



# **WASTE MANAGEMENT SCENARIO IN MALAYSIA: An Overview**

PROF DR AGAMUTHU P.

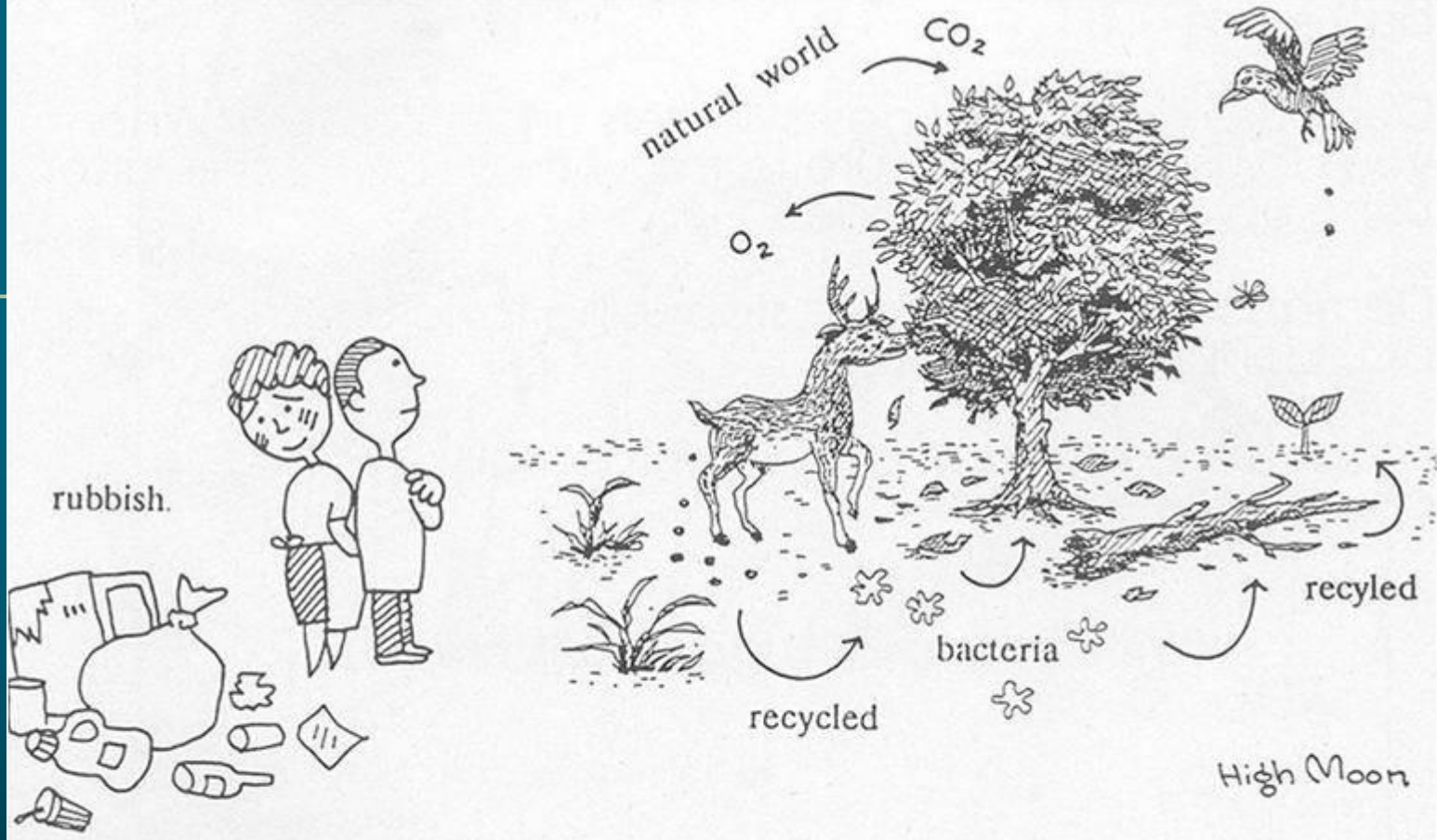
Institute of Biological Sciences, Faculty of  
Science, University of Malaya,  
50603 Kuala Lumpur

[agamuthu@um.edu.my](mailto:agamuthu@um.edu.my)



# Contents

- Waste Classification
- Waste composition
- Waste management
- Landfill issues
- Other options in waste management
- Industrial waste
- Hazardous waste
- Solid Waste and Public Cleansing Management (SWPCM) Bill 2007



In Nature, there was originally no such thing as "waste."

**No rubbish in nature!**



# WASTE CLASSIFICATION

1. Municipal waste
2. Bulky waste
3. Mining waste
4. Construction industry waste
5. Agro-waste
6. Sewage sludge
7. Clinical waste
8. Hazardous waste
9. Toxic waste
10. Industrial waste
11. Radioactive waste



