



Task Force on National Greenhouse Gas Inventories

IPCC Inventory Software: Waste Sector

Baasansuren Jamsranjav

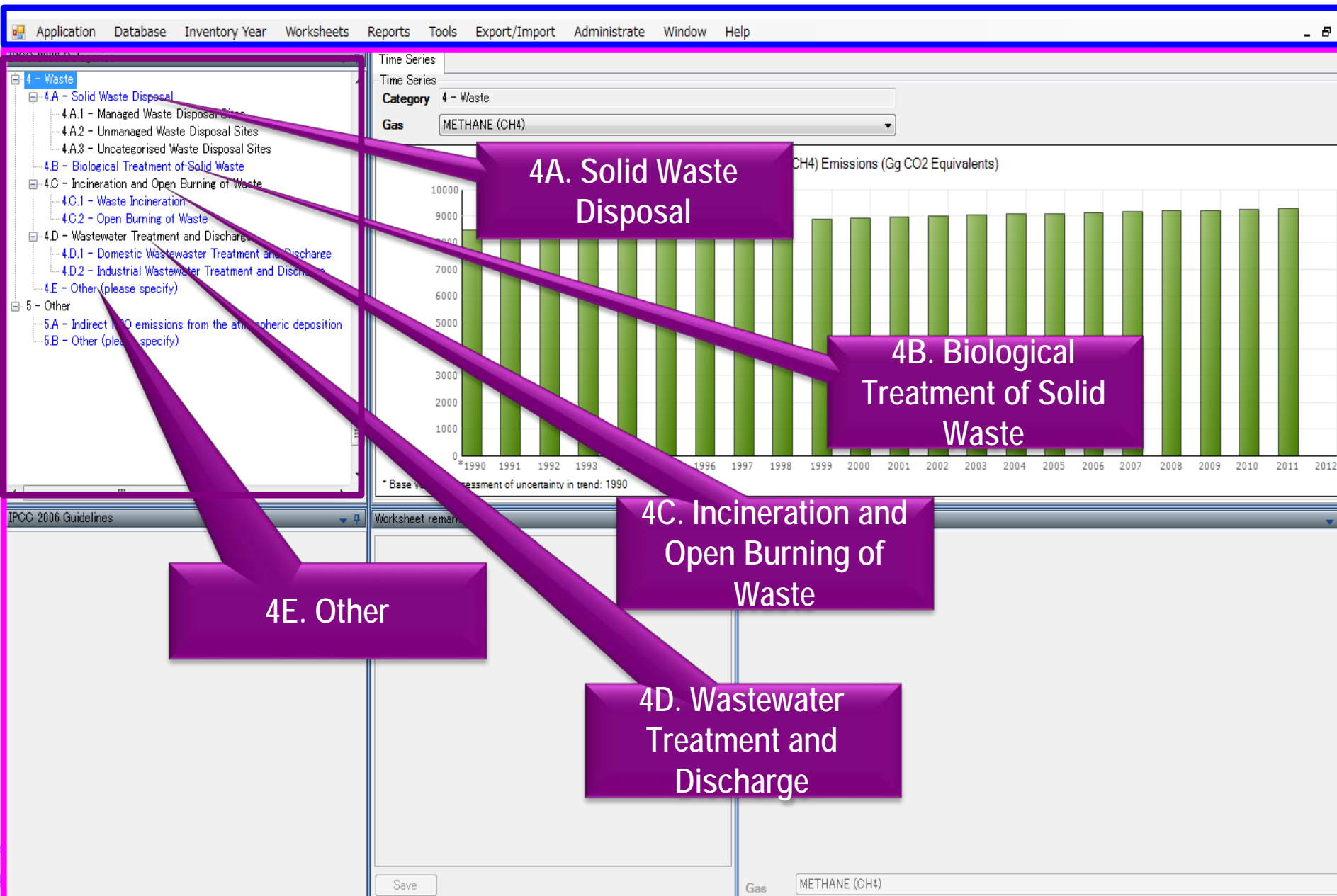
The 10th Workshop on GHG Inventories in Asia (WGIA10)

