necessarily be representative ².

Methane recovery (R)

CH₄ recovery is the amount of CH₄ generated at SWDS that is recovered and burned in a flare or energy recovery device. The uncertainty depends on the method used to estimate recovered CH₄. The uncertainty is likely to be relatively small compared to other uncertainties if metering is used. If other methods are used, for example by estimating the efficiency of CH₄ recovery equipment, the uncertainty will be larger ². (See Section 3.2.3.).

Oxidation Factor (OX)

The oxidation factor is very uncertain because it is difficult to measure, and varies considerably with the thickness and nature of the cover material, atmospheric conditions and climate, the flux of methane, and the escape of methane through cracks/fissures in the cover material. Field and laboratory studies that determine oxidation of CH_4 only through uniform and homogeneous soil layers may lead to overestimations of oxidation in landfill-cover soils ².

The Half-Life

There is high uncertainty in the estimates of half-life because it is difficult to measure decay rates under conditions equivalent to those prevailing in real SWDS. Also, since there is considerable variation in half-life with waste composition, climate, and site type, it is difficult to select values representative of a whole country 2 .

Uncertainty estimates for MSW_T (total MSW generated) and MSW_F (fraction of MSW_T disposed at SWDS) and the default model parameters are given in Table 4.12.





Table 12: Estimates of uncertainties associated with the default activity data and parameters in the FOD method for CH₄ emissions from SWDs

Activity data and Emission Factors	Uncertainty Range
Total Municipal Solid Waste (MSWT)	Country-specific: 30% is a typical value for countries that collect waste generation data regularly. ±10% for countries with high-quality data (e.g., weighing at all SWDS and other treatment facilities). For countries with poor quality data: more than a factor of two.
A fraction of MSWT sent to SWDS (MSWF)	 ±10% for countries with high-quality data (e.g., weighing at all SWDS). ±30% for countries collecting data on disposal at SWDS. For countries with poor quality data: more than a factor of two.
The total uncertainty of Waste composition	 ±10% for countries with high-quality data (e.g., regular sampling at representative SWDS). ±30% for countries with country-specific data based on studies including periodic sampling. For countries with poor quality data: more than a factor of two.
Degradable Organic Carbon (DOC)7	For IPCC default values: ±20% For country-specific values: Based on representative sampling and analyses: ±10%
Fraction of Degradable Organic Carbon Decomposed (DOCf)	For IPCC default value (0.5): ± 20% For country-specific value ± 10% for countries based on the experimental data over longer periods.
Methane Correction Factor (MCF) = 1.0 = 0.8 = 0.5 = 0.4 = 0.6	For IPCC default value : -10%, +0% ±20% ±20% ±30% -50%, +60%
Fraction of CH ₄ in generated Landfill Gas $(F) = 0.5$	For IPCC default value: ±5%
Methane Recovery (R)	The uncertainty range will depend on how the amounts of CH ₄ recovered and flared or utilized are estimated: ± 10% if metering is in place. ± 50% if metering is not in place.







Oxidation Factor (OX)	Include OX in the uncertainty analysis if a value other than zero has been used for OX itself. In this case, the justification for a non-zero value should include consideration of uncertainties.
half-life (t1/2)	Ranges for the IPCC default values are provided in Annex Table A4.5. Country-specific values should include consideration of uncertainties.
Source: Expert judgment by Lead Aut	thors of the Chapter.







DOMESTIC WASTEWATER

4.3.6 METHODOLOGY CHOICE FOR DOMESTIC WASTEWATER

The decisions implemented during this operation are indicated by the red arrows.

Figure 3: Decision Tree for Method Selection in Estimating Actual Emissions from Sub-Category 4.D.1 Domestic Wastewater Treatment and Discharge



Figure 4.3 (See 2006 IPCC Guidelines, Vol. 5, Figure 6.2)

Note: Due to the national circumstances (lack of resources) Vanuatu does not have yet reliable country-specific emission factors and parameters and therefore, is applying the default parameters and Tier 1 methods to estimate emissions from the 4.D.1 Sub-Category.







EQUATIONS USED

Equation 1

EQUATION 6.3

Total Organically Degradable Material in Domestic Wastewater

 $TOW = P \bullet BOD \bullet 0.001 \bullet I \bullet 365$

Where:

- **TOW**: total organics in wastewater in inventory year, kg BOD/yr. (Biochemical Oxygen Demand (BOD) is the amount of carbon that is aerobically biodegradable) (See 2006 IPCC Guidelines, Vol.5, Pg. 13, Equation 6.3)
- **P**: country population in inventory year, number of people (See 2006 IPCC Guidelines, Vol.5, Pg. 13, Equation 6.3).
- **BOD**: country-specific per capita BOD in inventory year, g/person/day (Biochemical Oxygen Demand) (See 2006 IPCC Guidelines, Vol.5, Pg. 13, Equation 6.3)
 - conversion from grams BOD to kg BOD (See 2006 IPCC Guidelines, Vol.5, Pg. 13, Equation 6.3)
- I: correction factor for additional industrial BOD discharged into sewers (for collected the default is 1.25, for uncollected the default is 1.00). In some countries, information from industrial discharge permits may be available to improve this parameter (See 2006 IPCC Guidelines, Vol.5, Pg. 13, Equation 6.3)

Equation 2:

EQUATION 6.1 Total CH₄ Emissions From Domestic Wastewater

N2O EMISSIONS = $\left[\sum (U_i \times T_{i,j} \times EF)\right](TOW - S) - R$

Where:

- **TOW**: total organics in wastewater in inventory year, kg BOD/yr. (See 2006 IPCC Guidelines, Vol.5, Pg. 1, Equation 6.1)
- S: organic component removed as sludge in inventory year, kg BOD/yr. (See 2006 IPCC Guidelines, Vol.5, Pg. 1, Equation 6.1)






- U_i: fraction of population in income group I in inventory year (these are rural population and high/low-income urban population) (See 2006 IPCC Guidelines, Vol.5, Pg. 1, Equation 6.1).
- **T**_{i,j}: degree of utilization of treatment/discharge pathway or system, j, for each income group fraction I in inventory year (See 2006 IPCC Guidelines, Vol.5, Pg. 1, Equation 6.1).
- I: income group: rural, urban high income, and urban low income (See 2006 IPCC Guidelines, Vol.5, Pg. 1, Equation 6.1)
- **j**: each treatment/discharge pathway or system (See 2006 IPCC Guidelines, Vol.5, Pg. 1, Equation 6.1)
- **EF**_{j:} emission factor, kg CH₄ / kg BOD (See 2006 IPCC Guidelines, Vol.5, Pg. 1, Equation 6.1)
- **R**: amount of CH₄ recovered in inventory year, kg CH₄ /yr (See 2006 IPCC Guidelines, Vol.5, Pg. 1, Equation 6.1)

Equation 3:

EQUATION 6.7

Domestic wastewater: N₂O emissions

 N_2O Emissions= $N_{EFFLUENT} \bullet EF_{EFFLUENT} \bullet 44/28$

Where:

- N₂O emissions = N₂O emissions in inventory year, kg N₂O/yr (2006 IPCC Guidelines, Vol. 5, Pg. 25, Equation 6.7)
- N _{EFFLUENT} = Nitrogen in the effluent discharged to aquatic environments, kg N/yr (2006 IPCC Guidelines, Vol. 5, Pg. 25, Equation 6.7)
- **EF**_{EFFLUENT} = Emission factor for N₂O emissions from discharged to wastewater, kg N₂O-N/kg N (2006 IPCC Guidelines, Vol. 5, Pg. 25, Equation 6.7)
- The factor 44/28 is the conversion of kg N₂O-N into kg N₂O (2006 IPCC Guidelines, Vol. 5, Pg. 25, Equation 6.7).







<u>4.3.7 STEP – BY – STEP CALCULATION, DOCUMENTING RESOURCES</u> <u>USED</u>

1.0 Open Google chrome and search "Inventory Software - IPCC-TFI" (See illustration below)

$\leftarrow \rightarrow$	×	G Search Google or type a URL	*	G 🌒	a	:
					Bookma	irks



1.1: Click on the "New Version 2.91 – IPCC Inventory Software (See illustration below)









1.2: Click on the "ver 2.91 IPCC inventory Software – 32bit" and download the software (See illustration below).

