

Malaysia: Report For Greenhouse Gas Inventories for Second National Communication (NC2), (Waste Sector)

Prepared by



Advised by



Sponsored by



For 6th.WGIA
16-18 July 2008
Tsukuba, Japan

1.0 OBJECTIVES

1. To present the findings of GHG Inventory for the Waste Sector i.e methane emission from the following sources:
 - Waste water from domestic and commercials;
 - ii) Waste water from industries (palm oil mills and natural rubber mills); and
 - Solid waste disposal sites (landfills).
2. To compare GHGs emission load for the year 1994 and 2000 using both IPCC Guidelines 1995 and 1996
3. To present conclusion of several meetings and workshops held to confirm and verify the data collected in accordance with the IPCC Guideline 1996.

2. BUDGET

The Project was carried out under the support of the United Nation Development Programme (UNDP) and in-kind contribution by the Malaysian Government.

A sum of RM38,000.00 is allocated for the Project (Waste Sector) and the details expenditure to date is shown below:

Budget Used for GHG Waste Sector Till 30 June 2008
(Amount allocated for the Project is RM 38, 000.00)

| Activities | Year 1 2007 (RM) | Year 2 2008 (RM) | Year 3 2009 (RM) | Total (RM) |
|---|------------------------|---|------------------------|---------------|
| Preparing National GHG Inventory Procurement of Notebook PC 5 unit of Flash Drives EFT of Waste SWG to Sabah & Sarawak Consultant fee | - | 4, 419.00 250.00 1, 756.20 3, 000.00 | - | - |
| Meeting / Workshop | 120.00 | 14, 597.83 | - | - |
| Final Technical Reports National Communication Procedural Document Draft NC2 Report | - | - | - | - |
| Second Annual Progress, Financial Report | - | - | - | - |
| TOTAL: | 120.00 | 24, 023.03 | - | 24, 143.03 |

3. METHODOLOGY

1. For the purpose of preparing NC2, Revised IPCC 1996 Guidelines had been used, however other guidelines such as Good Guidance Practice 2000 and 2003 (GPG 2000 & 2003), UNFCCC Software and IPCC 2006 Guidelines were also used as references
2. Based on Decision Article 17/CP.8 of COP (Appendix 1) required non-Annex 1 Parties preparing for their second or third National Communication to use the Revised 1996 Guidelines in estimating and reporting their national GHG inventories.
3. According to the IPCC Guideline 1996, two types of waste need to be considered, that is **waste water** and **municipal solid waste**. As for the waste water it is divided into two main groups, that is waste water from industries and waste water from domestic as well as commercials. The Sub Working Group (SWG) Waste Sector in their Second meeting on 24th August 2007 decided to focus GHGs inventory only on 2 major industries in the country i.e palm oil mills and raw natural rubber mills which consists of latex concentrate mill and Standard Malaysia Rubber mill (SMR). These industries are being licensed by the Department of Environment (DOE) and thus complete data inventory are available.

This spreadsheet contains sheet 4 of Worksheet 6-3, in accordance with the

Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories.

| MODULE | WASTE | | | | |
|---------------|--|--|---|---|--|
| SUBMODULE | METHANE EMISSIONS FROM INDUSTRIAL WASTEWATER AND SLUDGE TREATMENT | | | | |
| WORKSHEET | 6-3 | | | | |
| SHEET | 4 OF 4 ESTIMATION OF METHANE EMISSIONS FROM INDUSTRIAL WASTEWATER AND SLUDGE | | | | |
| COUNTRY | Malaysia | | | | |
| YEAR | 0 | | | | |
| STEP 4 | | | | | |
| | A Total Organic Product (kg COD/yr) | B Emission Factor (kg CH ₄ /kg COD) | C Methane Emissions without Recovery/Flaring | D Methane Recovered and/or Flared (kg CH ₄) | E Net Methane Emissions (Gg CH ₄) |
| | Worksheet 6-3, Sheet 1 | Worksheets 6-3, Sheets 2 and 3 | $C = (A \times B)$ | | $E = (C - D) / 1\ 000\ 000$ |
| Wastewater | 1,436,577,587.50 | 0.05625 | 80,807,489.30 | | 80.80749 |
| Sludge | 0.00000 | 0.00625 | 0.00 | | 0.00 |
| Total: | | | | | 80.80749 |

