

Development of Waste Statistics to Estimate Activity Data: Waste Sector in Thailand

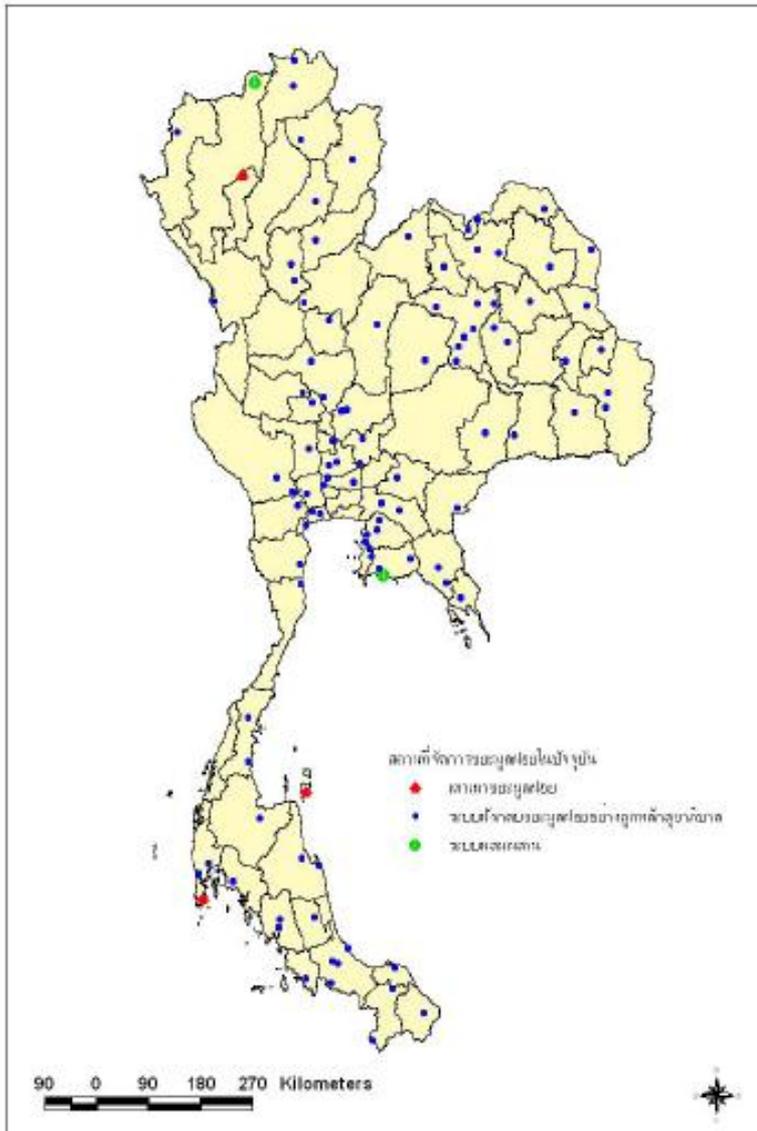
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General Statistics of MSW in Thailand (2008)

Total MSW generation	41,023	tpd
- <i>Bangkok</i>	8,780	tpd
- <i>Municipalities & Pattaya</i>	14,766	tpd
- <i>Sub-district Administrative Organization</i>	17,477	tpd
Waste recycling (22.7%)	9,329	tpd
Waste disposal		
- <i>Sanitary landfill (35.5%)</i>	10,832	tpd
- <i>Open dumping (64.5%)</i>	20,862	tpd