← → C ipcc-nggip.iges.or.jp/software/index.h	tml	☆ 🕹 💿 :
Task Force on National Greenho	Duse Gas Inventories	Î
	Inventory Software	
Home IPCC	New Version 2.91 – IPCC Inventory Software	
IPCC-TFI Home Organization	This is the new version 2.91 of the IPCC Inventory Software released on 5 April, 2024. Changelog	
Publications Emission Factor Database (EFDB)	Please note that version 2.91 comes in 2 different files for installation. Thus, before downloading the file you shall check which one you actually need by using this decision free.	_
Inventory Software	Ver. 2.91 IPCC Inventory Software - 64bit	
Meetings FAQs	I Ver. 2.91 IPCC Inventory Software - 32bit "Click on the "ver. 2.91 IPCC Inventory Software - 32bit"	
Links	If you find any issues in the use of the IPCC Inventory offware, come back to us at ipcc-software@jges.or.jp .	
Electronic Discussion Group (EDG)	Thank you very much for your support.	
Contraction of the second	Important!	
	When setting YOUR Password always set YOUR Password Hint too. It is highly recommended that you take note of your password and store it in a safe place. In case you lose or forget your password, the IPCC Inventory Software does not have a mechanism to restore your	
© ⊗ The Nobel Foundation	password, this means that you can no longer access your database.	
IPCC honoured with the 2007 Nobel Peace Prize	Please note that the IPCC Inventory Software cannot be used with IOS (Apple Computers).	
Convrict	Getting started with the IPCC Inventory Software	
Disclaimer	After installing the IPCC Inventory Software, launch it for the first time and you will be asked to initialize the associated database by arraiding VOLID Logic (Log Mang) and VOLID Decement	

1.3: Launch the <u>Ver. 2.901 IPCC Inventory Software - 32bit</u> and follow the installation steps to install to your PC.

1.4: Create your password and username. If you have an existing account, type in your username and password.

1.5: Type in the year of your choosing or the current inventory year.

1.6: Scroll down the "2006 IPCC Category" tab on the left-hand side of the page till you reach 4.D "Waste Water Treatment and Discharge".







2006 IPCC Categories - 3.C.12 - N20 Emissions for - 3.C.13 - CH4 Emissions for - 3.C.14 - Other (please specif) - 3.D.0 Other - 3.D.1 - Harvested Wood Pro - 3.D.2 - Other (please specify	ector: Was Category: Was Subcategory: 4.D. Sheet: CH4 Data	Emissions fro 2006 IPC te tewater Treat 1 - Domestic V Emissions fro	om Constructor C category ment and Dis Wastewater T m Domestic V	ed Wet y" tal charge Freatme Wastev	ands Dire	ct N2O Emissio arge	ons from Treat	tment Plants	Indir	ect N2O Emie	sions Dire	act N2O Emis	sions from C	onstructed V	/etlan
🖃 4 - Waste								Equati	on 6.1	63					_
 4.A - Solid Waste Disposal 4.A.1 - Managed Waste Disp 4.A.2 - Unmanaged Waste D 4.A.3 - Uncategorised Waste 4.B - Biological Treatment of Sol 4.C - Incineration and Oneo Bur 	Subdivision (Region, city, etc.)	Weighted (kg C	Emission Fa H4/kg BOD)	actor	Population (Capita)	Degradable organic component (g/cap/day)	Correction BOD disc	factor for inc harged in se	dustrial wers	Organically material in (kg Bi	degradable wastewater OD/yr)	Sludge removed (kg BOD/yr)	Methane (kg	recovered CH4)	Em (k
 -4.C.1 - Waste Incineration -4.C.2 - Open Burning of Was -4.D - Wastewater Treatment and -4.D 1 - Domestic Wastewate -4.D.2 - Industrial Wastewate 	ΔŢ		WEF		Р	BOD		ı			TOW = P * BOD * 0.001 * I * 365 or specified	s	Flaring F	Energy use R	E : (TC
4.E - Other (please specify)	Unspecified	Specified	300		900	60 🗸	Specified	80		Calculated	1576800	909	0	C	4
⊟ 5 - Other	*														
	Total										1576800		0	0	4
5.C - Other															
														Uncerta	aintie
								- 1							
	User notes							▼ ₽	4.D.1	- Time Series	s				
									150 100 500		1994 1995 1996	00000000000000000000000000000000000000	E (CH4) Emissi	ons (Gq CO2 E	2011 2012
									+ Bas	* e year for asses	sment of uncer	tainty in trend: 1	1990		

1.7: Click on the subcategory 4.D.1 "Domestic Wastewater Treatment and Discharge".









1.8: Under the "CH₄ Emission" tab, the table under the "Subdivision (Region, City, etc.)" tab, click on the drop-down tab and select "Unspecified" (see illustration below)

CH4 Emissions	CH4 E	Emissions fro	om Construc	ted Wet	lands Dire	ct N2O Emissio	ns from Trea	tment Plants	Indi	ect N2O Emis	sions Dire	ect N2O Emis	sions from C	onstructed W	etlands				
Sector: Category: Subcategory: Sheet: Data	Was Was 4.D.1 CH4	te tewater Treat 1 - Domestic Emissions fro	tment and Dis Wastewater om Domestic	scharge Treatme Wastev	e ent and Discha vater	irge											2	016	;
								Equati	on 6.1,	6.3									
Subdivision (Region, city, e	Subdivision (Region, city, etc.) Weighted Emission Factor (kg CH4/kg BOD) Population (Capita) Degradable organic (glcapiday) Organically degradable (kg BOD/yr) Sludge removed (kg BOD/yr) Methane recovered (kg BOD/yr) CH4 Emissions (kg CH4) CH4 Emissions (kg CH4)																		
	۵Ţ		WEF Click o	en the	P drop dow	BOD n tab		I			TOW = P* BOD * 0.001 * I * 365 or specified	s	Flaring F	Energy use R	E = WEF * (TOW - S) - F - R	E/ 1000000			
1/ Unspecified	v				0	0	Specified	0		Calculated			0	0	0	0	21	2	×
Unspecified				2					2								2		4
Select "Un	spec	ified"									0		0	0	0	0			
													(Uncerta	inties	Time Serie	s data e	ntry	
User notes								• 1	4.D.1	- Time Series	5								,

1.9: Select the drop-down tab under the "Weight Emission Factor (KgCH₄ BOD)" in the table and select "Specified" (see illustration below)

🕘 IPCC Inventory Software - ANITAKAY -	[Worksheets]														-	D	Х
🛃 Application Database Inventor	y Year Administra	e Workshee	ts Tools Exp	ort/Import	Reports Wir	ndow Hel	р									-	. æ ×
2006 IPCC Categories 3.C.12 · N2O Emissions fro 3.C.33 · CH4 Emissions fro 3.C.14 · Other (please specif 3.D Other 3.D Other 3.D. 1 · Harvested Wood Pro 3.D. 2 · Other (please specify	CH4 Emissions Worksheet Sector: Category: Subcategory: Sheet: Data	CH4 Emissions f Waste Wastewater Tre 4.D.1 - Domestic CH4 Emissions f	rom Constructed W atment and Dischar Wastewater Treatu rom Domestic Wast	letlands Dir ge nent and Disch ewater	ect N2O Emissio arge	ons from Trea	tment Plants	Indir	ect N2O Emis	ssions Dire	ect N2O Emis	sions from C	onstructed W	/etlands		20	16
E-4 - Waste	Data																
🗎 4.A - Solid Waste Disposal							Equati	on 6.1,	6.3								
 4.A.1 - Managed Waste Disp 4.A.2 - Unmanaged Waste D 4.A.3 - Uncategorised Waste 4.B - Biological Treatment of Sol 4.C - Incineration and Open Bur 	Subdivision (Region, city, et	Weighte c.) (kg	d Emission Factor CH4/kg BOD)	Population (Capita)	Degradable organic component (g/cap/day)	Correction BOD disc	factor for in harged in si	dustrial ewers	Organically material in (kg B	degradable wastewater OD/yr)	Sludge removed (kg BOD/yr)	Methane (kg	recovered CH4)	CH4 Emissions (kg CH4)	CH4 Emissions (Gg CH4)		
		۵Ţ	WEF	Р	BOD					TOW = P* BOD * 0.001 * I * 365 or specified		Flaring F	Energy use R	E = WEF * (TOW - S) - F - R	E / 1000000		
4.E - Other (please specify)	10 Unspecified	Specif	/ <mark>0</mark>	9	θ	Specified	0		Calculated			0	0	0	0 0	2 🖬 🕈) 🗙
⊟-5 - Other	*	Calculated						2								2	
-5.A - Indirect NZO emissions fro -5.B - Indirect CO2 emissions fro -5.C - Other	Total Sel	cSpecified ect "Unspeci	fied"							0		0	0 Uncerta	ainties) 0 Time Serie	s data ent	ry
	<u>.</u>							(. . .									
	User notes						▲ ù	4.D.1	- Time Serie	S							• †







1.10: Under the same tab "Weight Emission Factor (KgCH₄ BOD)" within the table, Enter the value for the WEF (See Illustration below). Use default if national data is unavailable.



