Chapter 6:
Pollution Sources Inventory

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WATER POLLUTION SOURCES

The sources of water pollution can be categorized as point and non-point sources. Point sources include sewage treatment plants, manufacturing and agro-based industries and animal farms. Non-point sources are mainly diffused sources such as agricultural activities and surface runoffs.

The Department of Environment (DOE) maintains mainly records of point sources. In 2009, 20,702 water pollution point sources were recorded. These comprise of manufacturing industries (9762: 47.15%), sewage treatment plants (9676: 46.74% inclusive of 736 Network Pump Stations), animal farms (769: 3.72%) and agro-based industries (495: 2.39%) as shown in **Figure 6.1**.

Clean river amidst a dramatic clear sky at a bridge crossing Linggi River, border of Melaka and Negeri Sembilan

The DOE compiles statistics of industrial water pollution sources from agro-based and manufacturing industries through field surveys and questionnaires. **Figure 6.2** shows the distribution of these sources in 2009. A total of 10,311 sources were identified with Johor having the highest number of water pollution sources (4917: 47.69%).

Data from the Veterinary Department of Malaysia shows that there were 1.67 million standing pig population in 2009. This was a decrease of 4.57 percent compared to 2008 where the standing pig population was 1.75 million. Correspondingly, the number of pig farms decreased to 769 farms in 2009 compared to 788 in 2008.

Indah Water Konsortium Sdn. Bhd. (IWK) managed public sewage treatment plants only in Peninsular Malaysia and Labuan. The number of sewage treatment plants under the management of IWK increased from 9524 plants in 2008 to 9676 in 2009. Selangor had the largest number of sewage treatment plants (2764: 28.57%), followed by Perak (1461:15.10%), Johor (1089: 11.25%) and Negeri Sembilan (949 : 9.81%) **(Figure 6.3)**.

BOD LOAD

In terms of BOD load, domestic treated and partially treated sewage remained the largest contributor with an estimated load of 991,165.78 kg/day. The other major contributors were pig farming (217,619.09 kg/day) and agro-based manufacturing industries (115,319.75 kg/day).

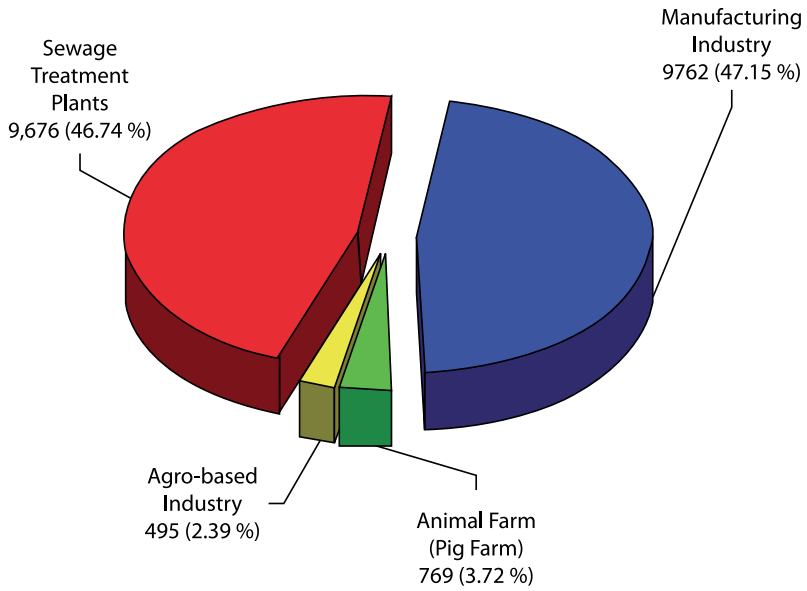

Figure 6.1 Malaysia : Composition of Water Pollution Sources by Sector, 2009

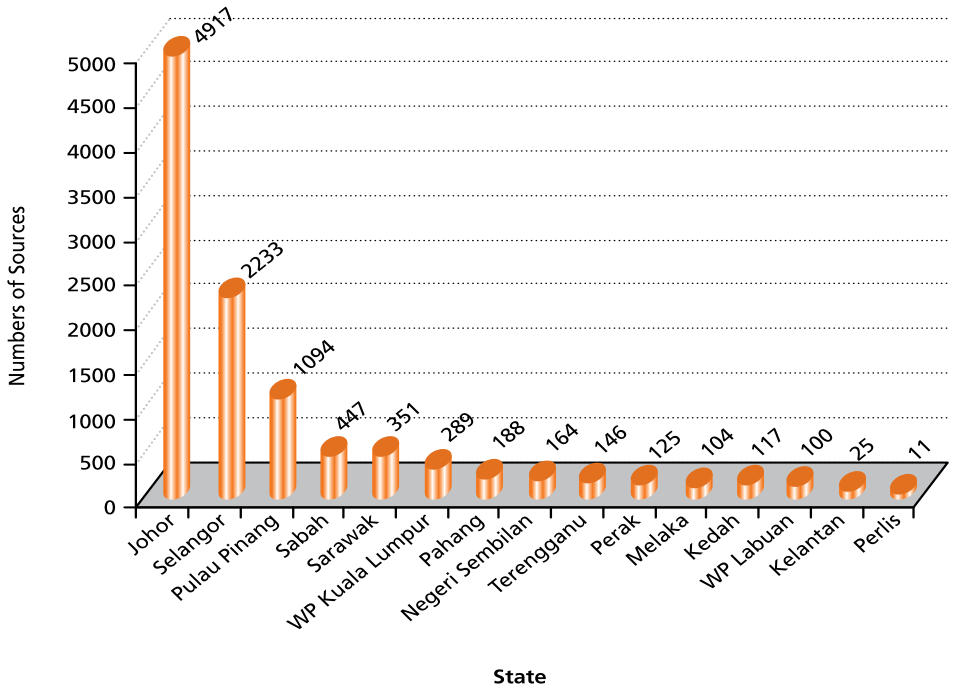

Figure 6.2 Malaysia : Distribution of Industrial Water Pollution Sources (Agro-based and Manufacturing Industries) by State, 2009