- Capacity building for measurability, reportability and verifiability -

10-12 July 2012

Hanoi, Vietnam

Waste Sector



Waste Sector: 4A. Solid Waste Disposal

First order decay (FOD) method for estimation of CH₄ emissions from solid waste disposal sites (SWDS)

- *Estimates actual emissions*

Two options for estimation of emissions from municipal solid waste (MSW) depending on data availability

- *Waste composition*
- *Bulk waste*

Historical data on solid waste disposal

- *Amount of MSW can be estimated from population and per capita waste generation data (Tier1)*

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

IPCC 2006 Categories

- 4 - Waste
 - 4.A - Solid Waste Disposal
 - 4.A.1 - Managed Waste Disposal Sites
 - 4.A.2 - Unmanaged Waste Disposal Sites
 - 4.A.3 - Unrecategorised Waste Disposal Sites
 - 4.B - Biological Treatment of Solid Waste
 - 4.C - Incineration and Open Burning of Waste
 - 4.C.1 - Waste Incineration
 - 4.C.2 - Open Burning of Waste
 - 4.D - Wastewater Treatment and Discharge
 - 4.D.1 - Domestic Wastewater Treatment and Discharge
 - 4.D.2 - Industrial Wastewater Treatment and Discharge
 - 4.E - Other (please specify)
- 5 - Other
 - 5.A - Indirect emissions from the atmospheric deposition of nitrogen in NO_x and NH₃
 - 5.B - Other (please specify)

Parameters: Methane Correction Factor Activity Data Amount Deposited Methane Calculations Methane Recovery Results Long Term stored C in SWDS Harvested Wood Products

Country/Territory Slovakia

Region Europe - Eastern

Climate Zone Boreal and temperate dry

*Approach Waste by composition

**Activity Data Population / GDP (Tier 1)

Starting year 1950

DOC (Degradable organic carbon) [weight fraction, wet basis]

Methane generation rate constant (k) [1 / years]

Food Waste	0.150	0.060
Garden	0.200	0.050
Paper	0.400	0.040
Wood and straw	0.000	0.020
Textiles	0.000	0.040
Disposable nappies	0.000	0.050
Sewage sludge	0.000	0.050
Industrial Waste	0.000	0.050

DOC (fraction of DOC dissimilated) 0.50

Delay Time (months) 6

Fraction of methane in developed gas 0.50

Conversion Factor CH₄ 1.333333

Oxidation Factor (O₂) 0.00

Parameters for carbon

% paper in industrial waste 0.00 %

% wood in industrial waste 0.00 %

* The bulk waste option is only for countries without data or with limited data on waste composition, but with good information on bulk waste disposed at a particular location. Default values are estimated based on the location of the climate zone.

** In case of "Population and GDP" sheet to estimate amount of waste to SWDS based on Population and GDP.

In case of "National statistics" sheet, amounts directly into "Amount deposited" sheet.

Uncertainties Reset to default Save

Worksheet remarks 4.A - Time Series

Save

Gas CARBON DIOXIDE (CO₂)

Solid Waste Disposal

Select appropriate region and climate zone

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

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 - 5.A - Indirect N₂O emissions from the atmospheric deposition of nitrogen in NO_x and NH₃
 - 5.B - Other (please specify)

Parameters: Methane Correction Factor **Activity Data** **Amount Deposited** Methane Calculations Methane Recovery Results Long Term stored C in SWDS Harvested Wood Products

Worksheet

Sector: Waste
 Category: Methane emissions from Solid Waste Disposal Sites
 Subcategory: 4.A - Solid Waste Disposal
 Sheet: Industrial and MSW Activity Data