1.11: Under the "Population" column in the table, enter the Population of the chosen inventory year into the Cell. (See illustration below)

💀 Application Database Inventory	Year Administrate	Worksheet	s Tools Expo	rt/Import	Reports Wir	ndow Hel	р									- 8 >
2006 IPCC Categories	CH4 Emissions CH	4 Emissions fr	om Constructed We	tlands Dire	ect N2O Emissio	ons from Treat	tment Plants	Indire	ect N2O Emis	sions Dire	ct N2O Emis	sions from C	onstructed W	/etlands		
 - 3.C.12 - N20 Emissions fro - 3.C.13 - CH4 Emissions fro - 3.C.14 - Other (please specif - 3.D. 0 Other - 3.D.1 - Harvested Wood Pro - 3.D.2 - Other (please specify 	Worksheet Sector: W Category: W Subcategory: 4.1 Sheet: CH Data	aste astewater Trea D.1 - Domestic 14 Emissions fri	tment and Discharg Wastewater Treatm om Domestic Waster	e ent and Discha water	arge											2016
- 4 - Waste		Equation 6.1, 6.3														
 	Subdivision (Region, city, etc.)	ibdivision city, etc.) Weighted Emission Factor Population Capital Degradable (Gapita) Degradable (Gapita													CH4 Emissions (Gg CH4)	
 4.C.1 - Waste Incineration 4.C.2 - Open Burning of Was 4.D - Wastewater Treatment and 4.D.1 - Domestic Wastewate 4.D.2 - Industrial Wastewate 	Δ,	7	WEF	Ρ	BOD		1			TOW = P * BOD * 0.001 * I * 365 or specified	s	Flaring F	Energy use R	E = WEF * (TOW - S) - F - R	E / 1000000	
4.E - Other (please specify)	M Unspecified	Specified	θ	θ	θ	Specified	θ		Calculated			0	0	0	0	z 🖬 🤈 🗙
-5A - Indirect N2O emissions fro	*							2								
-5.B - Indirect CO2 emissions fro -5.C - Other	Total	C: Wastewater Treatment and Discharge gory: 4.D.1 - Domestic Wastewater Treatment and Discharge CH4 Emissions from Domestic Wastewater Equation 6.1, 6.3 rdivision n, city, etc.) Weighted Emission Factor (kg CH4/kg BOD) Population (Capita) Degradable organic (Gapiday) Correction factor for industrial BOD discharged in severs Organically degradable material in wastewater Studge (kg CH4/kg BOD) Methane recovered (kg CH4) CH4 Emissions ((kg CH4) △ \vert WEF P BOD I TOW = P ⁺ 80D S Flaring 900,001 *1 * 365 or specified Flaring F Energy R E=WEF * (rOW-S) (-F-R pecified Specified O O O O O O L O Specified O Specified O O O O O L D I Specified I												0 Time Serie	s data entry	







1.12: Click on the drop-down tab under the "Degradable Organic Component (g/cap/day)" select the default value "60" (see Illustration below)



1.13: Under the first column in the tab "Correction factor for industrial BOD discharge in sewers" in the table click on the drop-down tab and select "Specified" (see illustration below).









1.14: Enter the Correction factor (I) into the cell under the tab "Correction factor for industrial BOD discharge in sewers". Use default value of 1.25 if national data is unavailable. (See illustration below).



1.15: Click on the drop-down tab under the "Organically degradable material in wastewater (Kg BOD/yr.)" in the table and select "Calculated" (See illustration below).









1.16: Under the same tab "Organically degradable material in wastewater (Kg BOD/yr)", click on the green cell to generate the value for the "TOW".

CH4 Emissions Worksheet Sector: Category: Subcategory: Sheet: Data	CH4 Was Was 4.D. CH4	Emissions fro te tewater Treat 1 - Domestic Emissions fro	om Construct tment and Dis Wastewater T m Domestic \	ed Wet charge reatme Vastew	alands Dire	ect N2O Emissio arge	ns from Treat	ment Plants	Indir	ect N2O Emis	sions Di	rect N2O Emis	sions from C	onstructed W	/etlands		2	:016	
								Equation	on 6.1,	6.3									
Subdivisio (Region, city,	Subdivision (Region, city, etc.) Weighted Emission Factor (kg CH4/kg BOD) Population (Capita) Degradable organic (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 BOD/yr) CH4 Emissions (kg CH4) CH4 Emissions (kg CH4) CH4 Emissions (kg CH4)																		
	۵Ţ		WEF		Ρ	BOD		I			TOW = P* BOD * 0.001 * I * 365 or specified	s	Flaring F	Energy use R	E = WEF * (TOW - S) - F - R	E / 1000000			
Unspecifie	d	Specified	θ		0	60	Specified	0		Calculated		70	0	0	0	0	7 6) X	
*			-	2	-			_	2								2		Í
Total																			i
											- 4	4	0	0	0	0			
												Enter Valu green cell	ie into	Uncerta	inties	Time Serie	s data e	ntry)

1.17: Under the tab "Sludge removed (kg BOD /year)", enter the data value 0 into the cell since sludge is not removed in Vanuatu. (See illustration below).

CH4 Emissions	CH4	Emissions fro	om Construct	ted Wet	tlands Dire	ect N2O Emissio	ns from Treat	tment Plants	Indir	ect N2O Emis	sions Dir	ect N2O Emis	sions from Co	onstructed W	etlands				
Worksheet Sector: Category: Subcategory: Sheet: Data	Was Was 4.D. CH4	te tewater Trea 1 - Domestic Emissions fro	tment and Dis Wastewater T om Domestic V	scharge Treatme Wastev	e ent and Discha vater	arge											2	201	6
								Equati	on 6.1,	6.3									
Subdivision (Region, city, e	Subdivision Region, city, etc.) Weighted Emission Factor Population (kg CH4/kg BOD) Degradable (kg CH4/kg BOD) Degradable (g/capiday) Correction factor for industrial BOD discharged in sewers (kg BOD/yr) BOD/yr) Methane recovered (kg BOD/yr) Methane recovered (kg BOD/yr) Correction factor for industrial BOD discharged in sewers (kg BOD/yr) TOW = P*																		
	47		WEF		P	BOD		I			TOW = P * BOD * 0.001 * I * 365 or specified	s	Flaring F	Energy use R	E = WEF * (TOW - S) - F - R	E / 1000000			
Unspecified		Specified	θ		θ	60	Specified	θ		Calculated		7	0	0	0	0	2	2	X
* Total																	2		4
											0	-4	0	0	0	0			
										H c	Enter Valı xell	1e into		Uncerta	inties	Time Serie	s data e	entry.	







1.18: Methane is not recovered in Vanuatu, therefore Enter 0 for both "Flaring" and "Energy use R" under the tab "Methane Recovered" (See Illustration below).

CH4 Emissions	CH4	Emissions fro	om Construct	ed Wet	ands Dire	ect N2O Emission	ns from Treat	ment Plants	Indir	ect N2O Emis	sions Dire	ect N2O Emis	sions from C	onstructed W	etlands			
Sector: Category: Subcategory: Sheet: Data	Was Was 4.D. CH4	ste stewater Treat 1 - Domestic Emissions fro	tment and Dis Wastewater T om Domestic V	charge Freatme Nastew	nt and Discha ater	arge											20)16
								Equation	on 6.1,	6.3								
Subdivisio (Region, city,	in etc.)	Weighted (kg C	Emission Fa H4/kg BOD)	actor	Population (Capita)	Degradable organic component (g/cap/day)	Correction BOD disc	factor for ind harged in se	lustrial wers	Organically material in (kg B(degradable wastewater DD/yr)	Sludge removed (kg BOD/yr)	Methane (kg i	recovered CH4)	CH4 Emissions (kg CH4)	CH4 Emissions (Gg CH4)		
	۸Ÿ		WEF			BOD					TOW = P * BOD * 0.001 * I * 365 or specified	s	Flaring F	Energy use R	E = WEF * (TOW - S) - F - R	E / 1000000		
M Unspecified	ł	Specified	0		θ	60	Specified	0		Calculated			0	0	0	0) 🗙
* Total																	2	
											0		0	0	0	0		
													Enter 0	Lta Enter	inties	Time Serie	s data en	ry

1.19: Click on the green cells under CH₄ Emissions (kg CH₄) and CH₄ Emissions (Gg CH₄) to generate values (see Illustration below).

