Training on data collection and management to improve GHG inventory compilation in the waste sector

PATPA Asia-Pacific Workshop
28-30 March 2018

Oscar Zarzo, GIZ
## Agenda overview

<table>
<thead>
<tr>
<th>TIME</th>
<th>Activity</th>
<th>Responsible</th>
</tr>
</thead>
<tbody>
<tr>
<td>DAY 1 3:15-3:30 pm</td>
<td>Introduction</td>
<td>Oscar Zarzo, GIZ</td>
</tr>
<tr>
<td>DAY 1 3:30-3:50 pm</td>
<td>UNFCCC reporting</td>
<td>Oscar Zarzo, GIZ</td>
</tr>
<tr>
<td>DAY 1 3:50-4:10 pm</td>
<td>Bangladesh’s GHG inventory on waste</td>
<td>Mr Mokhtar Ahmed, Ministry of Environment, Bangladesh</td>
</tr>
<tr>
<td>DAY 1 4:10-5:15 pm</td>
<td>Overview of 2006 IPCC GL for GHG inventory waste</td>
<td>Oscar Zarzo, GIZ</td>
</tr>
<tr>
<td>DAY 2 9-9:15 am</td>
<td>Recap of day 1</td>
<td>Oscar Zarzo, GIZ</td>
</tr>
<tr>
<td>DAY 2 9:15 – 10:15 am</td>
<td>Dealing with data needs</td>
<td>Oscar Zarzo, GIZ</td>
</tr>
<tr>
<td>DAY 2 10:15-11:15 am</td>
<td>Group work: Data needs</td>
<td>All</td>
</tr>
<tr>
<td>DAY 2 11:30 am-12:15 pm</td>
<td>Inst. Arrangements</td>
<td>All</td>
</tr>
<tr>
<td>DAY 2 12:15-12:30 pm</td>
<td>(Short) Summary</td>
<td>All</td>
</tr>
</tbody>
</table>
CONTENT

Module 1 – Policy and institutional framework
Module 2 – GHG inventory in the waste sector
Module 3 – Waste data management
Module 4 – In depth calculation methods
Module 5 – Mitigation actions
Module 1 - Policy and Institutional framework
M1 : Policy and institutional framework

M1.1 • The Evolution of International Climate Policy

M1.2 • Reporting requirements arising from the UNFCCC

M1.3 • Institutional roles in GHG Inventory development in the waste sector
  • Data sources
  • Inventory compilation

M1.4 • Policy instruments for mitigation
  • GHG emissions and mitigation in the waste sector
M1.1 The evolution of International Climate Policy

Did You Know?

The first time the term “global warming” entered the public domain was in the title of a scientific paper by US scientist Wallace Broecker in 1975. The paper was entitled “Climate change: Are we on the Brink of a Pronounced Global Warming?”
M1.1 The evolution of International Climate Policy

- 1988: IPCC established
- 1991: December 1990 - UN General Assembly Negotiations on a Framework Convention Begin
- 1994: June 1992 - UNFCCC Opens for Signature at Rio Earth Summit
- 1997: March 21, 1994 - UNFCCC Enters into Force
- 2000: December 11, 1997 - Kyoto Protocol Adopted, developed countries
- 2003: November 2001 - Marrakesh
- 2006: January 2005 - EU Emissions Trading Launches
- 2012: COP 13, 2007 - Bali aiming at global action
- 2015: COP 15, 2009 - Copenhagen, Bali Action Plan continued
- 2018: COP 16, 2010 - Cancun Agreements, NAMAs, early funding
- COP 20, 2014 - Lima Call for Action, INDCs
- COP 21, 2015 - Paris Agreement, NDCs, finance
- Global warming of 3-4 degrees by 2100
M1.2 Reporting requirements arising from the UNFCCC

Annex 1
- CRF & NIR
- NCs
- BRs

Non-Annex 1
- NCs
- BURs
M1.2 NCs and BURs

NC from a Non-Annex 1 Party

- National context and institutional arrangements
- National GHG inventory
- Climate Change Mitigation and Adaptation Programmes
- Transfer of technologies
  - Research
  - Education and public awareness
  - Capacity building
  - Information and networking
- Financial, technical and capacity needs
- Technical annex (optional)
M1.2 NCs and BURs

National context and institutional arrangements relevant for NCs

National inventory of anthropogenic emissions by sources and removal of sinks of all GHGs not controlled by the Montreal Protocol, including a NIR

Mitigation actions and associated methodologies and assumptions

NAMA and description of the mitigation actions

Methodologies and assumptions

Objectives and actions

Progress of implementation of the mitigation actions

International market mechanism

Domestic measurement reporting and verification

Constraints and gaps and related financial, technical and capacity needs

Any other relevant information

Technical annex (optional)
M1.3 Institutional roles in GHG Inventory development in the waste sector