Data

Waste Composition Type: Municipal Solid Waste

Year	Population [millions]	Waste per capita [g/cap/yr]	Total MSW [Gg]	% SWDS [%]	Total to SWDS [Gg]	Composition of waste going to solid waste disposal sites								Total [=100 %]
						Food [%]	Garden [%]	Paper [%]	Wood [%]	Textile [%]	Nappies [%]	Plastics, other inert [%]		
IPCC Regional Defaults	6	320	1920	80	1536	30.1	1	21.8	7.5	4.7	0.5	34.4	100	
1950	6	320	1920	80	1536	30.1	1	21.8	7.5	4.7	0.5	34.4	100	
1951	6	320	1920	80	1536	30.1	1	21.8	7.5	4.7	0.5	34.4	100	
1952	6	320	1920	80	1536	30.1	1	21.8	7.5	4.7	0.5	34.4	100	
1953	6	320	1920	80	1536	30.1	1	21.8	7.5	4.7	0.5	34.4	100	
1954	6	320	1920	80	1536	30.1	1	21.8	7.5	4.7	0.5	34.4	100	
1955	6	320	1920	80	1536	30.1	1	21.8	7.5	4.7	0.5	34.4	100	
1956	6	320	1920	80	1536	30.1	1	21.8	7.5	4.7	0.5	34.4	100	
1957	6	320	1920	80	1536	30.1	1	21.8	7.5	4.7	0.5	34.4	100	
1958	6	320	1920	80	1536	30.1	1	21.8	7.5	4.7	0.5	34.4	100	
1959	6	320	1920	80	1536	30.1	1	21.8	7.5	4.7	0.5	34.4	100	
1960	7	2240	2240	80	1792	30.1	1	21.8	7.5	4.7	0.5	34.4	100	
1961	7	2240	2240	80	1792	30.1	1	21.8	7.5	4.7	0.5	34.4	100	
1962	7	2240	2240	80	1792	30.1	1	21.8	7.5	4.7	0.5	34.4	100	
1963	7	2240	2240	80	1792	30.1	1	21.8	7.5	4.7	0.5	34.4	100	
1964	7	2240	2240	80	1792	30.1	1	21.8	7.5	4.7	0.5	34.4	100	
1965	7	2240	2240	80	1792	30.1	1	21.8	7.5	4.7	0.5	34.4	100	
1966	7	2240	2240	80	1792	30.1	1	21.8	7.5	4.7	0.5	34.4	100	
1967	7	2240	2240	80	1792	30.1	1	21.8	7.5	4.7	0.5	34.4	100	

This worksheet allows Ctrl+C/Ctrl+V to copy/paste data. Only edited cells can be overwritten when pasting.

IPCC 2006 Guidelines

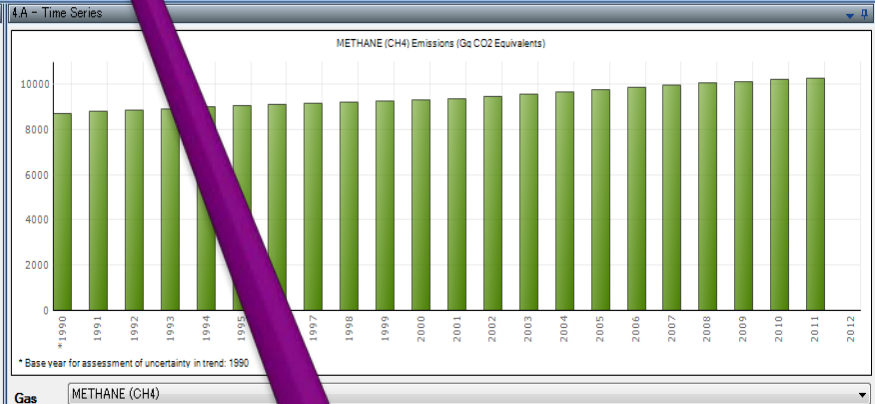
Time Delay

The default assumption is that the reaction starts on the first of January in the year after deposition, which is equivalent to an average delay time of six months before decay to methane commences ("Delay time" = 6). It is good practice to assume an average delay of from two to six months. If a value greater than six months is chosen, evidence to support this must be provided. To make the model work for delay times from 7 to 18 months, the number 13 in "exp2" in all the methane calculating sheets is changed to 25, and DDOCmd in columns F and G is readdressed one cell down.