CH4 Emissions	CH4	Emissions fro	om Construct	ed Wet	lands Dire	ct N2O Emissio	ns from Treat	tment Plants	Indir	ect N2O Emis	sions Dire	ect N2O Emis	sions from Co	onstructed W	/etlands			
Worksheet Sector: Category: Subcategory: Sheet: Data	Was Was 4.D. CH4	ste stewater Treat 1 - Domestic Emissions fro	tment and Dis Wastewater T om Domestic V	charge Freatme Wastew	ent and Discha vater	arge											20	16
								Equation	on 6.1,	6.3								
Subdivisio (Region, city,	on etc.)	Weighted (kg C	Emission F H4/kg BOD)	actor	Population (Capita)	Degradable organic component (g/cap/day)	Correction BOD disc	factor for ind harged in se	lustrial wers	Organically material in (kg Bi	degradable wastewater OD/yr)	Sludge removed (kg BOD/yr)	Methane r (kg C	recovered CH4)	CH4 Emissions (kg CH4)	CH4 Emissions (Gg CH4)		
	۵Ţ		WEF		Р	BOD		I			TOW = P * BOD * 0.001 * I * 365 or specified	S	Flaring F	Energy use R	E = WEF * (TOW - S) - F - R	E / 1000000		
M Unspecified	d	Specified	0		θ	60	Specified	θ		Calculated			0	0	0	0	2) 🗶
*				2					2								2	
											0		0	0 Lincerta	inties	0 T Serie	s data ent	
														Shoone	Click on	green cells		1







1.20: Within the same Subcategory 4.D.1, click on the Indirect N_2O Emissions from the top-hand corner of the IPCC software page (see Illustration below).



1.21: Under the "Subdivision" tab click on the drop-down bar and select "Unspecified".









1.22: Enter the population for the selected Inventory year under the "Population (P) (People)"

(see illustration below).

CH4 Emissions	CH4 En	nissions fron	n Constructed V	/etlands Direct N	120 Emissions fron	n Treatment Plants	Indirect N2O	Emissions Di	rect N2O Emiss	sions from Construc	ted Wetlands			
Sector: Category: Subcategory: Sheet: Data	Waste Waster 4.D.1 - Indirect	water Treatm Domestic W t N2O Emissi	ient and Discha lastewater Treat ons from Waste	rge ment and Discharge water	1								20	16
						Equati	on 6.7, 6.8							
Subdivis (Region, ci	sion ity, etc.)	Populatio n (P) (people)	Per capita protein consumption (Protein) (kg/person/Y ear)	Fraction of nitrogen in protein (Fnpr) (kg N/kg Protein)	Fraction of non- consumption protein (Fnon-con) (-)	Fraction of industrial and commercial co- discharged protein (Find-com)	Nitrogen removed with sludge (Nsludge) (kg)	Total nitrogen in effluent (Neffluent) (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)		
	Δγ	A	В					G = (A*B*C*D*E)- F)			J = (G - H) * I * 44/28	K = J / 10^6		
Unspecifie	ed	θ 🛓	0	0.16	1.1	1.25	0			0.005			22) 🗶
*														
Total								0			0	0		
			Enter Popul	ilation for the year					-	Ur	ncertainties	Time Serie	s data enti	y

1.23: Enter the value for the "Per capita protein consumption (protein) (Kg/person/year)" (See illustration below).









1.24: Click on the drop-down bar under the "Fraction of Nitrogen in Protein (Fnpr) (Kg N/ Kg protein)" and select the default value of 0.16 (see illustration below).

CH4 Emissions Worksheet Sector: Category: Subcategory: Sheet: Data	CH4 Em Waste Wastev 4.D.1 - Indirect	vater Treatm Domestic W N2O Emissi	n Constructed V nent and Dischai /astewater Treat ions from Waste	Vetlands Direct N rge ment and Discharge water	120 Emissions fron	n Treatment Plants	Indirect N2O	Emissions Di	irect N2O Emis	sions from Construc	ted Wetlands		20	16
						Equatio	on 6.7, 6.8							
Subdivisi (Region, city	on /, etc.)	Populatio n (P) (people)	Per capita protein consumption (Protein) (kg/person/Y ear)	Fraction of nitrogen in protein (Fnpr) (kg N/kg Protein)	Fraction of non- consumption protein (Fnon-con) (-)	Fraction of industrial and commercial co- discharged protein (Find-com)	Nitrogen removed with sludge (Nsludge) (kg)	Total nitrogen in effluent (Neffluent) (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)		
	Δγ		В	С				G = (A*B*C*D*E)- F)		I	J = (G - H) * I * 44/28	K = J / 10^6		
 Unspecified 		θ	θ	0.16 🗸	1.1	1.25	0			0.005			2 🖬 🄈	X
*				Name	D	efinition	Value	e Rar	nge 🔺				2	
Total				Fnpr	Fraction of nitro N/kg protein)	gen in protein (kg		0.16 0.15 - 0.1	7		0	0		
								Select the Default "0.16"	e IPCC Value	U	ncertainties	Time Serie	s data entry	I
User notes						• 1	4.D.1 - Time S	"0.16" eries					e cald only	• I

1.25: Click on the drop-down bar under the "Fraction of non-consumption protein (Fnon-con) (-)" and select the default value of 1.1 (see Illustration below).

CH4 Emissions	CH4 Emi	issions fron	n Constructed W	/etlands Direct N	V2O Emissions fron	n Treatment Plants	Indirect N2O	Emission	ns Dire	ect N2O Emis	sions from Constru	ted Wetlands			
Worksheet Sector: Category: Subcategory: Sheet: Data	Waste Wastew 4.D.1 - I Indirect	vater Treatm Domestic W N2O Emissi	ient and Dischar /astewater Treat ions from Waster	rge ment and Discharge water	9									2	2016
						Equati	on 6.7, 6.8								
Subdivisi (Region, city	on ; etc.)	Populatio n (P) (people)	Per capita protein consumption (Protein) (kg/person/Y ear)	Fraction of nitrogen in protein (Fnpr) (kg N/kg Protein)	Fraction of non- consumption protein (Fnon-con) (-)	Fraction of industrial and commercial co- discharged protein (Find-com)	Nitrogen removed with sludge (Nsludge) (kg)	Total ni in effl (Nefflu (kg N	trogen uent uent) I/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)		
	۵V				D Clici	on drop-dow		G (A*B*C F	= *D*E)-)		I	J = (G - H) * I * 44/28	K = J / 10^6		
Unspecified		θ	0	0.16	11 🗸	.25	θ				0.005			2) 🎽 🗶
*					Name		efinition)		Val	ue	Range 🔺			2	
Total					Fnon-con1	Factor to adjust protein - for cou garbage disposi	for non-consum Intries with no als	ned		1.1 1.0 -	1.5	0	0		
					Fnon-con2	Factor to adjust protein - for cou garbage dispos	for non-consum intries with als	ned	4	1.4 1.0 - Select	1.5 value "1.1" 🔻				
											l	ncertainties	Time Serie	es data (entry
User notes						▼ ₽	4.D.1 - Time S	Series							•







1.26: Click on the tab under the "Fraction of industrial and Commercial co-discharge protein (Find-com) and select the default value of 1.25 (see Illustration below).

CH4 Emissions Worksheet Sector: Category: Subcategory: Sheet: Data	CH4 Em Waste Wastev 4.D.1 - Indirect	issions from vater Treatm Domestic W N2O Emissi	n Constructed W nent and Dischar Vastewater Treat ions from Waster	Vetlands Direct N rge ment and Discharge water	120 Emissions from	Treatment Plants	Indirect N2O	Emissions Di	irect N2O Emis:	sions from Constr	ucted Wetlands		20	16
						Equatio	on 6.7, 6.8							
Subdivisi (Region, city	ion y, etc.)	Populatio n (P) (people)	Per capita protein consumption (Protein) (kg/person/Y ear)	Fraction of nitrogen in protein (Fnpr) (kg N/kg Protein)	Fraction of non- consumption protein (Fnon-con) (-)	Fraction of industrial and commercial co- discharged protein (Find-com)	Nitrogen removed with sludge (Nsludge) (kg)	Total nitrogen in effluent (Neffluent) (kg N/yr)	Nitrogen from Wastewater plants (kg N/yr)	Emission Facto (kg N2O-N/kg N	N2O Emissions (kg N2O/yr)	N2O Emissions (Gg N2O/yr)		
	ΔŢ	A	В		D	E	F	G = (A*B*C*D*E)- F)		I	J = (G - H) * I * 44/28	K = J / 10^6		
Unspecified	ł	θ	0	0.16	1.1	1.25 🗸		Select drop	~down bar	0.00	5		2 🖬 🤈	X
*						Name		Definition		Value	Range 4	<u>ــــــــــــــــــــــــــــــــــــ</u>	2	
Total						Find-com	Factor to all industrial nit countries wi processing j higher. Expe recommende	ow for co-discha trogen into sewe th significant fis plants, this facto ert judgment is ed.	arge of ers. For h or may be	1.25 1.0	- 1.5	0		
										T	Uncertainties	Time Serie	s data entrj	/
User notes						→ ‡	4.D.1 - Time S	eries		Se "1	lect the value 25"			• 7

1.27: Enter the value in the cell under the "Nitrogen removed with Sludge (NSludge)(kg)". Vanuatu do not remove Nitrogen in sludges therefore enter 0 under *F*. (See illustration below).