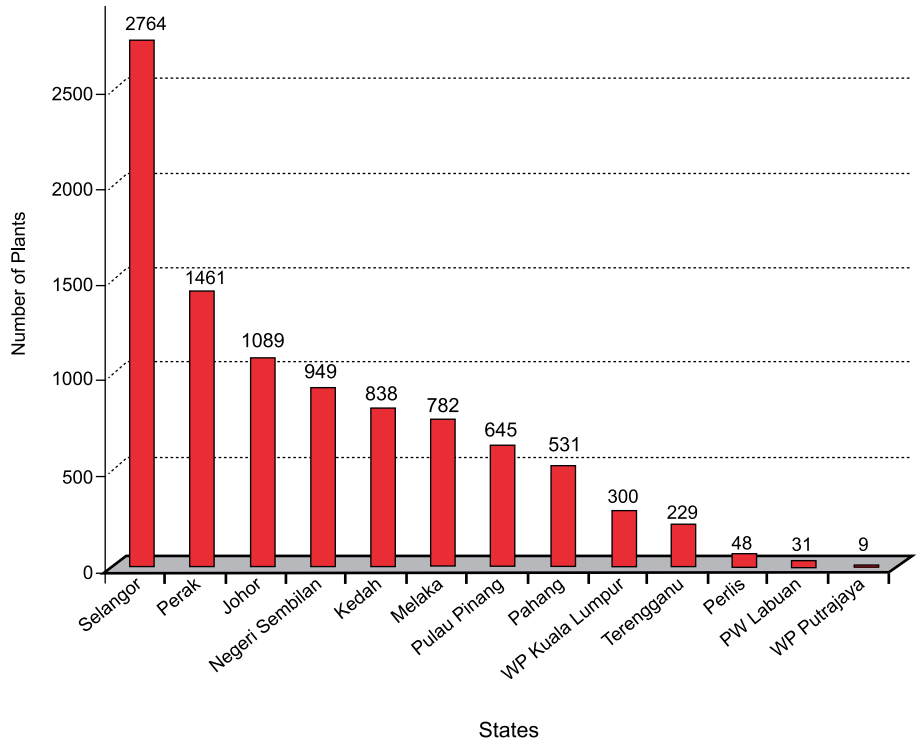

Figure 6.3 Malaysia : Distribution of Sewage Treatment Plants by State, 2009
Source : IWK Sdn. Bhd.

Table 6.1 Malaysia : Total BOD Load (kg/day) from Sewage Treatment Plants

State	No. of STP	Total PE	Flow (m^3/day)	BOD Load (kg/day)
Selangor	2764	6,833,733	1,537,590	384,397.48
Perak	1461	1,376,881	309,798	77,449.56
Johor	1089	1,437,705	323,484	80,870.91
Negeri Sembilan	949	1,174,785	264,327	66,081.66
Kedah	838	683,531	153,794	38,448.62
Melaka	782	654,178	147,190	36,797.51
Pulau Pinang	645	1,581,808	355,907	88,976.70
Pahang	531	349,123	78,553	19,638.17
WP Kuala Lumpur	300	3,309,207	744,572	186,142.89
Terengganu	229	70,340	15,827	3,956.63
Perlis	48	29,804	6,706	1,676.48
WP Labuan	31	41,928	9,434	2,358.45
WP Putrajaya	9	77,702	17,483	4,370.74
Total	**9676**	**17,620,725**	**3,964,663.13**	**991,165.78**

Note : STP = Sewage Treatment Plant
PE = Population Equivalent
Source : IWK Sdn. Bhd

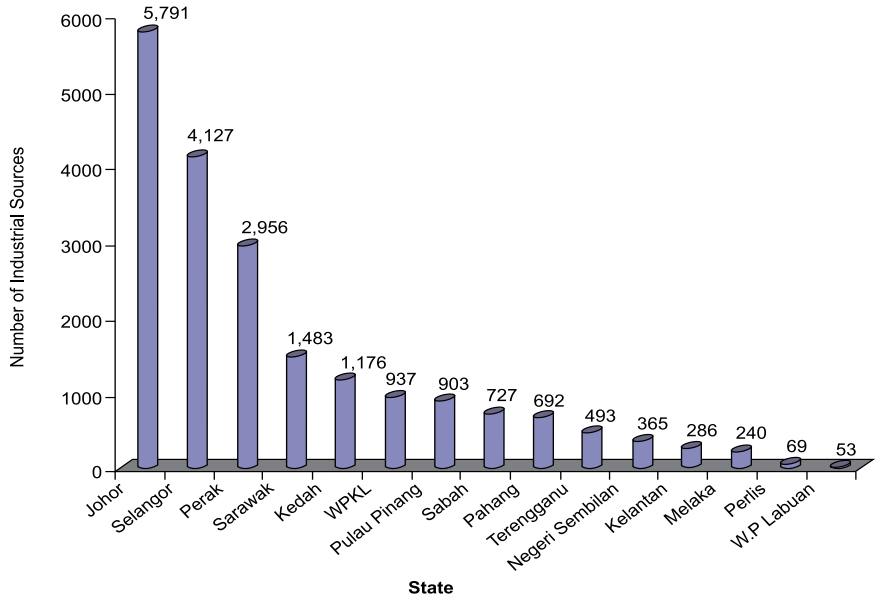

Figure 6.4 Malaysia : Industrial Air Pollution Sources by State, 2009

Table 6.1 shows the total BOD load in kg/day discharged from sewage treatment plants in the states managed by IWK in 2009.

SOURCES OF AIR POLLUTION

Industries including power stations, motor vehicles and open burning activities remain the major sources of air pollution in the country.

In 2009, a total of 20,298 industrial sources were subjected to the Enviornmental Quality (Clean Air) Regulations, 1978. The breakdown of industrial sources by states is as shown in **Figure 6.4**. The highest number of stationary pollution sources was in Johor (5,791: 28.5%) followed by Selangor (4,127: 20.3%) and Perak (2,956: 14.6%).

As for the past years motor vehicles remain the major contributor of air pollution especially in urban areas. In 2009, there was an overall increase in the number of motor vehicles registered. The number of registered passenger cars increased by 6.6%, motorcycles by 5.3%, buses by 4.0% and taxis by 5.5% in 2009 compared to 2008 except for goods vehicles registered which decreased to about 31.3%. The number of registered vehicles in Malaysia for

the year 2008 and 2009 is as shown in **Figure 6.5**. The number of in-use or active vehicles on the road namely passenger cars, motorcycles, goods vehicles and taxis increased by 12.3%, 4.6%, 5.3% and 12.8% respectively while the number of buses decreased by 5.0% compared to 2008 **(Figure 6.6)**.

AIR POLLUTANT EMISSION LOAD

Overall Emission Load

It is estimated that in 2009 the combined air pollutant emission load was 1,621,264 metric tonnes of carbon monoxide (CO); 756,359 metric tonnes of nitrogen dioxide (NO_2); 171,916 metric tonnes of sulphur dioxide (SO_2) and 27,727 metric tonnes of particulate matter (PM). A comparison of the combined air pollutant emission load in 2008 and 2009 is shown in **Figure 6.7**. Except for PM there was an increase in emission load for CO, NO_2 and SO_2 compared to 2008. The increase of 11.7 percent in CO emission load was due to an increase in the number of in-use or active motor vehicles in 2009 while the increase in emission load for NO_2 and SO_2 was due to the additional number of power and heat generation plants in the country. (Source : National Energy Balance 2007).