Save

Worksheet remarks

4.A - Time Series



Are historical data on solid waste disposal available?

NO

YES



IPCC 2006 Categories

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 - 4.D.2 - Industrial Wastewater Treatment and Discharge
- 4.E - Other (please specify)
- 5 - Other
 - 5.A - Indirect N2O emissions from the atmospheric deposition
 - 5.B - Other (please specify)

Parameters Methane Correction Factor Activity Data Amount Deposited **Methane Calculations** Methane Recovery Results Long Term stored C in SWDS Harvested Wood Products

Worksheet

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

Data

Waste Type: Industrial Waste

DOC 0.15 DOCf 0.5 k 0.05 Half-life time (h=ln(2)/k) 13.86294361

exp1=exp(-k) 0.951229424 Month when the reaction set to start (M) 13 exp2=exp(-k*((13-M)/12)) 1 CH4 Fraction 0.5

Year	Amount deposited	MCF	Decomposable DOC (DDOCm) deposited	DDOCm not deposited on year	DDOCm decomposed. Deposition year	DDOCm accumulated in SWDS end of year	DDOCm decomposed	CH4 generated
	g	fraction	Gg		Gg	Gg	Gg	Gg
1950	11875	0.675	601.17188	0	0	601.17188	0	0
1951	11875	0.675	601.17188	0	0	1173.02425	29.3195	19.54633
1952	11875	0.675	601.17188	0	0	1716.98706	57.20907	38.13938
1953	11875	0.675	601.17188	0	0	2234.42049	83.73845	55.82563
1954	11875	0.675	601.17188	0	0	2726.61839	108.97397	72.64932
1955	11875	0.675	601.17188	0	0	3194.81152	132.97875	88.6525
1956	11875	0.675	601.17188	0	0	3640.17058	155.8128	103.8752

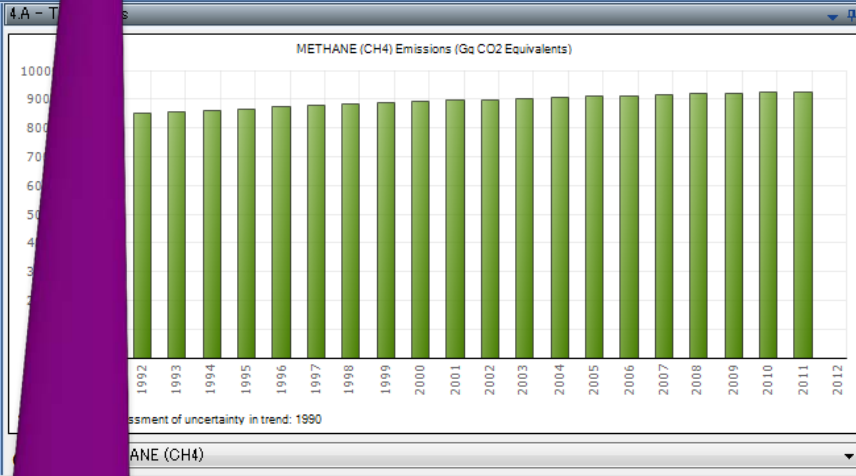
IPCC 2006 Guidelines

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The default assumption is that the reaction starts on the first of January in the year after deposition, which is equivalent to an average delay time of six months before decay to methane commences ("Delay time" = 6). It is good practice to assume an average delay of from two to six months. If a value greater than six months is chosen, evidence to support this must be provided. To make the model work for delay times from 7 to 18 months, the number 13 in "exp2" in all the methane calculating sheets is changed to 25, and DDOCm in columns F and G is readdressed one cell down.