Note : For Malaysia Yr 2000

Industrial Source : i. Oil & Grease - crude oil palm

Source : Dept. of Statistics, Malaysia : 1975 - 1985

Malaysia Palm Oil Board : 1986 - 2004

| | | | | | |
|------------------|--|--|--|---|--|
| MODULE | WASTE | | | | |
| SUBMODULE | METHANE EMISSIONS FROM DOMESTIC AND COMMERCIAL WASTEWATER AND SLUDGE TREATMENT | | | | |
| WORKSHEET | 6-2 | | | | |
| SHEET | 4 OF 4 ESTIMATION OF METHANE EMISSIONS FROM DOMESTIC/COMMERCIAL WASTEWATER AND SLUDGE | | | | |
| COUNTRY | Malaysia | | | | |
| YEAR | 0 | | | | |
| STEP 4 | | | | | |
| | A Total Organic Product (kg BOD/yr) | B Emission Factor (kg CH ₄ /kg BOD) | C Methane Emissions Without Recovery/Flaring | D Methane Recovered and/or Flared (kg CH ₄) | E Net Methane Emissions (Gg CH ₄) |
| | from Worksheet 6-2, Sheet 1 | from Worksheet 6-2, Sheets 2 and 3 | C = (A x B) | | E = (C - D)/1 000 000 |
| Wastewater | 135,721,230.43750 | 0.01875 | 2,544,773.07070 | 0.00 | 2.54477 |
| Sludge | 67,894.56250 | 0.01405 | 953.91860 | 0.00 | 0.00095 |
| Total: | | | | | 2.54573 |

Note : For Yr 2000

Source : Dept. of Statistics, Malaysia

Indah Water Konsortium Sdn Bhd, Malaysia

This spreadsheet contains sheet 4 of Worksheet 6-3, in accordance with the IPCC 1996 Guidelines

| MODULE | WASTE | | | | |
|---------------|---|--|---|---|--|
| SUBMODULE | METHANE EMISSIONS FROM INDUSTRIAL WASTEWATER AND SLUDGE TREATMENT | | | | |
| WORKSHEET | 6-3 | | | | |
| SHEET | 4 OF 4 ESTIMATION OF METHANE EMISSIONS FROM INDUSTRIAL WASTEWATER AND SLUDGE (Rubber- Standard Malaysia Rubber) | | | | |
| COUNTRY | Malaysia | | | | |
| YEAR | 0 | | | | |
| STEP 4 | | | | | |
| | A Total Organic Product (kg COD/yr) | B Emission Factor (kg CH ₄ /kg COD) | C Methane Emissions without Recovery/Flaring | D Methane Recovered and/or Flared (kg CH ₄) | E Net Methane Emissions (Gg CH ₄) |
| | Worksheet 6-3, Sheet 1 | Worksheets 6-3, Sheets 2 and 3 | $C = (A \times B)$ | | $E = (C - D) /$ 1 000 000 |
| Wastewater | 15,852,727.80 | 0.14625 | 2,318,461.44075 | | 2.31846 |
| Sludge | 6,794,026.20 | 0.01625 | 110,402.92575 | | 0.11040 |
| Total: | | | | | 2.42886 |