Emission Load by Sources

Power stations contributed the highest SO_2 emission load (47%), industries (27%), motor vehicles (7%)

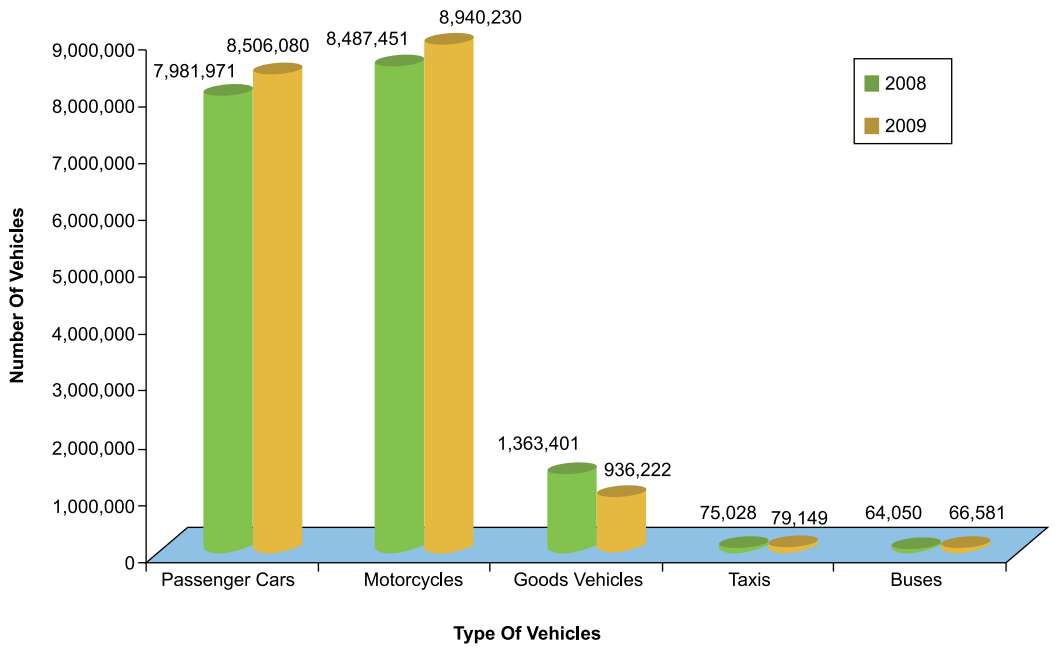

Figure 6.5 Malaysia : Number of Registered Vehicles in 2008 and 2009
(Source : Road Transport Department, Malaysia, 2009)

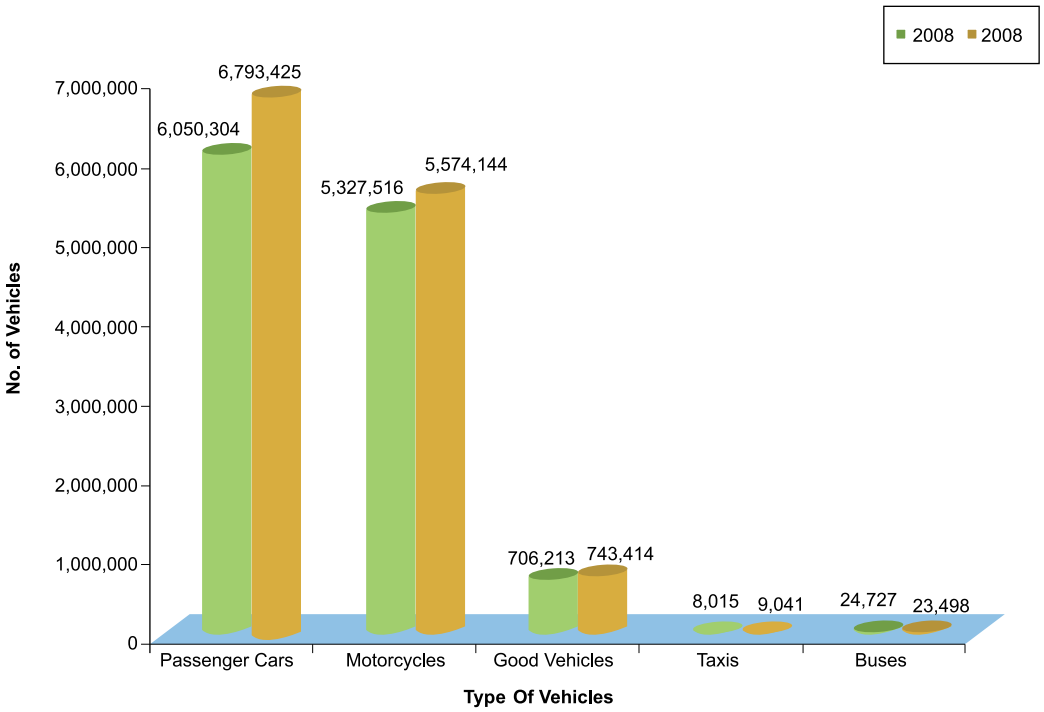

Figure 6.6 Malaysia: Number of In Use Vehicles in 2008-2009
(Source: Road Transport Department, Malaysia, 2009)

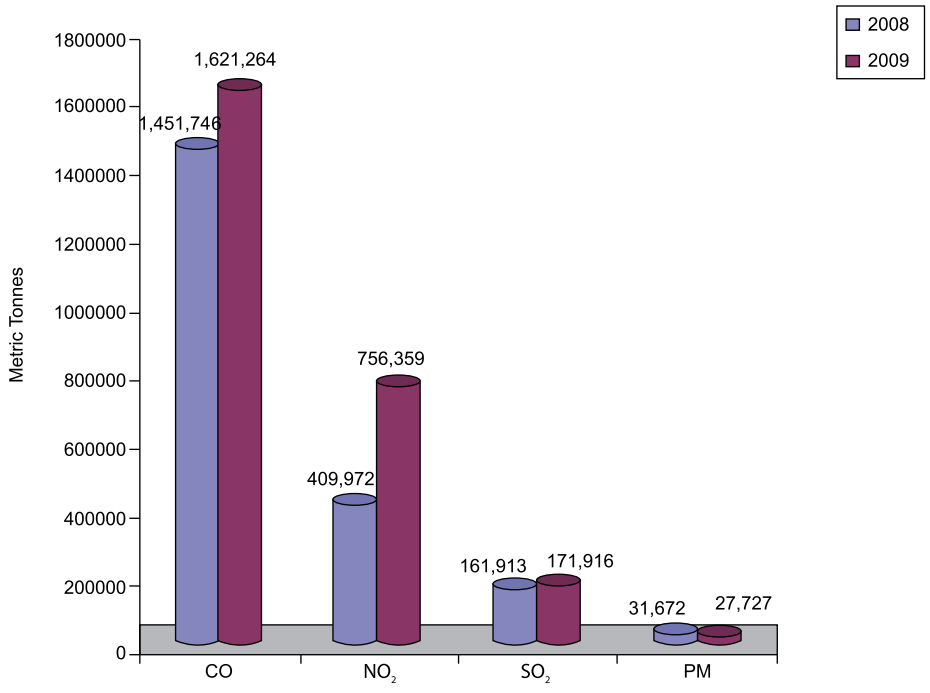

Figure 6.7 Malaysia: Air Pollutant Emission Load from All Sources, 2008-2009
(Source: From National Energy Balance 2007)