- Data collection
- Management
- Reporting
M1.3 Sources of data

Institutional functions in waste management
M1.3 GHG Inventory compilation

National Inventory preparation and reporting processes
M1.3 Sustainable institutional arrangements

BURs and NCs

- enhance coordination and inter-sectoral dialogue
- raise awareness
- facilitate consultation
M1.4 Policy instruments for mitigation

NDCs
- Paris Agreement
- Long term goals

NAMAs
- Individual vs national
- Integrated approach
M1.4 GHG emissions and mitigation

M1.4 GHG emissions and mitigation

Mitigation actions should follow efforts along the waste management hierarchy.
Module 2 – GHG inventory in the waste sector
M2: GHG inventory in the waste sector

- M2.1 Guidelines
- M2.2 Solid waste disposal
- M2.3 Biological treatment
- M2.4 Incineration and open burning
- M2.5 Wastewater treatment and discharge
- M2.6 Key data category and double counting
- M2.7 Exercise on key data category
M2.1 Structure of categories

4. Waste

4A. SW disposal
- 4A1. Managed SWD sites
- 4A2. Unmanaged SWD sites
- 4A3. Uncategorised SWD sites

4B. Biological treatment
- 4C. Incineration and open burning
  - 4C1. Waste incineration
  - 4C2. Open burning of waste

4D. Wastewater treatment and discharge
- 4D1. Domestic wastewater treatment
- 4D2. Industrial wastewater treatment

4E. Other
M2.2 Solid Waste Disposal

What is not included in the Inventory
M2.2 Solid waste disposal, First Order Decay
M2.2 Solid waste disposal, First Order Decay

Did You Know?

First Order Decay (FOD) that for a population of atoms, molecules or anything else, a constant fraction/ unit time is converted to something else. The actual fraction/ unit time is expressed as a constant rate, in units of time. The FOD method assumes that the degradable organic component in waste decays slowly throughout a few decades, during which CH4 and CO2 are formed. If conditions are constant, the rate of CH4 production depends solely on the amount of carbon remaining in the waste.
M2.2 Solid waste disposal, Data needs

1. Population for 50 years
2. Waste generation rate in kg/capita
3. The share of total waste deposited in solid waste disposal sites
4. The share of different types of disposal sites
5. The waste composition of the waste disposed

- Sludge (industrial and household), industrial waste, other waste
- Landfill gas use and flaring
# M2.2 Population data

<table>
<thead>
<tr>
<th>Country</th>
<th>Disaggregation</th>
</tr>
</thead>
</table>
| Namibia  | • Split into “high income” and “low income” urban regions for 2010.  
• Why? - Sustained and significant migration from rural to urban, fast-expanding low income suburbs |
| Tunisia  | • Data is available from 1950 onwards from Tunisia’s National Statistics Institute.  
• A distinction is made between the rural and urban population and different generation rates are applied. |
M2.2 Waste generation rate

<table>
<thead>
<tr>
<th>Country</th>
<th>Interpolation, single regression</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bulgaria</td>
<td>• 1950-1978 calculated based on urban population&lt;br&gt;• 1979-1993 data on waste generation from operators of service&lt;br&gt;• 1999-2010 statistical data on waste generation is available Missing years (1994-1999) calculated by single regression method</td>
</tr>
<tr>
<td>Brazil</td>
<td>• calculated based on data from two different waste management companies&lt;br&gt;• data from one is used to estimate the waste landfilled in 1970 from the other for waste landfilled in 2005&lt;br&gt;• data for the intermediate years were linearly interpolated</td>
</tr>
</tbody>
</table>
M2.2 Data needs

Did You Know?

Collection coverage increases with income, but can be as low as 20 - 30%; 2 billion people have no access to solid waste collection services\(^1\)

Waste collection coverage (%) vs income level
## M2.2 Share of waste disposed

<table>
<thead>
<tr>
<th>Country</th>
<th>Using data and expert judgement</th>
</tr>
</thead>
</table>
| Armenia| Inventory of solid waste disposal sites/landfills operating over the period of 1990-2012. Based on urban population data:  
- The capital city of Yerevan - Anaerobic managed solid waste disposal sites  
- Secondary cities (Gyumri and Vanadzor) - Unmanaged solid waste disposal sites – deep and/or with high water table.  
- 45 additional cities and towns – unmanaged solid waste disposal sites. |
| Tunisia|  
- There is a number of managed disposal sites with weighbridges – anaerobic controlled disposal site  
- The difference between the amount of waste generated and the amount measured entering managed disposals sites is attributed to uncontrolled landfills.  
- The first managed landfill opened in 1999. By 2010 ten landfills opened in Tunisia, which receive more than 85% of the waste. |
# M2.2 Waste composition

<table>
<thead>
<tr>
<th>Country</th>
<th>Using data and expert judgment</th>
</tr>
</thead>
</table>
| Bulgaria | • a study conducted in 2002 that determines the shares of different waste types depending on the geographical distribution and population size of different settlements  
• a model has been developed, which calculates different fractions of the biodegradable organic content of waste for different population groups according to the size of settlements |
| Tunisia  | • The composition of the waste comes from a study conducted in 2007 (feasibility study for the construction of a second landfill for the Greater Tunis, ANGed).  
• This composition is also verified in the context of CDM projects on landfills. |
M2.2 Data needs

Did You Know?