Note : For Yr 2000

Industrial Source : i. Rubber - Standard Malaysian Rubber

Source : ii. Dept. of Statistics, Malaysia ; and

iii. Malaysia Rubber Board : 1996 - 2006

| | | | | | |
|------------------------------------|--|---|---------------------|---|---|
| MODULE | WASTE | | | | |
| SUBMODULE | METHANE EMISSIONS FROM INDUSTRIAL WASTEWATER TREATMENT | | | | |
| SOURCE | Oil & Grease (palm oil) & Rubber | | | | |
| WORKSHEET | 6-3 | | | | |
| SHEET | 3 OF 4 ESTIMATION OF EMISSION FACTOR FOR SLUDGE HANDLING SYSTEMS | | | | |
| COUNTRY | 0 | | | | |
| YEAR | 0 | | | | |
| STEP 2 | | | | | |
| A Sludge Handling System | B Fraction of Sludge Treated by the Handling System | C Methane Conversion Factor (MCF) | D Product | E Maximum Methane Producing Capacity (kg CH ₄ /kg COD) | F Emission Factor for Industrial Sludge Source (kg CH ₄ /kg COD) |
| | | | D = (B x C) | | F = (D x E) |
| Biological | 0.1 | 0.65 | 0.06500 | | |
| | Reference: IPP 96 GL, 90% is wastewater, so, 10% is the sludge. Workbook Moudule 6-Waste, Page 6.19, Table 6-8 | | 0.00 | | |
| | | | 0.00 | | |
| | | | 0.00 | | |
| Aggregate MCF: | | | 0.06500 | 0.25 | 0.01625 |

Urban Population in Malaysia - By State For Year 2000

| State | Total Population | Percentage Urban Population | Total Urban Population |
|-----------------|-------------------|-----------------------------|------------------------|
| Johor | 2,740,625 | 65.2 | 1,786,888 |
| Kedah | 1,649,756 | 39.3 | 648,354 |
| Kelantan | 1,313,014 | 34.2 | 449,051 |
| Melaka | 635,791 | 67.2 | 427,252 |
| Negeri Sembilan | 859,924 | 53.4 | 459,199 |
| Pahang | 1,288,376 | 42 | 541,118 |
| Perak | 2,051,236 | 58.7 | 1,204,076 |
| Perlis | 204,450 | 34.3 | 70,126 |
| Pulau Pinang | 1,313,449 | 80.1 | 1,052,073 |
| Sabah | 2,603,485 | 48 | 1,249,673 |
| Sarawak | 2,071,506 | 48.1 | 996,394 |
| Selangor | 4,188,876 | 87.6 | 3,669,455 |
| Terengganu | 898,825 | 48.7 | 437,728 |
| Kuala Lumpur | 1,379,310 | 100 | 1,379,310 |
| Labuan | 76,067 | 77.7 | 59,104 |
| Total | 23,274,690 | | 14,429,800 |

| | A | B | C | D | E |
|-----------------|---|-------------------------------------|---|--|---|
| | Population whose Waste goes to SWDSs (Urban or Total) (persons) | MSW Generation Rate (kg/capita/day) | Annual Amount of MSW Generated (Gg MSW) | Fraction of MSW Disposed to SWDSs (Urban or Total) | Total Annual MSW Disposed to SWDSs (Gg MSW) |
| STATE | | | $C = (A \times B \times 365) / 1\,000\,000$ | | $E = (C \times D)$ |
| JOHOR | 1,786,888 | 1.35 | 880.48882 | 1 | 880.488816 |
| KEDAH | 648,354 | 1.08 | 255.58119 | 1 | 255.581189 |
| KELANTAN | 449,051 | 0.5 | 81.95177 | 1 | 81.951769 |
| MELAKA | 427,252 | 1.2 | 187.13618 | 1 | 187.136180 |
| NEGERI SEMBILAN | 459,199 | 1.2 | 201.12934 | 1 | 201.129344 |
| PAHANG | 541,118 | 0.92 | 181.70740 | 1 | 181.707398 |
| PERAK | 1,204,076 | 0.8 | 351.59006 | 1 | 351.590055 |
| PERLIS | 70,126 | 0.5 | 12.79806 | 1 | 12.798059 |
| PULAU PINANG | 1,052,073 | 0.96 | 368.64626 | 1 | 368.646256 |
| SABAH | 1,249,673 | 0.91 | 415.07882 | 1 | 415.078821 |
| SARAWAK | 996,394 | 0.91 | 330.95240 | 1 | 330.952395 |
| SELANGOR | 3,669,455 | 1.26 | 1,687.58253 | 1 | 1,687.582527 |
| TERENGGANU | 437,728 | 0.86 | 137.40275 | 1 | 137.402749 |
| KUALA LUMPUR | 1,379,310 | 1.57 | 790.41360 | 1 | 790.413596 |
| LABUAN | 59,104 | 0.91 | 19.63141 | 1 | 19.631413 |
| Total/Avg | 14,429,800 | 0.99533 | 5,902.09057 | | |