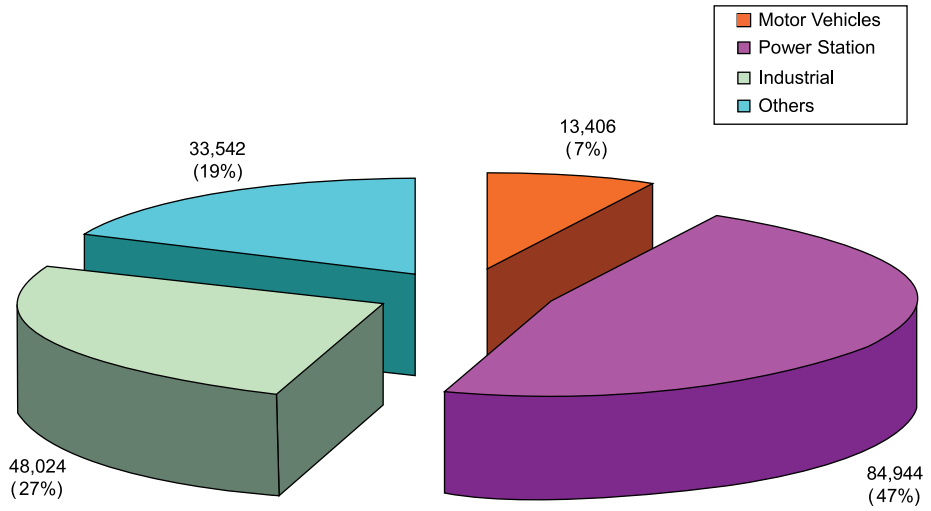

Figure 6.8 Malaysia: SO_2 Emission by Sources (Metric Tonnes), 2009

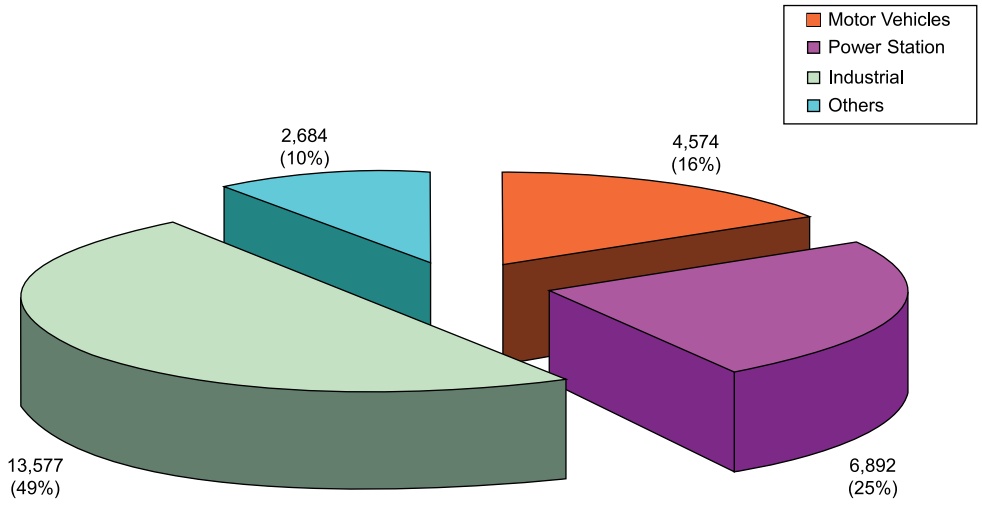

Figure 6.9 Malaysia: Particulate Matter (PM) Emission Load by Sources (Metric Tonnes), 2009

and others (19%) **(Figure 6.8)**. As to PM the highest contributor was industries (49%) followed by power stations (25%), motor vehicles (16%) and others (10%) **(Figure 6.9)**. As shown in **Figure 6.10** the highest contributor of NO_2 was from power stations (57%) followed by motor vehicles (28%), industries (12%) and others (3%). Motor vehicles remain the highest contributor of CO (95%) **(Figure 6.11)**.

The estimated annual air pollutant emission loads of HC, CO, PM, NO_2 and SO_2 from motor vehicles for 2008 and 2009 is shown in **Figure 6.12**. In 2009, the emission load of HC, CO, PM, SO_2, and NO_2 were estimated to be 357,266 metric tonnes, 1,533,191 metric tonnes, 4,574 metric tonnes, 13,406 metric tonnes and 211,599 metric tonnes respectively. Generally, there was an increase in emission load from motor vehicles in 2009 compared to 2008.

SCHEDULED WASTES INVENTORY

Based on the notification on scheduled wastes received by the DOE, a total of 1,705,308.14 metric tonnes of scheduled wastes were generated in 2009 as compared to 1,304,898.77 metric tonnes in 2008. In 2009, it was found that dross/slag/clinker/ash, gypsum, e-waste, oil and hydrocarbon, clinical / pharmaceuticals and heavy metal sludge were the main categories of waste produced in the country. The breakdown according to waste categories and industry type are given in **Tables 6.2, 6.3** and **Figures 6.13, 6.14** respectively.

Terengganu generated the largest amount of scheduled wastes (21.56%), followed by Johor (19.83%), Pulau Pinang (15.08%) and Negeri Sembilan (13.86%). Distribution of Scheduled wastes generated by state is shown in **Figure 6.15.**