Of all credits issues for Clean Development Mechanism (CDM) projects so far, 6% come from projects in the waste sector. This is significant, taking into account that most CDM projects are landfill gas extraction projects, not touching on other mitigation strategies in the sector.
M2.3 Biological treatment, Composting

What is not included in the Inventory
M2.3 Biological treatment, Anaerobic digestion

? What is not included in the Inventory
M2.3 Data needs

- Amount of organic waste treated
- Emission factor for treatment
  - Default emission factors are available
  - On a wet and dry weight basis

*Biogas production, Seini, Romania*

*Source: RWA Group*
**M2.3 Tier 1 is used, uncertainty is high**

<table>
<thead>
<tr>
<th>Country</th>
<th>Interpolation, single regression</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chile</td>
<td>• No registry of facilities</td>
</tr>
<tr>
<td></td>
<td>• Data relies on facilities that are permitted</td>
</tr>
<tr>
<td></td>
<td>• Efforts were made to survey large facilities and large municipalities</td>
</tr>
<tr>
<td>Tunisia</td>
<td>• Official statistics were used, but data is unreliable, not clear if all operators report (uncertainty at 20%, doubled)</td>
</tr>
<tr>
<td></td>
<td>• 100% uncertainty is assumed for the emission factors</td>
</tr>
</tbody>
</table>
M2.4 Incineration and open burning

What is not included in the Inventory
M2.4 Incineration and open burning, Data needs

**Incineration**

- Amount of waste burned per type of waste (municipal, industrial, hazardous, clinical, sewage sludge)
- Amount of fossil liquid waste
- Amount of fossil carbon per waste type (for CO₂ emissions)

**Open burning**

- Population burning waste
- Per capita waste generation rate for population burning waste
- Fraction of waste burned
# M2.4 Incineration and open burning, Examples

<table>
<thead>
<tr>
<th>Country</th>
<th>Methods to collect data, estimations used</th>
</tr>
</thead>
<tbody>
<tr>
<td>Armenia</td>
<td>• Assumed that 100% of rural population burns all waste openly</td>
</tr>
</tbody>
</table>
| Mexico   | • Incineration of medical waste only, the facilities report to the EPA  
          • Assumed that 40% of waste generated in rural areas is burned |
| Tunisia  | • Amount of medical waste estimated by # of bed and occupancy rate in hospitals  
          • Assumed that 20% of population in rural area is burning the waste  
          • Energy and waste sector inventory experts exchange |
M2.5 Wastewater treatment and discharge

Did You Know?

Biological Oxygen Demand (BOD) is the amount of dissolved oxygen needed (demanded) by aerobic biological organisms to break down organic material present in water at certain temperature over a specific time period. Total organically degradable carbon is measured and expressed in BOD.
M2.5 Wastewater treatment systems and discharge pathways
**M2.5 Steps**

- Determine Total Organic Biodegradable Content (TOW)
- Emission factors for each pathway of the system
- Relative share of each pathway in the system
- Default values based on the carbon discharged per person and total population
- Systems may be distributed based on rural, urban high income, urban low income population
- The main industries to consider are pulp and paper, food and beverage and organic chemical industry
- For N_{2}O the protein intake per person
**M2.5 CH₄ estimation from wastewater – estimating activity data**

<table>
<thead>
<tr>
<th>Country</th>
<th>Interpolation, single regression</th>
</tr>
</thead>
</table>
| Armenia     | Population classified into 3 groups: large cities, other towns and villages  
• Cities (95% sewer, 5% latrines); towns (50% sewer, 50% latrines); villages (5% sewers, 95% latrines) |
| South Africa| NIR includes detailed table on treatment type or discharge pathway per income group (according to the 3 suggested categories) |
| Chile       | Industrial wastewater data was available for 2006-2010. Extrapolation was tempted by different methods, tying extrapolation to GDP changes proved best. |
M2.5 $\text{N}_2\text{O}$ estimation from wastewater

<table>
<thead>
<tr>
<th>Country</th>
<th>Interpolation, single regression</th>
</tr>
</thead>
</table>
| Armenia  | • FAO protein consumption rates used  
          | • Interpolation for interim years missing (2009-2010) |
| Vietnam  | • Data from Vietnam’s National Institute on Nutrition was used |
M2.6 Key data categories and double counting