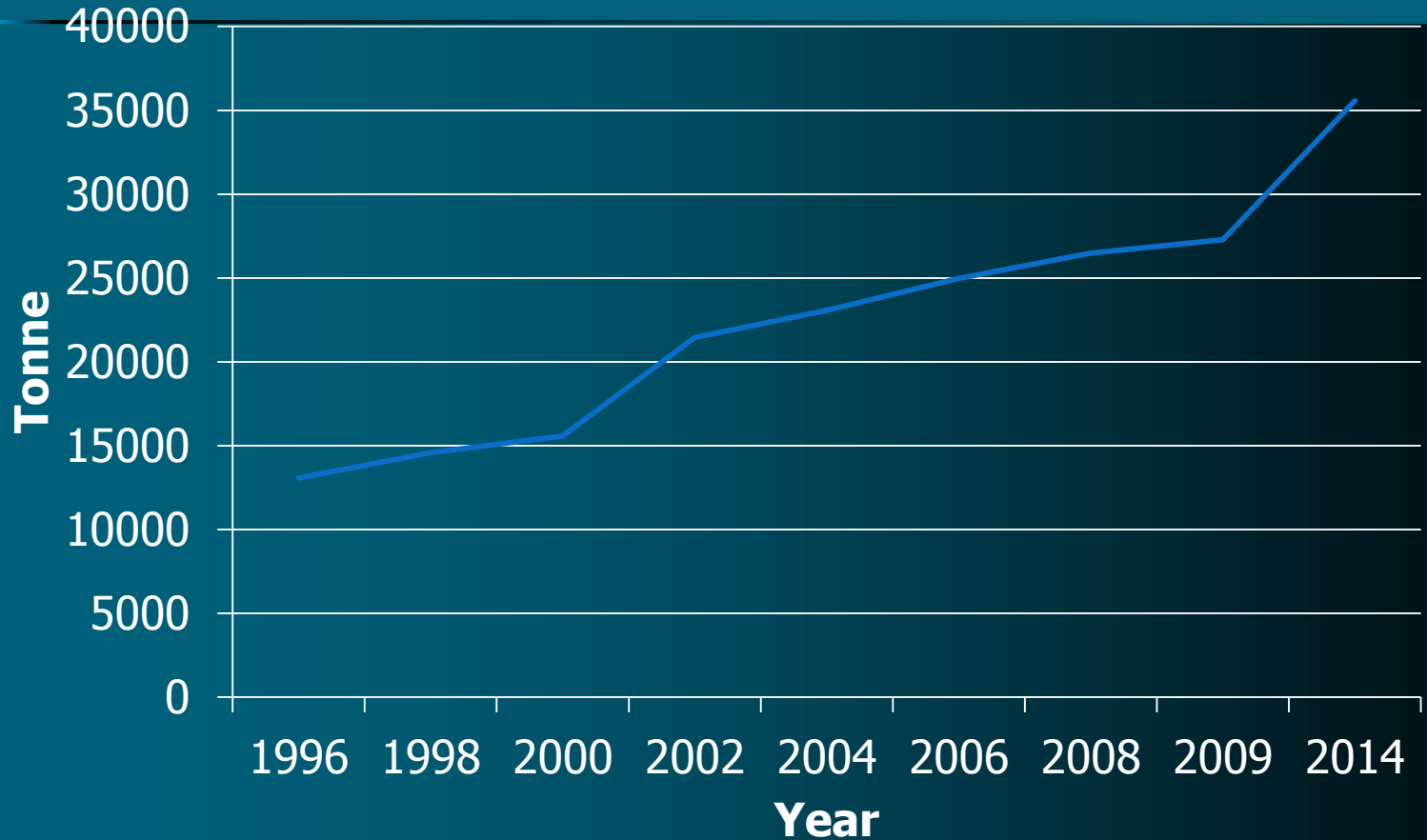


# URBAN WASTE TYPE

- Garbage
- Municipality waste
- Commercial waste
- Industrial waste
- Liquid waste
- Gas emissions
- Medical waste
- Hazardous waste
- Radioactive waste