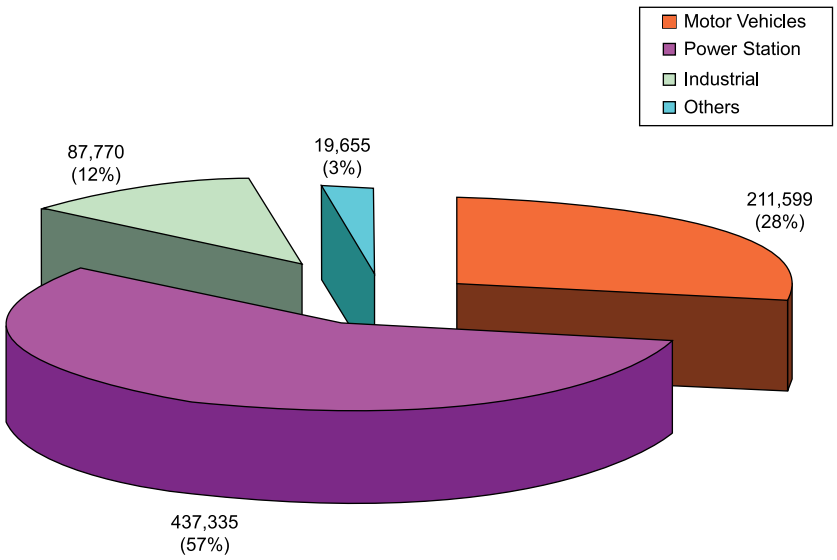

Figure 6.10 Malaysia: NO_2 Emission by Sources (Metric Tonnes), 2009

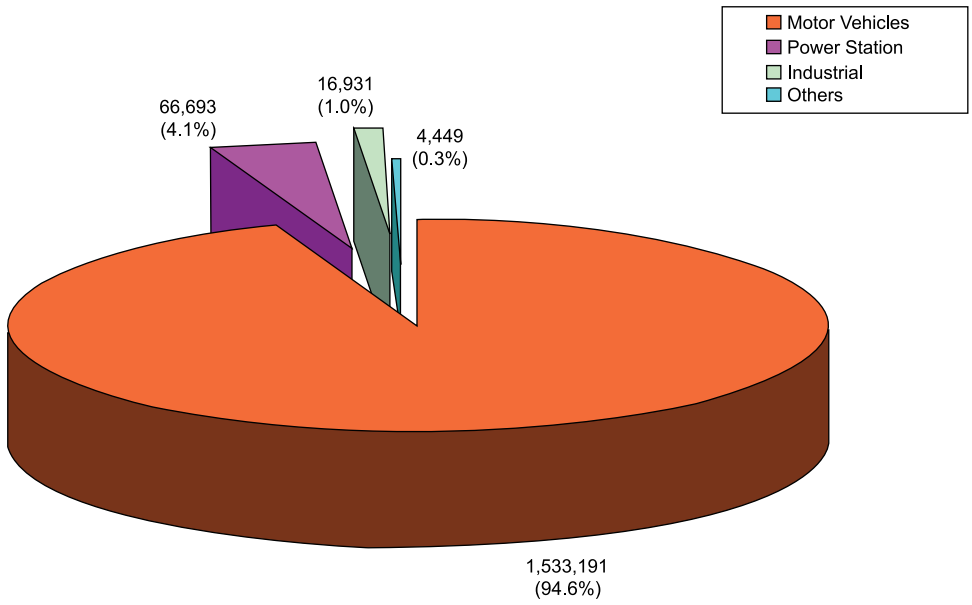

Figure 6.11 Malaysia: CO Emission by Sources (Metric Tonnes), 2009

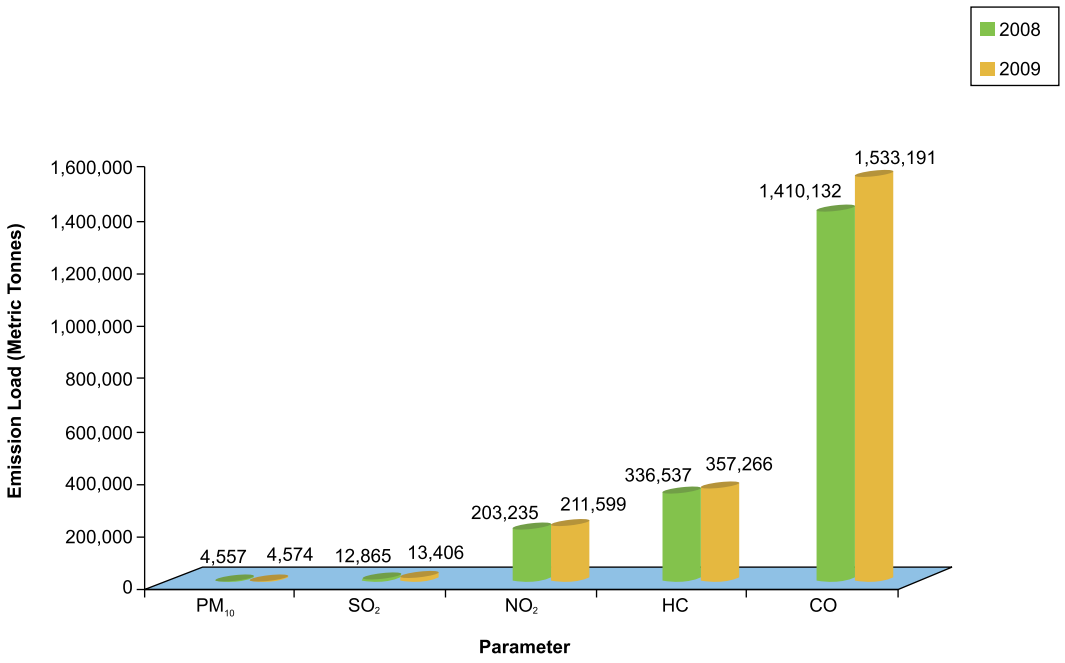

Figure 6.12 Malaysia: Air Pollutant Emission Load from Motor Vehicles, 2008-2009

Table 6.2 Malaysia : Quantity of Scheduled Wastes Generated by Category, 2009

NO.	CATEGORY OF WASTE	QUANTITY OF WASTE	
		(MT / Year)	PERCENTAGE (%)
1	Dross / Slag / Clinker / Ash	515924.06	30.25
2	Gypsum	405135.96	23.76
3	E-Waste	134035.70	7.86
4	Oil & Hydrocarbon	132849.20	7.79
5	Clinical/Pharmaceutical	94601.63	5.55
6	Heavy Metal Sludge	83568.76	4.90
7	Acid & Alkali	58512.37	3.43
8	Mixed Wastes	51131.87	3.00
9	Used Containers	37475.21	2.20
10	Mineral Sludge	34582.10	2.03
11	Batteries	32337.08	1.90
12	Spent Solvent	30132.53	1.77
13	Paper & Plastic	24422.79	1.43
14	Ink & Paint Sludge	16838.65	0.99
15	Rubber Sludge	16379.37	0.96
16	Residue	13280.83	0.78
17	Phenol/Adhesive/Resin	5591.19	0.33
18	Catalyst	5533.65	0.32
19	Photographic Waste	3886.89	0.23
20	Others	3168.39	0.19
21	Arsenic	1457.00	0.09
22	Chemical Waste	1254.33	0.07
23	Mercury	1045.82	0.06
24	Contaminated Active Carbon	964.10	0.06
25	Contaminated Land / Soil	759.17	0.04
26	Asbestos	321.07	0.02
27	Peroxide Agent	113.24	0.01
28	Pesticide	3.03	< 0.01
29	Sludge Contain Cyanide	2.16	< 0.01
	TOTAL	**1,705,308.14**	**100.00**