Worksheet

Save



Waste category and type (e.g. industrial waste)

Amount of CH₄ generated

After entering parameters and activity data

IPCC 2006 Categories

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 - 4.E - Other (please specify)
 - 5A - Indirect N2O emissions from the atmospheric deposition
 - 5B - Other (please specify)

Parameters Methane Correction Factor Activity Data Amount Deposited Methane Calculations Methane Recovery Results Long Term stored C in SWDS Harwested Wood Products

Worksheet

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

Data

Year	Methane generated									Total	Methane recovery	Methane Emissions
	Food	Garden	Paper	Wood	Textiles	Nappies	Sludge	Industrial				
	A (Gg)	B (Gg)	C (Gg)	D (Gg)	E (Gg)	F (Gg)	G (Gg)	H (Gg)	I (Gg)	J (Gg)	M = (I-J) * (1-OX) (Gg)	
1950	0	0	0	0	0	0	0	0	0	0	0	0
1951	0.94908	0.03521	1.23418	0.23051	0.15965	0.02113	0.13753	19.54633	22.31362	0	22.31362	
1952	1.0429	0.0687	2.41997	0.45645	0.31304	0.04122	0.26836	38.13938	43.55001	0	43.55001	
1953	2.68466	0.10056	3.55926	0.67792	0.46042	0.06033	0.3928	55.82563	63.76158	0	63.76158	
1954	3.4774	0.13086	4.65388	0.89202	0.62022	0.07852	0.51118	72.64992	82.99817	0	82.99817	
1955	4.22397	0.15969	5.70558	1.10000	0.73806	0.09581	0.62378	88.6525	101.30718	0	101.30718	
1956	4.92707	0.18711	6.71604	1.30000	0.86877	0.11227	0.73089	103.8752	118.7337	0	118.7337	
1957	5.58923	0.21319	7.68688	1.50000	0.99436	0.12791	0.83278	118.35548	135.32062	0	135.32062	
1958	6.21282	0.238	8.61965	1.70000	1.11502	0.1428	0.9297	132.12954	151.10873	0	151.10873	
1959	6.8001	0.2616	9.51585	1.90000	1.23095	0.15696	1.02189	145.23184	166.13681	0	166.13681	
1960	7.35317	0.28405	10.37691	2.10000	1.34233	0.17043	1.10958	157.69513	180.44177	0	180.44177	
1961	8.03222	0.31128	11.4099	2.30000	1.47596	0.18677	1.193	169.55050	194.497	0	194.497	
1962	8.67172	0.33717	12.40239	2.50000	1.60435	0.2023	1.27295	180.82784	207.87806	0	207.87806	
1963	9.27399	0.3618	13.35596	2.70000	1.7277	0.21708	1.34783	191.55509	220.61762	0	220.61762	
1964	9.84118	0.38524	14.27215	2.90000	1.84621	0.23114	1.41963	201.75917	232.74679	0	232.74679	
1965	10.37533	0.40752	15.1524	3.10000	1.96008	0.24451	1.48793	211.46559	244.29513	0	244.29513	
1966	10.87839	0.42873	15.99815	3.30000	2.06949	0.25724	1.55289	220.69863	255.29078	0	255.29078	
1967	11.35214	0.44899	16.8107	3.50000	2.1746	0.26934	1.61469	229.48136	265.76048	0	265.76048	
1968	11.79831	0.46808	17.5907	3.70000	2.27559	0.28085	1.67347	237.83675	275.7297	0	275.7297	
1969	12.21849	0.48632	18.3607	3.90000	2.37262	0.29179	1.72939	245.7827	285.22264	0	285.22264	
1970	12.61491	0.50368	19.1207	4.10000	2.46595	0.30291	1.78958	253.34207	294.26233	0	294.26233	