## Daily MSW Generation



**Waste generation increase in Malaysia**

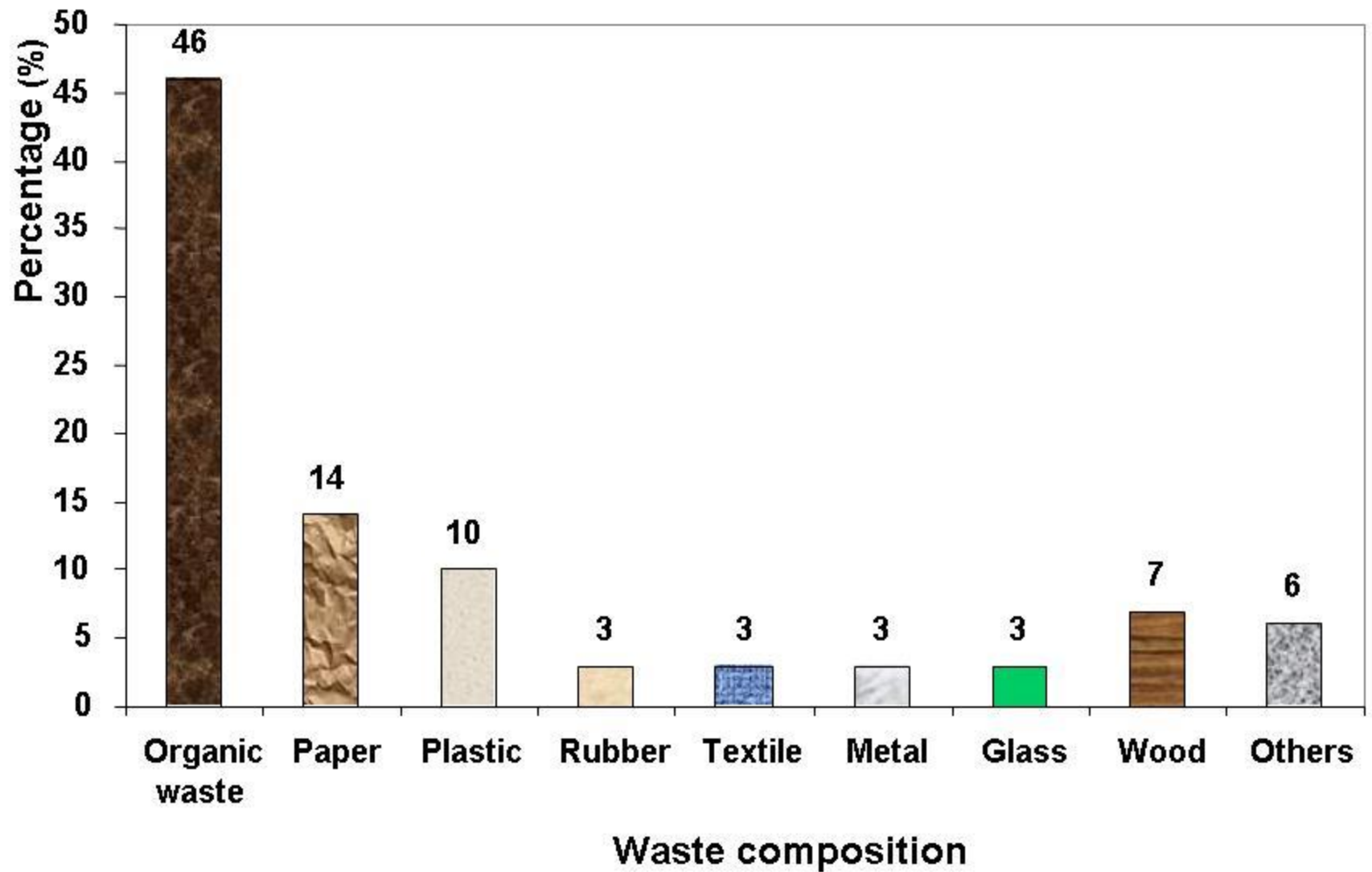
# MSW component



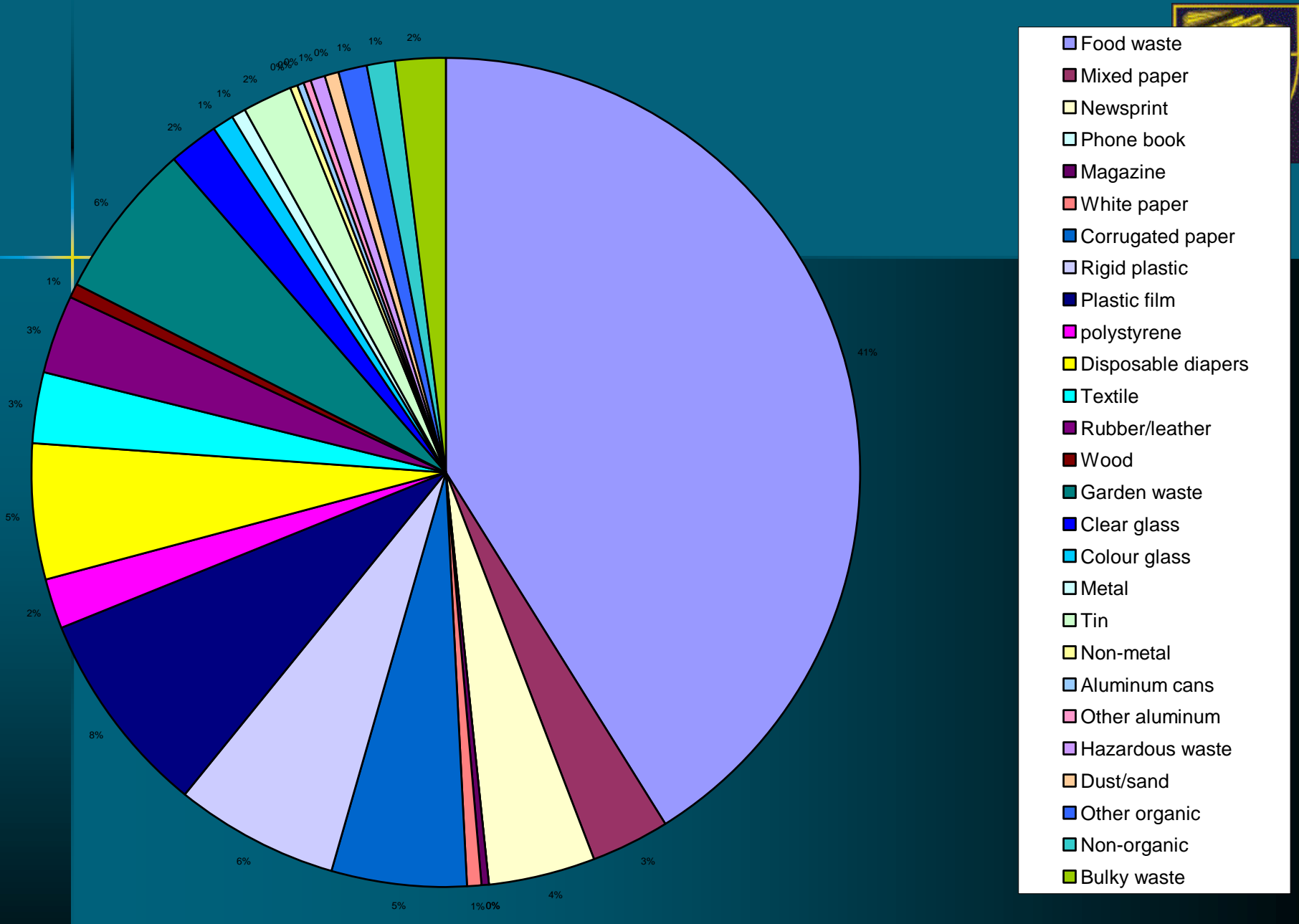
## Composition of MSW for Malaysia and the USA (% by mass)

Waste Composition	Range	Typical	Malaysia <sup>1</sup>	USA <sup>1</sup>
Organic/food waste	5-25	17	62.0	25.0
Yard waste	0-10	10	-	-
Paper	10-40	33	7.0	34.0
Plastic	2-8	5	12.0	12.0
Textile/leather	0-3	2	-	-
Rubber	0-1	0.5	-	-
Wood	1-3	2	-	-
Glass	4-15	5	3.0	5.0
Ceramic	-	-	0.4	-
Ferrous metal	1-3	1	6.0	8.0
Non-ferrous metal	0-1	1	-	-
Others	0-10	8	10.0	16.0

Source: Sincero & Sincero, 1996; <sup>1</sup>World Bank, 2012



The composition of MSW in Malaysia (2010)



Average composition of waste received by landfills in Malaysia



# Average composition (%) of waste received by landfills

	Rural	Sub-urban	Urban
Organic	27.3	20.4	26.5
Paper	6.8	9.9	5.0
Plastic	13.8	4.0	8.9
Rubber	8.7	8.3	14.4
Textile	7.9	11.6	6.2
Metal	5.0	5.6	3.7
Glass	3.7	17.7	13.4
Wood	4.9	12.3	5.2
Miscellaneous	22.0	10.3	16.6



# MSW generated by the high, medium and low socio-economic areas in Petaling Jaya



Composition (%)	Socio-economic status		
	High	Middle	Low
Paper products	19.79	15.73	13.04
Plastic and rubber	21.05	18.61	13.01
Glass and ceramics	14.99	9.42	7.57
Food waste	24.13	29.77	31.86
Metals	8.80	12.75	9.15
Textiles	1.57	3.87	3.08
Garden waste	5.50	6.95	15.56
Wood	3.45	2.90	6.72
Total	100.00	100.00	100.00