Table 6.3 Malaysia: Quantity of Scheduled Wastes Generated by Industry, 2009

NO.	CATEGORY OF INDUSTRY	QUANTITY OF WASTE	
		(MT / Year)	PERCENTAGE (%)
1	Chemical	521187.43	30.56
2	Water Treatment Plant / Power Station	235812.63	13.83
3	Electronic / Electrical	196808.64	11.54
4	Licensed Facilities	168106.98	9.86
5	Metal / Engineering	126763.70	7.43
6	Automotive/Workshop	104656.83	6.14
7	Shipping	102586.51	6.02
8	Hospital/Pharmaceutical	80324.60	4.71
9	Petroleum / Petrochemical	42595.91	2.50
10	Printing & Packaging	30057.52	1.76
11	Rubber Based	29565.61	1.73
12	Paper Based	15847.97	0.93
13	Paint	9500.32	0.56
14	Plastic	6983.10	0.41
15	Wood Based	6057.77	0.36
16	Food	5748.28	0.34
17	Industrial Gas	5321.50	0.31
18	Batteries	3760.54	0.22
19	Photographic	3562.78	0.21
20	Mineral / Ceramic / Tiles / Plaster	2342.39	0.14
21	Others	2004.51	0.12
22	Glass / Crystal	1976.19	0.12
23	Textile	1559.00	0.09
24	Resin & Adhesive	991.60	0.06
25	Laundry	664.96	0.04
26	Cement Based	281.44	0.02
27	Quarry	140.90	0.01
28	Asbestos	98.53	0.01
	TOTAL	**1,705,308.14**	**100**