- Avoiding double counting
- Key category analysis
Graphic focuses on the most important emissions in a circular economy as well as potentials for mitigation. All treatment options result in emissions (i.e. due to electricity consumption), which are typically only a percentage of the emissions avoided by the respective treatment option.
M2.6 Avoiding double counting

- Allocation to “budget lines” or SECTORS (waste to energy, sludge used as fertilizer)

- Anthropogenic and not biogenic origin (CO₂ emissions from landfills)
M2.6 Key categories

- Qualitative assessment – which seems to be the most important source(s) of emissions?
- Based on previous emission estimates
- Trend assessments
- Future policies
- Based on uncertainties
  - Lack of completeness – if data is not complete, this may lead to a bias
  - Lack of data – if data is not available, it may be better to use default
  - Data is not representative – if data is not representative, this may lead to bias
M2.7 Quality Quiz TRUE or FALSE

1. The amount of waste collected is less than the amount of waste generated.

2. The composition of waste generated is the same as the composition of the waste disposed

3. Methane is generated in anaerobic conditions

4. Small scale biogas production generates Greenhouse Gas emissions and should be included in the Waste Sector Greenhouse Gas Inventory

5. GHG emissions from material recycling are included in the waste sector GHG inventory
# Agenda overview Day 2

<table>
<thead>
<tr>
<th>TIME</th>
<th>Activity</th>
<th>Responsible</th>
</tr>
</thead>
<tbody>
<tr>
<td>9-9:25 am</td>
<td>Recap of day 1 and exercise KCA and double counting</td>
<td>Oscar Zarzo, GIZ</td>
</tr>
<tr>
<td>9:25 – 10:35 am</td>
<td>Dealing with data needs Exercise: Landfill categorisation</td>
<td>Oscar Zarzo, GIZ</td>
</tr>
<tr>
<td>10:35-11:15 am</td>
<td>Group work: Data needs</td>
<td>All</td>
</tr>
<tr>
<td>11:30 am-12:15 pm</td>
<td>Institutional Arrangements</td>
<td>All</td>
</tr>
<tr>
<td>12:15-12:30 pm</td>
<td>(Short) Summary</td>
<td>All</td>
</tr>
</tbody>
</table>
Exercise 1. Key category analysis and double counting

In this exercise, each source of emission must be allocated to the correct category making sure that no emissions are accounted twice.

To illustrate where these treatment options may be in your process flow diagram, we illustrate on the next slides a couple of options through a process flow diagram showing also a mass balance. Depending on the level of development of the sector, the diagram changes.
M2.7 Process flow example: Middle income
M2.7 Process flow example: High income
M2.7 Process flow example: Low income
Module 3
Waste data management
M3: Waste data management

- M3.1: Waste data collection
- M3.2: Data management
- M3.3: Waste characterization
- M3.4: SWDS classification
- M3.5: Exercise on SWDS classification
- M3.6: Exercise Waste Data Management
“Measurement is the first step that leads to control and eventually to improvement. If you can’t measure something, you can’t understand it. If you can’t understand it, you can’t control it. If you can’t control it, you can’t improve it.”

Prof. H. James Harrington
## M3.1: Waste data collection

<table>
<thead>
<tr>
<th>Diversity of data generation and collection</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Who (collects the data)</strong></td>
</tr>
<tr>
<td><strong>What (data is collected)</strong></td>
</tr>
<tr>
<td><strong>Where (is it collected)</strong></td>
</tr>
<tr>
<td><strong>When (is it collected)</strong></td>
</tr>
<tr>
<td><strong>Why (is it collected)</strong></td>
</tr>
</tbody>
</table>
M3.1 The Waste Management Service and Value Chains

Service Chain
- Waste Generation (quantity, composition, source)
- Storage (handling & segregation)
- Collection (logistical optimisation)
- Transfer (sort, bulk, haul)
- Treatment & Disposal

Value Chain
- Reduce
- Reuse
- Recycle
- Recover

(circular economy opportunities)

composition, material quality, quantity, transport distances, infrastructure, assets markets (at all links in the chains)
M3.1 Management (SWM) Practitioners’ Integrated SWM Data Interests

Waste Generation
(Mass, Composition, Origin)
- Food Waste
- Parks & Garden
- Paper & Cardboard
- Wood
- Textiles
- Nappies
- Rubber & leather
- Plastics
- Metal
- Glass
- Other (ash, dirt, electronic, etc.)
- Manufacturing
  Industry process wastes
- Domestic wastewater
  Industrial wastewater
- Clinical
  Hazardous
  Certain agricultural wastes