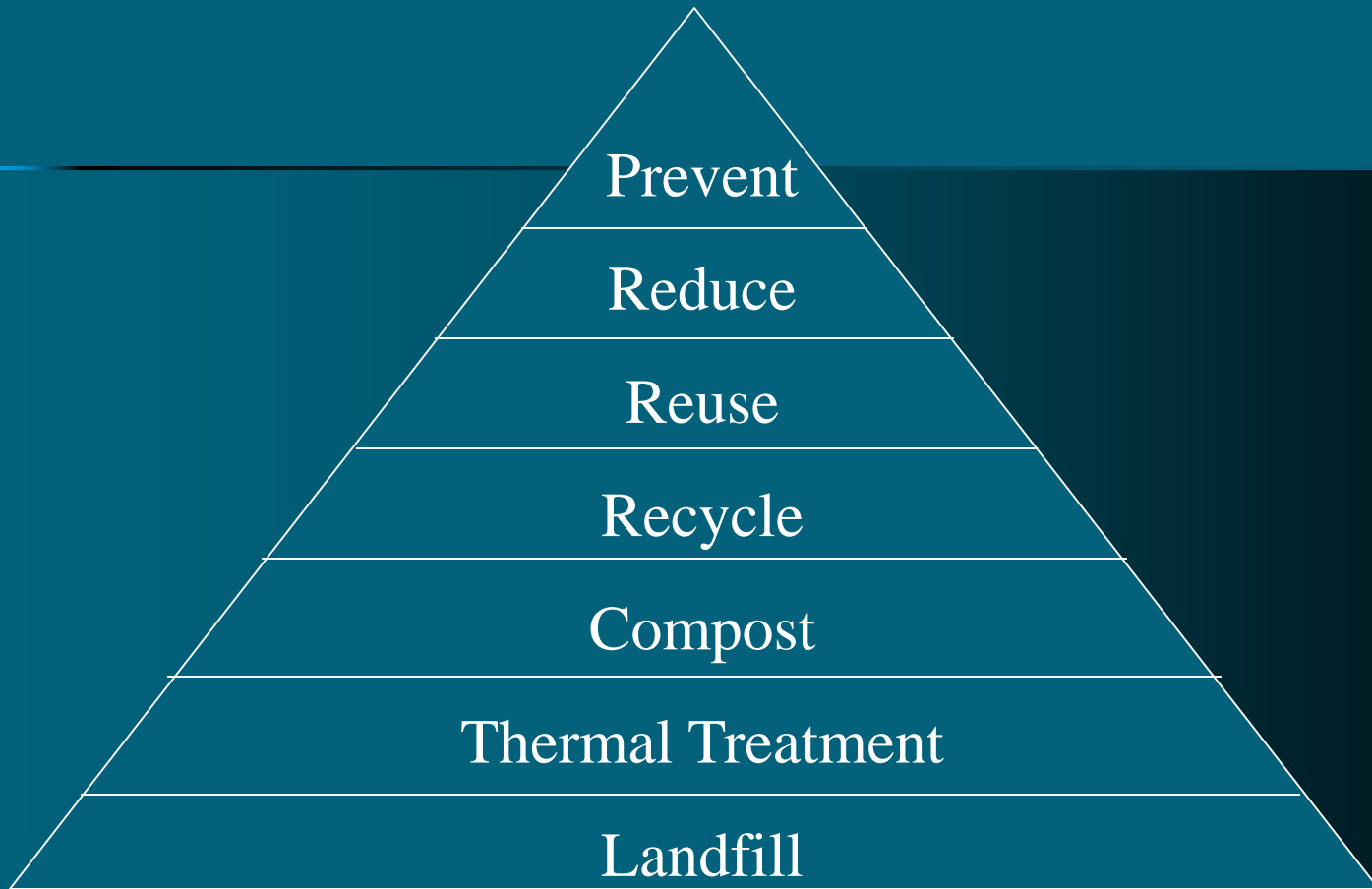


# BACKGROUND

- SWM problem gaining prominence
- Increased waste generation
- Ineffective mechanism to tackle problem holistically
- Many associated problems, including lack of space



**Overflowing of waste**



Hierarchy for Waste Management Strategy: Current Scenario



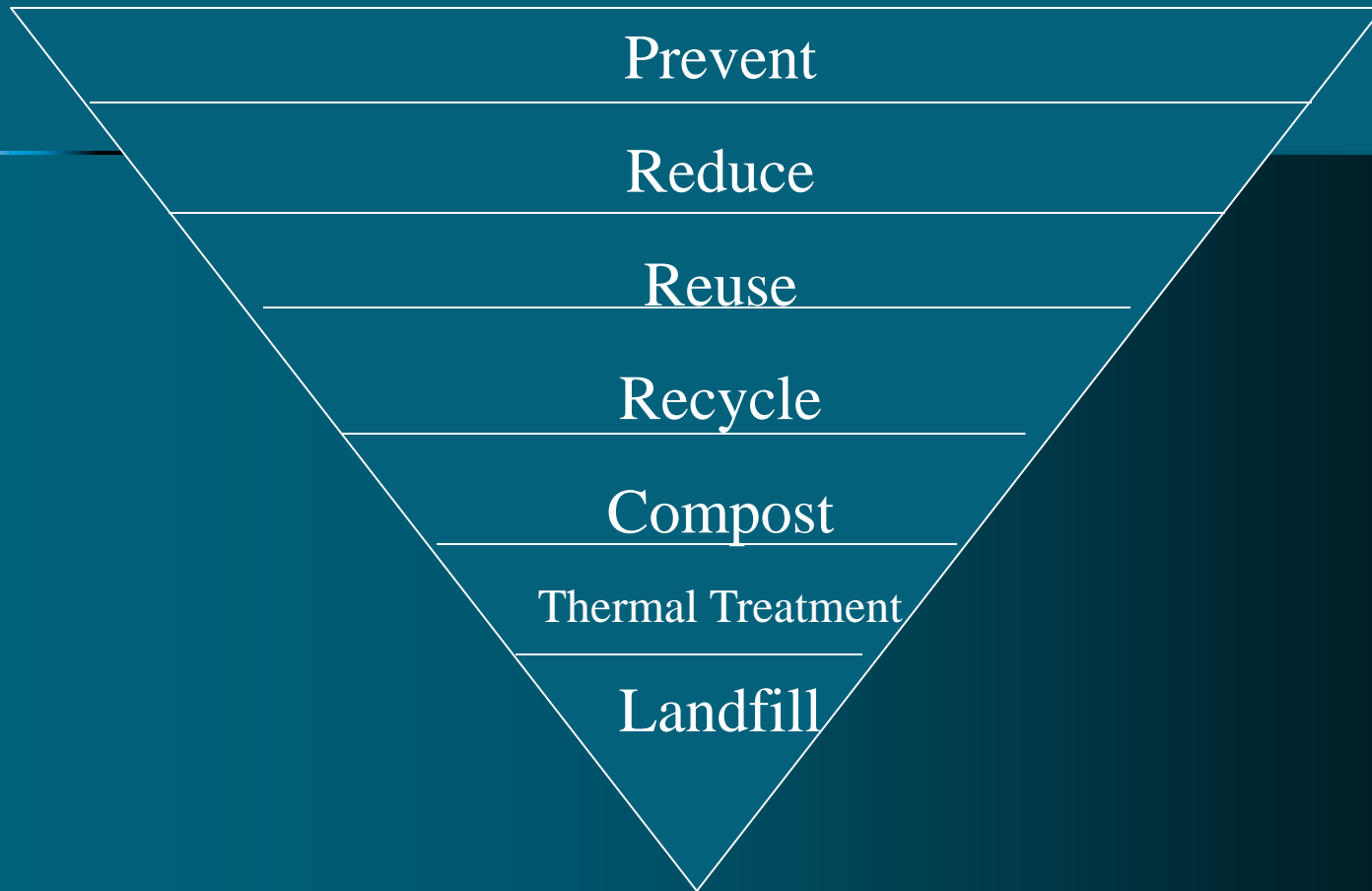


**A Typical MSW Landfill in Malaysia**



**Human scavenging activities in Hulu Yam Bharu landfill**





Hierarchy for Waste Management Strategy: Future Scenario

# Priority issues on National Waste Management



Treatment	Malaysia	National Goal		
	2002	2001	2005	2020
Recycling	5.0	3.0	7.0	22.0
Composting	0.0	0.0	4.0	8.0
Incineration	0.0	0.0	11.9	16.8
Inert landfill	0.0	0.0	9.2	9.1
Sanitary landfill	95.0	97.0	67.9	44.1
<b>Total</b>	100.0	100.0	100.0	100.0

# Waste Management Scenario in Malaysia



- **Annual increase** in waste generation = 3%
- Currently **lack** of an integrated waste management system.
- Natural waste degradation became difficult due to higher **complexity of waste**
- Requires an **allocation** of more than RM 2 billion annually for management.
- **Alternative options** are crucial to divert the waste volume to other economical routes.



# Treatment and Disposal of MSW

- 95% of MSW collected is landfilled
- 15% of MSW recycled
- Since privatization, MSW collected by 3 consortia:
  - Alam Flora Pvt. Ltd.
  - Southern Waste Pvt. Ltd.
  - E-Idaman Pvt. Ltd.