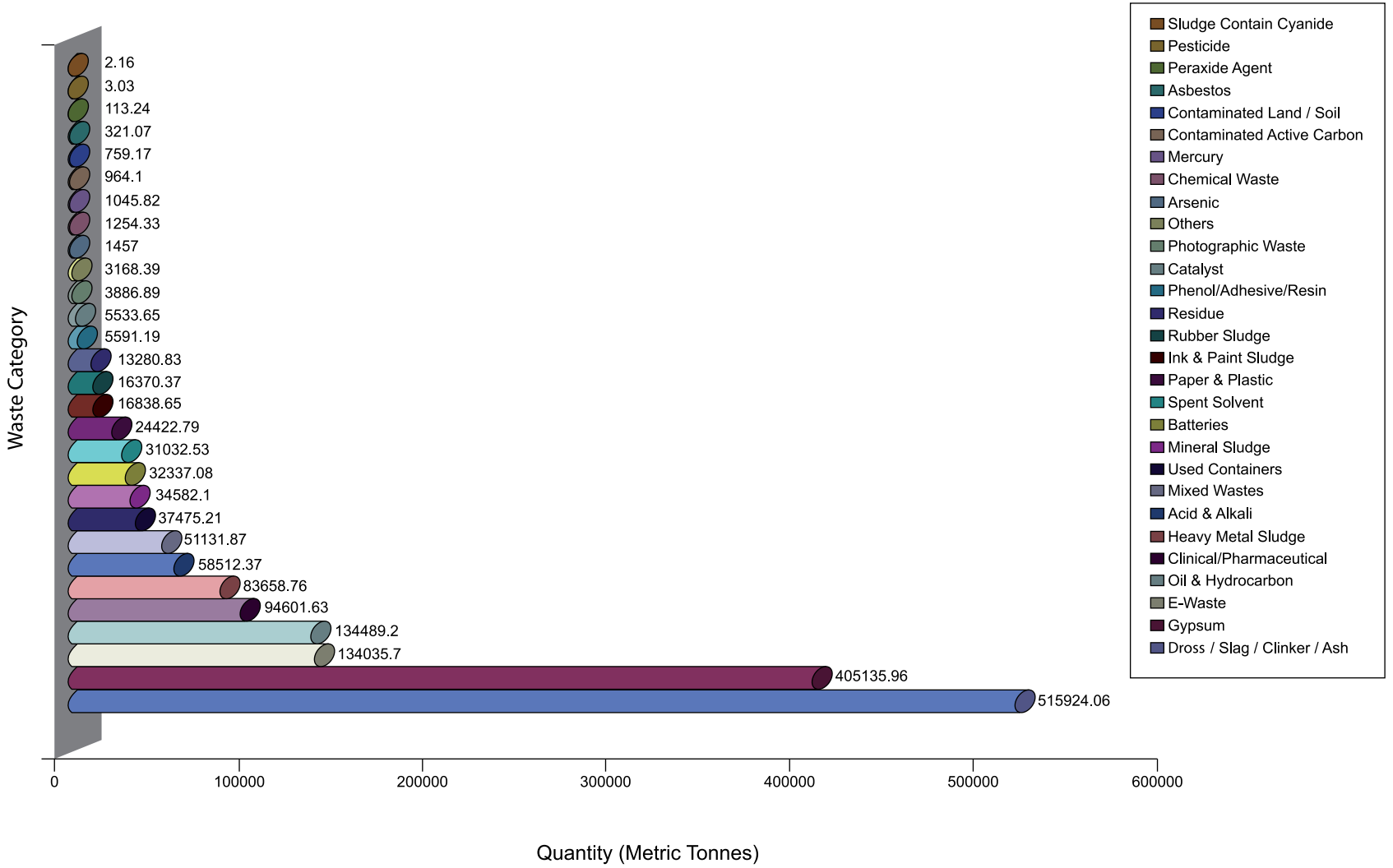

Figure 6.13 Malaysia: Quantity of Scheduled Wasted Generated by Category, 2009

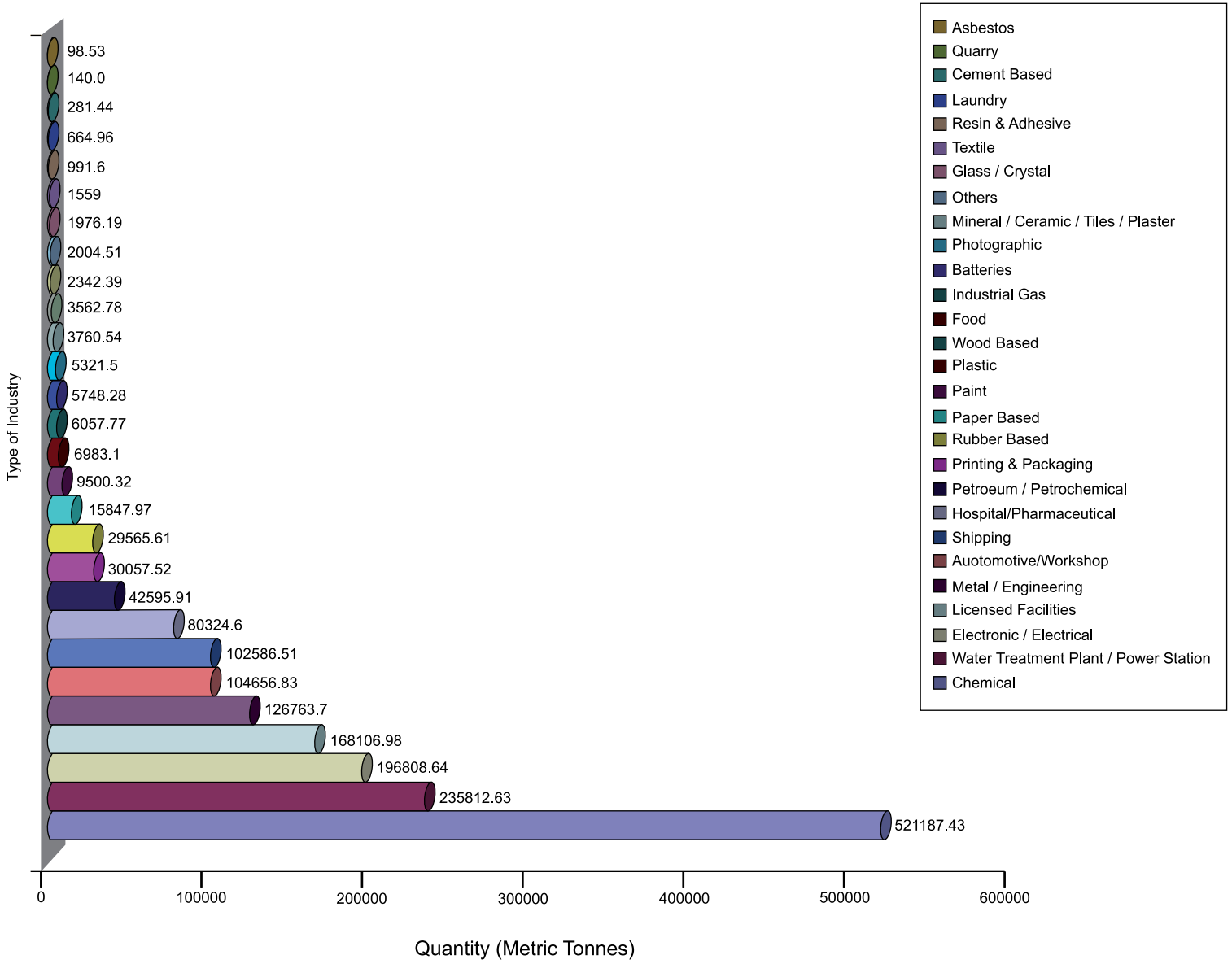

Figure 6.14 Malaysia: Quantity of Scheduled Waste Generated by Industry, 2009

Table 6.4 Malaysia : Facilities Handling Scheduled Wastes, 2009

NO.	FACILITY	TONNES	PERCENTAGE (%)
1	Local Off-site Recovery Facilities	686,011.92	40.23
2	On-site Treatment	520,751.65	30.54
3	Special Management	293,782.21	17.23
4	Kualiti Alam Sdn. Bhd.	126,288.00	7.41
5	On-site Storage	47,039.37	2.76
6	Off-site Clinical Waste Incinerators	16,558.99	0.97
7	Trinekens (Sarawak) Sdn. Bhd.	12,043.00	0.71
8	Foreign Facilities (Export)	2,833.00	0.17
	TOTAL	**1,705,308.14**	**100.00**

Of the total wastes produced, 126,288.00 metric tonnes (7.41%) were treated and disposed at Kualiti Alam Sdn. Bhd., 12,043.00 metric tonnes (0.71%) were treated and disposed at Trinekens (Sarawak) Sdn. Bhd., 16,558.99 metric tonnes (0.97%) of clinical wastes were incinerated at licensed off-site facilities; 2,833.00 metric tonnes (0.17%) were exported for recovery purposes, 686,011.92 metric tonnes (40.23%) of scheduled wastes were recovered at off-site facilities; an estimated 520,751.65 metric tonnes (30.54%) were treated on-site; 47,039.37 metric tonnes (2.76%) were stored on-site at waste generators' premises and 293,782.21 metric tonnes (17.23%) of scheduled waste were managed under special management as stipulated under Regulation 7, Environmental Quality (Scheduled Wastes) Regulations, 2005 **(Table 6.4)**. Three (3) landfarms for on-site treatment and 20 on-site waste incinerators had been licensed by DOE.

Of the 686,011.92 metric tonnes of wastes being recovered at local off-site recovery facilities, 39.3% are electronic and electrical wastes followed by dross/ash/slag/catalyst (11.1%) and oil/mineral sludge/spent coolant (9.7%).

A total of 351 off-site recovery facilities have been licensed by the department to recover various categories of scheduled wastes. **(Table 6.5)**

The categories of wastes sent to Kualiti Alam Sdn Bhd are sludges containing one or several metals, mixed wastes, dust/slag/dross/ash containing arsenic/mercury and spent inorganic acid. They were either incinerated, treated physically and chemically, solidified or disposed off in secured landfill. **(Figure 6.16)**

Table 6.5 Malaysia: Off-site Recovery Facilities and Quantity of Waste Handling, 2009

WASTE CATEGORY	RECOVERY FACILITY	HANDLING PERCENTAGE %
Electronic and Electrical Wastes	138	39.32
Dross / Ash / Slag / Catalyst	39	11.11
Oil / Mineral Sludge / Spent Coolant	34	9.69
Acid / Alkaline	29	8.26
Heavy Metal Sludge / Rubber	28	7.98
Used Container / Contaminated Waste / Ink / Paint / Lacquer	31	8.83
Solvent	22	6.27
Photographic	10	2.85
Phenol / Adhesive / Resin	9	2.56
Battery	7	1.99
Gypsum	4	1.14
TOTAL	**351**	**100.0**