Existing Solid Waste Disposal Facilities

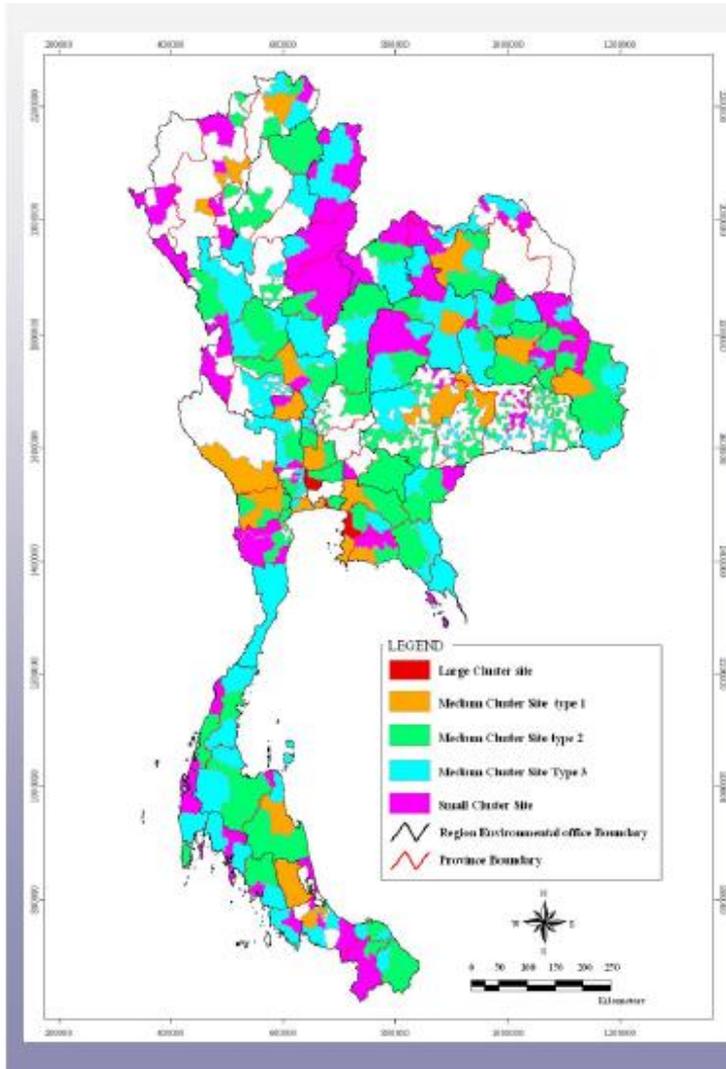


Incineration	<input type="checkbox"/> Phuket municipality (250 tpd) <input type="checkbox"/> Samui Island (75 tpd) <input type="checkbox"/> Lampoon Province (10 tpd)
Sanitary Landfill	<input type="checkbox"/> In operation 96 sites <input type="checkbox"/> Under construction/renovation 10 sites
Integrated Waste Management System	<input type="checkbox"/> Wieng Fang Municipality (150 tpd) <input type="checkbox"/> Rayong Municipality(80 tpd) <input type="checkbox"/> Chonburi Provincial Administrative Organization (300-400 tpd)

Total number of site = 927

Source: Pollution Control Department/ Kasetsart University

Cluster Organization of Solid Waste Disposal Facilities



Combination of Adjacent local Administrative Organization for handling municipal solid waste (privatization is needed)

Size of clusters	Solid waste to system (t/d)
Large (3 clusters)	> 500
Medium (206 clusters)	
M1	250 - 500
M2	100 - 250
M3	50 - 100
Small (90 clusters)	< 50

Thailand's waste statistics (1993-2008)

Description	Amount of waste															
	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
1. BMA	7,050	7,000	7,192	8,098	8,949	8,497	8,990	9,130	9,317	9,617	9,340	9,356	8,291	8,403	8,532	8,780
2. Municipality and Pattaya	3,422	5,618	6,311	6,658	8,196	7,414	12,328	11,785	11,903	11,976	12,100	12,500	12,635	12,912	13,600	14,766
3. Sanitary district	4,138	4,184	4,655	4,895	4,819	4,777	-	-	-	-	-	-	-	-	-	-
4. Out of Municipality and sanitary district	16,030	16,206	16,334	16,378	15,138	16,558	16,561	17,170	17,423	17,632	17,800	18,100	18,295	18,697	18,200	17,477
Total Waste Generation (t/d)	30,640	33,008	34,492	36,029	37,102	37,246	37,879	38,085	38,643	39,225	39,240	39,956	39,221	40,012	40,332	41,023
Waste Recycle Amount (t/d)	822	1,370	2,740	3,836	4,110	4,384	4,932	5,479	6,027	7,123	7,671	8,493	8,630	8,740	8,904	9,329
% of generated waste	2.7	4.2	7.9	10.6	11.1	11.8	13.0	14.4	15.6	18.2	19.5	21.3	22.0	21.8	22.1	22.7
Amount of waste sent to OD and LF:																
Disposal by landfill (%)	21.5	22.9	24.4	25.8	27.2	28.6	30.0	31.4	32.8	35.0	35.0	37.0	38.4	37.0	35.4	35.5
Disposal by open dumpsite (%)	78.5	77.1	75.6	74.2	72.8	71.4	70.0	68.6	67.2	65.0	65.0	63.0	61.6	63.0	64.6	64.5
Waste amount sent to landfill (t/d)	8,445	8,861	9,079	9,896	11,103	10,571	11,036	10,985	11,160	11,301	10,921	11,013	10,255	10,303	10,396	10,832
Waste amount sent to open dump site (t/d)	21,373	22,777	22,673	22,298	21,890	22,291	21,912	21,621	21,456	20,801	20,648	20,450	20,336	20,969	21,031	20,862