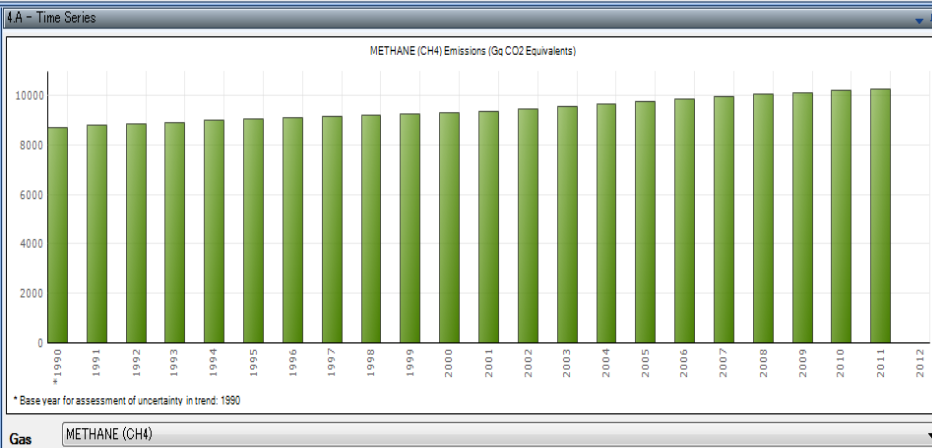
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Worksheet remarks

Annual CH₄ emissions

Save



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 - 5.B - Other (please specify)

Parameters Methane Worksheet

Export

- Worksheet Data
- CO₂ Equivalents
- F-Gases Data
- NAI Reporting Tables

Import

Methane generated

Year	Food (Gg)	Garden (Gg)	Paper (Gg)	Wood (Gg)	Textile (Gg)	Nappies (Gg)	Sludge (Gg)	Industrial (Gg)	Total (Gg)	Methane recovery (Gg)	Methane Emissions (Gg)
	A	B	C	D	E	F	G	H	I	J	M = (I-J) * (1-OX)
1950	0	0	0	0	0	0	0	0	0	0	0
1951	0.94908	0.03521	1.23418	0.23051	0.15965	0.02113	0.13753	19.54633	22.31362	0	22.31362
1952	1.8429	0.0687	2.41997	0.45645	0.31304	0.04122	0.26836	38.13938	43.55001	0	43.55001
1953	2.68466	0.10056	3.55926	0.67792	0.46042	0.06033	0.3928	55.82563	63.76158	0	63.76158
1954	3.4774	0.13086	4.65368	0.895	0.60262	0.07852	0.51118	72.64932	82.99817	0	82.99817
1955	4.22397	0.15969	5.70658	1.10778	0.73806	0.09581	0.62378	88.8525	101.30718	0	101.30718
1956	5.92707	0.18711	6.71604	1.31635	0.86877	0.11227	0.73089	103.8752	118.7337	0	118.7337
1957	7.58923	0.21319	7.66688	1.5208	0.99436	0.12791	0.83278	118.35548	135.32062	0	135.32062
1958	9.1282	0.238	8.61965	1.72119	1.11502	0.1428	0.9297	132.12954	151.10873	0	151.10873
1959	10.8001	0.2616	9.51585	1.91761	1.23095	0.15696	1.02189	145.23184	166.13681	0	166.13681
1960	12.6317	0.28405	10.37691	2.11015	1.34233	0.17043	1.10958	157.69513	180.44177	0	180.44177
1961	14.6222	0.31128	11.14099	2.33729	1.47596	0.18677	1.193	169.55058	194.497	0	194.497
1962	16.772	0.33717	12.40239	2.55933	1.60435	0.2023	1.27235	180.82784	207.87806	0	207.87806
1963	19.099	0.3618	13.35596	2.77817	1.7277	0.21708	1.34783	191.55509	220.61762	0	220.61762
1964	21.618	0.38524	14.27215	2.99208	1.84621	0.23114	1.41963	201.75917	232.74679	0	232.74679
1965	24.338	0.40752	15.1524	3.20176	1.96008	0.24451	1.48793	211.46559	244.29513	0	244.29513
1966	27.263	0.42873	15.99815	3.40728	2.06949	0.25724	1.55289	220.69863	255.29078	0	255.29078
1967	30.393	0.44889	16.81073	3.60874	2.1746	0.26934	1.61469	229.48136	265.76048	0	265.76048
1968	33.728	0.46808	17.59145	3.8062	2.27559	0.28085	1.67947	237.83675	275.7297	0	275.7297
1969	37.269	0.48632	18.34155	3.99876	2.37262	0.29179	1.72939	245.7827	285.22264	0	285.22264
1970	41.016	0.50369	19.06295	4.19048	2.46585	0.30291	1.78958	253.34207	294.26928	0	294.26928