1.28: Click on the green cell under the tab "Total Nitrogen in Effluent (Effluent (Kg N/yr.)" to generate the value (see illustration below).

CH4 Emissions Worksheet Sector: Category: Subcategory: Sheet: Data	CH4 Em Waste Wastev 4.D.1 - Indirect	issions from water Treatm Domestic W : N2O Emiss	n Constructed W nent and Dischar Vastewater Treat ions from Waster	/etlands Direct N rge ment and Discharge water	120 Emissions from	Treatment Plants	Indirect N2O	Emissions Di	rect N2O Emiss	sions from Construc	ted Wetlands		20	016
						Equation	on 6.7, 6.8							
Subdivis (Region, cit	ion y, etc.)	Populatio n (P) (people)	Per capita protein consumption (Protein) (kg/person/Y ear)	Fraction of nitrogen in protein (Fnpr) (kg N/kg Protein)	Fraction of non- consumption protein (Fnon-con) (-)	Fraction of industrial and commercial co- discharged protein (Find-com)	Nitrogen removed with sludge (Nsludge) (kg)	Total nitrogen in effluent (Neffluent) (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)		
	۵V							G = (A*B*C*D*E)- F)	н		J = (G - H) * I * 44/28	K = J / 10^6		
Unspecified	d	0	0	0.16	1.1	1.25	0			0.005			2) X
* Total														
Total											0	0		
								C t	lick on gre o generate v	en cell zalue				
										Ur	ncertainties	Time Serie	s data er	itry

1.29: Click on the drop-down tab under the tab "Emission factor (Kg $N_2O - N/Kg N$)" and select the default value 0.005 (see Illustration below).

CH4 Emissions	CH4 Em	issions fron	n Constructed V	/etlands Direct N	120 Emissions fron	Treatment Plants	Indirect N2O	Emissions	Direct N2O Emis	sions from Construc	ted Wetland:	s		
Worksheet Sector: Category: Subcategory: Sheet: Data	Waste Wastev 4.D.1 - Indirect	vater Treatm Domestic W N2O Emissi	ient and Dischar Vastewater Treat ions from Waster	ge ment and Discharge water	9								2016	
						Equati	on 6.7, 6.8							
Subdivis (Region, ci	sion ty, etc.)	Populatio n (P) (people)	Per capita protein consumption (Protein) (kg/person/Y ear)	Fraction of nitrogen in protein (Fnpr) (kg N/kg Protein)	Fraction of non- consumption protein (Fnon-con) (-)	Fraction of industrial and commercial co- discharged protein (Find-com)	Nitrogen removed with sludge (Nsludge) (kg)	Total nitroge in effluent (Neffluent) (kg N/yr)	en Nitrogen from Wastewater plants (kg N/yr)	Emission Factor (kg N2O-N/kg N)	N2O Emissior (kg N2O/)	N2O ns Emissions yr) (Gg N2O <i>l</i> yr)		
	۵Ţ							G = (A*B*C*D*E) F)		1	J = (G - H) * 44/28)*1 K=J/10% Click on drog	>down	
Unspecifie	ed	θ	0	0.16	1.1	1.25	0			0.005	<u> </u>	tab	🗹 🖬 🌖 🗙	0
*								Name		Definition		Value	Range	•
Total								EFeffluent	Emission	n factor, (kg N2O-N/	kg -N)	0.005 0.	0005 - 0.25	v
									V	U	ncertainties	Select defau "0.00 Time Seri	the IPCC It value 5" es data entry	
User notes						▼ ₽	4.D.1 - Time S	Series					Ŧ	ą







1.30: Click on the green cells under the tabs "N₂O Emissions (Kg N₂O / yr.)" and "(N₂O Emissions (Gg N₂O/ yr.) to generate the Emissions value for N₂O (see illustration below).

CH4 Emissions	CH4 Em	issions fror	n Constructed V	/etlands Direct N	120 Emissions from	Treatment Plants	Indirect N2O	Emissions D	lirect N2O Emiss	sions from Construc	ted Wetlands			
Sector: Category: Subcategory: Sheet: Data	Waste Wastev 4.D.1 - Indirect	vater Treatn Domestic W N2O Emiss	nent and Dischar Vastewater Treat ions from Waste	ge ment and Discharge water	1								2	016
						Equation	on 6.7, 6.8							
Subdivis (Region, cit	sion ty, etc.)	Populatio n (P) (people)	Per capita protein consumption (Protein) (kg/person/Y ear)	Fraction of nitrogen in protein (Fnpr) (kg N/kg Protein)	Fraction of non- consumption protein (Fnon-con) (-)	Fraction of industrial and commercial co- discharged protein (Find-com)	Nitrogen removed with sludge (Nsludge) (kg)	Total nitroger in effluent (Neffluent) (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)		
	۵Ţ							G = (A*B*C*D*E)- F)	н	1	J = (G - H) * I * 44/28	K = J / 10^6		
Unspecified	d	θ	0	0.16	1.1	1.25	θ			0.005			2	🤊 🗶
* Tetal													2	
Total								()					
									Clia gre the	ck on the two en cells to gene values	erate ncertainties	Time Serie	s data er	ntry
User notes						▼ ₽	4.D.1 - Time S	ieries						→ ₽

1.31: Place the cursor on the bar in the graph below entitled "Nitrous Oxide (N_2O) Emissions (Gg CO₂ Equivalent)" to find the Global Warming Potential (GWP) (See illustration below).

CH4 Emissions	CH4 Emi	issions fron	n Constructed V	/etlands Direct N	I2O Emissions fron	n Treatment Plants	Indirect N2O	Emissions Di	rect N2O Emiss	sions from Construc	ted Wetlands			
Sector: Category: Subcategory: Sheet: Data	Waste Wastew 4.D.1 - I Indirect	vater Treatm Domestic W N2O Emissi	nent and Dischar /astewater Treat ions from Waste	rge ment and Discharge water									2	016
						Equation	on 6.7, 6.8							
Subdivisi (Region, city	on (, etc.)	Populatio n (P) (people)	Per capita protein consumption (Protein) (kg/person/Y ear)	Fraction of nitrogen in protein (Fnpr) (kg N/kg Protein)	Fraction of non- consumption protein (Fnon-con) (-)	Fraction of industrial and commercial co- discharged protein (Find-com)	Nitrogen removed with sludge (Nsludge) (kg)	Total nitrogen in effluent (Neffluent) (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)		
	۵V		в	с	D			G = (A*B*C*D*E)- F)		I	J = (G - H) * I * 44/28	K = J / 10^6		
Unspecified		90000	600	0.16	1.1	1.25	70	11879930		0.005	93342.30714	0.09334	2	
▶		0	0	0	0	0	0			0			2	7 X
lotal								11879930			93342 30714	0.09334		
										Ur	ncertainties	Time Serie	s data e	entry
User notes						▼ ₽	4.D.1 - Time S	Series						-
							20 10 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Place the (C 2661 2566 2661 2661 2661 2661 2661 2661	NITROUS OX cursor on t g CO2 Equ 866 00 10 00 866 00 00 00 866 00 00 866 00 00 866 00 00 866 00 00 866 00 00 866 00	DE (N2O) Emissions (C he bar to give tivalent) value	aq CO2 Equivalents	24.735 910 5102	2020 L 2021 2022	2023 2024 2025
Save							Gas N	ITROUS OXIDE ((N2O)					







4.3.8. QUALITY CONTROL/ QUALITY CHECK

Table 13: The QC activities and procedures that will be followed

It is indicated in the table below. The Three consultants will handle the QC and Procedures based on the color in the table, Kay – pink, Florencza Abel – Green, and Zacky Bani – Blue.