# Landfilling Issues

- Post-closure issues
- Improper post-closure of landfills lead to disaster- unstable and continuous waste compaction





**Highly mixed waste generated by Malaysians**





**Plastic wastes at landfill site**

# Characteristics of Old Landfill Leachate



Parameter	Kundang landfill	Sungai Sedu landfill	EQA 1974	
			Std A	Std B
<b>BOD<sub>5</sub> (mg/l)</b>	27.5 ± 0.66	22.27 ± 0.46	20	50
<b>COD (mg/l)</b>	6232 ± 1824.3	169.3 ± 76.95	50	100
<b>pH</b>	7.43 ± 0.04	6.72 ± 0.02	6-9	5.5-9
<b>TSS (mg/l)</b>	0.06 ± 0.01	0.09 ± 0.001	50	100
<b>Hardness (CaCO<sub>3</sub>) (ppm)</b>	429.3 ± 240.0	135 573.3 ± 3144.9	-	-
<b>Cd (ppm)</b>	Not detected	0.002 ± 0.001	0.01	0.02
<b>Cr (ppm)</b>	0.193 ± 0.02	0.006 ± 0.005		0.05
<b>Cu (ppm)</b>	0.003 ± 0.002	0.005 ± 0.004	0.2	1.0
<b>Pb (ppm)</b>	0.027 ± 0.012	0.147 ± 0.172	0.1	0.5
<b>Zn (ppm)</b>	0.060 ± 0.044	0.153 ± 0.102	0.2	1.0
<b>Mg (ppm)</b>	4.245 ± 0.420	7.480 ± 3.780	-	-

# Leachate Characteristics: Selected Landfills in Asia



Parameter	Pillar Point (Hong Kong) <sup>a</sup>	Ma Yau Tong (Hong Kong) <sup>a</sup>	Lat Krabang (Thailand) <sup>a</sup>	Leuwigadja (Indonesia) <sup>a</sup>	Jeram (Malaysia) <sup>b</sup>
pH	8.6	8.1	7.6	8.4	7.35
COD	2830	873	2700	-	51,200
BOD <sub>5</sub>	384	117	-	-	27,000
Ammoniacal-N	2700	1156	3032	2000	0.085
Chloride	2740	853	3802	2330	4150
Alkalinity	11,700	4940	23,910	7840	1980
EC	30,400	14,000	28,100	-	12.30
Nitrate-N	2.5	1.1	<1	<1	38.6
Nitrite-N	<0.1	<0.1	<0.7	<1	4.8
Sulphate	-	-	15	159	54.89
Phosphate	125	29.7	1.7	12	113
Sodium	2100	600	2453	1130	58.7
Magnesium	32	21	121	56	11.4
Potassium	1130	375	1932	1600	530
Chromium	-	-	780	250	25.27
Manganese	-	-	240	473	540.76
Iron	6.6	8.5	2.77	6.23	97.76
Zinc	2.2	1	0.15	0.46	827.7
Mercury	-	-	-	-	0.05

All units in mg/L except EC ( $\mu\text{S}/\text{cm}$ ) and pH





**Leachate oozing out from covering soil**



**Leachate accumulation**





**Leachate flowing to the lower ground**





**Leachate mixed with surface water**





The flowing river dilute the pollution impact of the leachate



**Construction of low cost apartment  
near landfill site**

# OPTIONS ON MSW MANAGEMENT



- RECYCLING
- COMPOSTING
- ENERGY PRODUCTION
  - Refuse-derived fuel
  - Biogas





# 3R

- 8% plastic film and 6% rigid plastic.
- Other material for recovery → (approx 40% of the daily waste) paper, plastic, glass, and metals.
- recyclable components:
  - 14% paper,
  - 15% plastic,
  - 3% metal
  - 3% glass





# Theoretical Options: Composting

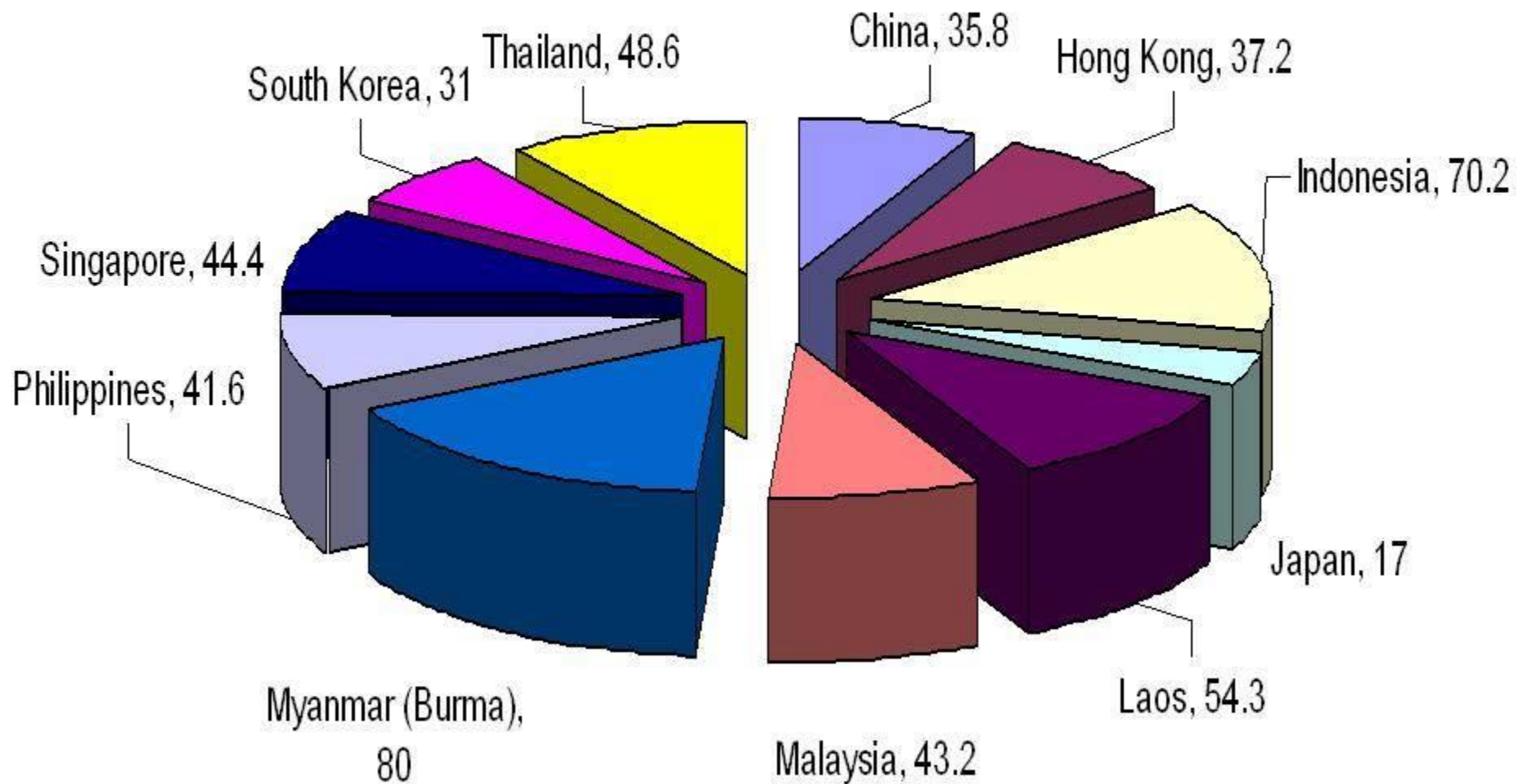
- At 50% recovery daily compost production of 5600 tonnes is achievable
- Conservatively at RM 2 per kg, an income of RM 11 million is possible daily
- Less labour costs etc., a net income of RM 3.65 billion per year is theoretically possible!