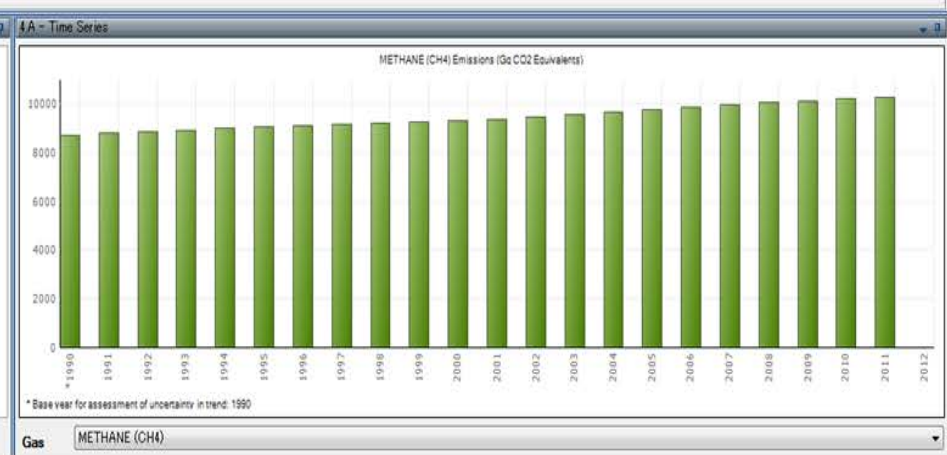
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Worksheet remarks

Export and Import of data

Save



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

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 - 4D.1 - Domestic Wastewater Treatment and Discharge
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 - 4E - Other (please specify)
- 5 - Other
 - 5A - Indirect N₂O emissions from the atmospheric deposition
 - 5B - Other (please specify)

Summary
Short Summary
Energy
IPPU
AFOLU
Waste
Table 7a - Uncertainties

Activity Data Amount Deposited Methane Calculations Methane Recovery Results Long Term stored C in SWGC Harvested Wood Products