Source: Pollution Control Department, Ministry of Natural Resources and Environment
Regional Environmental Office 1-16, Ministry of Natural Resources and Environment

Solid waste disposal sites in Thailand (2000-2005)

1 st NC (1994)				2000-2005																			
Method	No. of SWDS (Site)	Dis. Waste (t/d)	%	Org.	Dis. method	ค.ศ. 2000			2001			2002			2003			2004			2005		
						No. of SWDS (Site)	Dis. Waste (t/d)	%	No. of SWDS (Site)	Dis. Waste (t/d)	%	No. of SWDS (Site)	Dis. Waste (t/d)	%	No. of SWDS (Site)	Dis. Waste (t/d)	%	No. of SWDS (Site)	Dis. Waste (t/d)	%	No. of SWDS (Site)	Dis. Waste (t/d)	%
Trench dump	34	1147.2	25.4	BMA	Landfill	1	9130.0	26.50	1	9317.0	26.00	1	9617.0	26.00	1	9340.0	24.80	1	9356.0	24.10	1	8291.0	21.5
Open dump	8	215.7	4.8	Muni.	Landfill	54 (99)	2826.4	8.20	69 (99)	3466.6	9.70	84 (99)	3981.6	10.80	93 (99)	4250.7	11.30	97 (99)	4567.5	11.80	99 (99)	4718.3	12.2
Landfill	22	1039	22.9		Open dump	686 (827)	5375.7	15.60	715 (827)	5562.8	15.60	746 (827)	5770.7	15.60	775 (827)	6244.6	16.60	808 (827)	6815.6	17.50	827 (827)	7258.6	18.8
Open Burning	70	1819.9	40.2	LAO	Open dump	NA	17170	49.70	NA	17423	48.70	NA	17632	47.60	NA	17800	47.30	NA	18100	46.60	NA	18295	47.5
Others	3	301	6.7	Others																			
Total	137	4522.8	100	Total		740 (927)	34,502	100	785 (927)	35,769	100	831 (927)	37,001	100	869 (927)	37,635	100	906 (927)	38,839	100	927 (927)	38,563	100

Methodology used for estimation of GHG emission (1996 IPCC Guidelines)

6A Solid waste disposal on land

6A1 CH ₄ Emission	<p>Tier 1: mass balance $\text{CH}_4 \text{ Emission} = [(\text{MSW}_T * \text{MSW}_F * L_o) - R] * (1 - \text{OX})$</p> <hr/> <p>Tier 2: First order decay $\text{CH}_4 \text{ Emission } Q_{T,x} = k * R_x * L_o * e^{-k(T-x)}$ $Q_T = \sum Q_{T,x} \quad (\text{for } x = \text{initial year to } T)$</p>
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Activity data required

TIER 1;	MSW _T =	Total MSW Generated
	MSW _F =	Fraction of MSW disposed at SWDS
	L _o =	Methane Generation Potential, depending on waste composition
		= [MCF*DOC*DOC _F *F*16/12]
	MCF =	Methane Correction Factor, depending on disposal method
TIER2;	R _x =	The amount of waste disposed in year x
	x =	The year of waste input
	L _o =	Methane generation potential
	k =	First order decay rate constant, depending on waste composition
	T =	Current (estimation) year