Waste Treatment & Disposal
(Mass, Composition, Destination)
- Municipal solid waste
- Landfill managed
  Landfill unmanaged
  Uncategorized Landfill
- Biological treatment of solid waste
- Composting
  Anaerobic Digestion
  Mechanical biological treatment
- Incineration & open burning
  Open burning
  Incineration in controlled facilities
- Wastewater treatment & Discharge (WWT & D)
  Domestic WWT & D
  Industrial WWT & D
  Latrine
  Septic tank
  Plant (aerobic treatment)
  Plant (anaerobic treatment)
  Sea, river and lake
  Stagnant sewer
  Flowing Sewer

Waste to Energy
Reported in the Energy Sector
Material Recycling
Reported in the IPPU Sector
CO2 from biogenic or organic waste sources
Reported in the AFOLU Sector
## M3.1 Main waste categories and composition sub-categories of interest

<table>
<thead>
<tr>
<th>Main Category</th>
<th>Subcategory</th>
<th>Specific areas of Interest</th>
</tr>
</thead>
<tbody>
<tr>
<td>Municipal Solid Waste</td>
<td>Food Waste</td>
<td></td>
</tr>
<tr>
<td>(Household waste, Garden (yard) and park waste, Commercial/ institutional waste)</td>
<td>Garden (yard) and park waste</td>
<td>Specific interest within waste reporting due to high Degradable Organic Carbon (DOC) content</td>
</tr>
<tr>
<td></td>
<td>Paper and cardboard</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Wood</td>
<td>Mainly relevant where open burning or incineration is prevalent, or in IPPU sector</td>
</tr>
<tr>
<td></td>
<td>Textiles</td>
<td>Mainly related to IPPU Sector,</td>
</tr>
<tr>
<td></td>
<td>Nappies (disposable diapers)</td>
<td>Limited impact potential</td>
</tr>
<tr>
<td></td>
<td>Rubber and leather</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Plastics</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Metal</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Glass (and pottery and china)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Other (e.g. ash, dirt, dust, soil, electronic waste)</td>
<td></td>
</tr>
</tbody>
</table>
# M3.1 Main waste categories and composition sub-categories of interest

<table>
<thead>
<tr>
<th>Main Category</th>
<th>Subcategory</th>
<th>Specific areas of Interest</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wastewater &amp; Sludge</td>
<td>Sludge from domestic wastewater treatment plants</td>
<td>Storage, Conveyance and treatment (CH₄)</td>
</tr>
<tr>
<td></td>
<td>Sludge from industrial wastewater treatment plants</td>
<td>Storage, Conveyance and treatment (CH₄)</td>
</tr>
<tr>
<td>Industrial Waste</td>
<td>Manufacturing Industry process wastes (other than sludge)</td>
<td>(report by industry types, i.e.: Food, beverages &amp; tobacco; Textile; Wood and wood products; Pulp &amp; paper; Petroleum products, solvents, plastics; Rubber; Other)</td>
</tr>
<tr>
<td>Other</td>
<td>Construction and Demolition wastes</td>
<td>Mainly inert</td>
</tr>
<tr>
<td></td>
<td>Clinical Waste</td>
<td>i.e. syringes, needles, animal tissues, bandages, clothes, etc.</td>
</tr>
<tr>
<td></td>
<td>Hazardous Waste</td>
<td>Waste oils, solvents, ash, cinder, &amp; others of hazardous nature (flammability, explosiveness, causticity, toxicity)</td>
</tr>
<tr>
<td></td>
<td>Agricultural Waste</td>
<td>Certain manure, agricultural residues, animal carcasses, plastic film for greenhouses treated and/or disposed with other MSW and/or industrial wastes and not covered under AFOLU volume</td>
</tr>
</tbody>
</table>
M3.2 Waste data management

Did You Know?

The quantity and composition of waste varies between countries, but also between income groups, social groups, industrial processes, geographies, and climatic conditions within a country and even within a city. High income groups usually produce more waste with a higher percentage of plastics, electronic equipment etc., while low income groups generally produce less waste overall, with a greater percentage being food, and fines (ash, soil, sand, etc.). Knowing the waste generation and composition of different groups alongside population / size of each group is essential to producing reliable waste generation estimations, especially in locations where the formal waste collection system does not capture and report on all wastes.
M3.2 Waste generation

South African MSW Generation by income group:

- High Income: 0.55 Tonnes/cap/year
- Middle Income: 0.28 Tonnes/cap/year
- Low Income: 0.13 Tonnes/cap/year

National Average: 0.22 Tonnes/cap/year (fine for national statistics, but not site specific)

Senegal MSW Generation

National Average: 0.17 Tonnes/cap/year

IPCC 2006 Guidelines
Default for Africa: 0.29 Tonnes/cap/year
M3.2 MSW Composition for 2 different South African Municipalities