MSW Generation Rate based on the National Strategic Plan for Solid Waste Management Aug 2005(Local Government Department, Ministry of Housing and Local Government Malaysia, Volume 2, page 2-17)

| STATE | | | | | | | G= (C x D x E x F) | H= (B x G) | J= (H x A) | | L= (J - K) | | N= (L x M) |
|--------------------|-------------|-----|------|-----|-----|-------|--------------------------|-------------------|------------|---|------------|--------------|--------------------|
| JOHOR | 880.48882 | 0.6 | 0.55 | 0.9 | 0.5 | 16/12 | 0.33 | 0.198 | 174.33679 | 0 | 174.33679 | 1 | 174.33679 |
| KEDAH | 255.58119 | 0.6 | 0.55 | 0.9 | 0.5 | 16/12 | 0.33 | 0.198 | 50.60508 | 0 | 50.60508 | 1 | 50.60508 |
| KELANTAN | 81.95177 | 0.6 | 0.55 | 0.9 | 0.5 | 16/12 | 0.33 | 0.198 | 16.22645 | 0 | 16.22645 | 1 | 16.22645 |
| MELAKA | 187.13618 | 0.6 | 0.55 | 0.9 | 0.5 | 16/12 | 0.33 | 0.198 | 37.05296 | 0 | 37.05296 | 1 | 37.05296 |
| NEGERI SEMBILAN | 201.12934 | 0.6 | 0.55 | 0.9 | 0.5 | 16/12 | 0.33 | 0.198 | 39.82361 | 0 | 39.82361 | 1 | 39.82361 |
| PAHANG | 181.70740 | 0.6 | 0.55 | 0.9 | 0.5 | 16/12 | 0.33 | 0.198 | 35.97806 | 0 | 35.97806 | 1 | 35.97806 |
| PERAK | 351.59006 | 0.6 | 0.55 | 0.9 | 0.5 | 16/12 | 0.33 | 0.198 | 69.61483 | 0 | 69.61483 | 1 | 69.61483 |
| PERLIS | 12.79806 | 0.6 | 0.55 | 0.9 | 0.5 | 16/12 | 0.33 | 0.198 | 2.53402 | 0 | 2.53402 | 1 | 2.53402 |
| PULAU PINANG | 368.64626 | 0.6 | 0.55 | 0.9 | 0.5 | 16/12 | 0.33 | 0.198 | 72.99196 | 0 | 72.99196 | 1 | 72.99196 |
| SABAH | 415.07882 | 0.6 | 0.55 | 0.9 | 0.5 | 16/12 | 0.33 | 0.198 | 82.18561 | 0 | 82.18561 | 1 | 82.18561 |
| SARAWAK | 330.95240 | 0.6 | 0.55 | 0.9 | 0.5 | 16/12 | 0.33 | 0.198 | 65.52857 | 0 | 65.52857 | 1 | 65.52857 |
| SELANGOR | 1,687.58253 | 0.6 | 0.55 | 0.9 | 0.5 | 16/12 | 0.33 | 0.198 | 334.14134 | 0 | 334.14134 | 1 | 334.14134 |
| TERENGGANU | 137.40275 | 0.6 | 0.55 | 0.9 | 0.5 | 16/12 | 0.33 | 0.198 | 27.20574 | 0 | 27.20574 | 1 | 27.20574 |
| KUALA LUMPUR | 790.41360 | 0.6 | 0.55 | 0.9 | 0.5 | 16/12 | 0.33 | 0.198 | 156.50189 | 0 | 156.50189 | 1 | 156.50189 |
| LABUAN | 19.63141 | 0.6 | 0.55 | 0.9 | 0.5 | 16/12 | 0.33 | 0.198 | 3.88702 | 0 | 3.88702 | 1 | 3.88702 |
| | | | | | | | | | | | | Total | 1,168.61393 |