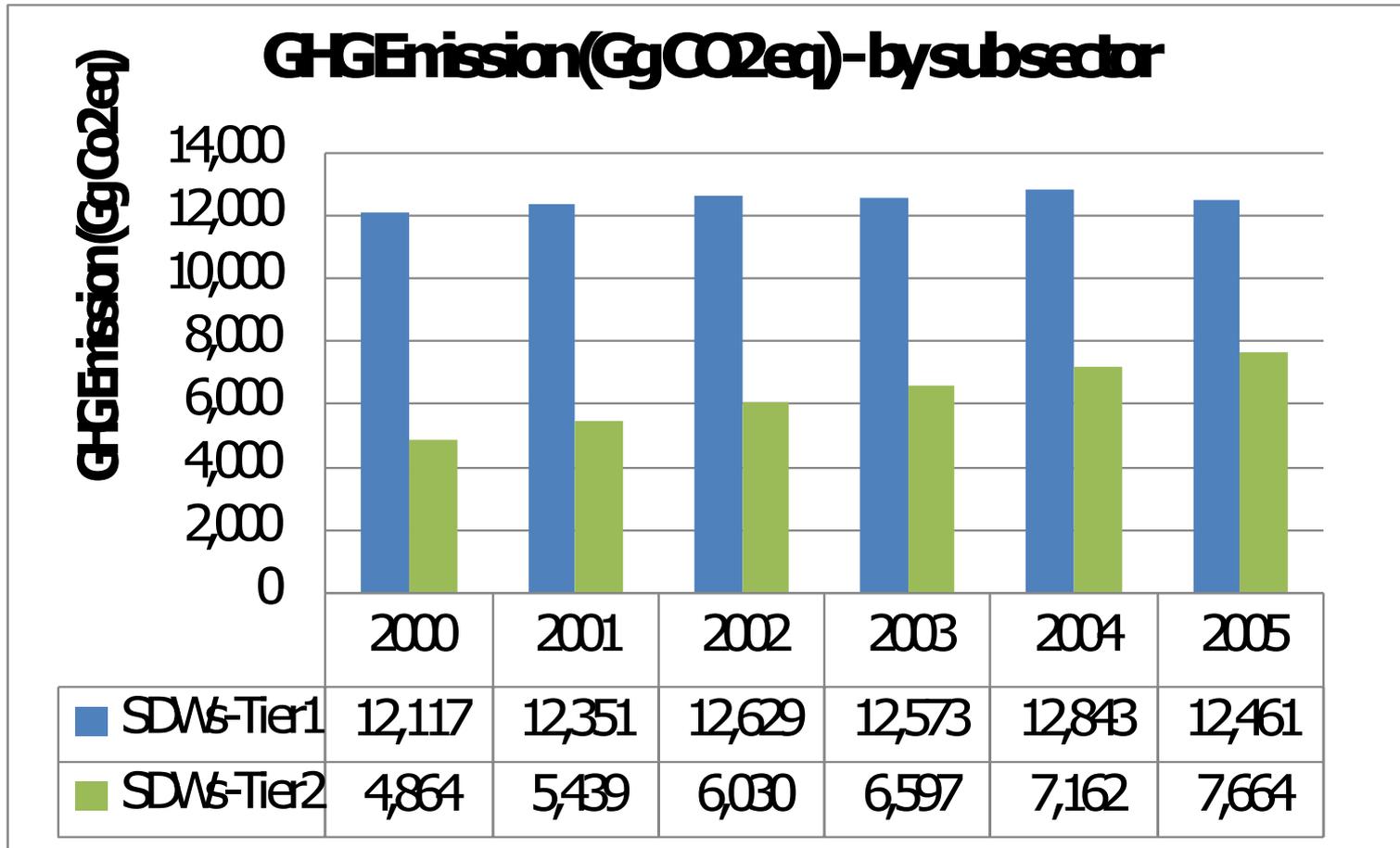
Activity data required for estimating GHG emission

Tier 1		Tier 2
-MSW quantity and characteristics	<ul style="list-style-type: none"> - Amount of MSW generation/ recycled/sent for disposal - Waste composition for estimating methane generation potential (Lo) 	<ul style="list-style-type: none"> - Amount of MSW generation/ recycled/sent for disposal - Waste composition for estimating methane generation potential (Lo)/first order decay rate constant (k)
-Disposal Management:	<ul style="list-style-type: none"> - Fraction of MSW disposed by each method (OD, sanitary LF, semi-aerobic LF) - Basic information of disposal condition e.g. depth of wastes 	<ul style="list-style-type: none"> - Information of disposal site necessary - Disposal method (OD, sanitary LF, semi-aerobic LF) - Depth of buried wastes - Opening/closing year of SWDS
	Top-down approach	Bottom-up approach

For higher tier approach, regular monitoring of waste quantity and their characteristics are required. Information should be available for all SWDS

Estimation of GHG emission from solid waste disposal:

Tier I & Tier 2



Waste statistics in Thailand : Limitation/Counter measures

Activity data	Limitation	Counter measure
Waste quantity	<ul style="list-style-type: none"> Annual statistics available only for large cities/ municipalities. For small LA, they were estimated based on waste generation rate 	<ul style="list-style-type: none"> Regular survey and compilation by responsible central governmental agency
Waste composition	<ul style="list-style-type: none"> Not monitored on regular basis 	<ul style="list-style-type: none"> Set as regulation for LAs to determine waste composition using standardized protocol
Solid waste disposal site	<ul style="list-style-type: none"> Only available for registered SWDS of cities/ municipalities. No information for small SWDS 	<ul style="list-style-type: none"> Set as regulation for all LAs to report site information using common database system. Compilation by responsible central governmental agency

Thank you for your kind attention