- **Food waste**: 20% (kg)
- **Garden waste**: 19%
- **PLASTICS**: 18%
- **PAPER & PAPERBOARD**: 18%
- **METAL**: 2%
- **GLASS**: 4%
- **C&D**: 0%
- **TEXTILES**: 7%
- **SPECIAL CARE WASTES**: 8%
- **OTHER WASTE**: 4%

- **Food waste**: 17%
- **Garden waste**: 19%
- **PLASTICS**: 21%
- **PAPER & PAPERBOARD**: 16%
- **METAL**: 2%
- **GLASS**: 9%
- **C&D**: 0%
- **TEXTILES**: 8%
- **SPECIAL CARE WASTES**: 5%
- **OTHER WASTE**: 3%
M3.2 Landfill Disposal Composition (includes Industrial and other wastes) for same 2 South African Municipalities

Food waste 42%  
Garden waste 13%  
PLASTICS 9%  
PAPER & PAPERBOARD 8%  
GLASS 7%  
METAL 3%  
PAPER & PAPERBOARD 2%  
SPECIAL CARE WASTES 2%  
OTHER WASTE 2%  
C&D 21%  
GARDEN WASTE 19%  
TEXTILES 19%  
OTHER WASTE 4%  
SPECIAL CARE WASTES 3%  
METAL 1%  
GLASS 5%  
PAPER & PAPERBOARD 9%  
PLASTICS 12%  
Garden waste 34%
M3.2 IPCC 2006 Guidelines Default MSW Composition for Southern Africa

- **Food waste**: 23%
- **Garden waste**: 25%
- **Wood**: 15%
- **Other waste**: 37%
M3.2 Solid Waste Management Facility - Weigh Bridge Data

Source: RWA Group
M3.2 Always difficulties knowing what enters a landfill
M3.2 Material Flow Mass Balance QA/QC Tool – Tier 3

Diagram showing the flow of waste generation to Quashie MBT Facility, including various waste categories and their quantities.
M3.2 Material Flow Mass Balance QA/QC Tool – Tier 1 / 2

- Mixed Municipal Solid Waste - to SWDS
- Mixed Municipal Solid Waste - to Open Burning
- Mixed Municipal Solid Waste - to Material Recycling
- Mixed Municipal Solid Waste - to Composting

Diagram:
- Municipal solid Waste Generation: 1000 t/c, 900 t/d
- Solid Waste Disposal: 750 t/d
- Material Recycling: 550 t/d
- Unmanaged Solid Waste Disposal Site - deep (20m deep)
- Anaerobic managed solid waste disposal site: 200 t/d
- Open burning of waste: 100 t/d
- Composting: 50 t/d
M3.2 GHG Inventory Focus areas in Wastewater
M3.2 Domestic Wastewater Service Chain
M3.2 Which sanitation option is worst?

A: Open Defecation
B: Stagnant Open Sewer
B: Latrine dumping to flowing river
Example: Dakar WWTP and Faecal Sludge Facility

Source: RWA Group
Example: Tankered Wastewater Treatment Plant – Gate Records
M3.3 Waste characterisation

Source: RWA Group
M3.3 Selecting an appropriate methodology

Waste Characterisation Analysis should be compliant with accepted international best practice, which include:


M3.3 Essential Steps

1. **Pre-investigation**
2. **Analysis design and planning**
3. **Execution of waste analysis**
4. **Evaluation of waste analysis**
M3.3 System Design - Essential

• Seasonality – Exercise must be conducted in all major climatic seasons (usually 3 times in a year)
• 32 x 100 kg randomly selected samples from each strata – minimum required

Main difference is where in the waste service chain the analysis is conducted
• Waste direct from households / commercial properties
• Waste from bins
• Waste from collection vehicles entering landfill
M3.3 Potential Strata

1. Urban High Income
2. Urban Middle Income
3. Urban Low Income
4. Collection system
5. Bin type and size
6. Food Market
7. Dry goods market
8. CBD Offices
9. Street bins
10. Commercial districts (commercial properties only)
11. Industrial sectors
12. Parks and Gardens
M3.3 Analysis at SWDS

Household Waste Analysis
- Organics: 29.5%
- Construction & Demolition Material: 0.1%
- Plastics: 19.1%
- Paper & Paperboard: 22.5%
- Metal: 2.8%
- Glass: 6.5%
- Textiles: 6.8%
- Special Care Wastes: 4.2%
- Other Waste: 0.0%
- E-waste: 8.6%

Landfill gate Records (Soil & Building rubble removed)
- Mixed MSW: 60%
- Industrial: 26.6%
- Organic (Garden): 5.2%
- C&D: 8%
- Cover material: 0%