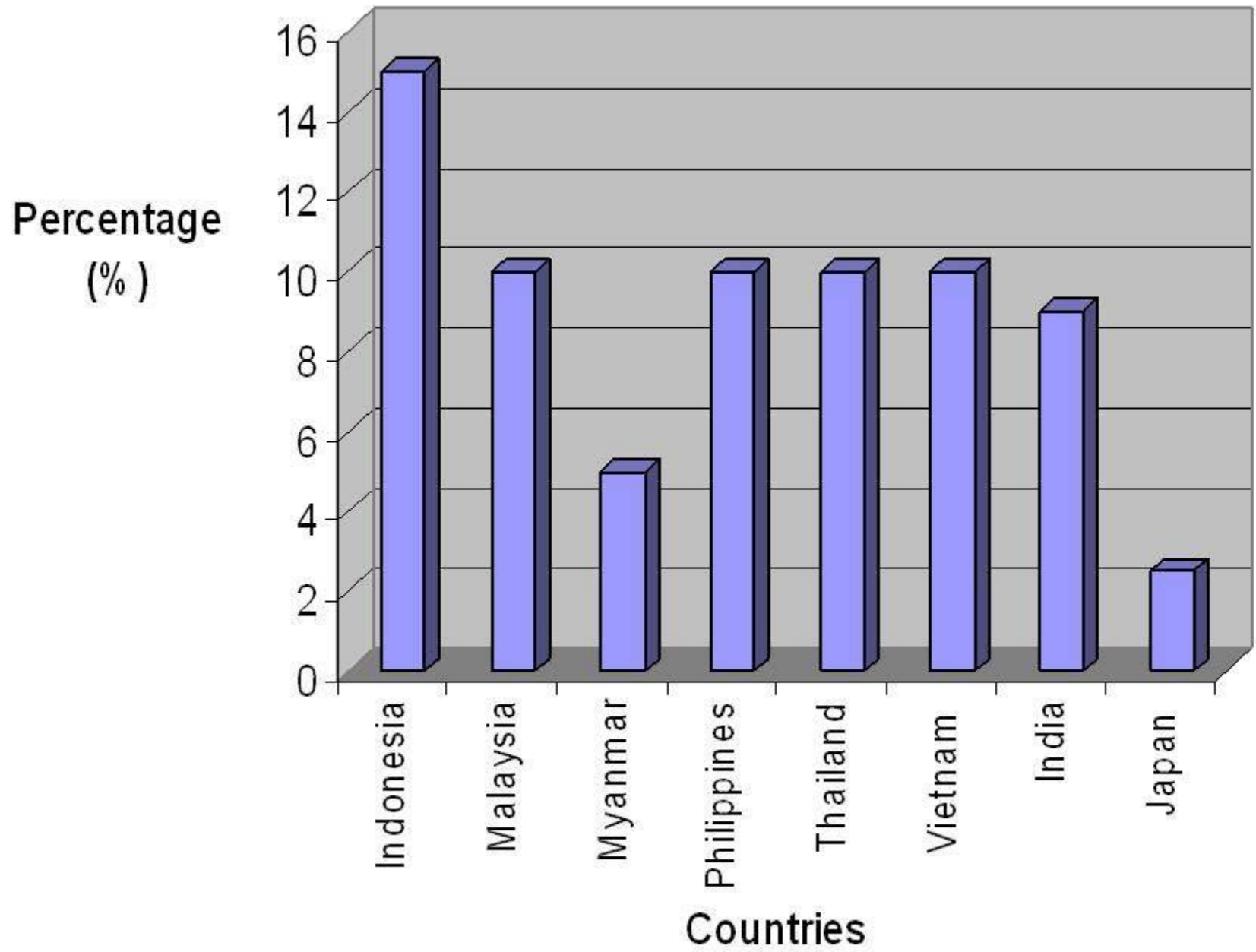
# ORGANIC WASTE TREATMENT

- The highest percentage → food waste at 41%
- 10,600 tonnes can be diverted into biological treatment.
- Composting programs would also utilize the 6% garden waste
- Reduce approximately 45% of the total MSW stream from landfill disposal.
- The quality of the compost can be monitored and various additives available in the market offer the quality improvement of compost from MSW to generate a net profit of RM 5.32 million daily.

## Organic waste in MSW in selected Asian countries (%)



# Composting of organic waste in selected Asian Countries







**Windrow composting of market waste in Malaysia**





# BIOGAS GENERATION

- Other option → biogas conversion.
- Biogas generation had gained importance worldwide.
- Lack of expertise and insufficient technology, biogas conversion not convenient in Malaysia.
- Developed countries convert landfills into bioreactors to generate biogas.

# Biogas generation in Malaysian landfills



- Air Hitam Landfill
  - 155 000 m<sup>3</sup> /day
  - Harvested to generate approx 2MW
- Taman Beringin Landfill
  - 168 000 m<sup>3</sup> /day
  - Passive emission to atmosphere