4. GAPS AND RECOMMENDATIONS

Several constrains were raised and discussed among the relevant agencies during SWG meetings and the workshops. Among others, four points were highlighted and agreed to be reported in the NC2 for the Waste Sector for Malaysia as follows:

- The Guidelines used;
- Default value used, where in NC2 the SWG for the Waste Sector applied local default values instead of default value given in the IPCCC Guideline;
- Lack of detail data and information; and
- Lack of expertise.

5. CONCLUSION

- By using IPCCC Guideline 1996, as of 30th June 2008, the total amount of CO₂ Equivalent of methane gas emission from waste sector was estimated at 26,358.80 Gg in CO₂ Equivalent for the year 2000, which had reduced from the total amount of 26, 614.77 Gg in CO₂ Equivalent of methane gas emission for the year 1994 as reported in the INC.
- However the grand total GHGs emission load in terms of CO₂ Equivalent for waste sector as reported in INC is higher i.e 26,925 Gg due to the fact that in the earlier reporting CO₂ emission from waste water of palm oil mills was taken into account.
- The comparison between GHGs emission load for the year 1994 and 2000 using both IPCCC Guidelines 1995 and 1996 are shown below:

| Sources | | 1995 IPCC Guidelines | | | | | | 1996 IPCC Guidelines | | | | | |
|---|--|----------------------|-----------------|------------------|-----------------|-----------------|------------------|----------------------|-----------------|------------------|--------------------|-----------------|------------------|
| | | INC(1994) | | | NC2(2000) | | | INC(1994) | | | NC2(2000) | | |
| | | CO ₂ | CH ₄ | N ₂ O | CO ₂ | CH ₄ | N ₂ O | CO ₂ | CH ₄ | N ₂ O | CO ₂ | CH ₄ | N ₂ O |
| Categories | | Gg | Gg | Gg | Gg | Gg | Gg | Gg | Gg | Gg | Gg | Gg | |
| 1 | Landfills | | 1043 | | | 1999.72 | | 625.8 | | | 1168.61393 | | |
| 2 | Domestic & Commercial Wastewater Treatment | | 3.5 | | | 4.78 | | 1.88 | | | 2.54573 | | |
| 3 | Industrial Wastewater Treatment | 318 | 220.87 | | | 326.47 | | 60.92 | | | 84.02137 | | |
| a. | Palm Oil | | 213.5 | | | 320 | | 57.4 | | | 80.80749 | | |
| b. | Rubber-Latex | | 2.64 | | | 1.54 | | 1.24 | | | 0.78501 | | |
| c. | Rubber-SMR | | 4.73 | | | 4.93 | | 2.28 | | | 2.42886 | | |
| Total (Gg) | | 318 | 1267.37 | | 478.14 | 2330.97 | | 688.6 | | | 1255.18102 | | |
| Global Warming Potential | | 1 | 21 | 290 | 1 | 21 | 290 | 1 | 21 | 310 | 1 | 21.00000 | 310 |
| Total (Gg CO_{2e}) | | 318 | 26014.77 | | 478.14 | 48950.37 | | 14460.6 | | | 26358.80147 | | |
| Grand Total (Gg CO_{2e}) | | 26932.77 | | | 49428.51 | | | 14460.6 | | | 26358.80147 | | |