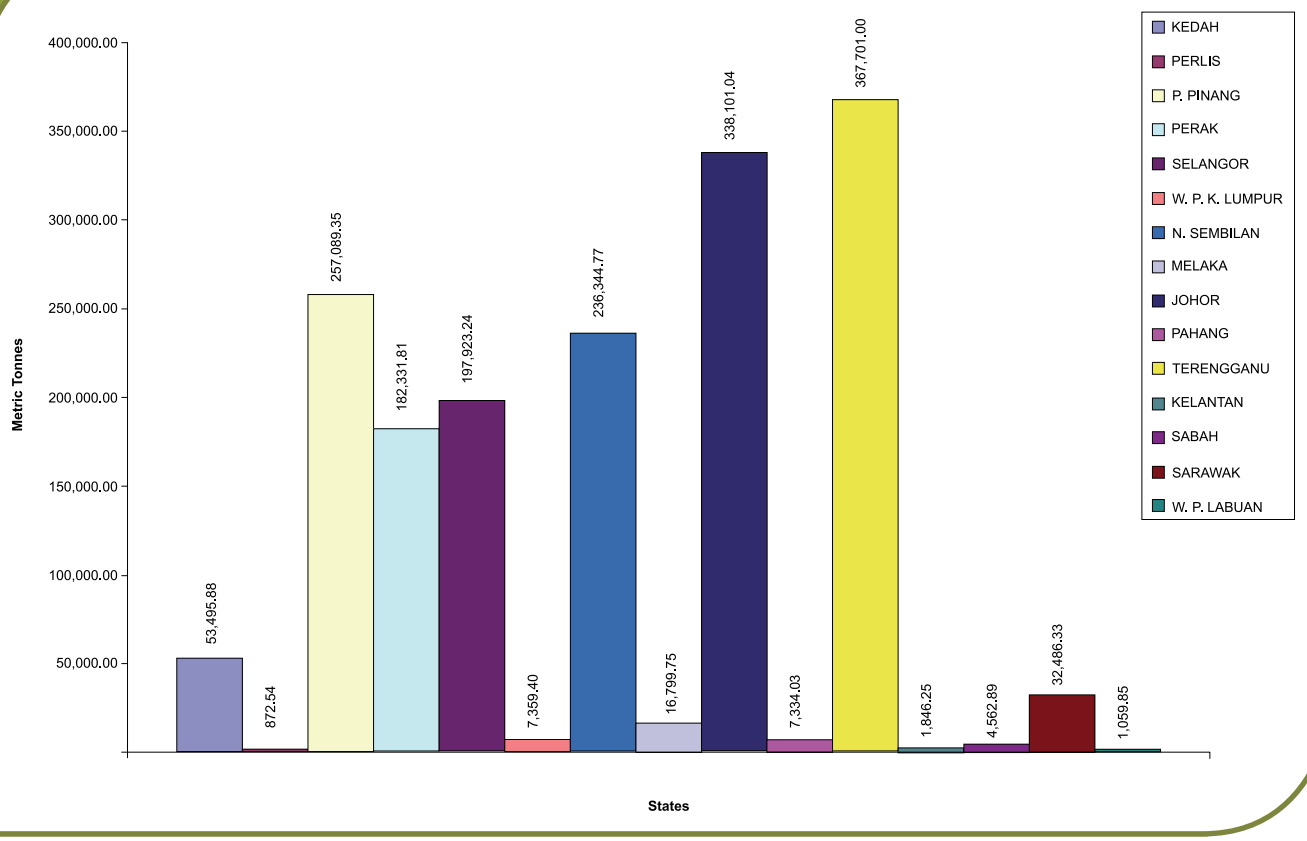

Figure 6.15 Malaysia : Distribution of Scheduled Wastes Generated By State, 2009

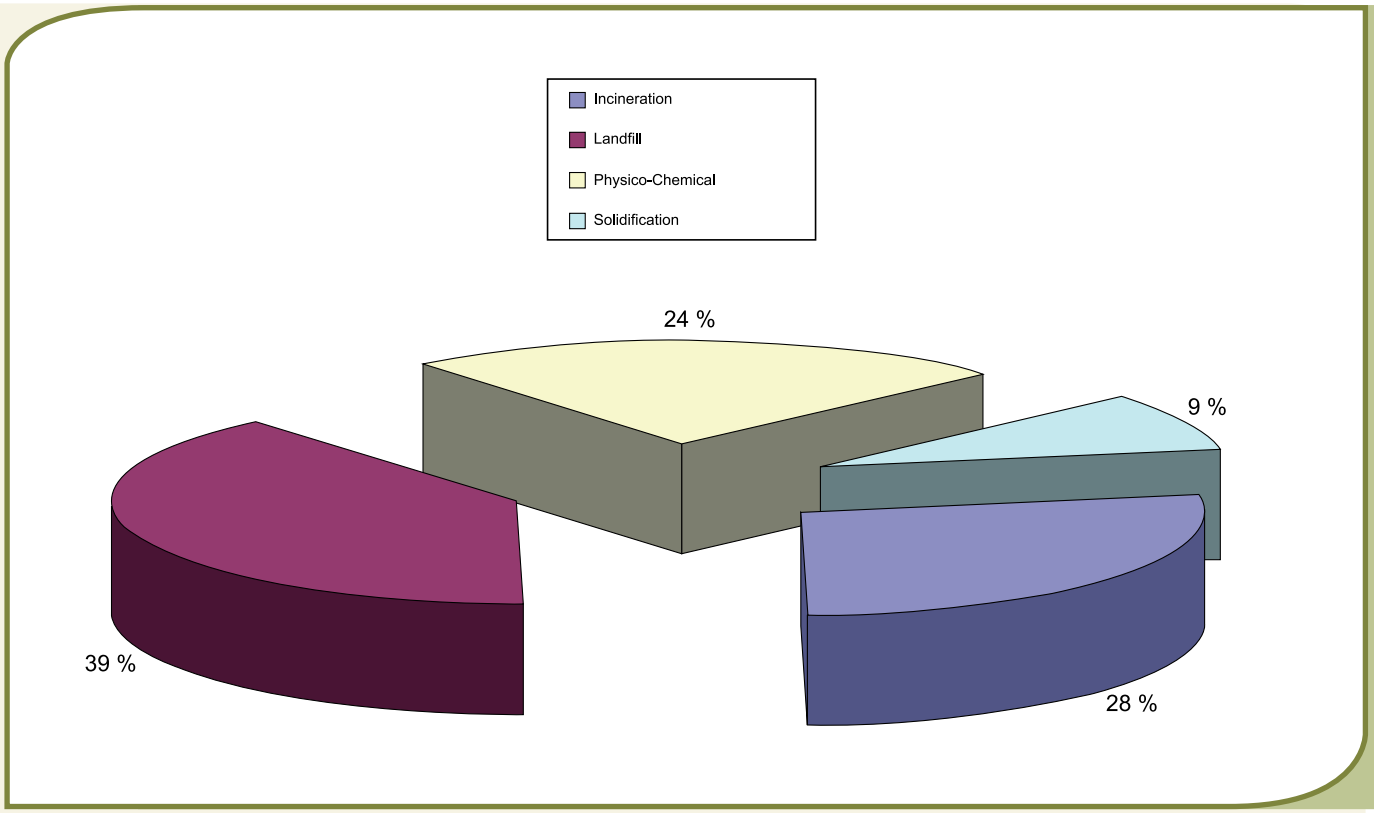

Figure 6.16 Malaysia : Types of Treatment and Disposal of Waste

Electronic Waste : Discarded Mobile Phones and Batteries