**Landfill gas released through the gas vent**

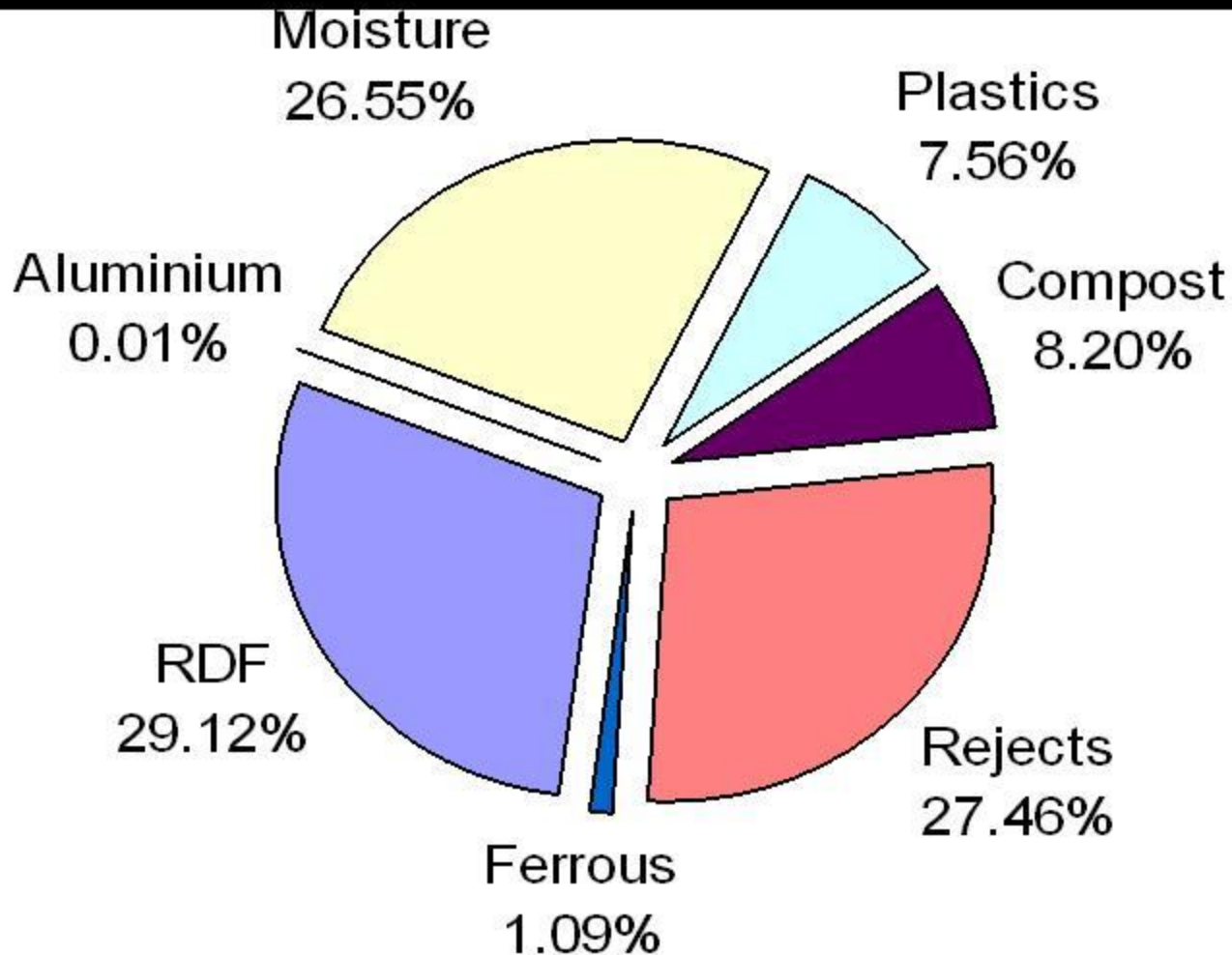
# Conversion to Refuse-Derived Fuel (RDF) Pallets



- high combustible nature of paper components and others.
- Also accounted for more than 86% of the total waste
  - 14% paper, 15% plastic, 45% organic waste and
  - Others: textile, wood, rubber and leather.
- Would offer a gross revenue of RM 18Mil daily through the marketing of RM 2.50/kg of RDF pallets.
- Daily generation of RDF pallet would account for up to 7,560 tonnes diverting approx 29% from landfills disposal.



# RDF Generation – Case Study



Refuse-derived fuel (RDF) Production And Recyclable Material Recovered in Recycle Energy Sdn Bhd RDF Pilot Plant, Semenyih, Malaysia



# Benefits in implementing RDF technology in MSW management in Malaysia

	Without RDF technology implementation	With RDF technology implementation	Positive impact of RDF technology implementation
End-point of MSW	- 95% landfill - 5% recycling	- 65% landfill - 30% RDF pellets* - 5% recycling	Reduction of 30% of MSW landfilled per day
Amount of MSW landfilled (tonne/day)	(95% x 27,300#) = 25,935	(65% x 27,300#) = 17,745	Reduction of 17,745 tonne of MSW landfilled per day
Cost of MSW disposal per day	(RM30** x 27,300) = RM 819,000	(RM30** x 17,745) = RM 532,350	Reduction of RM 532,350 disposal expenses per day
Renewable energy (RDF) production and income generated	-	1. (30%* x 27,300#) = 8,190 tonne/day 2. (RM50*** x 8,190 ) = RM 409,500	8,190 tonne/day of RDF produced and generates income RM 409,500/day

# Estimated MSW generation in Malaysia = 27,300 tonne/day

\*\* Cost of MSW disposal into landfill in Malaysia = RM30/tonne

\* Average percentage of RDF yield from MSW in Malaysia = 29.12% ≈ 30%

\*\*\* Proposed market price of RDF = RM50/tonne



# INDUSTRIAL WASTE

- Process and non-process waste
- Organic or inorganic process waste
- Hazardous or non-hazardous waste
- Highly heterogeneous among industries
- Within an industry rate of generation and waste type is predictable
- Waste minimization options available under Cleaner Technology



**Industrial waste in MSW landfill**





# HAZARDOUS WASTE

- Rate has been corresponding to economic activity
- Currently at 3 million tonnes/yr
- Waste type: slag/clinker, heavy metal sludge, metal finishing, textile etc.
- Generators: Selangor, Penang, Perak
- Signatory to Basel Convention
- Issues: waste definition, scope of application, recovery liability, funding, transport



# REGULATIONS

- DOE in 1984 together with a group of Danish consultants drafted a set of regulations dealing with hazardous waste management from 'cradle to grave' which will regulate the storage, transport, treatment and disposal of hazardous waste. The regulations and order gazetted in April 1989 are as follows:
- Environmental Quality (Scheduled Wastes) Regulations, 1989.
- Environmental Quality (Prescribed Premises) (Scheduled Waste Treatment and Disposal Facilities)
- Regulations, 1989. Environmental Quality (Prescribed Premises) (Scheduled Waste Treatment and Disposal Facilities) Order, 1989



# Scheduled Waste Definition in Malaysia

Scheduled waste refers to any waste falling within the 107 categories (grouped into specific and non specific sources) of hazardous waste listed in the First Schedule of the Environmental Quality (Scheduled Wastes) Regulations, 1989 (EQA, 1974). These wastes must as far as possible be rendered inert prior to disposal.



# Premises for Treatment & Disposal

Six types of premises prescribed for the treatment and disposal of hazardous waste in the Environmental Quality (Prescribed Premises) (Scheduled Waste Treatment and Disposal Facilities) Regulations, 1989.

They are:

- (i) land treatment facilities such as sludge farm
- (ii) off site recovery facilities
- (iii) off site centralized physical / chemical waste water treatment plants,
- (iv) scheduled waste incinerators,
- (v) off site storage facilities
- (vi) secure landfills.

\*\* The use of these premises will require a written permission and license from DOE.





Illegal storage of hazardous waste



Illegal storage of hazardous waste

# Integrated Waste Management Centre- Kualiti Alam Sdn. Bhd.



- There were many disposal sites all over the country for industrial waste but none were suitable for the disposal of toxic and hazardous waste because of their poor siting, unsuitable geological and hydro geological conditions of the sites or due to poor management.
- In 1991, Kualiti Alam Sdn. Bhd., Malaysia's only integrated hazardous waste management centre was incorporated and operates from Bukit Nanas, Negeri Sembilan.
- Kualiti Alam Sdn. Bhd. has been awarded a 15 year consignment to manage the collection, transportation, treatment and disposal of scheduled waste from waste generators in Peninsular Malaysia.