Industrial Waste Analysis
- Organics: 8%
- Construction & Demolition Material: 21%
- Plastics: 25%
- Paper & Paperboard: 32%
- Metal: 2%
- Glass: 3%
- Textiles: 4%
- Special Care Wastes: 5%
- Other Waste: 0%
- E-waste: 0%

Total Landfilled Composition
- Organics: 25%
- Construction & Demolition Material: 13%
- Plastics: 18%
- Paper & Paperboard: 22%
- Metal: 2%
- Glass: 5%
- Textiles: 5%
- Special Care Wastes: 4%
- Other Waste: 5%
- E-waste: 25%
## WASTE ANALYSIS FORM

- **DATE:**
- **TIME:**
  - STARTED:
  - FINISHED:
- **WEATHER CONDITIONS:**
- **VEHICLE ID:**
- **WASTE ORIGINATING FROM:**
  - FORM COMPLETED BY:
    - NAME:
    - SIGNATURE:

### MATERIAL TYPE

<table>
<thead>
<tr>
<th>Material Type</th>
<th>Gross (kg)</th>
<th>Tare (kg)</th>
<th>Net (kg)</th>
<th>% of Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>PAPER &amp; PAPERBOARD</td>
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</tr>
<tr>
<td>1. Newspaper</td>
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<tr>
<td>2. Cardboard/boxboard</td>
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<tr>
<td>3. Magazines/catalogues</td>
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<tr>
<td>4. Office paper</td>
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<tr>
<td>5. Other/miscellaneous paper</td>
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<tr>
<td>GLASS</td>
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<tr>
<td>6. Clear containers</td>
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<tr>
<td>7. Green containers</td>
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<tr>
<td>8. Amber containers</td>
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<tr>
<td>9. Remainder/composite glass</td>
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<tr>
<td>METAL</td>
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<tr>
<td>10. Tin/steel containers</td>
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<tr>
<td>11. Aluminium containers</td>
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<tr>
<td>12. Other ferrous metal</td>
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<tr>
<td>13. Other non-ferrous metal</td>
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<tr>
<td>14. Major appliances</td>
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</tr>
<tr>
<td>MATERIAL TYPE</td>
<td>Gross (kg)</td>
<td>Tare (kg)</td>
<td>Net (kg)</td>
<td>% of Total</td>
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<td>-------------------------------</td>
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<tr>
<td><strong>PLASTICS</strong></td>
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<tr>
<td>15 Clear PET Bottles/containers</td>
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<tr>
<td>16 Green PET Bottles/Containers</td>
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<tr>
<td>17 Amber PET Bottles/containers</td>
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<tr>
<td>18 HDPE containers</td>
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<tr>
<td>19 Film plastics</td>
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<tr>
<td>20 Other plastics</td>
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<tr>
<td><strong>TEXTILE</strong></td>
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<tr>
<td>21 Textiles</td>
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<tr>
<td><strong>ORGANICS</strong></td>
<td></td>
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<tr>
<td>22 Food waste</td>
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<tr>
<td>23 Garden waste</td>
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<tr>
<td>24 Agricultural waste</td>
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<tr>
<td>25 Abattoir Waste</td>
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<tr>
<td>26 Remainder/composite organics</td>
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<tr>
<td><strong>CONSTRUCTION &amp; DEMOLITION MATERIAL</strong></td>
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<tr>
<td>27 Concrete</td>
<td></td>
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<tr>
<td>28 Lumber</td>
<td></td>
<td></td>
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<tr>
<td>29 Remainder/composite C &amp; D</td>
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<tr>
<td><strong>SPECIAL CARE WASTES</strong></td>
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</tr>
<tr>
<td>30 Paint</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>31 Hazardous materials</td>
<td></td>
<td></td>
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<tr>
<td>32 Biomedical</td>
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<tr>
<td>33 Batteries</td>
<td></td>
<td></td>
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<tr>
<td>34 Oil Filters</td>
<td></td>
<td></td>
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<tr>
<td>35 Remainder/composite S. C. Waste</td>
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<tr>
<td><strong>OTHER WASTE</strong></td>
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<tr>
<td>36 Waste Electrical Equipment (WEEE)</td>
<td></td>
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<tr>
<td>37 Tyre</td>
<td></td>
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</tr>
</tbody>
</table>
## M3.5 SWDS classification & Methane Correction Factors (MCF)

<table>
<thead>
<tr>
<th>Type of Site</th>
<th>Methane Correction Factor (MCF) Default Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>Managed – anaerobic</td>
<td>1.0</td>
</tr>
<tr>
<td>Managed – semi-aerobic</td>
<td>0.5</td>
</tr>
<tr>
<td>Unmanaged– deep (&gt;5 m waste) and /or high water table</td>
<td>0.8</td>
</tr>
<tr>
<td>Unmanaged– shallow (&lt;5 m waste)</td>
<td>0.4</td>
</tr>
<tr>
<td>Uncategorised SWDS</td>
<td>0.6</td>
</tr>
</tbody>
</table>