QUALITY CONTROL CHECK	PROCEDURES	TIME TAKEN TO COMPLETE PROCEDURE (DAYS)	COMMENTS
Check the Assumptions and criteria for the selection of activity data, emissions factor, and other estimation parameters	 Confirm that estimates are reported for all categories and all years from the appropriate base year to the period of the current inventory. For subcategories, confirm that the entire category is being covered. Provide a clear definition of 'Other' type categories. Check that known data gaps that result in incomplete estimates are documented, including a qualitative evaluation of the importance of the estimate concerning total emissions (e.g., subcategories classified as 'not estimated', see Chapter 8, Reporting Guidance and Tables). 		
Check for transcriptions Errors in the data input and references	 Confirm that bibliographical data references are properly cited in the internal documentation. Cross-check a sample of input data from each category (either measurements or parameters used in calculations) for transcription errors. 		
Check that emissions and removals are calculated correctly	 Reproduce a set of emissions and removal calculations. Use a simple approximation method that gives similar results to the original and more complex calculation to ensure that there is no data input error or calculation error. 		
Check that parameters and units are correctly	• Check that units are properly labeled in calculation sheets.		







recorded and that	• Check that units are correctly carried	
appropriate	through from beginning to end of	
are used	• Check that conversion factors are	
are used.	correct.	
	• Check that temporal and spatial	
	adjustment factors are used correctly.	
	• Examine the included intrinsic	
	documentation (see also Box 6.4) to:	
	1. Confirm that the appropriate data	
	processing steps are correctly	
	represented in the database.	
Check the integrity	2. Confirm that data relationships are	
of database files	confective represented in the database.	
	3. Ensure that data fields are properly	
	specifications	
	4. Ensure that adequate documentation	
	of database and model structure and	
	operation are archived.	
	Identify parameters (e.g., activity data,	
Check for	constants) that are common to	
consistency in data	multiple categories and confirm that	
between categories.	there is consistency in the values used	
	emission/removal calculations	
	• Check that emissions and removal data	
Check that the	are correctly aggregated from lower	
movement of	reporting levels to higher reporting levels	
inventory data	• Check that emissions and removal data	
steps is correct	are correctly transcribed between different	
	intermediate products.	
	• Check that the qualifications of	
	individuals providing expert judgment for	
Check that	uncertainty estimates are appropriate.	
uncertainties in	• Check that qualifications,	
emissions and	assumptions, and expert judgments are	
removals are		
estimated and	• Check that calculated uncertainties are	
calculated		
correctly.	• If necessary, duplicate uncertainty	
	calculations on a small sample of the	
	Carlo analyses (for example, using	







	uncertainty calculations according to Approach 1).	
	• Check for temporal consistency in time series input data for each category	
	Check for consistency in the	
	algorithm/method used for calculations	
Check time series	throughout the time series.	
consistency.	• Check methodological and data changes resulting in recalculations.	
	• Check that the effects of mitigation	
	activities have been appropriately	
	reflected in time series calculations.	
	• Confirm that estimates are reported for	
	all categories and all years from the	
	appropriate base year to the period of the current inventory.	
	For subcategories, confirm that the entire category is being covered.	
Check Completeness	• Provide a clear definition of 'Other' type categories.	
completeness	• Check that known data gaps that result	
	in incomplete estimates are documented,	
	including a qualitative evaluation of the	
	importance of the estimate concerning	
	total emissions (e.g., subcategories	
	Classified as 'not estimated', see Chapter	
	o, Reporting Guidance and Tables)	

	• Confirm that estimates are reported for all categories and all years from the appropriate base year to the period of the	
	current inventory.	
	• Check the value of implied emission factors (aggregate emissions divided by	
	activity data) across time series.	
Trend Check	1. Do any year's show outliers that are	
field check	2. If they remain static across time	
	series, are changes in emissions or	
	removals being captured?	
	• Check if there are any unusual and	
	unexplained trends noticed for activity	
	data or other parameters across the	
	time series.	







	• Check that there is detailed internal documentation to support the estimates and enable the reproduction of the emission, removal, and uncertainty estimates.
Review of internal documentation and	• Check that inventory data, supporting data, and inventory records are archived and stored to facilitate detailed review.
archiving.	• Check that the archive is closed and retained in a secure place following completion of the inventory.
	• Check the integrity of any data archiving arrangements of outside organizations
	involved in inventory preparation

(Table 6.1 GENERAL INVENTORY QC PROCEDURES, Volume 1, 2006 IPCC Guidelines for National Greenhouse Gas Inventories).







4.3.9 TIME SERIES

Tier 1 method was used in the last National Inventory report. The method mainly consisted of the usage of Default value, default activity data, and default parameters ¹.

The Director General of the Ministry of Climate Change used office notifications to notify relevant ministries and departments, specified organizations, the public-private sector, and other institutions to collect data for this inventory period. The Department of Climate Change is responsible for maintaining the gathered data, database repository, and archives ⁴

Following the 2006 IPCC Guidelines, Vol. 5, figure 6.2, the Tier 1 Method Approach specifically will be used for this inventory. Estimated Emissions will be calculated using historical data and present up-to-date data.

To collect information, the Project Coordinator and the Consultants will notify Offices relevant to ministries and stakeholders such as the:

- Department of Environmental Protection and Conservation (DEPC)
- Department of Water Resources (DWR)
- Port Vila City Council (PVCC)
- Environment Unit, Public Health at the Ministry of Health
- Department of Climate Change (DOCC)
- UNELCO Engie
- Public Works Department (PWD)

The channels for requesting activity data meetings are the Electronic Single Window, emails, dialogues, and interviews. Consultants may ask the Prime Minister's Office for a Confidential Agreement or Right to Information (RTI) in specific situations where data is unavailable.

Table 14: Annual emissions of CH ₄ and N ₂ O from the base year of 1994 to 2023,
including the emissions values, emission factors, and the methods used to
estimate these emissions.

Year	CH ₄ Emission (Gg)	Emission Factor (Kg N ₂ O - N/Kg N)	N ₂ O Emission (Gg)	Weighted Emission Factor (Kg CH ₄ / Kg BOD)	Total CO ₂ e Emission (Gg)	Method
1994	NE	0.05	NE	0.6	NE	TIER 1
1995	NE	0.05	NE	0.6	NE	TIER 1
1996	NE	0.05	NE	0.6	NE	TIER 1
1997	NE	0.05	NE	0.6	NE	TIER 1
1998	NE	0.05	NE	0.6	NE	TIER 1

⁴ The Republic of Vanuatu Third National Communication to the the United Nations Framework Convention on Climate Change / Vanuatu Environment Data Portal (2020)







1999	NE	0.05	NE	0.6	NE	TIER 1
2000	NE	0.05	NE	0.6	NE	TIER 1
2001	NE	0.05	NE	0.6	NE	TIER 1
2002	NE	0.05	NE	0.6	NE	TIER 1
2003	NE	0.05	NE	0.6	NE	TIER 1
2004	NE	0.05	NE	0.6	NE	TIER 1
2005	NE	0.05	NE	0.6	NE	TIER 1
2006	NE	0.05	NE	0.6	NE	TIER 1
2007	0.157	0.05	0.0102	0.6	7.11	TIER 1
2008	0.157	0.05	0.0105	0.6	7.174	TIER 1
2009	0.157	0.05	0.0107	0.6	7.239	TIER 1
2010	0.157	0.05	0.011	0.6	7.304	TIER 1
2011	0.157	0.05	0.0112	0.6	7.371	TIER 1
2012	0.157	0.05	0.0115	0.6	7.439	TIER 1
2013	0.157	0.05	0.0117	0.6	7.509	TIER 1
2014	0.157	0.05	0.012	0.6	7.581	TIER 1
2015	0.157	0.05	0.0123	0.6	7.654	TIER 1
2016	NE	0.05	NE	0.6	NE	TIER 1
2017	NE	0.05	NE	0.6	NE	TIER 1
2018	NE	0.05	NE	0.6	NE	TIER 1
2019	NE	0.05	NE	0.6	NE	TIER 1
2020	NE	0.05	NE	0.6	NE	TIER 1
2021	NE	0.05	NE	0.6	NE	TIER 1
2022	NE	0.05	NE	0.6	NE	TIER 1
2023	NE	0.05	NE	0.6	NE	TIER 1

Where:

NE: Not estimated







4.3.10 UNCERTAINTY

The list of the uncertainty below was extracted from the (2006 IPCC guidelines, Vol.5, pg. 16)

Uncertainty Within the Ch4 Default Parameters

Chapter 3, Uncertainties, in Volume 1 provides advice on quantifying uncertainties in practice. It includes guidance on eliciting and using expert judgments that, combined with empirical data can provide overall uncertainty estimates. Table 6.7 provides default uncertainty ranges for emission factor and activity data of domestic wastewater. The following parameters are believed to be very uncertain (2006 IPCC guidelines, Vol.5, pg. 16):

• The degrees to which wastewater in developing countries is treated in latrines, septic tanks, or removed by sewer, for urban high, urban low-income groups, and rural populations (Ti, j) (2006 IPCC guidelines, Vol.5, pg. 16).