1994

Methane generated

	A	B	C	D	E	F	G	H	I	J	M = (I-J) * (1-IX)
	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)
1990	0	0	0	0	0	0	0	0	0	0	0
1991	0.94908	0.09521	1.29418	0.23051	0.15955	0.02113	0.19753	19.54633	22.31362	0	22.31362
1992	1.8429	0.0687	2.41997	0.45645	0.31304	0.04122	0.26926	38.13938	43.55001	0	43.55001
1993	2.80465	0.10056	3.55926	0.87792	0.46042	0.06093	0.39228	55.02563	63.76158	0	63.76158
1994	3.4774	0.13086	4.85389	0.895	0.60202	0.07952	0.51118	72.64932	82.99817	0	82.99817
1995	4.22397	0.15949	5.70958	1.18778	0.73806	0.09581	0.62378	98.6525	101.30718	0	101.30718
1996	4.92707	0.18711	6.71604	1.31635	0.86877	0.11227	0.73869	103.8752	110.7337	0	110.7337
1997	5.58923	0.21319	7.68888	1.5208	0.99436	0.12791	0.83278	118.35548	135.32062	0	135.32062
1998	6.21282	0.238	8.61965	1.72119	1.11502	0.1428	0.9297	132.12954	151.10873	0	151.10873
1999	6.8001	0.2616	9.51585	1.91761	1.23095	0.15696	1.02189	145.23184	166.10881	0	166.10881
2000	7.35317	0.28485	10.37691	2.11015	1.34238	0.17043	1.10958	157.89513	180.44177	0	180.44177
2001	8.03222	0.31128	11.4099	2.33729	1.47596	0.18677	1.193	169.55056	194.497	0	194.497
2002	8.67172	0.33717	12.40239	2.55993	1.60495	0.2023	1.27255	180.82784	207.87866	0	207.87866
2003	9.27399	0.3618	13.35596	2.77817	1.7277	0.21768	1.34763	191.65589	220.81762	0	220.81762
2004	9.84118	0.38524	14.27215	2.99288	1.84621	0.23114	1.41963	201.75917	232.74679	0	232.74679
2005	10.37533	0.40752	15.1524	3.20176	1.96088	0.24451	1.48793	211.46559	244.29519	0	244.29519
2006	10.87939	0.42873	15.99815	3.40728	2.06949	0.25724	1.55289	220.69683	255.29078	0	255.29078
2007	1.35214	0.44889	16.81873	3.60874	2.1746	0.26934	1.61469	228.48136	265.76049	0	265.76049
2008	7.9891	0.46898	17.59145	3.8062	2.27559	0.28095	1.67947	237.83575	275.7297	0	275.7297
2009	3.1849	0.48832	18.34155	3.99976	2.37262	0.29179	1.72839	245.7827	285.22264	0	285.22264
2010	14.91	0.50868	19.06396	4.19048	2.46586	0.30253	1.78358	252.94587	294.96393	0	294.96393

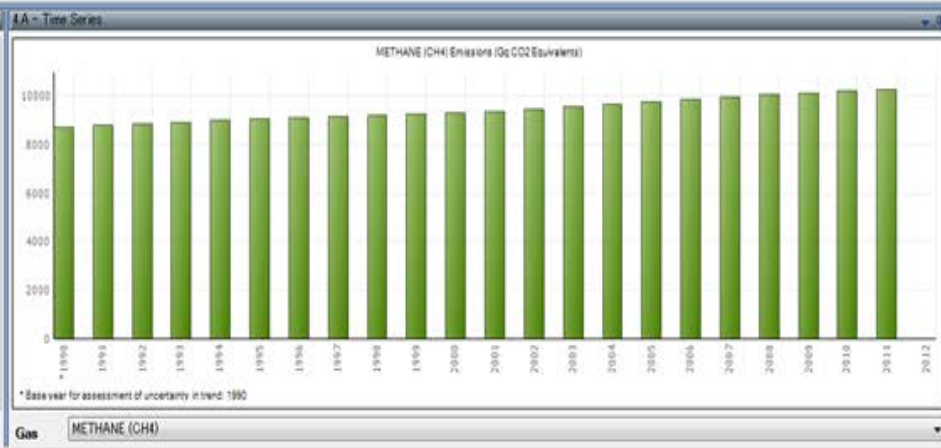
Reporting tables

IPCC 2008 Guidelines

Time Delay
The default assumption is that the reaction starts on the first of January in the year after deposition, which is equivalent to an average delay time of six months before decay to methane commences ("Delay time" = 6). It is good practice to assume an average delay of from two to six months. If a value greater than six months is chosen, evidence to support this must be provided. To make the model work for delay times from 7 to 18 months, the number 18 in "exp2" in all the methane calculating sheets is changed to 25, and DDOCD in columns F and G is readdressed one cell down.

Worksheet remarks

Save





Task Force on National Greenhouse Gas Inventories

Thank you

IPCC Inventory Software can be downloaded from
<http://www.ipcc-nggip.iges.or.jp>