# The Scheduled Waste Generators

- As of 2005- 70,000 scheduled waste generators in Malaysia represents USD264 million industry.
- Reported waste generators with DOE in 2003- 5139 waste generators
- Total waste generated in 2003 460,866 metric tons.
- Illegal storage and disposal :challenge for HW management.





# TECHNOLOGIES

1. Incineration (with energy recovery) – mainly for clinical waste and hazardous waste.
2. Pyrolysis – not common in Malaysia.
3. Secure landfill – hazardous waste, fly ash, bottom ash.
4. Bioremediation – mainly for soil.
5. Sanitary landfill – 95% of MSW is landfilled.



# The Solid Waste and Public Cleansing Management (SWPCM) Bill 2007

- has been in discussion for the last 10 years.
- finally tabled in May 2007.
- expected to bring major changes and challenges in waste management in Malaysia.

# Information on the SWPCM Bill 2007



- approved in July 2007.
- Aims to improve and ensure high quality services in managing solid waste.
- adapted from Best Management Practices from Japan, Denmark, Switzerland, Germany and United States.
- focused mainly on public cleanliness management.

# Strategies of the SWPCM Bill 2007



- to tackle the
  - 3R issues,
  - treatment of solid waste,
  - interim treatment and final disposal of solid waste,
  - other services related to public amenities.





# Main features of SWPCM Bill

- **Shifting** of solid waste and public cleansing authority from states and local authorities to the federal government.
- Sharing of the waste management **cost** (between federal and the local government).
- **Federal Corporation** appointed would ensure the implementation and the success of an effective solid waste management.
- **Covers all types of solid waste** from commercial centres, public sites, construction sites, households, industrial zones and institutions, as well as, imported solid wastes.

# The Solid Waste and Public Cleansing Management Corporation Fund consists of:



- **income** of the Corporation from investments.
- **allocations** provided by the Parliament for the purpose of the management of solid waste and public cleansing,
- income sourced from **property** of the Corporation
- **consultancy fees** from services provided by the Corporation.
- other sources.
- **loan** money by the Corporation.
- money earned from **operation** of projects.
- **donations** and contributions received from any sources.
- other money lawfully obtained by the Corporation.



# Payment

- **Punitive measures** to tackle problem of consumers who refuse to pay the waste disposal fees.
- Upon **failure to pay** the collection fees, offender will be brought to the Tribunal for Solid Waste Management.
- A **fine** up to RM5,000 (USD 1,316) and RM50 (USD 13) for each day of the continuation of the offence is proposed.

# Responsibilities of waste generators



- to conduct **waste separation**.
- Failure to separate the waste generated by the premises is an **offence** if a person.
- Upon conviction the person is liable to a **fine** not exceeding RM1000 (USD263).



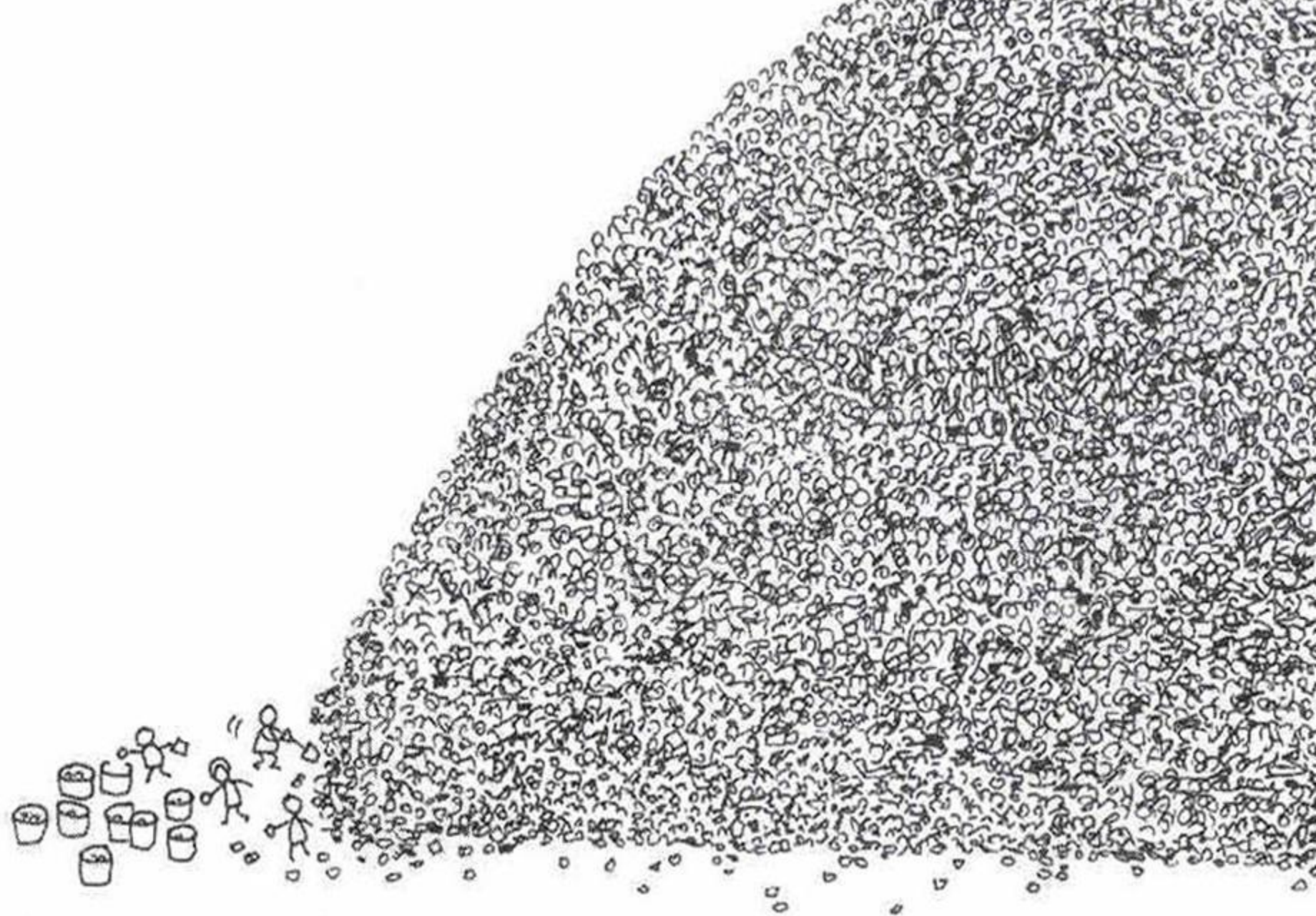


# ENFORCEMENT

- call for, examine, make copies or extract any book, document, instrument or **record** which is in custody or control of any person pertaining to any matter under the Act;
- **visit**, enter, inspect and examine with or without previous notice any solid waste management facilities;
- **investigate** to ensure proper maintenance and sanitation, matters related to safety and health, the effects of any operation or practice, presence and accumulation of noxious gas, in any solid waste management facilities, land or other premises; and
- take **samples** of any material found at the solid waste management facilities on land, water or air.



THANK YOU



**“Let’s separate and recycle!”**

*High Moon*