• The fraction of sewers that are 'open', as well as the degree to which open sewers in developing countries are anaerobic and will emit CH₄. This will depend on retention time, temperature, and other factors including the presence of a facultative layer and possibly toxic components to anaerobic bacteria (e.g., certain industrial wastewater discharges) (2006 IPCC guidelines, Vol.5, pg. 16).

• The amount of industrial TOW that is discharged into open or closed domestic sewers for each country is very difficult to quantify (2006 IPCC guidelines, Vol.5, pg. 16).

Table 4.15 illustrates the default uncertainty ranges for domestic wastewater this includes the Parameter, Emission Factor, Activity Data, and their Uncertainty.







Table 15: Default uncertainty ranges for Domestic Wastewater

Parameter	Uncertainty Range
Emission Factor	
Maximum CH ₄ producing capacity (B _o)	± 30%
Fraction treated anaerobically (MCF)	The MCF is technology dependent. See Table 6.3. Thus, the uncertainty range is also technology dependent. The uncertainty range should be determined by expert judgement, bearing in mind that MCF is a fraction and must be between 0 and 1. Suggested ranges are provided below.
	Untreated systems and latrines, $\pm 50\%$
	Lagoons, poorly managed treatment plants± 30%
	Centralized well managed plant, digester, reactor, $\pm 10\%$
Activity Data	
Human population (P)	$\pm 5\%$
BOD per person	$\pm 30\%$
Fraction of population income group (U)	Good data on urbanization are available, however, the distinction between urban high income and urban low income may have to be based on expert judgment. \pm 15%
Degree of utilization of treatment/ discharge pathway or system for each income group (T _{i,j})	Can be as low as \pm 3% for countries that have good records and only one or two systems. Can be \pm 50% for an individual method/pathway. Verify that total $T_{i,j} = 100\%$
Correction factor for additional industrial BOD discharged into sewers (I)	For uncollected, the uncertainty is zero %. For collected the uncertainty is $\pm 20\%$
Source: Judgement by Expert Group (Aut	hors of this section).

(2006 IPCC Guidelines, Vol.5, pg. 16, Table 6.7)







Uncertainty Within the N₂O Default Parameters

The IPCC default factors contain a significant level of uncertainty. Very little effort has been made to improve the Default factor values in the category as of yet (2006 IPCC guideline). Table 6.11 (See 2006 IPCC Guidelines, Vol.5, Table 6.11) below includes uncertainty ranges based on expert judgment (2006 IPCC Guidelines, Vol.5, pg26).

	Definition	Default Value	Range
Emission Fa	actor		
EF _{EFFLUENT}	Emission factor, (kg N ₂ O-N/kg –N)	0.005	0.0005 - 0.25
EF _{PLANTS}	Emission factor, (g N ₂ O/person/year)	3.2	2 - 8
Activity Da	ta		
Р	Number of people in country	Country-specific	± 10 %
Protein	Annual per capita protein consumption	Country-specific	± 10 %
FNPR	Fraction of nitrogen in protein (kg N/kg protein)	0.16	0.15 - 0.17
T _{plant}	Degree of utilization of large WWT plants	Country-specific	± 20 %
F _{NON-CON}	Factor to adjust for non-consumed protein	1.1 for countries with no garbage disposals,1.4 for countries with garbage disposals	1.0 - 1.5
Find-com	Factor to allow for co-discharge of industrial nitrogen into sewers. For countries with significant fish processing plants, this factor may be higher. Expert judgment is recommended.	1.25	1.0 - 1.5

Table 16: N₂O Methodology Default Emission factor and Activity data

(2006, IPCC Guidelines, Vol.5, Pg 27, Table 6.11)







4.4. IMPROVEMENT PLAN

4.4.1 VANUATU'S CURRENT INVENTORY PROCESS

The national Greenhouse Gas (GHG) inventory of anthropogenic (human- caused) GHG emissions and removals were estimated for the Republic of Vanuatu under the first, second, and third (draft) National Communications for 1994, 2000, and 2015 (Srikanth Subbarao, Subbarao Consulting Services, Naveen Pawar, Subbarao Consulting Services, 2020). However, the waste sector of Vanuatu comprises mainly solid waste and wastewater (Ministry of Climate Change, 2020). For first National Communications 1994, emissions for the waste sector were not estimated due to lack of resources. However, for the second and third National communications, emissions were estimated from the waste sector for the national greenhouse gas inventory 2007-2015.

Table 3.4.1.a Different Categories of Waste that is Relevant to Vanuatu.⁵

Categories	Remarks
4 - Waste	
4.A - Solid Waste Disposal	Estimated
4.B - Biological Treatment of Solid Waste	Not Occurring
4.C - Incineration and Open Burning of Waste	Not Estimated
4.D - Wastewater Treatment and Discharge	Estimated
4.E - Other (please specify)	Not Occurring

Source: Vanuatu's Third National Inventory (2020).

As mentioned above, this sector focuses mainly on two key categories, which is, solid waste management and disposal (excluding biological waste), and domestic and commercial wastewater handling (no industrial waste water generation). Therefore, emissions estimated is mostly methane (CH₄) and Nitrous Oxide (N₂O) from these categories.

⁵ https://unfccc.int/sites/default/files/resource/Vanuatu%20Third%20National%20Communication%20Report.pdf











4.4.2 AREAS IDENTIFIED FOR IMPROVEMENT AND IDENTIFIED GAPS

The improvement gap will be the waste sector data: The waste (Solid waste and waste water) activity data monitoring and reporting has been initiated in urban Centre's, therefore higher tier method (Tier 2) will be applied for the future inventory period (Ministry of Climate Change, 2020). There is also potential development of open burning estimates.

4.4.3: PROPOSED IMPROVEMENT ACTIONS

These are the outlined improvement actions the consultant needs to take into consideration while conducting the GHG inventory. This table shows detailed information on the data sources, how to access it, who is responsible and the relevant time it needs to collect data sets, thus, will result in accurate GHG inventory.

Department/	Roles and	Dates	Relevant	Contact Person	Comments
Organizatio	Responsibility		Governing		
n			Arrangement		
Department	To provide	First week of	A Memorandum	Department of	For significant
of Water	information on	April– First	of understanding	water resources	information and
Resources	measurements	week of May	or Right to	Tel:	data collection,
(DWR)	and analysis of	every year	Information (RTI)	(678)22423/3343	DOCC needs to
	BOD, COD, and		can be provided	5	send a prompt
	activity data on		between DWR		letter to DWR
	Domestic		and DOCC		two

⁶ https://unfccc.int/sites/default/files/resource/Vanuatu%20Third%20National%20Communication%20Report.pdf







	wastewater			Email:	months prior.
	operations			esteitoka@vanua	I
	(collection and			tu.gov.vu	A follow-up
	disposal of				email or call is
	waste) in rural				crucial as well.
	areas in Vanuatu.				
Department	To provide	First week of	A Memorandum		
of	relevant	April– First	of understanding	Environment	For significant
Environment	information on	week of May	or Right to	Unit	information and
al Protection	activity data and	every year	Information (RTI)		data collection.
&	key parameters		can be provided	Name: Ionie	DOCC needs to
Conservation	on SWD on land		between DEPC	Bolenga	send a prompt
(DEPC)			and DOCC	(Principal	letter to DEPC
(2210)				Officer on Waste	two
				Management and	months prior.
				Pollution	monum priori
				Control)	A follow-up
				Email: ibolenga	email or call is
				@vanuatu gov v	crucial as well
					er derar us wen.
				<u>u</u>	
				Name:	
				Annabelle Alilee	
				(Pollution	
				Control Officer)	
				Email.	
				aalilee@vanuatu.	
				gov.vu	
				<u></u>	
Public Works	To provide	First week of	A Memorandum	Public Works	For significant
Department	relevant	April– First	of understanding	Department	information and
(PWD)	information and	week of May	or Right to		data collection,
	data on the	every year	Information (RTI)	Email:	DOCC needs to
	operation		can be provided	pwdheadoffice@	send a prompt
	(collection and		between PWD	vanuatu.gov.vu	letter to PWD
	disposal) of		and DOCC	Tel: 33460 or	two
	domestic			22790	months prior.
	wastewater in				
	Urban and sub-				A follow-up
	urban areas.				email or call is
					crucial as well.
UNELCO	To provide	First week of	A Memorandum	UNELCO	For significant
Engie	relevant	April– First	of understanding	ENGIE	information and
	information and	week of May	or Right to	Email:	data collection,
	data on the	every year	Information (RTI)	unelco@engie.co	DOCC needs to
	operation		can be provided	<u>m</u>	send a prompt







Port Vila City Council (PVCC)	(collection and disposal) of domestic wastewater in Urban and sub- urban areas. To provide relevant information and data on the operation of SWD on land and domestic wastewater management within its jurisdiction.	First week of April– First week of May every year	between UNELCO and DOCC A Memorandum of understanding or Right to Information (RTI) can be provided between PVCC and DOCC	Tel: 26000	letter to UNELCO two months prior. A follow-up email or call is crucial as well. For significant information and data collection, DOCC needs to send a prompt letter to PVCC two months prior. A follow-up email or call is crucial as well
Department of Climate Change (DOCC)	DOCC is responsible to send a formal letter requesting relevant data and information on SWD on land and Domestic Wastewater to the Environmental Protection and Conservation, The Department of Water Resources, Public Works Department, UNELCO, Port Vila City Council, and the Environment Unit under the Ministry of Climate Change.	February – March every year	Provide a Memorandum of understanding or Right to Information (RTI) to the Environmental Protection and Conservation, The Department of Water Resources, Public Works Department, UNELCO, Port Vila City Council, and the Environment Unit under the Ministry of Climate Change	Name: Nelson Kalo Director of Climate Change Email: <u>nekalo@vanuatu</u> .gov.vu	DOCC is responsible for doing a follow- up to the departments or organization for the required data to be delivered upon schedule.