Solid Waste Disposal Site classification from 2006 IPCC Guidelines Volume 5, Chapter 3, Table 3.1
M3.5 Anaerobic managed SWDS

These must have **controlled placement of waste**. i.e.:

a) waste directed to specific deposition areas;
b) a degree of control of scavenging; and  
c) a degree of control of fires

and will include **at least one** of the following:

i. cover material; and / or  
ii. mechanical compacting; and / or  
iii. levelling of the waste.
Example: Anaerobic managed SWDS

Source: RWA Group
M3.5 Semi-aerobic managed SWDS

These must have controlled placement of waste and will include all of the following structures for introducing air to waste layer:

i. permeable cover material; and

ii. leachate drainage system; and

iii. Regulating pondage; and

iv. gas ventilation system.
Example: Semi-aerobic managed SWDS
M3.5 Unmanaged SWDS – Deep (>5m waste) and/or high water table

All SWDS not meeting the criteria of managed SWDS and which have depths of greater than or equal to 5 metres and/or high water table at near ground level.

Latter situation corresponds to filling inland water, such as pond, river or wetland, by waste.
Example: Unmanaged SWDS – Deep (>5m waste) and/or high water table
**M3.5 Unmanaged – Shallow (<5m waste)**

All SWDS not meeting the criteria of managed SWDS and which have depths of less than 5 metres.

Source: RWA Group
M3.5 Uncategorised solid waste disposal sites

Only if countries cannot categorise their SWDS into first four categories of managed and unmanaged SWDS, can the MCF for this category can be used.

Generally used for countries that cannot define what kind of landfills they have or had in the past.
**M3.5 Oxidation factor (OX) for SWDS**

<table>
<thead>
<tr>
<th>Type of site</th>
<th>Methane Correction Factor (MCF) default values</th>
</tr>
</thead>
<tbody>
<tr>
<td>Managed, unmanaged and uncategorised</td>
<td>0</td>
</tr>
<tr>
<td>Managed, covered with CH$_4$ oxidising material</td>
<td>0.1</td>
</tr>
</tbody>
</table>

IPCC 2006 Guidelines, Volume 5, Chapter 3, Table 3.2
M3.6 Exercise Classification of Solid Waste Disposal Sites

Observe the following Solid Waste Disposal Sites (SWDS) Examples and in your groups:

- Identify the classification of each example Solid Waste Disposal Sites using the 2006 IPCC Guidelines Volume 5 Chapter 3
Example 1 - Bahir Dar city dumpsite, Bahir Dar - Ethiopia

Source: RWA Group
Example 2 - Dakar city dumpsite, Dakar - Senegal

Source: RWA Group
Example 3 - Reppie SWDS - Addis Ababa - Ethiopia
Example 4: Potchefstroom SWDS – South Africa

Source: RWA Group
Example 5: Colombia, basurero Doña Juana

Source: https://static.iris.net.co/sostenibilidad/upload/images/2017/3/16/37342_1.jpg
Example 6: Amman, Jordan
M3.7 Exercise 3. Waste Data Management

An interactive group exercise based on a scenario country ("My Country") with two separate main waste management areas, the capital city “My City” and the rural area and secondary town areas of “My Country” (see map). Using two mass balance diagrams presenting example waste management data from the two subnational groups, analyse the data, aggregate it, validate it for the entire “country” waste management sector.
M3.7 Exercise 3. Waste Data Management
M5.8 Institutional arrangements and data flow

Exercise 9: Institutional arrangements and data flow
M5.8 Institutional arrangements and data flow

- National GHG Inventory
  - Line Ministries
  - National Statistics
    - Municipal Waste Management Dept.
    - Chamber of Commerce
    - City Sanitation Departments
      - Waste Treatment Facility Managers
      - Industrial Waste Producers
      - Private Waste Management Companies
      - Waste Water Treatment Facilities
      - Environmental Enforcement Officers
M5.8 Institutional arrangements and data flow

EPA (Environmental Protection Agency)

- Amount generated
  - Type of treatment: through Authorized Operators or on-site treatment
  - Amount handed to Operator 1

- Amount collected from Industry 1
  - Type of treatment: through Authorized Operators or on-site treatment
  - Amount handled to Operator 2

- Amount collected from Operator 1
  - Type of treatment: through Authorized Operators or on-site treatment
  - Amount treated

Reporting to EPA

- Industry 1 waste generation
- Operator 1 waste collection
- Operator 2 waste treatment and disposal
Thank you very much for your time and attention!

In all matters of the project please contact:

oscar.zarzo@giz.de
(MRV and GHG Inventory advisor at the German Environment Agency)

http://mitigationpartnership.net/information-matters