4.5 REFERENCES

- Goodwin, J., Woodfield, M., Ibnoaf, M., Koch, M., & Yan, H. (2006). 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Chapter 2: Approaches to Data Collection. Institute for Global Environmental Strategies (IGES).
- Ministry of Climate Change. (2020). *The Republic of Vanuatu, Third National Communication*. Port Vila.
- Ministry of Climate Change, M. (2020). *The Republic of Vanuatu Third National Communication to the The United Nations Framework Convention on Climate Change*. Port Vila: Ministry of Climate Change.
- MOCC. (2021). *The Republic of Vanuatu First Biennal Update Report, UNDER THE UNITED NATIONS FRAMEWORK CONVENTION ON CLIMATE CHANGE (UNFCCC).* Port Vila: The Ministry of Climate Change Adaptation, Meteorology and Geo- Hazards, Energy, Environment and National Disaster Management Government of Vanuatu.
- Pipatti, R., & Svardal, P. (2006). *SOLID WASTE DISPOSAL*. 2006 IPCC Guidelines for National Greenhouse Gas Inventories.







4.6 ANNEX

Figure A4.1 Structure of Waste Sector



(See 2006 IPCC Guidelines, Volume 5 Chapter 1, Introduction, Figure 1.1)



Г





٦

TABLE A4.1: ESTIMATED BOD5 VALUES IN DOMESTIC WASTEWATER FOR SELECTED REGIONS AND COUNTRIES

ESTIMATED BOD5 VALUES IN DOMESTIC WASTEWATER FOR SELECTED REGIONS AND COUNTRIES					
Country/Region	BOD5 (g/person/day)	Range	Reference		
Africa	37	35 - 45	1		
Egypt	34	27 - 41	1		
Asia, Middle East, Latin America	40	35 – 45	1		
India	34	27 - 41	1		
West Bank and Gaza Strip (Palestine)	50	32 - 68	1		
Japan	42	40 - 45	1		
Brazil	50	45 – 55	2		
Canada, Europe, Russia, Oceania	60	50 - 70	1		
Denmark	62	55 - 68	1		
Germany	62	55 - 68	1		
Greece	57	55 - 60	1		
Italy	60	49 - 60	3		
Sweden	75	68 - 82	1		
Turkey	38	27 - 50	1		
United States	85	50 - 120	4		

Note: These values are based on an assessment of the literature. Please use national values, if available.

Reference:

- 1. Doorn and Liles (1999).
- 2. Feachem et al. (1983).
- 3. Masotti (1996).
- 4. Metcalf and Eddy (2003).







(See 2006 IPCC Guidelines, Volume 5 Chapter 6, Wastewater treatment and Discharge, Table 6.4)

TABLE A4.2: DEFAULT MAXIMUM CH4 PRODUCING CAPACITY (B0) FORDOMESTIC WASTEWATER

Default maximum CH_4 producing capacity $(B_{\rm 0})$ for domestic wastewater

0.6 kg CH₄/kg BOD

0.25 kg CH₄/kg COD

Based on expert judgment by lead authors and on Doorn et al., (1997)

(See 2006 IPCC Guidelines, Volume 5 Chapter 6, Wastewater treatment and Discharge, Table 6.2)

TABLE A4.3: DEFAULT MCF VALUES FOR DOMESTIC WASTEWATER

DEFAULT MCF VALUES FOR DOMESTIC WASTEWATER				
Type of treatment and discharge pathway or system	Comments	MCF ¹	Range	
Untreated system				
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	
Flowing sewer (open or closed)	Fast moving, clean. (Insignificant amounts of CH ₄ from pump stations, etc.)	0	0	
Treated system				
Centralized, aerobic treatment plant	Must be well managed. Some CH ₄ can be emitted from settling basins and other pockets.	0	0 -0.1	
Centralized, aerobic treatment plant	Not well managed. Overloaded.	0.3	0.2-0.4	
Anaerobic digester for sludge	CH ₄ recovery is not considered here.	0.8	0.8 - 1.0	







Anaerobic reactor	CH ₄ recovery is not considered here.	0.8	0.8 – 1.0	
Anaerobic shallow lagoon	Depth less than 2 meters, use expert judgment.	0.2	0-0.3	
Anaerobic deep lagoon	Depth more than 2 meters	0.8	0.8 – 1.0	
Septic system	Half of BOD settles in anaerobic tank.	0.5	0.5	
Latrine	Dry climate, ground water table lower than latrine, small family (3-5 persons)	0.1	0.05 - 0.15	
Latrine	Dry climate, ground water table lower than latrine, communal (many users)	0.5	0.4 - 0.6	
Latrine	Wet climate/flush water use, ground water table higher than latrine	0.7	0.7 - 1.0	
Latrine	Regular sediment removal for fertilizer	0.1	0.1	
1 Based on expert judgment by lead authors of this section.				

(See 2006 IPCC Guideline, Vol.5, Chapt.6 Wastewater, Section 6.2.2.2, Table 6.3)

TABLE A4.4: N2O METHODOLOGY DEFAULT DATA

N ₂ O METHODOLOGY DEFAULT DATA					
	Definition	Default Value	Range		
Emission Fac	tor				
EFeffluent	Emission factor, (kg N ₂ O-N/kg –N)	0.005	0.0005 - 0.25		
EFPLANTS	Emission factor, (g N ₂ O/person/year)	3.2	2 - 8		
Activity Data					
Р	Number of people in country	Country-specific	± 10 %		
Protein	Annual per capita protein consumption	Country-specific	± 10 %		
Fnpr	Fraction of nitrogen in protein (kg N/kg protein)	0.16	0.15 - 0.17		
Tplant	Degree of utilization of large WWT plants	Country-specific	± 20 %		







Fnon-con	Factor to adjust for non-consumed protein	1.1 for countries with no garbage disposals,1.4 for countries with garbage disposals	1.0 - 1.5	
Find-com	Factor to allow for co-discharge of industrial nitrogen into sewers. For countries with significant fish processing plants, this factor may be higher. Expert judgment is recommended.	1.25	1.0 - 1.5	

(See 2006 IPCC Guidelines, Volume 5 Chapter 6, Wastewater treatment and Discharge, Table 6.11)

TABLE A4.5: RECOMMENDED DEFAULT HALF-LIFE (t1/2) VALUES (YR) UNDER TIER 1

Type of Waste		Climate Zone*							
		Boreal and Temperate (MAT ≤ 20°C)			Tropical ¹ (MAT > 20°C)				
		Dry (MAP/PET < 1)		Wet (MAP/PET > 1)		Dry (MAP < 1000 mm)		Moist and Wet (MAP ≥ 1000 mm)	
		Default	Range ²	Default	Range ²	Default	Range ²	Default	Range ²
Slowly degrading waste	Paper/textiles waste	17	$14^{3,5} - 23^{3,4}$	12	$10 - 14^{3,5}$	15	12 - 17	10	8-12
	Wood/ straw waste	35	23 ^{3,4} – 69 ^{6,7}	23	17 – 35	28	17 – 35	20	14 - 23
Moderately degrading waste	Other (non – food) organic putrescible/ Garden and park waste	14	12 – 17	7	6 – 9 ⁸	11	9 – 14	4	3 - 5
Rapidly degrading waste	Food waste/Sewage sludge	12	9 - 14	4 ⁴	$3^{3,4} - 6^9$	8	6-10	2	$1^{10} - 4$
Bulk Waste		14	12 - 17	7	$6 - 9^{8}$	11	9-14	4	3 - 5 ¹¹

(See 2006 IPCC Guidelines, Volume 5 Chapter 3, Solid Waste Disposal, Table 3.4)